International Banking and Cross-Border Effects of Regulation: Lessons from the United Kingdom*

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This paper examines whether U.K.-owned banks' domestic lending is affected by prudential actions in other countries where the banks have exposures. We also examine the impact of a change in prudential policy in a foreign-owned U.K.-resident bank's home jurisdiction on its lending to the United Kingdom. Our results suggest that prudential actions taken abroad do not have significant spillover effects on bank lending in the U.K. economy as a whole. But there are more disaggregated sectoral effects: for instance, when a foreign authority tightens loan-to-value standards, U.K. affiliates of banks owned from that country expand their lending to U.K. households.

JEL Codes: F32, F34, G21.

1. Introduction

In recent years, central banks and supervisors in many countries have been given new instruments and legal powers to address systemic

*We are grateful to James Benford, Claudia Buch, Matthieu Bussière, Linda Goldberg, Glenn Hoggarth, Friederike Niepmann, and Matthew Willison for excellent comments. We would like to thank the country teams of South Korea and Mexico for providing referee reports. We thank John Lowes and colleagues in the Bank's Statistics and Regulatory Data Division for answering many data-related questions. All errors remain ours. Any views expressed are solely those of the authors and so should not be taken to represent those of the Bank of England or its policies. Author e-mails: Robert.hills@bankofengland.co.uk, Dennis.reinhardt@bankofengland.co.uk, Rhiannon.sowerbutts@bankofengland.co.uk, tomaszwieladek@gmail.com. Tomasz Wieladek is currently at Barclays Capital but started this work while at the Bank of England.

risk, frequently referred to as "macroprudential" policies and instruments. In this paper, we examine the effect, when these instruments are used overseas, on U.K.-resident banks' lending behavior. Specifically, we look at how changes in "macroprudential" instruments in another country affect domestic lending in the United Kingdom, either via affiliates of banks from the country implementing macroprudential policy or via U.K.-owned banks that are exposed to that country.

This study represents the United Kingdom's contribution to the second project of the International Banking Research Network (IBRN) (Buch and Goldberg 2017). Some country contributions, like ours, focus on the *inward* transmission of foreign prudential policy; others focus on the *outward* transmission of domestic policy actions. Each country contribution runs the same core set of regressions, plus additional country-specific specifications as appropriate.

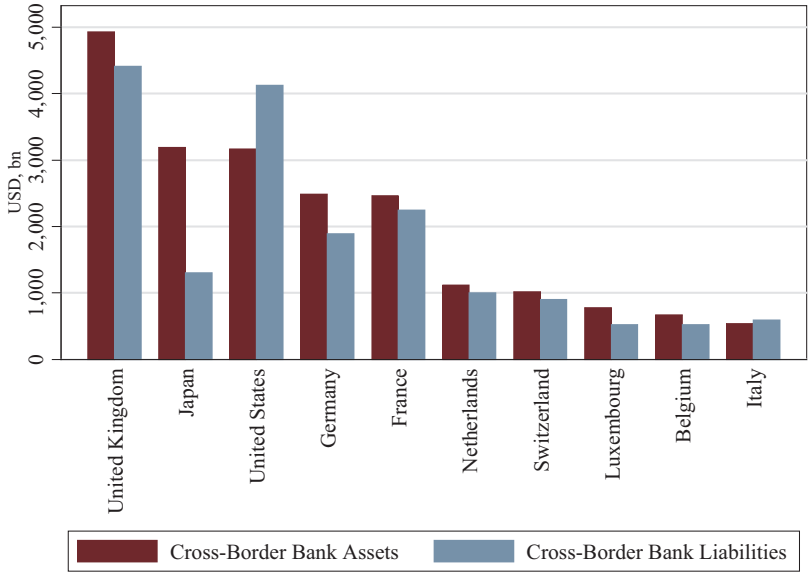
In this paper, we exploit the new IBRN Prudential Instruments Database (Cerutti et al. 2017), which covers seven different types of prudential policy actions taken in sixty-four countries. This rich database allows us to explore whether the implementation of any of these policies abroad affects lending to the U.K. economy.

Exploring the heterogeneity of prudential regulation is related to a recent paper by Reinhardt and Sowerbutts (2015), who find that domestic non-banks borrow more from abroad after an increase in capital requirements, but not after an increase in lending standards. They provide evidence that this is most likely the case because foreign branches are not subject to domestic capital regulations. This paper, however, used aggregate bank data and only focused on the effect of foreign banks' lending after a domestic macroprudential policy action.

The United Kingdom is a major global financial hub. Figure 1 illustrates how large and open the United Kingdom is, with the largest amount of cross-border assets and liabilities in nominal terms in the world. The U.K. banking system is notable in that there is a very high concentration in terms of banking system assets in a few banks with global operations; but also there is a large presence of foreign banks.

Foreign banks account for nearly half of total banking system assets in the United Kingdom, amounting to around 250 percent of GDP (of which around three-quarters is accounted for by branches,

Figure 1. Cross-Border Bank Assets and Liabilities across Countries



Source: BIS international banking statistics, 2013:Q4.

Note: The figure includes countries with more than US$500 billion cross-border bank assets.

and the remainder by subsidiaries). And U.K.-owned banks in aggregate have significant foreign exposures. This means that there are a large number of prudential actions taken abroad which may spill over to the United Kingdom, which explains this project's focus on inward spillovers. Equally, though, this diversity means that the potential impact of a policy action taken in a single country would not necessarily have a major impact on the United Kingdom.

Our results suggest that banks do not cut their lending significantly to the U.K. economy as a whole following a prudential action. This result holds for both U.K.-owned and foreign banks. Given that the United Kingdom is a core country within the international banking system, it is perhaps unsurprising that policy decisions taken by an individual foreign authority would have a

limited impact on lending to the United Kingdom. Aiyar et al. (2014) show the importance of core vs. non-core status in assessing regulatory spillovers. Specifically, they find that, faced with an increase in capital requirements, banks tend to favor their most important country relationships, so that the negative cross-border credit supply response in "core" countries is significantly less than in others.

Nevertheless, these aggregate results do appear to conceal important sectoral heterogeneity. The key result that stands out is that foreign affiliates in the United Kingdom expand their lending to households following a tightening of loan-to-value (LTV) standards in their home country. Foreign banks are only a small part of the market in the United Kingdom, so this does not materially affect the aggregate quantity of household lending. In addition, we find that U.K.-owned banks appear to demand less wholesale funding domestically and more from foreign sources if they are exposed to a country tightening LTV regulations.

