The Economic and Social Review, Vol. 46, No. 3, Autumn, 2015, pp. 339-365

Blowing the Bubble: The Global Funding of the Irish Credit Boom

MARY M. EVERETT*
Central Bank of Ireland, Dublin

Abstract: European global banks played a significant role in the international transmission of liquidity during the period prior to the global financial crisis. This paper examines how European global banks channelled finance, raised in US wholesale funding markets, via cross-border banking flows to Irish retail banks during the first decade of the euro. The results indicate that global factors, namely the US-sourced funding of European global banks and global risk, were influential in driving cross-border banking inflows to Ireland. Furthermore, the empirical analysis suggests these global factors contributed to changes in domestic private non-financial sector credit during the Irish credit boom. These results shed new light on the factors influencing the international funding of Irish retail banks and changes in domestic credit during the credit boom.

I INTRODUCTION

The period preceding the global financial crisis witnessed a surge in the international activities of global banks, reflected in an expansion of their balance sheets funded by the international wholesale markets. This leverage was associated with permissive financing conditions, denoted as global liquidity, and manifested in the significant growth of cross-border banking flows

Acknowledgements: I would like to thank associate editor John McHale and two anonymous referees for their useful comments and suggestions. I am grateful to Philip Lane for invaluable feedback. I also thank Mark Cassidy, Ronan Lyons and Vahagn Galstyan for their comments on a related earlier version, and participants at the 28th Irish Economic Association Annual Conference, Limerick 2014 for their feedback.

The views expressed in this paper are those of the author and do not necessarily reflect those of the Central Bank of Ireland or the European System of Central Banks.

* Email: mary.everett@centralbank.ie

during the mid-2000s (Bank for International Settlements, 2011). Consequently, cross-border banking flows were the key channel through which permissive financing conditions in global financial markets were disseminated internationally (Bruno and Shin, 2014).

Cross-border funding inflows to Irish retail banks grew by a factor of five during the first ten years of the euro, and peaked at 205 per cent of gross domestic product (GDP) in September 2008.[1] Concurrently, bank lending to households and non-financial corporates increased from 62 to 176 per cent of GDP. The interaction between global banks and Irish retail banks in international financial markets provided the latter with funding to facilitate increasing domestic credit demand, and contributed to fuelling the Irish credit boom during the mid-2000s (Honohan, 2006, 2009; Lane and McQuade, 2014). The factors attributed in the literature to enabling the growth in the international funding of Irish retail banks and the expansion in Irish credit during the boom period include: a stable low interest rate environment, financial liberalisation, a permissive regulatory framework and increased bank competition in the retail credit market.[2]

The paper builds upon this strand of literature by identifying additional factors that explain the increase in the foreign funding of Irish retail banks during the credit boom. Following the framework of Bruno and Shin (2014), this paper provides an empirical assessment of the relation between global factors and the international funding of Irish retail banks during the first decade of European Monetary Union (EMU). Understanding the determinants of cross-border inflows and the spillover of global financial conditions is important for researchers and policymakers alike, given it offers important insights in identifying the build-up of future imbalances.

What initiated the leverage of global and domestic banks during the mid-2000s?[3] Particular drivers were fluctuations in asset prices and risk, which affect the net worth of banks that react via balance sheet management (Adrian and Shin, 2010). This active adjustment of banks' balance sheets leads to greater leverage during booms and deleveraging during busts, whereby the response of banks to a shift in risk premia is reflected in the credit supply cycle. A global environment of low risk during the pre-crisis period permitted significant expansions in the leverage of global banks in the US, and domestic banks via the international wholesale funding markets.

In the empirical literature, Greenlaw *et al*. (2008) highlighted the positive relation between changes in leverage and changes in assets for US commercial

[1] Irish retail banks are defined as Irish resident banks, both Irish-owned and foreign-owned, active in the Irish retail credit market.

[2] Everett and Kelly (2004); Honohan (2006, 2009); Kelly *et al*. (2011); McCann and McIndoe-Calder (2012); Coates and Everett (2013).

[3] Bank leverage is defined as the ratio of assets to equity.

banks. Adrian and Shin (2010, 2011) support this empirically, by confirming that there is a positive relation between growth in total assets and leverage growth across security broker dealers (including investment banks), and commercial banks in the US. Damar *et al.* (2013) also find support for the pro-cyclicality of leverage for Canadian banks, reflected in the positive correlation between their leverage and changes in balance sheet size.

European global banks stand out as being particularly active in US wholesale funding markets during the pre-crisis period.[4] Their US branches and subsidiaries channelled part of these funds back to their European parents and affiliate banks, which in turn was disseminated domestically through increased lending (Bruno and Shin, 2014). This transmission of funds across borders by European global banks was the key channel through which global liquidity was disseminated into local credit markets via domestic banking systems.

During the 2000s expansionary macroeconomic conditions in Ireland – in parallel with a decline in global risk – suppressed the risk premium at both the local and international level, and incentivised the leverage of Irish retail banks through international funding. Accordingly, the balance sheet capacity of Irish retail banks expanded during this period of low measured risks and permitted increases in the supply of credit domestically. The response of banks to a contraction in the risk premium can amplify a credit boom (Shin, 2012; Bruno and Shin, 2014). Key drivers of the expansion in domestic credit supply in Ireland, therefore, include not only cross-border banking inflows but also the leverage cycle of banks driven by fluctuations in global risk.

The determinants of cross-border capital flows were decomposed into push and pull factors in a seminal paper by Calvo *et al*. (1996), and in a global environment of financial integration, the recent international macroeconomic literature has increasingly emphasised the role of push factors.[5] Push factors, exogenous to the economy in receipt of capital inflows, include the international activities of global banks, innovation in financial instruments and global risk appetite, and are significant in driving cross-border banking flows.[6] Specifically, fluctuations in global risk influence the leverage capacity of both global and domestic banks, and contribute to both cross-border and domestic credit dynamics.

[4] Bruno and Shin (2014); Baba *et al*. (2009); McGuire and Von Peter, (2009).

[5] Pull factors are domestic factors that include macroeconomic factors such as geographical distance, transaction costs, country size, expected asset returns, growth differentials, common language and cultural and institutional linkages (Buch, 2005; Portes and Rey, 2005; Aviat and Courdacier, 2007; Lane and Milesi-Ferretti, 2008).

[6] Committee on the Global Financial System (2011); Forbes and Warnock (2012); McCauley (2012); Shin (2012); Cetorelli and Goldberg (2012); Rey (2013).

Measurement of external imbalances routinely focuses on the current account. This approach, however, fails to account for the dynamics of international trade in financial assets, whose relevance has grown in importance over the past couple of decades in line with the large expansion of countries' international balance sheets. Brunnermeier *et al.* (2012) illustrate how for the US, which is a net debtor, its banking system increased its foreign assets vis-à-vis European banks in the mid-2000s. Obstfeld (2012) considers that banking flows can be sourced from both net deficit and surplus countries. Lane (2013) also confirms that gross flows can generate both macroeconomic and financial imbalances, even for those countries with zero net imbalances.[7] In light of the growing complexity of gross capital flows, whose size obfuscates net balances recorded on the current account, it is increasingly necessary to analyse their composition in terms of gross and net flows, functional component and sector (Lane, 2013).

The empirical analysis in this paper suggests that a global environment of declining risk was influential in expanding the leverage of US-based affiliates of European global banks in wholesale funding markets prior to the global financial crisis. In addition, the analysis provides empirical support for the transmission of global financial market conditions to the Irish credit market via-cross-border banking inflows to Irish retail banks. This paper complements earlier research, that the leverage of global banks is inversely related to global risk, and reinforces earlier findings on the role of global factors as determinants of cross-border banking flows.[8] The influence of global factors and cross-border banking flows on changes in private non-financial sector credit are indicative of global liquidity spillovers to the Irish market during the credit boom.

The remainder of the paper is organised as follows. Section II presents the stylised facts concerning the increase in European global banks' leverage and global transmission of liquidity. How cross-border inflows to Irish retail banks fuelled the Irish credit boom is also described in this section. The mechanisms through which global financial conditions are transmitted internationally are outlined in Section III. The data are summarised in Section IV. Section V presents the empirical analysis and Section VI concludes.

[7] For example, a country with a current account surplus may host banks that receive large inflows of capital from abroad, which is offset by the foreign investment by other resident sectors. This results in an overall net surplus, but a deficit at the sector level of the economy. Even if the inflows received by the domestic banks are from their affiliated banking offices located abroad, these inflows are recorded as liabilities of the domestic banking system as the balance of payments is compiled on a residency basis. This implies that the ultimate drivers of the capital may, for example, be German banks, but may flow via their affiliates which are located across a broad spectrum of jurisdictions internationally.

