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The Spillovers, Interactions, and (Un)Intended Consequences of Monetary and Regulatory Policies

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Abstract: Have bank regulatory policies and unconventional monetary policies—and any possible interactions—been a factor behind the recent "deglobalisation" in cross-border bank lending? To test this, we use bank-level data from the UK—a country at the heart of the global financial system. Our results suggest that increases in microprudential capital requirements tend to reduce international bank lending and some forms of unconventional monetary policy can amplify this effect. Specifically, the Bank of England's Funding for Lending Scheme (FLS) significantly amplified the effects of increased capital requirements on external lending. QE may have also had some amplification effect, but estimates are usually insignificant and smaller in magnitude. A rough aggregation exercise suggests that this interaction between microprudential regulations and the FLS can explain about 30% of the contraction in UK cross-border bank lending between the middle of 2012 and end-2013, corresponding to around 10% of the contraction globally. This suggests that unconventional monetary policy designed to support domestic lending can have the unintended consequence of reducing foreign lending.

Keywords: Capital requirements, Funding for Lending Scheme, financial deglobalisation.
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1. Introduction

Global financial intermediation has changed significantly since 2008 and cross-border capital flows have contracted sharply (Figure 1). This has largely corresponded to a reduction in international bank lending, but not a decline in FDI or international portfolio exposures (Figure 2). This contraction in cross-border bank lending has been described with terms such as "financial deglobalisation" (Forbes, 2014) and "the great cross-border bank deleveraging" (Cerutti and Claessens, 2014). It can be divided into two components: the sharp initial contraction that occurred during the crisis, and a more recent decline that began in 2012—what we refer to as the "second phase of banking deglobalisation". This most recent decline in international lending stands in sharp contrast to the relative stability in domestic bank lending over the same period in both the UK and the world (Figure 3). Proposed explanations for the initial phase of deglobalisation in banking since the crisis include government intervention in the banking system (Rose and Wieladek, 2014), increased home bias (Laeven and Valencia, 2013), reduced demand for loans, and reduced availability of wholesale funding for banks.[1] No previous work, however, has tested whether regulatory and/or unconventional monetary policy could be behind this contraction in global banking, and no previous paper has focused on this second phase of banking deglobalisation. This paper aims to fill these gaps.

Many countries have significantly tightened bank regulations over the past few years (such as shown in Figure 4a for UK capital requirements) in order to strengthen the resilience of their financial systems. At the same time, central banks pursued unconventional monetary policies, such as quantitative easing (shown in Figure 4b for the UK) and targeted lending policies aimed at stimulating aggregate demand. While these policies are obvious candidate explanations for the contraction in cross-border bank lending, there are several reasons why no other work has evaluated their effects empirically. First, distinguishing between cross-border loan supply and demand is difficult. Second, the temporal clustering of these different policies, in direct response to

[1] See Forbes (2014) for a more detailed discussion of various potential causes. See also Cerutti and Claessens (2014).

the financial crisis in most countries, makes disentangling their individual effects challenging. Third, it is difficult (if not impossible) to obtain the necessary data on all the relevant policies in most countries.

This paper is able to address these challenges with a unique UK dataset on external bank lending by country, which we have merged with detailed regulatory data[2] on microprudential capital requirements, as well as with information on bank balance sheets and different forms of unconventional monetary policy. The resulting bank-country-time panel allows us to separate country-specific loan demand from supply via country-time effects (as in Aiyar *et al*, 2014). The UK also provides an ideal empirical case study to address these estimation challenges and better understand the joint impact of regulatory and unconventional monetary policy on cross-border bank lending. The UK actively used different regulatory and unconventional monetary policies after the peak of the financial crisis: UK quantitative easing was actively conducted from 2009-2013; micro-prudential regulatory requirements were adjusted throughout; and the Funding for Lending Scheme (FLS), a policy designed to stimulate domestic lending, was introduced in July 2012. Finally, the UK is a useful case study because UK-resident banks are at the heart of the global financial system and have played a major role in the deglobalisation of bank flows.[3] Therefore, this dataset and characteristics of UK policy over this period allow us to identify and tackle this important question of what has caused the recent contraction in international bank lending.

Our results suggest that changes in capital requirements, and their interactions with certain types of unconventional monetary policies, have led to significant reductions in international bank lending. We find that an increase in a bank's capital requirement of 100 basis points leads to a contraction in its external lending growth of about 3.4%. For banks which specialised in FLS-eligible lending (before the introduction of this policy), the effects of increased capital requirements were amplified by a significant amount.

[2] To construct a continuous series of microprudential capital requirements, it was necessary to merge data across three different regulatory forms, as reporting requirements changed substantially over this time period.

[3] UK banks provide more international loans (bank-to-bank assets) than any other country in the world, with 15% of international interbank activity booked in the UK and the average UK bank lending to 53 countries. Cross-border UK bank assets and liabilities both contracted by over 2% of global GDP from 2008Q4 through 2013Q4—the largest contraction in global interbank activity corresponding to an individual country over this period.

More specifically, the same increase in a bank's capital requirement led to larger contraction in external lending under the FLS—with estimates suggesting the effect could have increased the effect substantially for the average bank. A similar analysis for Quantitative Easing, however, suggests that although it may have magnified the impact of increased capital regulations on external lending, these effects were insignificant, smaller in magnitude, and not robust to perturbations of our baseline empirical model. The main results on the significant effects of increased capital regulations and its interaction with the FLS on international lending are robust to different data cleaning techniques and the inclusion of various control variables in our econometric model. These results are also robust to an alternative estimation framework to address any potential endogeneity between capital regulations and international bank lending.

A more detailed analysis of the different FLS components supports these main findings and provides additional detail on exactly how this form of unconventional monetary policy interacted with and amplified the impact of capital regulations. This interaction between the FLS and increased capital regulations only occurred when the full FLS program—aimed at supporting both household and PNFC lending—was in place. The interactions are less powerful during the second phase of the FLS, which aimed at supporting only the much smaller component of PNFC lending. This is not surprising, since mortgage lending is a much larger fraction of UK bank lending.[4] Moreover, these interaction effects only appear to have contributed to a significant contraction in international bank-to-bank (but not bank-to-nonbank) lending, which is the type of lending behind the recent decline in cross-border banking flows since 2012 (as shown in Figures 5a and 5b). This supports the thesis that the interaction of increased capital requirements with the FLS (which began in 2012) may have played a significant role in the 'second phase of banking deglobalisation'.

In order to assess if the regression estimates based on UK microeconomic data can explain a meaningful amount of this second phase of deglobalisation in the aggregate international banking data, however, it is necessary to aggregate the results. We make a

[4] Bridges *et al* (2014) note that mortgages make up 65% of total UK domestic real sector lending, with PNFC lending making up the remaining 35%.

number of conservative assumptions that allow us to calculate how cross-border bank lending would have evolved in the absence of increased capital requirements and their interaction with the FLS. This counterfactual[5] exercise suggests that external bank-to-bank lending would have been higher in the absence of tighter capital requirements, and substantially higher in the absence of their interaction with the FLS. A simple back-of-the-envelope calculation suggests that the level of external UK (global) lending at the end of the first phase of the FLS in 2013 was approximately 30% (10%) lower as a result of these policies.

Overall, this series of results suggests that certain policies designed to support domestic lending, such as the UK's Funding for Lending scheme, might have the unintended consequence of amplifying the impact of microprudential capital requirements on external lending. The magnitude of these spillover effects can also be substantial. This finding has widespread implications for issues such as: the availability of credit, country vulnerability to foreign and domestic shocks, and the effectiveness of monetary policy. It also suggests that unconventional policies in economies that are a relatively small share of global GDP,[6] can still have significant repercussions far beyond their borders.

The rest of the paper proceeds as follows. Section 2 describes the various regulatory and unconventional monetary policies adopted by the UK during this period, explains why these policies and their interactions could impact cross-border lending, and summarizes the data. Section 3 develops the empirical framework and presents the main results and a series of robustness tests. Section 4 presents two extensions: an analysis of the different phases of the FLS and an analysis to address endogeneity concerns. Section 5 calculates the aggregate effects on international bank lending implied by our results and Section 6 concludes.

[5] Just as any counterfactual exercise, the findings will be subject to the Lucas Critique, but they are nevertheless useful to demonstrate the scale and economic significance of our results.
[6] UK GDP is roughly 3% of world GDP.

2. UK Bank Capital Regulations, Unconventional Monetary Policy and their Potential Interactions

2.1 Background on UK Policies

Since the introduction of Basel I in 1988, bank capital requirements in most countries were set at a fixed value at or above the minimum of 8 per cent of risk-weighted assets. In the UK, however, regulators also set bank-specific capital requirements, otherwise known as minimum trigger ratios[7], to address operational, legal or interest rate risks, which were not accounted for in Basel I (Francis and Osborne, 2012). Within this regulatory framework, capital requirements were split into two pillars. Pillar 1 capital requirements are set at the minimum Basel I 8 percent level and are meant to capture credit and market risks. Pillar 2 capital requirements are supplementary add-ons, meant to capture risks that were not contained in the first pillar, that differed across individual banks, and which were changed at the supervisors' discretion. These Pillar 2 requirements were reviewed either on an on-going basis or every 18-36 months. This regulatory regime was first implemented by the Bank of England, before responsibility was handed to the Financial Services Authority (FSA) in 1997.

These Pillar 2 capital requirements are the main variable of interest in this paper, so understanding how they are determined and what they represent is important for the estimation and identification in this paper. The FSA based regulatory decisions for banks on a system of guidelines called ARROW (Advanced Risk Responsive Operating frameWork), which covered a wide array of criteria related to operational, management, business as well as many other risks.[8] Econometric evidence[9], anecdotal evidence from senior policymakers' speeches[10], and parliamentary inquiries into UK Bank failures[11], all

[7] A trigger ratio is the technical term for capital requirement, since regulatory intervention would be triggered if the bank capital to risk-weighted asset ratio fell below this minimum threshold.
[8] The ARROW approach also encompassed prudential risks, but this was not one of the core supervision areas.
[9] Aiyar et al (2014a) show that, while bank size and writeoffs appear to be important determinants of the level of capital requirements in the cross-section, bank balance sheet variables can typically not predict quarterly time variation in capital requirements. Similarly, Aiyar et al (2015) estimate a bank panel VAR model on PNFC loan growth and capital requirement changes. They find evidence of causality running from changes in capital requirements to loan growth, but not vice versa.
[10] In his high-level review of UK financial regulation prior to the financial crisis of 2008, Lord Turner, the then chief executive of the FSA, concluded that: 'Risk Mitigation Programs set out after ARROW reviews therefore tended to focus more on organisation structures, systems and reporting procedures, than on overall risks in business models' (Turner, 2009).

suggest that capital requirement changes within this regulatory framework for the period from 1998 to 2006 were mainly determined by factors other than loan growth or credit risk. Not surprisingly, following the failure of the British bank Northern Rock and the financial crisis that started in 2007, there was a greater focus on credit risk in setting microprudential capital requirements.[12]

During the time period analysed in this paper, UK authorities implemented two main forms of unconventional monetary policy: quantitative easing (QE) and the Funding for Lending Scheme (FLS).[13] Quantitative easing was initiated by the Bank of England in March 2009 in response to the fall in demand associated with the onset of the global financial crisis in the UK. Under this program the Bank of England purchased a pre-announced stock of sovereign debt.[14] To avoid issues arising from the lack of stationarity in this series measuring the stock of asset purchases, we identify changes in quantitative easing in our econometric analysis by using announcements on the flow of purchases.

