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Modelling Cyclical Divergence in the Euro Area: The Housing Channel

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ABSTRACT

Modelling cyclical divergence in the euro area: the housing channel

After the launch of the single currency the euro exchange rate fell and interest rates had converged towards the (low) German level. These shocks have worked out differently for the small and large countries. Housing markets have acted as an important vehicle of transmission of these shocks onto economic activity and inflation. Simulations with a stylised econometric model for the euro area economy, making a distinction between the small and large countries in terms of the estimated parameters, illustrate this mechanism.

JEL codes: E32, E52, F42

Keywords: Economic and monetary union, business cycles

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RÉSUMÉ

Modélisation de la divergence conjoncturelle dans la zone euro : le canal de transmission du logement

Après le lancement de la monnaie unique, le taux de change de l'euro avait baissé et les taux d'intérêt avaient convergé vers les taux allemands (qui se situaient à un bas niveau). Ces chocs se sont répercutés de manière différente sur les petites et les grandes économies. Les marchés du logement ont joué un rôle important de canal de transmission de ces chocs, en les répercutant sur l'activité économique et l'inflation. Des simulations effectuées à l'aide d'un modèle économétrique de l'économie de la zone euro, établissant une distinction entre les petites et les grandes économies en termes de paramètres estimés, illustrent ce mécanisme.

Classification : JEL: E32, E52, F42

Mots-clé : Union économique et monétaire, cycles macroéconomiques

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MODELLING CYCLICAL DIVERGENCE IN THE EURO AREA: THE HOUSING CHANNEL

Paul van den Noord [1]

Introduction

1. The efficiency gains stemming from the single currency in terms of lowering transaction costs and enhancing the internal market are considerable, but for individual countries the membership in the euro area also implies the loss of sovereign interest rate and exchange rate instruments in the pursuit of stabilisation goals. How big this potential cost is depends *inter alia* on:

- The nature and frequency of the shocks that hit individual countries;
- The degree to which the monetary transmission mechanism differs across countries;
- The effectiveness of automatic fiscal stabilisers and other adjustment mechanisms.

2. Moreover, the run-up to and the adoption of the single currency itself may have represented a major shock to which individual countries have responded differently and to which they may still be adjusting. This may mask any underlying tendency towards a convergence of business cycles. A number of these start-up shocks can be identified, including misalignment of real exchange rates (Germany entered the area with an overvalued exchange rate while other countries enjoyed a boost from an undervalued exchange rate), real interest rate shocks (monetary union has meant sharply lower real interest rates for some countries with histories of higher inflation and conversely for others with histories of lower inflation) and rising capital mobility (with foreign direct investment benefiting also the "periphery" of the area which became less prone to exchange rate shocks).

3. The academic literature on cyclical convergence in the euro area is vast and rapidly expanding, but there are not that many papers explicitly looking at the relevance of the institutional features of housing markets as a driver of cyclical divergence. A good example of how such a relationship may be modelled is found in a recent paper by Arnold and Kool (2003) to explain cyclical divergence among US states. The present paper replicates this model for the euro area. However, while a similar model structure is adopted, this paper extends the model to allow for differences in parameters for country groups, notably for "small" and "big" countries (Arnold and Kool's model has uniform parameters across the US states). Moreover, a somewhat different model specification has been adopted, drawing on a recent paper by Honohan and Lane (2003). They, however, focus exclusively on explaining inflation differentials in the euro area.

4. The first section lays out the basic model in a stylised form. This is followed by the econometric estimation of the model and simulation results.

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1. Economics Department, OECD. The author is indebted to Jorgen Elmeskov, Peter Hoeller and Vincent Koen for comments on an earlier draft and to Marie-Christine Bonnefous for the research assistance. Any opinions expressed in this paper are the author's and should not be attributed to the Organisation or its member countries.

A stylised model

5. After the launch of the single currency the euro exchange rate fell while interest rates in most member countries had been converging towards the (low) German level. Housing markets may have acted as an important vehicle of transmission of these shocks onto economic activity and inflation. This transmission mechanism will be the main focus of our analysis.

6. The following stylised model describes the basic transmission mechanisms in an individual member country of a monetary union. It consists of a set of standard aggregate demand and aggregate supply (Phillips curve) equations determining the output gap (y) and the rate of inflation (Δp), extended with an equation for the rate of change of real house prices (Δq):

$$(1) \quad y = \alpha_1 \Delta q - \alpha_2 (e + p) - \alpha_3 (i - \Delta p) + \varepsilon_d$$

$$(2) \quad \Delta p = \beta_1 y - \beta_2 \Delta e - \beta_3 (e + p) + \varepsilon_p$$

$$(3) \quad \Delta q = -\gamma_1 (i - \Delta p) - \gamma_2 q + \varepsilon_h$$

7. Equation (1) is the aggregate demand function, relating the output gap to the real interest rate (capturing the traditional interest rate channel; i = nominal interest rate), the rate of change of real house prices (capturing a wealth effect) and the real exchange rate (capturing a competitiveness effect), which is the composite of the nominal effective exchange rate (e) and the price level (p)[2]. Equation (2) is the augmented Phillips curve, explaining inflation from the output gap, variations in the nominal effective exchange rate (to reflect the impact of changes in import prices) and the level of the real effective exchange rate. The latter captures a catch-up effect on inflation, pulling prices towards their equilibrium level consistent with purchasing power parity. The presence of a catch-up effect assumes that each individual country is well integrated in the global economy and therefore its real effective exchange rate cannot stay out of sync forever.