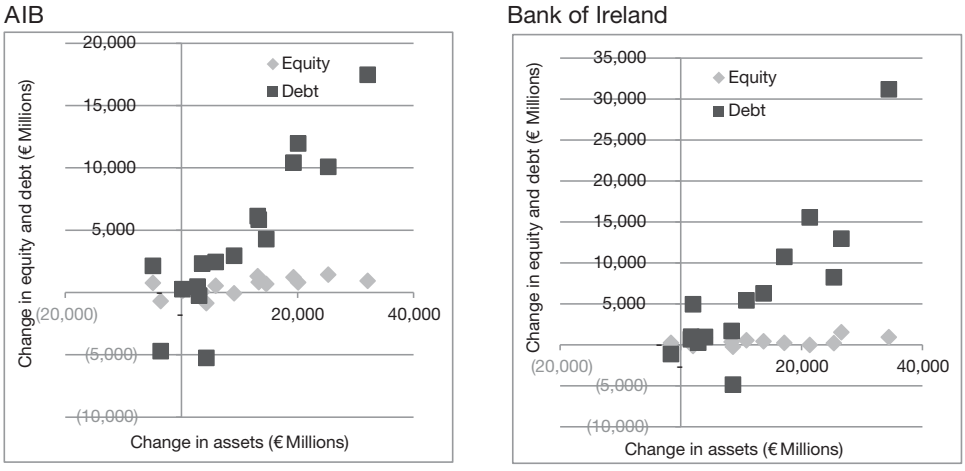
[8] Adrian and Shin (2010, 2011); Bruno and Shin (2014); Forbes and Warnock (2012); McCauley (2012); Rey (2013).

II STYLISED FACTS

The funding practices of global banks, specifically their increased leverage in US wholesale funding markets is the starting point in understanding the international transmission of global liquidity.[9] Prior to 2008, changes in European global banks' assets were predominantly funded through debt rather than equity (Adrian and Shin, 2010; Bruno and Shin, 2014). Similarly, the leverage of the two largest Irish retail banks, for illustration Bank of Ireland and AIB, was also driven by changes in debt pre-2008 (Figure 1). The funding of their assets via debt largely mirrors the developments in global banks, whereby changes in equity were a relatively sticky component of their balance sheets.

During the mid-2000s, European banks' demand for US dollar denominated assets exceeded their supply of retail deposits leading the US wholesale funding market, particularly money market funds, to become a key financing jurisdiction for the US-based affiliates of European banks (Figure 2).[10] While French banks were notably active in this funding market, a wide range of European banks were reliant on US dollar funding (Ivashina *et al*., 2012).

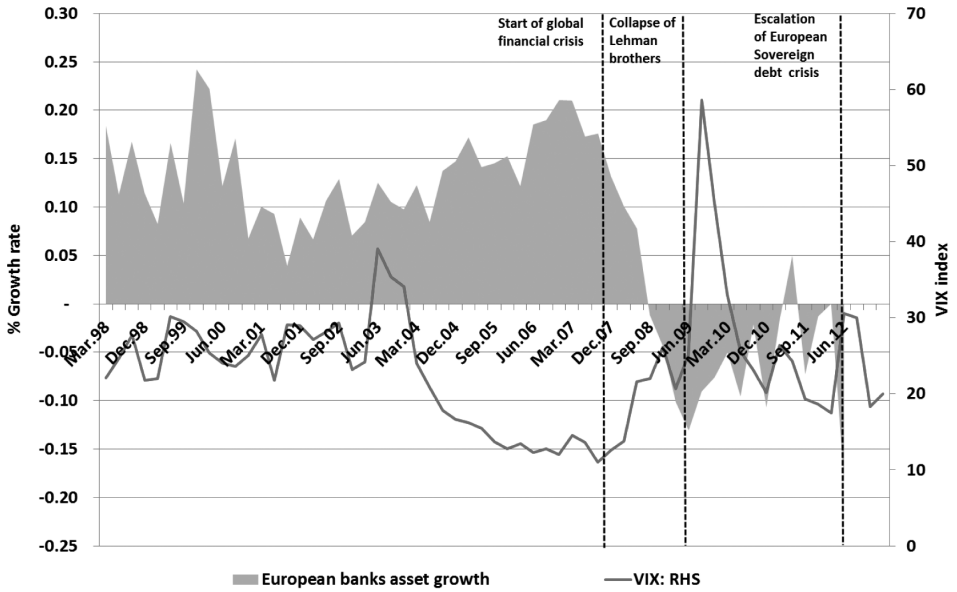
Figure 1: *Scatter Plots of Relationship Between Change in Total Assets and Corresponding Changes in Debt and Equity for the Two Largest Irish-Owned Retail Banks, 1994 to 2008*



Data source: Bloomberg.

[9] Global banks are defined as those that have one or more subsidiaries and branches in foreign countries (Ceterolli and Goldberg, 2012).
[10] Baba *et al*. (2009) and Correa *et al*. (2012).

Figure 2: *Asset Growth of European Banks' US-based Affiliates and the VIX*

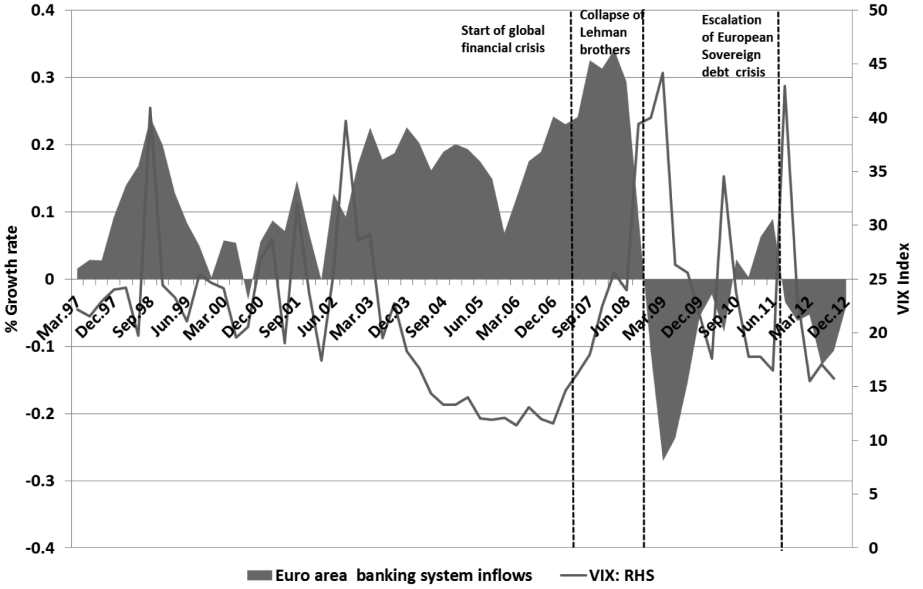


Sources: Structure and Share Data for US Banking Offices of Foreign Entities published by the Federal Reserve Board, and the Chicago Board Options Exchange (CBOE).

The proceeds of this funding were employed for a range of purposes, including local lending in the US market. It was also channelled back to the headquarters of the European banks who reinvested it across two asset categories. First, part of the US sourced funding was reinvested back in the US market through their acquisition of US assets, including asset-backed securities (Bertaut *et al*., 2012; Bernanke *et al*., 2011). Second, European banks also employed this US sourced funding to expand their domestic assets, through increased lending to European borrowers either directly in US dollars to facilitate the demand for US dollars for exporting companies, or by swapping it into euro and meeting increasing local credit demand (Blowers and Forsman, 2013).

The leverage of global banks is the primary mechanism through which financial conditions are transmitted internationally, a result of the interaction between global banks and domestic banking systems in the international interbank market (Shin, 2012; Bruno and Shin, 2014). The channelling of funding from the US-based affiliates of European banks back to their European parent and affiliate banks is reflected in the substantial cross-border inflows to domestic banking systems in Europe between 1999 and 2008 (Figure 3). It is worth noting the path of funds from US-based affiliates may not be direct

Figure 3: *Cross-border Inflows to the European Banking System*



Sources: Bank for International Settlements Locational Banking Statistics, Table 2a and the Chicago Board Options Exchange (CBOE).

between the US and Europe as offshore intermediaries are frequently used to channel funds globally (Lane and Milesi-Ferretti, 2011; Gourinchas and Obstfeld, 2012).

