Was the Scandinavian Monetary Union an Optimum Currency Area? A Generalised Purchasing-Power Parity Approach

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Abstract: *This paper explores the behaviour of the bilateral real exchange rates of Denmark, Norway and Sweden over the period 1870-1914, by testing the theory of generalised purchasing-power parity (G-PPP). The theory states that if economies are sufficiently integrated, bilateral real exchange rates will share a common stochastic trend. Evidence in favour of G-PPP can be interpreted in terms of an optimum currency area. It will be argued that the Scandinavian Monetary Union did not form an Optimum Currency Area.*

JEL Classification: F33, C12, C22.
Key words: *optimum currency area,* exchange rate, structural break.

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1. Introduction

The history of European monetary integration highlights a recurrent movement toward currency unions. After the German unification in the early XIXth century, the two most notable experiences were the Latin Monetary Union (1865-1926) and the Scandinavian Monetary Union (SMU). In 1872, Denmark, Norway and Sweden signed in Stockholm the Scandinavian mint convention and adopted a common currency, the *krona*, based on gold.[1] The three Scandinavian countries opted for a decimal system and included an escape clause in the treaty with a period of notice of one year (Alin, 1900). The rise of the SMU resulted from the failure of Parieu's project and the French opposition to the gold standard (Einaudi, 2000). The new common currency unit of 100 *øre* replaced the *rigsdaler*, which already circulated in the three Scandinavian countries at the fixed rate of one Norwegian *speciedaler* = 2 Danish *rigsdaler* = 4 Swedish *rigsdaler*. The coins issued by each central bank were given legal tender and were accepted at par without limit in the union, since 1894. Although the Scandinavian monetary authorities retained complete sovereignty, they agreed in 1885 to introduce a clearing mechanism, which permits each central bank to draw drafts on each other at par.[2]

Although Scandinavian central banks were able to increase their money supply independently, monetary policy was put in a straightjacket, as all countries adhered to the gold standard. According to this argument, the fall of the SMU was led by the loose of the nominal anchor, not just the inflationary pressures after the outbreak of World War I.

In spite of monetary cooperation between the three Scandinavian countries, intra-trade remained limited and was characterised by the dominance of the major trading partners: England and Germany. Furthermore, free trade-protectionist strife arose within the union in the 1880s and became visible in 1897, after the abrogation of the joint tariff laws between Norway and Sweden.

While the industrial structure was fairly similar between the three countries (see Jörberg, 1970), cyclical movements in agriculture did not exhibit the same trends. de Cecco (1992) argues that the SMU was the most successful currency union during the ninetieth century.

[1] The convention was rejected initially by the parliament of Norway, before it passed in 1875 by a comfortable margin of 82 to 28.

[2] de Cecco (1992) argues that this eliminated the gold points, bringing the Scandinavian countries much closer than what they would had been under the gold standard.

Bergman (1999) shows however that country-specific shocks within the union were not highly symmetric, and concludes that the three Scandinavian countries did not form an optimum currency area (OCA). The author argues that the adoption of a single currency in the SMU affected macroeconomic performance in a marginal fraction compared to the discipline instilled by the gold standard. A similar argument could be found in Bergman et al. (1993) who state that the original currency union lasted as long as the three Scandinavian countries adhered to the gold standard.

The purpose of this paper is to test whether the three Scandinavian countries formed an optimum currency area. Using an alternative methodology due to Enders and Hurn (1994) this paper tests the theory of Generalized Purchasing-Power Parity (G-PPP) among Scandinavian countries. The remainder of this paper is organised as the following: Section 2 addresses the theory of Generalised Purchasing-Power Parity. Sections 3 and 4 consider unit roots and cointegration allowing for one and two endogenous structural break(s). Sections 5 and 6 discuss the main results and their robustness. Section 7 concludes.

