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IMF Working Paper

Spillovers to Ireland

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Abstract

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This paper discusses Ireland's trade and financial linkages with key partner countries, and uses a vector autoregression to examine the impact of shocks to partner country GDP and shocks to Irish competitiveness on Irish GDP. Two main findings are that shocks to U.S. GDP have a larger impact on Irish GDP than shocks to the euro area or the U.K. Also, the share of the variance of Irish GDP explained by shocks to competitiveness rises with the forecast horizon, suggesting that past erosion of competitiveness may yet have a more substantial impact on economic activity.

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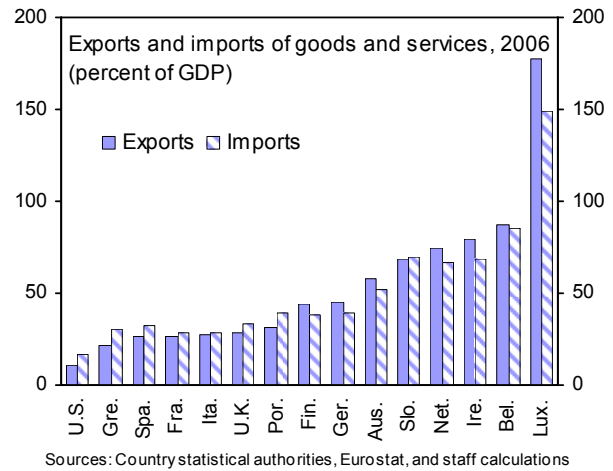
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I. BACKGROUND

1. **This paper examines how shocks to key trading partners and to competitiveness affect economic activity in Ireland.** Issues to be addressed include determining the relative importance of shocks in different trading partners on Irish economic activity, as well as the relative importance of external versus domestic shocks. At the current juncture, which features a worsening of the outlook for the international economy, the analysis helps shed light on the likely impact of these external developments on the Irish economy. Also, the real effective exchange rate for Ireland has exhibited a persistent and marked appreciation since 2001, and the analysis in this paper also sheds light on the effect this could have on Irish economic prospects.
2. **As a small open economy in a currency union, Ireland is likely to be significantly influenced by events in the international economy.** The literature on international business cycles typically finds that countries with greater trade and financial linkages have more synchronized business cycles (see, for example, Imbs (2003), Kose, Prasad, and Terrones (2003a and 2003b) and Baxter and Kouparitsas (2004)). In this regard, the Irish economy is very open, with high shares of exports and imports to GDP (see below). Since monetary policy is determined by the European Central Bank on the basis of developments in all euro area countries, developments in other euro area countries have a significant impact on monetary conditions in Ireland. Also, Irish banks are well integrated with the rest of the world (see, for example, Duggar and Mitra (2007) and the 2006 FSSA update), and are heavily dependent on external financial markets for their funding.
3. **Large FDI and migration flows also provide channels for the transmission of external shocks to Ireland.** In the last decade Ireland has been very successful in attracting a large number of multinational companies, with associated large inflows of foreign direct investment (FDI). Since multinational companies are concerned about global profits, external shocks can cause a reallocation of their investments and activities across different geographical regions, which would have an impact on Irish economic activity. Also, as noted by Honohan and Walsh (2002), the substantial acceleration of growth in Ireland since the mid-1990s has been fueled to a significant degree by increases in employment, fueled in part by inward migration. Although migration is governed by several factors, shocks in other countries can affect, at the margin, the relative attractiveness of migrating to Ireland, and thus affect Irish labor supply and output.
4. **The plan for this chapter is as follows:** Chapter II examines Ireland's linkages with its main partner countries; Chapter III uses VAR analysis to quantitatively assess how shocks in trading partners and to competitiveness affect Ireland; and Chapter IV concludes.

II. LINKAGES WITH PARTNER COUNTRIES

5. **Irish exports and imports, as a share of GDP, stand well above those of the typical industrial country.** A cross country comparison shows that as a share of GDP Irish exports and imports are well above the euro area average, and are also well above those in the U.S. and U.K. Within the euro area, only Belgium and Luxembourg have higher trade shares than Ireland.



6. **Annual trade data from 1970 reveals that the importance of trade for the Irish economy has grown substantially (Figure 1).** Between 1970 and 2000, the ratio of imports of goods and services to GDP doubled, peaking at over 80 percent, but it has since declined to 68½ percent in 2006. Exports of goods and services rose at an even faster pace, peaking at over 100 percent of GDP in 2000, before declining to about 80 percent in 2006. As a result, Ireland has enjoyed a surplus on the goods and services account since the mid 1980s. The importance of external trade in services has also increased steadily since the mid 1990s.

7. **The decline in trade as a share of GDP has broadly coincided with a pronounced appreciation in Ireland's real effective exchange rate.** From 1997 through 2001, Ireland's real effective exchange rate (REER) depreciated significantly, putting it in a very competitive position. Since then, however, the REER, calculated on both CPI and unit labor costs (ULC) basis, has appreciated strongly. Initially, this appreciation largely reflected the appreciation of the euro, as the nominal effective exchange rate (NEER) also appreciated. However, more recently the continued appreciation of the REER has been driven by higher inflation and unit labor cost growth in Ireland compared to its partner countries.