The considerable increases in cross-border banking inflows to Europe in the period following the dotcom bubble was associated with a declining trend in global risk, as measured by the VIX index (Figure 3). During periods of calm in capital markets when the perception of risk is low, leveraged investors expand their portfolios, which induce cross-border investment.[11] Indeed, the primary factor associated with capital flows episodes was found by Forbes and Warnock (2012) to be fluctuations in global risk. The significant and negative correlation between cross-border capital flows and global risk has also been documented by Rey (2013).

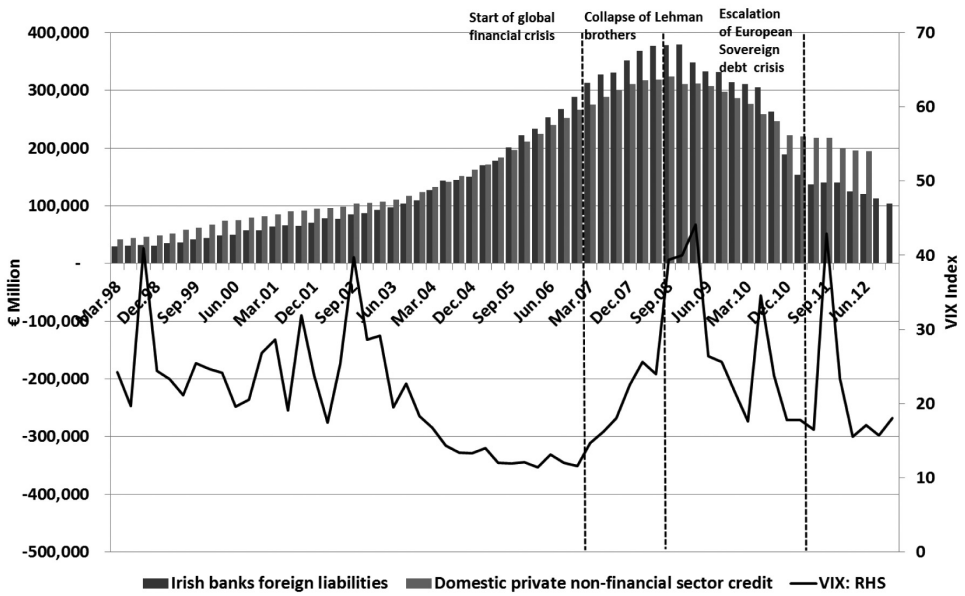
Financial liberalisation, free movement of capital in the European Union, and the advent of the euro were additional factors determining the increases in cross-border banking inflows to Europe (Hale and Obstfeld, 2014). These structural developments established the setting for increased cross-border banking activities and set the foundations for growth in European banking

[11] McCauley (2012); Shin (2012).

(Shin, 2012). In addition, the adoption of Basel II in the European Union, which incorporated Value-at-Risk as a risk management tool, amplified the capacity of European banks balance sheets to expand (Shin, 2010). The unprecedented increase in cross-border banking flows over the past number of decades is also associated with financial innovation. The rising issuance of financial instruments by banks for example, money market shares, certificates of deposit, commercial paper, and structured debt instruments, provided previously unavailable leverage opportunities via foreign creditors for both global and domestic banks (Baeriswyl and Ganarin, 2011; Kim *et al*., 2013).[12]

As part of the structural economic and regulatory developments in the European Union, Irish retail banks witnessed significant growth in cross-border inflows from the latter part of the 1990s onwards (Figure 4). This financially liberalised setting provided Irish retail banks with a more globalised financial environment than previously experienced, permitting them to avail of foreign credit to facilitate growing credit demand, and thereby reducing their reliance on traditional sources of funding. During the pre-crisis period, the international

Figure 4: *Irish Retail Banks, Cross-Border Inflows and Private Non-Financial Sector Credit*



Sources: Central Bank of Ireland and the Chicago Board Options Exchange (CBOE).

[12] The Asset Covered Securities Act 2001 established the Irish covered bond market. The covering assets permitted by this legislation included mortgage credit securities and public credit securities.

funding of Irish retail banks was a key factor in fuelling the credit and housing bubble in Ireland (Honohan, 2006, 2009; Bank for International Settlements, 2011).

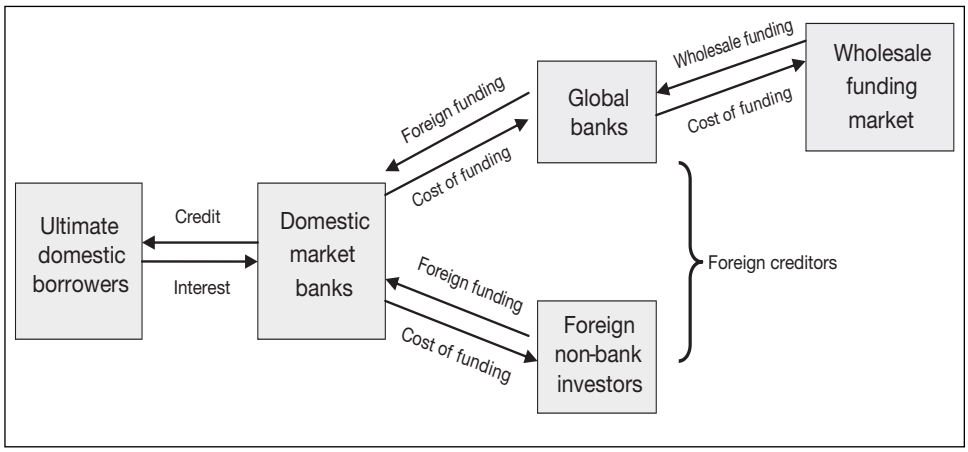
The international funding of Irish retail banks, outstanding at 39 per cent of GDP at end-1998, increased exponentially in the succeeding years, and amounted to 205 per cent of GDP by September 2008 (Figure 4). Over the same time horizon, domestic private non-financial sector credit from banks increased by a factor of 6.6, increasing from €49 billion at end-1998 to €324 billion or 176 per cent of GDP by September 2008. The large increase in cross-border banking flows appears to have significantly contributed to the expansion in domestic credit during the mid-2000s.

III THEORETICAL MOTIVATION

How do banks and other financial market participants respond to changes in perceived risk? Following the conceptual framework of Bruno and Shin (2014) this Section briefly describes the mechanism through which the portfolio decisions of banks, driven by fluctuations in perceptions of risk, influence domestic credit supply and can amplify a credit boom.

A stylised schematic of the transmission of global liquidity into the domestic credit market is presented below in Figure 5.

Figure 5: *International Funding, Cross-Border Banking Flows and Domestic Credit Supply*



Note: Principal is also repaid to creditors by ultimate domestic borrowers, domestic market and global banks.

In a simplified banking system, lending to domestic borrowers is driven by the deposits of households and non-financial corporates, the stock of which is relatively stable and fluctuates in tandem with household income and wealth. Where these deposits prove insufficient to meet the supply of domestic credit, domestic banks avail of alternative sources of external finance, namely equity capital or foreign funding.[13] In this setting, the availability of foreign financing to domestic banks facilitates a greater degree of lending than would otherwise be the case (Shin, 2010).

Foreign creditors can be decomposed into two primary categories, foreign non-bank investors and global banks. The former group of investors can be interpreted as households, insurance companies, and pension and investment funds, and the latter comprise global banks who actively manage their balance sheets in response to changes in the economic environment. These global banks have the capacity to leverage internationally by raising funding in wholesale money markets, and deploy it globally to domestic banking systems. Domestic banks utilise this foreign funding to finance their supply of domestic credit, leading global liquidity conditions to spillover into domestic credit markets.

The way in which both domestic and global banks' portfolios respond to fluctuations in the risk premium has consequences for credit supply. Banks actively manage their balance sheets according to the Value-at-Risk (VaR) prescribed by their internal models of risk and equity capital.[14] VaR measures the potential loss on a portfolio of assets (for example of loans or risky securities) over a period for a defined confidence level. This constraint stipulates that a bank must hold a sufficient amount of equity capital to limit the probability of insolvency, where the probability of failure is no greater than some small threshold. A bank remains solvent as long as the value of its assets exceeds its liabilities. The assumption of fixed probability of bank failure over the financial cycle implies the VaR of banks is equal to their equity at all times. Moreover, the application of a VaR constraint dictates the portfolio decisions of banks, whereby they adapt their portfolio decisions in response to changes in risk perception driven by variation in underlying macroeconomic conditions.