2. The theory of G-PPP

The theory of G-PPP states that real exchange rates tend to be nonstationary because of the nonstationarity of the fundamentals themselves such as real output and interest rates. Hence, if the fundamental variables are sufficiently interrelated, real exchange rates may share a common stochastic trend, although they may contain unit roots in data. G-PPP theory can be interpreted in terms of optimum currency areas (Enders et al, 1994). When factor mobility is relatively high between two countries, national boundaries do not correspond to the optimal domain of an OCA. These countries would be better off their national currencies in favour of a single unit of account. Several other criteria were added to the theory such as the degree of economic openness, terms of trade diversification, financial integration, and the convergence of inflation rates. The idea is that a higher synchronization of business cycles leads to a lower degree of asymmetric shocks (Mundell, 1963).

This paper tests whether real exchange rates among the three Scandinavian countries shared a common stochastic trend, which would indicate that fundamental macroeconomic variables were significantly synchronised. The argument stating that the SMU lowered only by a tiny margin the variability of macroeconomic variables, compared to the gold standard, will also be investigated.

The bilateral real exchange rate (RER) between the Scandinavian countries and England (the base country) is defined as:

$$q_{i,t} = e_{i,t} + p_t^* - p_{i,t} \qquad (1)$$

where $e_{i,t}$ is the natural logarithm of the domestic price of the pound, p_t^* and $p_{i,t}$ are the natural logarithms of price levels in period t in England and in country i. $q_{i,t}$ is the bilateral real exchange rate in period t between country i and England.

The real exchange rates are computed for the three Scandinavian countries (Denmark, Norway and Sweden), France, Germany, and the United States with England as the base country over the period 1870-1914.[3]

According to the G-PPP theory, if m-countries form an optimum currency area, in an n-country world, there exists then a long run relationship between the m-1 bilateral real exchange rates, such that:

$$q_{i,t} = \beta_0 + \sum_{j=i+1}^{m} \beta_{j,t} q_{j,t} + \varepsilon_t \quad \text{with } \varepsilon_t \sim I(0) \qquad (2)$$

where β_0 is an intercept term, $\beta_{i,t}$ the parameters of the cointegrating vector, and ε_t is a stationary error term.

Equation (2) implies that real exchange rates among the m-countries share a common stochastic trend, while the RER themselves are nonstationary, which could be interpreted as a long term equilibrium relationship (Stock and Watson, 1988).

3. Unit root tests

A first step before estimating the long run cointegration relationship is to determine the stationarity of the bilateral real exchange rates with England as the base country. The

[3] The *de jure* breakdown of the Scandinavian currency union is 1924. In this study, we consider however the *de facto* date after the outbreak of World War I in 1914. This is justified by the suspension of the fixed exchange rate.

augmented Dickey-Fuller (ADF) and the Phillips and Perron (PP) tests are computed. A general-to-specific methodology is used, and the optimal number of lags is chosen according to the Schwartz criterion.

Both tests indicate that all real exchange rates are I(1). However, it is well known that in the presence of structural breaks in data conventional tests, such as the ADF test, have a weak power and lead to under-reject the null hypothesis of a unit root.

The debate on structural change could be attributed to the seminal paper of Chow (1960). However, it is up to Nelson and Plosser (1982) that the debate has been renewed. The authors challenged the conventional wisdom of trend linearity, and showed that the trend could be characterized as a random walk. Admitting an exogenous known structural break in the Nelson-Plosser macroeconomic data, Perron (1989) showed that the sum of the autoregressive coefficients equals one when a structural break is allowed. The main weakness of this study is that it assumes known the break date, i.e. the latter is not correlated with the data (Christiano, 1992; Banerjee, Lumsdaine and Stock, 1992).

Zivot and Andrews (1992) criticised Perron's assumption, and proposed a test that allows for a single (endogenous) structural change in the intercept and/or trend. As some macroeconomic variables could exhibit more than one structural break, a loss of power could be expected from ignoring the possibility of multiple breaks in data. To address this drawback, Lumsdaine and Papell (1997) consider the case of two endogenous breaks in trend variables and show that inference related to unit roots is sensitive to the number of breaks. In case the variable is not characterised by a trended behaviour it is advisable to consider the statistics proposed by Clemente et al. (1998), which extend the results of Perron and Vogelsang (1992) to the case of a double change in the mean.