8. Equation (3), finally, relates real house price increases to the real interest rate and the level of real house prices. The interest rate effect on housing demand, and hence the rate of increase of house prices, runs through various channels: lower interest rates reduce the opportunity cost of capital invested in housing, reduce the servicing cost of mortgage credit and raise the present value of future household earnings. The level of real house prices exerts a negative influence on its rate of increase: as the level of house prices increases, affordability of housing diminishes and this will put downward pressure on housing demand.

9. The stylised model incorporates five exogenous shock variables: aside from the standard demand (ε_d) and price shock (ε_p) variables, there are exogenous shocks to housing prices (ε_h), to the nominal effective exchange rate (Δe) and the nominal interest rate (i). The exogeneity of the nominal interest and exchange rates aims to reflect that in a monetary union each individual member country exerts only a limited influence on its monetary conditions. An obvious extension of the model would be to partly endogenise the interest rate, by including a Taylor rule with the appropriate weight of the country concerned in the monetary union's economy. However, this would not fundamentally alter the analysis.

2. Arnold and Kool assume the United States to be a closed economy, hence e and Δe drop out of the equations.

10. It is particularly interesting to trace the impact of exogenous shocks onto the exchange rates and interest rates during the transition towards and in the immediate aftermath of the creation of the single currency. Between 1998 and 2002 the euro exchange rate fell by around a third against the US dollar, and this is expected to have affected some of the smaller euro area countries most because of their greater trade exposure. Meanwhile, interest rates in some of the smaller member countries converged towards the (low) German level. From the stylised model the following can be can be inferred:

- According to equation (2) a depreciation in the nominal exchange rate boosts inflation. This in turn leads to lower real interest rates and higher rates of change of real house prices, with the positive wealth effect and the traditional interest rate channel raising the output gap. This produces a second round of inflation as well as real house price increases, followed by subsequent rounds of price hikes. The impact on inflation peters out as the real effective exchange rate appreciates. This mechanism chokes off inflation through two channels: *via* a decline in competitiveness and *via* a convergence of the actual and equilibrium real exchange rate. The rate of increase in house prices is choked off as the level of real house prices increases and real interest rates rise.

- A fall in nominal interest rates acts not only through the traditional interest rate channel but also *via* the rate of increase in real house prices. The associated wealth effect boosts the output gap and inflation, which sparks second and third rounds of increases in real house prices, demand and inflation. As the level of real house prices and the real exchange rate increase, equilibrating forces get stronger and inflation and real house price increases taper off.

11. On theoretical grounds a real house price increase is expected to have a wealth effect on aggregate demand only if households' access to liquidity is affected or if there are asymmetries in the behaviour of existing and would-be home owners. The first condition is normally satisfied since house price increases raise the value of debtors' collateral. To the extent mortgage lenders take this into account when fixing their lending conditions, house price increases ease the liquidity constraint facing cash-strapped households. The second condition will be met if would-be home-owners view a house price increase as evidence that they may earn a capital gain if they step into the property market in time, rather than as a lost opportunity to earn a capital gain. Such a "speculative" attitude may be encouraged by lending institutions in search of market share amid a highly competitive mortgage market. Wealth effects from housing are thus most likely to occur in an environment in fairly liberal and competitive mortgage markets (OECD, 2004). Tax incentives for mortgage-financing, which increase the leverage of mortgage debt, may be an additional contributing factor.

Estimation results

12. The stylised model serves as a basis for an econometric model, which is estimated for a pool of euro area countries. A key feature of our model is that we allow for a distinction between countries that are relatively exposed to trade and ones that are less exposed. The three largest economies (Germany, France and Italy) are in the latter category and the smaller economies in the former category. The largest economies also are the least prone to housing wealth effects as their mortgage markets are relatively constrained (for example, loan-to-value ratios are low) and the tax incentives for mortgage lending are comparatively weak (Van den Noord, 2003). The reverse is generally the case for the smaller euro area economies.

13. The data source is the OECD's Analytical Data Base, except for the house price series which have been provided by the Bank for International Settlements. To estimate this model, the following approach has been adopted. First, the equation for the output gap is specified as:

$$GAP_{it} = a_{1j}GAP_{t-1} - a_{2j}RULC_{it-1} - a_{3j}\left(IR_{it-1} - 4\times\Delta P_{it-1}\right) + a_{4j}\Delta\left(H_{it-1} - P_{it-1}\right) + ... \quad (4)$$
$$... + \sum_t a_{5t}DUMT_t + \sum_i a_{6i}DUMC_i + \varepsilon_{it}^g$$

in which the subscript *i* denotes the country, the subscript *j* the country group to which country *i* belongs (big or small), *GAP* = output gap, *P* = logarithm of price level (harmonised index of consumer prices), *RULC* = logarithm of the relative trade-weighted unit labour costs in a common currency (a measure of the real effective exchange rate), *IR* = interest rate (arithmetic average of the short and long rates), *H* = logarithm of the house price index and ε = error term.[3] To control for the relative openness of the economies and the degree to which the housing wealth and interest rate effect operate the regression coefficients are allowed to take different values for small and big countries.

14. The equation incorporates two sets of dummy variables, time dummies $DUMT_t$ which take the value 1 in time *t* and zero otherwise and country dummies $DUMC_i$ which take the value 1 for country *i* and zero otherwise. The time dummies capture the symmetric (but time-variant) disturbances and the country dummies the asymmetric (but time-invariant) disturbances. The residual term captures all other (*i.e.* asymmetric time-variant) disturbances.