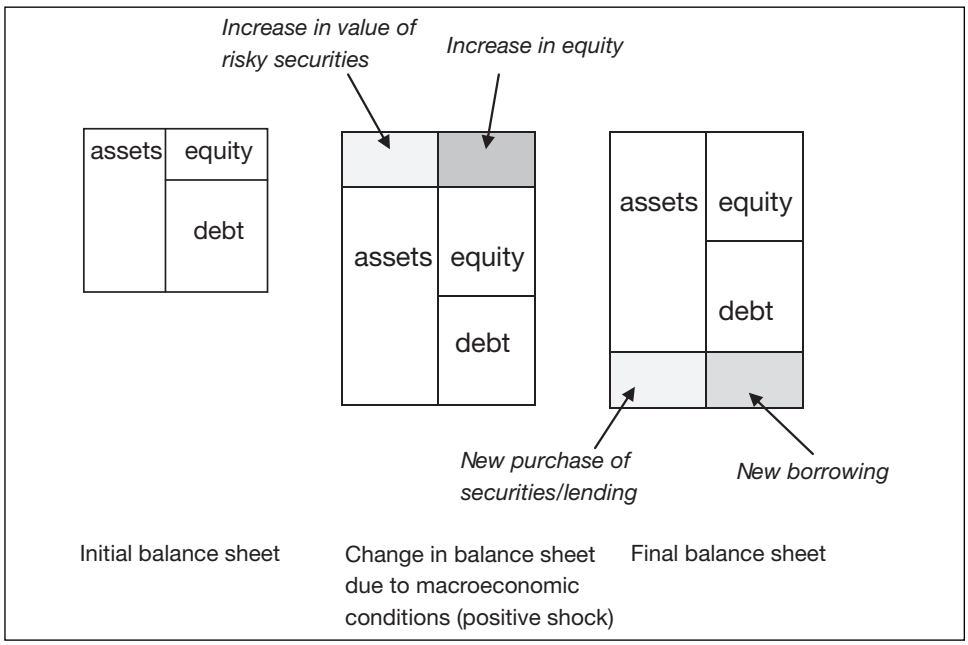
The debt issued by domestic banks and held by the foreign creditors can be thought of as a claim on the loan portfolio of domestic banks. It can, therefore, be interpreted as a risky security, where the risk component reflects the possibility that loans in the portfolio of domestic banks are only partially repaid. Buoyant macroeconomic conditions are associated with a contraction in the risk premium of the domestic economy, thereby increasing the probability of the payoff on the risky security. This results in greater demand for the risky

[13] In this bank funding framework, domestic interbank funding within the banking system is netted out; given the domestic liabilities of one bank are the domestic assets of another.
[14]Value-at-Risk is an inherent part of the capital regulations within Basel II.

security from both non-bank foreign investors and global banks, manifesting in greater cross-border banking inflows to the domestic banking system. This is the framework an improvement in the domestic macroeconomic environment positively affects the leverage capacity of domestic banks.

While the contraction in the risk premium and reduced probability of default increase demand for the risky securities, across both foreign non-bank and global banks, the response from the latter amplifies the positive shock. This is a result of the positive market price changes which lead to capital gains on their balance sheets. These marked-to-market gains on their assets feed entirely through to an increase in their equity, as there is no change to the value of their debt. This is illustrated in Figure 6.

Figure 6: *Changes in the Balance Sheet of Banks*

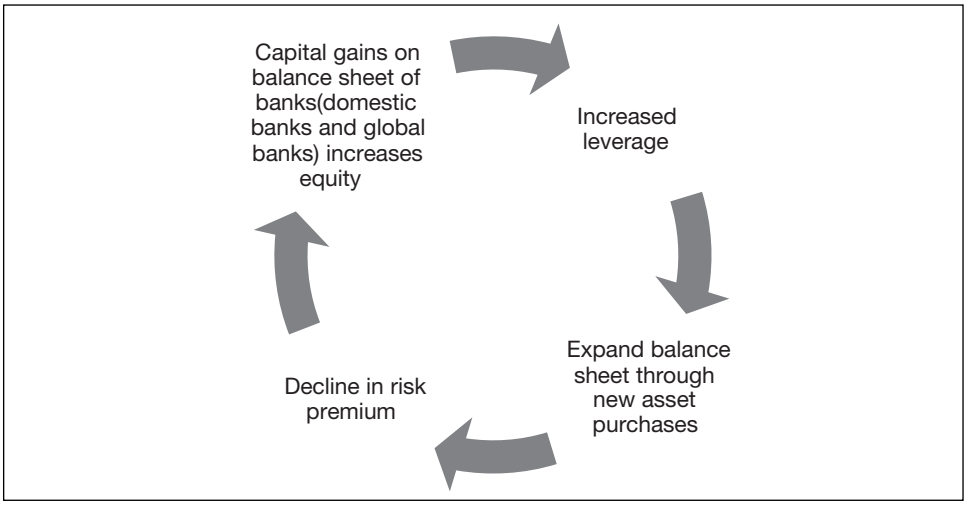


Banks' equity capital is now greater than is necessary to meet their VaR and in response, seek to optimise the spare capacity on their balance sheets, and avail of greater leverage via increases in debt financing. This new debt financing is used to purchase additional risky securities of domestic banks.

The capacity of domestic banks to issue these additional risky securities is a result of their own balance sheet management according to their VaR constraint. The reduction in default probability on their loan portfolio occurs via the same feedback loop, see Figure 7. As a consequence of the reduction in borrowers' default probability, and marked-to-market gains on assets, domestic

banks also have surplus equity. They then expand their balance sheet by increasing notional debt, which is purchased by global banks owing to their increased demand for risky securities. The proceeds of this debt issuance are used to expand the asset side of the balance sheets of domestic banks. In this context, they expand the supply of credit to domestic borrowers.

Figure 7: *Feedback Loop in a Credit Boom Scenario*



The pool of domestic potential borrowers varies from high-quality borrowers to subprime borrowers. First, domestic banks increase the credit supply to high-quality borrowers, which further improves aggregate macroeconomic conditions through a positive feedback effect, and in turn lowers the probability of loan default even further. The related balance sheet gains from positive increase in asset values leads domestic banks and global banks to further expand their balance sheets. As this process extends, the availability of high quality potential domestic borrowers' contracts becomes increasingly scarce, and domestic banks must reduce their lending standards if they wish to expand their balance sheets. The desire of domestic banks to employ its surplus equity incentivises lending to lower quality borrowers, which has implications for the downward phase of the credit cycle.

IV DATA

The basic descriptive statistics for the variables are summarised in Table 1 for the period 1999 to 2008. Following the empirical evidence in the related literature, the positive correlation between leverage growth and asset growth

Table 1: *Summary Statistics*

Variable	*Unit*	*Mean*	*Std. Dev.*	*Min*	*Max*
US-based affiliates' asset growth	%	12.69	5.30	–1.15	24.22
VIX	Log	3.02	0.35	2.40	3.67
Interest rate spread	%	0.57	0.55	0.16	3.14
GDP growth (European)	%	4.05	1.75	–0.35	8.13
Cross-border banking flows	%	25.48	7.12	13.59	39.45
Money stock growth	%	3.23	3.01	–1.02	17.64
GDP growth (Ireland)	%	8.67	5.23	–5.56	19.46
Govt.Debt/GDP	Ratio	49.12	25.47	25.00	111.00
Stock volatility	Log	5.29	0.50	4.43	6.32
Equity (Domestic banks)	Log	7.57	1.48	3.83	8.99
Credit growth	%	19.94	7.11	7.61	34.77

Note: The summary statistics include 39 observations.

is exploited.[15] The empirical counterpart to the change in leverage is taken to be the annual log difference of the assets held by US-based affiliates of European global banks, sourced from the quarterly statistical release, *Structure and Share Data for US Banking Office of Foreign Entities* of the Federal Reserve Board.

Global risk is measured as the log of the VIX index of implied volatility of the S&P 500 index options, published by the Chicago Board Options Exchange. Two additional measures of global risk are considered as part of the robustness checks, the VXO index of implied volatility of options on the S&P 100 index, and the VDAX volatility index as implied by the prices of DAX options.[16] Global financial conditions are captured by the spread between the LIBOR USD three month rate and the USD three month overnight index swap, which reflects the level of perceived counterparty risk of default in the interbank market. An additional global control variable is the annual log difference in European quarterly Gross Domestic Product (GDP), sourced from Eurostat.