These results are consistent with Ongena, Popov, and Udell (2013), who show that banks increase their lending abroad when faced with restrictions at home. The authors examine the spillovers of regulation via large international banks, examining business lending in Eastern Europe, and find that lower barriers to entry, tighter restrictions on bank activities, and higher minimum capital requirements in the parent market are associated with lower bank lending standards abroad.

In a similar vein, Houston, Lin, and Ma (2012) use aggregated country data and show that bank capital inflows increase to a particular country if that country has relatively fewer regulations; essentially, looser regulation acts as a "pull" factor for capital flows. Our focus on sectoral data is also motivated by Danisewicz, Reinhardt, and Sowerbutts (2015), who explore how branches and subsidiaries react differently to changes in prudential policy in their parent country, distinguishing between affiliates' interbank and non-bank lending. The sectoral results in this paper underscore the need for future research to examine the impact of prudential policies in a more disaggregated manner.

The paper proceeds as follows: section 2 describes the specific features of the U.K. data set and sets out the empirical specification, section 3 presents the headline results, and section 4 concludes.

2. Data and Stylized Facts—United Kingdom

2.1 Bank-Level Data and Balance Sheet Characteristics

The key features of our individual bank data set are described in detail in annex A2 of Hoggarth, Hooley, and Korniyenko (2013) and appendix 1 of Aiyar et al. (2014). Raw data from the Bank of England's regulatory reporting forms were collected at a quarterly frequency, covering the balance sheets of 360 individual U.K.-resident banks (excluding building societies) over the period 2000:Q1–2014:Q4 (the data are therefore confidential and available only to employees of the Bank of England). Bank nationality is determined by where its ultimate parent (e.g., holding company) is located and not by the nationality of the largest shareholder. For example, a "U.K.-owned" bank simply means that its ultimate parent is incorporated in the United Kingdom. Table 10 in the appendix describes the construction of variables and their sources.

2.1.1 Dependent Variable

In our main (IBRN-wide) specification, the dependent variable ($\Delta Y_{b,t}$) is the exchange-rate-adjusted log change in the stock of loans. To take into account the volatility of this series, we cut the edges of the distribution so that observations of growth rates outside of +/– 100 percent are dropped.[1] For the U.K.-specific part of this paper, we also explore whether lending to various sectors is affected differently, and so the dependent variable is the exchange-rate-adjusted log change in lending for interbank, private non-financial corporations (PNFC) and household loans. We also look at banks' borrowing and explore the log change in the short-term funding of U.K. banks from wholesale sources (see table 10 for details).

2.1.2 Balance Sheet Control Variables

For balance sheet characteristics, we have used the following variables:

[1]This drops 4 percent of the sample in the case of total loan growth and a sample including both U.K.-headquartered and non-U.K.-headquartered banks.

- Log real assets—i.e., the log of a bank's total assets in levels, deflated by CPI inflation, which we loosely interpret as "size" (and which will also probably pick up other factors such as the risk-taking behavior of banks, to the extent that this reflects too-big-to-fail subsidies ($LogAssets_{i,t-1}$)
- Bank's tier 1 capital to asset ratio ($Tier1Ratio_{i,t-1}$)
- Fraction of a bank's portfolio of assets that is illiquid (1 − holdings of cash and gilts divided by total assets) ($IlliquidAssetsRatio_{i,t-1}$)
- Ratio of total commitments divided by total assets ($CommitmentRatio_{i,t-1}$)
- Core funding, i.e., the fraction of time and sight deposits from domestic residents, divided by total liabilities less tier 1 capital ($CoreDepositsRatio_{i,t-1}$)

2.2 Data on Prudential Instruments

The data on prudential actions come from a new database put together with the expertise of individual central banks participating in the IBRN, together with the International Monetary Fund and the Bank for International Settlements (see Lim et al. 2011, Buch and Goldberg 2017, and Cerutti et al. 2017).

Summary statistics of the count of each type of regulation are presented in table 2 below. Specification A shows the count of the number of changes in regulation in any country in which a U.K. bank has operations for each type of regulation; for example, there are ninety-six capital requirement changes in countries to which the U.K. banking system lends, affecting 1,109 bank-time observations. In specification B, we examine changes in a foreign-owned bank's home country; for example, there are forty-five changes in capital requirements in countries where a foreign-owned bank which operates in the United Kingdom has a parent, affecting 196 bank-time observations. The nature of the United Kingdom's banking system, with U.K. banks holding diversified foreign portfolios and the large number of foreign banks, means that there are a large number of foreign policy actions to take into consideration. The exception is for the interbank exposure limit, where there are too few actions, and the concentration ratio, where there are too few actions for specification B, when we examine the impact of regulation in the home country of a foreign affiliate. Each macroprudential action is treated

as a dummy variable which takes the value of 1 if macroprudential policy is tightened, –1 if macroprudential policy is loosened, and 0 otherwise.

We use two separate specifications to examine the impact of prudential actions. The first is an exposure-weighted index. This is constructed for U.K.-owned banks only and weights are generated using the average of the assets to a particular country, averaged over the four quarters preceding the policy action. For example, if bank X has half of its exposures to country A, bank Y has one-tenth of its exposures to country A, and country A tightens capital requirements, and no other country takes an action, then the exposure-weighted index for capital requirements will be 0.5 for bank X and 0.1 for bank Y. If, however, country B, to which bank Y has one-fifth of its exposures, also tightens capital requirements, this exposure-weighted index becomes 0.3 for bank Y (i.e., 0.1 plus 0.2). When country B loosens requirements, this becomes 0.1 again for bank Y.

The second specification is applicable to banks with a foreign parent. In this case the index takes a value of 1 when the country of the parent bank tightens regulation and –1 when regulation is loosened.

- Regulation weighted by foreign exposures: All exposures of the banks *outside* the home and destination country
- $ExpP_{b,t-1}$: Foreign-exposure-weighted regulation
- $ExpP_{cum,b,t-1}$: Cumulative foreign-exposure-weighted regulation

For the second measure of prudential policy, we use an indicator for when regulation is taken in the parent country for foreign banks only.