15. For the inflation and real house price equations the following specifications are used:

$$\Delta P_{it} = b_{1j}\Delta P_{it-1} + b_{2j}GAP_{it-1} - b_{3j}\Delta NEER_{it-1} - b_{4j}RCPI_{it-1} + \sum_t b_{5t}DUMT_t + \sum_i b_{6i}DUMC_i + \varepsilon_{it}^p \quad (5)$$

$$\Delta H_{it} - \Delta P_{it} = c_{1j}\left(\Delta H_{it-1} - \Delta P_{it-1}\right) - c_{2j}\left(IR_{it-1} - 4\times\Delta P_{it-1}\right) - c_{3j}\left(H_{it-1} - P_{it-1}\right) + ... \quad (6)$$
$$... + \sum_t c_{4t}DUMT_t + \sum_i c_{5i}DUMC_i + \varepsilon_{it}^h$$

where *NEER* denotes the logarithm of the nominal effective exchange rate and *RCPI* is the logarithm of the relative trade-weighted consumer price index in a common currency. Because the model is estimated on quarterly data, the inflation rate in the real interest rate term in equation (6) must be multiplied by four. The other mnemonics have the same meaning as in equation (4). Coefficients are again allowed to vary for small and big countries to control for differences in openness and housing market institutions.[4]

16. Since the real effective exchange rates in equations (4) and (5) follow different definitions, one based on relative unit labour costs and the other on relative consumer prices, an equation to capture the relationship between consumer prices and unit labour costs (*ULC*) has been estimated for simulation purposes. This equation reads:

$$\Delta ULC_{it} = d_{1j}\Delta ULC_{it-1} + d_{2j}\Delta P_{it-1} + d_{3j}GAP_{it-1} + \sum_t d_{4t}DUMT_t + \sum_i d_{5i}DUMC_i + \varepsilon_{it}^u \quad (7)$$

3. Attempts to obtain significant coefficients on a fiscal stance variable in the output gap equation were unsuccessful.

4. Attempts to obtain significant coefficients on demographic variables or the output gap in the house price equation were unsuccessful.

Table 1. Pooled 2SLS estimates

Equation number	(4)	(5)	(6)	(7)
Dependent variable	Output gap	Inflation	Rate of change in real house prices	Rate of change in unit labour cost
Lagged explanatory variable				
Output gap				
• big countries	0.769 (8.53)***	0.051 (1.41)*		0.297 (3.34)***
• small countries	0.816 (25.22)***	0.041 (3.31)***		0.195 (6.09)***
Inflation				
• big countries		0.121 (1.01)		0.050 (0.17)
• small countries		0.197 (4.1)***		0.304 (2.57)***
Rate of change in real house prices				
• big countries	0.080 (0.85)		0.813 (13.10)***	
• small countries	0.119 (2.82)***		0.883 (31.51)***	
Level of real house prices				
• big countries			-0.013 (-1.79)**	
• small countries			-0.022 (-6.67)***	
Real effective exchange rate				
• big countries	-0.016 (-1.32)*	-0.022 (-2.47)***		
• small countries	-0.016 (-2.11)***	-0.049 (-5.42)***		
Change in nominal effective exchange rate				
• big countries		-0.015 (-0.84)		
• small countries		-0.035 (-2.51)***		
Real interest rate				
• big countries	0.059 (1.04)		-0.164 (-4.14)***	
• small countries	-0.050 (-1.59)*		-0.205 (-9.56)***	
Estimation period	1993Q1 - 2002Q4	1993Q1 – 2002Q4	1993Q1 – 2002Q4	1993Q1 – 2002Q4
Number of observations	320	440	320	440
Countries included in the sample	All euro countries except Austria, Greece, Luxembourg and Portugal	All euro countries except Luxembourg	All euro countries except Austria, Greece, Luxembourg and Portugal	All euro countries except Luxembourg

Note: Results for time and country dummies are not shown; all variables are defined in terms of logarithms or changes in logarithms, except for the output gap and the (real) interest rate which are expressed as one-hundreds of a per cent; the real effective exchange rate is deflated by the relative trade weighted consumer price and unit labour cost index in the inflation and output price equations, respectively; the "big" countries in the sample are Germany, France and Italy and the "small" countries are Austria, Belgium, Finland, Greece, Ireland, Netherlands, Portugal and Spain; Luxembourg is not included due to lack of data for the output gap; Austria, Greece and Portugal are excluded for the real house price and output gap equations due to the absence of data for real house prices; *,**,*** denote significance at the 10, 5 and 1 per cent levels, respectively; the autoregressive term was insignificant for the unit labour cost equation and has therefore been removed from the equation.

17. The estimation results are shown in Table 1. The results confirm all the theoretical priors:

- The wealth effect on the output gap stemming from variations in real house prices is comparatively large and significant for the small countries and insignificant for the big countries;
- The competitiveness effect on the output gap is more significant for the small countries than for the big countries;
- The feedback of misalignments in the real effective exchange rates onto inflation, while significant for both groups of countries is more than twice as large for the small countries than for the big countries;
- The impact of variations in the nominal effective exchange rate on inflation is significant for the small countries and insignificant for the big countries;
- Changes in the real house price portray a stronger sensitivity to the real interest rate for the small countries than for the big countries, although this sensitivity is significant for both groups.