Before estimating the model it is important to determine the most appropriate type of break since an incorrect determination may distort the behaviour of these statistics (Montañés et al., 2005). Some author, such as Perron (1994), argue in favour of the most general specification, comparing then the results to those of the alternative models in order to check their robustness. While others (Lumsdaine et al., 1997), consider the model that implies the lower value of the unit root tests. In this paper we consider the so-called crash model as it is the most likely to characterise the behaviour of exchange rates. The most general specification will also be considered, comparing the results to those of the crash model.

The presence of an additive outlier (AO) in the series leads to higher values of Skewness and Kurtosis, and then to significant results of the Jarque-Bera normality test. In the sample, all series suggest the rejection of the null hypothesis of a normal distribution for the estimated residuals, except for Germany and the United States.

Extending the work of Perron (1989) to the case of two endogenous structural breaks in the mean, the considered model is:

$$\Delta y_t = \mu + \beta t + \delta_1 DU_{1t} + \delta_2 DU_{2t} + \rho y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + e_t \quad (3)$$

where DU_1 and DU_2 are indicator dummy variables occurring at two distinct unknown breaks TB_1 and TB_2 with $DU_{it}=1$ for $t>TB_i$ $i \in \{1,2\}$ and 0 otherwise. The term Δy_{t-i} corrects for serial autocorrelation, and e_t is a random error assumed to be *iid* when the lag order is optimally chosen. A 10% trimming is considered to eliminate end points, and the breakdates are selected by minimising the t-statistic under the null hypothesis. The latter assumes a unit root ($\rho=1$) and no break in data.

Some authors have emphasised the importance of dating the break accurately as well as including a break under the null hypothesis. Indeed, Zivot and Andrews (1992), among others, assume no break in data under the null hypothesis. Lee et al. (2001) show that these tests tend to identify the break incorrectly at one period behind the true breakdate. Moreover, as these tests do not include a break under the null hypothesis, the rejection of the latter does not necessarily imply stationarity with structural break, but rejection of a unit root without structural breaks. In this paper we consider the test proposed by Lee et al. (2003) in which the alternative hypothesis unambiguously implies trend stationarity. The model tests the following hypotheses:

$$H_0 : y_t = \mu_0 + d_1 D(TB_1)_t + d_2 D(TB_2)_t + y_{t-1} + \upsilon_{1t} \quad (4)$$

$$H_A : y_t = \mu_1 + \beta t + d_1 DU_{1t} + d_2 DU_{2t} + \upsilon_{2t} \quad (5)$$

where $D(TB_i)_t = 1$ for $t = TB_i + 1$ $i \in \{1,2\}$, and 0 otherwise. In Zivot et al. (1992) and Lumsdaine et al.(1997) critical values are derived under the null assuming $d_1 = d_2 = 0$. This assumption may be required; otherwise, the unit root test statistics may depend on the breakdate location.

To test the robustness of breakdates, the sample is split at each breakdate candidate, and the test is conducted on subsamples, estimating the other breakdate candidates again. Bai (1997) showed that re-estimating the breakpoints improves the robustness of results.

4. Cointegration test

According to equation (2), if bilateral real exchange rates are nonstationary they may share a common stochastic trend if fundamentals are themselves sufficiently interrelated. In case bilateral real exchange rates have not the same order of integration, countries will not form an optimum currency area. For example, if q_{1t}~$I(0)$, q_{2t}~$I(1)$, and q_{3t}~$I(1)$, then the three countries will not form an OCA, while country 2 and 3 may form an OCA if real exchange rates are cointegrated.

To assess whether the ties between the SMU countries were maintained as long as they were linked to the gold standard, the paper tests equation (2) within the SMU and between each country of the SMU and the other biggest economies by that time (Germany, France, and the United States). Comparing the variance of residuals of the two equations for each country shows whether Scandinavian real exchange rates were more influenced by innovations within or outside the SMU, and hence the influence of the monetary union.

