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Boosting Competitiveness to Grow Out of Debt—Can Ireland Find a Way Back to Its Future?

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Boosting Competitiveness to Grow out of Debt -- Can Ireland Find a Way Back to Its Future?

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Abstract

This paper investigates the prospects for Ireland to grow its economy against the backdrop of high indebtedness. The paper uses vector autoregressive analysis to explore the interlinkages among competitiveness, exports, economic growth, and fiscal performance. The emerging conclusion is that Ireland, which has regained cost competitiveness following the crisis-driven fall in domestic prices, is poised to return to its path of strong exports and economic growth and lower imbalances provided that it maintains competitiveness, though a pickup in external demand is critical. Three main findings underpin this conclusion. First, external demand is an important driver of exports and also the single most important determinant of Ireland's GDP and government revenue. Second, declines in price competitiveness, featured by real effective exchange rate (REER) appreciations, restrain exports and economic growth. Third, exports boost output, which in turn enhances fiscal performance.

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I. INTRODUCTION

The Euro area debt crisis has reignited attention to the challenges of promoting sustainable economic growth in an environment of high debt and financial fragility. Large fiscal and external imbalances in peripheral countries of the European Monetary Union (EMU) ― Greece, Ireland, Portugal, and Spain (GIPS) ― not only pose risk to economic recovery in these countries but also contribute to disturbances in international financial markets that threaten the still fragile global economic recovery. These imbalances and the associated large gross financing requirements have adversely affected investor sentiment, thereby jeopardizing access to capital that is needed to finance investment for growth. Policymakers are therefore grappling with the issue of how to achieve and sustain high economic growth given the constraint of high debt and financial fragility.

Ireland is one of the EMU countries whose quadruple challenges of high debt, financial fragilities, high unemployment, and low growth epitomize the Euro area debt crisis. The bursting of Ireland's housing market bubble, coupled with the 2008–09 global financial crisis, brought the country's prolonged period of high export-led growth and strong macroeconomic performance to an end. During 2008–10, the cumulative decline in Ireland's GDP reached 8⅓ percentage points. Counter-cyclical fiscal measures and public financial support to ailing financial institutions led to a sharp increase in fiscal and external liabilities. By end-2011, both net international liabilities and public debt had soared to more or less 100 percent of GDP, nearly four to five times their 2007 levels. While there had been signs of a timid recovery, a key question is how to re-engineer the virtuous cycle of strong export-led growth and macroeconomic balances against the backdrop of financial fragility and subdued external demand. Thus, the competitiveness of the economy has taken center stage in the debate.

This paper contributes to the debate by examining the role of competitiveness in promoting strong growth and reducing imbalances. As a starting point, we investigate the linkages among exports, GDP, and government revenue using impulse response analysis and variance decomposition from an unrestricted vector autoregressive (VAR) model. We also delve deeper into these linkages by expanding the VAR to include other relevant variables such as real effective exchange rate (REER) measures, external demand, as well as foreign direct investment (FDI), which had been a central part of Ireland's economic success for about two decades.[2] The VAR is based on quarterly data covering 1980q1 to 2009q4.

The paper builds on earlier work on the role of competitiveness and external demand in economic performance and augments it in an important way. For studies of economies other than Ireland's, this paper is close to Federici and Marconi (2002) who investigate the link between exports and growth in Italy from a multivariate VAR framework including a proxy for external demand, Italy's REER, exports, and GDP. It is also close to Feasel, Kim and Smith (2001), thereafter FKS, who examine the linkages between per capita output, exports, and investment in Korea using VAR. For Ireland's specific studies, Kanda (2008) examines the role of competitiveness and external demand broken down among trading partners but does not include exports. Bermingham and Conefrey (2011) also examine the

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[2] The appropriateness or viability of Ireland's FDI-centered growth strategy is beyond the focus of this paper.

role of external demand from different trading partners and, unlike Kanda (2008), include exports. However, their framework includes neither the REER nor any other indicator of competitiveness. This paper presents a broader perspective by assessing Ireland's macroeconomic performance from a framework including competitiveness indicators, trading partners' demand, and exports.

The emerging conclusion is that Ireland can regain sustainable growth and lower its indebtedness provided that it maintains competitiveness, but a pickup in external demand is critical. The results underpinning this conclusion are generally intuitive and consistent with some earlier findings in the literature:

- Trading partners' demand is the single largest driver of economic growth and government revenue. The key role of external demand for growth lends supports to Federici and Marconi (2002), Kanda (2008); Bermingham and Conefrey (2011).

- REER appreciations constrain total exports.

- FDI flows have a positive short-lived impact on exports and growth. This result is in line with KFS' finding regarding the impact of shocks to investment on exports and growth of per capita income.

- Exports boost GDP growth, which boosts revenue and unsurprisingly reduces the debt burden.

The remainder of the paper is structured as follows. Section 2 presents stylized facts about Ireland's remarkable pre-crisis economic performance and its struggle with post-crisis large fiscal and external imbalances. Section 3 presents an econometric analysis of the linkages between exports, output, and government revenue and discusses how developments in these variables can pave Ireland's way back to its future of economic prosperity with low imbalances. Section 4 discusses prospects and challenges. Section 5 concludes and highlights policy implications.

II. DEBT AND GROWTH: IRELAND'S EXPERIENCE AND CURRENT STRUGGLE

Ireland is a compelling case study of the nexus between high debt and low growth. In the 1980s and early 1990s, Ireland travelled the route of high debt and low growth and gradually grew out of debt. Currently, it is one of the advanced economies (AEs) whose post-crisis public debt levels are near or above thresholds characterized as harmful to growth.[3]

Ireland is already dealing with standard debt-related financial constraints to growth. These are large debt service liabilities and the difficulty of obtaining finance at a steady low

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[3] Some of the thresholds are shown in Figure 1. Cecchetti, Mohanty, and Zampolli (2011) find that that the threshold for public debt-to-GDP to harm growth is around 85 percent. Using a sample of 12 Euro area countries, Checherita and Rother (2010) place the threshold in the 90 percent to 100 percent range. Likewise, Reinhart and Rogoff (2010) find that countries with gross public debt exceeding about 90 percent of GDP tend to grow at a much slower pace than their peers with lower debt. For AEs in particular, those with public debt-to-GDP levels above the 90 percent threshold registered average annual growth about two percentage points lower than for countries with public debt of less than 30 percent of GDP. Kumar and Woo (2010) find an inverse relationship between initial debt and subsequent growth.

cost because of high risk premiums. The spread of a 10-year Irish government bond yield over the yield of a corresponding bund is very volatile and has widened notably. It increased from almost nil during 2003−07 to 3 percentage points at end-2010 and almost 8 percentage points by end-2011, with bouts of much higher spreads in times of increased stress in financial markets. Interest payments on public debt stood at €6 billion and accounted for 11 percent of total government revenue in 2011, compared with only 2⅓ percent of revenue in 2007. These payments, which are projected to rise to an annual average of €9¾ billion or 15½ percent of revenue during 2013−16, together with scheduled amortization, leave little or no room for growth-enhancing investment spending. Ireland's earlier experience growing out of debt can provide insights and lessons for Ireland itself and probably for the debate on debt and growth.

Figure 1. Ireland: Public Debt in an International Perspective and Interest Burden
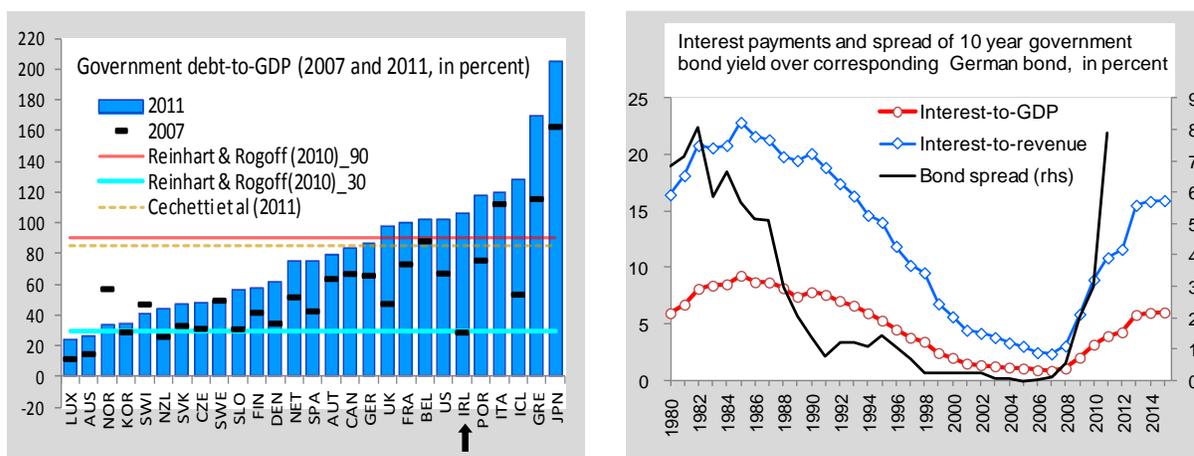
Note: The thresholds for debt-to-GDP are discussed in footnote 3.
Sources: OECD, WEO, Ireland Central Statistics Office (CSO) and author's calculations.

A. Ireland's Pre-crisis Reforms, Growth, and Public Debt: A Virtuous Cycle

Up to the late 1980s, Ireland experienced a lengthy period of economic stagnation and large fiscal and external imbalances perceived as signs of a grim economic outlook. For over two decades, Ireland's economic performance was characterized by high unemployment, large fiscal and external deficits, and crippling public debt despite high taxes (Honohan and Walsh, 2002). The long struggle with poor economic performance was breeding a pessimistic perception of the economic future, thereby fuelling massive emigration.

Ireland's struggle with high indebtedness in the 1980s and the subsequent turnaround are relevant its post-2008/09 situation and efforts to grow out of debt. The post-crisis situation resembles the dark years of the 1970s and 1980s in many respects. Both public and external debts are as high as in the mid-1980s, unemployment is high, and emigration on the rise. A key difference is that the major structural rigidities of the past no longer exist.

The tides of Ireland's economic performance started turning near the year 1987. The Irish government embarked on a host of structural reforms that yielded multiple dividends. Structural grants from the European Union contributed to improving the socioeconomic

environment by helping finance important infrastructure projects. Key aspects of the reforms and their implications are as follows:

- Spending cuts and a tax amnesty that generated windfall revenue, helping fiscal consolidation;

- Deregulation of telecommunication, road infrastructure, and air travel services promoted competition and lowered costs notably;[4]

- A lowering of corporate profit tax rates encouraged foreign investment;

- Expansion and reorientation of state-funded tertiary education towards engineering, science, and information technology helped attract investment in high-tech sectors.

Public policies helped enhance competitiveness, attract FDI, and boost external trade.
Falling domestic costs underpinned a depreciation of the REER, which, together with other incentives for inward FDI, boosted investment.[5] Growth of real exports of goods and services (G&S) averaged 15 percent per year during 1994–2002, compared with about half as much during 1981–86. Reflecting in part the fact that multinational companies (MNCs) producing exports rely on imported inputs, imports were growing in tandem with exports. Nonetheless, exports growth outpaced imports growth except in the five-year leading to the 2007/08 crisis.

Attractiveness to FDI had been both a sign of Ireland's competitiveness and an important contributor to its technological competitiveness. MNCs that settle in Ireland further reinforce its technological competitiveness as they channel their funds predominantly into high-tech export sectors. For instance, following the increase in FDI in the late 1980s, the makeup of Ireland's exports shifted drastically towards high-tech products. As early as 2000–01, the share of low-tech products in total exports declined to only 14 percent, from almost 50 percent during 1985–89. Over the same period, the share of high-tech exports almost doubled to 46 percent compared for instance with 12 percent and 21 percent for Greece and the Euro area average, respectively (Figure 2, lower-left chart).

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[4] Ireland's rating on the OECD's energy, transport, and communication regulation (ETCR) index declined from 5.67 in 1985 to 4.95 in 1988. The scale is 0 to 6, where "6" is for the most regulated environment.

[5] Low headline corporate tax rate has been the cornerstone of Ireland's industrial policy for several decades, but it is not the only important competitiveness factor. The Ireland Development Agency (IDA), which is charged with attracting and developing foreign investment in Ireland, suggests that MNCs choosing Ireland as a destination for their businesses are attracted by several drivers of Ireland's competitiveness summarized as the 4 Ts—Talent, Technology, Taxes, and Track record (See http://www.idaireland.com/invest-in-ireland/).

