EMU, Trade and Business Cycle Synchronization: What Do We Know and What Does it Mean for Poland?

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Abstract

This short paper reviews the recent literature linking monetary union, international trade, and business cycle synchronization. I survey the literature using the quantitative technique of meta-analysis, which allows me to estimate the effects of EMU taking into account the entire extant literature. Twenty-six recent studies have investigated the effect of currency union on trade, using actual European data of relevance. Taking all these studies into account, EMU has raised trade inside the Eurozone by at least 8% and perhaps 23%. Twenty different studies have estimated the effect of trade on the synchronization of business cycles. Aggregating across these estimates, an increase of bilateral trade between two countries raises the synchronization of their business cycles by an economically and statistically significant effect. I estimate that a one percent increase in bilateral trade increases the correlation coefficient of detrended output by .02. Taken together, the estimates suggest that EMU has created a virtuous circle; by increasing trade and the synchronization of business cycles, EMU reduces the need for national monetary policy. Poland's trade is an important part of the Polish economy and is already focused on EMU members; Poland's business cycle also seems to be positively synchronized with the Eurozone. Thus these arguments provide a positive argument in favor of Polish entry into EMU.

Keywords: meta; analysis; monetary; currency; union; literature; test; study; estimate.

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Introduction

This short paper summarizes two recent empirical literatures. The first estimates the effect of European Monetary Union (EMU) on trade; the second estimates the effect of trade on the cross-country synchronization of business cycles. Meta-analysis is used to provide a quantitative summary of both literatures.

These literatures deal with important questions that are inter-related. Any reduction of the transactions costs associated with trade inside the Eurozone by EMU is of general interest. Indeed, one of the few undisputed benefits of EMU is its trade-promoting effect, so quantifying its size is an important exercise. The second linkage is also of interest. If increased trade raises the coherence of business cycles across countries, it thereby reduces the need for national monetary policy. If *both* links work in practice, then a currency union like EMU which does not look like an optimal currency area *ex ante* may become one *ex post*. This can occur if the trade increase stemming from currency union actually makes the currency union optimal, by reducing or eliminating the need for a national monetary policy to reduce idiosyncratic business cycles. Frankel and Rose (1997, 1998) lay out the argument in detail. Clearly this argument is of special interest for European countries contemplating entry into EMU, such as Poland. If both linkages are empirically relevant in practice, they jointly constitute one powerful argument in favor of entry into monetary union.

A Brief History of the Literature

In the summer of 1999, I began to circulate a paper that estimated the effect of currency union on trade; *Economic Policy* subsequently published this paper in 2000. This paper exploited a panel of cross-country data covering bilateral trade between a large number of

countries. Since most of the variation was across pairs of countries rather than time, I used a conventional "gravity" model of trade to account for factors that drive trade (other than monetary arrangements). This equation has now become the standard vehicle for the literature, and takes the form:

$$\ln(T_{ijt}) = \beta_1 \ln D_{ij} + \beta_2 \ln(Y_i Y_j)_t + \Sigma_k \beta_k Z_{ijt} + \Sigma_t \delta_t T_t + \gamma CU_{ijt} + u_{ijt}, \quad (1)$$

where: T_{ijt} denotes trade between countries i and j at time t, $\{\beta\}$is a set of nuisance coefficients, D_{ij} denotes the distance between i and j, Y denotes real GDP, Z denotes other controls for bilateral trade, CU_{ijt} is a dummy variable that is one if countries i and j are in a currency union at t and zero otherwise, and u is a well-behaved disturbance term. The coefficient of interest is γ, which represents the partial effect of currency union on trade, *ceteris paribus.*

The surprising and interesting finding was that currency union seemed to have a strong and robust effect on trade. Even using the standard linear gravity model that accounts for most variation in trade patterns, my point estimate was that the coefficient for a currency union dummy variable (which is unity when a pair of countries share a common currency and zero otherwise) has a point estimate of around =1.21. This implies that members of currency unions traded over three times as much as otherwise similar pairs of countries *ceteris paribus*, since exp(1.21)>3. While there was no benchmark from the literature, this estimate seemed implausibly large to me (and others). Almost all the subsequent research in this area has been motivated by the belief that currency union cannot reasonably be expected to triple trade. I provided a meta-analysis of the work as it existed in March 2004 in my 2005 paper with Stanley.

One of the problems with almost all the work that Stanley and I surveyed was that it estimated the effect of currency unions on trade using monetary unions that preceded EMU. This choice was made of necessity; since the euro only started to circulate in 2002, there was essentially no European data of relevance available. However, the currency unions that existed before the Eurozone involved countries that were either small or poor (or both). Clearly the relevance of such currency unions for EMU was unknown.