18. All other coefficients also look plausible, although not necessarily providing strong evidence in favour of a "big-small dichotomy":

- The feedback from misalignments in the real housing price on the rate of change in real house prices is found to be somewhat stronger for the small countries than for the big countries. This may be due to less segmentation of real estate markets in the smaller countries (as geographical conditions are more homogeneous), which may raise the speed of adjustment of house prices towards their equilibrium level;

- The direct impact of interest rates on the output gap is negative and (weakly) significant for the small countries, and insignificant (with a positive sign) for the large countries. Although it is hazardous to draw strong conclusions from this result it does suggest that the traditional interest rate channel must be rather weak, and perhaps even perverse in the big countries;

- The unit labour cost responds less strongly to the output gap in the small countries than in the big countries. This may reflect the predominance of informal incomes policy agreements in the small countries to the extent these may tend to smooth the responsiveness of wages to the cycle. Meanwhile, the unit labour cost is found to be more responsive to inflation in the small countries than in the big countries. This may again be related to informal incomes policy arrangements to the extent these incorporate price indexation mechanisms.

Simulations

19. The estimated reaction equations, completed with identities to link levels to rates of changes, can be used to construct a dynamic model for simulation purposes. The relationships are listed below (exogenous and shock variables are underlined; the model structure is identical for the big and small countries but the parameters have been taken from the regression results reported in Table 1)[5]:

$$GAP_t = a1*GAP_{t-1} - a2*(ULC_{t-1} + NEER_{t-1}) + a3*(\underline{IR}_{t-1} - 4*\Delta P_{t-1}) + a4*\Delta(H_{t-1} - P_{t-1}) + \underline{ED}$$

$$\Delta P_t = b1*\Delta P_{t-1} + b2*GAP_{t-1} - b3*\underline{\Delta NEER}_{t-1} - b4*(P_{t-1} + NEER_{t-1}) + \underline{EP}$$

$$\Delta H_t = \Delta P_t + c1*(\Delta H_{t-1} - \Delta P_{t-1}) - c2*(\underline{IR}_{t-1} - 4*\Delta P_{t-1}) - c3*(H_{t-1} - P_{t-1}) + \underline{EH}$$

$$\Delta ULC_t = d2*\Delta P_{t-1} + d3*GAP_{t-1}$$

$$P_t = P_{t-1} + \Delta P_t$$

$$NEER_t = NEER_{t-1} + \underline{\Delta NEER}_t$$

$$ULC_t = ULC_{t-1} + \underline{\Delta ULC}_t$$

$$H_t = H_{t-1} + \Delta H_t$$

5. However, the wrongly-signed but non-significant coefficient for the real interest rate in the demand equation for the big countries was set to zero.

20. The first illustrative simulation that has been run is a one-off permanent 5 per cent demand shock. The results are shown in Table 2 and Figure 1 (Figures are included at the end of the paper). In both group of countries the impact on the output gap peters out after about 10 quarters, due to an erosion of competitiveness as inflation picks up. The response of house prices is somewhat stronger and more cyclical in the smaller countries than in the big ones. A simulated one-off permanent shock to the overall price level yields a similar profile for house price developments, as shown in Table 3 and Figure 2. However, the impact on the output gap is small, although it is slightly bigger in the group of smaller countries. The impact of a 5 per cent one-off permanent shock to house prices (Table 4 and Figure 3) on the output gap is again small (but initially clearly positive), while overall inflation hardly responds.

Table 2. Simulation of a 5 per cent aggregate demand shock

Deviations from baseline, per cent

	Quarters after shock					
	1	2	3	4	8	12
Big countries						
Output gap	3.8	2.9	2.1	1.6	0.4	-0.1
Overall inflation[1]	1.0	0.9	0.7	0.5	0.0	-0.1
House price inflation[1]	1.0	1.6	1.8	1.8	0.9	-0.1
Small countries						
Output gap	4.1	3.3	2.6	2.1	0.9	0.2
Overall inflation[1]	0.8	0.8	0.6	0.4	0.0	-0.1
House price inflation[1]	0.8	1.5	1.8	2.0	1.2	-0.3

1. Annualised rate.

Table 3. Simulation of a 5 per cent shock to overall inflation

Deviations from baseline, per cent

	Quarters after shock					
	1	2	3	4	8	12
Big countries						
Output gap	-0.3	-0.2	-0.1	0.0	0.1	0.0
Overall inflation[1]	0.5	-0.1	-0.2	-0.2	-0.1	-0.1
House price inflation[1]	3.8	2.8	2.1	1.4	-0.1	-0.7
Small countries						
Output gap	-0.2	-0.1	0.1	0.2	0.2	0.0
Overall inflation[1]	0.7	-0.2	-0.3	-0.3	-0.2	-0.2
House price inflation[1]	4.8	4.0	3.0	2.1	-0.6	-2.0

1. Annualised rate.

Table 4. Simulation of a 5 per cent shock to house price inflation

Deviations from baseline, per cent

	Quarters after shock					
	1	2	3	4	8	12
Big countries						
Output gap	0.1	0.2	0.2	0.2	0.1	0.0
Overall inflation[1]	0.0	0.0	0.0	0.0	0.0	0.0
House price inflation[1]	4.0	3.2	2.4	1.8	0.2	-0.6
Small countries						
Output gap	0.1	0.3	0.3	0.3	0.2	0.0
Overall inflation[1]	0.0	0.0	0.0	0.1	0.0	0.0
House price inflation[1]	4.3	3.6	3.0	2.3	0.1	-1.4