**Figure 2. Ireland: Reforms, Productivity, and Macroeconomic Performance
(1981-2007; Annual or period averages in percent, unless otherwise specified)**

*Deregulation, reflected in a declining ECTR, was
Accompanied by REER depreciation and rising FDI*

ETCR index
REER_CPI (2005=1)
REER_ULC (2005=1)
Inward FDI (in bn. 2005 Euros, rhs)
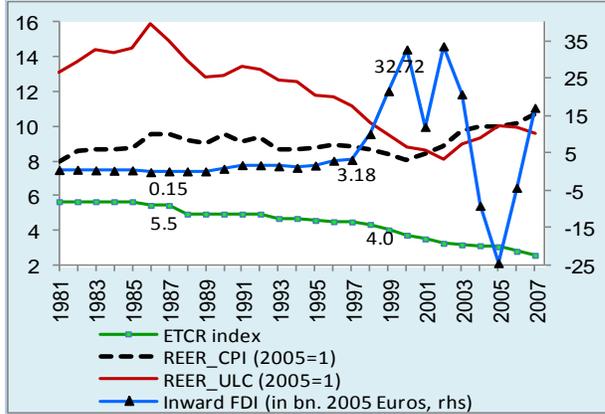
*...supporting strong investment and productivity
growth*

Growth GFCF
Growth MFP
ETCR
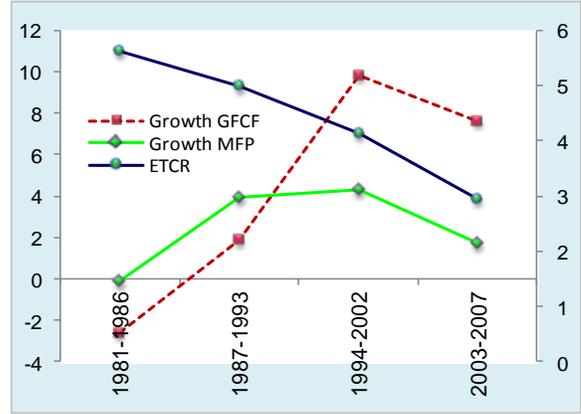
Productivity became the main driver of growth,

Sources of growth, in percent

MPF growth   Capital growth   Labor growth
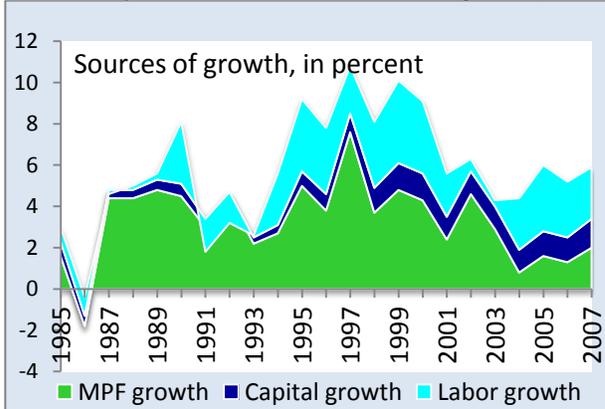
...outpacing that of Ireland's trading partners

Growth of MFP, in percent

1985-1986
1987-1993
1994-2002
2003-2007
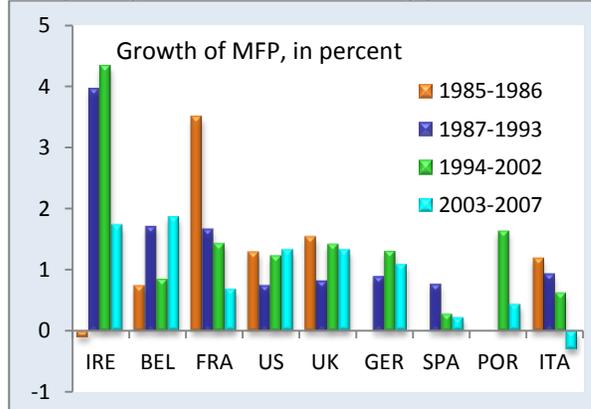
*High-tech exports picked up, outperforming the
Euro area[1]...*

Composition of merchandise exports

Ireland   Greece   Euro area average

Low-tech   Medium-tech   High-tech

*GDP growth picked up, fiscal and external
imbalances declined*

Gov debt-to-GDP (right scale)   GDP growth
Primary balance-to-GDP   Current account-to-GDP
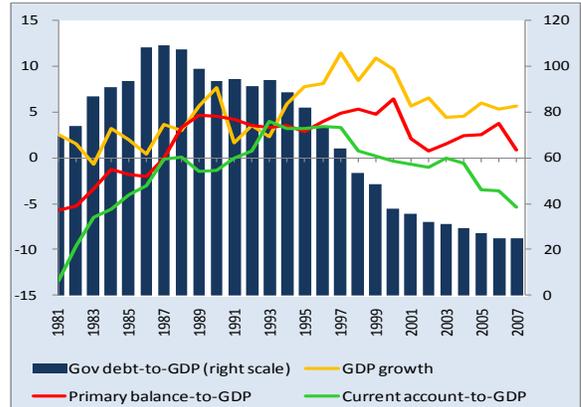
[1] The breakdown of exports is from ECB (2005).The original data is from World Trade Analyzer (WTA),
merchandise trade flows database compiled by Statistics Canada.

Sources: OECD, ECB, WEO, and author's calculations.

Reforms brought about a virtuous cycle of strong productivity-driven economic growth, together with low unemployment and low fiscal and external imbalances. Growth accounting suggests that productivity growth —referred to as change in multi-factor productivity (MFP)—was the main driver of Ireland's growth for most of the 1987–2002 period but subsided subsequently.[6] Accordingly, economic growth during Ireland's "Celtic Tiger" period is undoubtedly a productivity story (Figure 2, left-middle chart). Real GDP expanded by an annual average of 6 percent during 1988 to 2007, reaching double digits during the sub-period 1995–2000. Along with strong economic growth, the rate of unemployment declined from 17 percent in the mid-1980s to 4½ percent by 2007. Budget performance improved and public debt fell notably, reaching 25 percent in 2007, from almost 110 percent in 1987. The deficit of the net international investment position (NIIP) stood at just over 20 percent of GDP in 2007.

Ireland's apparently strong macroeconomic performance prior to the crisis raises the question of what went wrong to explain the deep crisis the country has experienced. A quick answer is that underlying macroeconomic performance weakened in the early 2000s. A closer look at key economic indicators by sub-periods highlights lurking vulnerabilities in the run up to the crisis. Reflecting several developments discussed below, the fiscal and net external positions from which Ireland confronted the crisis were apparently strong, yet very fragile.

B.   The crisis and its aftermath: Unearthing the seeds of the severity of the crisis

Pre-crisis Disruption of Ireland's Economic Fabric

The mix of Euro area and Ireland's own macroeconomic and financial sector policies in the run-up to the crisis fostered the buildup of macroeconomic vulnerabilities. At the Euro area level, three main regional policies facilitated the inflation of Ireland's real estate bubble and financial excesses. First, low interest rates fuelled credit demand. Second, the integration of Euro-based wholesale funding markets eased Irish banks' access to cross-border financing within the EMU in the absence of exchange rate risk. Third, the integration of Euro area retail markets heightened competition among banks in mortgage lending, contributing to the loosening of lending standards and excessive risk-taking. Against this backdrop, Ireland's own financial sector regulation and supervision remained relatively lax, allowing for financial excesses to build up in households' and financial sector balance sheets.

The fabric of Ireland's output weakened notably in the five years leading to the crisis (Figure 3, upper two charts). On the supply side, reflecting in part a shift of economic activity to more labor-intensive sectors connected to the real estate boom—such as construction and services— average productivity growth fell during 2003–07. On the demand side, reflecting the real estate boom, investment in buildings picked up notably and outpaced equipment

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[6] Unlike the standard measure of productivity as output per worker, MFP relates output to the combination of capital and labor inputs. Accordingly, the change in MFP is computed as the difference between the rate of change of output and the rate of change of total inputs; shares of compensation of labor input and of capital inputs in total costs for the total economy measured at current prices and total inputs calculated as volume indices of combined labor and capital inputs for the total economy (OECD).

investment. Overall, the GDP share of domestic demand increased from 84 percent in 2002 to 91 percent in 2007 and that of net exports fell accordingly.

Figure 3. Ireland: Economic Changes in the Run-up to the Crisis: Seeds of a Severe Crisis (in percent, unless otherwise specified)

Productivity growth fell notably during 2003–07

...as labor intensive real estate building became the main driver of investment growth.
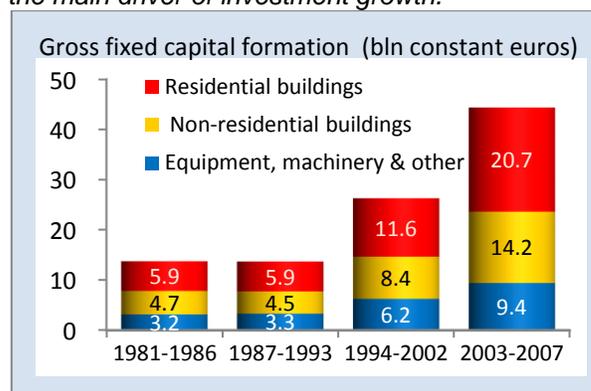
Headline fiscal indicators improved, but the cyclically-adjusted bal. fell, as did the external CA.
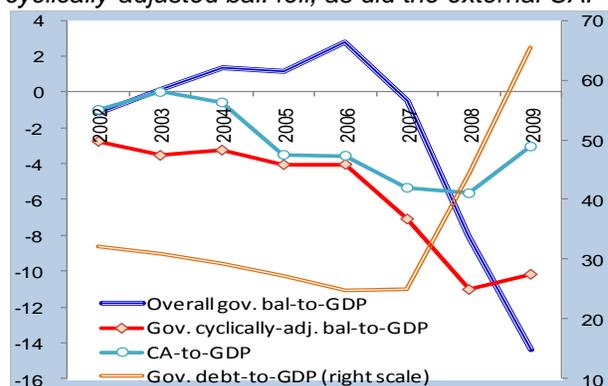
Financing of the larger CA deficit by banks' non-FDI flows altered the NIIP landscape notably.
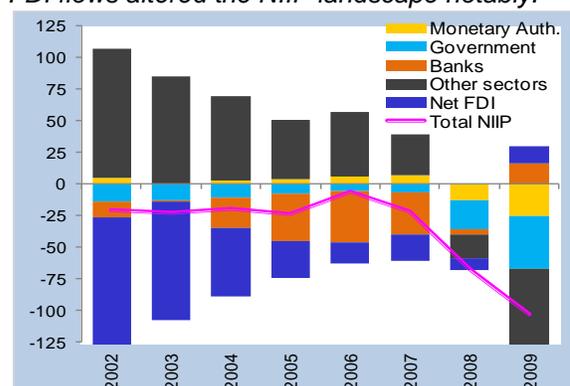
Sources: OECD, WEO, and author's calculations.

Fiscal and external vulnerabilities were mounting in the run-up to the crisis (Figure 3, lower two charts). The availability of cyclically-sensitive revenue associated with the real estate boom gave policymakers a false sense of security regarding the appropriateness of the fiscal stance as the overall government balance improved and public debt declined despite sharply rising government spending. However, the cyclically-adjusted deficit deteriorated notably to over 7 percent of GDP in 2007, from only 2¾ percent of GDP in 2002. On the external side, in line with the fall in next exports, the current account (CA) balance deteriorated from balance in 2003 to a deficit of 5½ percent of GDP by 2007. Notwithstanding external capital needed to cover the widening CA deficit, the NIIP remained almost at its 2002 level. However, its composition shifted towards larger banks' debt liabilities and a much lower net inward FDI position compared with the 2002 level as discussed below. The wider CA deficit and the change in the makeup of the NIIP deficit,

together with the looser fiscal stance raised Ireland's vulnerability to a downturn or change in investors' sentiment.

The role of dwindling FDI and cost competitiveness

Net inward FDI dynamics fell in the run-up to the crisis, reflecting in part loss of competitiveness. The stock of net FDI into Ireland, which represented almost 100 percent of GDP in 2002, fell gradually to less than 20 percent of GDP by end-2007. The decline, stemming from loss of competitiveness as well as other factors unrelated to competitiveness, is reflected in both inward and outward FDI flows (Figure 4).[7] The drop in outstanding net inward FDI took place across several export-contributing sectors, notably computer hardware and software, thereby weakening the country's export potential. Certainly, rising domestic costs rendered Ireland less attractive, contributing to the adverse net FDI dynamics.[8]

Figure 4. Ireland: FDI Dynamics in the Run-up to the Crisis

Outstanding inward FDI declined notably during 2003-07, ...
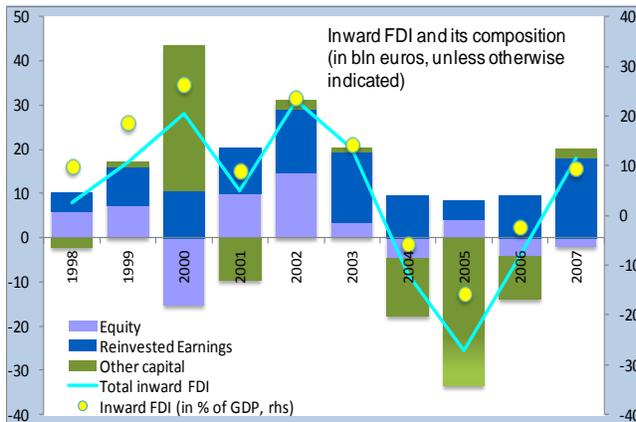
reflecting a combination of rising outflows and deteriorating inflows, except for a pickup in 2007.
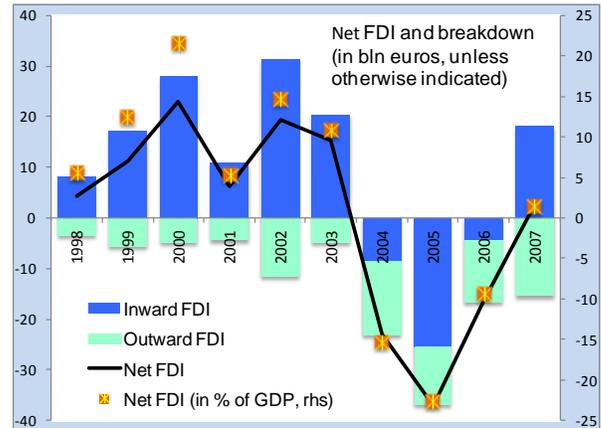
Sources: Ireland's Central Statistics Office (CSO) and author's calculations.

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[7] Everett (2006) mentions two factors unrelated to cost competitiveness. First, the enactment of the 2004 American Jobs Creation Act created a one-off incentive for subsidiaries of US MNCs to repatriate funds to the US at a reduced corporate rate, resulting in a reduction of earnings reinvested in Ireland in 2005. Second, inter-company loans from Irish-based subsidiaries of MNCs to their overseas affiliates turned the "other capital" component of inward FDI into large negative figures, pushing total inward FDI flows into negative territories in both 2004 and 2005. Inter-company loans reflect internal financial management structures of MNCs and their reshuffling of international lending and borrowing operations to minimize their global tax liabilities taking into account cross-country differences in financial market conditions and tax regimes.

[8] White (2003) indicates that the increase in the cost of living in Dublin in the early 2000s made it difficult for Dublin-based MNCs affiliates operating in the computer software sector to recruit and retain skilled staff. Press releases on the closure of plants producing hardware components and products outside the computer sector also point to concerns over costs. Capell (2010) notes that at a Dublin conference in September 2009, a former Intel Chairman (Craig R. Barrett) stated that of the 14 reasons Intel came to Ireland two decades earlier, only one remained: a low corporate tax rate of 12.5% and that Ireland needed "a new game plan." http://www.businessweek.com/magazine/content/10_08/b4167050028125.htm

Competitiveness indicators send mixed signals (Figure 5). On the one hand, Ireland's overall manufacturing producer price index (PPI) has been trending down since the early 2000s, in contrast with those of its main trading partners. On the other, its REER, either ULC-based or CPI-based, had been trending up. However, developments differed across the two REER measures. Over an almost 20-year period starting with the 1987 onset of Ireland's reforms, the CPI-based REER appreciated while the ULC-based one depreciated. Over the period 2003–07, both REER measures appreciated but at markedly different paces. The ULC-based REER and the CPI-based one appreciated by 10 percent and 32½ percent, respectively. The appreciation weakened total exports in the run-up to the crisis but after the breakdown of exports between goods and services, trends in net exports and in Ireland's market shares in the global markets for goods and services reveal that the response to REER appreciations is heterogeneous across the two exports groups.