Some four years have now passed since I finished my 2005 survey (with Stanley), and much work has been done. I am now aware of 26 studies that estimate the currency union effect on trade – γ in equation (1) above – using actual data from EMU, and it seems appropriate to see what these studies say, taken as a whole.

Meta-Analysis: The Effect of Currency Union on Trade

Meta-analysis is a set of quantitative techniques for evaluating and combining empirical results from different studies. Essentially one treats different point estimates of a given coefficient as individual observations. One can then use this vector of estimates to: estimate the underlying coefficient of interest, test the hypothesis that the coefficient is zero, and link the estimates to features of the underlying studies. Since there are currently a number of studies that have provided estimates of γ, the effect of currency union on trade, meta-analysis seems an appropriate way to summarize the current state of the literature. Stanley (2001) provides an excellent recent review and further references.

One begins meta-analysis by collecting as many estimates of a common effect as possible. To my knowledge, there are twenty-six papers that provide estimates of the effect of currency union on bilateral trade (γ) using data of relevance, i.e., post-2001 European

observations. These articles are tabulated in Table 1 (I note parenthetically that I am a co-author of none.) I also present the studies' preferred estimates of γ, along with appropriate standard errors. In each case, I present the estimate of γ that seems to be most preferred or representative (if a preferred estimate is not available) by the author(s) of the study. While I have strong views about the value of some of these estimates (or lack thereof), I weigh each estimate equally, simply because there is no easily defensible alternative weighting scheme.

The most basic piece of meta-analysis is a test of the null hypothesis $\gamma=0$ when the twenty-six point estimates (and their standard errors) are pooled across studies. This classic test is due originally to Fisher (1932) and uses the p-values from each of the (26) underlying γ estimates. Under the null hypothesis that each of the p-values is independently and randomly drawn from a normal [0, 1] distribution, minus twice the sum of the logs of the p-values is drawn from a chi-square. The hypothesis can be rejected at any standard significance level, since under the null hypothesis the test-statistic of 785 is drawn from chi-squared (52).[1]

I tabulate meta-estimates of the currency effect on trade in Table 2. I provide both "fixed effect" and "random effect" meta-estimates that are common in the area. The former are based on the assumption that a single fixed effect underlies every study, so that, in principle, if every study were infinitely large, every study would yield an identical result. This is the same as assuming there is no heterogeneity across studies. By way of contrast, the random effects estimator assumes that the studies are estimating different treatment effects, drawn from a distribution whose mean is of interest.[2]

Manifestly, there is considerable heterogeneity; the fixed and random effect estimators are not similar in magnitude. However, both estimates are both economically substantial; the

smaller fixed effect estimate of γ indicate that currency union raises trade by about 8% (as ln(.08)-1=.08), while the random effect estimate indicates that the effect is more like 23%.

There is little indication that any single study is especially influential in driving these results. If the studies are omitted from the meta-analysis one by one, one finds the (fixed-effect) point estimates for γ tabulated in Table 3, along with a 95% confidence interval.

It seems that EMU has had a measurable effect already on trade. In the spirit of trying to stay modest, the few years since EMU began have already seen trade rise within the Eurozone by at least 8%. Since EMU is a relatively young institution, it seems likely (though uncertain) that this effect will grow with time. I also note that this conclusion is consistent with writers who have surveyed the literature in a more qualitative fashion. The best known of these is Baldwin (2006), who writes "The bottom line of this literature is that the euro probably did boost intra-Eurozone trade by something like five to ten percent on average, although the estimates size of this effect is likely to change as new years of data emerge." Similarly, Frankel (2008) writes "If one estimates the effects of the euro versus other monetary unions in a large sample that includes all countries and all years, thereby bringing to bear as much information as possible on questions such as the proper coefficients on common border and common language in a gravity model, then the effect of the euro in the first eight years is seen to be large, and comparable with the effect of the other non-euro monetary unions."

Increased Trade Enhances Business Cycle Synchronization

I now turn to the link between international trade and business cycle synchronization. It is now standard to estimate this relationship using the following equation:

$$BCS_{ijt} = \alpha + \beta * \ln(trade_{ijt}) + controls + \varepsilon_{ijt} \quad (2)$$

where BCS a measure of business cycle synchronization between countries i and j during time period t. Countries might choose their monetary regime, such as a fixed exchange rate, to both simultaneously enhance trade and affects BCS, so β is often estimated with instrumental variables.

Frankel and Rose (1997, 1998) show that theoretically β is ambiguously signed; it depends on what kind of trade is spurred by integration, and what sorts of shocks hit the economy. However, *if* β is positive, then currency unions may endogenously become optimal. In particular, if currency raises trade significantly, then by indirectly raising BCS it reduces the need for a national monetary policy to offset idiosyncratic domestic shocks, thus making the currency union sustainable.