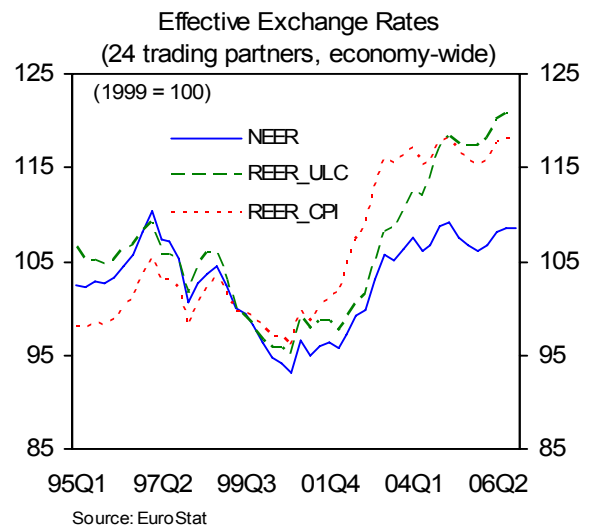
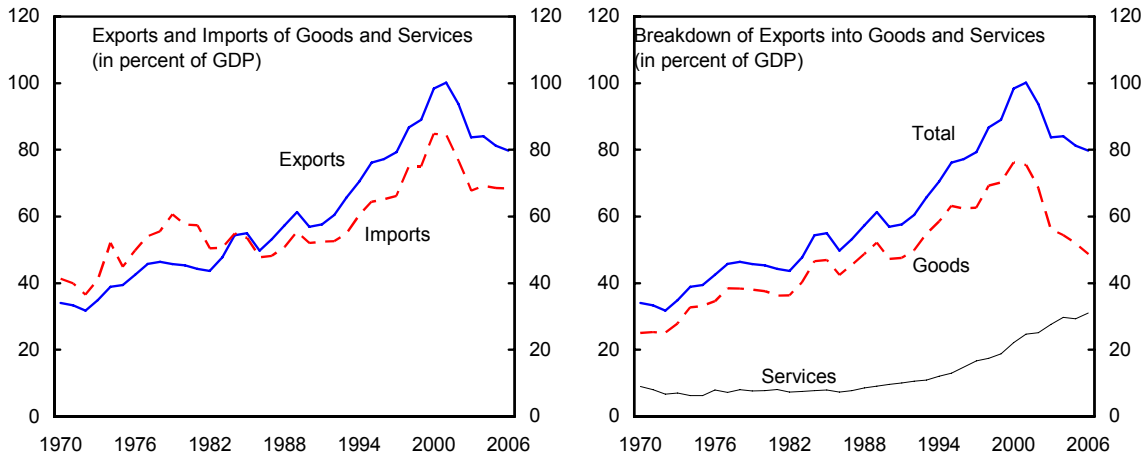
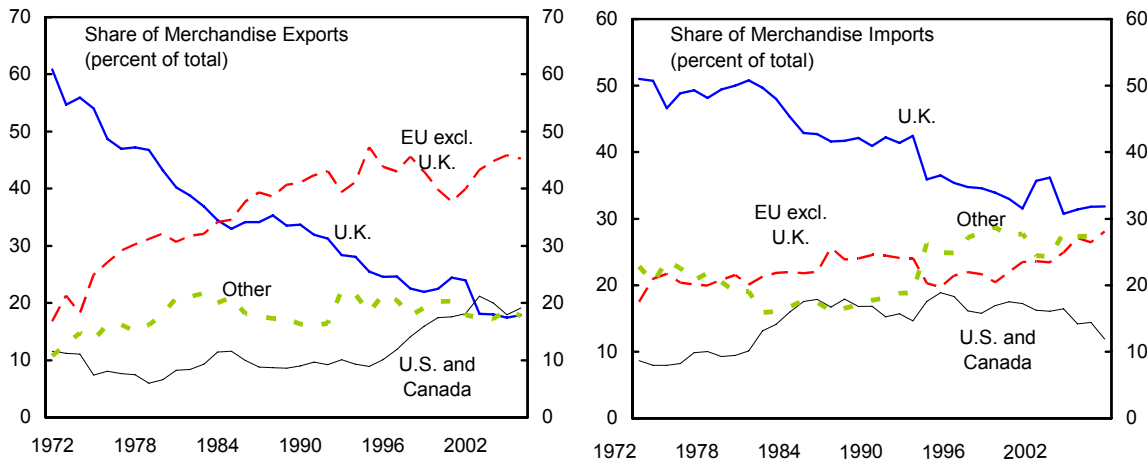
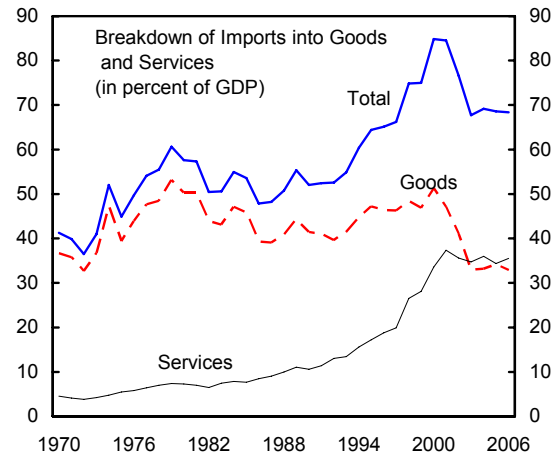


Figure 1. Trade Developments in Ireland



Direction of Trade (percent of total)		
	2005	2006
Exports		
EU-23 1/	46.5	46.3
o/w euro area	43.7	43.2
U.S. and Canada	18.2	18.7
o/w U.S.	17.8	18.3
U.K.	17.7	17.5
Other	17.6	17.5
Imports		
EU-23 1/	25.5	27.0
o/w euro area	22.2	23.3
U.S. and Canada	14.4	11.9
o/w U.S.	13.9	11.3
U.K.	31.8	31.7
Other	28.3	29.4

1/ EU-25 excluding UK and Ireland



Sources: CSO and Staff calculations.

8. **Data on the direction of merchandise trade indicate that Ireland's biggest trading partners are the euro area, the U.S., and the U.K.** These trading partners account for the bulk of Irish merchandise exports and imports. The latest data available, for 2006, indicate that the euro area is Ireland's largest export market, accounting for 43¼ percent of Irish exports, followed by the U.S. and the U.K. with 18¼ percent and 17½ percent, respectively. On the imports side, the U.K. has the largest share (31¾ percent), followed by the euro area and the U.S., with 23¼ percent and 11¼ percent shares, respectively.

9. **The relative importance of these trading partners has varied significantly over time, however.** The share of the U.K. in Irish exports and imports has fallen steadily since the 1970s, whereas those of the euro area have risen. The share of the U.S. in Irish exports has risen strongly since the mid 1990s, but its share of Irish imports has fallen recently. The share of exports and imports to other countries has also increased gradually.