Figure 5. Ireland: Competitiveness Indicators Send Mixed Signals

Ireland's PPI has been trending down since 2002, in contrast with those of trade partners.
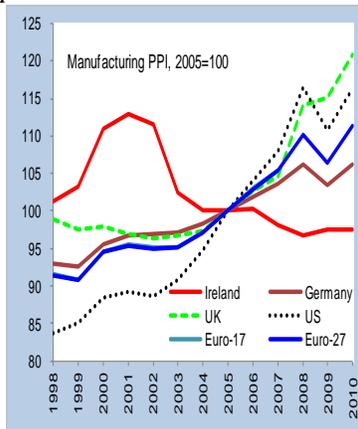
But, its REER were trending up and Ireland lost share in the global market for goods and gained in the services market.
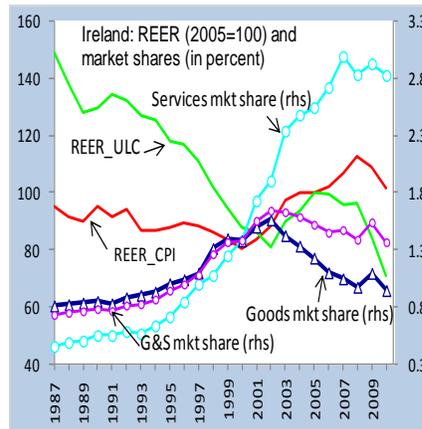
Ireland's trade balances for goods and services have had divergent trends, including in the run-up to the crisis.
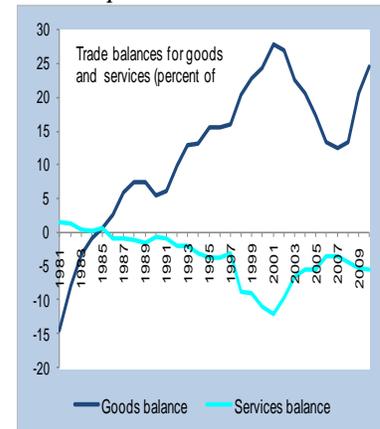
Sources: IMF WEO, OECD, and author's calculations.

C. The Post-Crisis Imbalances: a Stumbling Block on Ireland's Way

Pre-crisis financial excesses and Ireland's high trade openness provided fertile ground for adverse shocks to weaken Ireland's economic performance significantly. The end of the housing boom with the onset of price declines in early 2007 was associated with a contraction of the housing sector, rising unemployment, and a deterioration in banks' loan portfolios. When the 2008 global financial crisis hit, it affected Ireland badly, owing to the country's exceptionally large exports-to-GDP ratio (80 percent in 2007) and the vertical integration of its manufacturing sector into the supply chains of MNCs. Domestic and external shocks, together with a full-blown banking crisis, crippled the economy notably.

The post-crisis growth decline had been associated with a significant increase in fiscal and external imbalances. During 2008–11, Ireland registered a cumulative negative GDP growth rate of almost 7 percentage points. Reflecting both the decline in economic growth and expansionary fiscal measures implemented to stimulate the economy and support financial institutions, the post-crisis increase in the country's public debt and net external liabilities have been very pronounced. Public debt-to-GDP and the deficit of the NIIP-to-GDP hovered 100 percent by end-2011, from 25 percent and 21 percent, respectively at end-2007.

III. ECONOMETRIC ANALYSIS

A. Data and stylized facts

The analysis is based on Ireland's quarterly data covering 1980Q1 to 2009Q4. We use GDP, exports, government revenue and some of their determinants to capture linkages relevant for fiscal and external balances. Both exports and revenue are in real terms. Real revenue is derived as nominal general government revenue scaled by the GDP deflator. Revenue is deflated to ensure that inference on its developments and prospects is also valid for the revenue-to-GDP ratio, which is more relevant for fiscal consolidation analysis. Other indicators of relevance included in the analysis are the REER, trading partners' demand, and inward FDI. The REER is either CPI-based or ULC-based. Inward FDI is included considering its role as a key ingredient in Ireland's economic performance. It is expressed in 2005 Euros. For trading partners' demand, the partners considered account for 95 percent of Ireland's exports. Variables' description and data sources are in Appendix Table A1.

Bivariate relationships between REER indicators, exports, and inward FDI highlight striking differences between ULC- and CPI-based REER. (See Appendix Table A2).

- Appreciation of the ULC-based REER is harmful to both FDI and exports.

- The correlation between the CPI-based REER and exports is counterintuitive as it emerges with a statistically significant positive sign.

The linkages between exports and GDP on the one hand and GDP and fiscal performance on the other are meaningful (Figure 6).

- There is a positive relationship between exports and GDP;

- Stronger economic growth improves fiscal performance. In particular, economic growth is positively associated with both government revenue and the primary balance, and negatively associated with public debt.[9]

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[9] The negative correlation between GDP growth and public debt does not suggest anything about causality. Results available upon demand point to a two-way causality between real GDP and public debt and suggest that causality from GDP to debt is stronger.

**Figure 6. Ireland: Exports, GDP Growth, and Fiscal performance
(1981–2007)**

Over the past two decades, exports have been a clear driver of Ireland's output performance

Real exports and real GDP, 1981-2007 (bn. euros)

y = 0.94x + 39.19
R² = 0.99

Real GDP (y-axis)
Real exports of goods and services (x-axis)
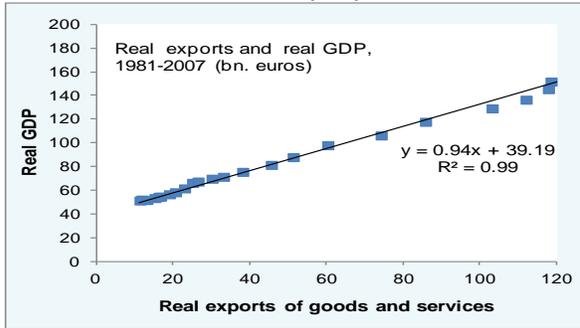
...and output has been positively associated with real government revenue

Real GDP and real gov. revenue, 1981-2007 (bn. euros)

y = 0.32x + 4.69
R² = 0.99

Real general government revenue (y-axis)
Real GDP (x-axis)
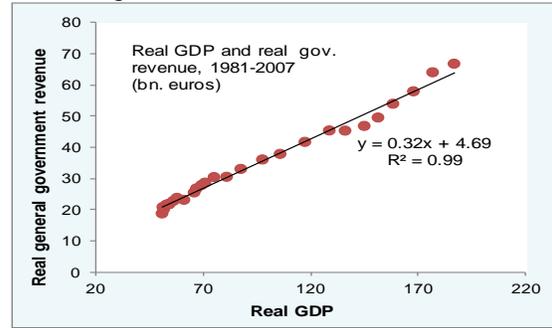
Accordingly, GDP growth has been associated with fiscal consolidation...

y = 0.72x - 1.82
R² = 0.49

2000
1981

Primary balance (in percent of GDP) (y-axis)
GDP growth (in percent) (x-axis)
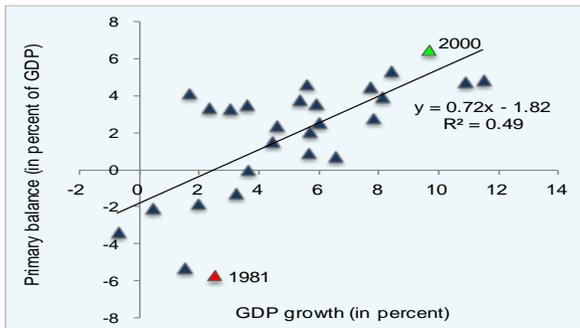
and a fall in government debt. By 2006-07, public debt was a quarter of its 1987 level

1987
1983
2007

y = -4.18x + 90.33
R² = 0.19

Public debt-to-GDP (in percent) (y-axis)
GDP growth (in percent) (x-axis)
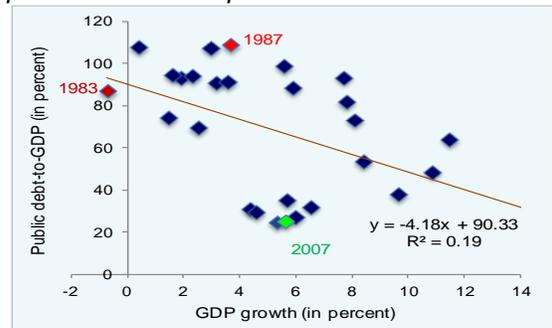
Sources: OECD, IMF World Economic Outlook

B. Vector Autoregressive Specification

We assess the interrelationships between macroeconomic performance and revenue. The focus is on the triangle exports growth, GDP growth and revenue growth for two main reasons. First, prior to the crisis, strong exports growth was a very important part of Ireland's success story. Second, to the extent that the collapse in tax revenue played an important role in the widening of Ireland's fiscal deficit during 2008–09, revenue mobilization is a key ingredient of Ireland's quest to reduce fiscal imbalances. Honohan (2009) notes that while tax revenue shrunk in many countries as a result of the economic downturn associated with the global financial crisis, the revenue collapse in Ireland had been much more pronounced.

Two VAR models are used to assess the relationships between our variables of interest. A trivariate VAR, considered as the baseline, contains the three endogenous variables— exports growth, GDP growth, and revenue growth—forming our triangle of particular interest. An expanded model, which has two variants, depending of the REER measure used, includes additional variables that have a bearing on Ireland's economic performance, in addition to the three variables of interest. The models to estimate are specified as follows.

$$Y_t = \sum_{i=1}^{q} A_i Y_{t-i} + BZ_t + u_t \qquad (1)$$

where $Y_t = (Y_{1t}, \ldots, Y_{kt})'$ is a (k x 1) vector of endogenous variables; Z_t contains m deterministic variables including a constant and a dummy variable for EMU that takes the value of 1 from 1991Q1 onward; u_t is a (k x 1) vector of unobservable error terms; and p is the lag order. The A_i and B are parameter matrices of dimension (k x k) and (k x m), respectively.

In the baseline VAR, thereafter VAR1, the vector of endogenous variables comprises exports growth, GDP growth and revenue growth, in the same order. The ordering of variables reflects the following considerations. Exports come first because of their role as an engine of growth. Growth comes before revenue growth because it is associated with changes in the taxable base. The vector of endogenous variables is (3x1). The model includes also a constant and the dummy variable EMU. Accordingly, the vector of pre-determined variables is (2x1). Four lags are used following results of a lag selection test (Appendix Table A4).

An expanded VAR helps explore the role of other seemingly important variables. As indicated earlier, one such factor is FDI, a key ingredient of Ireland's economic development strategy. The other two factors are the REER and trading partners' demand, which are hypothesized to be important determinants of exports and economic growth. Therefore, the expanded model, thereafter VAR2, adds the following three variables to VAR1: the change in trading partners' demand for G&S (DLNMGS_TP), the change in inward FDI (DINFDIR), and the change in the REER (DLNREER_ULC or DLNREER_CPI). Accordingly, the vector of endogenous variables becomes (6x1) and that of pre-determined variables remains (2x1) as in VAR1. The lag selection criteria favor four lags (Appendix Table A3).

The identification of the VAR2 model relies on information from several angles. These include Granger-causality, prior beliefs, and generalized impulse results. Generalized impulse response functions from an unrestricted VAR, unlike Cholesky factorization, do not depend on the ordering of variables in the VAR model. As such, they provide a yardstick to which we compare results from the selected Choleski factorization. The impulse responses from the selected Choleski factorization are very close to the generalized ones (Table 1).[10] We rely on such factorization for variance decomposition. In the Choleski factorization, the variables added to the VAR1 vector are placed first in the vector in the following order: DLNMGS_TP, which is the most exogenous, followed by DINFDIR, and DLNREER_ULC. The ordering of DLNREER_ULC after DINFDIR is informed by Granger-causality, which suggests that the probability that DLNREER_ULC does not Granger-cause DINFDIR is almost 1 (Table A4).

C. Exploring the linkages between exports, GDP, and revenue: baseline model

The baseline model confirms the strength of the exports, GDP, and revenue nexus. Impulse response functions (IRFs) and forecast error variance decompositions (FEVD) complement each other well and are used to assess the interrelationships among variables. The first linkage is from exports of G&S to GDP and the second is from GDP to revenue.

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[10] A drawback from generalized procedure is that the shares of the forecast error variances explained by different variables do not sum up to unity whereas with Choleski factorization they do.

Exports help predict GDP and GDP helps predict revenue. The direct relationship from exports to revenue is weak. Surprisingly, there seems to be some feedback from revenue to both exports and GDP.

The impulse responses from VAR1 are intuitive and have statistically significant and long-lived effects (Figure A1). As all the variables included in the VAR are in first-difference, the discussion of the impact of shocks refers simply to variables and not their growth rates. Also, any mention of shock refers to a one standard deviation shock. Standard deviations are in the summary statistics Table (Table A5).

- A shock to exports of G&S (equivalent to 6½ percent) is associated with a 1 percentage point increase in GDP after one quarter, augmenting gradually to a cumulative 7 percent by the 8th quarter and just over 8 percent at the end of the 16th quarter.

- A shock to GDP (corresponding to 4 percent) has a statistically-significant cumulative impact on revenue of 2 percent after four quarters, rising gradually to peak at 5 percent after eight quarters. This cumulative impact loses statistical significance afterwards and falls to almost 3½ percent in the 16th quarter.

The FEVD suggest that export is less of a direct driver of revenue than it is for GDP and also that there is a two-way relationship between revenue and GDP. These decompositions show the proportion of the variation of a given variable that can be explained by shocks to other variables included in the VAR model.

- Exports dominate all variables in explaining changes in output over time, except in the first two quarters in which output is predominantly explained by its own innovations. A shock to exports explains 34½ percent of the variation in GDP after one quarter and its share peaks at 42¾ percent after three quarters and falls to almost 39 percent after eight quarters and 16 quarters. Revenue also explains an important share of the variance of GDP, accounting for 32½ percent on average five to 16 periods ahead and exceeding even the contribution of GDP's own innovations. This lends support to the idea that revenue and GDP influence each other.

