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Vulnerability to Shocks in EMU: 1991–2004*

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Abstract
We analyze the nature of economic shocks hitting European Economic and Monetary Union (EMU) member countries from 1991 to 2004, as well as for two sub-periods before and after the launch of EMU. To this end, we first evaluate the relative importance of symmetric versus asymmetric shocks, and then extract their temporary component. Our final aim would be assessing the vulnerability of EMU to transitory asymmetric shocks, that is, to the most harmful situation for the operation of a monetary union. Overall, our results show that in the period of analysis, symmetric shocks predominated over asymmetric shocks, but the temporary component of asymmetric shocks was higher than that of symmetric shocks.

1. Introduction

Starting on 1 January 1999, 12 European countries formed the so-called Economic and Monetary Union (EMU). However, as stressed by the literature on optimum currency areas initiated in (Mundell, 1961), the presence of asymmetric shocks (i.e., those requiring a different optimal policy response in different countries) represents a potential difficulty for the adequate working of a monetary union. The argument is well known: a common monetary policy for all the member countries of the union cannot be the proper instrument when facing asymmetric shocks. The ultimate reason is that for each member country forming a monetary union means not only surrendering monetary policy independence, but also losing the exchange rate vis-à-vis the other members of the union as a potential shock absorber; this in turn raises the importance of fiscal policy in order to cope with asymmetric shocks (see, e.g., (Bajo-Rubio, Díaz--Roldán, 2003)). Accordingly, in the years before the start of EMU a large number of empirical studies tried to characterize, using different methodologies, the kind of shocks affecting the European economies as well as the main features of their business cycle. A non-exhaustive list would include, among others, (Cohen, Wyplosz, 1989), (Bayoumi, Eichengreen, 1993), (von Hagen, Neumann, 1994), (Helg et al., 1995), (Bayoumi, Prasad, 1997), (Forni, Reichlin, 2001), (Barrios, de Lucio, 2003) and (Artis et al., 2004); an up-to-date review of the issue is provided in (De Grauwe, 2005).

In an influential contribution, Cohen and Wyplosz (1989) argued that it is not enough to determine whether shocks are symmetric or asymmetric. They argue that, due to the presence of an externality in the trade balance of a monetary union, the distinction between permanent and transitory shocks would also be relevant. In particular, asymmetric *and* temporary shocks would be those that are potentially more harmful for the operation of a monetary union.

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On the other hand, Frankel and Rose (1998) claim that greater economic integration would lead to increased trade, which would result in more highly correlated business cycles. This effect, however, might be offset if (as argued by, e.g., Krugman, (1993)) an increase in industrial specialization across countries would develop, resulting in more asynchronous business cycles after an industry-specific shock. Still, Frankel and Rose present evidence supporting their hypothesis from twenty industrialized countries over a thirty-year period. As an implication of these results, Frankel and Rose argue that, by expanding trade among members and increasing the correlation of their business cycles, EMU might be more desirable *ex post* than *ex ante*.

Some evidence supporting the above-mentioned ideas is provided in (Rose, Engel, 2002) using a sample of 210 countries between 1960 and 1996. Rose and Engel conclude that countries that are members of a currency union would have more trade and more highly synchronized business cycles in comparison with countries having their own currencies. In turn, Alesina et al. (2002) find, from a similar data set, that the formation of a monetary union would tend to increase the volume of bilateral trade and the co-movement of prices among members, but would not be systematically related to the co-movement of outputs. However, Tenreyro and Barro (2007) observe that the estimation of the effects of a monetary union on economic variables could be affected by a problem of endogeneity. Once this problem is addressed, using an instrumental variables approach, Tenreyro and Barro ascertain that the co-movement of outputs would actually decrease following the formation of a monetary union, which they interpret as consistent with the view that currency unions lead to greater sectoral specialization. Notice, on the other hand, that none of these papers analyze the case of EMU.

In this paper we re-examine the issue of the nature of the shocks hitting the EMU member countries, *before and after* the start of EMU, following Cohen and Wyplosz's (1989) approach. In particular, we should be able to assess whether the formation of EMU had led to a greater similarity of the participating economies (confirming Frankel and Rose's arguments) or, on the contrary, to an increase in specialization, which would have important consequences on the working of EMU in practice. The underlying framework and empirical methodology, together with the main results, are presented in the next section; the final section concludes.