The chief measurement issue is determining an empirical analogue for business cycle synchronization (BCS). This is typically (though not always) measured as a correlation coefficient that is estimated between detrended levels of activity for countries i and j, over some reasonable period of time.[3] Since EMU has only existed for a short period of time, no study, to the best of my knowledge, creates BCS measures using only post-EMU data.

The coefficient of interest is β, which measures the effect of trade on BCS. This has been estimated by twenty different studies. These studies, along with their estimates of β (and its standard error) are tabulated in Table 4. While twenty studies are not enough to give one a truly large sample, it still seems worthwhile to use meta-analysis to aggregate their estimates quantitatively.

The hypothesis that β is statistically insignificantly different from zero is grossly rejected; under the null hypothesis of no effect, the test-statistic of 277 is drawn from chi-squared (40).[4]

The meta-estimates of the effect of trade on BCS are presented in Table 5. As with the effect of currency union on trade, there is considerable heterogeneity and the fixed and random effect estimators are not close. I continue to be conservative, and focus on the lower, fixed-effect, estimate of $\beta \approx .02$. While this is considerably lower than I estimated in my 1998 paper with Frankel, it is still economically significant. If EMU has thus been associated with a trade increase of say 8% and each 1% increase in bilateral trade leads to an average increase in BCS of .02, then EMU leads to an increase in the correlation coefficient of detrended outputs of (.02*8=) .16. Since the sample average of BCS is around .22, this represents an economically relevant increase in the synchronization of business cycles across the members of EMU. While this reduction in idiosyncratic national business cycles is substantial, whether it is enough to obviate the need for a national monetary policy is, of course, a different question.

What Does this Mean for Poland?

Poland is already a relatively open economy. The CIA's *World Factbook* gives the ratio of Polish trade (exports plus imports) to GDP in 2007 to be 73%.[5] Further, this trade is already focused on the Eurozone; some 54% of Poland's trade is with the fifteen current EMU members.[6] If Poland's trade with the Eurozone rose by 8% because of EMU accession, that would amount to a growth of trade of over (.08 x .54 x .73 ≈) 3% of Poland's GDP.

But this figure would be misleadingly low, for two reasons. First, trade is growing quickly relative to output for Poland; the ratio has almost doubled over the last two decades from a ratio of just 29% during the dark days of 1989.[7] As Poland continues to be integrated into the global economy, there is every reason to expect its openness to rise further. Second, EMU is likely to continue to expand, and much of this growth will involve the accession of Poland's

trading partners in the Baltics and central Europe. Judging by current trade patterns, continued growth in EMU could easily boost the share of trade conducted with Euroland to 70% of all Polish trade. Thus the direct boost to trade that Poland can plausibly expect from joining EMU can be expected to be non-trivial, measured relative to output.

What of the synchronization between Poland's business cycle and that of the Eurozone? EMU has only been in existence since 1999, and Poland is a country very much still in the process of economic transformation; thus it is difficult to be precise on this issue. However, the evidence we have makes it clear that the Polish business cycle moves in tandem with that of EMU.

It is difficult to measure the Polish business cycle through movements in the labor market, because of the enormous impact of economic transition. This is made clear in Figure 1, which plots Polish unemployment over time since the start of EMU in 1999.[8] Polish unemployment has risen tremendously during recent years to levels of over 20%, while comparable data for the Eurozone show much more moderate and cyclic fluctuations.

Aggregate real output seems a much more natural place to look to measure Polish business cycles. However, one then has to deal with the tremendous trend growth in Polish GDP, clearly visible in Figure 2.[9] There is no single widely-accepted way to detrend output for a country in transition like Poland. Accordingly, I detrend real GDP for both EMU and Poland in three different ways. In Figure 3 I plot output for Poland and EMU de-trended by taking growth rates for each economy. Figure 4 is a comparable plot that de-trends each series by taking out the effects of a linear time-trend; Figure 5 is the analogue that uses output de-trended via the Hodrick-Prescott technique. It turns out that the exact method of de-trending output makes little difference; Poland and EMU have business cycles that are already moderately synchronized.

The correlation coefficient (measured over time between the two de-trended output series) varies from .48 to .58, indicating a relatively high degree of business cycle synchronization.[10] If an expansion in Poland's trade with EMU raises this degree of BCS further, it will raise an already high number.

Poland already has an economy that trades intensely and moves cyclically with that of the Eurozone. The literature I have reviewed above suggests that both features are likely to grow with Polish accession to EMU. On the basis of these critical features, Poland seems like a good candidate for entry into European monetary union.

Summary and Conclusion

The primary objective of this paper was to provide a brief quantitative survey of two related literatures. The effect of EMU on trade has now been examined by some 26 studies; I use meta-analysis to aggregate these together. If one weighs each of the studies equally, the literature has not yet come to a consensual view concerning the effect of EMU; a conservative estimate is that EMU has already lead to an increase in trade of some 8%, but a more substantive effect of 23% is also plausible. The hypothesis that EMU has had no effect at all on trade can be easily rejected by the literature taken as a whole.