The second main form of unconventional monetary policy was the Funding for Lending Scheme, which was announced by the Chancellor of the Exchequer in June 2012, and coordinated between the Bank of England and Her Majesty's Treasury (HMT). This was specifically designed to increase bank lending by ensuring that high bank funding costs and capital constraints within the British banking system did not impede lending to the UK's real economy. This scheme consisted of several components—which we exploit in our econometric analysis to help to better identify the impact of this policy. First, HMT insured interbank funding for participating institutions, which likely led to lower interbank funding costs and hence lower effective interest rates on mortgage and PNFC loans in the UK. Even institutions that did not directly participate in the scheme would presumably have benefited from the reduction in interbank funding costs. The cost

[11] The inquiry into the failure of the British bank Northern Rock concluded that 'under ARROW I there was no requirement on supervisory teams to include any developed financial analysis in the material provided to ARROW Panels' (FSA, 2008).
[12] This is discussed in more detail in Section 3.1 and our regression analysis considers how changes in bank-specific credit risk and international exposures might affect a banks' Pillar 2 capital requirement. We also do an analysis in Section 4.2 that is aimed at addressing any potential bias resulting from endogeneity.
[13] Earlier versions of this paper also investigated the impact of forward guidance, which was implemented at the end of the period. Measuring and calibrating forward guidance is difficult, however, and results using different approaches were generally insignificant and not robust to various iterations of the model.
[14] This was different than the US program of QE, which focused on the flow of asset purchases and included purchases of government debt, as well as mortgage backed securities.

at which banks were able to borrow from the FLS facility was decreasing in the amount of the Bank's "FLS-eligible" lending—which was initially defined as lending to PNFCs and households.

A second component of the program provided preferential capital treatment for specific FLS-eligible lending in order to stimulate domestic lending. More specifically, as discussed above, UK-regulated banks are subject to a minimum 8% capital requirement (Pillar 1) and bank-specific capital requirements (Pillar 2). These bank-specific capital requirements can be split into different components, one of which is the "capital-planning buffer" (also referred to as Pillar 2b). Banks were expected to hold this capital-planning buffer on top of the total minimum capital requirement (consisting of the 8% Pillar 1 requirement and any other Pillar 2 capital requirements). When the bank's actual buffer falls below the bank's planning buffer, this usually triggers heightened scrutiny from regulators. Under the FLS, however, banks were allowed to apply for permission to reduce this capital-planning buffer by the amount of capital that was spent on FLS-eligible lending. While the receipt of this Pillar 2b offset was by no means automatic and banks had to apply for it, this option to offset capital buffers for certain types of lending under the FLS would likely have changed the value that banks attached to FLS-eligible versus other types of lending.

A final key aspect of the FLS was how it was changed over time. In response to the relatively greater improvement in household credit availability and conditions and renewed momentum in house price inflation, the subsidy to household lending under the FLS was removed on January 1st 2014. More specifically, both components of the FLS (the eligibility for household lending to serve as collateral to borrow from the facility and the option for beneficial capital weighing) were ended. It was hoped that removing the support for household lending, but keeping the program in place for PNFC lending, would encourage banks to lend more to the small business, instead of the housing, sector. This second phase of the FLS therefore provides a natural experiment to further test and explore how various components of the policy affected external lending.

Finally, unconventional monetary policies (in the form of QE or the FLS) could interact with changes in microprudential regulation (in the form of bank capital requirements) to have different effects on domestic and external lending growth through their different effects on risk weights. The UK, as all other European countries, adopted Basel II and the corresponding model-based risk weights. Unconventional monetary policy could affect these risk weights in a number of ways—such as by affecting the outlook for the UK macroeconomy, loan terms and interest rates. For example, for mortgage lending these risk weights are based on the interest rate on the loan, the risk of unemployment, and loan terms (such as the LTV ratio). Any of these variables could be affected by unconventional monetary policy, thereby providing a direct interaction between these policies, risks weights, and bank lending.

2.2: Why Capital Requirements, Unconventional Monetary Policy, and their Interactions could affect International Bank Lending

Economic theory suggests tighter capital requirements as one explanation for reduced cross-border lending. Figure 6a illustrates that a rise in capital requirements can lead to a decline in risk-weighted assets and lending. But for this to be the case, i) bank equity needs to be more expensive than bank debt; and ii) capital requirements need to be a binding, consistent with a bank's actual capital choice. Theory[15] and evidence[16] suggests that this is the case. Indeed, previous work for the UK typically documents a negative impact on loan supply following a rise in capital requirements.[17] [18] Taken at face value,

[15] Condition i) implies a failure for banks of the Modigliani-Miller (1958) theorem, as otherwise changes in capital requirements do not need to affect a bank's cost of funding. But economic theory provides reasons for why condition i) should be satisfied, such as asymmetric information (Myers and Majluf, 1984) and different tax treatment for debt and equity.

[16] Similarly, empirical work documenting the impact of adverse shocks to bank capital on loan growth, as in Bernanke (1983) and Peek and Rosengren (1997, 2000) provides support for this assumption. Several other empirical studies also suggest that condition ii) is likely to be satisfied, with wide-ranging evidence that capital requirements were a binding constraint on banks' choices of capital structure during the 1998-2011 period. See for example, Francis and Osborne (2012), Aiyar, Calomiris and Wieladek (2014a) and Bridges, Gregory, Nielsen, Pezzini, Radia and Spaltro (2014).

[17] In theory, higher capital requirements could increase lending at banks with very low or negative net worth, particularly if they help to address the debt overhang problem. Similarly, in the medium-run, improvements in the stability of the banking system that result from higher capital requirements could improve banks' abilities to raise funds in the market and thereby mitigate any decline in short-run loan supply. But given the time period of this study, the short-run loan supply decline effect is expected to dominate.

[18] For example, after a 100 basis point increase in capital requirements, Aiyar, Calomiris and Wieladek (2014) find a contraction of 5.6% in domestic PNFC lending while Aiyar, Calomiris, Hooley, Korniyenko and Wieladek (2014) find a contraction of about 5.4% in cross-border loan supply. Bridges et al (2014) also find a quantitatively similar impact on domestic lending.

the findings from this literature would suggest a substantial contraction in bank loans, split between domestic and external assets, following the steep rise in microprudential capital requirements since 2009.

But the decision on which type of lending to contract may depend on the presence of unconventional monetary policies through their impact on relative risk weights. If equity is expensive and capital buffers binding, the only way to adjust quickly to higher capital requirements is to reduce risk-weighted assets. This is most easily achieved by reducing those loans with the highest risk weights. Reducing assets with a zero percent risk weight, such as government debt, will not reduce risk-weighted assets at all. Moreover, UK banks have adopted model-based risk weights since 2008, which are typically based on borrower risk and loan terms. These models typically suggest that the probability of default, and hence the risk weights, for mortgage lending typically increase with higher unemployment risk, higher LTV ratio, and higher interest rate on the loan. As illustrated in Figure 6b, if unconventional monetary policy lowers interest rates or improves the economic outlook and hence reduces the risk weight, it will skew an individual bank's incentives to reduce one type of lending over another in response to higher capital requirements. Conceptually, this is how quantitative easing could interact with changes in microprudential requirements.

The FLS was specifically designed to reduce bank funding costs and increase bank lending. The cost of funds borrowed directly from the facility was decreasing with the amount of the new FLS-eligible (i.e. household and PNFC sector) lending by the borrowing bank. The greater availability of funds also led to a general decline in bank funding costs (see Churm *et al.* 2015). The corresponding pass-through to interest rates should have also had a direct negative impact on the probability of default and hence risk weights associated with UK bank loans, just like QE. As discussed above, the FLS also worked by providing preferential capital treatment for FLS-eligible lending. This differential treatment by loan type could have further reduced risk weights on FLS-eligible domestic lending. This would have made qualified domestic lending relatively more attractive to banks than international lending. Figure 6b shows that each of these

channels through which the FLS could have affected bank lending might have been magnified by any simultaneous changes in microprudential capital requirements. Finally, when the definition of FLS-eligible lending was changed in 2012 to no longer include household lending (but still include PNFC lending), this would be expected to weaken any impact of such policies on the transmission of capital requirements on cross-border lending, especially because household lending forms a relatively larger share of UK banks' balance sheets.

2.3 Data

Appendix A provides information on the data that is used for our main regression analysis. Table A1 defines each of the variables and explains how they were constructed. Table A2 provides summary statistics. Our main dependent variable of interest, country-specific cross-border bank lending is volatile in its raw form, with some suspicious outliers in the growth rate of lending. Therefore we use several different strategies to deal with outliers (discussed in the sensitivity analysis). In our base case, we drop any growth rates of external lending that are greater than 100% in absolute value. We also drop small recipient countries (those with less than £500 million in received funds on average) and bank-country lending pairs if the stock of lending did on average not exceed £1 million.[19] For our main dependent variable, the change in the bank-specific capital requirements, Figure 7 shows the histogram of changes before and after 2007. That suggests that there was a larger number of bank capital requirement increases during the more recent period.

3. Empirical Framework and Central Results

This section begins by discussing the framework to test each of the proposed hypotheses about how microprudential capital requirements and their interactions with unconventional monetary policies affect international bank lending. Then it reports the central reports and a series of robustness checks.

[19] Finally, we only consider observations of bank-lending pairs if the stock of lending exceeds a share of 0.2% in the current or the preceding quarter's total stock of external lending. Keeping only significant portfolios makes sure that we focus on economically meaningful changes in external lending. Results are robust to choosing a higher threshold.

3.1 Empirical Framework

The regression model that will be used as the central framework to test our various hypotheses about the effects and interactions of regulatory and unconventional monetary policy on cross-border bank lending is:

$$\Delta l_{ijt} = \sum_{k=0}^{3} \Delta KR_{i,t-k} \left(\beta_k + \delta_k QE_t + \mu_k FLS_t + \rho_k w_i + \sigma_k (FLS_t * w_i)\right) + \gamma(FLS_t * w_i) + \Lambda F_{jt} + e_{ijt} \quad ,$$

where Δl_{ijt} is the growth rate of lending by bank i to country j at time t. This comprises bilateral cross-border lending by the UK-incorporated PRA regulated entity. ΔKR_{it} is the rise[20] in bank i's minimum capital requirement (in percent of risk-weighted assets) in quarter t. Following previous work by Aiyar *et al* (2014), the contemporaneous value and three lags of this term are included to allow lending to adjust gradually to changes in the regulatory ratio. QE_t is the announced flow of asset purchases, scaled by 2009Q1 UK nominal GDP. This only varies with time, which means that, unless interacted, it is absorbed by the time effects. FLS_t is a dummy variable that takes the value of zero until 2012Q2, and the value of 1 thereafter. This also only varies with time and is meant to capture the idea that during this time period, *all* UK banks benefited from the option to apply for beneficial capital weighting, regardless of their direct participation in the scheme. The key to identification is that the extent to which the enactment of the FLS will skew a bank's incentive to cut back one type of lending versus another will depend upon the fraction of FLS-eligible to total lending w_i(which then merits the reduced risk weighting).[21] FLS_t is therefore interacted with w_i, the pre-FLS 2012Q2 fraction of FLS

[20] Most studies of UK capital requirement changes (i.e. Bridges *et al.* (2014); Aiyar *et al.* (2014) pool capital requirement increases and decreases into one variable. This is because for the time period that they consider (1997-2007), it is not possible to reject the null hypothesis that the sums of coefficients on capital requirements increases and decreases are the same. But as shown in table A3, for the period 2010-2015, this hypothesis can be rejected at the 5% confidence level. This may not be surprising given that banks may have held back with expanding lending when faced with a loosening in capital requirements in preparation of higher banking-system wide requirements due to the introduction of Basel III. Therefore, for the remainder of the paper, we only model and study the impact of capital requirement increases (tightening).

[21] The change in the relative risk-weights of cross-border to domestic lending only applies to new lending. The fraction of the existing stock of these types lending on the balance sheet is likely to reflect a bank's business model. Clearly, if a bank specialises in domestic lending, one would expect a relatively larger pull back in non-core activities, such as cross-border bank lending. On the other hand, a bank that mostly

eligible to total lending on bank *i*'s balance sheet, to capture its effect. The interaction between the FLS_t term and w_i is included independently and interacted with changes in bank capital requirements. To complete the specification, these terms are also interacted with ΔKR_{it} independently.

This simple design has one particularly noteworthy feature: F_{jt}, the country-specific, time-fixed effects, is a way of asking whether the *same* country in the *same* time period borrowing from multiple UK-incorporated banks experiences a larger decline in lending from the bank facing a relatively greater increase in minimum capital requirements. This term is therefore the direct analogue of the firm-specific, fixed-effects methodology pioneered by Khwaja and Mian (2008) to absorb changes in demand conditions. Since the comparison is across banks for the *same* country in a *given* time period, all demand shocks in country *j* at time *t* should be absorbed by this term.