- The variance of revenue is explained predominantly by its own innovations. The share of own innovations starts at 98¾ percent after one quarter, falling to 82¾ percent and 80¼ percent after eight quarters and 16th quarters, respectively. The remaining variation is explained by GDP whose share rises from nil after one quarter, to 14 percent after 16 quarters. The share of innovations to exports is small, starting at ½ percent after one quarter, rising gradually to reach 7 percent after eight quarters and decline to 6½ percent by the end of the 16th quarter. We infer that any significant role for shocks to exports in explaining variations in revenue is likely to be exerted through GDP.

D. Expanded model: what does it reveal?

The model highlights the key role of external demand in Ireland's economic performance. As noted above, the variables added to the baseline VAR are trading partners' demand, inward FDI, and either the ULC-based REER or the CPI-based one. While all added variables have generally intuitive impacts, the role of trading partners' demand is worthy of

note. Of all the new variables, external demand seems to play a key role in altering the predictive power of the baseline model's variables. Therefore it appears like a game changer.

REER appreciations are a break on economic macroeconomic performance

A positive shock to the REER, featuring an adverse shock to competitiveness, reduces GDP growth (Table 1). Specifically, a one standard deviation (SD) shock to the ULC-based REER (equivalent to 6¼ percent), reduces GDP by almost 2 percent after a year. Also, a one SD deviation shock to the CPI-based REER (equivalent to 5 percent) reduces GDP by a marginally not significant one percent after a year. The adverse shock on GDP is likely to take place through at least two channels: subdued inward FDI and lower exports growth.[11]

Table 1. Effects of Shocks to the REER measures: Impulse Responses and Forecast Error Variance Decomposition

Responding variable	Models	IRFs/FEVD	Time Horizon in Quarters									
			1	2	3	4	5	6	7	8	12	16
DLNEXPGS	VAR including DLNREER_ULC	IRFs Gen.	-1.2	-2.9	-4.4	-5.3	-5.6	-5.8	-5.9	-6.1	-6.4	-7.2
		IRFs Chol.	-1.2	-2.8	-4.3	-5.2	-5.7	-6.0	-6.2	-6.5	-6.9	-7.8
		FEVD	21.2	32.9	32.7	29.4	25.7	23.7	22.3	21.3	18.8	18.5
	VAR including DLNREER_CPI	IRFs Gen.	-0.7	-1.8	-2.8	-3.7	-4.3	-4.8	-5.2	-5.5	-5.6	-6.4
		IRFs Chol.	-0.7	-1.8	-2.9	-3.8	-4.5	-5.1	-5.5	-5.8	-6.0	-6.8
		FEVD	8.1	13.2	14.4	14.8	14.5	14.4	13.8	13.3	11.7	11.7
GRW	VAR including DLNREER_ULC	IRFs Gen.	-0.2	-0.8	-1.4	-1.9	-2.3	-2.6	-2.9	-3.3	-3.7	-3.8
		IRFs Chol.	-0.2	-0.8	-1.5	-1.9	-2.5	-2.9	-3.3	-3.8	-4.4	-4.5
		FEVD	0.4	2.4	4.3	4.0	4.9	5.8	6.3	7.3	7.3	7.1
	VAR including DLNREER_CPI	IRFs Gen.	-0.1	-0.3	-0.7	-1.0	-1.4	-1.9	-2.2	-2.7	-3.2	-3.2
		IRFs Chol.	-0.1	-0.4	-0.8	-1.1	-1.6	-2.1	-2.5	-3.0	-3.6	-3.6
		FEVD	0.4	2.4	4.3	4.0	4.9	5.8	6.3	7.3	7.3	7.1
DLNREV	VAR including DLNREER_ULC	IRFs Gen.	0.1	0.0	0.0	-0.1	-0.2	-0.1	0.0	0.2	-0.2	-1.1
		IRFs Chol.	0.1	0.0	-0.1	-0.2	-0.4	-0.4	-0.4	-0.2	-0.8	-1.7
		FEVD	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.3	0.9	1.8
	VAR including DLNREER_CPI	IRFs Gen.	0.0	0.0	-0.2	-0.5	-0.9	-1.3	-1.7	-1.8	-1.6	-1.8
		IRFs Chol.	0.0	-0.1	-0.3	-0.6	-1.0	-1.5	-1.9	-2.1	-1.9	-2.1
		FEVD	0.1	0.3	0.4	0.9	1.6	2.3	2.8	2.8	2.5	2.5

Note: the figures represent the impulse responses of the variables shown in the first column to a one standard deviation shock to REER changes, as well as the share of the FEVD attributable to such shock. The IRFs and FEVD are derived from variants of VAR2 in which DLNREER_ULC and DLNREER_CPI are used alternatively. Green highlights denote statistical significance at the standard significance levels of 1 percent, 5 percent, and 10 percent.

REER appreciations negatively affect total exports of G&S. A one SD shock to the ULC-based REER is associated with a highly-significant 1½ percent decline in exports of G&S after one quarter and the decline reaches over 6 percent after 8 quarters. Likewise, a one SD shock to the CPI-based REER reduces exports of G&S by ¾ percent and 5½ percent after one quarter and 8 quarters, respectively. While the magnitudes of the response of exports of G&S to the CPI-based REER are smaller than those of the response to the ULC-based one, the

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[11] REER appreciations reduce inward FDI although owing to the wide error bands, the impulse responses are not statistically different from zero (see Figure A2).

elasticities tell a different story. As discussed later, in response to a one percentage point increase in the ULC-based REER and the CPI-based one, exports of G&S decline by 0.6 percentage points and one percentage point, respectively.

The impacts of the remaining two variables added to VAR1—trading partners' demand and inward FDI —are also generally intuitive.

- A shock to trading partners' demand increases exports by ⅓ percent after one quarter, 4½ percent after four quarters, and 7 percent after eight quarters. It increases GDP by ⅓ percent, 3 percent, 6⅓ percent, and 7¾ percent in the first, 4th, 8th, and 16th quarter, respectively. The response of revenue starts at almost nil in the first quarter and reaches 3 percent, 4½ percent, and 5⅓ percent in the 4th, 8th, and 16th quarter, respectively.

- A shock to inward FDI has positive and short-lived impacts on exports and GDP. It boosts Ireland's exports by ¾ percent after one quarter, rising to almost 1 percent by the second quarter and losing statistical significance thereafter. It increases GDP by about ⅓ percent one quarter ahead. Thereafter, the impact becomes negative but statistically not significant.

The FEVD complement the IRFs well as in VAR1 and provide insights into the importance of added variables as well as that of components exogenous to the VAR system.

Besides exports' own innovations, shocks to the REER and to trading partners' demand are the most important in explaining the variance of exports. Throughout the forecast period, own innovations account for the greatest share of the variance of exports, explaining around 69¼ percent, 40 percent, and 32 percent in the first, 4th, and 16th quarter, respectively. For the first 4 quarters, the REER is the second most important contributor, accounting for up to 29¼ percent of the variance of exports. From 5 quarters out, while the REER remains significant, trading partner's demand takes over as the 2nd most important contributor to the variance of exports accounting for 27 percent. Its share decays to 22 percent 16 quarters out.

The variance of GDP is explained by own innovations, trading partners' demand, and revenue. Own innovations account for 81 percent of the variance of GDP after one quarter, decaying quickly to 36¼ percent after four quarters and 19 percent by the end of the 16-quarter forecast period. The share of trading partners' demand in explaining the variance of GDP starts at 6½ percent after one quarter, rising to 29 percent after 4 quarters, and reaching a peak of 34¾ percent after six quarters. From the 5th quarter, trading partners' demand takes over from GDP's own innovations as the single most important determinant of fluctuations in Ireland's economic growth. The share of revenue starts at 13¾ percent after two quarters and rises to a peak of 25½ percent after five quarters. It remains significant thereafter although it subsides to 21½ percent after in the 16th quarter.

Only innovations to external demand and revenue's own innovations are significant in explaining the forecast error variance of revenue throughout the forecast period. The share of revenue's own innovations starts at 97 percent after one quarter and decays to 67 percent after 8 quarters. Afterwards, it decays very little to 64¾ percent after 16 quarters. The share of trading partners' demand becomes significant after three quarters at 13½ percent and is the second most important determinant of fluctuations in revenue after revenue's own

innovations. It rises to a peak of 19¼ percent after 5 quarters and decays very slowly to 17¾ percent after 16 quarters. The shares of the remaining VAR variables are not significant.

Government revenue seems to depend more on variables exogenous to the VAR2 system than does GDP. Meese and Rogoff (1983) suggest that the larger the share of a variable's forecast error variance attributable to its own innovations, the more important the role of components exogenous to the VAR system in explaining the variance of the variable in question. At a 16-quarter horizon, own innovations account for 16½ percent and 68 percent in explaining the variance of GDP and government revenue, respectively. Accordingly, variables not included in the VAR systems seem to play a relatively more important role in explaining the variance of revenue.

Trading partners' demand is a game changer

The importance of each of the three variables of the baseline model in explaining the variance of the other two diminishes in the presence of external demand. With trading partners' demand in the VAR, the shares of exports in explaining the variance of GDP and the shares of GDP in explaining revenue fall drastically and are well within their corresponding shares in VAR1 (Figure 7). In a side exercise excluding trading partners' demand from VAR2 and leaving the REER and INFDIR, there is no drastic decline in the shares of the baseline variables, compared with those emerging from VAR1. Against this backdrop, to the extent that VAR1 variables capture also the shares of excluded variables that may be relevant, they seem to predominantly capture the share of trading partners' demand, whose inclusion in VAR2 is really a game changer.

Figure 7. Ireland: Comparison of IRFs and FEVD from VAR1 and VAR2 models
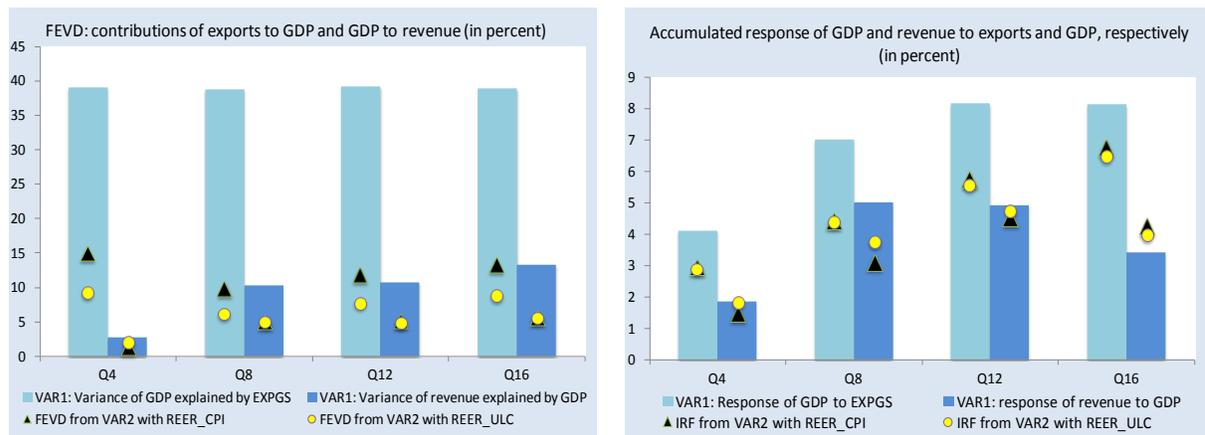
Source: author's calculations.

The IRFs also indicate that the inclusion of trading partners' demand in the VAR alters the impact of the three endogenous variables of the baseline VAR notably. The IRFs suggest that, while the thrust of the direction of the relationships among the variables of the baseline model remain, the impacts of shocks to these variables are generally smaller and, in some cases, of a shorter lifespan from a statistical significance standpoint.

- A shock to exports of G&S boosts GDP by ¾ percent in the first quarter, 4½ percent and 6½ percent after 8 quarters and 16 quarters, respectively. The magnitudes of the response

of GDP are smaller than in the baseline in which they stand at 1 percent, 7 percent, and 8 percent, after one quarter, eight quarters, and 16 quarters, respectively.

- A shock to GDP boosts revenue by a statistically significant 1¾ percent after four quarters, although the first quarter impact was not significant. It rises gradually to 3½ percent after seven quarters and loses statistical significance afterwards. Again, the magnitudes of revenue's responses are smaller than in the baseline model in which, by the 7th quarter, the increase is 4½ percent and 5 percent in the 8th quarter.

IV. PROSPECTS AND CHALLENGES

Ireland has shown signs of economic recovery on the back of a pickup in export growth, but important challenges remain. The tepid and still fragile global economic recovery is likely to be a challenge for Ireland's growth prospects given the economy's heavy dependence on exports. Moreover, domestic financing conditions remain relatively tight and access to capital markets is limited as investors' confidence has been eroded by the high public debt and banking fragilities in Ireland as well as in other Euro area countries. As a result of tight financing conditions and high unemployment, the contribution of domestic demand to economic growth, which was negative for most of the post-crisis period, could remain subdued in the near term. Therefore, strong export growth will be crucial to propelling economic growth.

A. Paving Ireland's Way Back to the Future: the Role of Exports

Exports have a central role to play in Ireland's economic recovery and in reducing the fiscal and external imbalances. Our analysis points to a strong relationship between exports and GDP and between GDP and government revenue. The bivariate historical relationships suggest that economic growth is negatively associated with public debt. Against this background, exports growth would boost economic growth which, in turn, would reduce the debt burden if spending is kept in check. On average, a one percentage point increase in GDP would be associated with a 4 percentage point fall in the public debt-to-GDP ratio (Figure 7).

Adverse shocks to external demand growth pose a threat to Ireland's economic performance. The econometric analysis suggests that trading partners' demand is the single most important determinant of Ireland's GDP and government revenue. Growth of Ireland's trading partners import demand is projected to average 4¼ percent during 2013–17. This, and the elasticities derived from our VAR results, point to modest growth rates of exports, GDP, and government revenue. The sensitivity analysis suggests that if trading partners' demand growth reaches 6 percent, the recorded average of the 5 years leading into the crisis, the odds of Ireland reducing its public debt would improve as both GDP and revenue would grow at a faster rate.[12] In contrast, an adverse shock that would reduce external demand by 5½ percent, the average of the 2008–09 crisis years, would significantly worsen Ireland's economic performance and keep the country under water (Table 2, column 9).

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[12] A higher growth rate of external demand is likely if issues associated with the debt crisis in Europe are addressed and demand in the main non-Euro area exports markets for Ireland (the US and the UK) strengthens.