- Home-country regulation: Home = country of the parent bank
- $HomeP_{j,t-1}$: Home-country regulation
- $HomeP_{cum,b,t-1}$: Cumulative home-country regulation

2.3 Summary Statistics for the Data Set

Table 1 shows summary statistics for U.K. and foreign-owned banks. U.K. and foreign-owned banks are of comparable size, although

Table 1. Summary Statistics on Bank Lending and Characteristics

Balance Sheet Characteristics (all in %)	Median	25th Percentile	75th Percentile	N
U.K.-Owned Banks:				
Total Loans (Ln Change)	1.805	−1.403	5.030	1,360
Interbank Loans (Ln Change)	1.420	−4.804	7.919	1,320
PNFC Loans (Ln Change)	0.892	−2.770	5.431	1,203
Household Loans (Ln Change)	1.260	−0.962	4.117	1,209
Wholesale Funding Domestic (Ln Change)	1.992	−7.709	13.681	1,264
Wholesale Funding Foreign (Ln Change)	1.102	−4.822	9.018	1,224
Log Total Assets	16.638	15.204	18.448	1,360
Tier 1 Ratio	10.555	7.198	15.256	1,356
Illiquid Assets Ratio	75.655	54.130	86.378	1,354
International Ratio	17.425	6.730	34.616	1,360
Deposits Ratio	42.948	25.974	59.740	1,359
Foreign-Owned Banks:				
Total Loans (Ln Change)	0.394	−10.906	11.666	8,613
Interbank Loans (Ln Change)	0.069	−19.596	18.636	7,590
PNFC Loans (Ln Change)	−0.075	−8.032	7.130	4,860
Household Loans (Ln Change)	0.000	−8.004	6.597	4,117
Wholesale Funding Domestic (Ln Change)	0.000	−18.493	17.938	6,375
Wholesale Funding Foreign (Ln Change)	0.997	−8.639	11.100	6,482
Log Total Assets	14.937	13.484	16.181	8,613
Tier 1 Ratio	4.456	1.957	12.546	8,355
Illiquid Assets Ratio	54.903	30.876	79.151	8,520
International Ratio	63.153	43.676	74.845	8,528
Deposits Ratio	6.344	1.292	16.646	8,595

Notes: This table provides summary statistics for bank balance sheet and lending data. Data are observed quarterly from 2000:Q1 to 2013:Q4. Banking data come from the Bank of England (BoE) BT and AL forms and are reported at a quarterly frequency. Banks are split into subgroups—U.K.-owned banks and foreign banks—on the basis of the ownership of a parent firm. Information on banks' ownership comes from the BoE. Variable definitions and sources are given in table 10 in the appendix.

Table 2. Summary Statistics on Changes in Prudential Instruments

Inward: Specification A					
	Base Data (Before Aggregating to Exposure-Weighted Measures)				Exposure-Weighted Observations
Instrument	No. of Country-Time Changes	No. of Country-Time Changes (Tightening)	No. of Country-Time Changes (Loosening)	No. of Bank-Time Changes	Proportion $ExpP_t$ Non-zero
Prudential Index	546	365	181	5,804	0.677
General Capital Requirements	96	96	0	1,109	0.135
Sector-Specific Capital Buffer	72	53	19	804	0.276
Loan-to-Value Ratio Limits	94	70	24	1,174	0.407
Reserve Requirements: Foreign	122	76	46	984	0.340
Reserve Requirements: Local	277	126	151	2,681	0.474
Interbank Exposure Limit	22	21	1	343	0.122
Concentration Ratio	33	31	2	430	0.196
Inward: Specification B					
Instrument	No. of Country-Time Changes	No. of Country-Time Changes (Tightening)	No. of Country-Time Changes (Loosening)	No. of Bank-Time Changes	Proportion $HomeP_t$ Non-zero
Prudential Index	253	189	64	867	0.101
General Capital Requirements	45	45	0	196	0.023
Sector-Specific Capital Buffer	39	32	7	136	0.016
Loan-to-Value Ratio Limits	70	52	18	252	0.029
Reserve Requirements: Foreign	40	25	15	61	0.007
Reserve Requirements: Local	108	58	50	324	0.038
Interbank Exposure Limit	12	12	0	94	0.011
Concentration Ratio	19	19	0	67	0.008

Source: IBRN.
Notes: This table shows summary statistics on changes in prudential instruments for banks located in the United Kingdom over the period 2000–13. Data on the instruments come from Cerutti et al. (2017) and are a quarterly basis. The number of changes in prudential instruments is reported on several dimensions, i.e., on the country-time level and on the bank-time level. The last column of each panel shows the share of prudential changes to total observations (i.e., the share of non-zero observations). The column "Exposure-Weighted Observations" is based on the underlying data on prudential changes in foreign countries. The reported data are based on the regression sample.

foreign-owned banks have lower and more varied loan growth. Foreign banks are often non-retail banks and do not raise deposits in the United Kingdom, as shown by their much lower deposit ratio, which might help to explain the limited aggregate spillover effects we find. The tier 1 capital ratio appears lower for foreign-owned banks, although this partly reflects the fact that many foreign affiliates are branches and so do not have capital located in the United Kingdom (for branches that do not report their own balance sheet, we set tier 1 ratios to zero).

3. Empirical Method and Estimation Results

3.1 Empirical Method

In this section, we describe our empirical model that we use to examine regulatory spillovers from abroad. Specifically, following Buch and Goldberg (2017), we use the following regression model:

$$\Delta Y_{b,t} = \alpha_0 + \sum_{k=1}^{3} \alpha_j ExpP_{b,t+1-k} + \alpha_4 X_{b,t-1} + f_b + f_t + \epsilon_{b,t}, \quad (1)$$

where $\Delta Y_{b,t}$ is the (exchange-rate-adjusted) change in log stock of loans to U.K. residents of bank b at time t, and $ExpP_{b,t}$ is an exposure-weighted measure of the prudential policy actions taken outside the United Kingdom. The weights are based on the average share in total lending of the individual banks' cross-border lending to the affected country in the four quarters before the policy was implemented. Note that $ExpP_{b,t}$ enters the model contemporaneously and with two lags. This is to allow prudential policy changes abroad to affect U.K. lending over the course of three quarters. $X_{b,t-1}$ is the vector of balance sheet characteristics listed in section 2.2. f_b and f_t are bank and time effects, respectively.