An important assumption in this regression model is that ΔKR_{it} is exogenous with respect to external lending by bank *i* in country *j*. Aiyar *et al* (2014) document that the word 'cross-border lending' was not even mentioned in regulatory guidelines pre-2006. But this concern is more likely after the global financial crisis when regulators paid more attention to bank-specific vulnerabilities and adjusted capital requirements more regularly (as discussed in Section 2.1). We take two approaches to addressing any potential econometric bias from this reverse causality.

First, our main dependent variable of interest is cross-border bank lending by bank *i* to country *j* at time *t*. As discussed in Section 2.1, capital requirements can be split into two pillars; Pillar 1 which is set at the minimum Basel I 8 percent level and is meant to capture credit and market risks, and Pillar 2 which are supplementary add-ons, changed at the supervisors' discretion, and meant to capture risks not contained in the first pillar. Pillar 2 capital requirements, the main variable of interest in this paper, would therefore only be changed in response to external exposures to one individual country if these were not adequately captured by the credit risk component in first pillar.

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specialises in cross-border bank lending would probably not cut back cross-border, more relative to domestic, lending. It is of course possible that banks choose to change their specialisation in response to the FLS. But given any lack of indication that this policy was permanent, this strikes us as unlikely.

Conceptually, one would therefore expect any omitted variable and endogeneity bias to be less severe for external than for domestic lending or total credit growth, and especially for external lending to one specific country.[22]

Nonetheless, endogeneity may still be a concern, so we also adapt a second approach that goes further and which is discussed in more detail in Section 4.2 and Appendix B. This extension explicitly tests for any effects of endogeneity and other bank-specific omitted variables by modelling the determinants of capital requirements and separately identifying the exogenous and endogenous components of rises in capital requirements. Then, we use the residuals from this analysis as a measure of rises in capital requirements that is exogenous and does not result from changes in balance sheet risk. Our main results using the alternative measure of capital requirements are very similar, in fact often stronger, to those in the baseline model across a number of specifications.

Finally, this model easily maps into several different testable hypotheses. First, to examine how increases in capital requirements affect external lending, we sum the β_k coefficients and use an *F*-test to assess if this sum is different from zero. Second, to assess how QE has affected the transmission of changes in capital requirement, we sum the δ_k coefficients and also use an F-test. Third, to test for the impact of FLS interacted with capital requirements, we also sum the above with the σ_k coefficients and perform another F-test. We can also test for independent effects of the FLS (with the γ coefficient). This framework therefore allows us to simultaneously test for the effects of microprudential regulations, as well as how these microprudential policies have interacted with unconventional policies such as QE and the FLS.

Economic theory predicts that the sign of the main coefficient of interest, $\sum_{k=0}^{3} \beta_k$, should be negative. If equity is expensive and capital requirements are a binding constraint on an individual bank's choice of capital structure, one would expect that an increase in regulations in the form of an increase in capital requirements would generate a reduction in the supply of loans. As discussed above, QE would be expected to have a

[22] This could of course be different for lending to the home country of the Bank, such as in the case of the Icelandic banks in the UK for example. Similarly, some countries might be riskier than others and prudential regulators may set capital requirements in response to very quickly growing exposure to one particular country. Country-time effects should pick up some of these concerns, but not all. The results are robust to dropping the bank's home country from the sample, as well as dropping countries with low sovereign ratings.

greater impact on domestic relative to external risk weights, implying that reducing external lending would be a more effective way to respond to increased regulations than reducing domestic lending. In other words, QE would amplify the effect of increased regulations on external lending and the sign on $\sum_{k=0}^{3} \delta_k$ should be negative.[23] The FLS probably reduced interbank fund costs, and hence loan terms and interest rates, in the UK. Similarly, FLS-eligible lending provided the option to apply for a capital offset to all banks, regardless of their participation in the scheme. For these reasons, we expect the FLS to have had a much stronger impact on domestic, as opposed to external, risk weights and thus the predicted sign on $\sum_{k=0}^{3} \sigma_k$ should also be negative.

3.2 Baseline Results and Robustness Checks

Estimates of the model are presented in Table 1. Column 1 shows that increases in capital requirements have a negative and statistically significant impact on cross-border bank lending, as expected.[24] Column 2 adds the FLS term and its various interactions. The coefficient on changes in capital requirements continues to be negative and significant at the 5% level, as is the coefficient where this is interacted with the FLS term and share of FLS-eligible lending. The sum of coefficients on the interaction is -28.62. This estimate, however, is for a bank with a fraction value (w_i) of 1, meaning that this bank only does FLS-eligible lending. Such a bank would of course not engage in external lending and hence not enter our sample. A more useful way to interpret this estimate is for the value of the FLS interaction term for the average bank in the sample, which is 0.1528. This means that for the average bank, the relevant coefficient is -4.37—about the same magnitude as the coefficient on changes in capital requirements. *In other words, the presence of the FLS would for the average bank roughly double the negative impact of increases in capital requirements on external lending.*

[23] Note that a positive value of the QE variable is an expansion. A negative coefficient on $\sum_{k=0}^{3} \delta_k$ is therefore consistent with exacerbating the change in capital requirements effect.

[24] The magnitude, at -3.39, is smaller than that reported in Aiyar *et al* (2014), but when we estimate our model up to 2006 only, as done in their paper, we get a magnitude closer to theirs. One potential explanation for this discrepancy is that the adoption of model-based risk weights introduced an additional margin of adjustment in response to changes in capital requirements.

Column 3 tests for a similar effect of QE. The sum of coefficients on the QE interaction has the expected negative sign, but is not significantly different from zero. This result is reinforced in columns 4 through 6, which each simultaneously control for the effects of QE, the FLS and changes in capital regulations. The coefficients on the FLS and QE interaction terms remain negative in each specification, but only the FLS interactions are significant. Column 5 includes a number of additional controls for individual bank characteristics. Column 6 reports the same analysis, but for ease of exposition, rescales w_i (the fraction of FLS-eligible, to total, lending) to take a value of one for the average bank. Since this scaling makes it easier to infer the effect for the average bank from the tables directly (as shown in the example above), we will use this rescaling when we present all of our subsequent results.

Table 2 reports a series of robustness checks to the baseline from column 6 in Table 1. These tests are particularly important in our analysis given the volatility and noise in the banking data, especially for international loan growth. Columns 1 and 2 in Table 2 show results when we winsorise the dependent variable at 1%/99% and at 5%/ 95%, respectively. Column 3 clusters by country-time, as opposed to by bank-time as done in the baseline. Column 4 shows estimates when the sample is restricted to larger banks, defined as banks with an average balance sheet in excess of 5 billion pounds sterling. Column 5 only focuses on the more recent period starting in 2008 (instead of 1997).

The key results are robust across these various iterations in Tables 1 and 2, and the estimated magnitudes of the key coefficients are quite stable. Increases in capital regulation tend to decrease cross-border bank lending—and the effect is significant when there are not extensive controls for the interaction of increases in capital requirements with the FLS and other variables. The FLS magnifies the effects of capital regulations on external lending. This effect is substantial and estimated to roughly double the magnitude of the impact of increases in capital requirements for the average bank. QE may also have magnified the effects of capital regulations on cross-border bank lending, but any such impact is estimated to be substantially smaller and usually insignificant. Therefore,

different unconventional monetary policies appear to have different effects. But the Funding for Lending Scheme, a policy aimed at boosting domestic bank lending, appears to have had the unintended consequence of reducing international bank lending.

4. Extensions: Two Phases of the FLS and Addressing Endogeneity

This section reports two extensions of our baseline model in order to address specific aspects of the UK regulatory and unconventional monetary policies that could affect our results. It begins by analysing if results change across the different phases of the FLS, which focused on different types of lending. It ends with a more detailed discussion of potential endogeneity between external lending and capital requirements and then presents a series of new results aimed at addressing these concerns.

4.1 The Two Phases of the FLS

As described in Section 2.1, the Funding for Lending Scheme was announced in June 2012, but then changed on January 1st 2014—about half way through our sample period. More specifically, in response to improvement in the housing market and household credit conditions, the Bank of England and HMT decided to reduce both the funding subsidy and the beneficial capital weighting for household lending. But they maintained the preferential terms for small business lending. Figures 8a and 8b show the fraction of FLS-eligible lending during the two phases of the FLS. Clearly, when mortgage lending is included, the share of FLS-eligible lending with respect to the total balance sheet is much larger. Therefore, we would expect that the FLS impact on relative risk weights, and hence the overall effects on external lending through the interaction with capital requirements, would become weaker after January 2014.

To test this, column 1 of Table 3 repeats the base case analysis from column 6 of Table 1, but includes two sets of FLS interaction terms: one set for the first phase of the program that included household and PNFC lending; and one for the second phase which only covers PNFC lending. The main coefficient of interest, the interaction between changes in capital requirements and FLS-eligible lending, continues to be significant for

the first phase of the FLS. As expected, it is also slightly larger in magnitude than in the estimates that include the full period of the FLS program. On the other hand, the same interaction term is no longer significant in the second phase of the program—although the coefficient still has the same negative sign. This is intuitive, since mortgage lending is typically a much larger fraction on the average bank's balance sheet than PNFC lending. This finding therefore also provides some additional support that the estimation framework is capturing the effects of the FLS as discussed above.

Finally, it is also possible to decompose external bank lending data (both in BIS and UK data), into lending to banks abroad and lending to other non-banks abroad. Figures 5a and 5b show these two series for all BIS reporting banks as an aggregate and for the UK's banking system. These figures suggest that much of the contraction in external bank lending, and virtually all of the contraction since 2012 (the "second phase" of bank deglobalisation) is due to a contraction in bank-to-bank, as opposed to bank-to-non-bank, cross-border bank lending.

To test if unconventional monetary policy or regulatory policy had different effects on these different types of international bank flows, and in turn if this could explain these trends across different types of bank lending, columns 2 and 3 of Table 3 repeat the base case, except now split the data into bank-to-bank and bank-to-nonbank lending. The coefficient on which we have been focusing—the interaction between changes in regulation and FLS-eligible lending, is only statistically significant for bank-to-bank, but not bank-to-non-bank lending. It is also only statistically significant for the first phase of the FLS, but not the second, as found in column 1. This interaction term is also larger in magnitude when estimated only for bank-to-bank lending than for the larger lending category. This result could arise from a number of factors, but it is noteworthy that the sharpest contraction in cross-border capital flows—which occurred in cross-border bank-to-bank lending—is for the type of flow most strongly affected by the introduction of the full FLS program (and its interaction with capital regulations). This could indicate the FLS played a substantive role in explaining the second phase of the deglobalisation in banking.

4.2 Potential Endogeneity between Capital Requirements and External Lending

An important assumption in our main regression model in Section 3.1 is that ΔKR_{it} is exogenous with respect to external lending by bank *i* in country *j*. But as discussed in Section 2.1, the regulation of capital requirements around the world has changed significantly since the Global Financial Crisis, so that there is now a greater focus on balance sheet and credit risks. In the UK's current regulatory regime, Pillar 1 capital requirements are meant to address credit and market risks directly. Changes in Pillar 2 capital requirements, the main variable of interest in this study, are changed at the discretion of the regulator to address risks that are not believed to be captured in the Pillar 1 capital requirement. If the first pillar captured all of the credit and market risks contained in balance sheet variables, then one would expect Pillar 2 changes to be orthogonal to changes/growth rates in balance sheet and credit risks. This section tests this proposition and then reports results from an alternative specification which attempts to control for any potential endogeneity between capital requirements and external lending.

To begin, we examine whether the current, lagged or annual growth rate of 31 different variables that supervisors could have taken into account in their regulatory decisions predict changes in Pillar 2 capital requirements. Appendix B discusses the estimation and approach in more detail. To summarize, we use single and Bayesian Model Averaging regression models to identify the most important predictors of increases in capital requirements. The results (in Appendix Table B2) suggest that the strongest predictors are domestic lending growth to the real sector, financial & operating charges, and other operating income. These variables alone explain 30% of the R^2 of increases in capital requirements. This suggests that the majority of capital requirement increases are due to non-balance sheet risk, in line with our initial assumption.