The Irish banking system is diverse, comprising two primary sub-sectors, international investment banks hosted as part of the International Financial Services Centre (IFSC), and a domestic banking system. Consistent with Lane and Milesi-Ferretti (2011), IFSC banks contribute significantly to Irish aggregate cross-border banking inflows and outflows. Furthermore, with the exception of employment and the export of financial services, their activities bear little relation to the core Irish economy, and they are not active in the Irish retail credit market. The domestically relevant banking system comprises both Irish-owned banks and subsidiaries of European banks, active in the Irish retail

[15] Greenlaw *et al*. (2008); Adrian and Shin (2010, 2011); Damar *et al.* (2013).
[16] The DAX is the German Stock Market Index of 30 German companies.

credit market. To comprehensively capture the foreign borrowing of Irish banks active in the domestic retail banking market, the empirical work is based on published quarterly data related to Irish retail banks, sourced from the Central *Bank of Ireland's Quarterly Bulletin* and *Money and Banking Statistics* for the years 1999 to 2012. Cross-border banking inflows are the annual change in the log of quarterly external positions of Irish retail banks.

In addition to global variables, standard domestic factors that influence cross-border inflows are incorporated into the empirical analysis. Included are the annual log difference in nominal GDP for Ireland, and money stock measured by the quarterly growth in Ireland's contribution to the M2 monetary aggregate, sourced from Eurostat and the ECB's *Statistical Data Warehouse*, respectively. The proceeds of foreign borrowing by domestic non-financial corporates, for example for the purpose of hedging against currency risk, can be deposited in the domestic banking system, reflected in an increase in the M2 money stock. An increase in cross-border non-bank inflows is, therefore, associated with an increase in M2. High levels of sovereign debt increase the probability of default and raise the concerns of foreign investors regarding the ability of a sovereign debtor to sustain or repay in terms of interest and/or principal. Government debt/GDP ratio is the outstanding stock of Government debt as a ratio to GDP, sourced from Eurostat. To measure the volatility of the Irish stock market, the 90 day rolling standard deviation of daily returns on the Irish Stock Exchange index is included. The index of domestic banks' shares is included as a proxy for domestic banks' equity.

Domestic bank credit to the private non-financial sector, non-financial corporates and households, is sourced from the Bank for International Settlements database on *Total Credit to the Private Non-Financial Sector* (Dembiermont *et al*., 2013). Importantly, these data exclude credit to the private financial sector which inflate private sector credit data. The growth in credit is measured as the annual change in the quarterly log of outstanding credit.

V EMPIRICAL MODEL AND ESTIMATION RESULTS

5.1 *Determinants of European Global Banks Leverage in the United States*

To examine the relation between the leverage of European global banks in the US wholesale markets and global risk, the following regression is considered:

$$\Delta Leverage = \beta_0 + \beta_1 VIX_t + controls_t + \varepsilon_t \quad (1)$$

where the dependent variable Δ*Leverage* is the annual change in the assets of US-based affiliates of European global banks, and VIX denotes global risk. Two global factors are controlled for, namely the spread between the LIBOR USD three month rate and the USD three month overnight index swap, and growth in European GDP.

Table 2 presents the OLS regression results, with robust standard errors, from 1999Q1 to 2008Q3. Throughout the regression results, the coefficient on the measure of global risk is both of the predicted sign and significant. In regression (1), where the VIX enters as the sole explanatory variable, it explains 24 per cent of the variation in the change in the leverage of European global banks in the US wholesale funding markets. When the control variables are included in regressions (2) to (4), the VIX continues to be significant with the correct sign. The size of the coefficients on the VIX, between –0.06 and –0.08, suggest a 10 per cent decline in global risk would increase European global bank leverage in the US by between 0.6 and 0.8 per cent.

Table 2: *The US Funding of European Banks*

	(1) Δ*Leverage*	*(2)* Δ*Leverage*	*(3)* Δ*Leverage*	*(4)* Δ*Leverage*
VIX	–0.075**	–0.072**	–0.059**	–0.058**
	(0.02)	(0.02)	(0.02)	(0.02)
Interest spread		–0.019		–0.008
		(0.01)		(0.01)
GDP growth			1.683***	1.628***
			(0.347)	(0.358)
Constant	0.353***	0.353***	0.238***	0.242***
	(0.07)	(0.07)	(0.06)	(0.06)
Observations	39	39	39	39
R^2	0.244	0.283	0.542	0.549
Adjusted R^2	0.223	0.243	0.517	0.510

Notes: The table presents OLS regressions with the annual growth in the leverage of European global banks US-based affiliates as the dependent variable, and the log of the VIX index as the explanatory variable. The interest spread is the spread between the LIBOR USD three month rate and the US dollar three month overnight index swap. GDP growth is the annual growth in European nominal GDP. The Breusch-Pagan test for the presence of heteroskedasctity suggests the residuals are homogeneous in regressions (1) to (4). The Durbin-Watson, Durbin's alternative and Breusch-Godfrey tests for autocorrelation do not reject the Null hypothesis of no serial correlation in regressions (3) and (4). Data are from 1999Q1 to 2008Q3. Standard errors are in the parentheses, * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

To assess the sensitivity of these results a number of additional specifications are considered and reported in Table 3. As alternative measures of global risk, two additional volatility indices are considered, the VXO volatility index of the implied volatility of options on the S&P 100 index, and the VDAX volatility index as implied by the prices of DAX options. The VXO and the VDAX are included as measures of global risk in regressions (1) and (2), respectively in Table 3. The coefficients on both alternative measures of global risk are of the predicted sign and statistically significant, indicating global risk plays a role in determining the leverage of European global banks.

Table 3: *Alternative Measures of Global Risk, Expanded Estimation Horizon and Crisis Dummy*

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
	Δ*Leverage*	Δ*Leverage*	Δ*Leverage*	Δ*Leverage*	Δ*Leverage*
Global risk indicator	–0.068***	–0.056*	–0.065**	–0.052**	–0.047*
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)
Interest spread			0.02	0.03	0.02
			(0.01)	(0.01)	(0.01)
GDP growth			0.849**	0.760**	0.694*
			(0.28)	(0.26)	(0.30)
Crisis dummy			–0.413**	–0.284*	–0.254
			(0.14)	(0.12)	(0.15)
Global risk*Crisis dummy			0.08	0.04	0.029
			(0.05)	(0.04)	(0.05)
Constant	0.331***	0.303***	0.279***	0.242***	0.238**
	(0.06)	(0.08)	(0.06)	(0.06)	(0.08)
Observations	39	39	54	54	54
R^2	0.262	0.125	0.834	0.825	0.814
Adjusted R^2	0.242	0.101	0.816	0.807	0.795

Notes: The table presents OLS regressions with the annual growth in the leverage of European banks US-based affiliates assets as the dependent variable. The global risk explanatory variable in each regression is: (1) log of VXO index, (2) log of VDAX index, (3) log of VIX index, (4) log of VXO index, and (5) log of VDAX. Robust standard errors are reported in regressions (1) and (2). The Breusch-Pagan test for the presence of heteroskedasctity suggests the residuals are homogeneous in regressions (3) to (5) and The Durbin-Watson, Durbin's alternative and Breusch-Godfrey tests for autocorrelation do not reject the Null hypothesis of no serial correlation in regressions (3), to (5). Regressions (3) to (5) lengthen the estimation period to 1999Q1 to 2012Q2. Standard errors are in the parentheses, * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

The influence of global risk on European global bank funding in the US is estimated over a longer time horizon, 1999 to 2012, in regressions (3) to (5), where the measures of global risk are the VIX, VXO and VDAX in each regression, respectively. The extended estimation period includes both the global financial crisis and the European Sovereign debt crisis. To capture these crises, a dummy variable, *Crisis dummy*, equal to 1 for the quarters following September 2008, and 0 otherwise, is included. The coefficients on *Crisis dummy* are both statistically significant and negative in regressions (3) and (4), implying the crisis period is associated with a contraction in European bank leverage. The statistically significant results indicate that fluctuations in global risk influence the leverage of European banks across the financial cycle. To capture the effect of global risk during the period of the global financial and European Sovereign crises with respect to the boom period, the *Crisis dummy* variable is interacted with the three measures of global risk. The coefficient on the interaction term, *Global risk*Crisis dummy*, is found to be positive but not significant across regressions (3) to (5).

5.2 *Determinants of Cross-Border Banking Flows*

The importance of global factors, such as European global bank leverage and fluctuations in global risk, in determining cross-border banking inflows to Ireland are tested empirically in this Section. Following an empirical approach similar to that in Bruno and Shin (2014), the specification of the equilibrium condition for cross-border banking flows is given by:

$$\Delta L_t = \beta_0 + \beta_1 \Delta Leverage_t + \beta_2 VIX_t + controls_t + e_t \quad (2)$$

where ΔL denotes cross-border banking inflows from foreign investors into Irish retail banks. The $\Delta Leverage$ and *VIX* variables are defined as before, and *controls* represents a range of domestic factors including: GDP growth, Government debt as a ratio to GDP, stock market volatility, domestic banks' equity and money stock, to control for the role of pull effects on cross-border banking inflows. All control variables are lagged by one quarter to account for the potential effects of endogeneity. To further mitigate the potential of reverse causality between GDP growth and cross-border banking inflows, instrumental variable (IV) analysis is also conducted, where the lagged values of GDP are employed as instruments.