The second issue of interest is the effect of international trade on business cycle synchronization (BCS); I also ask what can be learned from the twenty papers that estimate this relationship. The meta-estimates here are also heterogeneous, though again the idea that trade has no effect on BCS seems grossly inconsistent with the data. A conservative estimate is that each 1% increase in trade between a pair of countries seems to raise the correlation coefficient for their detrended outputs by around .02.

EMU thus seems to have had a combination of two effects: the *direct* consequence of increased trade, and an *indirect* benefit through the effect of this trade expansion on business cycle synchronization. This means that EMU may have created a virtuous circle that might make currency union closer to being sustainable. Whether the effect is big enough to make Europe an optimal currency area remains to be seen. A modern currency union between large rich countries like EMU has no historical precedent, and too little time has passed since the introduction of the euro for the trade and BCS effects to be clearly estimated. Still, the existence of both of these effects clearly bolsters the case for entry into EMU by outsiders such as Poland. Poland is in an especially good situation to benefit from EMU since it already trades so much with EMU and has a business cycle that moves closely with that of the Eurozone.

I close with a caveat. EMU has had and is having an enormous number of economic consequences, and I have ignored almost all of them in this brief paper. Countries choosing whether or not to enter (or stay in) EMU have to consider its effect on the efficiency of capital and labor markets, the quality of monetary policy inside EMU, risk-sharing, and so forth. The non-economic issues associated with sovereignty and political influence within the EMU may be of equal or greater importance. Still, the two literatures I have surveyed provide some grounds for an optimistic, though early, view of EMU and Polish entry into the Eurozone.

Table 1: Recent Studies of Currency Union and Trade

			Gamma	SE
1	**Bun and Klaassen**	**2002**	0.33	0.1
2	**de Souza**	**2002**	0.17	0.24
3	**de Nardis and Vicarelli**	**2003**	0.061	0.027
4	**Cabasson**	**2003**	0.63	0.24
5	**Micco, Stein, Ordonez**	**2004**	0.089	0.025
6	**Barr, Breedon and Miles**	**2004**	0.25	0.033
7	**Baldwin and Taglioni**	**2004**	0.034	0.015315
8	**Faruqee**	**2004**	0.082	0.018
9	**de Nardis and Vicarelli**	**2004**	0.093	0.039
10	**Clark, Tamirisa, and Wei**	**2004**	0.22	0.38
11	**Baldwin, Skudelny, and Taglioni**	**2005**	0.72	0.06
12	**Yamarik and Ghosh**	**2005**	1.8285	0.30475
13	**Adam and Cobham**	**2005**	1.029	0.039486
14	**Baxter and Koupritsas**	**2006**	0.47	0.22
15	**Flam and Nordstrom**	**2006b**	0.139	0.02
16	**Berger and Nitsch**	**2006**	-0.001	0.036
17	**Gomes, Graham, Helliwell, Kano, Murray and Schembri**	**2006**	0.069	0.011
18	**Baldwin and Taglioni**	**2006**	-0.02	0.03
19	**Baldwin and Di Nino**	**2006**	0.035	0.01
20	**Flam and Nordstrom**	**2006a**	0.232	0.024
21	**Tenreyro and Barro**	**2007**	1.899	0.351
22	**Bun and Klaassen**	**2007**	0.032	0.016
23	**de Nardis, De Santis and Vicarelli**	**2007**	0.04	0.01278
24	**Brouwer, Paap, and Viaene**	**2007**	0.067	0.025769
25	**Flam and Nordstrom**	**2007**	0.248	0.046
26	**de Nardis, De Santis and Vicarelli**	**2008**	0.09	0.033962

Table 2: Meta-Analysis of Impact of Currency Union on Trade

Estimation Technique	Pooled Estimate of γ	Lower Bound of 95%	Upper Bound of 95%
Fixed	.08	.07	.09
Random	.21	.15	.27