2. Methodology and Empirical Results

The argument on the relevance of the degree of temporariness of the shocks for a monetary union relies on Cohen and Wyplosz's (1989) concept of "trade balance externality". These authors consider the case of a monetary union made up of two identical countries. The trade balance of the union with the rest of the world is determined by the common real exchange rate, and each country's trade balance is equal to one half of the union's trade balance. Then, the externality arises because each country does not necessarily perceive the relationship between its own trade balance and the common real exchange rate. Take the case of, e.g., a depreciation of the union's real exchange rate. This would lead each country to overestimate the responsiveness of its own trade balance, for two reasons. First, if the partner's trade balance is taken as given, a country expects that all the effect of the depreciation will be reflected one-for-one in its own trade balance. But, since the imports from the rest of the world become more expensive, this country also expects that the depreciation

will worsen the partner's trade balance, which implies an additional improvement in its own trade balance.

Given this externality, Cohen and Wyplosz argue, whether the shocks potentially affecting a monetary union are permanent or transitory becomes crucial, in addition to their characterization as symmetric or asymmetric. The basic argument runs as follows. Faced with a permanent (symmetric or asymmetric), e.g., adverse output shock, a country would respond optimally through the corresponding fall in demand, so the trade balance would remain in equilibrium. Conversely, if the shock was both transitory and asymmetric, the optimal response would now be to maintain spending roughly unchanged, which would be achieved through a trade deficit (surplus) via a real exchange rate appreciation (depreciation) in the country where output falls (rises). However, not only the optimal response to the shock in each country will hurt the other, due to its asymmetric nature, but, in the search of a new equilibrium, both countries would overreact, failing to recognize the trade balance externality that appears in a monetary union. Finally, notice that this inefficiency would also occur in the case of a transitory and symmetric shock although to a lesser extent, since now both countries would call for the same response to the shock. As a consequence, transitory asymmetric shocks would be those more potentially harmful for the operation of a monetary union.

Cohen and Wyplosz also propose a simple method for assessing the relative importance of symmetric versus asymmetric shocks, and of permanent versus temporary shocks. If we denote as X_1 and X_2 the levels of a particular variable for two economies:

First, symmetric shocks are captured by their sum, $X_1 + X_2$, and asymmetric shocks by their difference, $X_1 - X_2$. The relative importance of symmetric versus asymmetric shocks would be evaluated by their corresponding standard deviations.[1]

Second, the temporary component of both symmetric and asymmetric shocks is calculated. The ratio of the standard deviation of these temporary components over the standard deviation of each original series would measure the extent of permanent versus temporary shocks, for either symmetric or asymmetric shocks.

This identification of symmetric and asymmetric shocks with the sum and the difference of X_1 and X_2 is reminiscent of Aoki (1981). Notice that, in the two-country case, asymmetric shocks would include both country-specific shocks, i.e., those affecting one of the countries but not the other, as well as those shocks that affect the two countries but lead to opposite effects in each of them, thus requiring

[1] Notice that, denoting as var and cov the variance and covariance, respectively:

$$\text{var}\,(X_1 + X_2) = \text{var}\,(X_1) + \text{var}\,(X_2) + 2\,\text{cov}\,(X_1, X_2)$$
$$\text{var}\,(X_1 - X_2) = \text{var}\,(X_1) + \text{var}\,(X_2) - 2\,\text{cov}\,(X_1, X_2)$$

so that the standard deviation of $(X_1 + X_2)$ will be higher (lower) than the standard deviation of $(X_1 - X_2)$, provided that the covariance between X_1 and X_2 was positive (negative). In other words, when symmetric and asymmetric shocks are identified this way, the former will be quantitatively more (less) important than the latter if the real GDP of economy 1 is positively (negatively) correlated with that of economy 2. In the same way, the relative importance of both kinds of shocks (symmetric versus asymmetric) will be higher the greater, in absolute value, the (positive or negative) correlation between the levels of real GDP of the two economies.

a different policy response. On the other hand, regarding the temporary component of shocks, recall that the objective of this empirical approach is not to separate out trend and temporary components, but rather to compare the relative proportion of the temporary component for the sum and the difference of X_1 and X_2, which reveal symmetric and asymmetric shocks, respectively; see (Cohen, Wyplosz, 1989, p. 322).