**Table 2. Ireland: Trading Partners' Demand, the REER, and Economic Outlook—
A Sensitivity Analysis**

Responding variables	Elasticities from VAR1[1] Shocked variables		Elasticities from VAR2[1] Shocked variables			Sensitivity to trading partners' (TP) import demand From VAR2 TP imports' growth[2]				Sensitivity to the ULC-based REER From VAR2 REER_ULC change (+ is appreciation[3])		
	Exports of G&S (1)	GDP growth (2)	TP demand (3)	REER_CPI (4)	REER_ULC (5)	6 percent (6)	4¼ percent (WEO) (7)	1½ percent (8)	-5½ percent (9)	- 5 percent (10)	- 8 percent (11)	+7 percent (12)
Exports of G&S	----	----	0.88	-1.01	-0.58	5.25	3.72	1.31	-4.82	2.88	4.61	-4.04
GDP	0.56	----	0.82	----	-0.31	4.93	3.49	1.23	-4.52	1.53	2.45	-2.14
Government revenue	0.27	0.67	0.58	----	----	3.45	2.44	0.86	-3.16	----	----	----

[1] Elasticities are derived from the IRFs in Table A6, parts A and B. The direct elasticity of GDP with respect to the CPI-based REER is not statistically significant. The same applies to the direct elasticities of revenue with respect to exports of G&S and to both the CPI-based and ULC-based REER.

[2] For illustrative purposes, the projected average growth of TP import demand in the October 2012 WEO (4¼ percent) is used. Optimistic and pessimistic projections are considered, including a slower growth of 2½ percent mimicking the one observed during 2001–03 after the dot com bubble burst; and a decline of 5½ percent, matching the growth rate recorded during 2008–09. Columns (6) to (9) show by how much each of the responding variables would grow if TP import grows as specified in the column.

[3] Possible depreciation rates are considered in light of the slack in the economy. An adverse scenario with an appreciation matching the average of 7 percent observed in the run-up to the crisis is also considered. Columns (10) to (12) show by how much each of the responding variables would grow if the ULC-based REER changes as specified in the column.

In addition to the uncertainties from external demand, Ireland's own domestic dynamics present challenges. Final domestic demand registered year-on-year negative growth from 2008Q2 to 2012Q2 before turning positive in 2012Q3. Its pick up and sustained growth is needed to return Ireland to a high growth trajectory. High unemployment, high household debt, and tight domestic credit conditions, which are not included in our econometric framework, are likely to subdue domestic demand for some time. On the external side, near-term economic recovery prospects for AEs, which constitute major markets for Ireland's exports, remain dim and highly uncertain. Therefore, creating and nurturing conditions that allow for grabbing as great a share of the subdued external demand as possible is important for Ireland.

B. Maintaining Competitiveness: A Must

The success of Ireland in increasing exports will depend on domestic policies that can bolster competitiveness. Taking trading partners' demand as given, Ireland can build on the improvement in cost competitiveness that has been in motion since the crisis to increase exports. Over the period 2008–11, the CPI-based REER and the ULC-based one depreciated by 10 percent and 28⅓ percent, respectively. The FEVD and IRF suggest that the accumulated impact of shocks to competitiveness on Ireland's exports increases strongly at horizons of up to 9 quarters. Therefore, exports could still grow as a lagged response to the observed post-crisis depreciation. Should the REER continue to depreciate, exports could get a further boost. For instance, a 5-percentage points depreciation of the ULC-based REER would boost Ireland's exports by 2½ percentage points. However, an appreciation of let's say

7 percent, matching the average recorded in the years leading up to the crisis, would worsen the outlook by repressing the growth of exports that would have otherwise been associated with external demand growth (Table 2, column 12).

Bolstering competitiveness hinges on not only containing REER appreciations, but also implementing supporting measures in other areas that have a bearing on productivity. During the 1990s and part of the 2000s, innovation and uptake of new technologies shaped Ireland's export competitiveness by increasing the technology content of its exports. Going forward, nurturing these factors would be important to boost Ireland's market share, which is more or less where it was in the early 2000s, despite the growth of exports the country has experienced in the aftermath of the crisis. As regards structural reforms, some observers suggest that notwithstanding Ireland's highly liberalized and business-friendly environment, there is scope to enhance productivity through further reforms. These include promoting competition and opening markets in sheltered sectors of the economy and upgrading the infrastructure for telephone, broadband communication, and distribution of goods (Forfás, 2008 and 2011).

C. Challenging domestic financing conditions though FDI is a bright spot

The picture for financing conditions is mixed and uncertainties remain (Figure A4). On the one hand, bank lending on which domestic non-financial firms rely for funding remains relatively tight as a result of fragilities in the banking system and could be a drag on domestic output and aggregate demand. On the other, FDI, the major source of financing for MNCs that account for the bulk of Ireland's exports, has increased notably in the past two years. Overall, financing conditions are mixed.

Domestic credit remains tight reflecting both demand and supply factors and the outlook is uncertain. On the demand side, post-crisis loan officers' surveys suggest that the demand for business loans fell significantly over the period 2007–10 and, while it picked up thereafter, Ireland has continued to trail the Euro area as a whole. On the loan supply side, though loan officers' surveys indicate that lending standards for both business loans and households' home loans eased more in Ireland than in the rest of the Euro area since mid-2010,[13] data on actual access to credit tell a different story. In 2010, only 50 percent of business loan applications were successful, down from 90 percent in 2007 (Ireland CSO, 2011). Between September 2011 and March 2012, the level of rejections among Irish small and medium-term enterprises applying for bank loans or overdrafts was the second highest in the euro area (Central Bank of Ireland, 2012, p. 5). Clearly, bank credit remains very tight and the outlook is uncertain as banks may still need fresh capital to expand loan portfolios after bad assets erode their capital.

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[13] Analysis based on the July 2012 lending surveys. The surveys are undertaken on a quarterly basis and aim at providing qualitative information on developments in loan supply and demand factors, including information on changes in credit standards, loan terms and conditions, and loan demand for both enterprises and households. Responses are rated on a scale of 1 to 5, where "3" denotes unchanged conditions and figures below (above) 3 denote deterioration (improvement).

FDI flows have been a bright spot but their persistence requires high maintenance.
Registered FDI flows indicate that Irish firms have benefited from increased financing from
parent companies in the past couple of years. Net FDI-to-GDP rose significantly during 2010–
11 from the negative net flows of 13½ percent and ¼ percent recorded for 2008 and 2009,
respectively. It reached 4 percent in 2010 and 13¾ percent in 2011, the largest of the past nine
years. It has been a key source of finance for companies operating in Ireland, contributing to
exports growth and playing an important role in the economic recovery observed during 2010-
11.[14] As our econometric analysis suggest that shocks to FDI have short-lived positive impacts
on exports and GDP, for FDI flows to remain a bright spot for the growth outlook, conditions
that attract investors should be catered for on a continuous basis.

V. Conclusion

The paper has investigated the prospects of Ireland growing out of its debt. To this end,
the paper analyzed the interlinkages between competitiveness, exports, economic growth and
fiscal performance over the period 1980–2009 using VAR analysis. The main finding is that
competitiveness and external demand growth can help Ireland take small, though important
steps, to grow out of debt although challenges and uncertainties remain.

**Four specific findings point to the importance of external demand and competitiveness
for Ireland's quest to grow out of debt.** *First*, trading partners' demand is an important
driver of exports and also the single most important driver of Ireland's GDP and revenue
performance. *Second*, exports boost GDP, which in turn boosts government revenue and
reduces public debt. *Third*, shocks to inward FDI have a positive, albeit short-lived impact on
exports and GDP. *Lastly*, positive shocks to the REER (appreciations) weaken FDI and have
adverse impacts on exports and economic growth that build up over time.

**These findings suggest that Ireland is poised to return to its path of strong growth and
low imbalances, though the road could be bumpy due to ongoing challenges**. Enhanced
competitiveness was a key factor in pulling Ireland out of its high indebtedness of the late
1980s and can play that role again. The decline in domestic costs registered since the crisis,
together with the associated boost to inward FDI, suggests that even with the tepid external
demand currently projected for the medium-tem, Ireland can still register moderate exports
growth and a boost to GDP and fiscal revenue. However, as our sensitivity analysis suggests,
adverse shocks to either external demand or competitiveness pose a threat to the economic
outlook. Beyond our analysis, the confluence of high unemployment, subdued domestic
demand and tight domestic financing conditions are a challenge to the growth outlook.

**From a policy standpoint, efforts to boost and maintain both price and non-price
competitiveness would be crucial to reducing imbalances**. Once the slack in the economy

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[14] Exports growth recovered from negative 3¾ percent in 2009 to 6¼ percent and 5 percent in 2010 and 2011,
respectively. It has compensated for falling domestic demand, helping subdue the decline in real GDP to less
than one percent in 2010 and boost GDP growth to almost 1½ percent in 2011. Holton and O'Brien (2011)
indicate that the increase in Ireland's GDP towards the end of 2010 had been led by the export-oriented MNCs,
which tend to be less reliant on domestic banks. This is in line with the finding of studies suggesting that post-
crisis declines in exports tend to be smaller for large firms and MNCs (Iacovone and Zavacka, 2009).

dissipates, an important issue for Ireland would be to contain domestic prices and labor costs considering that, in the context of EMU, national policymakers cannot directly influence monetary conditions nor use the nominal exchange as a policy instrument. Therefore, domestic policies aimed at maintaining competitiveness, including by nurturing the knowledge economy, which underpins Ireland's technological competitiveness, would be critical to reengineering the virtuous cycle of strong export-led economic growth and low public debt. The breakdown of exports between goods and services suggest that the two respond differently to REER appreciations, a fact that merits to be investigated further.

The conclusions of our analysis should be interpreted with the following caveats. First, the analysis includes financing from FDI only and not from the domestic financial sector, whose collapse was at the center of Ireland's crisis. Second, the post-crisis environment of high household debt, high unemployment, and bank fragility presents challenges that do not feature in our analysis and merit to be researched further. Third, our analysis does not include public expenditure developments. As such, the conclusion that Ireland is poised to find the way back to its future is predicated on the assumption that public spending is kept in check to allow for improvements in government revenue to strengthen the fiscal balance and reduce public debt. These caveats notwithstanding, our expanded VAR model helps explain more than 80 percent of the variation in GDP growth.

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APPENDIX

Table A1. Variables Used in the Econometric Analysis: Description and Data Sources

Variable and description	Source
CPI-based real effective exchange rate (REER_CPI)	OECD and IMF, Information Notice System (INS).
Unit labor cost-based real effective exchange rate (REER_ULC)	OECD and IMF, INS.
Log of REER_CPI (LNREER_CPI) or REER_ULC (LNREER_ULC)	Calculated as noted in the description
First difference of LNREER_CPI(DLNREER_CPI) or LNREER_ULC (DLNREER_ULC) in percent	Calculated as noted in the description
Real exports of goods and services (EXPGS)	OECD
Log of exports of goods and services (LNEXPGS)	Calculated as noted in the description
First difference of LNEXPGS (DLNEXPGS)	Calculated as noted in the description
Real net exports of goods and services (NX)	OECD
Year-on-year change in real net exports of goods and services in percent (DLNNX)	Calculated as noted in the description
Real GDP (RGDP)	OECD
Real GDP growth (GRW) is year-on-year change in RGDP	Calculated as noted in the description
Real government revenue (REV) is government revenue deflated by the GDP deflator.	Derived from OECD data as noted in the description
Log of real revenue (LNREV)	Calculated as noted in the description
First-difference of LNREV in percent (DLNREV)	Calculated as noted in the description
General government debt to GDP (DEBT_GDP)	OECD
Trading partners' demand for goods and services (MGS_TP), 2005=100	IMF, World Economic Outlook (WEO)
Log of trading partners' demand (LNMGS_TP)	Calculated as noted in the description
First-difference of LNMGS_TP in percent (DLNMGS_TP)	Calculated as noted in the description
Real foreign direct investment (INFDIR) is inward FDI Euros deflated by the GDP deflator with base 2005=100	OECD and Ireland Central Statistics Office (CSO)
Annual percentage change in INFDIR (DINFDIR)	Calculated as noted in the description

Table A2. Correlation Analysis

	LNREER_ULC	LNREER_CPI	LNMGS_TP	LNINFDIR	LNEXPGS	LNGDP_R	LNREV_R
LNREER_ULC	1.00 -----						
LNREER_CPI	-0.23 *** 0.01	1.00 -----					
LNMGS_TP	-0.89 *** 0.00	0.56 *** 0.00	1.00 -----				
LNINFDIR	-0.27 *** 0.00	-0.22 ** 0.02	0.08 0.37	1.00 -----			
LNEXPGS	-0.92 *** 0.00	0.51 *** 0.00	1.00 *** 0.00	0.12 0.21	1.00 -----		
LNGDP_R	-0.92 *** 0.00	0.55 *** 0.00	0.99 *** 0.00	0.09 0.34	0.99 *** 0.00	1.00 -----	
LNREV_R	-0.89 *** 0.00	0.58 *** 0.00	0.99 *** 0.00	0.06 0.54	0.99 *** 0.00	1.00 *** 0.00	1.00 -----

P-values are below correlation coefficients. The correlations in the solid-line circles are intuitive whereas the ones in the dashed-line rectangle are counterintuitive. Variables are as defined in Table A1. LINFDIR is the logarithm of (100+INFDIR), a transformation aimed at avoiding taking logs of non-positive numbers. *, **, and *** denote statistical significance at the 10 percent, 5 percent, and 1 percent significance level.