Structural breaks may occur in the long run equilibrium relationship, either as a level change or a change in the cointegrating vector.[4] In this case, conventional cointegration tests, such as the ADF test, will under reject the null hypothesis of no cointegration.

In this paper we follow the methodology of Gregory et al. (1996) who extend the augmented Dickey-Fuller (*ADF*) and Phillips (Z_t, Z_α) tests. In these tests, the null hypothesis assumes no cointegration and regime shifts occur only under the alternative. Hence, rejection of the null

[4] Structural breaks may also occur through a change in the marginal distribution without any change in the cointegrating relationship.

hypothesis needs to be interpreted with caution, as there is no clear-cut evidence that there is a structural change in the long run relationship. In other words, if rejection of the null leads to ascertain the existence of cointegration, there is no clear and strong evidence that the cointegrating relationship has changed over time. To overcome this drawback, Gregory et al. (1996) compare the results of their tests to those of conventional tests. Thus, if the latter do not reject the null while the modified ADF test does, there is evidence in favour of cointegration with a structural change.

In this paper we consider the level shift model with an unknown breakdate, which could be written:

$$y_{1t} = \mu_1 + \mu_2 \varphi_{t\tau} + \alpha y_{2t} + e_t \qquad (6)$$

with t = 1,…,n ; μ_1, μ_2 represent the intercept before the shift and the change in the intercept at the time of the structural change, and $e_t \sim I(0)$. The model minimises the cointegration test statistic computed for all possible structural breaks over the sample taking into account a 15% trimming. The regime shift model –a change in level and in the slope coefficient of the cointegrating relationship–is also considered in order to test the sensitivity of the model to the type of the chosen structural break.

5. Data and interpretation of results

To compute bilateral real exchange rates consumer price indices are used from Mitchell (1998a, b). Nominal exchange rates were kindly provided by the Central Banks of France, England, Norway and Sweden. Danish/sterling bilateral nominal exchange rates are end year rates, and are from several issues of the Financial Times.[5] The sample covers the period 1870 to 1914. Bilateral real exchange rates are expressed in natural logarithms and normalised such as the first year is equal to zero.

Table 1 reports the results of conventional unit root tests. Both conventional tests show evidence in favour of nonstationarity in levels. These results may be biased in the presence of a structural break. As shown in table 3, the Zivot et al. test rejects the null hypothesis of a unit

[5] The sample is available from the author upon request.

root at the 5% significance level only in Germany and Denmark. However, these results do not allow ascertaining whether real exchange rates contain a structural change. The test of Lee et al., which includes one endogenous break under the null, is not able to reject the null hypothesis in all countries, except in the United States. Bilateral real exchange rates are then nonstationary with a structural break, except in the United States. These results emphasise the importance of the structural change, as both tests assume a unit root under the null while only the latter includes a break.

To take into account any loss of power led by the number of included breaks, the Lumsdaine et al. (LP) and Lee et al. (LS) tests were run allowing for the existence of two endogenous breaks in data. In Germany, the null hypothesis is rejected by both tests at the 1% significance level, suggesting stationarity with two structural breaks in 1895 and 1899. To test the robustness of these two break candidates, the sample is split at each of these breakdate candidates and the Lee et al. two breaks test is conducted on subsamples. The results do not show any evidence in favour of two breaks in data.[6] There is some evidence in favour of one structural break in 1899 with a unit root in data. These results emphasise the importance of correctly estimating the number of structural breaks.

In Denmark, the LP test rejects the null at the 1% significance level, while the LS test fails to reject it, which shows the importance of allowing for a structural break under the null hypothesis. In the United States, only the LS test rejects the null hypothesis, suggesting the existence of at least one break in data. The sample was split at each break candidate (1884, 1897) and re-estimated with the LS two breaks test. The results show some evidence in favour of stationarity with two breaks, which leads to drop out the United States from the sample. In France, Norway and Sweden there is evidence in favour of a unit root with two structural breaks. In a nutshell, bilateral real exchange rates in Germany, France, and the three Scandinavian countries are integrated of order one and may contain an optimum currency area if they are cointegrated.