In their original contribution, Cohen and Wyplosz applied this procedure to the real GDP, GDP deflator, and real wages of France and Germany for the period 1965–1987. The results suggested that symmetric shocks were much larger than asymmetric shocks, but the predominance of transitory shocks was greater for the latter. The procedure was repeated to analyze the kind of shocks experienced by "Europe" (consisting of the sum of France and Germany) and the United States, obtaining somewhat different results; in particular, it was no longer true that symmetric shocks prevail over asymmetric shocks, and there was no overwhelming association between temporariness and asymmetric shocks. From this evidence, they concluded that, from the point of view of the shocks they faced, a monetary union would make more sense between France and Germany than between "Europe" and the United States.

Note that Cohen and Wyplosz did not provide a systematic application of this methodology to all potential candidate countries for EMU membership in order to analyze the nature of the shocks they faced, as we will do in this paper. More precisely, they presented a simple illustration in the context of a broader discussion of some of the main issues in the debate at that time on the formation of EMU, such as the extent of seigniorage and the role of the European Monetary System in dealing with the trade balance externality.

In this section we apply the above method to real GDP data (in millions of euros, at 1995 prices and exchange rates, seasonally adjusted), for all the countries participating in EMU (except Luxembourg), against the whole euro zone (excluding the country concerned in each case). In addition, we have also considered the case of the three EU members that chose not to participate in EMU from the start, i.e., Denmark, Sweden, and the United Kingdom. The data are quarterly, covering the period from 1991.I through 2004.IV (except for Ireland, Portugal and Sweden, where the data are available from 1997.I, 1995.I, and 1993.I, respectively), and are taken from Eurostat. Finally, the exercise has been performed for the whole period, and for the two subperiods 1991.I–1998.IV and 1999.I–2004.IV, in order to assess whether the nature of the shocks faced by the European economies would have changed before and after the start of EMU.

The results for the whole period are presented in *Table 1*. *Part A* of the table shows the size of symmetric and asymmetric shocks, as measured by their standard deviation. In addition, we also present the variances and covariances of the GDPs of every country in the table and that of the euro zone (excluding the country concerned in each case). *Part B* of the table, in turn, shows the temporary component of both symmetric and asymmetric shocks, as measured by the ratio of the standard deviation of the temporary component to the standard deviation of the original series, in percentage. The temporary component has been calculated using three alternative methods: a linear trend, a quadratic trend, and the Hodrick-Prescott filter.

As can be seen, when measured by their standard deviations, symmetric shocks were quantitatively more important than asymmetric shocks for all of the EMU

TABLE 1 Vulnerability to Shocks in EMU: Whole Period 1991.I–2004.IV

Part A Symmetric vs. Asymmetric Shocks

	Symmetric	Asymmetric	var (X_1)	var (X_2)	cov (X_1,X_2)
Belgium	0.0740	0.0042	0.001378	0.001421	0.001364
Germany	0.0690	0.0213	0.000600	0.002059	0.001078
Greece	0.0887	0.0220	0.003018	0.001236	0.001846
Spain	0.0891	0.0168	0.002840	0.001348	0.001914
France	0.0748	0.0037	0.001383	0.001480	0.001399
Ireland	0.0924	0.0477	0.005071	0.000525	0.001566
Italy	0.0678	0.0118	0.000824	0.001592	0.001116
Netherlands	0.0836	0.0126	0.002227	0.001416	0.001708
Austria	0.0769	0.0055	0.001579	0.001452	0.001473
Portugal	0.0616	0.0092	0.001089	0.000902	0.000928
Finland	0.0959	0.0229	0.003530	0.001424	0.002170
Denmark	0.0783	0.0083	0.001706	0.001456	0.001518
Sweden	0.0789	0.0094	0.001959	0.001267	0.001534
United Kingdom	0.0874	0.0136	0.002532	0.001456	0.001865

Part B Temporary Component of the Shocks (%)

	Symmetric			Asymmetric		
	L	Q	HP	L	Q	HP
Belgium	15.74	14.96	9.68	99.32	84.77	76.52
Germany	21.54	20.29	9.70	29.21	16.37	12.12
Greece	22.74	15.65	7.67	55.76	36.42	22.71
Spain	20.96	18.14	7.50	30.40	23.79	17.24
France	21.86	19.43	9.18	92.09	84.49	68.96
Ireland	19.16	8.86	11.33	19.16	11.99	13.69
Italy	21.47	20.48	9.95	38.27	25.00	19.96
Netherlands	22.25	22.23	8.34	72.71	85.16	22.79
Austria	19.60	19.14	7.45	95.22	66.67	53.14
Portugal	25.68	12.87	11.01	99.32	37.30	40.26
Finland	23.41	21.69	9.56	47.49	46.87	30.82
Denmark	20.49	20.44	8.74	94.10	64.75	42.91
Sweden	11.57	10.08	7.73	42.87	38.93	34.74
United Kingdom	17.94	17.29	6.25	45.70	41.67	25.21

Notes: [a] Part A: The first two columns show the standard deviations of $X_1 + X_2$ and $X_1 - X_2$, and the last three the variances and covariances of X_1 and X_2, where X_1 and X_2 denote, respectively, the (log of the) GDP for every country in the table and the euro zone (excluding the country concerned in each case).