The estimates from the regressions are presented in Table 4. The positive and significant sign on the $\Delta Leverage$ coefficient in regression (1) indicates that increased leverage of European global banks contributes in determining foreign funding inflows to Irish retail banks between 1999Q1 and 2008Q3. The associated positive coefficient suggests that for a 10 per cent increase in the

leverage of European global banks in the US wholesale funding market, cross-border banking inflows to Ireland are estimated to have increased by around 8 per cent.

Table 4: *Determinants of Cross-Border Inflows to Irish Retail Banks from Foreign Investors*

	(1) ΔL	*(2)* ΔL	*(3)* ΔL	*(4)* ΔL	*(5)* ΔL
Global Factors					
ΔLeverage	0.826***		0.571**	0.345*	0.374**
	(0.18)		(0.20)	(0.18)	(0.15)
VIX		–0.115***	–0.072**	–0.126***	–0.094**
		(0.03)	(0.03)	(0.03)	(0.03)
Domestic Factors					
GDP growth				0.355*	0.711**
				(0.20)	(0.33)
Govt. Debt/GDP				0.062	–0.031
				(0.05)	(0.07)
Stock volatility				–0.050**	–0.053***
				(0.02)	(0.01)
Domestic banks' equity				–0.115*	–0.139**
				(0.06)	(0.06)
Money stock				–0.914**	–0.631**
				(0.29)	(0.28)
Constant	0.150***	0.597***	0.395***	0.629**	0.838***
	(0.03)	(0.08)	(0.10)	(0.18)	(0.21)
Observations	39	39	39	38	38
R^2	0.357	0.323	0.447	0.705	0.737
Adjusted R^2	0.339	0.305	0.417	0.636	0.676
Method	OLS	OLS	OLS	OLS	IV

Notes: The table presents OLS and IV regressions, with the annual log difference in the external positions of Irish retail banks as the dependent variable. The Breusch-Pagan test for the presence of heteroskedasctity suggests the residuals are homogeneous in regressions (1) to (4). The Durbin-Watson, Durbin's alternative and Breusch-Godfrey tests for autocorrelation do not reject the Null hypothesis of no serial correlation in regressions (3) and (4). The Durbin Hu Hausman test for endogeneity does not reject the null hypothesis that the variables are exogenous. The joint significance test of the instruments reports an F statistic of 3.6 and P-values of 0.07, suggesting the instruments are weak. Standard errors are in the parentheses, * p<0.05, ** p<0.01, *** p<0.001.

The coefficient on the VIX variable is reported with the correct negative sign and is significant in regression (2), suggesting a fall in global risk is correlated with an increase in cross-border banking inflows to Irish retail banks. The significant results and correct signs on $\Delta Leverage$ and VIX continue to hold in regression (3) when both global factors are included. In addition, the fit of regression (3) is good, in that the variables explain close to half of the variation in cross-border banking inflows.

When both domestic and global factors are included in regression (4) the fit increases to 0.71, and the global factors, $\Delta Leverage$ and VIX, continue to retain their influence in determining cross-border banking inflows. The estimates from the IV regression are reported in regression (5), and are estimated using the lagged values of GDP as instruments.[17] In terms of domestic factors, GDP growth is positively correlated with cross-border banking inflows, suggesting a positive macroeconomic performance should increase a country's attractiveness to foreign investors. An increase in the volatility of a stock market index will have a negative effect on foreign investors, therefore, a negative sign is expected on the Stock Volatility variable. Stock Volatility is found to be negatively and significantly correlated with cross-border banking inflows. While domestic banks' equity and money stock are found to be statistically significant, they enter regressions (4) and (5) with the incorrect sign.

Table 5 reports the sensitivity analysis for the model in Equation (2). As an alternative measure of cross-border inflows to Irish retail banks, the sample of Irish retail banks is narrowed to only include Irish-owned retail banks. These are the banks whose liabilities were guaranteed by the Irish Government in 2008.[18] In regression (1), global banks' leverage continues to play a role in influencing cross-border inflows to Irish-owned retail banks. Throughout regressions (2) to (5) global risk is found to play a role in influencing cross-border inflows to Irish-owned banks during the credit boom in Ireland.

5.3 *Determinants of Domestic Credit*

To investigate how global financial market conditions affect the domestic credit market, the following relation is considered:

$$\Delta Credit_t = \beta_0 + \beta_1 \Delta L_t + \beta_2 \Delta Leverage_t + \beta_3 VIX_t + controls_t + e_t \qquad (3)$$

[17] The results from the first-stage regression results suggest the lagged values are highly correlated with GDP.

[18] Irish-owned retail banks are defined as those covered under the Credit Institutions (Financial Support) Act 2008 and include AIB, Bank of Ireland, Irish Bank Resolution Corporation (formerly Anglo Irish Bank), EBS Building Society, Permanent tsb Plc (formerly Irish Life and Permanent Plc), Irish Nationwide Building Society and their subsidiaries.

Table 5: *Global Factors Determining Irish-Owned Banks Cross-Border Flows*

	(1) ΔL_Cov	*(2)* ΔL_Cov	*(3)* ΔL_Cov	*(4)* ΔL_Cov	*(5)* ΔL_Cov
Global Factors					
ΔLeverage	0.690**		0.374	0.138	0.191
	(0.24)		(0.27)	(0.22)	(0.22)
VIX		–0.117**	–0.089**	–0.130**	–0.072*
		(0.03)	(0.04)	(0.04)	(0.04)
Domestic Factors					
GDP growth				0.649**	1.301**
				(0.24)	(0.48)
Govt. Debt/GDP				–0.007	–0.178*
				(0.06)	(0.10)
Stock volatility				–0.041*	–0.047**
				(0.02)	(0.02)
Domestic banks' equity				–0.126	–0.170**
				(0.08)	(0.09)
Money stock				–1.227**	–0.708*
				(0.36)	(0.41)
Constant	0.153***	0.589***	0.456**	0.834***	1.216***
	(0.03)	(0.10)	(0.14)	(0.22)	(0.31)
Observations	39	39	39	38	38
R^2	0.182	0.245	0.284	0.605	0.483
Adjusted R^2	0.160	0.224	0.244	0.513	0.362
Method	OLS	OLS	OLS	OLS	IV

Notes: The table presents OLS and IV regressions with the cross-border inflows of Irish-owned banks as the dependent variable. The Breusch-Pagan test for the presence of heteroskedasctity suggests the residuals are homogeneous in regressions (1) to (4). The Durbin-Watson, Durbin's alternative and Breusch-Godfrey tests for autocorrelation do not reject the Null hypothesis of no serial correlation in regressions (1) to (3). The Durbin Hu Hausman test for endogeneity does not reject the null hypothesis that the variables are exogenous. The joint significance test of the instruments reports an F statistic of 6.2 and P-values of 0.02, suggesting the instruments are weak. Standard errors are in the parentheses, * p<0.05, ** p<0.01, *** p<0.001.

where the dependent variable $\Delta Credit$ is domestic private non-financial sector credit growth. The domestic and global explanatory variables are similar to those outlined in Sections 5.1 and 5.2, and the role of cross-border banking inflows to Irish retail banks ΔL is also included as an explanatory variable of credit developments in Ireland.