As a first step, a cointegration test is conducted for each Scandinavian country with Germany and France, and only with France. The results in table 5 show that neither Norway nor Sweden did form an optimum currency area with Germany and France, as the Gregory et al.

[6] The results are not reported here, but are available upon request from the author.

test fails to reject the null hypothesis. In Denmark, the null is rejected at the 5% significance level for the ADF^* and Z_t tests. Dropping Germany from the equation does not qualitatively enhance results. Only the ADF^* test rejects the null hypothesis for Norway at the 10% significance level and for Denmark and Sweden at the 5% level. G-PPP holds then only between Denmark and the other majoreconomies: Germany and France. Real exchange rates in Norway and Sweden do not seem to be influenced by innovations in major currencies. This result is surprising as Germany was one of the major trading partners of the Scandinavian countries.[7]

In a second step, G-PPP theory is tested among the Scandinavian countries. The results are reported in table 6 and show that respectively in Norway and Sweden real exchange rates do not follow a time path influenced by the other two Scandinavian countries and, thus, G-PPP does not hold among these countries. However, in Denmark the ADF^* and Z_t tests reject the null of no cointegration at the 5% and 10% significance level. While there is no evidence that Scandinavian countries formed an optimum currency area, Denmark seems to be influenced by the other two countries. This result could be explained by the fact that Denmark was the only country that maintained free trade during all the period, while it was abandoned in the other two Scandinavian countries by the late 1880s and 1890s.

The results are in line with those of Bergman (1999) who concludes that SMU countries did not form an OCA. The author argues that the adoption of the SMU affected at the margin the macroeconomic conditions in the Scandinavian countries, as the adoption of the gold standard put in straightjacket monetary policies.

Comparing the variance of residuals of tables 5 and 6 for each country of the SMU, shows that real exchange rates in Norway and Denmark were more influenced by innovations in the other Scandinavian countries than in Germany and France. When Germany is excluded the variance of residuals is lower within the SMU than with France.

Although there is no evidence that Scandinavian countries formed an optimum currency area, these countries were influenced by the monetary union. The high degree of cooperation between monetary policies within the currency union may explain the lower variance of

[7] The United Kingdom was also one of the main trading partners of the SMU.

residuals within SMU. However, because of the poor economic integration between the three Scandinavian countries the synchro-nisation of business cycles remained limited. Indeed, intra-trade within SMU represented only a tiny fraction of total trade with the United Kingdom and Germany. This leads to the conclusion that economic integration matters for the establishment of a successful monetary union.

6. Sensitivity and robustness analysis [8]

In order to assess the sensitivity of results to the choice of the model, unit root tests were conducted again for each test, using the most general specification. The latter allows for an endogenous structural change in level and in slope coefficient. The results do not show any significant difference with the change in the intercept model, except for the Lee et al. two breaks tests where all bilateral real exchange rates are significant at the 10% level. The results of the first model will be favoured as it is the most likely to characterise the behaviour of exchange rates.

Cointegration tests were also estimated again using the most general specification model with a change in the intercept and the slope coefficient of the cointegrating relationship. The results do not seem to be sensitive to the choice of the model.

To test the robustness of results to the choice of the reference currency, all real exchange rates are expressed against the US dollar and DM as a base country. The results do not show any significant difference with the above analysis.

7. Conclusion

This paper explores the behaviour of bilateral real exchange rates and tests the theory of Generalised-Purchasing Power Parity within the Scandinavian Monetary Union and between the three Scandinavian countries (Denmark, Norway, and Sweden) and Germany, France, and the United States over the period 1870-1914. The results show no evidence in favour of an optimum currency area between the three Scandinavian countries. The adoption of the gold

[8] The results of the sensitivity analysis are not reported here, but are available from the author upon request.

standard in the three Scandinavian countries imposed discipline on monetary policies, and played a major role in the viability of the Scandinavian Monetary Union.