[b] Part B: Ratio of the standard deviation of the temporary component to the standard deviation of $X_1 + X_2$ or $X_1 - X_2$, for symmetric and asymmetric shocks, respectively, in percentage. L, Q, and HP denote the method used to smooth the original series, i.e., a linear trend, a quadratic trend, and the Hodrick-Prescott filter, respectively. The smoothing parameter for the Hodrick-Prescott filter is 1600.

countries over the period of analysis, reflecting the presence of a positive covariance of the real GDP of each EMU member country and that of the rest of the euro zone. The countries where asymmetric shocks were larger are Ireland, Finland, Greece and Germany, and the opposite occurred in the case of France, Belgium and Austria. On the other hand, the variability of the own GDP was higher than that of the rest of EMU in the case of Greece, Spain, Ireland, the Netherlands, and Finland. The opposite result holds for Germany and Italy, whereas for the rest of the countries the weights of the variability of the own output, that of the rest of EMU, and

TABLE 2 Vulnerability to Shocks in EMU: Subperiod 1991.I–1998.IV

Part A Symmetric vs. Asymmetric Shocks

	Symmetric	Asymmetric	var (X_1)	var (X_2)	cov (X_1,X_2)
Belgium	0.0371	0.0034	0.000392	0.000305	0.000332
Germany	0.0330	0.0076	0.000175	0.000401	0.000251
Greece	0.0377	0.0067	0.000428	0.000308	0.000335
Spain	0.0409	0.0077	0.000579	0.000288	0.000391
France	0.0333	0.0043	0.000228	0.000336	0.000264
Ireland	0.0292	0.0150	0.000490	0.000052	0.000138
Italy	0.0338	0.0035	0.000258	0.000320	0.000274
Netherlands	0.0451	0.0117	0.000802	0.000285	0.000460
Austria	0.0392	0.0058	0.000485	0.000303	0.000365
Portugal	0.0314	0.0094	0.000413	0.000127	0.000211
Finland	0.0492	0.0174	0.001067	0.000299	0.000515
Denmark	0.0442	0.0104	0.000726	0.000308	0.000449
Sweden	0.0393	0.0068	0.000523	0.000273	0.000359
United Kingdom	0.0467	0.0128	0.000868	0.000308	0.000490

Part B Temporary Component of the Shocks (%)

	Symmetric			Asymmetric		
	L	Q	HP	L	Q	HP
Belgium	26.12	17.92	19.30	76.50	80.75	75.07
Germany	26.08	17.15	18.76	51.86	28.50	34.10
Greece	35.51	17.13	21.62	97.62	74.23	79.24
Spain	30.37	13.68	17.72	61.13	25.24	33.99
France	28.39	16.11	18.83	58.05	56.63	52.87
Ireland	21.24	12.63	21.18	24.74	20.82	24.70
Italy	27.80	18.87	20.21	82.08	78.33	75.18
Netherlands	22.89	10.69	13.52	22.78	16.22	17.20
Austria	18.56	10.92	12.53	48.71	38.80	39.19
Portugal	11.71	6.40	11.09	24.19	24.17	24.12
Finland	41.06	16.01	22.31	74.97	34.57	43.88
Denmark	21.84	16.66	16.97	43.86	42.20	40.01
Sweden	19.93	11.97	11.74	19.04	34.15	38.83
United Kingdom	17.39	10.84	11.93	31.81	30.56	29.18

Notes: See Table 1.

the covariance were roughly similar. However, when computing their temporary component, this was clearly higher for asymmetric than for symmetric shocks, with the exceptions of Germany, Ireland, and, to a lesser extent, Spain and Italy. Finally, the pattern for the three countries that chose not to participate in EMU is not very different from that followed by the rest.