Table A3. Vector Autoregressive Models (VAR) Lag Selection Criteria

VAR models and specification	Lag	LogL	LR	FPE	AIC	SC	HQ
Model VAR1							
Endogenous variables: DLNEXPGS GRW DLNREV							
Exogenous variables: C EMU	0	-966.20	NA	6953.91	17.36	17.51	17.42
	1	-784.00	348.12	315.60	14.27	14.63	14.42
	2	-744.80	72.81	184.14	13.73	14.31*	13.96*
	3	-739.32	9.89	196.31	13.79	14.59	14.12
	4	-724.32	26.24*	176.73*	13.68*	14.70	14.10
Model VAR2 with DLNREER_ULC							
Endogenous variables: DLNMGS_TP DINFDIR DLNREER_ULC							
DLNEXPGS GRW DLNREV							
Exogenous variables: C EMU	0	-2790.89	NA	2.20E+14	50.05	50.34	50.17
	1	-2458.42	617.43	1.11E+12	44.76	45.92	45.23
	2	-2328.91	226.64	2.10E+11	43.09	45.13	43.91
	3	-2241.95	142.87	8.57E+10	42.18	45.09*	43.36*
	4	-2191.26	77.85*	6.78e+10*	41.92*	45.70	43.45
Model VAR2 with DLNREER_CPI							
Endogenous variables: DLNMGS_TP DINFDIR DLNREER_CPI							
DLNEXPGS GRW DLNREV							
Exogenous variables: C EMU	0	-2013.45	NA	2.06E+08	36.17	36.46	36.29
	1	-1655.18	665.36	6.52E+05	30.41	31.58	30.89
	2	-1515.25	244.88	1.03E+05	28.56	30.60*	29.39
	3	-1431.19	138.10	4.42E+04	27.70	30.61	28.88*
	4	-1387.98	66.35*	39955.31*	27.57*	31.36	29.11

Notes: Sample 1980Q1-2009Q4. * indicates lag order selected by the criterion.
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table A4. Bivariate Granger-causality Tests

Null Hypothesis	F-statistic	P-value
DLNREER_ULC does not Granger Cause DINFDIR	0.08	0.99
DINFDIR does not Granger Cause DLNREER_ULC	0.79	0.53
DLNREER_ULC does not Granger Cause DLNEXPGS	1.15	0.34
DLNEXPGS does not Granger Cause DLNREER_ULC	0.76	0.56
DLNREER_ULC does not Granger Cause GRW	2.83	**0.03**
GRW does not Granger Cause DLNREER_ULC	0.53	0.72
DINFDIR does not Granger Cause DLNEXPGS	1.30	0.27
DLNEXPGS does not Granger Cause DINFDIR	0.27	0.89
DINFDIR does not Granger Cause GRW	3.56	**0.01**
GRW does not Granger Cause DINFDIR	0.59	0.67
DINFDIR does not Granger Cause DLNREV	5.60	**0.00**
DLNREV does not Granger Cause DINFDIR	3.83	**0.01**
DLNEXPGS does not Granger Cause GRW	1.612	0.177
GRW does not Granger Cause DLNEXPGS	1.608	0.178
GRW does not Granger Cause DLNREV	3.26	**0.01**
DLNREV does not Granger Cause GRW	10.80	**0.00**

Note. Tests based on 112 observations and four lags. Variables are defined in Table A1.
Bold fonts denote statistical significance at the standard significance levels.

Table A5. Summary Statistics of the Main Variables Used in the VAR Models

	DLNMGS_TP	DINFDIR	DLNREER_ULC	DLNREER_CPI	DLNEXPGS	DLNNX	GRW	DLNREV
Mean	4.96	1006.99	-1.40	1.04	8.85	26.63	4.34	3.63
Median	5.96	-5.98	-1.35	1.24	8.92	-9.68	4.52	4.35
Std. Dev.	4.71	11181.05	6.25	5.02	6.49	264.84	3.96	4.77
Observations	116	116	116	116	116	116	116	116

All variables are in percent and defined in Table A1. Sample covers 1980Q1–2009Q4. Variables are as described in Table A1. The growth rate of net exports (DLNNX) is too volatile compared with other exports measures. A VAR framework including it in place of other export growth measures did not produce meaningful results.

Table A6. Impulse Responses from Baseline and Expanded VAR Models

A. VAR1 Model

B. VAR2 Model Including Change in CPI_based REER (DLNREER_CPI)

Accumulated Response of DLNMGS_TP:

Period	DLNMGS_TP	DINFDIR	DLNREER_CPI	DLNEXPGS	GRW	DLNREV
1	**0.6**	0.0	0.0	0.1	**0.1**	0.0
2	**2.1**	0.0	0.0	**0.4**	**0.7**	0.3
3	**4.4**	-0.1	0.0	**0.9**	**1.6**	**1.0**
4	**6.5**	-0.4	-0.3	**1.4**	**2.5**	**2.2**
5	**7.9**	-0.7	-0.8	1.9	**3.1**	**3.7**
6	**8.3**	-1.1	-1.3	2.0	**3.2**	**5.2**
7	**8.1**	-1.5	-1.6	2.0	2.9	**6.1**
8	**7.9**	-2.0	-1.7	1.8	2.7	**6.5**
12	**9.7**	-3.0	-1.2	2.9	3.8	**6.7**
16	8.5	-3.0	-1.2	2.8	3.8	5.7

Accumulated Response of DLNREER_CPI:

Period	DLNMGS_TP	DINFDIR	DLNREER_CPI	DLNEXPGS	GRW	DLNREV
1	0.1	-0.1	**2.7**	**-0.8**	-0.2	0.1
2	0.5	0.2	**4.9**	**-1.2**	-0.2	0.3
3	1.3	0.5	**6.5**	**-1.6**	0.0	-0.2
4	2.1	1.0	**7.6**	-1.8	0.6	-0.5
5	2.5	1.5	**7.6**	-1.8	1.1	-0.7
6	2.1	2.0	**6.9**	-2.0	1.3	-1.0
7	1.1	2.3	**6.1**	-2.6	1.1	-1.5
8	-0.2	2.3	**5.4**	-3.3	0.5	-2.1
12	-0.1	2.2	**5.9**	-4.1	-0.7	-3.2
16	0.0	2.6	**6.2**	-4.0	-1.5	-2.0

Accumulated Response of DLNEXPGS:

Period	DLNMGS_TP	DINFDIR	DLNREER_CPI	DLNEXPGS	GRW	DLNREV
1	0.4	**0.7**	-0.7	2.6	**1.4**	0.0
2	1.4	**1.1**	-1.8	**4.9**	2.6	0.5
3	2.7	1.3	-2.8	**7.2**	3.8	1.3
4	4.3	1.7	-3.7	**8.7**	5.0	2.0
5	5.6	1.1	-4.3	**9.6**	5.6	2.9
6	6.4	0.2	-4.8	**10.2**	6.1	3.7
7	6.7	-0.6	-5.2	**10.6**	6.4	4.7
8	6.7	-1.2	-5.5	**11.1**	6.6	5.9
12	8.1	-2.4	-5.6	**13.4**	9.1	8.2
16	8.0	-3.1	-6.4	**14.2**	10.7	7.2

Accumulated Response of GRW:

Period	DLNMGS_TP	DINFDIR	DLNREER_CPI	DLNEXPGS	GRW	DLNREV
1	**0.4**	**0.3**	-0.1	**0.7**	**1.4**	-0.1
2	**1.1**	0.3	-0.3	**1.5**	**2.3**	0.5
3	**2.0**	0.3	-0.7	**2.4**	**3.5**	1.4
4	**3.2**	0.5	-1.0	**3.0**	**4.7**	2.1
5	**4.3**	0.0	-1.4	**3.5**	**5.4**	3.2
6	**5.2**	-0.5	-1.9	**3.8**	**6.3**	3.6
7	**6.0**	-1.1	-2.2	**4.0**	**6.7**	4.3
8	**6.5**	-1.7	-2.7	**4.4**	**7.0**	4.8
12	**7.9**	-2.9	-3.2	**5.8**	**7.8**	5.7
16	7.9	-3.1	-3.2	6.8	**8.3**	5.9

Accumulated Response of DLNREV:

Period	DLNMGS_TP	DINFDIR	DLNREER_CPI	DLNEXPGS	GRW	DLNREV
1	0.1	0.0	0.0	0.0	-0.1	**1.5**
2	**0.7**	-0.2	0.0	0.3	0.1	**3.4**
3	**1.7**	-0.1	-0.2	0.7	0.7	**5.5**
4	**2.8**	-0.4	-0.5	1.3	1.5	**7.7**
5	**3.7**	-0.9	-0.9	1.6	2.3	**9.1**
6	**4.1**	-1.7	-1.3	1.7	2.7	**10.1**
7	4.0	-2.4	-1.7	1.6	3.0	**10.2**
8	3.8	-3.0	-1.8	1.4	3.1	**9.7**
12	5.8	-3.7	-1.6	2.2	4.5	**7.5**
16	5.7	-3.3	-1.8	3.0	4.3	8.3

C. VAR2 Model Including Change in ULC_based REER (DLNREER_ULC)

Accumulated Response of DLNMGS_TP:

Period	DLNMGS_TP	DINFDIR	DLNREER_ULC	DLNEXPGS	GRW	DLNREV
1	**0.6**	0.0	0.0	**0.1**	**0.1**	0.1
2	**2.1**	-0.1	0.0	**0.4**	**0.6**	0.3
3	**4.4**	-0.4	-0.2	**1.0**	**1.5**	**1.0**
4	**6.6**	-1.0	-0.5	**1.6**	**2.3**	**2.3**
5	**8.0**	-1.6	-0.9	2.0	**2.8**	**3.9**
6	**8.5**	-2.1	-1.2	2.2	**2.8**	**5.3**
7	**8.2**	-2.5	-1.3	2.1	2.5	**6.2**
8	**7.9**	-2.9	-1.1	1.9	2.2	**6.5**
12	**9.7**	-3.9	-0.1	2.7	3.3	**6.6**
16	**9.0**	-3.9	-0.4	2.9	3.6	6.3

Accumulated Response of DLNREER_ULC:

Period	DLNMGS_TP	DINFDIR	DLNREER_ULC	DLNEXPGS	GRW	DLNREV
1	0.1	-0.4	**3.0**	**-1.4**	**-0.5**	0.1
2	0.6	-0.5	**6.5**	**-3.0**	-1.0	0.5
3	1.1	-0.7	**9.5**	**-4.5**	-1.3	0.3
4	1.4	-0.8	**11.1**	-5.3	-1.3	0.6
5	1.3	-0.3	**11.3**	-5.4	-1.0	1.1
6	1.1	0.7	**11.0**	-5.3	-0.5	1.7
7	0.8	1.5	**10.7**	-5.4	-0.1	2.0
8	0.6	1.6	**10.7**	-5.8	0.0	1.6
12	-2.8	1.4	**11.7**	-8.6	-2.4	-2.9
16	-2.8	3.0	**11.3**	-8.8	-3.4	-4.0

Accumulated Response of DLNEXPGS:

Period	DLNMGS_TP	DINFDIR	DLNREER_ULC	DLNEXPGS	GRW	DLNREV
1	0.4	**0.6**	-1.2	2.5	**1.3**	0.0
2	1.5	**1.0**	-2.9	**4.7**	2.5	0.4
3	2.8	1.1	-4.4	**7.0**	3.7	1.2
4	4.4	1.3	-5.3	**8.6**	4.8	1.9
5	5.9	0.6	-5.6	**9.5**	5.4	2.9
6	6.8	-0.4	-5.8	**10.1**	5.8	3.7
7	7.1	-1.3	-5.9	**10.5**	6.0	4.7
8	6.9	-1.7	-6.1	**11.0**	6.2	5.8
12	8.0	-2.7	-6.4	**13.3**	8.7	8.2
16	8.1	-3.7	-7.2	**14.3**	10.3	7.7

Accumulated Response of GRW:

Period	DLNMGS_TP	DINFDIR	DLNREER_ULC	DLNEXPGS	GRW	DLNREV
1	**0.3**	**0.2**	-0.2	**0.7**	**1.4**	-0.1
2	**1.1**	0.1	-0.8	**1.4**	**2.2**	0.6
3	**1.9**	0.0	-1.4	**2.3**	**3.3**	**1.5**
4	**3.1**	0.0	-1.9	2.9	**4.4**	**2.3**
5	**4.2**	-0.7	-2.3	3.4	**5.0**	**3.4**
6	**5.3**	-1.4	-2.6	3.8	**5.8**	**3.9**
7	**6.0**	-2.2	-2.9	4.0	**6.0**	**4.6**
8	**6.5**	-2.9	-3.3	4.4	**6.2**	**5.1**
12	**7.7**	-4.1	-3.7	5.6	**6.6**	5.8
16	7.8	-4.3	-3.8	6.5	7.1	6.3

Accumulated Response of DLNREV:

Period	DLNMGS_TP	DINFDIR	DLNREER_ULC	DLNEXPGS	GRW	DLNREV
1	0.1	0.0	0.1	0.0	-0.1	**1.5**
2	**0.7**	-0.1	0.0	0.3	0.3	**3.4**
3	**1.8**	0.0	0.0	0.7	0.9	**5.5**
4	**3.0**	-0.4	-0.1	1.4	**1.8**	**7.7**
5	**4.1**	-1.0	-0.2	1.8	2.7	**9.2**
6	**4.6**	-1.8	-0.1	2.0	3.3	**10.1**
7	**4.6**	-2.5	0.0	2.0	3.6	**10.2**
8	4.6	-3.0	0.2	1.8	3.8	**9.8**
12	6.1	-3.9	-0.2	2.6	4.7	**7.6**
16	5.3	-3.7	-1.1	3.0	4.0	8.2

Accumulated Response of DLNEXPGS: (A. VAR1 Model)

Period	DLNEXPGS	GRW	DLNREV
1	**2.8**	**1.6**	**0.2**
2	**5.4**	**3.1**	**1.3**
3	**8.1**	**4.5**	**2.6**
4	**9.8**	**5.6**	**3.6**
5	**11.0**	**6.2**	**4.8**
6	**11.7**	**6.7**	**5.9**
7	**12.2**	**7.1**	**7.1**
8	**12.6**	**7.5**	**8.4**
12	**14.1**	**9.5**	**12.1**
16	**14.7**	**10.2**	**11.8**

Accumulated Response of GRW: (A. VAR1 Model)

Period	DLNEXPGS	GRW	DLNREV
1	**0.9**	**1.5**	0.0
2	**1.9**	**2.6**	**1.0**
3	**3.2**	**4.1**	**1.9**
4	**4.1**	**5.5**	**2.9**
5	**5.1**	**6.5**	**4.0**
6	**5.8**	**7.5**	**4.8**
7	**6.5**	**8.1**	**5.5**
8	**7.0**	**8.5**	**6.1**
12	**8.2**	**8.8**	**7.1**
16	**8.1**	**8.2**	**7.3**

Accumulated Response of DLNREV: (A. VAR1 Model)

Period	DLNEXPGS	GRW	DLNREV
1	0.1	-0.1	**1.7**
2	0.6	0.4	**3.7**
3	1.2	1.0	**6.1**
4	1.8	1.9	**8.1**
5	2.4	**2.9**	**9.6**
6	2.8	**3.7**	**10.5**
7	3.2	**4.5**	**10.7**
8	3.4	**5.0**	**10.5**
12	3.7	4.9	**8.5**
16	3.6	3.4	**8.3**

Note: Generalized Impulse with Monte Carlo standard errors (1000 repetitions). Bold fonts denote statistical significance at the standards levels of 1 percent, 5 percent, and 10 percent.