Table 6: *Determinants of Domestic Credit*

	(1) ΔCredit	*(2)* ΔCredit	*(3)* ΔCredit	*(4)* ΔCredit	*(5)* ΔCredit	*(6)* ΔCredit
Global Factors						
Inflows	0.723***			0.388**	0.319**	0.348**
	(0.11)			(0.13)	(0.10)	(0.14)
ΔLeverage		1.018***		0.601**	0.412**	0.399***
		(0.15)		(0.17)	(0.12)	(0.10)
VIX			–0.118***	–0.027	–0.104***	–0.104***
			(0.02)	(0.02)	(0.02)	(0.02)
Domestic Factors						
GDP growth					–0.033	–0.087
					(0.13)	(0.29)
Govt. Debt/GDP					0.165***	0.174***
					(0.03)	(0.05)
Stock volatility					0.024*	0.025**
					(0.01)	(0.01)
Domestic banks' equity					–0.002	0.004
					(0.04)	(0.05)
Constant	0.015	0.070**	0.549***	0.105	–0.328**	–0.370*
	(0.03)	(0.02)	(0.08)	(0.09)	(0.13)	(0.22)
Observations	39	39	39	39	38	38
R^2	0.525	0.544	0.339	0.681	0.887	0.893
Adjusted R^2	0.512	0.531	0.321	0.653	0.861	0.868
Method	OLS	OLS	OLS	OLS	OLS	IV

Notes: The table presents OLS and IV regressions with the change in private non-financial sector credit as the dependent variable. The Breusch-Pagan test for the presence of heteroskedasctity suggests the residuals are homogeneous in regressions (1), (2), (4) and (5). Robust standard errors are included in regression (3). The Durbin-Watson, Durbin's alternative and Breusch-Godfrey tests for autocorrelation do not reject the Null hypothesis of no serial correlation in regressions (1), (2) and (4). The Durbin Hu Hausman test for endogeneity does not reject the null hypothesis that the variables are exogenous. The joint significance test of the instruments reports an F statistic of 2.7 and P-values of 0.11, suggesting the instruments are weak. Data are quarterly, from 1999Q1 to 2008Q3. Standard errors are in the parentheses, * p<0.05, ** p<0.01, *** p<0.001.

The estimates from Equation (3) are reported in Table 6. Regressions (1) to (4) consider whether global factors influence domestic credit supply. The results suggest that during the first ten years of EMU, cross-border banking inflows to

Table 7: *Global Factors Determining Changes in Irish Mortgage Credit*

	(1) ΔMort	*(2)* ΔMort	*(3)* ΔMort	*(4)* ΔMort	*(5)* ΔMort	*(6)* ΔMort
Global Factors						
Inflows	0.526***			0.461**	0.182	0.014
	(0.13)			(0.17)	(0.18)	(0.26)
Leverage		0.398*		–0.143	–0.200	–0.119
		(0.20)		(0.23)	(0.21)	(0.19)
VIX			–0.087**	–0.045	–0.071*	–0.071**
			(0.03)	(0.03)	(0.04)	(0.03)
Domestic Factors						
GDP growth					0.197	0.514
					(0.23)	(0.53)
Govt. Debt/GDP					0.032	–0.021
					(0.05)	(0.08)
Stock volatility					–0.048**	–0.059**
					(0.02)	(0.02)
Domestic banks' equity					0.072	0.035
					(0.07)	(0.09)
Constant	0.059*	0.143***	0.453***	0.228*	0.506**	0.757*
	(0.03)	(0.03)	(0.08)	(0.12)	(0.24)	(0.41)
Observations	39	39	39	39	38	38
R^2	0.321	0.096	0.215	0.358	0.588	0.581
Adjusted R^2	0.302	0.072	0.194	0.303	0.492	0.483
Method	OLS	OLS	OLS	OLS	OLS	IV

Notes: The table presents OLS and IV regressions with the changes in domestic mortgage credit as the dependent variable. The Breusch-Pagan test for the presence of heteroskedasctity suggests the residuals are homogeneous in regressions (1) to (5). The Durbin-Watson, Durbin's alternative and Breusch-Godfrey tests for autocorrelation do not reject the Null hypothesis of no serial correlation in regressions (1) to (5). The joint significance test of the instruments reports an F statistic of 4.1 and P-values of 0.05, suggesting the instruments are weak. Data are quarterly, from 1999Q1 to 2008Q3. Standard errors are in the parentheses, * p<0.05, ** p<0.01, *** p<0.001.

Irish retail banks, Δ*Leverage*, and global risk all contributed to growth in domestic private non-financial sector credit.

When domestic factors are controlled for in regression (5), global factors continue to retain their explanatory power. In the IV estimates reported in regression (6), where the lagged using the lagged values of GDP as instruments, the estimated size of the coefficient on the variable Δ*Leverage* is the largest of the global factors and positively influences the change of domestic credit supply to households and non-financial corporates. The explanatory power of the model in regression (6) where both domestic and global factors are included is quite high, with a reported R^2 of 0.89.

The results of the sensitivity analysis related to the growth in domestic private non-financial credit are reported in Table 7. To examine the effects of global factors on the housing bubble in Ireland during the mid-2000s, the dependent variable Δ*Credit* is replaced with mortgage credit growth, Δ*Mort*. A number of global variables maintain their explanatory power in regressions (1) to (4). Global risk is found to be both statistically significant and of the correct sign, when domestic factors are included across both the OLS and IV analysis in regressions (5) and (6).

5.4 *Discussion of Results*

A period of calm in global financial markets, reflected in a declining value of the VIX, is expected to increase the leverage of European global banks in the US wholesale funding market. The estimations show that the ability of European global banks to raise wholesale funding in the US is a result of their employment of a VaR constraint in managing their balance sheets. The formal analysis in Section 5.1 shows that the leverage of European global banks is inversely related to global risk, which closely mirrors the VaR (Adrian and Shin, 2011). This implies that a decline in the perception of global risk induces greater leverage of European global banks. The analysis is consistent with the empirical findings of Adrian and Shin (2010) and Bruno and Shin (2014), that there is a close association between the leverage of banks and the VIX. The empirical findings reported here also provide support for the pro-cyclicality of European global banks leverage due to their balance sheet adjustment as prescribed by their VaR constraint.

The interaction between global and Irish retail banks in the inter-bank market, reflected in cross-border banking flows, is confirmed to be a mechanism through which global liquidity is transmitted into the Irish domestic banking system. Further to traditional determinants of cross-border banking flows, the econometric analysis suggests that global factors were influential in driving cross-border banking flows to Irish retail banks during the credit boom in Ireland. Of the global factors considered in the empirical analysis, the leverage

of European global banks in the US wholesale funding market is found to be the most economically significant.

The empirical analysis also indicates that the decline in global risk was also associated with the surge in cross-border inflows to Irish retail banks in the period prior to the global financial crisis. In this context, these results are consistent with the recent international macroeconomic literature that has emphasised the importance of global factors as a determinant of gross cross-border flows.[19] The empirical results are in line with related findings, that global bank leverage is a driver of cross-border banking flows, and that cross-border banking flows are increasing during a period of declining global risk (Bruno and Shin, 2014).

Finally, the empirical evidence suggests that the international funding of Irish retail banks was correlated to the credit boom in Ireland. In addition to cross-border banking inflows, the results suggest that global factors influenced changes in domestic credit to the private non-financial sector during the boom period. While the domestic banking system provides a layer of financial intermediation between the domestic private non-financial sector and international financial markets, the empirical results confirm the spillover of global liquidity into the domestic credit market during the boom.

VI CONCLUSIONS

The aim of this paper has been to assess how global factors influenced cross-border banking inflows to Irish retail banks and determine changes in domestic non-financial sector credit during the credit boom in Ireland. The analysis complements previous studies concerning the Irish credit boom by confirming the role of exogenous global factors as influential determinants of inflows to Irish retail banks.

Consistent with the findings of Bruno and Shin (2014), the leverage of European global banks in US wholesale funding markets and declining global risk were the principal global factors determining cross-border banking flows during the pre-crisis period. Moreover, the results provide empirical support for the transmission of global liquidity – via the international funding of Irish retail banks – into the retail credit market during the Irish credit boom.

These findings have direct implications for both cross-border banking analysis and macro-prudential policy. In terms of the former strand of research, the increased role of global factors in determining cross-border banking flows highlights the need for these to be considered in addition to traditional factors,

[19] Forbes and Warnock (2012); Bruno and Shin (2014); Cerutti (2013).

such as information costs. The relationship between the global financial environment and domestic credit growth provides insight for macro-prudential analysis. This is particularly important given that the pro-cyclicality of bank lending can exacerbate credit booms. Moreover, the build-up of leverage through international funding by domestic banking systems increases vulnerability to sudden stops and susceptibly to banking crises.

Increased reliance of the domestic banking system on foreign funding to support domestic credit growth emphasises the importance of monitoring excessive bank leverage by both domestic and pan-European financial regulators. It is necessary that the advent of centralised bank supervision in Europe through the European Banking Authority, and the Single Supervisory Mechanism will be successful in building essential early warning systems. In light of the growing complexity of global bank structures and related cross-border banking, the role of the Financial Stability Board in mitigating a repeat of the global financial crisis is crucial.

Overall, these results warrant investigation of deeper inter-linkages between macroeconomic indicators, bank foreign funding and financial market developments.

REFERENCES

ADRIAN, T. and H. S. SHIN, 2010. "Liquidity and Leverage", *Journal of Financial Intermediation*, Elsevier, Vol.19, No.3, pp. 418-437.