The results before and after the start of EMU appear in *Table 2* and *Table 3*, respectively. First, according to their standard deviations shown in *Part A* of both tables, the weight of asymmetric shocks increased, from the first subperiod to the second, for Ireland, Greece, Germany, Belgium, Italy and, very slightly, Spain and Austria. Conversely, asymmetric shocks became relatively less important, once EMU came into force, only for Finland, the Netherlands, France and Portugal (very slightly

TABLE 3 Vulnerability to Shocks in EMU: Subperiod 1999.I–2004.IV

Part A Symmetric vs. Asymmetric Shocks

	Symmetric	Asymmetric	var (X_1)	var (X_2)	cov (X_1,X_2)
Belgium	0.0273	0.0071	0.000158	0.000230	0.000173
Germany	0.0264	0.0127	0.000056	0.000375	0.000129
Greece	0.0433	0.0213	0.001028	0.000138	0.000341
Spain	0.0357	0.0081	0.000457	0.000216	0.000291
France	0.0299	0.0028	0.000211	0.000240	0.000212
Ireland	0.0582	0.0298	0.001930	0.000214	0.000599
Italy	0.0258	0.0069	0.000094	0.000264	0.000149
Netherlands	0.0243	0.0078	0.000082	0.000246	0.000128
Austria	0.0265	0.0062	0.000130	0.000237	0.000163
Portugal	0.0235	0.0087	0.000078	0.000236	0.000114
Finland	0.0349	0.0076	0.000408	0.000230	0.000278
Denmark	0.0264	0.0047	0.000153	0.000276	0.000194
Sweden	0.0320	0.0047	0.000294	0.000232	0.000241
United Kingdom	0.0339	0.0058	0.000361	0.000232	0.000268

Part B Temporary Component of the Shocks (%)

	Symmetric			Asymmetric		
	L	Q	HP	L	Q	HP
Belgium	30.11	21.82	26.04	87.64	68.65	77.76
Germany	35.40	20.14	28.17	24.63	21.25	22.51
Greece	14.32	11.52	12.86	23.01	20.93	21.71
Spain	21.70	12.40	17.32	41.20	30.99	35.64
France	31.58	18.94	25.39	95.40	87.01	89.57
Ireland	23.16	12.67	19.00	22.10	19.56	21.04
Italy	34.77	18.75	27.36	29.41	26.51	27.55
Netherlands	40.90	22.82	32.34	26.99	26.97	26.78
Austria	28.42	18.94	23.45	72.84	51.29	61.89
Portugal	44.87	23.79	35.06	36.97	35.83	36.30
Finland	21.77	16.75	18.88	70.20	53.57	61.31
Denmark	29.25	49.38	23.74	65.10	78.95	56.21
Sweden	23.33	16.44	19.62	87.14	63.34	74.62
United Kingdom	19.89	13.82	16.63	65.15	31.91	50.41

Notes: See Table 1.

in this case), and, interestingly, for the three "outsiders" (Denmark, Sweden and the United Kingdom). On the other hand, the variability of the own GDP decreased in all cases, with Greece and Ireland being the only exceptions; and the variability of the GDP of the rest of EMU slightly decreased, except in the case of Ireland and Portugal. The covariance, in turn, experienced also a generalized decrease, with the exception, again, of Ireland, and was roughly unchanged for Greece.

We now turn to the temporary component of shocks, shown in *Part B* of both tables. As can be seen, in the second subperiod the temporary component of symmetric shocks decreased, or remained at similar levels, for France, Greece, Italy, Ireland, Finland, and Spain, and increased for the rest of the countries. Finally, the temporary component of asymmetric shocks remained roughly unchanged in the EMU subpe-