Nonetheless, there is still a valid concern about endogeneity, so we pursue a second and more formal approach to see if this could affect our central estimates. More specifically, we use the key variables and results from above to predict increases in capital

requirements using two different models (as shown in Appendix Table B3 and discussed in more detail in Appendix B). We then use these residuals from the two regressions as two alternative measures of $\Delta KR_{j,t}$, which we refer to as 'Model 1' and' Model 2'. These should be more reflective of increases in capital requirements due to operational, as opposed to credit and market risk, and should therefore not be affected by changes in external lending. In other words, these residuals are orthogonal to balance sheet characteristics by construction.

Table 4 reports regression results with these alternative and more exogenous measures of capital requirements. Before discussing the results, it is important to note that the baseline sample is different from the main regression sample. This is because supervisors adopted a new regulatory form, the FSA003 form, after the UK's financial crisis in 2008. This form is a critical source of information to identify key variables used in setting capital requirements during this relevant period after the crisis. The availability of this form causes the number of observations in our sample to shrink substantially from 47,421 to 13,411. Column 1 in Table 4 begins by evaluating if this change in the sample affects the main results. Reassuringly, the baseline results are robust to estimating our regression model on this much shorter sample, but now the effect is larger in magnitude.[25]

Next, columns 2 and 3 show results when we use our more exogenous measure of increases in capital requirements, i.e. the residual measure based on the regressions that predict regulatory changes with detailed balance-sheet information. The sum of our main coefficients of interest, $\sum_{k=0}^{3} \sigma_k$, remains positive and statistically significant, suggesting that our main result is robust to addressing endogeneity, It is worth noting that this coefficient is quantitatively larger than in column 1. This might suggest that any reverse-causality between external lending growth and changes in capital requirements generates a upward bias in $\sum_{k=0}^{3} \sigma_k$ in a reduced-form regression.

Finally, some authors argue that the contemporaneous term in panel time-series regressions is subject to a greater degree of endogeneity bias than the lagged dependent

[25] This is not surprising as estimating on a shorter sample is equivalent to removing a large number of zeros in the interaction term in our application by construction.

variables.[26] As a final test, we therefore re-estimate our baseline model, but drop the contemporaneous capital requirement term everywhere. This exercise is presented in columns 4-6 of Table 4, for the baseline estimates and then the two models controlling for endogeneity. This does not yield any substantive differences in the baseline estimates. For the application in this paper, it is of course impossible to know if we fail to model an important part of the transmission mechanism by omitting the contemporaneous term. For this reason, we follow the standard approach in this literature and include the contemporaneous term in the baseline regression. Nonetheless, it is reassuring to know that this does not significantly change our results.

To summarize, this issue of whether an explanatory variable is exogenous with respect to the dependent variable is often difficult to resolve in any applied economics paper. In the absence of strong instruments for our main variable of interests, we have therefore modelled changes in bank-specific capital requirements as a function of a wide array of balance sheet and regulatory variables and used the residuals from those regressions as a more exogenous measure of capital requirement changes. This exercise suggests that our baseline results are robust to concerns about endogeneity. This is not surprising given our theoretical prior that most of the credit risk exposure should have been reflected in the Pillar 1 capital requirement, so that movements in Pillar 2 capital requirements should reflect mostly non-balance sheet risks, and hence be exogenous with respect to bank balance sheet variables.

5. Aggregate Effects on International Bank Lending

The main motivation for this paper was to test if changes in bank regulation and unconventional monetary policy contributed to the sharp deglobalisation in banking since the financial crisis, and especially since 2012. This motivation is based on aggregate BIS and banking-system wide data for the UK, but the analysis in this paper is based on individual bank balance sheet data. Using this detailed microeconomic data was critical in order to identify and estimate our model, but it raises a valid question whether the results

[26] See for example, Cornett, Strahan and Tehranian (2011).

found in our UK bank-level sample are economically relevant in explaining the broader international macroeconomic trends. This section attempts to bridge this gap through an aggregation exercise. As with any such exercise, this requires making a number of assumptions, and therefore the results should be taken as illustrative only.

In order to perform this exercise, we use our central results from the estimated regression model reported in column 1 of Table 3 to remove the impact of those FLS and capital requirement coefficients which are statistically significant. Since only the sums of coefficients associated with $(FLS_t * w_i)\Delta KR_{it}$ are statistically significant, only these effects of the interaction of the FLS and capital requirements are removed (and not the impact of the capital requirement itself). We then cumulate the growth rate back to the level of lending in pound sterling for each bank, based on an initial condition of that given banks total external lending in 2011Q3. The resulting series is then summed across banks to give an aggregate series of international bank lending by UK banks.

Figure 9a shows the resulting calculation of international bank lending after removing the interaction of the FLS and increases in capital regulations (in red). Actual data on international bank lending is also shown on the figure (in blue). A comparison of the two lines suggests that aggregate external bank lending would have been substantially higher in the absence of the FLS. Specifically, external bank lending was £1300bn before the introduction of the policy and fell to £1050bn by the end of 2013. The red line shows a decline to only £1125bn. In other words, the £250bn decline would have been £75bn, or 30% smaller, in the absence of the policy. Since the decline in UK external bank lending during this period accounts for a third of the decline in the corresponding BIS data covering most banking flows, this suggests that the FLS and UK capital requirement interaction can explain about 10% of the global bank lending contraction during this period. The magnitude of the drag on external bank lending from the FLS is therefore economically meaningful.

Finally, the results in Section 4.1 suggest that most of the negative effect of the FLS on international bank lending occurred through reductions in bank-to-bank lending (instead of bank-to-nonbank lending). Therefore, we repeat this aggregation exercise to

focus on the estimated effects of the FLS on aggregate bank-to-bank lending. For this calculation, we use the estimated coefficients reported in column 2 of Table 3, which find that changes in capital requirements ($(w_i)\Delta KR_{it}$), as well as its interaction with the FLS ($(FLS_t * w_i)\Delta KR_{it}$), are significant. As a result, we remove the effects of both of these terms when constructing a counterfactual estimate for international bank lending.

The resulting calculations are shown in Figure 9b. The blue line shows actual international bank lending. The green line shows estimated lending absent the effects of increased capital regulations, and the red line shows estimated lending absent increased capital regulations and its interaction with the FLS. The calculations suggest that external bank-to-bank lending would have been higher in the absence of increases in capital requirements. It would have been substantially greater in the absence of the FLS and its interaction with higher capital requirements. In fact, the FLS seems to have more than doubled the effect of tighter capital requirements on international bank lending.

6. Conclusions

Following the Global Financial Crisis, countries around the world introduced prudential policies to improve the resilience of their financial systems. Many also introduced unconventional monetary and lending policies to stimulate demand, support lending, and boost growth. At the same time international bank lending experienced a historically unprecedented contraction—not only in the initial phase of the crisis, but in a "second phase of deglobalisation" that started in 2012. In this paper we examine if these developments are related, using the experience in the United Kingdom as a case study.

Previous analyses of trends in international bank lending have examined the causes of the initial contraction in 2008/2009, unlike our focus on the second phase of banking deglobalisation. We are also the only paper—to the best of our knowledge—to focus on the interactions between various forms of unconventional monetary policy and changes in microprudential capital requirements. We document that UK microprudential capital requirements have increased substantially during this time period, as they have in many countries. Previous analysis of the impact of increases in capital requirements

suggests that this should have generated a contraction in domestic and external lending of roughly the same magnitude[27]. But this is not what seems to have happened in practice; there has been a much larger decline in external bank lending.

UK authorities also pursued unconventional monetary policies during this time period, such as quantitative easing and the Funding for Lending Scheme (FLS). We investigate if, through their impact on risk weights or preferential capital treatment, these policies amplified the impact of higher capital requirements on external lending. Our results indicate that the interaction of increased capital requirements with quantitative easing may have contributed to a reduction in international lending, but any such effect is estimated to be insignificant, small in magnitude, and not robust to different perturbations of the model.

In contrast, the FLS appears to have substantially magnified the contraction in external lending resulting from increased capital requirements. More specifically, our baseline estimates suggest that a 100 basis point rise in capital requirements reduced external loans by 3.4%, and that this effect increased substantially in the presence of the FLS. These results are robust to a number of tests and extensions, including a model aimed at addressing potential endogeneity. More disaggregated results indicate that the contraction in external lending, and primary effects of the FLS on external lending, occurred through reductions in bank-to-bank lending (as opposed to bank to non-bank lending).

Finally, a simple exercise that attempts to aggregate these results based on micro-level UK bank data indicates that the estimated effects of changes in capital regulations and the FLS on external bank lending were also important at an aggregate level. Calculations indicate that these effects can explain a meaningful part of the contraction in international bank lending, especially in international bank-to-bank lending that occurred from mid-2012 to 2014. As a result, unconventional monetary policy, and its interaction with regulatory policy, can have important global spillovers.

[27] For UK data, identical to those used in this paper, but estimated on the pre-crisis sample period, after a 100 basis point increase in capital requirements, Aiyar, Calomiris and Wieladek (2014) find a contraction of 5.6% in domestic PNFC lending while Aiyar, Calomiris, Hooley, Korniyenko and Wieladek (2014) find a contraction of about 5.4% in cross-border loan supply. Bridges et al (2014) also find a quantitatively similar impact on domestic lending.

Overall, our results suggest that a policy such as the FLS, although aimed at boosting domestic lending, can also have the unintended consequence of reducing international lending, especially when taking into account its interactions with capital requirements. Unconventional monetary policies can generate substantive global spillovers, even when adopted in countries that constitute a fairly small share of global GDP.

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Table 1: Baseline Results

	Total External Lending Growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Capital Requirements	-3.394***	-4.014**	-2.570*	-2.430	-2.136	-2.136
p-val	0.00430	0.0272	0.0666	0.209	0.286	0.286
Δ Capital Requirements * FLS		5.099*		3.621	4.737*	4.737*
p-val		0.0550		0.177	0.0778	0.0778
Δ Capital Requirements * Fraction		0.568		-2.332	-2.722	-0.416
p-val		0.914		0.654	0.609	0.609
Δ Capital Requirements * FLS * Fraction		-28.62**		-24.89**	-28.21**	-4.311**
p-val		0.0169		0.0375	0.0225	0.0225
Δ Capital Requirements * QE			-0.781	-0.828	-0.784	-0.784
p-val			0.156	0.153	0.182	0.182
FLS * Fraction		0.0170		0.0157	0.0293	0.00447
s.e		(0.0362)		(0.0362)	(0.0362)	(0.00554)
Liquid Asset Share					-0.0336	-0.0336
					(0.0223)	(0.0223)
Bank Size					0.0225***	0.0225***
					(0.00688)	(0.00688)
Commitment Share					0.0394**	0.0394**
					(0.0198)	(0.0198)
Deposit Share					-0.0277	-0.0277
					(0.0275)	(0.0275)
Writeoffs (Changes)					-0.931**	-0.931**
					(0.451)	(0.451)
Writeoffs (Changes, L)					-0.356	-0.356
					(0.434)	(0.434)
Writeoffs (Changes, L2)					-0.0556	-0.0556
					(0.409)	(0.409)
Writeoffs (Changes, L3)					-0.575	-0.575
					(0.414)	(0.414)
Observations	47,421	47,421	47,421	47,421	47,421	47,421
R-squared	0.13	0.134	0.133	0.134	0.135	0.135
Adjusted R-squared	0.0341	0.0343	0.0343	0.0345	0.0356	0.0356
Bank Controls	NO	NO	NO	NO	YES	YES
Bank Fixed Effects	YES	YES	YES	YES	YES	YES
Country-Time-Effects	YES	YES	YES	YES	YES	YES
Cluster	Bank-Time	Bank-Time	Bank-Time	Bank-Time	Bank-Time	Bank-Time

Note: The table presents the estimated parameter values from fixed effects panel regressions. The dependent variable is the quarterly percentage change in external bank lending. The data are discussed in Section 2.3 and variables are discussed in Section 3.1. Standard errors are clustered at the bank-time level. . *** is significant at the 1% level, ** at the 5% level and * at the 10% level. The sample period is 1997Q1 to 2015Q1.