Table 3: Checking for Influential Studies in the Meta-Estimate of γ

	Study Omitted	Gamma	Lower Bound of 95%	Upper Bound of 95%
1	**Bun and Klaassen**	.08	.07	.09
2	**de Souza**	.08	.07	.09
3	**de Nardis and Vicarelli**	.08	.07	.09
4	**Cabasson**	.08	.07	.09
5	**Micco, Stein, Ordonez**	.08	.07	.09
6	**Barr, Breedon and Miles**	.08	.07	.09
7	**Baldwin and Taglioni**	.09	.08	.10
8	**Faruqee**	.08	.07	.09
9	**de Nardis and Vicarelli**	.08	.07	.09
10	**Clark, Tamirisa, and Wei**	.08	.07	.09
11	**Baldwin, Skudelny, and Taglioni**	.08	.07	.09
12	**Yamarik and Ghosh**	.08	.07	.09
13	**Adam and Cobham**	.07	.06	.08
14	**Baxter and Koupritsas**	.08	.07	.09
15	**Flam and Nordstrom**	.08	.07	.09
16	**Berger and Nitsch**	.08	.08	.09
17	**Gomes, et al**	.09	.08	.10
18	**Baldwin and Taglioni**	.09	.08	.09
19	**Baldwin and Di Nino**	.10	.09	.10
20	**Flam and Nordstrom**	.08	.07	.09
21	**Tenreyro and Barro**	.08	.07	.09
22	**Bun and Klaassen**	.09	.08	.10
23	**de Nardis, De Santis and Vicarelli**	.09	.08	.10
24	**Brouwer, Paap, and Viaene**	.08	.07	.09
25	**Flam and Nordstrom**	.08	.07	.09
26	**de Nardis, De Santis and Vicarelli**	.08	.07	.09

Table 4: Recent Studies of Trade and Business Cycle Synchronization

			Beta	SE
1	**Baxter and Kouparitsas**	**2005**	0.134	0.032
2	**Bower and Guillenmineau**	**2006**	0.02055	0.00528
3	**Calder**	**2007**	0.013	0.004
4	**Calderon Chong and Stein**	**2007**	0.015	0.003055
5	**Choe**	**2001**	0.027	0.008333
6	**Clark and van Wincoop**	**2001**	0.09	0.03
7	**Crosby**	**2003**	0.048	0.063
8	**Fidrmuc**	**2004**	0.021	0.044872
9	**Fiess**	**2007**	0.123	0.062
10	**Frankel and Rose**	**1998**	0.086	0.015
11	**Gruben, Koo and Mills**	**2002**	0.059	0.017206
12	**Imbs**	**2003**	0.03089	0.020058
13	**Imbs**	**2004**	0.074	0.022289
14	**Inklaar, Jong-a-Pin and de Haan**	**2005**	0.115	0.041071
15	**Kose and Yi**	**2005**	0.091	0.022
16	**Kose, Prasad and Terrones**	**2003**	0.0107	0.0045
17	**Kumakura**	**2006**	0.0575	0.0354
18	**Kumakura**	**2007**	0.05555	0.01232
19	**Otto, Voss and Willard**	**2001**	0.0461	0.090999
20	**Shin and Wang**	**2004**	0.07665	0.07665

Table 5: Meta-Analysis of Impact of Trade on Business Cycle Synchronization

Estimation Technique	Pooled Estimate of γ	Lower Bound of 95%	Upper Bound of 95%
Fixed	.020	.016	.023
Random	.043	.031	.054