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Appendix

Table 1: Unit root test: ADF and Phillips-Perron tests

		PP		ADF	
	lags	level	1st diff.	level	1st diff.
Germany	1	-3.113	-6.908^{***}		nocons
France	1	-1.467	-6.146^{***}	-1.488	-5.245^{***}
United States	1	-3.092	-7.139^{***}	-2.967	-5.162^{***}
Norway	2	-2.987	-5.400^{***}	-3.800^{**}	nocons
Sweden	1	-3.499^{*}	-5.490^{***}		nocons
Denmark	1	-2.734	-7.748^{***}	-2.795	-5.940^{***}

**(**) denotes significance at the 5%(1%) level.*

Table 2: Normality tests

	Skewness	Kurtosis	Jarque-Bera	p-value
Germany	0.5716	2.6002	2.7502	0.252
France	1.0101	3.1097	7.6749	0.021
United States	0.3704	2.2233	2.1598	0.339
Norway	1.3574	5.0039	21.350	0.000
Sweden	1.1167	4.3047	12.545	0.001
Denmark	-2.3521	7.1343	73.543	0.000

Table 3: Unit root tests: one structural break

Model A: $\Delta y_t = \mu + \beta t + \delta_1 DU_{1t} + \rho y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + e_t$

	Zivot and Andrews test			Lee and Strazicish test		
	lag	breakdate	t-statistic	lag	breakdate	t-stat
Germany	2	1900	-5.762^{**}	2	1899	-2.979
France	0	1897	-2.838	3	1896	-2.171
United States	0	1885	-4.417	0	1884	-3.858^{**}
Norway	1	1900	-4.940^{*}	1	1892	-2.227
Sweden	1	1900	-5.180^{*}	5	1880	-1.310
Denmark	0	1875	-17.35^{**}	0	1900	-2.630

**(**) denotes significance at the 5%(1%) level.*
The critical values at 1%(5%(10%)) level are -4.239(-3.566(-3.211)).

Tale 4: Unit root tests: two structural breaks

Model A: $\Delta y_t = \mu + \beta t + \delta_1 DU_{1t} + \delta_2 DU_{2t} + \rho y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + e_t$

	Lumsdaine and Papell test			Lee and Strazicich test		
	lag	breakdate	t-statistic	lag	breakdate	t-stat
Germany	1	1895 1899	-7.250***	1	1895 1899	- 5.401***
France	3	1882 1896	-5.515	3	1894 1896	-2.071
United States	2	1884 1897	-5.548	0	1884 1897	-4.305**
Norway	3	1896 1901	-5.567	1	1892 1899	-2.348
Sweden	4	1885 1889	-6.237	1	1895 1899	-3.104
Denmark	4	1888 1907	-19.50***	0	1890 1899	-2.619

((***)) denotes significance at the 10%(5%(1%)) level.*

The critical values of the LP test are -6.94(-6.24(-5.96)) at the 1%(5%(10%)) significance level.

Table 5: Cointegration test: Country i with Germany and France

Model C: $y_{1t} = \mu_1 + \mu_2\varphi_{t\tau} + \alpha y_{2t} + e_t$

	$q_{i,t} = \alpha + q_{Germany,t} + q_{France,t} + \varepsilon_{i,t}$			$q_{i,t} = \alpha + q_{France,t} + \varepsilon_{i,t}$		
	Norway	Sweden	Denmark	Norway	Sweden	Denmark
ADF* test	-4.604	-4.139	-4.998**	-4.478*	-5.248***	-4.632**
Zt	-3.397	-3.826	-5.056**	-3.301	-3.551	-4.672**
Zα	-19.51	-21.87	-33.29	-17.81	-18.75	-29.73
Variances of residuals	0.0019	0.0012	0.0167	0.0018	0.0026	0.0164