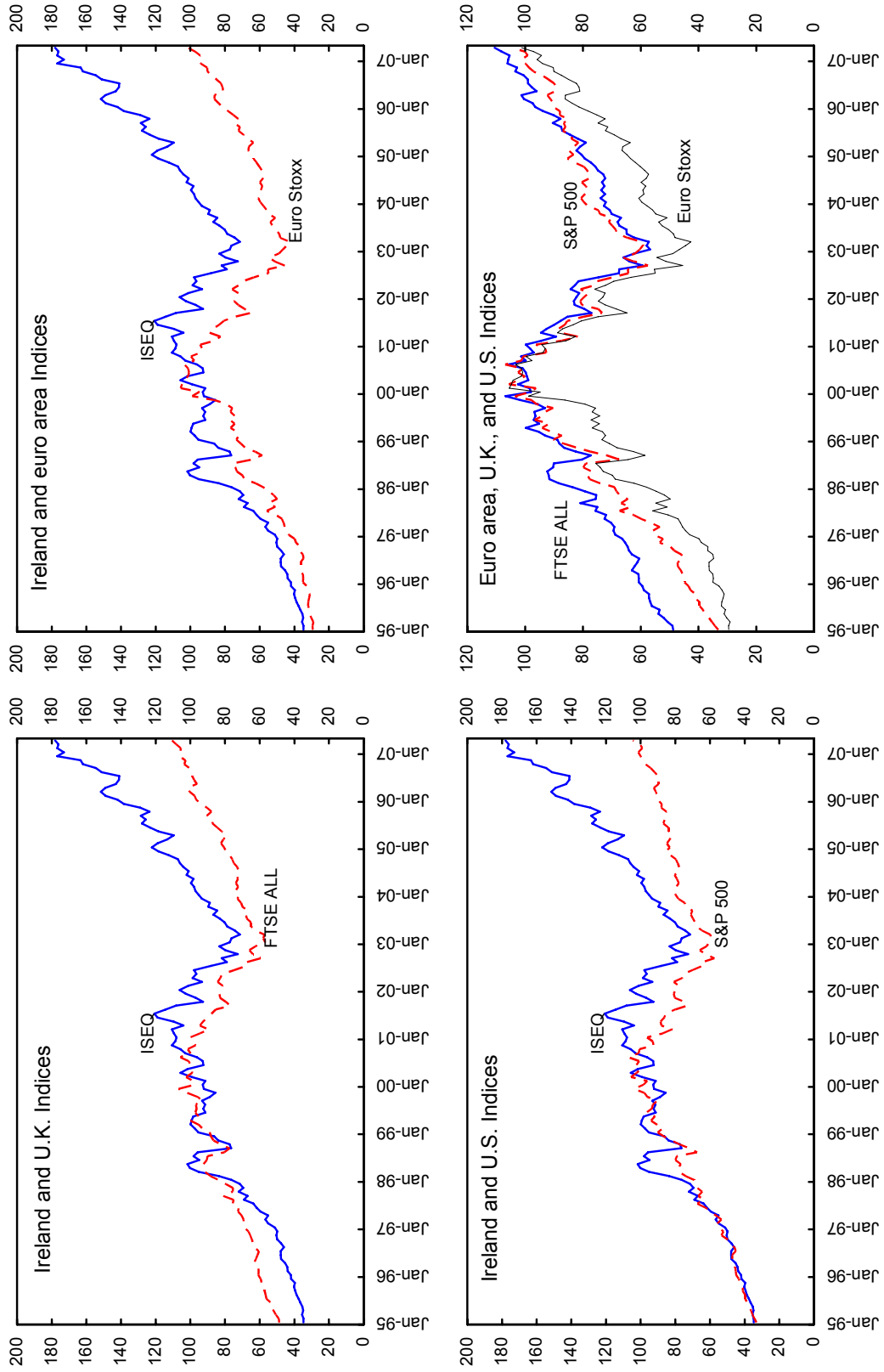
10. **Regarding multinational companies in Ireland, U.S. companies dominate.** Data from IDA Ireland indicate that almost one-half of all multinationals are U.S. companies. Moreover, the U.S. companies have had a disproportionate impact on employment, accounting for over 70 percent of all employment by multinationals. Firms from continental Europe and the U.K. also have a significant presence in Ireland.

	Companies		Employment	
	Number of Companies	Percent of Total	Total Employment	Percent of Total
Total	1,010	100.0	132,728	100.0
U.S.	473	46.8	93,331	70.3
Continental Europe	345	34.2	27,350	20.6
U.K.	117	11.6	7,239	5.5
Other	75	7.4	4,808	3.6

Source. IDA Ireland Annual Report 2005.

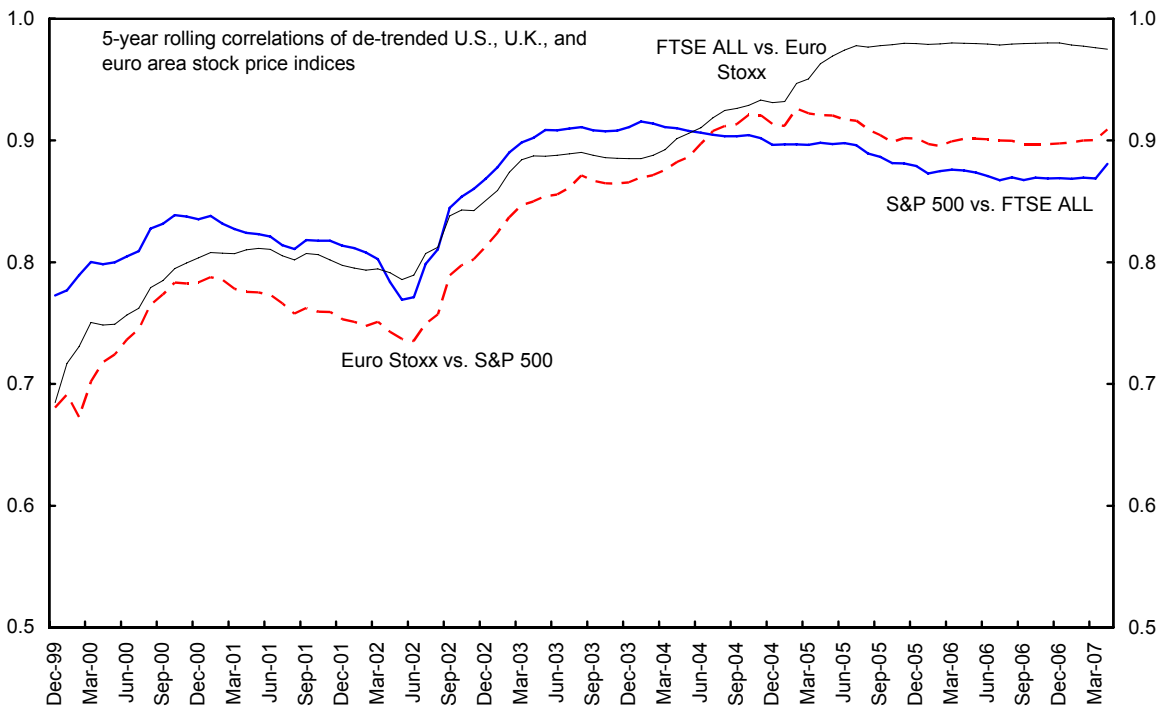
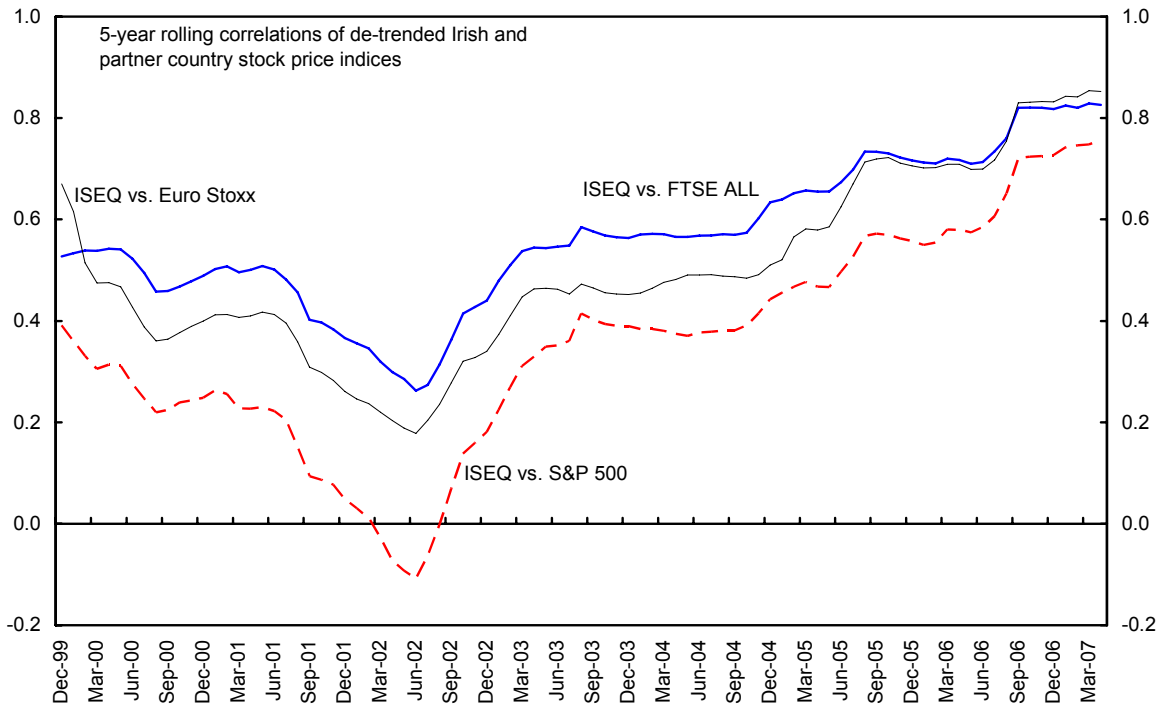
11. **There are also strong linkages between Irish and world financial markets.** This is confirmed by stock price indices as well as data on capital inflows and outflows. Figures 2-3 present a comparison of the ISEQ, FTSE all-share, Euro STOXX, and S&P 500 indices. Clearly the ISEQ tends to co-move with the partner country indices, though it is sometimes out of phase with them. In particular, Figure 3, which presents 5-year rolling correlations, indicates that between 1999 and 2002 the correlation of the ISEQ with the other indices declined, as the ISEQ responded to the downward trend in partner country indices (in the aftermath of the dot-com bust) with a lag. From 2003 onwards, however, the ISEQ has moved back into phase with the other indices, and 5-year rolling correlations with partner country indices have risen to a high level of around 0.8 in the past year, while correlations among the partner country indices have increased to an even higher level. In this same period the ISEQ has grown faster than the other indices, and has also been more volatile,