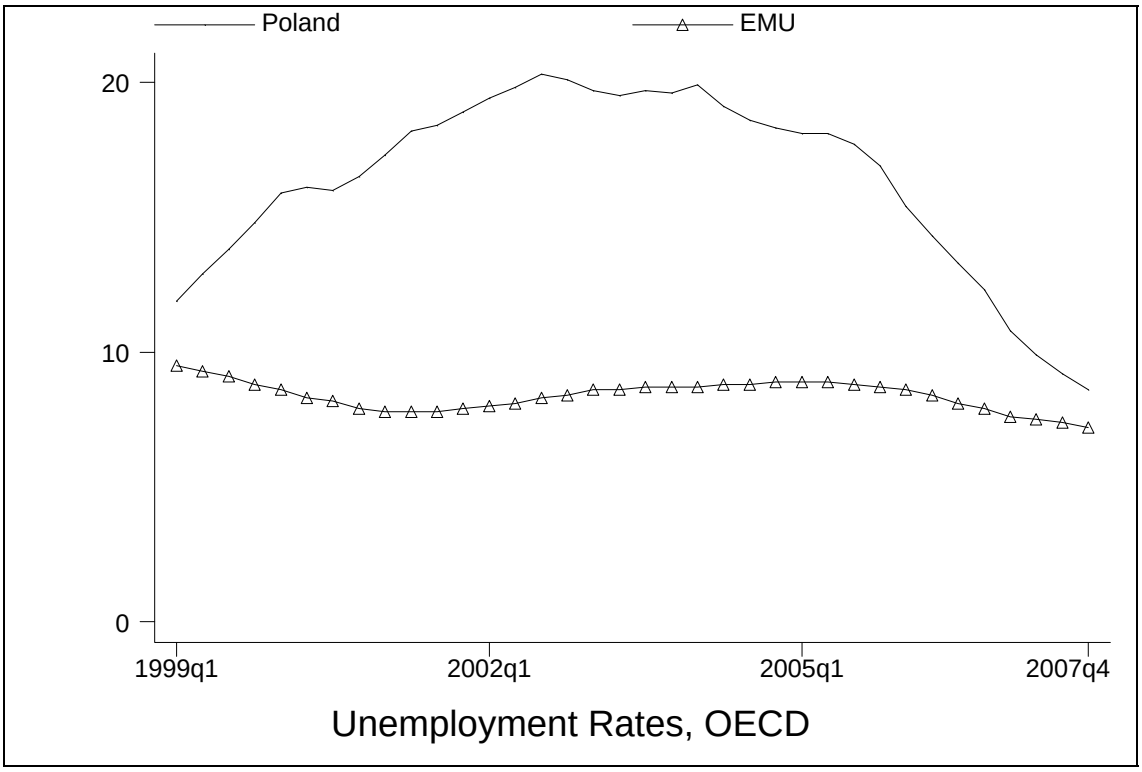

Figure 1

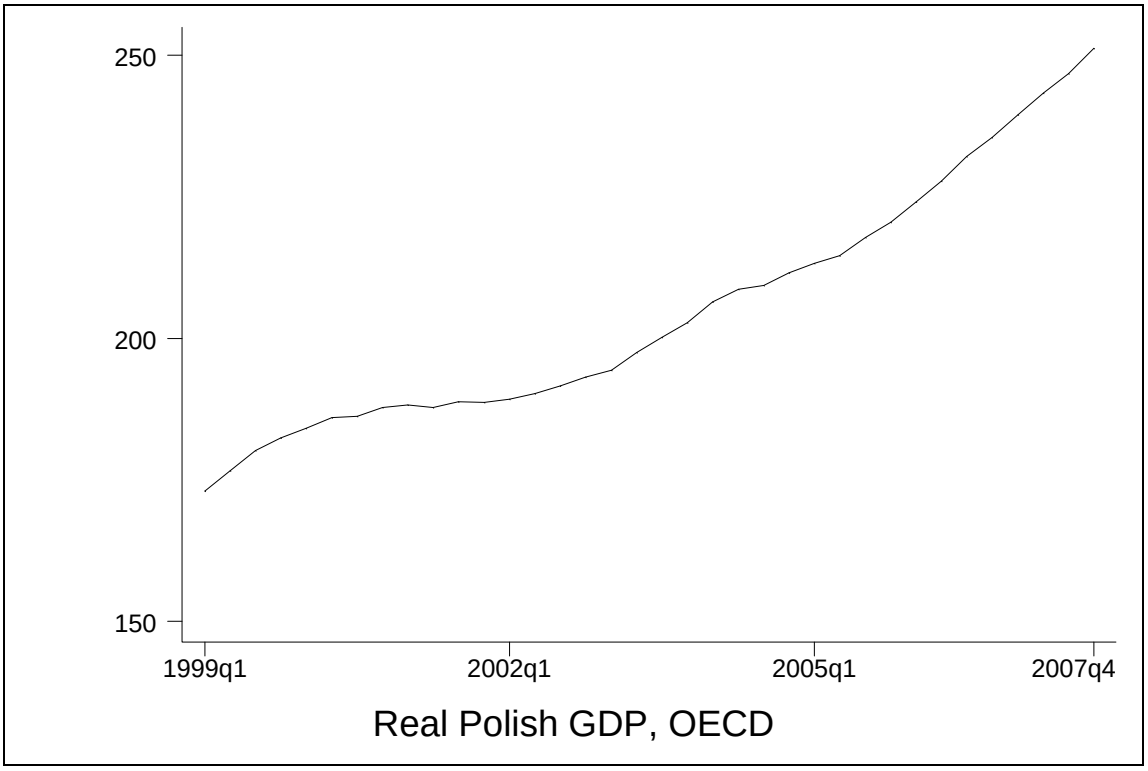

Figure 2

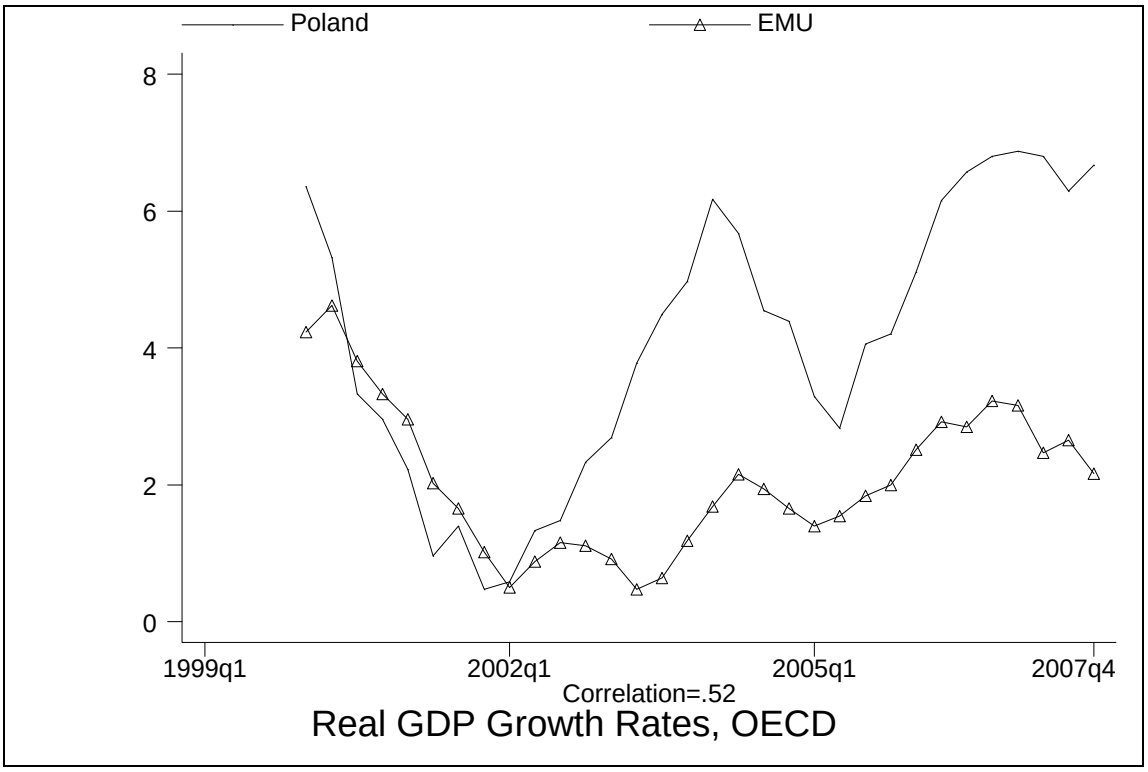

Figure 3

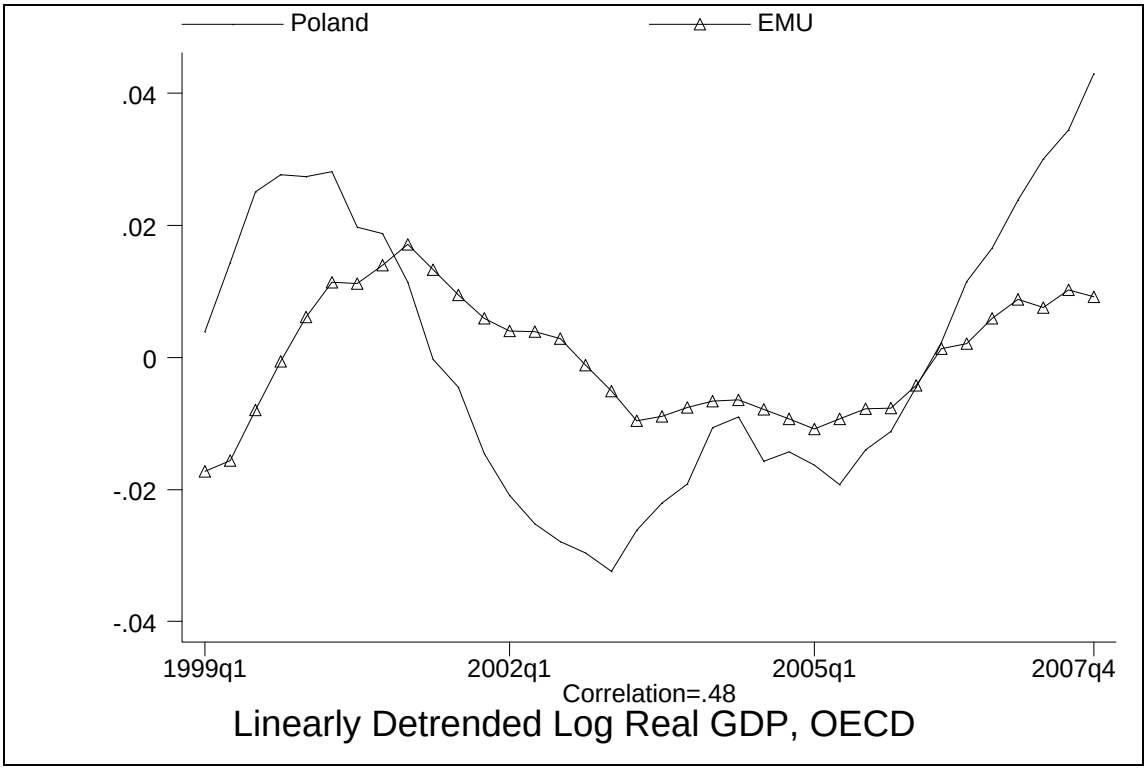

Figure 4

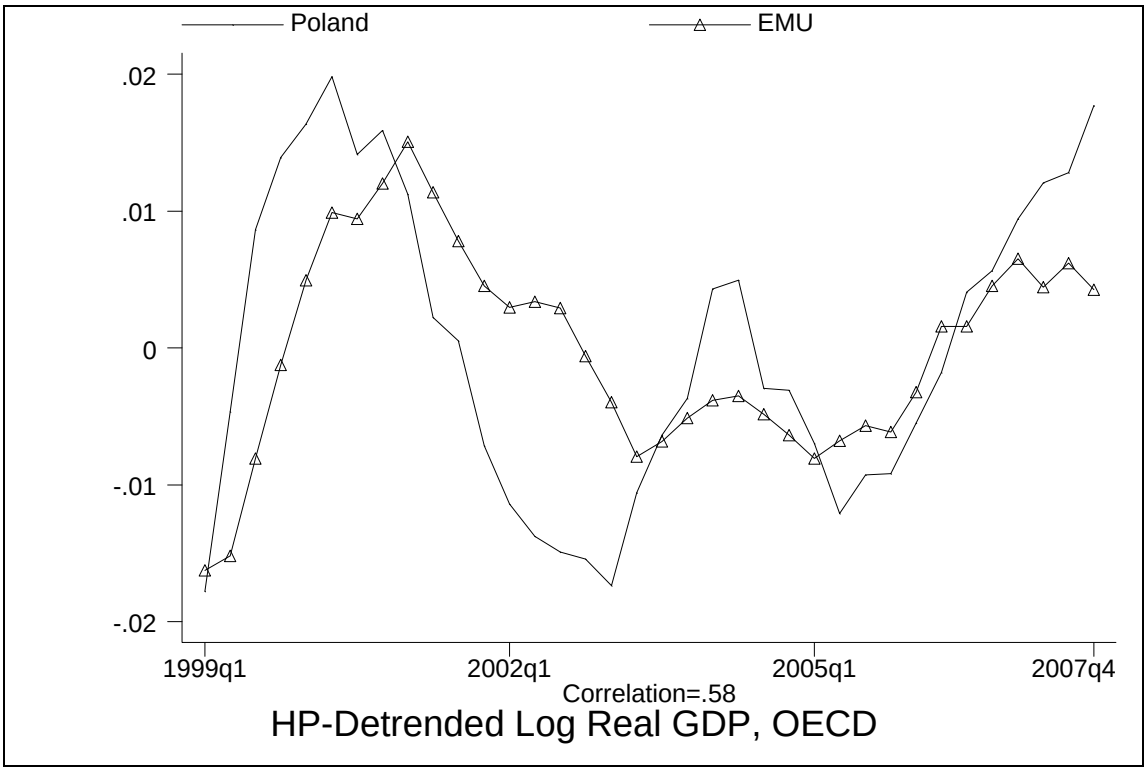
Poland
EMU
.02
.01
0
-.01
-.02
1999q1
2002q1
2005q1
2007q4
Correlation=.58
HP-Detrended Log Real GDP, OECD

Figure 5

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Endnotes

[1] Edgington's small sample correction leads to the same conclusion.
[2] http://www.cochrane-net.org/openlearning/HTML/mod13.htm. To elaborate: the fixed effect assumption is that differences across studies are only due to within-study variation. By way of contrast, random effects models consider both between-study and