Table A7. Forecast Error Variance Decomposition

A. VAR1 Model	B. VAR2 Model with Change in CPI_based REER (DLNREER_CPI)	C. VAR2 Model with Change in ULC_based REER (DLNREER_CPI)

B. VAR2 Model — Variance Decomposition of DLNMGS_TP:

Period	DLNMGS_TP	DINFDIR	DLNREER_CPI	DLNEXPGS	GRW	DLNREV
1	**100.0**	0.0	0.0	0.0	0.0	0.0
2	**98.3**	0.1	0.1	0.1	0.7	0.7
3	**93.3**	0.5	0.4	0.4	1.5	3.9
4	**84.7**	1.3	1.2	0.6	1.7	**10.6**
5	**74.2**	1.9	2.3	0.7	1.5	**19.3**
6	**66.1**	2.4	3.2	0.6	1.4	**26.3**
7	**62.8**	2.9	3.5	0.6	1.4	**28.8**
8	**61.8**	3.8	3.5	0.6	1.5	**28.8**
12	**60.8**	5.3	3.4	2.2	1.7	**26.7**
16	**60.5**	5.1	3.3	2.2	1.7	**27.1**

C. VAR2 Model — Variance Decomposition of DLNMGS_TP:

Period	DLNMGS_TP	DINFDIR	DLNREER_ULC	DLNEXPGS	GRW	DLNREV
1	**100.0**	0.0	0.0	0.0	0.0	0.0
2	**98.1**	0.1	0.3	0.1	0.6	0.8
3	**92.7**	1.0	0.7	0.4	1.1	4.1
4	**83.9**	2.3	1.5	0.5	1.1	**10.7**
5	**73.9**	3.3	2.3	0.5	0.9	**19.1**
6	**66.3**	4.0	2.7	0.4	0.8	**25.8**
7	**63.3**	4.5	2.6	0.4	1.0	**28.2**
8	**62.5**	5.1	2.7	0.4	1.2	**28.1**
12	**60.6**	5.9	3.4	2.3	1.5	**26.1**
16	**60.6**	5.9	3.4	2.4	1.6	**26.1**

B. Variance Decomposition of DINFDIR:

Period	DLNMGS_TP	DINFDIR	DLNREER_CPI	DLNEXPGS	GRW	DLNREV
1	0.2	**99.8**	0.0	0.0	0.0	0.0
2	0.3	**92.7**	0.5	0.4	0.1	6.0
3	0.5	**89.7**	0.5	0.4	0.1	8.7
4	0.7	**86.4**	1.1	1.4	0.8	9.6
5	0.7	**85.8**	1.2	1.5	0.9	10.0
6	1.1	**84.5**	1.3	2.1	0.9	10.1
7	1.6	**82.8**	1.4	2.0	0.9	11.2
8	1.7	**82.3**	1.6	2.1	1.0	11.2
12	2.3	**80.2**	1.8	2.3	1.2	12.2
16	3.4	**78.8**	1.9	2.3	1.2	12.4

C. Variance Decomposition of DINFDIR:

Period	DLNMGS_TP	DINFDIR	DLNREER_ULC	DLNEXPGS	GRW	DLNREV
1	0.0	**100.0**	0.0	0.0	0.0	0.0
2	0.1	**90.4**	0.2	1.9	0.1	7.4
3	0.6	**86.8**	0.5	2.1	0.1	9.9
4	1.0	**83.8**	0.5	3.7	0.6	10.5
5	1.0	**83.5**	0.5	3.7	0.6	10.8
6	1.8	**82.0**	0.7	3.8	0.6	11.1
7	2.7	**80.0**	0.7	3.7	0.6	12.2
8	3.0	**79.6**	0.8	3.7	0.7	12.2
12	3.2	**78.2**	0.9	3.7	0.8	13.1
16	3.9	**77.2**	1.0	3.7	0.9	13.3

B. Variance Decomposition of DLNREER_CPI:

Period	DLNMGS_TP	DINFDIR	DLNREER_CPI	DLNEXPGS	GRW	DLNREV
1	0.2	0.0	**99.8**	0.0	0.0	0.0
2	1.5	0.5	**97.9**	0.0	0.0	0.1
3	4.6	0.9	**92.0**	0.2	0.2	2.1
4	7.6	1.9	**86.7**	0.2	1.1	2.4
5	8.2	3.3	**82.7**	0.6	2.7	2.5
6	8.2	4.2	**79.2**	2.1	3.7	2.6
7	12.1	4.2	**72.9**	4.3	3.7	2.7
8	17.2	3.7	**65.9**	6.3	3.3	3.5
12	21.1	3.4	**58.5**	7.2	3.9	5.9
16	22.1	3.5	**55.6**	7.1	4.6	7.1

C. Variance Decomposition of DLNREER_ULC:

Period	DLNMGS_TP	DINFDIR	DLNREER_ULC	DLNEXPGS	GRW	DLNREV
1	0.0	1.5	**98.5**	0.0	0.0	0.0
2	1.2	0.6	**98.1**	0.0	0.0	0.1
3	1.9	0.6	**96.9**	0.1	0.1	0.3
4	2.0	0.6	**96.4**	0.1	0.5	0.4
5	1.9	1.3	**94.3**	0.2	1.0	1.3
6	2.0	3.9	**89.6**	0.4	1.6	2.5
7	2.1	5.4	**86.8**	0.7	2.3	2.7
8	2.2	5.4	**85.5**	1.3	2.6	2.9
12	7.8	5.1	**69.1**	3.1	2.6	12.3
16	7.7	6.2	**65.8**	3.3	3.2	13.9

A. Variance Decomposition of DLNEXPGS:

Period	DLNEXPGS	GRW	DLNREV
1	**100.0**	0.0	0.0
2	**94.1**	0.0	5.9
3	**91.2**	0.2	8.6
4	**89.2**	0.2	10.6
5	**86.4**	0.2	13.4
6	**83.5**	0.2	16.3
7	**79.9**	0.2	19.9
8	**76.0**	0.3	23.7
12	**68.5**	1.4	30.1
16	**68.1**	1.7	30.2

B. Variance Decomposition of DLNEXPGS:

Period	DLNMGS_TP	DINFDIR	DLNREER_CPI	DLNEXPGS	GRW	DLNREV
1	2.4	7.3	**8.1**	**82.3**	0.0	0.0
2	8.6	4.7	**13.2**	**72.4**	0.0	1.1
3	14.6	3.1	**14.4**	**64.3**	0.1	3.4
4	21.6	2.9	**14.8**	**56.4**	0.2	4.1
5	24.5	4.0	**14.5**	**50.5**	0.2	6.2
6	24.5	6.3	**14.4**	**47.2**	0.3	7.2
7	23.0	7.9	**13.8**	**44.7**	0.3	10.3
8	21.7	8.2	**13.3**	**43.2**	0.3	13.3
12	20.5	8.2	**11.7**	**41.9**	1.7	16.0
16	19.9	8.2	**11.7**	**40.8**	3.4	16.0

C. Variance Decomposition of DLNEXPGS:

Period	DLNMGS_TP	DINFDIR	DLNREER_ULC	DLNEXPGS	GRW	DLNREV
1	2.9	6.7	21.2	**69.2**	0.0	0.0
2	10.2	4.4	32.9	**51.4**	0.0	1.1
3	15.7	2.9	32.7	**45.2**	0.1	3.5
4	23.0	2.6	29.4	**40.3**	0.1	4.6
5	27.0	4.1	25.7	**36.2**	0.1	6.8
6	27.3	6.7	23.7	**34.3**	0.1	7.8
7	25.7	8.4	22.3	**32.8**	0.1	10.7
8	24.4	8.5	21.3	**32.2**	0.1	13.5
12	22.7	8.1	18.8	**32.5**	1.7	16.3
16	22.0	8.5	18.5	**32.1**	2.8	16.0

A. Variance Decomposition of GRW:

Period	DLNEXPGS	GRW	DLNREV
1	34.6	65.4	0.0
2	37.9	40.6	21.5
3	42.8	33.4	23.8
4	39.1	34.3	26.6
5	38.9	30.1	30.9
6	38.4	30.2	31.4
7	38.2	28.9	32.9
8	38.7	27.9	33.4
12	39.2	27.4	33.4
16	38.9	28.0	33.1

B. Variance Decomposition of GRW:

Period	DLNMGS_TP	DINFDIR	DLNREER_CPI	DLNEXPGS	GRW	DLNREV
1	6.8	4.1	0.4	20.8	**67.9**	0.0
2	**18.1**	2.3	2.4	21.3	**44.0**	**11.9**
3	**22.8**	1.4	4.3	20.4	**32.6**	**18.5**
4	**29.8**	1.2	4.0	15.0	30.7	**19.3**
5	**32.1**	2.8	4.9	12.4	**24.7**	**23.0**
6	**33.7**	4.6	5.8	10.9	24.1	**20.9**
7	**33.6**	6.7	6.3	10.0	**22.1**	**21.4**
8	**32.6**	8.2	7.3	9.9	20.7	**21.3**
12	**32.1**	9.6	7.3	11.8	**18.9**	**20.4**
16	**31.7**	9.5	7.1	13.3	**18.5**	**20.0**

C. Variance Decomposition of GRW:

Period	DLNMGS_TP	DINFDIR	DLNREER_ULC	DLNEXPGS	GRW	DLNREV
1	5.9	3.1	2.8	17.9	**70.4**	0.0
2	**17.9**	1.8	9.5	13.9	**43.1**	**13.8**
3	**21.7**	1.3	13.1	12.6	**31.0**	**20.2**
4	**28.7**	1.0	11.3	9.3	**28.3**	**21.4**
5	**31.9**	3.8	10.4	7.5	**21.4**	**25.1**
6	**34.0**	6.5	10.3	6.6	**19.8**	**22.9**
7	**33.8**	9.4	10.0	6.0	17.7	**23.0**
8	**32.8**	11.2	10.5	6.2	**16.5**	**22.8**
12	**32.2**	12.3	10.3	7.7	**15.6**	**21.9**
16	**31.7**	12.2	10.1	8.9	**15.3**	**21.7**

A. Variance Decomposition of DLNREV:

Period	DLNEXPGS	GRW	DLNREV
1	0.5	0.8	**98.7**
2	2.8	0.9	**96.3**
3	4.4	1.5	**94.2**
4	5.6	2.7	**91.6**
5	6.3	5.2	**88.5**
6	6.7	7.3	**86.0**
7	6.9	9.2	**83.9**
8	7.0	10.2	**82.8**
12	6.7	10.7	**82.6**
16	6.5	13.3	**80.2**

B. Variance Decomposition of DLNREV:

Period	DLNMGS_TP	DINFDIR	DLNREER_CPI	DLNEXPGS	GRW	DLNREV
1	0.7	0.0	0.1	0.0	1.6	**97.7**
2	4.8	0.7	0.3	0.7	0.6	**92.8**
3	11.5	0.4	0.4	0.9	0.6	**86.2**
4	**14.8**	1.0	0.9	1.4	1.4	**80.6**
5	15.8	2.3	1.6	1.5	2.8	**76.0**
6	14.8	4.4	2.3	1.4	3.6	**73.5**
7	14.3	6.2	2.8	1.4	4.6	**70.8**
8	14.0	7.3	2.8	1.4	5.1	**69.5**
12	16.0	7.7	2.5	2.0	5.2	**66.6**
16	16.2	7.7	2.5	2.4	5.6	**65.6**

C. Variance Decomposition of DLNREV:

| Period	DLNMGS_TP	DINFDIR	DLNREER_ULC	DLNEXPGS	GRW	DLNREV
1	0.8	0.1	0.2	0.0	0.9	**98.0**
2	5.7	0.4	0.2	0.6	0.8	**92.4**
3	**12.6**	0.3	0.1	1.1	1.0	**84.9**
4	**16.6**	0.7	0.2	2.0	2.1	**78.4**
5	**18.2**	2.1	0.2	2.4	3.6	**73.5**
6	**17.6**	4.3	0.2	2.6	4.1	**71.1**
7	**17.1**	6.0	0.2	2.7	4.9	**69.1**
8	**16.7**	7.1	0.3	2.7	5.1	**68.2**
12	**17.4**	7.5	0.9	2.7	4.9	**66.6**
16	**17.7**	7.3	1.8	2.6	5.5	**65.0**

Note: Cholesky Ordering: DLNEXPGS GRW DLNREV in VAR1; DLNMGS_TP DLNREER_CPI or DLNREER_ULC DINFDIR DLNEXPGS GRW DLNREV in VAR2. Bold fonts denote statistical significance at the standard significance levels of 1 percent, 5 percent, and 10 percent.