1. Annualised rate.

21. The next simulation is a depreciation of the nominal effective exchange rate by 4½ per cent. This is the order of magnitude of the exchange rate shock to which the member countries were exposed on average in the first two years of the single currency, although this shock was more drawn out than simulated here. It is roughly equivalent to a drop in the nominal effective exchange rate for the area as a whole by 10 per cent, reflecting that on average the share of extra-area trade in total foreign trade is around 40 per cent.[6]Table 5 and Figure 4 show the results. The differences between the small and big country groups' results are indeed very striking. The boost to (nominal and real) house prices, inflation and the output gap is much larger in the small countries than in the big countries. Moreover, while house prices tend to converge relatively quickly towards their (new) equilibrium level in the big countries, they are strongly overshot and then undershot in the small countries.[7] Hence, the small countries would go through a pronounced boom and bust, which is reflected also in a greater cyclicality of the output gap in response to the shock.

22. Finally, a one-off permanent cut in the nominal interest rate by 1 per cent has been simulated for both groups of countries. In reality the small countries have been exposed to a stronger (favourable) interest rate shocks in the run-up to the single currency than the large ones (except Italy), but for the sake of comparability the same shock has been simulated for both groups. The results are shown in Table 6 and Figure 5. In this simulation the differences between the two country groups are somewhat less pronounced, but still striking. The order of magnitude of the inflation effect is similar as for the exchange rate shock. This suggests that an increase in the interest rate by 1 percentage point would be roughly sufficient to offset the inflationary impact of a 4½ per cent negative exchange rate shock.

6. In reality, the spread around this number can be large. For example, at one extreme, an effective depreciation of the euro by 10 per cent would mean a 9 per cent depreciation in nominal effective terms for Ireland, reflecting its large exposure to non-euro area trade. For the two country groups as a whole, however, the average relationship of 4 to 10 roughly holds.

7. However, eventually they will also converge to equilibrium for the small country.

Table 5. Simulation of a 4½ per cent depreciation of the nominal effective exchange rate

Deviations from baseline, per cent

	Quarters after shock					
	1	2	3	4	8	12
Big countries						
Output gap	0.1	0.1	0.1	0.1	0.2	0.3
Overall inflation[1]	0.7	0.5	0.4	0.4	0.4	0.4
House price inflation[1]	0.7	0.9	1.1	1.3	1.5	1.3
Small countries						
Output gap	0.1	0.1	0.1	0.2	0.4	0.5
Overall inflation[1]	1.5	1.1	1.0	0.9	0.8	0.6
House price inflation[1]	1.5	2.4	3.0	3.4	3.8	2.8

1. Annualised rate.

Table 6. Simulation of a permanent 1 percentage-point fall in the interest rate

Deviations from baseline, per cent

	Quarters after shock					
	1	2	3	4	8	12
Big countries						
Output gap	0.0	0.0	0.0	0.1	0.1	0.2
Overall inflation[1]	0.0	0.0	0.0	0.0	0.0	0.0
House price inflation[1]	0.7	1.2	1.6	1.9	2.5	2.4
Small countries						
Output gap	0.0	0.1	0.2	0.3	0.5	0.7
Overall inflation[1]	0.0	0.0	0.0	0.0	0.1	0.1
House price inflation[1]	0.8	1.5	2.1	2.7	3.7	3.4

1. Annualised rate.

Concluding remarks

23. Our analysis provides evidence that the fall of the euro exchange rate after and the fall in interest rates prior to the launch of the single currency have worked out differently for the small and large countries. The simulations with a stylised econometric model for the euro area economy, making a distinction between the small and large countries in terms of the estimated parameters, illustrate this mechanism. Housing markets seem to have acted as an important vehicle of transmission of these shocks onto economic activity and inflation. Small countries portray significantly greater sensitivity to these shocks than the big countries, which can be traced back to the greater exposure to fluctuations in the (effective) euro exchange rate, international competitiveness and real interest rates of the former.

24. The upshot is that monetary transmission through the housing channel is stronger in the smaller countries than in the larger ones. Structural reform (including tax reform) which leads to a more even monetary transmission through the housing channel should be undertaken primarily for the sake of economic efficiency, but it may also enhance the monetary transmission in the euro area as a whole. However, for such reform to be successful it is crucial that a financial system is in place that is robust in the face of asset bubbles. If banks misjudge risks during the business cycle, underestimating them in good times and overestimating them in bad times, the potential for credit and asset booms and busts are increased, thereby destabilising the economy.