TABLE 4 Vulnerability to Shocks in EMU: Differences Across Subperiods

	Symmetric vs. asymmetric shocks		Temporary component of the shocks					
	Sym-metric	Asym-metric	Symmetric			Asymmetric		
			L	Q	HP	L	Q	HP
Belgium	1.3518	0.6557	1.1729	1.1102	1.0023	0.5723	0.7713	0.6330
Germany	1.2428	0.5945	0.9158	1.0582	0.8279	1.2518	0.7974	0.9005
Greece	0.8668	0.3130*	2.1482*	1.2891	1.4568	1.3278	1.1096	1.1420
Spain	1.1372	0.9527	1.5914	1.2551	1.1636	1.4135	0.7759	0.9086
France	1.1072	1.5010	0.9956	0.9416	0.8214	0.9134	0.9770	0.8859
Ireland	0.5259	0.5264	0.4824	0.5240	0.5860	0.5893	0.5605	0.6178
Italy	1.3008	0.5067	1.0403	1.3093	0.9610	1.4137	1.4971	1.3825
Netherlands	1.8405	1.4910	1.0302	0.8621	0.7695	1.2586	0.8967	0.9581
Austria	1.4697	1.0957	0.9600	0.8473	0.7855	0.7327	0.8288	0.6939
Portugal	1.3534	1.0923	0.3535*	0.3643*	0.4284	0.7149	0.7369	0.7257
Finland	1.4047	2.2687*	2.6488*	1.3429	1.6597	2.4231*	1.4642	1.6239
Denmark	1.6680	2.1774*	1.2455	0.5628	1.1923	1.4670	1.1640	1.5498
Sweden	1.2251	1.4412	1.0465	0.8924	0.7332	0.7520	0.7770	0.7499
United Kingdom	1.3697	2.1912*	1.1973	1.0742	0.9830	1.0699	2.0981	1.2686

Note: F-test statistic of the equality of two variances; * denotes significance at the 5% level.

riod for Belgium, Spain, Ireland, and Finland; it fell only for Germany, Greece, and Italy, and increased for France, the Netherlands, Austria, Portugal, and the three "outsiders" (Denmark, Sweden and the United Kingdom).

In summary, the importance of asymmetric shocks decreases in a few cases (despite the general decrease in output variability), and the same can be said about the degree of temporariness of asymmetric shocks. Accordingly, there is not much room for discerning a particularly differentiated pattern across countries from the first subperiod to the second.

Finally, in order to check whether the differences in the results from *Table 2* and *Table 3* are significant or not, we have performed a simple test of the equality of two variances. In its general form, for any two variables x and y, this test involves computing the test statistic:

$$\frac{m-1}{n-1}\frac{\sum_{i=1}^{n}\left(x_i-\bar{x}\right)^2}{\sum_{i=1}^{m}\left(y_i-\bar{y}\right)^2}$$

which, under the null hypothesis of equality of the two variances, is distributed as a Snedecor's F with $m-1$ and $n-1$ degrees of freedom. This test has been applied to the variability of symmetric and asymmetric shocks, and their temporary component, i.e., the (square of) the denominator and numerator of the ratios shown in *Part B* of *Tables 2 and 3*, respectively. The results appear in *Table 4* and, as can be seen, the null hypothesis cannot be rejected at the 5% level in most cases. Thus, according to the results of the test, the implementation of EMU would not have led,

at least in the first years, to significant changes in the characteristics of the shocks affecting the EMU member countries on statistical grounds.

3. Conclusions

In this paper we have analyzed the nature of the shocks hitting the EMU member countries over the period 1991–2004, as well as for the two subperiods before and after the start of EMU, following the approach of Cohen and Wyplosz (1989). According to our results, during the whole period symmetric shocks predominated over asymmetric shocks; however, the temporary component of asymmetric shocks was higher than that of symmetric shocks. In other words, although asymmetric shocks were less important in quantitative terms than symmetric shocks, when they did occur they were potentially more harmful.

These results, on the other hand, would not be too different from those found for the three countries that chose not to participate in EMU from its start (i.e., Denmark, Sweden and the United Kingdom), unlike the case of the Central and Eastern European countries analyzed in a companion paper. According to the results in (Bajo--Rubio, Díaz-Roldán, 2005), the predominance of symmetric shocks was lower, and the temporary component of asymmetric shocks higher, than in the case of the EMU members, with Hungary, Slovenia and, to a lesser extent, Poland facing a more favourable situation.[2]

In addition, we analyzed the change across the two subperiods, before and after the start of EMU in January 1999. First, the importance of asymmetric shocks decreased only in the cases of Finland, the Netherlands, France and Portugal, as well as for the three "outsiders" (Denmark, Sweden and the United Kingdom); also, output variability decreased in all cases, with the only exceptions of Greece and Ireland. In turn, the degree of temporariness of asymmetric shocks decreased only for Germany, Greece, and Italy. These differences in results, however, did not prove to be significant, according to a simple test of the equality of two variances.

Although these results should be taken with caution, due to the still short period of time available for analysis, they would suggest, if anything, a certain increase in specialization in production following the formation of EMU. More importantly, our results do not allow discerning any different patterns between the European "centre" and "periphery" (as in, e.g., (Bayoumi, Eichengreen, 1993)), or for the three countries that chose not to participate in EMU from its start.

[2] In fact, Slovenia finally joined EMU in January 2007.

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