within-study variability and assume that the studies are a random sample from the universe of all possible studies.
[3] Different measures of real activity are available (real GDP; the unemployment rate; industrial production …), as are detrending techniques (HP-filtering; Baxter-King filtering; first-differencing; linear detrending …). These do not seem to have an appreciable difference on the results in practice.
[4] Again, Edgington's technique changes nothing.
[5] The CIA records 2007 Polish exports of $144.6 billion, imports of $160.2 billion and nominal GDP at the official exchange rate of $420.3 billion; https://www.cia.gov/library/publications/the-world-factbook/geos/pl.html#Econ. The World Bank's *World Development Indicators* gives a consistent picture; the most recent annual figure is for 2006 when merchandise trade amounted to 70% of GDP.
[6] I use 2007 bilateral trade data taken from the IMF's *Direction of Trade Statistics* and include all fifteen current members of the EMU.
[7] For the decade from 1989 through 1998, trade averaged just 40% of output for Poland, according to *WDI* data.
[8] I use the standardized OECD unemployment rate for all persons, SA.
[9] I use OECD data on real GDP.
[10] This degree of BCS is broadly comparable to that of existing members of EMU. By way of comparison, the average correlation coefficient for detrended output for two randomly chosen countries would be between .1 and .25, depending somewhat on the exact de-trending procedure.