Figure 2. Stock Price Indices in Ireland and Key Trading Partners: 1995–2007
(2000=100)



Sources: Standard & Poor, Dow Jones, FTSE Group, Irish Stock Exchange, and staff calculations

Figure 3. Correlations of U.S., U.K., euro area, and Irish Stock Price Indices: 1999–2007



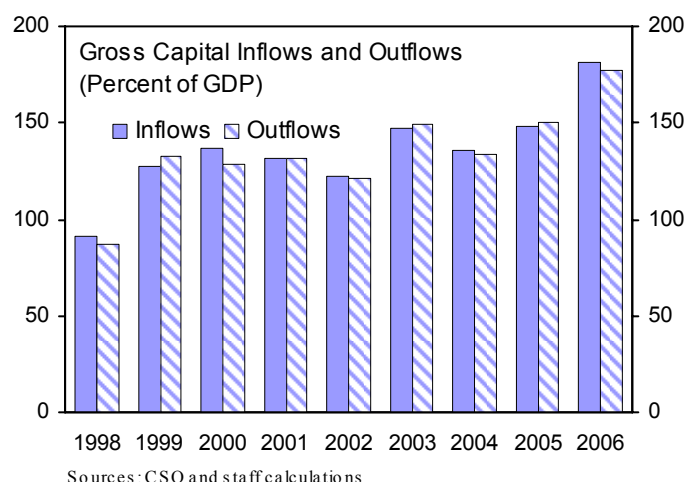
Sources: Standard & Poor, Dow Jones, FTSE Group, Irish Stock Exchange, and staff calculations

which could reflect a growing recognition of Ireland's economic success as well the relatively small size of the Irish stock exchange.

12. **And capital inflows and outflows are high and rising.** Data on gross capital flows show large and growing inflows and outflows of capital. Both gross capital inflows and gross capital outflows have exceeded

100 percent of GDP since 1999. Following a mild decline after 2000, in the aftermath of the dot-com bust, both inflows and outflows have risen strongly since 2004, and both exceeded 170 percent of GDP in 2006, well above the peak reached under the Celtic tiger period.

Reflecting these large flows, gross foreign assets and liabilities of Ireland both stood at around 10 times GDP at the end of 2005.