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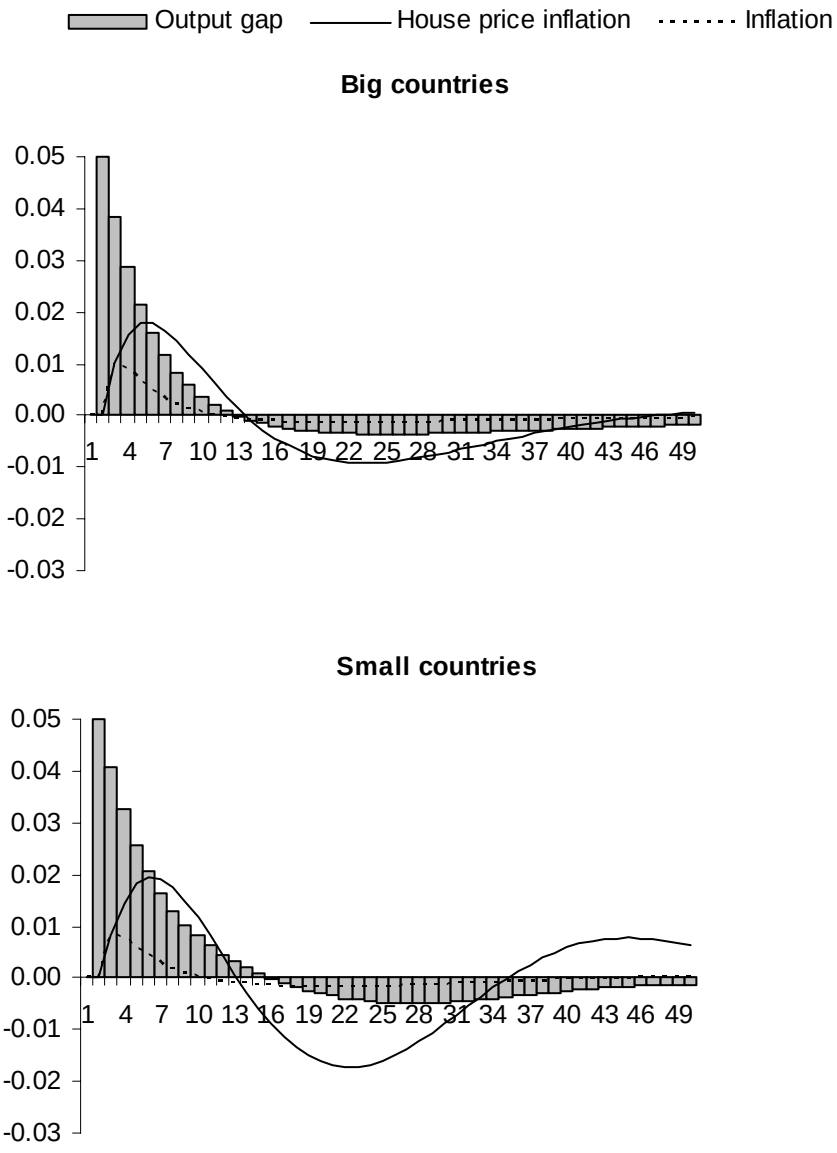
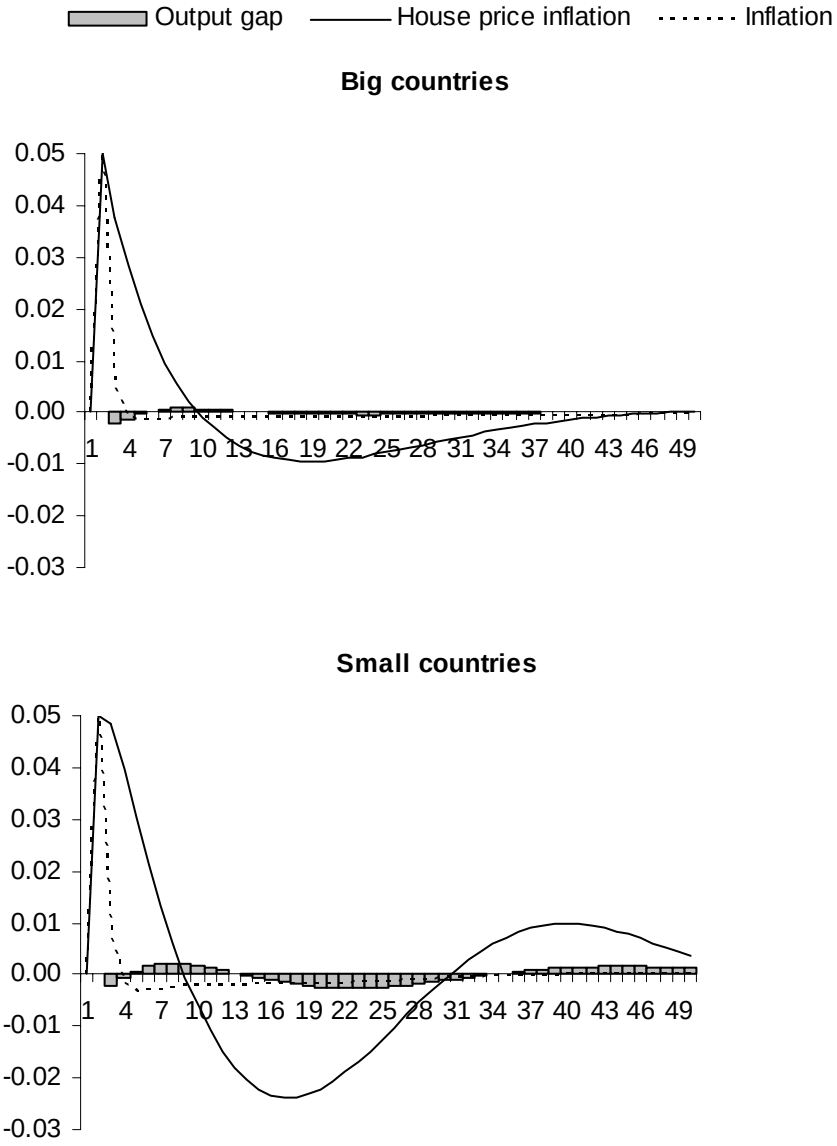
ANNEX A