Table 2: Robustness

		Total External Lending Growth				
		(1)	(2)	(3)	(4)	(5)
		Winsorise at 1%	Winsorise at 5%	Different clustering	Drop small banks	2008Q1 onwards
Δ Capital Requirements		-2.112	-1.888	-2.136	-2.024	-1.017
	p-val	0.289	0.289	0.270	0.313	0.646
Δ Capital Requirements * FLS		4.716*	4.231*	4.737*	4.658*	2.356
	p-val	0.0781	0.0791	0.0752	0.0834	0.389
Δ Capital Requirements * Fraction		-0.410	-0.390	-0.416	-0.444	-0.444
	p-val	0.614	0.595	0.572	0.585	0.696
Δ Capital Requirements * FLS * Fraction		-4.315**	-3.883**	-4.311***	-4.287**	-4.723**
	p-val	0.0222	0.0224	0.00672	0.0234	0.0190
Δ Capital Requirements * QE		-0.783	-0.689	-0.784	-0.801	-0.953
	p-val	0.182	0.196	0.150	0.174	0.0825
FLS * Fraction		0.00440	0.00294	0.00447	0.00449	0.00515
	s.e	(0.00553)	(0.00500)	(0.00481)	(0.00555)	(0.00557)
Observations		47,421	47,421	47,421	46,801	17,558
Adjusted R-squared		0.0359	0.0386	0.0356	0.0357	0.0317
Bank Controls		YES	YES	YES	YES	YES
Bank Fixed Effects		YES	YES	YES	YES	YES
Country-Time-Effects		YES	YES	YES	YES	YES
Cluster		Bank-Time	Bank-Time	Country-Time	Bank-Time	Bank-Time

Note: The table presents the estimated parameter values from fixed effects panel regressions. The dependent variable is the quarterly percentage change in external bank lending. In column (1), we winsorise the LHS variable at the 1% level. In column (1), we winsorise the LHS variable at the 5% level. In column (3), we cluster standard errors at the country-time instead of the bank-time dimension. In column (4), we exclude banks with less than £5bn balance sheet on average. In column (5), run the regression from 2008 Q1 onwards – i.e. when Basel II was introduced. The data are discussed in Section 2.3 and variables are discussed in Section 3.1. Standard errors are clustered at the bank-time level. . *** is significant at the 1% level, ** at the 5% level and * at the 10% level. The sample period is 1997Q1 to 2015Q1.

Table 3: The Two Phases of the FLS

	(1)	(2)	(3)
	Total External Lending	Bank-to-Bank Lending	Bank-to-Non-Bank Lending
Δ Capital Requirements	-1.687	4.616	-1.670
p-val	0.390	0.122	0.423
Δ Capital Requirements * FLS 1	3.099	0.747	0.949
p-val	0.280	0.870	0.772
Δ Capital Requirements * Fraction 1	-0.795	-4.904*	-1.534
p-val	0.644	0.0677	0.464
Δ Capital Requirements * FLS 1 * Fraction 1	-5.801**	-6.829**	-4.640
p-val	0.0212	0.0126	0.130
Δ Capital Requirements * FLS 2	9.551*	12.13*	4.702
p-val	0.0757	0.0995	0.396
Δ Capital Requirements * Fraction 2	-0.348	1.910	2.269
p-val	0.797	0.384	0.175
Δ Capital Requirements * FLS 2 * Fraction 2	-1.597	-2.876	-3.275
p-val	0.465	0.285	0.187
Δ Capital Requirements * QE	-0.801	-1.028	-1.456**
p-val	0.168	0.196	0.0289
Observations	47,421	29,317	43,051
R-squared	0.135	0.199	0.152
Adjusted R-squared	0.0358	0.0645	0.0429
Bank Controls	YES	YES	YES
Bank Fixed Effects	YES	YES	YES
Country-Time-Effects	YES	YES	YES
Cluster	Bank-Time	Bank-Time	Bank-Time

Note: The table presents the estimated parameter values from fixed effects panel regressions. In column (1), the dependent variable is the quarterly percentage change in external bank lending; in column (2), the quarterly percentage change in external bank lending to other banks; in column (3), the quarterly percentage change in external bank lending to non-banks. The data are discussed in Section 2.3. Variables are discussed in Section 3.1. Standard errors are clustered at the bank-time level. . *** is significant at the 1% level, ** at the 5% level and * at the 10% level. The sample period is 1997Q1 to 2015Q1.

Table 4: Exogeneity of Capital Requirements

		Total External Lending Growth					
		(1)	(2)	(3)	(4)	(5)	(6)
		Baseline for Model 1,2 Sample	Model 1	Model 2	Drop contemporaneous KR	Drop contemporaneous KR - Model 1	Drop contemporaneous KR - Model 2
Δ Capital Requirements		-0.477	4.440	4.019	-2.584	2.413	1.793
	p-val	0.835	0.313	0.350	0.138	0.463	0.580
Δ Capital Requirements * FLS		3.093	9.621	3.137	4.872*	2.023	0.971
	p-val	0.332	0.198	0.599	*0.0373*	*0.675*	*0.816*
Δ Capital Requirements * Fraction		-0.323	-1.835	-1.676	0.0195	-1.484	-1.457
	p-val	0.860	0.528	0.544	*0.977*	*0.458*	*0.437*
Δ Capital Requirements * FLS * Fraction		-8.129***	-13.97**	-11.33**	-5.058***	-9.599**	-9.413**
	p-val	0.00635	0.0154	0.0252	*0.00319*	*0.0157*	*0.0138*
Δ Capital Requirements * QE		-0.922	-3.434***	-3.038***	-0.384	-2.021***	-1.824***
	p-val	0.119	0.000377	0.00136	*0.377*	*0.00614*	*0.00950*
FLS * Fraction		0.00735	-0.00501	-0.00340	0.00500	-0.00246	-0.00170
	s.e	(0.00843)	(0.00758)	(0.00760)	(0.00534)	(0.00688)	(0.00677)
Observations		13,411	13,411	13,411	48,187	14,241	14,241
Adjusted R-squared		0.0368	0.0369	0.0368	0.0353	0.0353	0.0356
Bank Controls		YES	YES	YES	YES	YES	YES
Bank Fixed Effects		YES	YES	YES	YES	YES	YES
Country-Time-Effects		YES	YES	YES	YES	YES	YES
Cluster		Bank-Time	Bank-Time	Bank-Time	Bank-Time	Bank-Time	Bank-Time

Note: The table presents the estimated parameter values from fixed effects panel regressions. The dependent variable is the quarterly percentage change in external bank lending. In column (1), we reproduce our baseline result for the period for which we could identify exogenous changes in capital requirements due to availability of regulatory data (2008 Q3 to 2013 Q4) - see section 4.2. In column (2), use the residuals from Model 1 in Table B3 as an exogenous measure of capital requirement tightening. In column (3), we use the residuals from Model 2 in Table B3 as an exogenous measure of capital requirement tightening. In column (4), we drop contemporaneous capital requirement tightening and only retain the three lags. In columns (5) and (6) we again use the residuals from Model 1 and 2 in Table B3 now in a specification without cotemporaneous changes in capital requirements. The data and variables are discussed in Sections 2.3 and 3.1, respectively. Standard errors are clustered at the bank-time level. . *** is significant at the 1% level, ** at the 5% level and * at the 10% level.

Appendix A: Data and Statistics

Appendix Table A1 - Variable Definitions and Sources

Variable	Definition	Source
Cross-border bank lending growth	Per cent change in cross-border lending to banks plus non-banks [CC15], only banks [CC15A] or only non-banks [CC15B].	Bank of England CC forms.
Capital Requirements (Changes)	FSA/PRA-set minimum ratio for Pillar 1 plus Pillar 2 capital-to-risk weighted assets (RWA) for the banking book. [NHD80/NHD70 for BSD3 and 108A/(12.5* 70A) for FSA3	Bank of England BSD3 form for data up to 2008 Q1. FSA3 form thereafter.
Fracdummy	Fraction of bank lending to UK households and PNFCs in total bank lending	Bank of England BT, AL and CC forms
QE	Changes in the size of the Bank of England's Quantitative Easing programme scaled by UK nominal GDP as of 2009 Q1 (expressed in %).	Bank of England MPC minutes.
Commitment Share	Commitment ratio: Ratio of total commitments divided by total assets. [BT43/BT40]	Bank of England BT forms
Liquid Asset Share	Holdings of liquid assets [(BT21+BT23+BT32D)/(BT20-BT19)].	Bank of England BT forms
Deposit Share	Deposit Share. Fraction of the banking organization's balance sheet financed with core deposits [(BT2H + BT3H)/(BT20-BT19)].	Bank of England BT forms
Writeoffs	Writeoffs (Changes) [80T from BSD3 and 32J from FSA15].	Bank of England BSD3 forms for data up to 2008 Q1 and FSA15 forms for data thereafter.
Bank size	Bank size: The log of a bank's total assets in levels (£1000s), deflated by CPI inflation [BT40].	Bank of England BT forms

Appendix Table A2: Summary Statistics

Variable	Median	Mean	p25	p75	Obs.
External bank lending growth	-0.005	-0.036	-0.158	0.096	47421
External bank-to-bank lending growth	-0.039	-0.138	-0.415	0.086	31791
External bank-to-non-bank lending growth	-0.005	-0.036	-0.127	0.072	41839
Fraction	0.087	0.153	0.007	0.236	47421
Liquid Asset Share	0.272	0.359	0.172	0.529	47421
Bank Size (Log, deflated)	16.445	16.712	15.034	18.46	47421
Commitment Share	0.506	0.517	0.33	0.691	47421
Deposit Share	0.204	0.294	0.044	0.506	47421
Writeoffs	0.004	0.013	0	0.015	47421
			min	*max*	
Quantiative Easing	3.6	3.834	1.8	5.339	7

Note: The data are discussed in Section 2.3. Variables are discussed in Section 3.1. Fraction refers to the fraction of domestic non-financial lending to total lending. Summary statistics for Quantitative Easing refer to the 7 quarters in which the size of the asset purchase programme was altered (see Figure 4b).

Appendix Table A3: Tightening vs. Loosening of Capital Regulations

		Total External Lending Growth	
		(1)	(2)
		pre-GFC 1997-2007	post-GFC 2010-2015
Δ Capital Requirements Tightening		-6.177***	-4.794***
	p-val	0.00669	0.00560
Δ Capital Requirements Loosening		-2.697	-0.959
	p-val	0.106	0.491
Test if Tightening diff. from Loosening (p-val)		0.207	0.053
Observations		41,792	17,186
Adj. R-squared		0.0468	0.0284
Bank Fixed Effects		YES	YES
Country-Time-Effects		YES	YES
Cluster		Bank-Time	Bank-Time

Note: The table presents the estimated parameter values from fixed effects panel regressions. The dependent variable is the quarterly percentage change in external bank lending. In column (1), the sample period is 1997 Q1 to 2007Q4. In column (2), the sample period is 2010 Q1 to 2015Q1. The data are discussed in Section 2.3. Variables are discussed in Section 3.1. Standard errors are clustered at the bank-time level. . *** is significant at the 1% level, ** at the 5% level and * at the 10% level.

Appendix B – Exogeneity of $\Delta KR_{j,t}$

An important assumption within our regression framework is the exogeneity of changes in the capital requirement with respect to bank balance sheet variables. But given the importance of this assumption to our framework, it needs to be explored more formally. In order to do so, we test if bank balance sheet variables that supervisors had access to at the time of the regulatory decision can statistically predict the regulatory change. If this is the case and the balance sheet variables can explain a high fraction of the variation in capital requirements, then our initial assertion would have been invalid. If all relevant balance sheet variables have been included in the model predicting changes in capital requirements, however, then the residual will reflect any capital requirement changes that reflect non-balance sheet risk. We can therefore use the residual from a model using balance sheet variables to predict changes in capital requirements to verify if the results change when we use these "non-balance sheet based" capital requirement changes in our model. We have collected 31 such variables. These are mainly taken from the FSA003 form, the reporting form that regulators had access to when making regulatory decisions. This form also contains information on the several measures of balance sheet risk, such as interest rate, counter-party or foreign exchange rate risk. We also incorporate additional balance sheet information that may be relevant but was not on this form, such as the growth in lending to different domestic and external sectors, liquid assets and the deposit ratio. This is a fairly complete and exhaustive list of the information available to the regulators when making their assessments. Of course, supervisors could have also considered additional information and less tangible measures, but this extensive set of variables should allow us to create a fairly exogenous measure of changes in capital regulations.