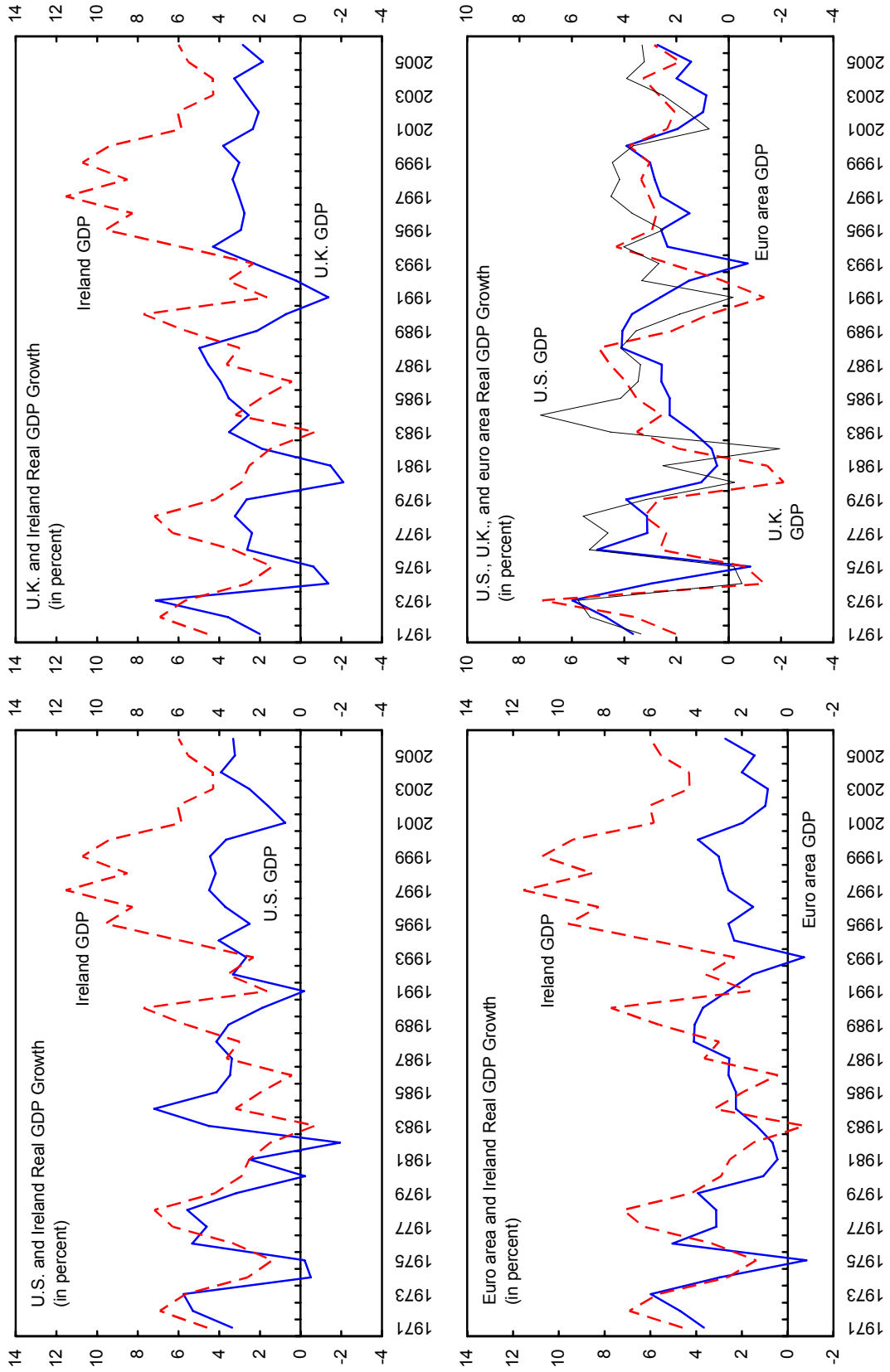


13. **Reflecting these linkages, there is a relatively strong relationship between real GDP growth rates in Ireland and its trading partners.** Figure 4 indicates that peaks and troughs in Irish GDP growth typically occur in the vicinity of similar turning points in its partners, though the turning points are sometimes out of phase. Partner country cycles are also similar, which could reflect the influence of a common world business cycle (see Kose, Otrok, and Whiteman (2003)), common global shocks, or the dominance of the U.S. economy. Figure 5, which presents 10-year rolling correlations of the respective output gaps, suggests that Irish cycles have typically been more synchronized with euro area cycles than with U.S. and U.K. cycles. Also, the correlation between euro area cycles and those in the U.K. and U.S. fell sharply in the early 1990s, as a trough in euro area growth significantly lagged that in the U.S. and U.K., possibly reflecting the impact of German reunification. However, the correlation between cycles in Ireland and the U.S. and U.K. has returned to a high level over the past 10 years.

III. ECONOMETRIC ANALYSIS USING A VAR

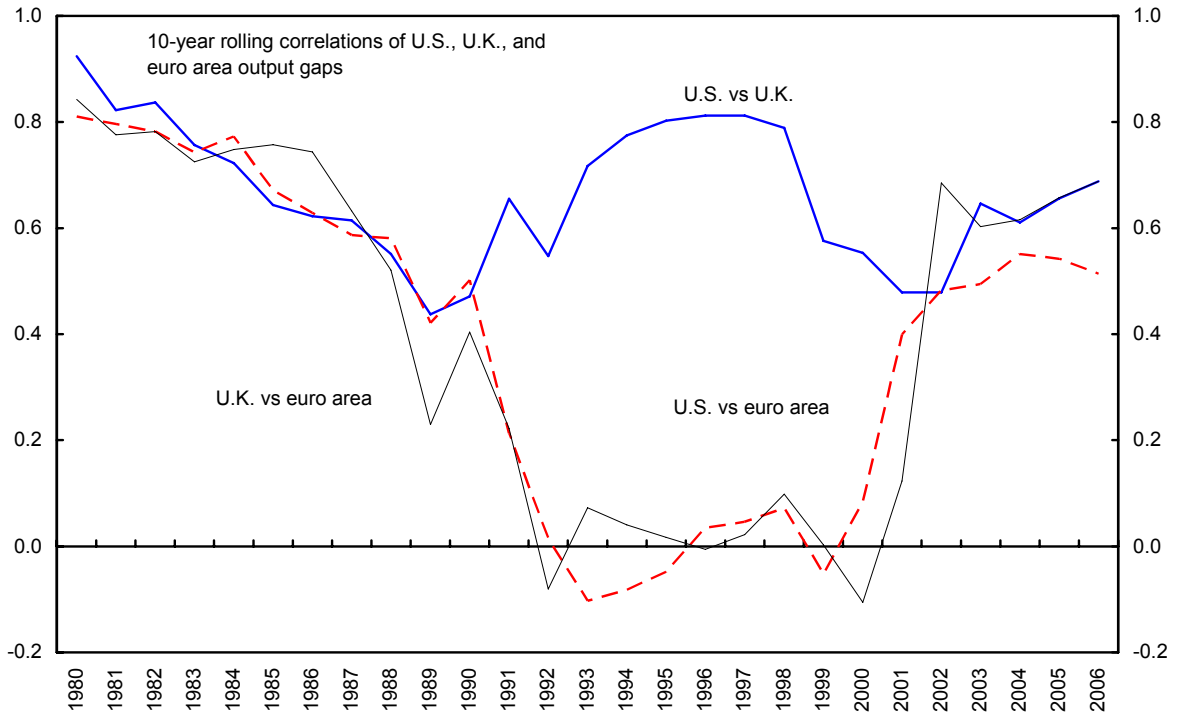
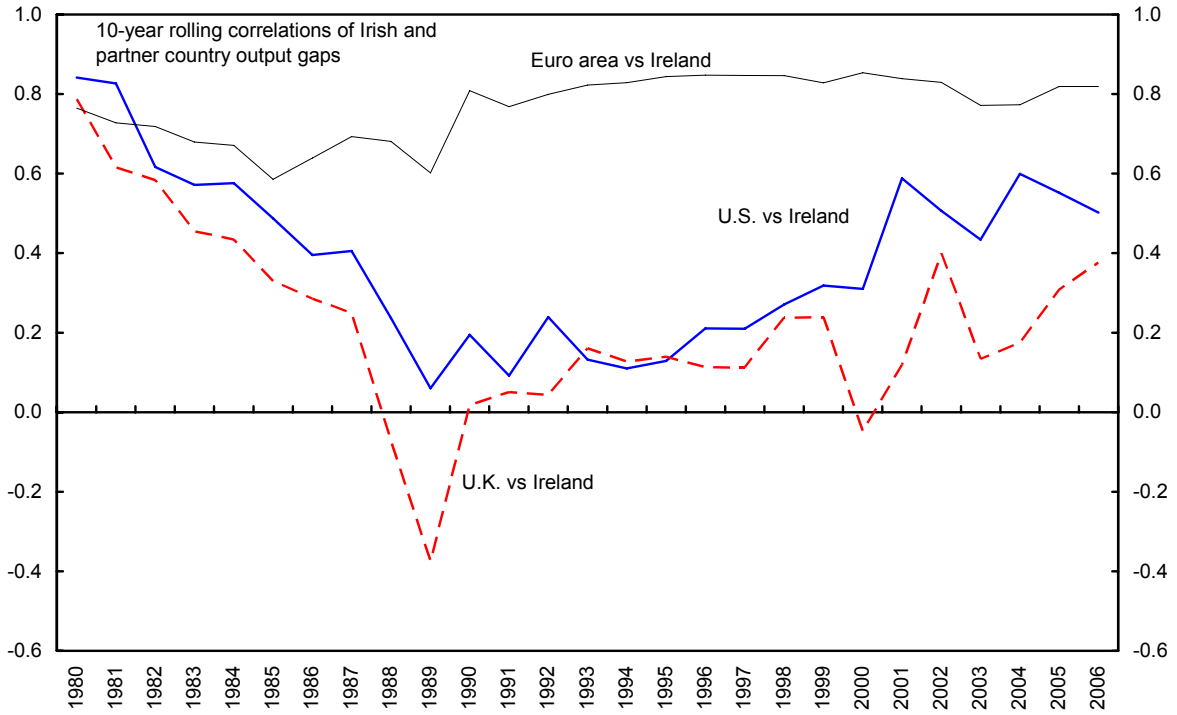
14. **To enable a more rigorous assessment of the impact of spillovers from external shocks on Ireland, a vector autoregression (VAR) was estimated.** A 5-variable VAR was estimated using quarterly data from 1997: Q1 to 2006: Q4. This period basically coincides with the Celtic tiger and subsequent period, where there has been high growth and no serious downturn, and so raises the possibility of bias in the estimation results. We are limited to this relatively short dataset because quarterly data for Irish GDP is only available for that period. In any case, given the dramatic transformation in the Irish economy since the mid 1990s, data