In addition to these regressions, which all countries that participate in the IBRN were asked to estimate on their own national data sets, we also explore angles which are unique to the United Kingdom. Given that London is one of the world's largest financial centers, two notable features are that a large fraction of bank lending in the United Kingdom is interbank or to other financial entities, and that foreign-owned banks account for about two-thirds of total

activity. This type of lending might clearly react differently to regulatory spillovers than either real economy or mortgage lending. We therefore also estimate model (1) for lending to four different sectors of the economy: the financial sector, the commercial real estate sector, the household sector, and the PNFC sector.

The United Kingdom, as a global financial center, is also a funding source for foreign banks and U.K. banks, and so we also investigate whether banks increase their funding from the United Kingdom after a prudential action is taken elsewhere.

It is of course plausible that certain bank characteristics could mitigate or amplify the transmission of external prudential policy actions to U.K. bank lending. To exploit this hypothesis, we use the following model:

$$\Delta Y_{b,t} = \alpha_0 + \sum_{k=1}^{3} \alpha_j ExpP_{b,t+1-k} + \alpha_4 X_{b,t-1} + \sum_{k=1}^{3} \beta_j ExpP_{b,t+1-j} - X_{b,t-1} + f_b + f_t + \epsilon_{b,t}. \quad (2)$$

Model (2) is identical to model (1), with the difference that the exposure index is now interacted with individual bank characteristics.

Finally, the impact of the changes in policy could also be dependent on the business or credit cycle; we use the following model to investigate if this is the case:

$$\Delta Y_{b,t} = \alpha_0 + \alpha_1 ExpP_{cum,b,t-1} + \alpha_2 X_{b,t-1} + \alpha_3 ExpP_{cum,b,t-1} Z_t + f_b + f_t + \epsilon_{b,t}, \quad (3)$$

where Z_t is either the output or credit gap and $ExpP_{cum,b,t-1}$ is a cumulative measure of the credit or business cycle index, cumulated over the last three quarters. Models (1)–(3) assume that prudential policy abroad affects lending in the United Kingdom (specification A) through banks' portfolio exposure to countries that implemented these policies. Another plausible channel of transmission is that those banks that are headquartered in the country that implemented

the policies transmit the change in regulation. We therefore reestimate models (1)–(3), replacing $ExpP_{b,t}$ with the indicator of prudential policy in the affected bank's home country $HomeP_{j,t}$ (specification B), where j stands for a bank's home country j. Given that foreign banks have a large market share in the U.K. financial system, it seems important to test for the effects of both U.K.-headquartered banks (specification A) and foreign-headquartered banks operating in the United Kingdom (specification B).[2]

3.2 Baseline Analysis of Transmission of Prudential Policies to the United Kingdom

Table 3 shows the results for the baseline regressions which examine the effect of exposure-weighted changes in regulation on log changes in total loans of U.K.-owned banks to U.K. financial and non-financial sectors. Our results suggest that prudential actions taken abroad do not have significant spillover effects on bank lending in the U.K. economy as a whole. A change in capital requirements and sector-specific capital requirements have a small contemporaneous impact on lending to the United Kingdom; but this becomes insignificant after the first period, and the F-test of the contemporaneous term and its two lags suggests that there are no significant spillovers to U.K. lending over a three-quarter period.

There is a puzzle in the sign of these point estimates. A reduction in lending to the United Kingdom following a tightening of capital requirements abroad is consistent with the hypothesis that the bank becomes more capital constrained after an increase in capital requirements and so cuts lending across the globally consolidated group as a whole. However, the sign is different for sectoral capital requirements which only apply to domestic lending (such as on domestic real estate); this may be due to the fact that the

[2]As specification B focuses on the specific links between affiliates and their home countries, we can also include the business and credit cycle variables of the affiliate's home country as a control variable in all of the specifications. This should help to account for possible endogeneity driven by the fact that macropru is often tightened in the upswing, which could lead to different lending patterns abroad independently of macropru, especially with regard to the lending of foreign affiliates.

Table 3. Exposure-Weighted Inward Transmission of Regulation

	ExpP = Prudential IndexC (1)	**ExpP = Capital Requirements (2)**	**ExpP = Sector-Specific Capital Buffer (3)**	**ExpP = LTV Ratio (4)**	**ExpP = Reserve Requirements: Foreign (5)**	**ExpP = Reserve Requirements: Local (6)**	**ExpP = Interbank Exposure Limits (7)**	**ExpP = Concentration Ratios (8)**
Foreign-Exposure-Weighted Regulation $ExpP_t$	−0.00369	−0.147**	0.0804*	0.0335	0.454**	0.208*	−0.180	−0.348*
	(0.0338)	(0.0697)	(0.0438)	(0.0482)	(0.221)	(0.121)	(0.170)	(0.191)
Foreign-Exposure-Weighted Regulation $ExpP_{t-1}$	0.0277	0.185	−0.0129	−0.0582	−0.218	−0.158	0.136	−0.0798
	(0.0424)	(0.150)	(0.0404)	(0.0388)	(0.273)	(0.136)	(0.114)	(0.0796)
Foreign-Exposure-Weighted Regulation $ExpP_{t-2}$	−0.00304	−0.208	0.0188	0.0818	0.185	0.149	−0.0843	−0.0845
	(0.0550)	(0.222)	(0.0330)	(0.0669)	(0.356)	(0.101)	(0.0789)	(0.139)
Sum of Coefficients	*0.0210*	*−0.170*	*0.0864*	*0.0571*	*0.421**	*0.198***	*−0.128*	*−0.512***
F-Test	*0.195*	*1.263*	*1.151*	*0.374*	*2.919*	*3.750*	*0.257*	*5.197*
p-value	*0.661*	*0.266*	*0.288*	*0.544*	*0.0935*	*0.0582*	*0.614*	*0.0268*
Log Total $Assets_{t-1}$	1.154	1.142	1.111	1.160	1.191	1.215	1.150	1.030
	(1.737)	(1.759)	(1.704)	(1.743)	(1.725)	(1.725)	(1.728)	(1.732)
Tier 1 $Ratio_{t-1}$	0.00742	0.00788	0.00816	0.0106	0.00754	0.00624	0.00373	−0.00136
	(0.0615)	(0.0651)	(0.0620)	(0.0596)	(0.0604)	(0.0631)	(0.0614)	(0.0615)
Illiquid $Assets\ Ratio_{t-1}$	0.106**	0.100**	0.108**	0.107**	0.105**	0.100**	0.105**	0.104**
	(0.0445)	(0.0427)	(0.0446)	(0.0446)	(0.0443)	(0.0431)	(0.0456)	(0.0444)
International $Activity_{t-1}$	0.0858	0.0757	0.0889	0.0874	0.0854	0.0917	0.0849	0.0853
	(0.0950)	(0.0911)	(0.0954)	(0.0967)	(0.0953)	(0.0979)	(0.0963)	(0.0949)
Core Deposits $Ratio_{t-1}$	0.114*	0.114*	0.116*	0.116*	0.118*	0.125*	0.117*	0.122*
	(0.0649)	(0.0651)	(0.0645)	(0.0650)	(0.0656)	(0.0674)	(0.0658)	(0.0640)
Observations	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360
R^2	0.088	0.106	0.089	0.089	0.090	0.096	0.088	0.091
Adjusted R^2	0.0419	0.0610	0.0429	0.0431	0.0441	0.0510	0.0427	0.0453
No. of Banks	53	53	53	53	53	53	53	53
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample of Banks: Domestic Owned	1	1	1	1	1	1	1	1