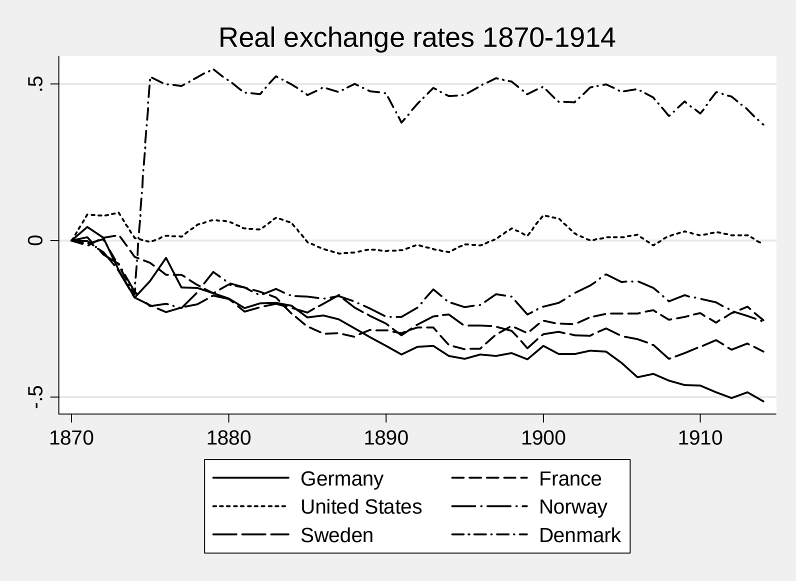
((***)) denotes significance at the 10%(5%(1%)) level.*

Table 6: Cointegration test: OCA within SMU

Model C: $y_{1t} = \mu_1 + \mu_2\varphi_{t\tau} + \alpha y_{2t} + e_t$

	$q_{NOR,t} = \alpha + q_{SEK,t} + q_{DEN,t} + \varepsilon_{1,t}$	$q_{SEK,t} = \alpha + q_{NOR,t} + q_{DEN,t} + \varepsilon_{2,t}$	$q_{DEN,t} = \alpha + q_{NOR,t} + q_{SEK,t} + \varepsilon_{3,t}$
ADF* test	-4.320	-3.981	-4.95**
Zt	-3.112	-4.009	-4.874*
Zα	-17.84	-23.34	-33.55
Variances of residuals	0.0016	0.0024	0.0162

((***)) denotes significance at the 10%(5%(1%)) level.*


Real exchange rates 1870-1914
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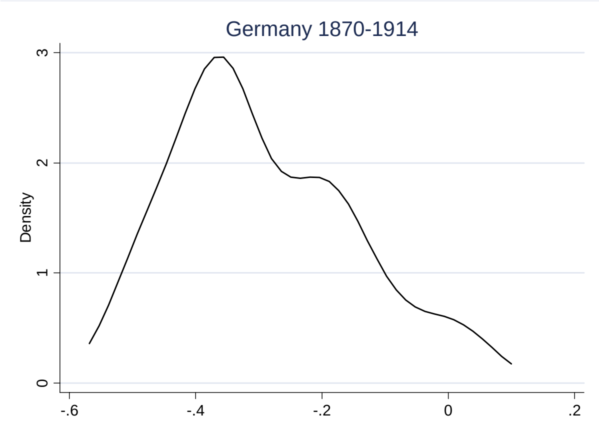
0
-.5
1870
1880
1890
1900
1910
Germany
France
United States
Norway
Sweden
Denmark


Germany 1870-1914
Density
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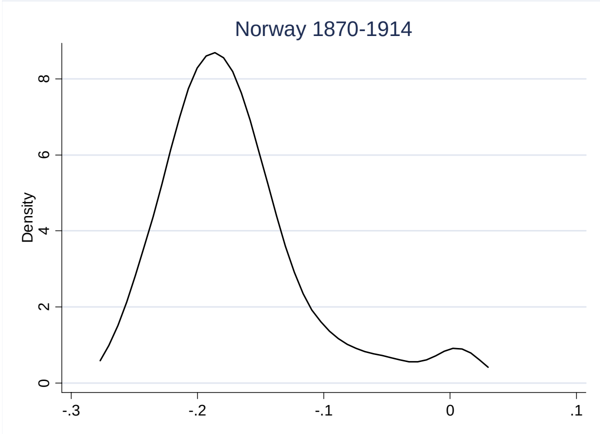
2
3
-.6
-.4
-.2
0
.2