Figure 4. Business Cycles in the U.S., U.K., euro area, and Ireland: 1971–2006



Sources: Country statistical authorities, Eurostat, WEO database, and staff calculations.

Figure 5. Correlations of Output Gaps in the U.S., U.K., euro area, and Ireland: 1980–2006



Sources: Country statistical authorities, Eurostat, WEO database, and staff calculations

prior to this period may not be very useful in shedding light on the current impact of spillovers. All variables were seasonally adjusted and transformed into logs. Although the Akaike and Schwarz criteria pointed to a VAR with one lag, the residuals from this specification exhibited fourth order serial correlation, and to correct for this the VAR was estimated with four lags.

15. **The variables in the VAR included—in that order—euro area real GDP (excluding Ireland), U.S. real GDP, U.K. real GDP, Irish real GDP, and the unit labor cost based Irish real effective exchange rate (REER).** The shocks in the VAR were orthogonalized using a Cholesky decomposition, with the variables in the order specified above. As is well known, this implies that variables appearing earlier in the ordering are considered more exogenous, while those appearing later in the ordering are considered more endogenous. As a check, the ordering of euro area and U.S. GDP was reversed to see whether this changed the results. This exercise produced very similar results. The error bands of the impulse responses are the 16th and 84th fractiles of the distributions of the responses, corresponding to one standard deviation bands, and were computed by Monte Carlo integration using the software package *RATS*.

16. **Ng Perron tests rejected non-stationarity in all the variables.** Phillips (1998) shows that the presence of nonstationary or near-integrated data in a VAR leads to long-horizon impulse responses and variance decompositions that are not consistent, but rather approach a random variable. To examine this possibility, all the variables were subjected to unit root tests using the method of Ng and Perron (2001), which yields tests with superior size and power compared to the traditional Dickey-Fuller and Phillips Perron tests. Ng and Perron developed four test statistics, all with the same limiting distribution, and Table 1 presents results for all the four tests for unit roots, generated using *Eviews* software. The tests rejected non stationarity in all the variables examined.

17. **However, we cannot rule out the possibility that some variables have near-unit roots.** Indeed, it is well known that many macroeconomic variables, such as GDP, interest rates, and exchange rates, exhibit such high persistence that it is difficult to reject the unit root hypothesis. Bearing this in mind, we will in general restrict our analysis of impulse responses and variance decompositions to no more than an 8-quarter horizon.

18. **The variance decomposition indicates that a substantial part of the variance of Irish GDP is explained by shocks to U.S. GDP, particularly beyond a 2-quarter horizon** (Table 2). Up to a 2 quarter horizon, fluctuations in Irish GDP are largely explained by shocks to Irish GDP itself, but with a significant part explained by shocks to euro area GDP. However, at longer horizons the share explained by shocks to U.S. GDP increases substantially. At an 8 quarter horizon, shocks to U.S. GDP explain 41½ percent of fluctuations in Irish GDP, while shocks to Irish GDP itself explain only 26½ percent of its variance. This is followed in importance by shocks to euro area GDP, the REER, and U.K. GDP, which explain 15 percent, 12 percent, and 5½ percent, respectively, of the variance of Irish GDP at this horizon. It is also noteworthy that although not very important at a 4 quarter

horizon, the share of fluctuations in Irish GDP explained by shocks to the REER (and thus to Irish competitiveness) increases significantly over a longer horizon.¹

Table 1. Ng Perron Unit Root Tests of the Variables in the VAR

	Test statistics 1/	Critical values		
		10 percent level	5 percent level	1 percent level
U.S. Real GDP				
Mza	-33.63 ***	-14.20	-17.30	-23.80
MZt	-4.10 ***	-2.62	-2.91	-3.42
MSB	0.12 ***	0.19	0.17	0.14
MPT	2.71 ***	6.67	5.48	4.03
U.K. Real GDP				
Mza	-16.88 *	-14.20	-17.30	-23.80
MZt	-2.88 *	-2.62	-2.91	-3.42
MSB	0.17 *	0.19	0.17	0.14
MPT	5.56 *	6.67	5.48	4.03
Euro Area Real GDP				
Mza	-127.49 ***	-14.20	-17.30	-23.80
MZt	-7.98 ***	-2.62	-2.91	-3.42
MSB	0.06 ***	0.19	0.17	0.14
MPT	0.72 ***	6.67	5.48	4.03
Ireland Real GDP				
Mza	-28.18 ***	-14.20	-17.30	-23.80
MZt	-3.75 ***	-2.62	-2.91	-3.42
MSB	0.13 ***	0.19	0.17	0.14
MPT	3.27 ***	6.67	5.48	4.03
REER (ULC based)				
Mza	-166.75 ***	-14.20	-17.30	-23.80
MZt	-9.10 ***	-2.62	-2.91	-3.42
MSB	0.05 ***	0.19	0.17	0.14
MPT	0.19 ***	6.67	5.48	4.03