Notes: This table reports the effects of changes in regulation and firm characteristics on log changes in total loans. The data are quarterly from 2000:Q1 to 2013:Q4. (Cumulative) foreign-exposure-weighted regulation is calculated as the weighted average of (cumulative) changes in foreign regulation weighted with total assets and liabilities of that bank in the respective foreign country. For more details on the variables, see table 10 in the appendix. Each column gives the result for the regulatory measure specified in the column headline. All specifications include fixed effects as specified in the lower part of the table. Standard errors are clustered by bank. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

relative-price effect dominates the income effect in this case. This warrants more investigation in future work.

We find that banks expand their lending to the United Kingdom following a reserve requirement action taken abroad, but although the test over the three-quarter period is significant, this seems to be driven again by the first quarter only.

When the bank-specific (table 4) and financial and business cycle (table 5) variables are interacted, these bank-specific and cycle controls rarely seem to have significant effects. This may be because the time and bank fixed effects already account for a lot of the variation in these variables.[3]

The small and only-contemporaneous effects for all instruments suggest that prudential actions taken abroad do not have a long-lasting impact on U.K.-owned banks' lending to the United Kingdom. This has a number of potential explanations. For instance, U.K. banks have diversified country exposures, meaning that the impact of one country's actions may be very small for the bank as a whole and the bank does not optimize or adjust its strategy in response to changes in regulation which only affect a small part of its balance sheet; alternatively banks could react to prudential policy by rebalancing, but not by changing lending to core markets (as suggested by Aiyar et al. 2014) and so U.K.-based banks do not cut lending to the United Kingdom; another possibility is that banks rebalance their portfolios across sectors, leaving overall lending unchanged. We do not have sufficient data or actions to test the first two hypotheses, but we do explore the final—sectoral rebalancing—hypothesis below.

Tables 6–8 show the results for the baseline regressions which examine the effects of a change in lending to the United Kingdom by foreign-owned affiliates after a change in regulation in their home country. Table 6 provides some weak evidence that regulatory tightening in affiliates' home countries has an impact on their lending

[3]However, the inclusion of fixed effects remains essential to help ascertain that the respective balance sheet characteristics are not capturing other unobservable differences between banks. Rerunning the regression in table 4, column 1 as a pooled regression with and without fixed effects reveals that they explain 11.67 percentage points of an overall R^2 of 15.36 percent (note the current table displays the "within" R^2). Likewise, in table 5, column 1, fixed effects explain 11.17 percentage points of the total 13.13 percent.

Table 4. Exposure-Weighted Inward Transmission of Regulation—Bank Variables Interactions

	ExpP = Prudential IndexC (1)	ExpP = Capital Requirements (2)	ExpP = Sector-Specific Capital Buffer (3)	ExpP = LTV Ratio (4)	ExpP = Reserve Requirements: Foreign (5)	ExpP = Reserve Requirements: Local (6)	ExpP = Interbank Exposure Limits (7)	ExpP = Concentration Ratios (8)
Foreign-Exposure-Weighted Regulation (ExpP)	−0.424	−0.608	0.366	−0.0904	17.73*	−0.431	2.576	0.371
	0.413	0.885	0.0627	0.00389	3.900	0.332	0.685	0.0307
	0.524	0.351	0.803	0.950	0.0536	0.567	0.412	0.862
Log Total Assets$_{t-1}$	1.016	0.493	0.921	1.065	1.225	1.225	1.171	0.953
	(1.686)	(1.736)	(1.730)	(1.736)	(1.668)	(1.797)	(1.729)	(1.721)
Tier 1 Ratio$_{t-1}$	0.00876	−0.0242	0.0123	0.00909	0.0180	0.00527	−0.00524	0.00645
	(0.0623)	(0.0771)	(0.0638)	(0.0620)	(0.0578)	(0.0673)	(0.0634)	(0.0599)
Illiquid Assets Ratio$_{t-1}$	0.125**	0.126**	0.113**	0.106**	0.105**	0.101**	0.0977**	0.104**
	(0.0489)	(0.0525)	(0.0472)	(0.0459)	(0.0460)	(0.0446)	(0.0443)	(0.0453)
International Activity$_{t-1}$	0.0631	0.0550	0.0873	0.0862	0.0966	0.0961	0.0891	0.0899
	(0.0955)	(0.0914)	(0.0957)	(0.0986)	(0.0956)	(0.100)	(0.0947)	(0.0966)
Core Deposits Ratio$_{t-1}$	0.0993	0.0825	0.109	0.115*	0.134**	0.123*	0.123*	0.129*
	(0.0638)	(0.0622)	(0.0655)	(0.0678)	(0.0649)	(0.0672)	(0.0651)	(0.0662)
Log Total Assets*ExpP	0.0153	0.0283	0.00830	0.00372	−0.0881	0.0272	−0.0858	0.0190
	0.665	2.123	0.0142	0.00575	0.183	1.390	0.632	0.0519
	0.418	0.151	0.906	0.940	0.671	0.244	0.430	0.821
Tier 1 Ratio*ExpP	0.000612	−4.78e-05	−0.0153**	0.00891	−0.116	0.00160	0.0311	−0.00895
	0.0716	0.000134	4.066	0.677	1.424	0.241	1.763	0.247
	0.790	0.991	0.0489	0.415	0.238	0.625	0.190	0.621
Illiquid Assets Ratio*ExpP	−0.00279	−0.00651	−0.00541	0.00274	−0.0739**	0.00234	0.00686	−0.00192
	0.947	1.626	1.610	0.154	5.099	0.290	0.237	0.0291
	0.335	0.208	0.210	0.696	0.0282	0.592	0.628	0.865