We then explore if changes in capital requirements can be predicted by any of these variables with the following regression framework:

$$\Delta KR_i = \beta X_i + \varepsilon_i \ ,$$

where ΔKR_i is the non-zero change in capital requirement for bank i and X_i is the matrix of exogenous variables that helps to predict this particular instance of ΔKR_i. Under the assumption that the information set contained in the vector of predictors X_i, the residual (ε_i) will reflect capital requirement changes due to non-balance sheet risk, which are exogenous with respect to balance sheet items. There is also uncertainty about whether these predictors affect the supervisory decisions contemporaneously or with a lag. For these reasons, we use growth rates that are contemporaneous, lagged, or taken with respect to the same value a year ago. We adopt a two-step approach to isolate the most important predictors of changes in capital requirements among these 93 potential candidate predictors. First, we regress each individual predictor against the change in the capital requirement with a single regression. The results are reported in table A1. We then retain those predictors which are statistically significant. This allows us to reduce the universe of candidate predictors to about 18. However, we have little information on whether supervisors looked at these indicators together or individually to form their judgement about a capital requirement change. With the 18 relevant variables, there are over 262,144 regression models that could be explored for this purpose. We therefore follow the Bayesian Modelling Approach (BMA) proposed in the economic growth literature and discussed in more detail below to explore all of these possible model combinations.[28] Table A2 presents the results from this

[28] See Doppelhofer, Miller and Sala-i-Martin (2004).

exercise. This suggests that variables such domestic real sector growth and financial operating charges are strong predictors of tightening in Pillar 2 capital requirements.

Finally, we use all of the important predictors from this BMA exercise in multiple regressions to derive our measure of exogenous changes in capital requirements. Recognising the second step nature of the BMA output, we include all predictors that have a posterior inclusion probability (PiP) of either 40 or 20 percent in regression equations (1) and (2). Results are reported in table A3. Both regression equations include external lending growth, which is not statistically significant in either case. We only retain predictors that entered as significant in both of these regression equations in regression equation 3. We refer to regression equations two and three in table A3 as models 1 and 2 for the remainder of the paper. Each of the resulting balance sheet variables used to predict changes in capital requirements are highly statistically significant in both of these regression models. Therefore, balance sheet characteristics do predict changes in capital requirements. According to the R^2, in these equations, however, the can only explain 25% to 30% of the variation in capital requirements. Assuming that we included all relevant balance sheet variables, this means that between 70% and 75% of the variation in capital requirement changes is due to non-balance sheet risk. This is consistent with the regulatory approach during this period; credit and market risk would typically be accounted for in the Pillar 1 capital requirement. The Pillar 2 add on, which is the focus of this paper, is primarily used as a discretionary supplement to account for other risks.

Given that the residuals of these regressions are, by definition, orthogonal to the balance sheet characteristics, we can use them as measures of changes in non-balance sheet risk capital requirements. We refer to the residuals obtained from columns (1) and (2) as model (1) and model (2) capital requirement changes, respectively.

Details on Bayesian Model Averaging

In this section we provide more detail on our implementation of Bayesian Model Averaging. We have up to 18 (k) possible predictors of the change in capital requirements, but only some of these predictors seem to matter the most for regulatory decision. The economic growth literature has proposed Bayesian Model Averaging to objectively determine which variable has the highest explanatory power. We follow this approach here to select the best predictors of changes in capital requirements based on their posterior inclusion probabilities.

The idea underlying Bayesian Model Averaging is to consider the results for all the models which include all possible combinations of the regressors and average them. In our case there are 2^k or up to 262,144 models. The weights in the averaging are given by the posterior model probabilities $p(M|y)$ where M is the model and y is the data. In order to compute the posterior model probabilities by means of Bayes rule, two elements are required. First, we need the posterior distribution of the parameters in each model M, which is used to derive the marginal likelihood $p(y|M)$. Second, we need to specify the prior distribution of the models $p(M)$. With marginal likelihood and model prior distributions at hand, the model posterior probabilities can be derived as

$$p(M|y) \propto p(y|M)p(M)$$

As to the setup of the priors, we follow Fernandez, Ley and Steel (2001). In particular, for each model, we compute the posterior probability distribution of the parameters by assuming an uninformative prior on the variance of the residuals and on the intercept. For the remaining regression coefficients we use the g-prior of Zellner (1986), setting $g = \frac{1}{\max(N,k^2)}$ .We set a uniform prior for the distribution of the models.[29] Since we only have up to 8,388,608 models, we follow Magnus, Powel and Pruefer (2010) and evaluate each one of them to obtain the exact likelihood, without having to rely on MCMC methods for approximation. High posterior inclusion probabilities indicate that, irrespective of which other explanatory variables are included, the regressor has a strong explanatory power. We argue that this is therefore an efficient and objective way to select the best predictors of the changes in capital requirements.

[29] In practical terms, Bayesian Model Averaging is implemented with the STATA BMA function documented in De Luca and Magnus (2011).

Appendix Table B1: Determinants of Capital Requirements: Single Regressions

	Capital Requirement Tightening		
	(1)	(2)	(3)
	Lagged Growth	Annual Growth	Current Growth
Financial and Operating Income	0.0168	0.238***	-0.0106
	(0.0214)	(0.0895)	(0.0271)
Interest income	0.0319	0.338**	-0.00886
	(0.0326)	(0.170)	(0.0447)
Fee and commission income	0.0228	0.593**	-0.0485
	(0.0474)	(0.292)	(0.0783)
Trading income/losses	0.0371	-0.272	-0.226
	(0.128)	(0.228)	(0.169)
Trading income/losses on trading investments	0.0813	0.315	0.0719
	(0.0914)	(0.476)	(0.144)
Trading income/losses on foreign exchange	-0.108	-0.866	-0.278
	(0.201)	(1.024)	(0.303)
Realised gains/losses on financial assets & liabilities	-0.0363	3.301***	0.664
	(0.273)	(1.021)	(0.837)
Dividend income	-0.138	0.0151	0.170
	(0.277)	(0.672)	(0.235)
Other operating income	-0.0956	0.795***	0.558**
	(0.271)	(0.159)	(0.236)
Financial & Operating Charges	0.0358	0.466***	0.00455
	(0.0407)	(0.152)	(0.0591)
Other costs	0.00737	0.376***	0.0125
	(0.0266)	(0.119)	(0.0362)
(of which) Impairment/Provisions	-0.0278	0.861***	0.204*
	(0.0796)	(0.271)	(0.123)
Net profit (loss)	0.0305	-0.154	-0.0725
	(0.0505)	(0.337)	(0.0636)
Write-offs	0.0886	-0.161*	-0.00731
	(0.183)	(0.0961)	(0.202)
Counterparty risk capital component	0.391	-0.436	-1.352
	(0.649)	(1.984)	(1.006)
Interest Rate Risk (PRR, stan. approach)	-0.214	0.602	0.00829
	(0.411)	(1.582)	(1.048)
Foreign currency Risk (PRR, stan. approach)	2.019***	1.679	-0.895
	(0.615)	(2.672)	(0.945)
Position, FX and commodity risk (internal models)	-0.676*	0.0545	0.837*
	(0.393)	(0.813)	(0.438)
Pillar 1 credit risk capital component	0.188*	0.484	0.197
	(0.108)	(0.428)	(0.222)
Pillar 1 market risk capital component	-0.175	0.397	0.0776
	(0.226)	(0.949)	(0.422)
Deposit Share	0.00454	0.0131	0.00359
	(0.0498)	(0.0178)	(0.0384)
Liquid Asset Share	0.00758	-0.00147	0.0175
	(0.00825)	(0.00701)	(0.0120)
Commitment Share	-0.0106	0.00931	0.0178
	(0.0246)	(0.00881)	(0.0282)
Leverate Ratio	0.0283	0.0126	-0.00162
	(0.0453)	(0.0232)	(0.0566)
External bank lending growth	0.00910	0.0195*	0.00629
	(0.00648)	(0.00989)	(0.00617)
External bank-to-bank lending growth	-1.46e-05	0.0120*	0.00659
	(0.00296)	(0.00663)	(0.00419)
External bank-to-non-bank lending growth	0.00673	0.00890	-0.00374
	(0.00609)	(0.0102)	(0.00824)
Total balance sheet growth	0.0104	0.0253	0.00738
	(0.0111)	(0.0187)	(0.0110)
Domestic real sector lending growth	-0.00513	0.0122*	0.0160*
	(0.00607)	(0.00644)	(0.00814)
Domestic financial lending growth	0.000716	0.00362	0.00669
	(0.00527)	(0.00620)	(0.00423)
Domestic interbank lending growth	0.00285	0.00326	0.00331
	(0.00342)	(0.00493)	(0.00320)

Note: The table presents the estimated parameter values cross-sectional regressions of capital requirement tightening on regulatory and balance sheet variables. In column (1), we use the lagged change of the respective variables scaled risk weighted assets in the quarter before. In column (2), we use changes of respective variables scaled risk weighted assets in the quarter before averaged over 1 year and lagged by one quarter. In column (3), we use the current change of the respective variables scaled risk weighted assets of the quarter before. See section 3.3 for further information on how we obtain the exogenous component of capital requirement changes. Robust standard errors are given in parenthesis. . *** is significant at the 1% level, ** at the 5% level and * at the 10% level.

Appendix Table B2: Determinants of Capital Requirement Tightening: BMA

Variable	Transformation	(1) Coefficient	(2) PIP
Constant		0.00934***	
		(0.000939)	
Financial and Operating Income	Annual Growth	-0.00256	0.08
		(0.0540)	
Interest income	Annual Growth	-0.0818	0.22
		(0.230)	
Fee and commission income	Annual Growth	-0.00573	0.06
		(0.0913)	
Realised gains/losses on financial assets & liabilities	Annual Growth	0.943	0.34
		(1.523)	
Other operating income	Annual Growth	0.0152	0.09
		(0.169)	
Other operating income	Current Growth	0.468	0.74
		(0.339)	
Financial & Operating Charges	Annual Growth	0.541*	0.95
		(0.278)	
Other costs	Annual Growth	0.00913	0.08
		(0.0607)	
Impairment/Provisions	Annual Growth	0.0461	0.12
		(0.163)	
Impairment/Provisions	Current Growth	-0.000106	0.05
		(0.0277)	
Write-offs	Annual Growth	0.00155	0.05
		(0.0662)	
Foreign currency Risk (PRR, stan. approach)	Lagged Growth	0.0836	0.07
		(0.495)	
Position, FX and commodity risk (internal models)	Lagged Growth	-0.0473	0.08
		(0.221)	
Position, FX and commodity risk (internal models)	Current Growth	0.0297	0.07
		(0.193)	
Pillar 1 credit risk capital component	Lagged Growth	0.00327	0.05
		(0.0376)	
External bank lending growth	Annual Growth	0.000758	0.08
		(0.00400)	
External bank-to-bank lending growth	Annual Growth	0.000167	0.06
		(0.00200)	
Domestic real sector lending growth	Annual Growth	0.000125	0.05
		(0.00239)	
Domestic real sector lending growth	Current Growth	0.0150***	0.96
		(0.00520)	
Observations	126		

Note: The table presents the estimated parameter values of Bayesian Model Averaging regressions. PiP stands for the posterior inclusion probability. See this Appendix and section 3.3 for further information. Robust standard errors are given in parenthesis. . *** is significant at the 1% level, ** at the 5% level and * at the 10% level.