ADRIAN, T. and H. S. SHIN, 2011. "Financial Intermediary Balance Sheet Management", *Annual Review of Financial Economics*, Vol. 3, No. 1, pp. 289-307.

AVIAT, A. and N. COEURDACIER, 2007. "The Geography of Trade in Goods and Asset Holdings", *Journal of International Economics*, Vol. 71, No. 1, pp. 22-51.

BABA, N., R. MCCAULEY and S. RAMASWAMY, 2009. "US Dollar Money Market Funds and non-US Banks", *Quarterly Review*, March, pp. 65-81, Basle: Bank for International Settlements.

BAERISWYL, R. and M. GANARIN, 2011. "The Non-Inflationary Great Leveraging", mimeo, Swiss National Bank.

BANK FOR INTERNATIONAL SETTLEMENTS (BIS), 2011. "Annual Report", Basle, Switzerland, available at www.bis.org

BERNANKE, B., C. BERTAUT, L. POUNDER DEMARCO, L. and S. KAMIN, 2011. "International Capital Flows and the Returns to Safe Assets in the United States, 2003-2007", *International Finance Discussion Papers*, Vol. 2011, No. 1014, Washington: Board of Governors of the Federal Reserve System.

BERTAUT, C., L. POUNDER DEMARCO, S. KAMIN, S. and R. TRYON, 2012. "ABS Inflows to the United States and the Global Financial Crisis", *Journal of International Economics*, Vol. 88, No. 2, pp. 215-436.

BLOWERS, B. and D. FORSMAN, 2013. "European Banks' Use of US Dollar Funding: System Risk Issues", European Systemic Risk Board, *Macro-prudential Commentaries*, No. 5, March 2013.

BRUNO, V. and H. S. SHIN, 2013. "Cross-Border Banking and Global Liquidity", *Review of Economic Studies*, forthcoming.

BRUNNERMEIR, M., J. GREGORIO, B. EICHENGREEN, M. EL-ERIAN, A. FRAGA, T. ITO, P. LANE, J. PISANI-FERRY, E. PRASAD, R. RAJAN, M. RAMOS, H. REY, D. RODRIK, K. ROGOFF, H. S. SHIN, A. VELASCO, B. WEDER DI MAURO, and Y. YU, 2012. "Banks and Cross-Border Capital Flows: Policy Challenges and Regulatory Responses", Brookings Committee on International Economic Policy and Reform.

BUCH, C., 2005. "Distance and International Banking", *Review of International Economics*, Vol. 13, No. 4, pp. 787-804.

CALVO, G., L. LEIDERMAN and C. RHEINHART, 1996. "Inflows of Capital to Developing Countries in the 1990s", *The Journal of Economic Perspectives*, Vol. 10, No. 2, pp. 123-139.

CERUTTI, E., 2013. "Banks' Foreign Credit Exposures and Borrowers' Rollover Risks: Measurement, Evolution, and Determinants", Washington: IMF Working Paper 13, No. 9.

CETORELLI, N. and L. GOLDBERG, 2012. "Banking Globalization and Monetary Transmission", *Journal of Finance*, Vol. 67, No. 5, pp. 1811-1843.

COATES, D. and M. EVERETT, 2013. "Profiling the Cross-Border Funding of the Irish Banking System", *Economic Letter Series*, Vol. 2013, No. 4, Dublin: Central Bank of Ireland.

COMMITTEE ON THE GLOBAL FINANCIAL SYSTEM (CGFS), 2011. "Global Liquidity – Concepts, Measurement and Policy Implications," Committee on the Global Financial System, Paper No.45.

CORREA, R., H. SAPRIZE and A. ZLATE, 2012. "Liquidity Shocks, Dollar Funding Costs and the Bank Lending Channel During the European Sovereign Crisis", Washington: Board of Governors of the Federal Reserve System International Finance Discussion Papers, Vol. 2012, No. 1059.

DAMAR, H., C. MEH and Y. TERAJIMA, 2013. "Leverage, Balance-Sheet Size and Wholesale Funding", *Journal of Financial Intermediation*, Vol. 22, No. 4, pp. 639-662.

DEMBIERMONT, C., M. DREHMANN and S. MUKSAKUNRATANA, 2013. "How Much Does the Private Sector Really Borrow – A New Database for Total Credit to the Private Non-Financial Sector", *Quarterly Review*, March, pp. 65-81, Basel: Bank for International Settlements.

EVERETT, M. and J. KELLY, 2004. "Financial Liberalisation and Economic Growth in Ireland", *Quarterly Bulletin*, Autumn 2004, Dublin: Central Bank of Ireland.

FORBES, K. and F. WARNOCK, 2012. "Capital Flow Waves: Surges, Stops, Flight and Retrenchment", *Journal of International Economics*, Vol. 88, No. 2, pp. 235-251.

GOURINCHAS, P. O. and M. OBSTFELD, 2012. "Stories of the Twentieth Century for the Twenty-First", *American Economic Journal: Macroeconomics*, Vol. 4, No. 1, pp. 226-265.

GREENLAW, D., J. HAYZIUS, A. KASHYAP and J. STEIN, 2008. "Leveraged Losses: Lessons from the Mortgage Market Meltdown", Booth School of Business, Proceedings of the US Monetary Policy Forum, Report No. 2, Chicago: University of Chicago.

HALE, G. and M. OBSTFELD, 2014. "The Euro and the Geography of International Debt Flows", Working Paper, Vol. 2014, No. 10, San Francisco: Federal Reserve Bank of San Francisco.

HONOHAN, P., 2006. "To What Extent Has Finance Been a Driver of Ireland's Economic Success?", *Quarterly Economic Commentary*, December, pp. 59-72, Dublin: The Economic and Social Research Institute.

HONOHAN, P., 2009. "Resolving Ireland's Banking Crisis", *The Economic and Social Review*, Vol. 40, No. 2, pp. 207-231.

IVASHINA, V., D. SCHARFSTEIN and J. STEIN, 2012. "Dollar Funding and the Lending Behaviour of Global Banks", Finance and Economics Discussion Series, No. 74, Washington: Board of Governors of the Federal Reserve System.

KELLY, R., K. MCQUINN and R. STUART, 2011. "Exploring the Steady-State Relationship Between Credit and GDP for a Small Open Economy – The Case of Ireland", *The Economic and Social Review*, Vol. 42, No. 4, pp. 455-477.

KIM, H., H. S. SHIN and J. YUN, 2013. "Monetary Aggregates and the Central Bank's Financial Stability Mandate", *International Journal of Central Banking*, Vol. 9, No. 1, pp. 69-108.

LANE, P., 2013. "Capital Flows in the Euro Area", European Economy Economic Paper, No. 497, April 2013, Brussels: European Commission.

LANE, P and G. MILESI-FERETTI, 2008. "The Drivers of Financial Globalization", *American Economic Review*, Vol. 98, No. 2, pp. 327-332.

LANE, P and G. MILESI-FERETTI, 2011. "Cross-Border Investment in Small International Financial Centers", *International Finance*, Vol. 14, No. 2, pp. 301-330.

LANE, P. and P. MCQUADE, 2014. "Domestic Credit Growth and International Capital Flows", *The Scandinavian Journal of Economics*, Vol. 116, No. 1, pp. 218-252.

MCCANN, F. and T. MCINDOE-CALDER, 2012. "Bank Competition Through the Credit Cycle: Implications for SME Financing", Mimeo, Dublin: Central Bank of Ireland.

MCCAULEY, R., 2012. "Risk-on/Risk-off, Capital Flows, Leverage and Safe Assets", *Public Policy Review*, Ministry of Finance, Vol. 8, No.3, pp. 281-298, Japan: Policy Research Institute.

MCGUIRE, P. and G. VON PETER, 2009. "The US Dollar Shortage in Global Banking", *Quarterly Review*, March, pp. 47-63, Basle: Bank for International Settlements.

OBSTFELD, M., 2012. "Does the Current Account Still Matter?", *American Economic Review*, Vol. 102, No. 3, pp. 1-23.

PORTES, R. and H. REY, 2005. "The Determinants of Cross-Border Equity Flows", *Journal of International Economics*, Vol. 65, No. 2, pp. 269-296.

REY, H., 2013. "Dilemma Not Trilemma: The Global Financial Cycle and Monetary Policy Independence", Proceedings – Economic Policy Symposium – Jackson Hole, Federal Reserve Bank of Kansas City, pp. 1-2.

SHIN, H. S., 2010. *Risk and Liquidity*, Oxford: Oxford University Press.

SHIN, H. S., 2012. "Global Banking Glut and Loan Risk Premium", *IMF Economic Review*, Vol. 60, No. 2, pp. 155-192.