(*continued*)

Table 4. (Continued)

	ExpP = Prudential IndexC (1)	ExpP = Capital Require-ments (2)	ExpP = Sector-Specific Capital Buffer (3)	ExpP = LTV Ratio (4)	ExpP = Reserve Require-ments: Foreign (5)	ExpP = Reserve Require-ments: Local (6)	ExpP = Interbank Exposure Limits (7)	ExpP = Concen-tration Ratios (8)
International Activity*ExpP	0.00588	0.00503	−0.000951	−0.00421	−0.100	0.00238	−0.0163	−0.0174
	1.315	1.187	0.0127	0.267	0.502	0.497	0.629	1.530
	0.257	0.281	0.911	0.608	0.482	0.484	0.431	0.222
Core Deposits Ratio*ExpP	0.00518	0.00686**	0.00373	−0.00245	−0.114	−0.00158	−0.0353**	−0.0113
	1.814	4.998	0.375	0.186	1.947	0.435	4.294	1.393
	0.184	0.0297	0.543	0.668	0.169	0.512	0.0432	0.243
Observations	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360
R^2	0.110	0.140	0.094	0.093	0.104	0.101	0.099	0.100
Adjusted R^2	0.0544	0.0866	0.0376	0.0359	0.0483	0.0451	0.0431	0.0435
No. of Banks	53	53	53	53	53	53	53	53
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample of Banks: Domestic Owned	1	1	1	1	1	1	1	1

Notes: This table reports the effects of changes in regulation and firm characteristics and their interactions on log changes in total loans. Bank control variables are included as specified in the lower part of the table but not reported for the sake of brevity. For ExpP and its interaction effects, the reported coefficient is the sum of the contemporaneous term and two lags, with the corresponding F-stats for joint significance in parentheses. The data are quarterly from 2000:Q1 to 2013:Q4. (Cumulative) foreign-exposure-weighted regulation is calculated as the weighted average of (cumulative) changes in foreign regulation weighted with total assets and liabilities of that bank in the respective foreign country. For more details on the variables, see table 10 in the appendix. Each column gives the result for the regulatory measure specified in the column headline. All specifications include fixed effects as specified in the lower part of the table. Standard errors are clustered by bank. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

Table 5. Exposure-Weighted Inward Transmission of Regulation—Cycle Interactions

	$ExpP_{cum}$ = Prudential IndexC (1)	$ExpP_{cum}$ = Capital Require-ments (2)	$ExpP_{cum}$ = Sector-Specific Capital Buffer (3)	$ExpP_{cum}$ = LTV Ratio (4)	$ExpP_{cum}$ = Reserve Require-ments: Foreign (5)	$ExpP_{cum}$ = Reserve Require-ments: Local (6)	$ExpP_{cum}$ = Interbank Exposure Limits (7)	$ExpP_{cum}$ = Concen-tration Ratios (8)
Cumulative Foreign-Exposure-Weighted Regulation ($ExpP_{cum}$)	0.0250***	−0.870	0.0216*	0.0258**	0.270***	0.0289	0.0525	−0.00119
	(0.00831)	(0.747)	(0.0122)	(0.0129)	(0.0878)	(0.0278)	(0.0455)	(0.0395)
Log Total $Assets_{t-1}$	−0.514	−0.317	−0.422	−0.648	−0.00214	−0.221	−0.158	0.0582
	(1.517)	(1.652)	(1.576)	(1.597)	(1.610)	(1.745)	(1.794)	(1.715)
Tier 1 $Ratio_{t-1}$	−0.0311	−0.0338	−0.0609	−0.0332	−0.00406	−0.0434	−0.00380	0.00550
	(0.0659)	(0.0704)	(0.0756)	(0.0728)	(0.0755)	(0.0784)	(0.0845)	(0.0834)
Illiquid $Assets\ Ratio_{t-1}$	0.142**	0.141**	0.137**	0.141**	0.148**	0.136**	0.142**	0.154**
	(0.0559)	(0.0558)	(0.0540)	(0.0555)	(0.0554)	(0.0542)	(0.0595)	(0.0628)
International $Activity_{t-1}$	0.0981	0.0871	0.0856	0.0974	0.111	0.0989	0.0963	0.0913
	(0.0862)	(0.0866)	(0.0861)	(0.0872)	(0.919)	(0.0899)	(0.0908)	(0.0949)
Core $Deposits\ Ratio_{t-1}$	0.0751	0.0730	0.0731	0.0715	0.0809	0.0863	0.0693	0.0636
	(0.0536)	(0.0587)	(0.0582)	(0.0544)	(0.0586)	(0.0606)	(0.0537)	(0.0583)
BIS Financial Cycle (Host Country)*$ExpP_{cum}$	0.000166	−0.0373	−0.000149	−0.00125	0.00731	0.00151	−2.30*e*-05	−0.00257
	(0.000317)	(0.0309)	(0.000616)	(0.000988)	(0.00533)	(0.00106)	(0.00278)	(0.00181)
BIS Business Cycle (Host Country)*$ExpP_{cum}$	0.00413	−0.561	0.00238	0.00933	0.00900	0.00565	−0.0221	−0.00973
	(0.00419)	(0.413)	(0.00545)	(0.00728)	(0.0332)	(0.00928)	(0.0285)	(0.0126)
Observations	1,363	1,363	1,363	1,363	1,363	1,363	1,363	1,363
R^2	0.078	0.085	0.074	0.076	0.076	0.075	0.075	0.075
Adjusted R^2	0.0337	0.0411	0.0302	0.0317	0.0315	0.0312	0.0304	0.0310
No. of Banks	57	57	57	57	57	57	57	57
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample of Banks: Domestic Owned	1	1	1	1	1	1	1	1

Notes: This table reports the effects of changes in regulation and business and financial cycles and firm characteristics on log changes in total loans. Unilateral cycle variables are controlled for by the fixed effects. The data are quarterly from 2000:Q1 to 2013:Q4. (Cumulative) foreign-exposure-weighted regulation is calculated as the weighted average of (cumulative) changes in foreign regulation weighted with total assets and liabilities of that bank in the respective foreign country. For more details on the variables, see table 10 in the appendix. Each column gives the result for the regulatory measure specified in the column headline. All specifications include fixed effects as specified in the lower part of the table. Standard errors are clustered by bank. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