Norway 1870-1914
Density
0
2
4
6
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0
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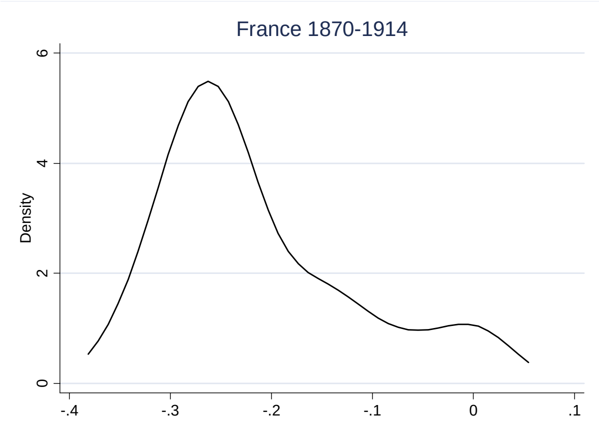
France 1870-1914
Density
0
2
4
6
-.4
-.3
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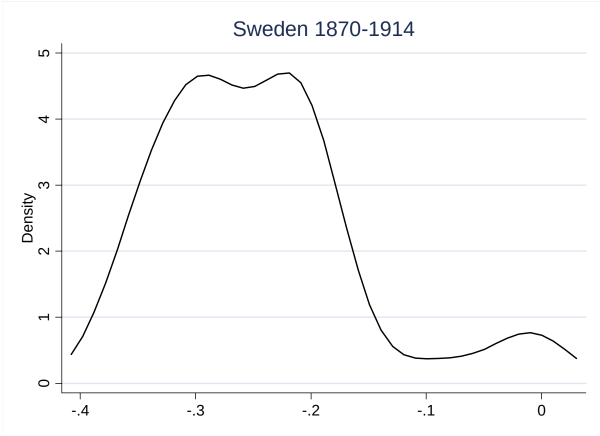
-.1
0
.1


Sweden 1870-1914
Density
0
1
2
3
4
5
-.4
-.3
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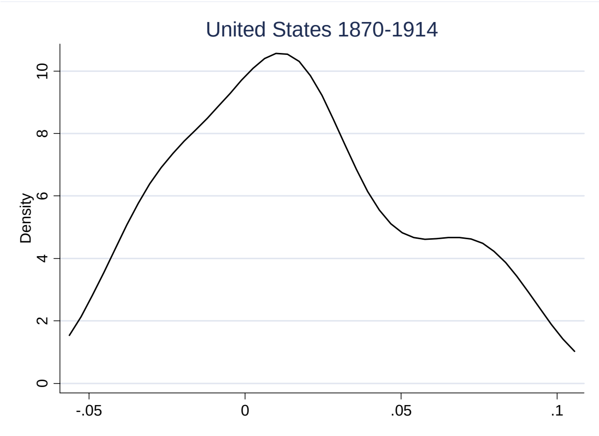
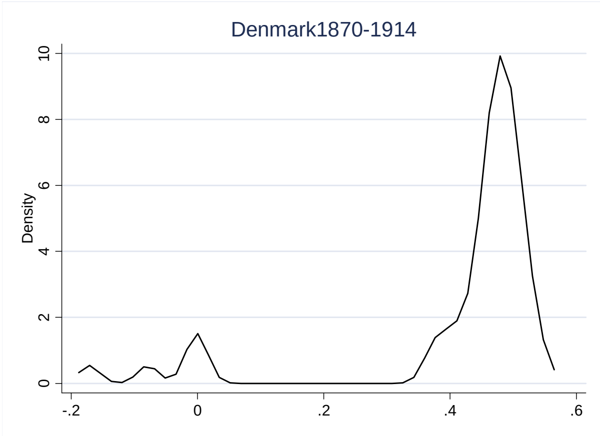
-.1
0


United States 1870-1914
Density
0
2
4
6
8
10
-.05
0
.05
.1


Denmark1870-1914
Density
0
2
4
6
8
10
-.2
0
.2
.4
.6