Figure A1. Generalized Impulse Responses from VAR1

Accumulated Response to Generalized One S.D. Innovations ± 2 S.E.
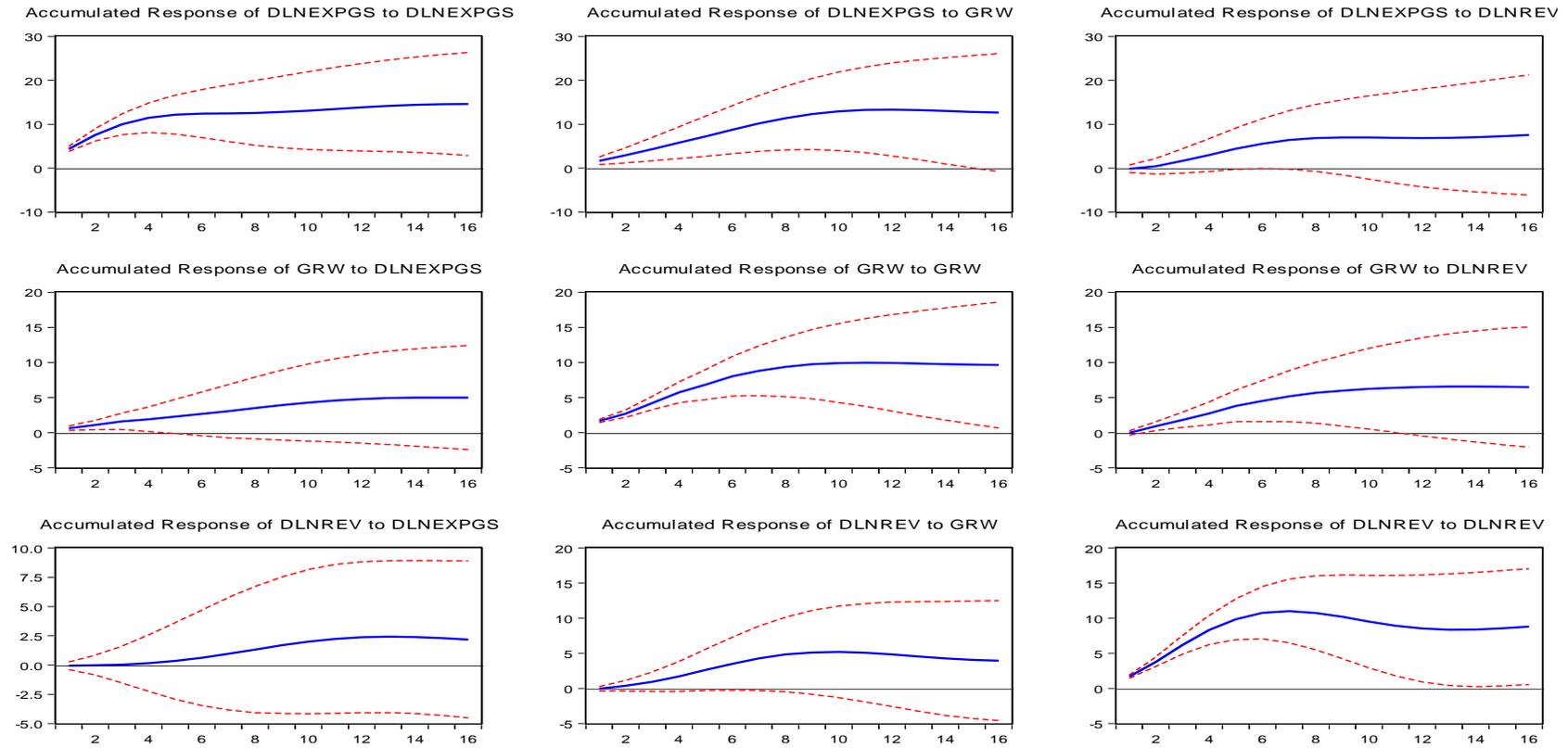
Figure A2. Generalized Impulse Responses from VAR2 Model

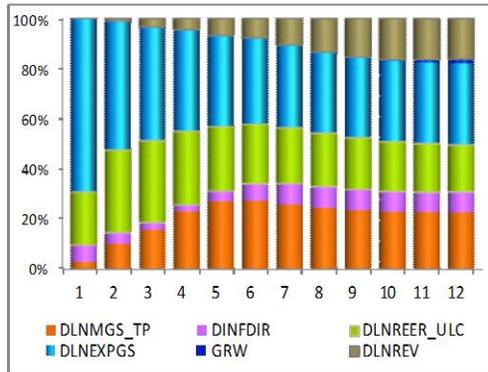Accumulated Response to Generalized One S.D. Innovations ± 2 S.E.
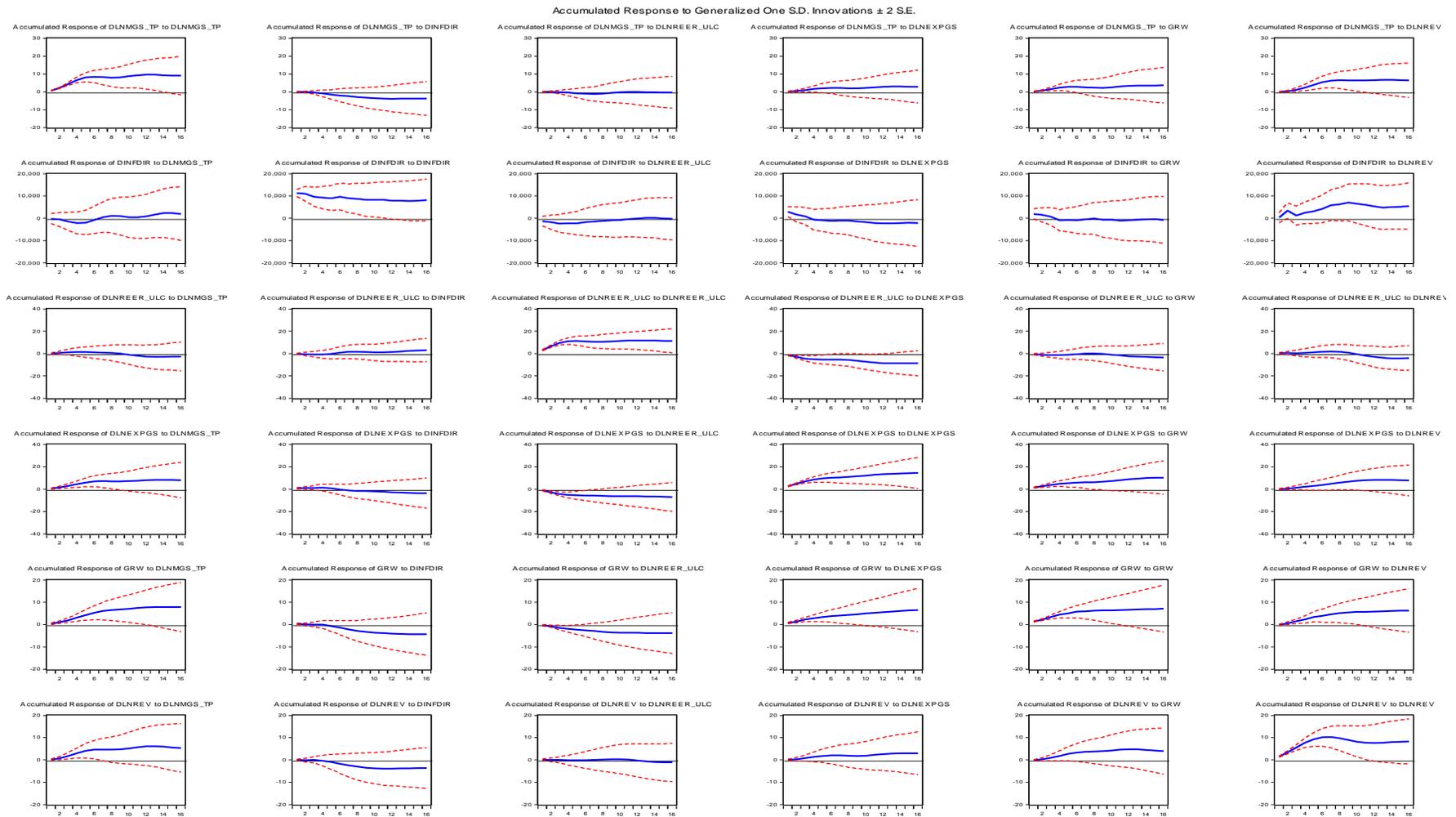
Note. Variables are as defined in Table A1. Impulses are generalized with Monte Carlo standard errors (1000 repetitions).

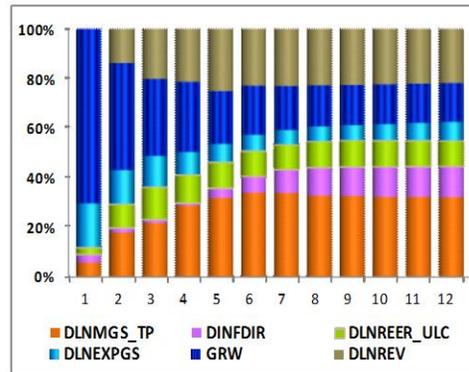# Figure A3. Variance Decomposition of Exports, GDP, and Revenue from VAR2 Models
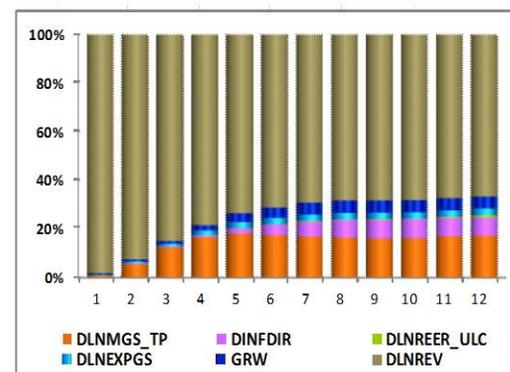
1. Models including change in the ULC-based REER

(a) Growth of exports of goods and services (DLNEXPGS)   (b) GDP growth (GRW)   (c) Growth of government revenue (DLNREV)

2. Models including change in the CPI-based REER
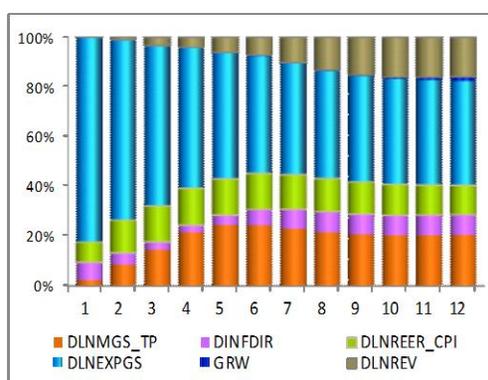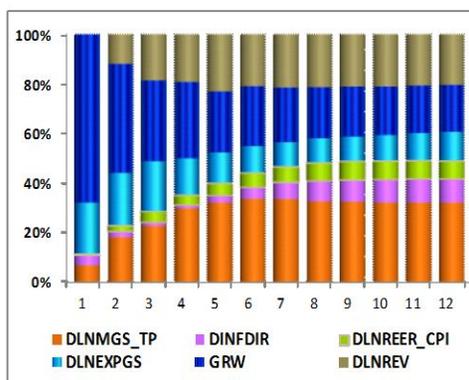
(a) Growth of exports of goods and services (DLNEXPGS)   (b) GDP growth (GRW)   (c) Growth of government revenue (DLNREV)
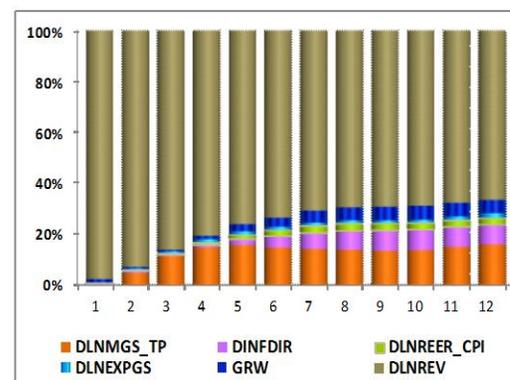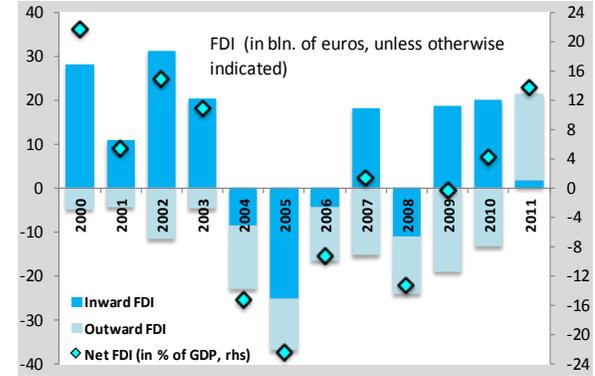

Cholesky Ordering: DLNMGS_TP DINFDIR DLNREER_ULC (DLNREER_CPI) DLNEXPGS GRW DLNREV.

Figure A4. Ireland Foreign Direct Investment and Credit Market Developments from Bank Lending Surveys[1]
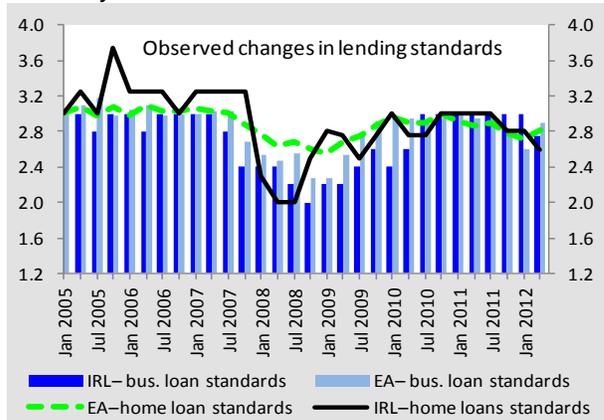
*Inward FDI picked up in 2009 and 2010 after registering a desinvestment in 2008*
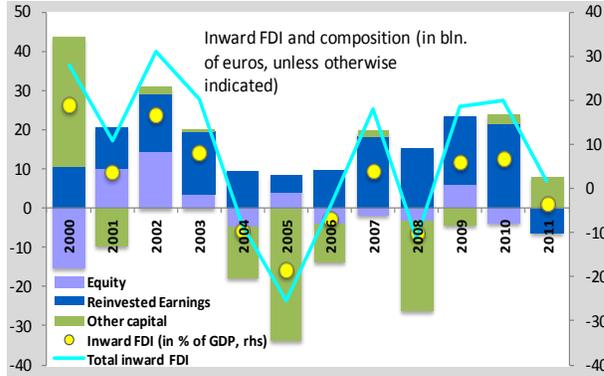
Repatriation of outward FDI helped bring net FDI in percent of GDP to a 9-year high.

Lending standards eased more in Ireland compared with the Euro Area (EA) since mid-2010, except for a setback in January 2012.

But for loan demand, the EA has outperformed Ireland since mid-2007, though Ireland has fared better on home loans since mid-2011.
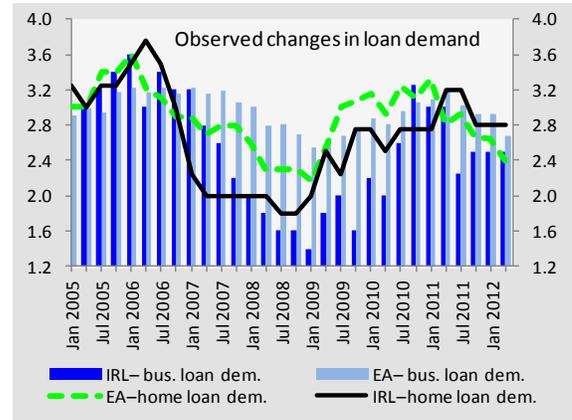
Sources: Ireland CSO, ECB, WEO, and author's calculations.

[1] The surveys provide qualitative information on developments in loan supply and demand factors. Responses are rated on a scale of 1 to 5, where "3" denotes unchanged conditions and figures below (above) 3 denote deterioration (improvement).