Table 6. Inward Transmission of Home Prudential Policy via Affiliates

	HomeP = Prudential IndexC (1)	HomeP = Capital Require-ments (2)	HomeP = Sector-Specific Capital Buffer (3)	HomeP = LTV Ratio (4)	HomeP = Reserve Require-ments: Foreign (5)	HomeP = Reserve Require-ments: Local (6)	HomeP = Interbank Exposure Limits (7)	HomeP = Concen-tration Ratios (8)
Home-Country Regulation HomeP_{t}	−0.154	−0.830	2.037	−1.433	−5.587*	1.789	0.359	−5.065
	(1.140)	(2.139)	(1.772)	(2.160)	(3.256)	(2.247)	(2.146)	(4.001)
Home-Country Regulation HomeP_{t-1}	−1.932**	3.292	−0.406	−3.465*	2.107	−4.251***	0.737	−2.763
	(0.963)	(2.140)	(2.135)	(1.982)	(2.488)	(1.448)	(2.842)	(3.240)
Home-Country Regulation HomeP_{t-1}	0.697	1.754	−2.239	4.282**	5.018	1.472	−3.146	−2.913
	(0.996)	(1.907)	(2.012)	(2.056)	(4.023)	(1.600)	(2.384)	(3.470)
Sum of Coefficients	*−1.389*	*4.217*	*−0.608*	*−0.616*	*1.538*	*−0.989*	*−2.049*	*−10.74**
F-test	*1.154*	*1.161*	*0.0420*	*0.0419*	*0.240*	*0.220*	*0.234*	*3.374*
p-value	*0.284*	*0.282*	*0.838*	*0.838*	*0.624*	*0.640*	*0.629*	*0.0672*
Log Total Assets_{t-1}	−2.445***	−2.439***	−2.443***	−2.423***	−2.438***	−2.433***	−2.425***	−2.388***
	(0.827)	(0.826)	(0.827)	(0.825)	(0.826)	(0.825)	(0.828)	(0.828)
Tier 1 Ratio_{t-1}	0.104**	0.106**	0.104**	0.105**	0.104**	0.105**	0.105**	0.107**
	(0.0495)	(0.0493)	(0.0492)	(0.0492)	(0.0493)	(0.0493)	(0.0493)	(0.0492)
Illiquid Assets Ratio_{t-1}	0.0953***	0.0948***	0.0952***	0.0955***	0.0940***	0.0948***	0.0951***	0.0955***
	(0.0255)	(0.0254)	(0.0255)	(0.0254)	(0.0254)	(0.0255)	(0.0254)	(0.0254)
Core Deposits Ratio_{t-1}	−0.0283	−0.0268	−0.0268	−0.0279	−0.0270	−0.0272	−0.0273	−0.0279
	(0.0320)	(0.0319)	(0.0320)	(0.0318)	(0.0319)	(0.0319)	(0.0319)	(0.0318)
BIS Financial Cycle (Home Country)	0.0446*	0.0419*	0.0443*	0.0424*	0.0434*	0.0439*	0.0438*	0.0422*
	(0.0239)	(0.0238)	(0.0239)	(0.0241)	(0.0240)	(0.0240)	(0.0240)	(0.0240)
BIS Business Cycle (Home Country)	0.435*	0.403*	0.399*	0.427*	0.387*	0.402*	0.407*	0.413*
	(0.233)	(0.227)	(0.231)	(0.233)	(0.227)	(0.227)	(0.228)	(0.227)
Observations	8,613	8,613	8,613	8,613	8,613	8,613	8,613	8,613
R^2	0.019	0.019	0.019	0.019	0.019	0.019	0.018	0.019
Adjusted R^2	0.0117	0.0114	0.0115	0.0123	0.0118	0.0120	0.0113	0.0115
No. of Banks	312	312	312	312	312	312	312	312
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample of Banks: Domestic Owned	1	1	1	1	1	1	1	1

Notes: This table reports effects of changes in parent-country regulation and firm characteristics on log changes in total loans. HomeP refers to changes in regulation in the home (i.e., parent-bank) country of foreign affiliates. The data are quarterly from 2000:Q1 to 2013:Q4. (Cumulative) foreign-exposure-weighted regulation is calculated as the weighted average of (cumulative) changes in foreign regulation weighted with total assets and liabilities of that bank in the respective foreign country. For more details on the variables, see table 10 in the appendix. Each column gives the result for the regulatory measure specified in the column headline. All specifications include fixed effects as specified in the lower part of the table. Standard errors are clustered by bank. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

in the United Kingdom negatively: the coefficient on the first lag of the prudential index is negative and significant. A tightening in reserve requirements in foreign currency leads to a contemporaneous fall in the growth rate of lending to the United Kingdom, while lagged reserve requirement tightenings in domestic currency have a similar effect. This is consistent with the hypothesis that replacing reserves is costly, and as a result, banks cut back on their lending. The results on LTV tightening are inconclusive, indicating the possibility that banks rebalance their portfolios across sectors, which we will explore below. However, the F-test on the sum of coefficients to examine the effect of policies over three quarters indicates non-significant spillovers for the prudential index and all of its subcomponents. A possible explanation for the lack of significant results stems from the fact that the United Kingdom is a major international financial center and so is likely to be a core country for many banks and hence protected from a retrenchment in lending.

As above, the effect of the cycle- or bank-specific controls does not seem to be strong (tables 7 and 8). There is tentative evidence that a positive home-country financial cycle increases lending growth in the United Kingdom (table 6), suggesting that financial conditions abroad do spill over to the United Kingdom via lending of foreign affiliates.

Finally, in table 11 in the appendix, we explore our baseline results for including all instruments jointly. Point estimates, and in most cases their significance, are comparable to the just-discussed results on including the instruments separately. In specification A (U.K.-headquartered banks), the significance of changes in reserve requirements drops once including local- and foreign-currency reserve requirements jointly. This may be unsurprising, as regulators often tighten local and foreign reserve requirements jointly (see Cerutti et al. 2017).