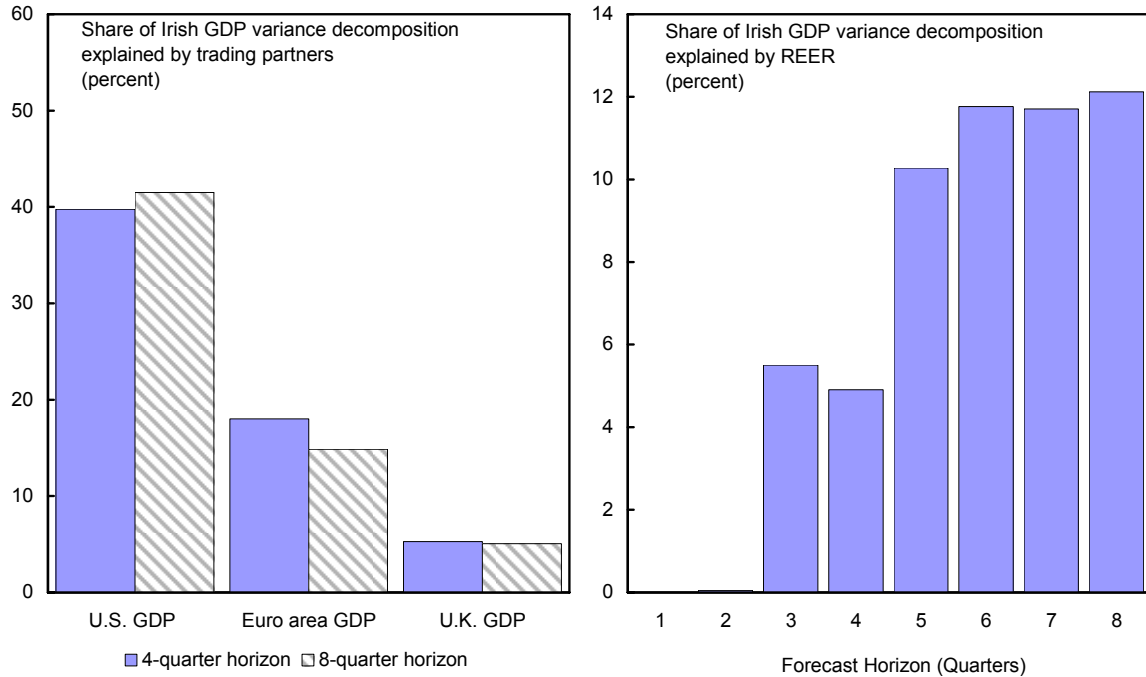
Source. Author's calculations

1/ ***, **, and * represent rejection of the unit root hypothesis at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 2. Decomposition of Variance for Irish Real GDP

Horizon (Quarters)	Euro area GDP	U.S. GDP	U.K. GDP	Irish GDP	REER (ULC based)
1	18.1	1.0	6.3	74.6	0.0
2	21.0	16.3	4.9	57.7	0.0
3	18.9	37.2	2.8	35.7	5.5
4	18.0	39.8	5.3	32.0	4.9
5	16.7	38.5	4.9	29.7	10.3
6	16.3	37.8	5.5	28.7	11.8
7	16.0	38.3	5.4	28.5	11.7
8	14.9	41.5	5.1	26.5	12.1

¹ Also, examination of the variance decomposition at horizons longer than 8 quarters suggests that the importance of the REER increases further at longer horizons.

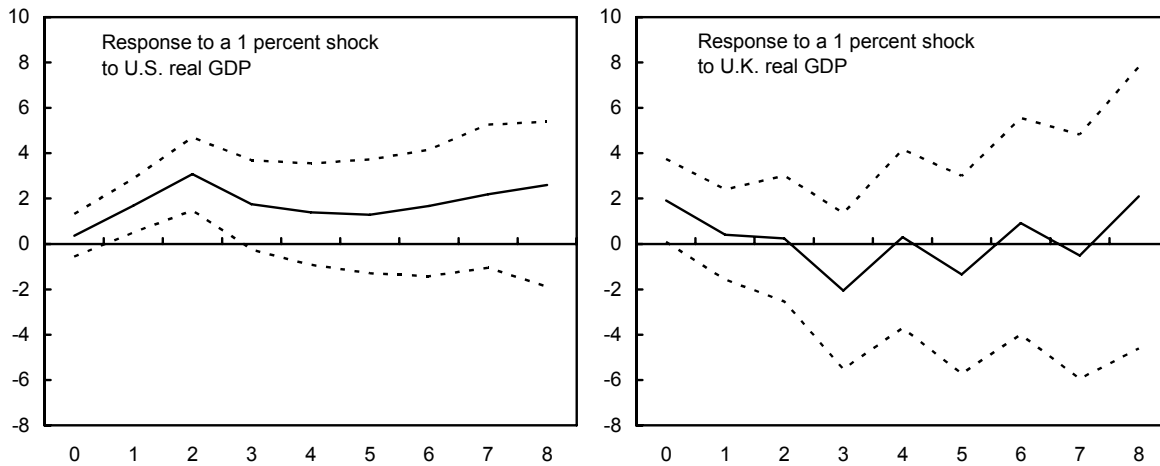


19. **In general, the impulse responses have the expected signs, but the shocks do not appear to have very persistent effects.** The impulse responses arising from shocks to partner economy own GDP were normalized to present the percentage change in Irish GDP in response to one percent shocks in those variables. In the case of shocks to the REER, however, the response to a one percent shock was rather small. Thus, the impulse response was normalized to present the percentage change in Irish GDP in response to a 4 percent shock to the REER.² The charts indicate, as would be expected, that positive shocks in the trading partners typically increase economic activity in Ireland, while an adverse shock to competitiveness (a positive shock to the REER) reduces Irish economic activity. Also, shocks to U.S. GDP have a larger and somewhat more persistent impact on Irish GDP than shocks to U.K. and euro area GDP. However, possibly reflecting the short dataset, the error bands are relatively wide, and all impulse responses are not significantly different from zero by the fourth quarter after a shock.