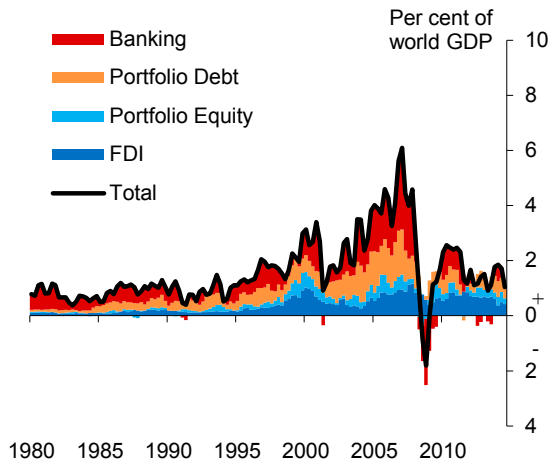
Appendix Table B3: Determinants of Capital Requirement Tightening: Keeping Important Predictors

	(1)	(2)	(3)
Other operating income	0.596***	0.664***	0.617***
	(0.163)	(0.178)	(0.163)
Financial & Operating Charges	0.461***	0.818***	0.487***
	(0.118)	(0.287)	(0.115)
Domestic real sector lending growth	0.0166***	0.0158**	0.0162***
	(0.00598)	(0.00619)	(0.00607)
External bank lending growth	0.00817	0.00856	
	(0.00899)	(0.00900)	
Realised gains/losses on financial assets & liabilities		2.116	
		(1.287)	
Interest income		-0.356	
		(0.243)	
Constant	0.00943***	0.00910***	0.00930***
	(0.000884)	(0.000879)	(0.000876)
		Model 1	Model 2
Observations	126	126	126
R-squared	0.259	0.299	0.255
Adjusted R2	0.235	0.263	0.237

Note: The table presents the estimated parameter values cross-sectional regressions of capital requirement tightening on regulatory and balance sheet variables. In column (1), we keep variables which have in Table A2 a posterior inclusion probability (PiP) of 40 percent in addition to external bank lending growth. In column (2), we include also variables with a PiP of 20 percent. In column (3), we keep only the significant variables. See this Appendix and section 3.3 for further information on how we obtain the exogenous component of capital requirement changes. Robust standard errors are given in parenthesis. . *** is significant at the 1% level, ** at the 5% level and * at the 10% level.

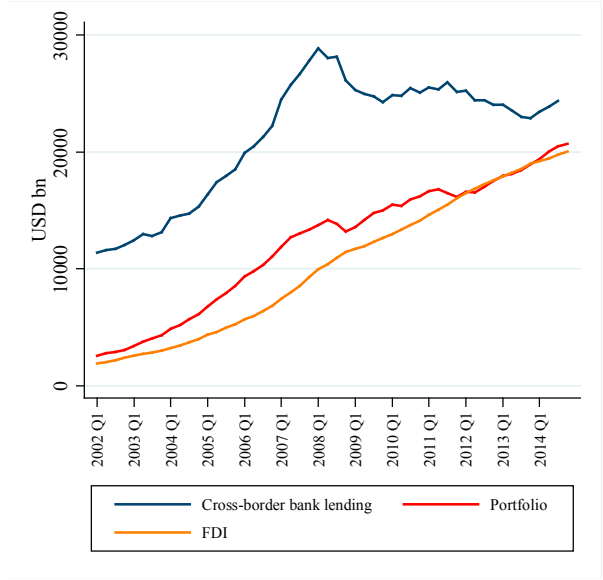
Figures

Figure 1: Contraction in global capital flows



Sources: IMF International Finance Statistics and World Economic Outlook Database. Note: For each quarter, flows are summed over all available country data and then smoothed by averaging over the current and previous quarter.

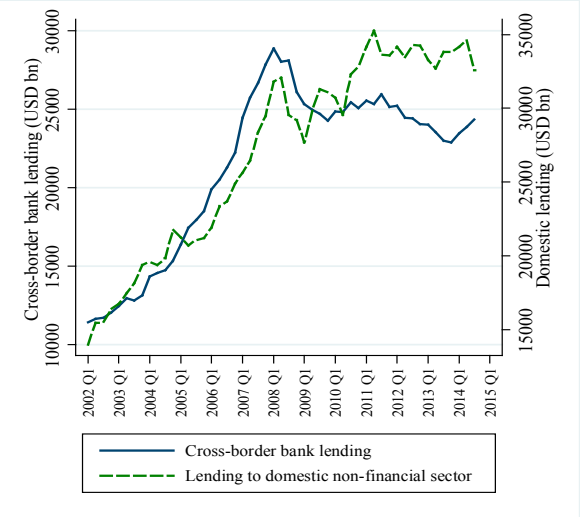
Figure 2: The retrenchment in global banking contrasts to growth in other international financial exposures



Sources: IMF International Financial Statistics and BIS Banking statistics. Note: Gross lending in different types of assets is the cumulated (exchange-rate adjusted) USD bn flow in cross-border lending since 2002 Q1 summed across the BIS reporters for which data was available and then added to 2001 Q4 stocks.

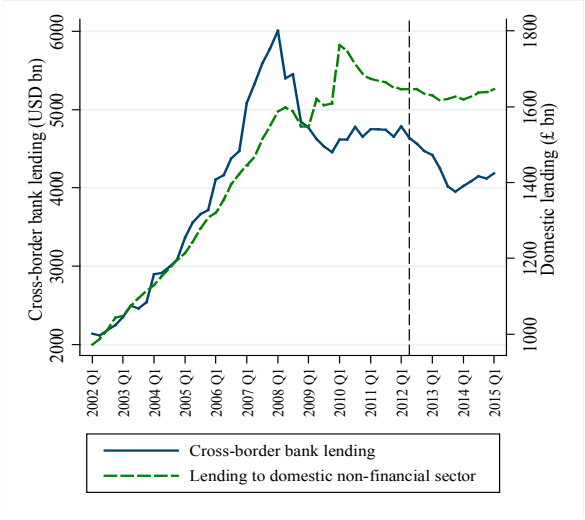
Figure 3: Cross-border bank lending vs. domestic credit

Figure 3a: For all countries



Source: BIS. Note: Gross bank to bank and bank to non-bank lending is the cumulated (exchange-rate adjusted) USD bn change in cross-border lending since 2002 Q1 summed across the BIS reporters for which data was available and then added to 2001 Q4 stocks. Domestic credit is the USD value of credit to the non-bank private sector summed across all BIS reporter (after converting into USD).

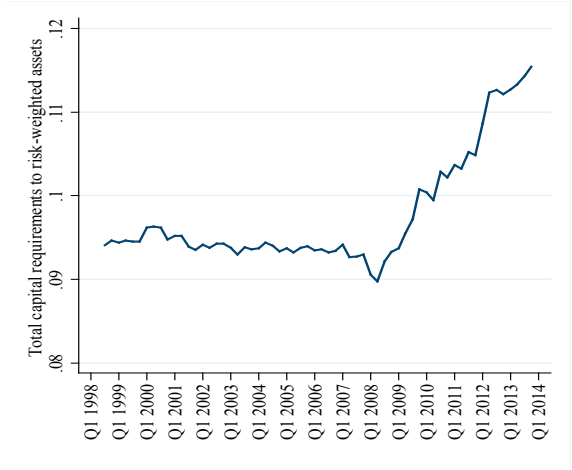
Figure 3b: For the UK



Source: BIS. Note: Gross bank to bank and bank to non-bank lending is the cumulated (exchange-rate adjusted) USD bn change in cross-border lending since 2002 Q1 and then added to 2001 Q4 stocks. Domestic credit is the sterling value of credit to the UK non-bank private sector. The dashed line indicates the introduction of the FLS.

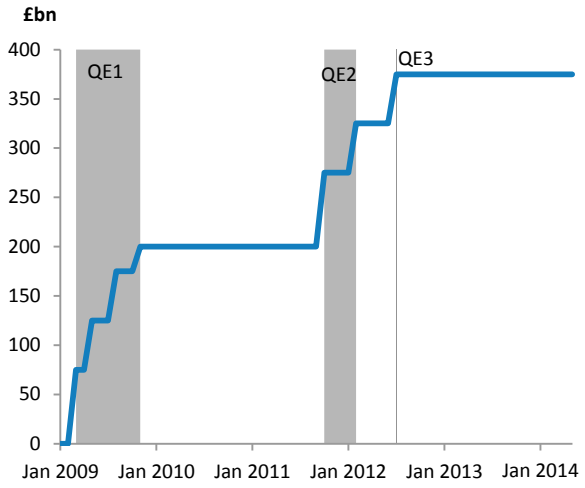
Figure 4: Capital Requirements and Asset Purchase Announcements in the UK

4a: UK Capital Requirements



Source: Bank of England. Note: UK-resident banks' capital requirement refer to both Pillar 1 and Pillar 2. Changes are weighted by total risk weighted assets.

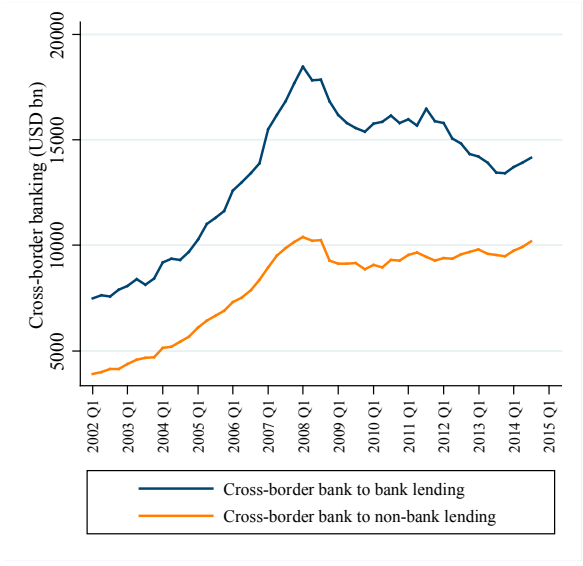
4b: UK Asset Purchase Announcements



Source: MPC minutes.

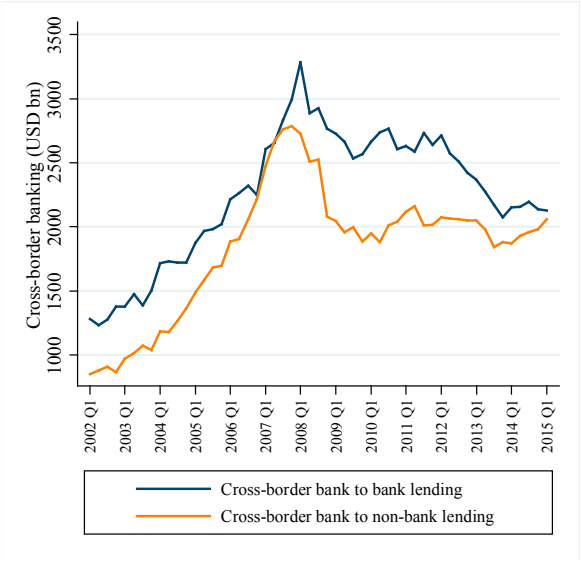
Figure 5: Bank to Bank vs. Bank to Non-Bank lending

Figure 5a: All BIS reporters



Source: BIS. Note: Gross bank to bank and bank to non-bank lending is the cumulated (exchange-rate adjusted) USD bn change i cross-border lending since 2002 Q1 summed across the BIS reporter for which data was available and then added to 2001 Q4 stocks. Domestic credit is the USD value of credit to the non-bank private sector summed across all BIS reporter (after converting into USD).

Figure 5b: UK Only



Source: BIS. Note: Gross bank to bank and bank to non-bank lending is the cumulated (exchange-rate adjusted) USD bn change in cross-borde lending since 2002 Q1 summed across the BIS reporters for which data was available and then added to 2001 Q4 stocks. Domestic credit is the USD value of credit to the non-bank private sector summed across all BIS reporter (after converting into USD).