Figure 1. Impact of an aggregate demand shock



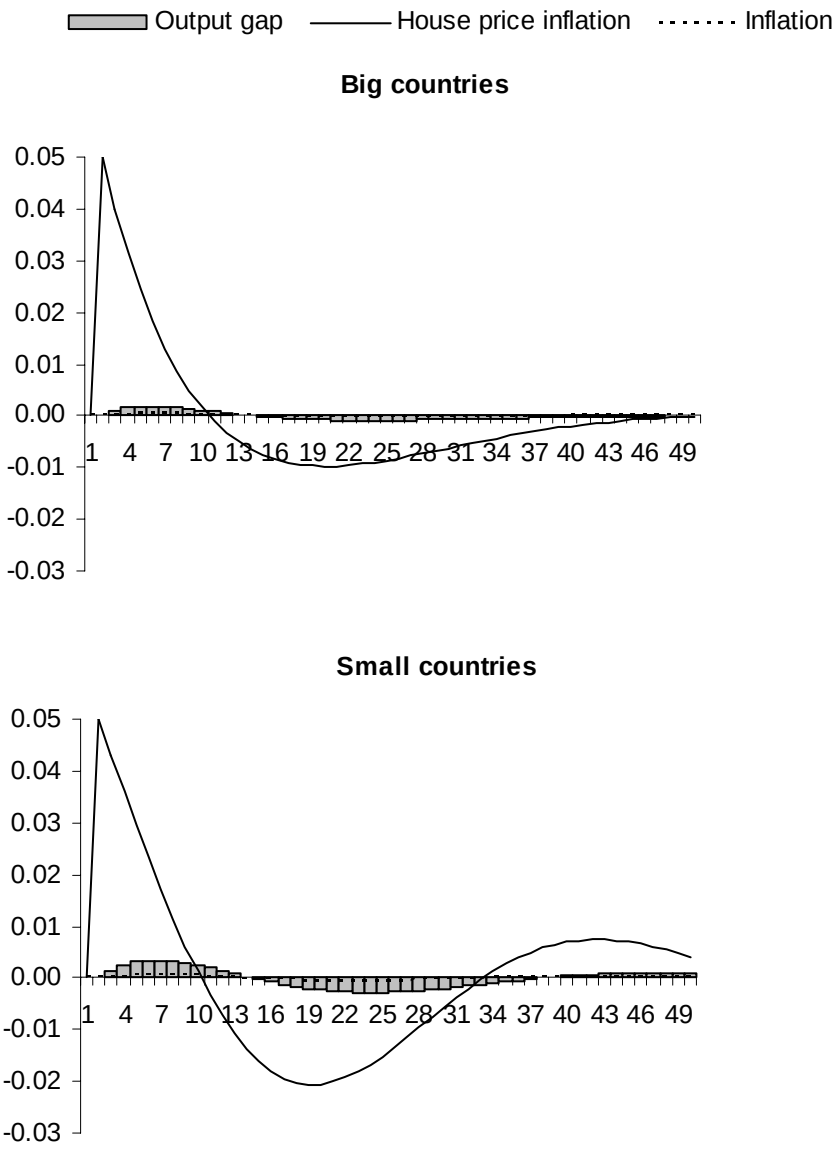
Note: Impact of a one-off increase in the output gap by 5 percentage points; periods indicated on the x-axis are quarters, units on the y-axis are one-hundreds of a percentage point; inflation and house price inflation are annualised.

Figure 2. Impact of a price shock



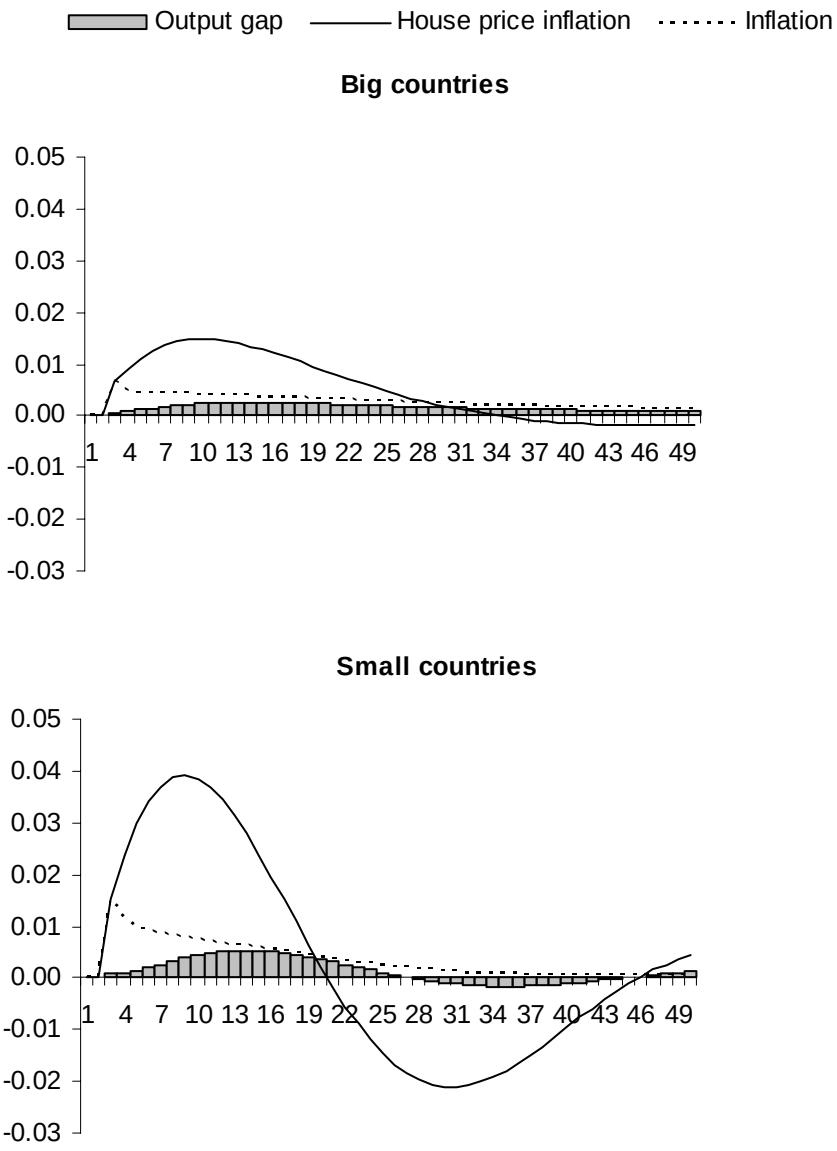
Note: Impact of a one-off increase in the overall inflation rate by 5 per cent (annual rates); periods indicated on the x-axis are quarters, units on the y-axis are one-hundreds of a percentage point; inflation and house price inflation are annualised.