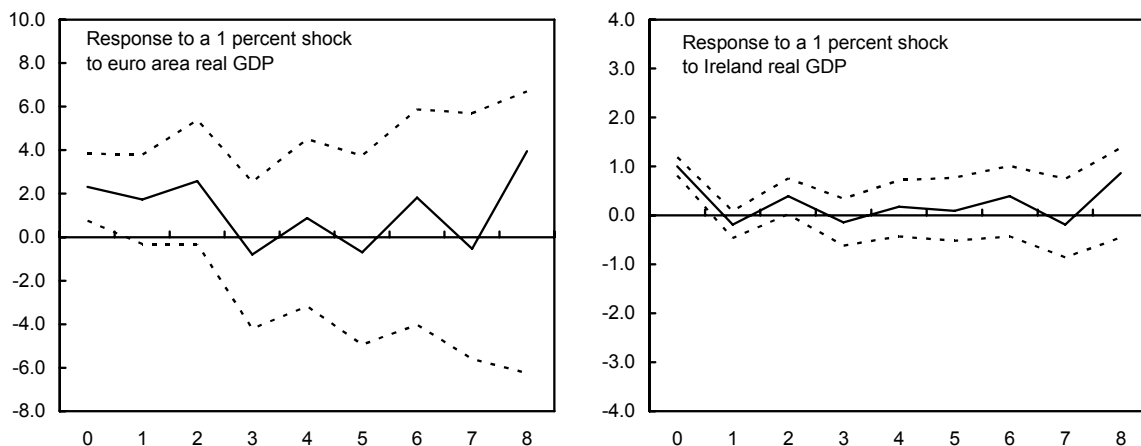
20. **Shocks to quarterly U.S. GDP have a significant impact on quarterly Irish GDP between one and three quarters after they occur.** The contemporaneous impact is small, and not statistically distinguishable from zero. However, the magnitude of the response increases strongly to a peak of about 3 percentage points after two quarters, and then declines. This impact is larger and more persistent than the effects of shocks to euro area and U.K. GDP, even though the EU area has a larger share of goods trade with Ireland. This could reflect several other factors, including the large presence of U.S. multinationals in

² 4 percent is the typical percentage change (annualized) observed in the REER data.

Ireland and the associated capital flows. It may also be that the share of the U.S. in trade with Ireland rises when trade in services is factored in. For example, exports of information technology and business services, which are likely to be heavily linked to multinational companies, constitute over one half of services exports. However, data on the direction of trade in services is not available to confirm this conjecture.



21. **In contrast, shocks to quarterly euro area and U.K. GDP have a strong contemporaneous impact on Irish GDP, but no significant effect thereafter.** In both cases, a one percent shock leads to a contemporaneous jump in Irish GDP of around 2 percentage points. Subsequently, however, the impulse responses cannot be statistically distinguished from zero, because of wide error bands. In the case of shocks to euro area GDP, the lower error band is very close to zero at a one and two quarter horizon, suggesting that the positive impact on Irish GDP could persist for up to two quarters before dissipating.



22. **Shocks to Irish GDP itself do not appear to be strongly propagated within the economy.** Following a contemporaneous one percent jump as the shock occurs, the impulse

response falls to near zero after one quarter, then increases in the next quarter by about 0.4 percentage points before dissipating.

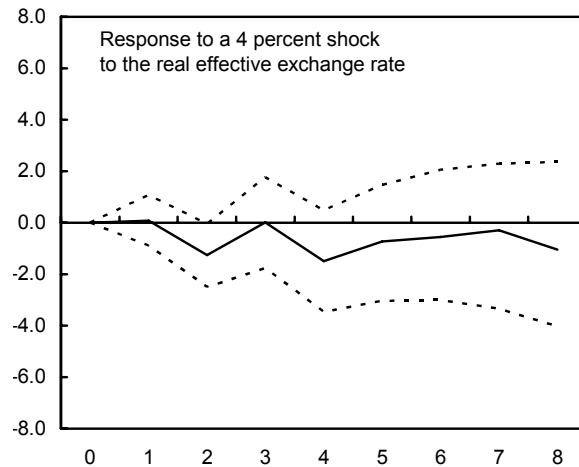
23. **The impulse responses enable the calculation of “elasticities” that indicate how annual Irish GDP responds to a shock that causes annual GDP in a partner country to decline by one percentage point over a 4 quarter horizon.** The calculations indicate that shocks that cause one percentage point declines in annual US, euro area, and UK GDP over a 4-quarter horizon cause annual Irish GDP to decline by about 1¾, 1½, and ¼ percentage points, respectively, in the same time frame. Thus, Irish economic activity appears to be very sensitive to developments in the US and the euro area, but much less so for the UK. The low “elasticity” to shocks to UK GDP reflects the fact that the impulse response of Irish GDP is negative in the third quarter after the shock (see above), but is surprising given the long ties between the UK and Ireland. One possible explanation is that given the virtually unified labor market between the two countries, a negative shock to the UK economy causes an increase in labor supply in Ireland strong enough to significantly offset the negative impact of lower activity in the UK.

Elasticity of Irish GDP with Respect to Partner Country GDP Shocks 1/ (percentage point change)

Response to US GDP shock	1.8
Response to Euro area GDP shock	1.5
Response to UK GDP shock	0.2

1/ Response of annual Irish GDP to shock causing annual partner country GDP to decline by one percentage point over a 4 quarter horizon.

24. **Finally, adverse shocks to competitiveness significantly depress Irish GDP after a two quarter lag.** Up to one quarter following a shock to the REER, the impulse response is virtually zero. However, two quarters after a 4 percent shock Irish GDP declines by 1 percent, and there is a further dip in Irish GDP after 4 quarters which is close to being significant, suggesting that the effects could persist beyond the two quarter horizon. This view is lent support by the results of the variance decomposition, which shows the impact of shocks to competitiveness on Irish GDP increasing through the 8 quarter horizon.



IV. POLICY IMPLICATIONS AND CONCLUDING REMARKS

25. **The results imply that the recent financial market turmoil which originated from the U.S. sub-prime mortgage market carries a significant downside risk for Ireland.** The turmoil is expected to have a significant adverse impact on the outlook for advanced economies, and particularly so for the US economy. If the downside risks to U.S. growth are realized, this is likely to have a significant adverse impact on Irish growth, since the impulse responses and variance decompositions suggest that shocks to the U.S. economy tend to have stronger effects on the Irish economy than those originating in other partner economies.

26. **Secondly, the past deterioration in Irish competitiveness may have a stronger adverse impact on Irish GDP over time than has been observed thus far.** The variance decompositions reveal that the impact of shocks to competitiveness on Irish GDP increases strongly at longer time horizons. This suggests that the past persistent increases in the REER could have a substantial negative impact on the Irish economy over a longer time horizon.

Appendix: Description of data used in the VAR³

Euro area real GDP excluding Ireland. Quarterly GDP for the 13 euro area countries less the quarterly GDP for Ireland, in millions of euro at 1995 prices and exchange rates. Seasonally adjusted and adjusted for working days. Source, EuroStat.

Ireland real GDP. Quarterly GDP for Ireland, in millions of euro at 1995 prices and exchange rates. Seasonally adjusted and adjusted for working days. Source, EuroStat.

UK real GDP. Quarterly GDP for the UK, in millions of euro at 1995 prices and exchange rates. Seasonally adjusted and adjusted for working days. Source, EuroStat.

US real GDP. Quarterly GDP for the US, in millions of euro at 1995 prices and exchange rates. Seasonally adjusted and adjusted for working days. Source, EuroStat.

REER. Real effective exchange rate for Ireland, based on unit labor costs for whole economy. Source, EuroStat.

³ The actual data used can be found in the accompanying Microsoft Excel file also posted on the web.

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