Figure 6A

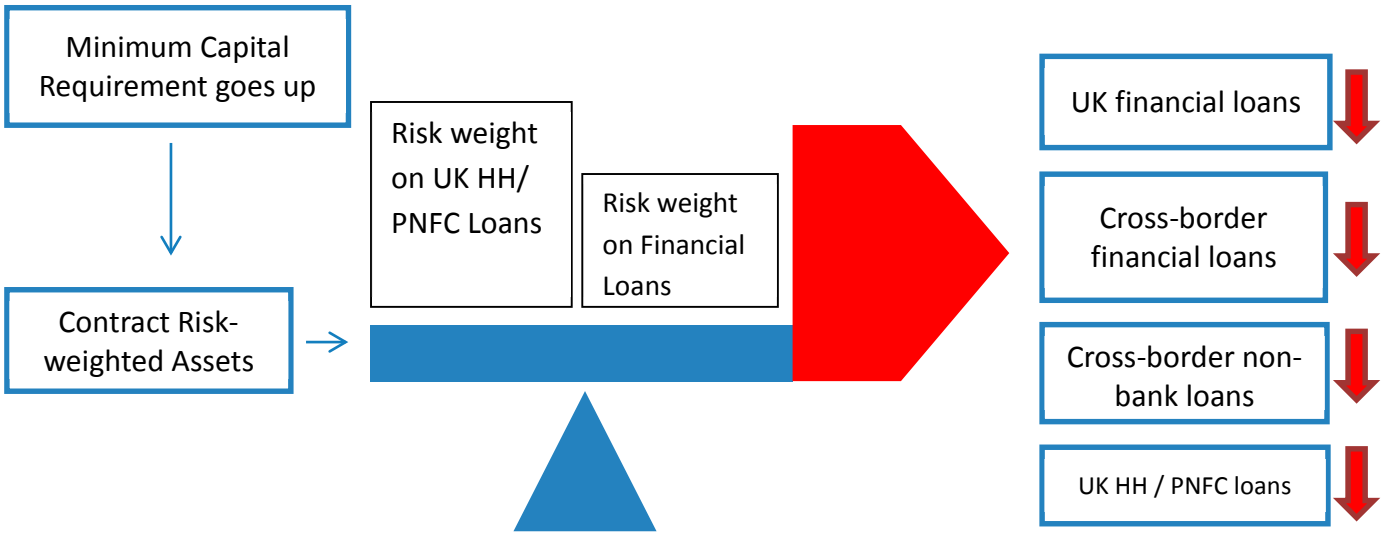


Figure 6B

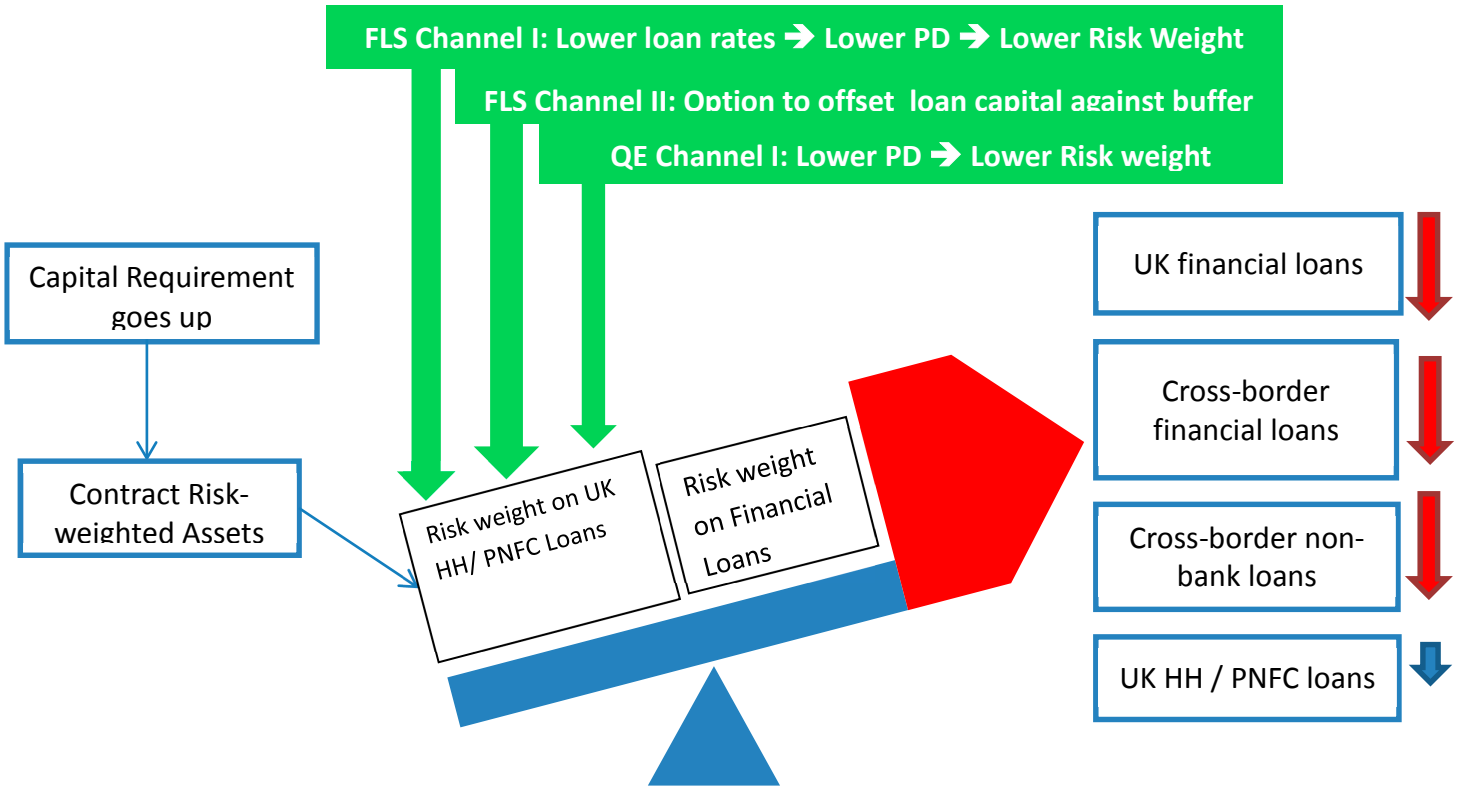
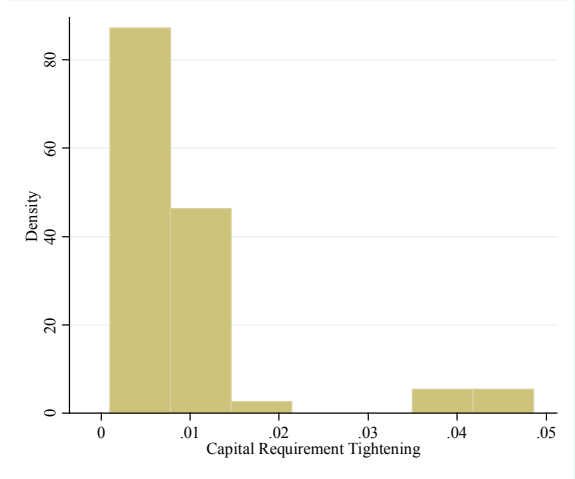


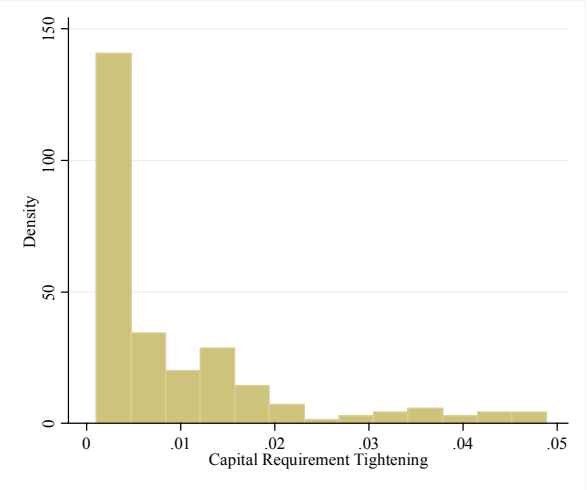
Figure 7: Tightening in Capital Requirements

Figure 7a: 2007 and before



Source: Bank of England.

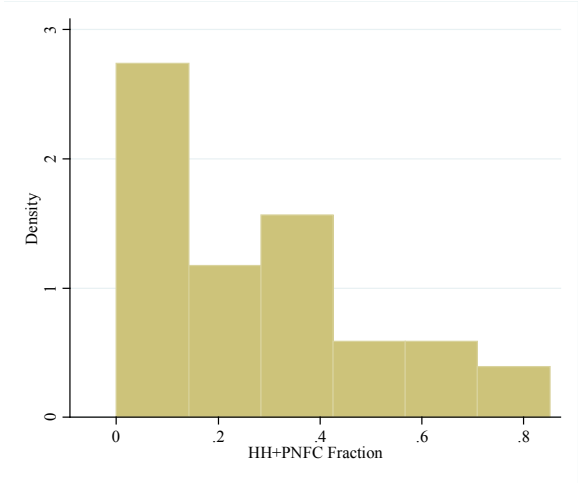
Figure 7b: After 2007



Source: Bank of England.

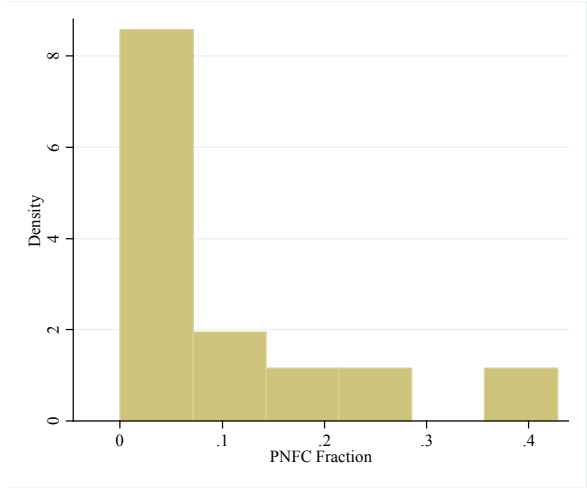
Figure 8: Fraction of FLS-eligible Lending:

Figure 8a: Household and PNFC



Source: Bank of England. Note: The fraction is defined as UK-resident banks lending to the UK household (HH) and PNFC sector divided by total lending (external + domestic financial + HH/PNFC lending).

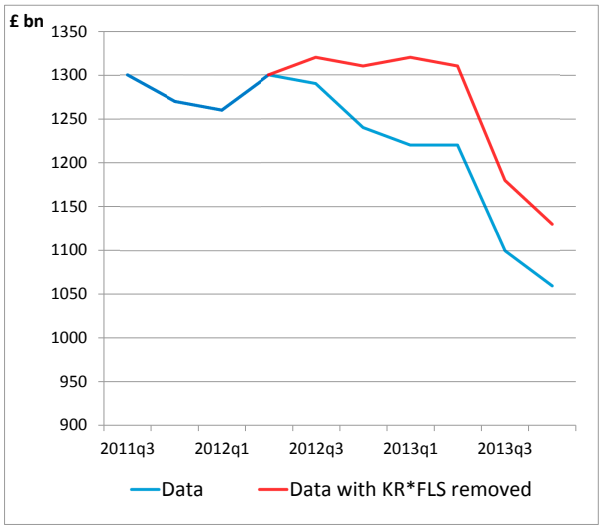
Figure 8b: PNFC Only



Source: Bank of England. Note: The fraction is defined as UK-resident banks lending to the UK household (HH) and PNFC sector divided by total lending (external + domestic financial + HH/PNFC lending).

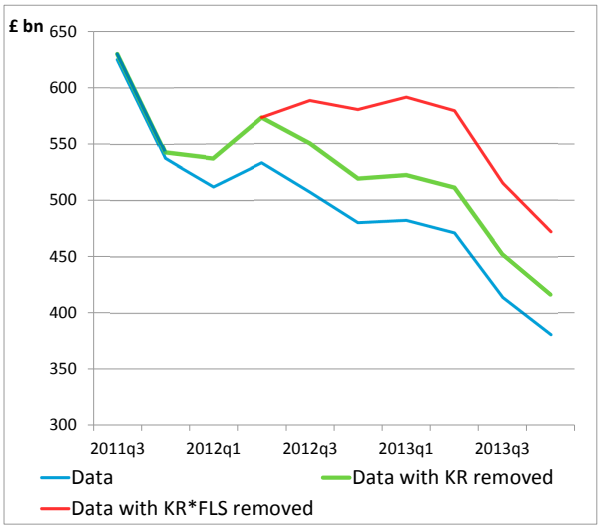
Figure 9: Aggregation Exercise: International Bank Lending

Figure 9a: Aggregate Lending



Note: See section 5 for the description of the aggregation exercise.

Figure 9b: Bank-to-Bank Lending Only



Note: See section 5 for the description of the aggregation exercise.