Figure 3. Impact of a house price shock



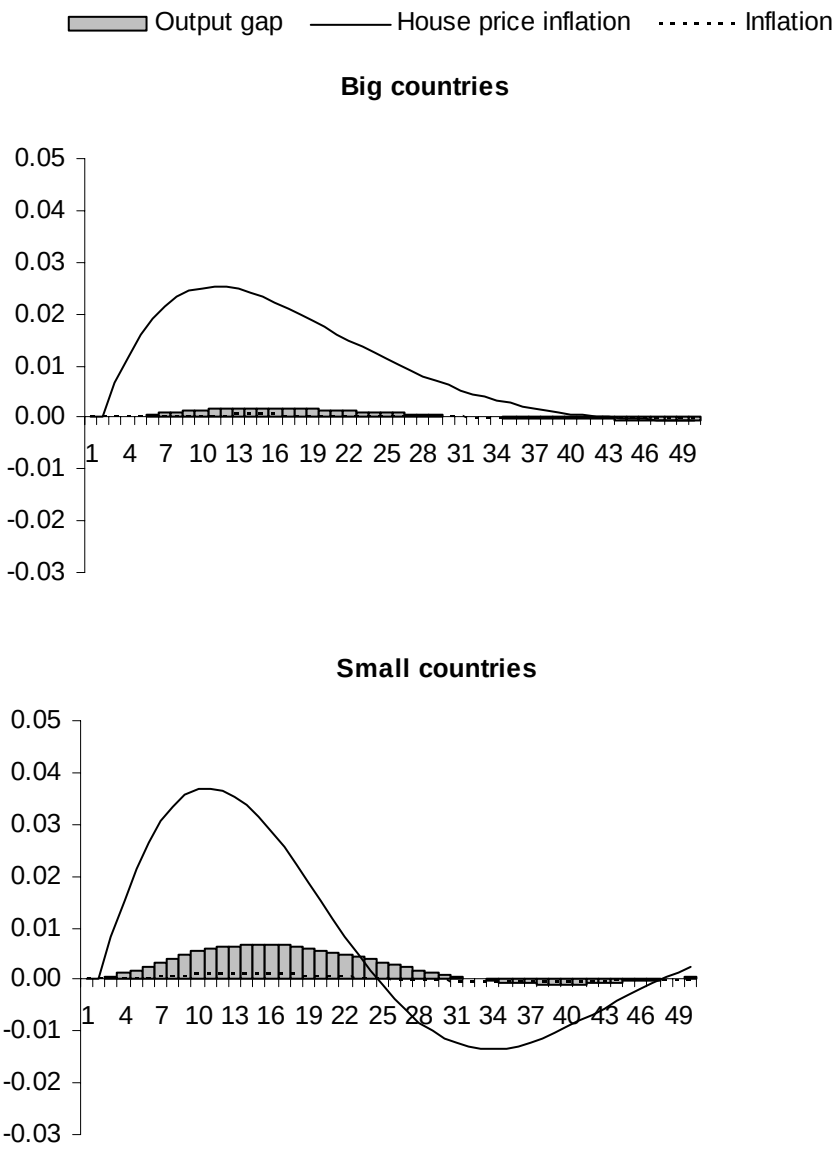
Note: Impact of a one-off permanent rise in the nominal house price by 5 per cent (annual rates); periods indicated on the x-axis are quarters, units on the y-axis are one-hundreds of a percentage point; inflation and house price inflation are annualised.

Figure 4. Impact of a nominal effective exchange rate shock



Note: Impact of a one-off permanent decline in the nominal effective exchange rate by 4½ per cent; periods indicated on the x-axis are quarters, units on the y-axis are one-hundreds of a percentage point; inflation and house price inflation are annualised.

Figure 5. Impact of a nominal interest rate shock



Note: Impact of a one-off permanent decline in the nominal interest rate by 1 per cent; periods indicated on the x-axis are quarters, units on the y-axis are one-hundreds of a percentage point; inflation and house price inflation are annualised.

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