3.3 Exploration of Sectoral Lending and Bank Funding

Table 9 summarizes the results when we repeat the analysis above at a sectoral level and also examine the role of funding (the results for interbank exposure limits and concentration ratios are excluded, given that table 2 shows that we do not have sufficient country-time changes in regulatory policies to draw reliable inferences). Turning

Table 7. Inward Transmission of Home Prudential Policy via Affiliates—Bank Variables Interactions

	HomeP = Prudential IndexC (1)	HomeP = Capital Requirements (2)	HomeP = Sector-Specific Capital Buffer (3)	HomeP = LTV Ratio (4)	HomeP = Reserve Requirements: Foreign (5)	HomeP = Reserve Requirements: Local (6)	HomeP = Interbank Exposure Limits (7)	HomeP = Concentration Ratios (8)
Home-Country Regulation HomeP_{t}	11.52	11.61	11.39	−9.816	68.10**	23.73	1.935	4.508
	(8.730)	(15.90)	(9.724)	(16.88)	(32.35)	(18.30)	(14.40)	(20.64)
Home-Country Regulation HomeP_{t-1}	−11.68	15.26	4.773	−28.91	49.00	6.586	−2.547	−50.60*
	(8.065)	(18.93)	(15.77)	(17.93)	(36.94)	(15.24)	(28.22)	(28.34)
Home-Country Regulation HomeP_{t-1}	−3.360	−23.35	−10.04	9.691	−54.38*	−4.594	−36.92**	0.0754
	(8.254)	(16.20)	(19.43)	(15.41)	(32.60)	(13.52)	(15.09)	(33.87)
Sum of Coefficients	*−3.517*	*3.517*	*6.117*	*−29.03*	*62.72**	*25.73*	*−37.53*	*−46.02*
F-test	*0.0890*	*0.0145*	*0.0597*	*1.785*	*2.891*	*0.872*	*1.570*	*0.780*
p-value	*0.766*	*0.904*	*0.807*	*0.183*	*0.0901*	*0.351*	*0.211*	*0.378*
Log Total Assets_{t-1}	−2.405***	−2.415***	−2.473***	−2.478***	−2.437***	−2.384***	−2.428***	−2.395***
	(0.818)	(0.820)	(0.828)	(0.824)	(0.828)	(0.819)	(0.830)	(0.831)
Tier 1 Ratio_{t-1}	0.0938*	0.111**	0.101**	0.0936*	0.0992**	0.111**	0.103**	0.118**
	(0.0506)	(0.0497)	(0.0500)	(0.0488)	(0.0490)	(0.0491)	(0.0490)	(0.0500)
Illiquid Assets Ratio_{t-1}	0.101***	0.0995***	0.0979***	0.0992***	0.0942***	0.0988***	0.0943***	0.0977***
	(0.0258)	(0.0253)	(0.0255)	(0.0255)	(0.0255)	(0.0254)	(0.0254)	(0.0257)
Core Deposits Ratio_{t-1}	−0.0274	−0.0252	−0.0332	−0.0270	−0.0266	−0.0236	−0.0267	−0.0294
	(0.0319)	(0.0321)	(0.0322)	(0.0315)	(0.0319)	(0.0315)	(0.0321)	(0.0321)
BIS Financial Cycle (Home Country)	0.0477**	0.0403*	0.0476**	0.0452*	0.0425*	0.0435*	0.0437*	0.0436*
	(0.0238)	(0.0238)	(0.0241)	(0.0241)	(0.0240)	(0.0241)	(0.0240)	(0.0241)
BIS Business Cycle (Home Country)	0.468**	0.394*	0.404*	0.458*	0.368	0.408*	0.398*	0.427*
	(0.233)	(0.228)	(0.230)	(0.236)	(0.230)	(0.228)	(0.228)	(0.229)
Log Total Assets*HomeP	0.179	0.803	0.0093	2.115	−6.046**	−2.166	1.707	3.173
	0.0586	0.241	0.00288	2.108	5.487	1.212	1.105	0.993
	0.809	0.623	0.957	0.148	0.0198	0.272	0.294	0.320
Tier 1 Ratio*HomeP	0.240	−0.0380	0.129	0.723***	0.659***	0.294	0.473	−0.244
	2.273	0.0164	0.142	7.223	8.518	0.911	1.759	0.144
	0.133	0.898	0.706	0.00759	0.00377	0.341	0.186	0.704

(*continued*)

Table 7. (Continued)

	HomeP = Prudential IndexC (1)	HomeP = Capital Require-ments (2)	HomeP = Sector-Specific Capital Buffer (3)	HomeP = LTV Ratio (4)	HomeP = Reserve Require-ments: Foreign (5)	HomeP = Reserve Require-ments: Local (6)	HomeP = Interbank Exposure Limits (7)	HomeP = Concen-tration Ratios (8)
Illiquid Assets Ratio*HomeP	−0.0589	−0.155	−0.248*	−0.165*	0.166	−0.00344	0.114	−0.169
	1.446	0.969	3.680	3.362	1.970	0.000970	0.361	0.703
	0.230	0.326	0.0560	0.0677	0.161	0.975	0.548	0.402
Core Deposits Ratio*HomeP	0.0180	−0.163	0.245**	0.0288	0.709***	0.0692	−0.0912	−0.0538
	0.157	1.707	5.784	0.0775	13.58	0.373	0.279	0.0633
	0.692	0.192	0.0168	0.781	0.000270	0.542	0.598	0.802
Observations	8,613	8,613	8,613	8,613	8,613	8,613	8,613	8,613
R^2	0.020	0.020	0.020	0.021	0.022	0.020	0.019	0.021
Adjusted R^2	0.0117	0.0112	0.0114	0.0128	0.0131	0.0119	0.0104	0.0127
No. of Banks	312	312	312	312	312	312	312	312
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample of Banks: Domestic Owned	1	1	1	1	1	1	1	1

Notes: This table reports the effects of changes in regulation and firm characteristics and their interactions on log changes in total loans. HomeP refers to the changes in regulation in the home (i.e., parent-bank) country of foreign affiliates. Bank control variables are included as specified in the lower part of the table but not reported for the sake of brevity. For HomeP interaction effects, the reported coefficient is the sum of the contemporaneous term and two lags, with the corresponding F-statistics for joint significance in parentheses. The data are quarterly from 2000:Q1 to 2013:Q4. (Cumulative) foreign-exposure-weighted regulation is calculated as the weighted average of (cumulative) changes in foreign regulation weighted with total assets and liabilities of that bank in the respective foreign country. For more details on the variables, see table 10 in the appendix. Each column gives the result for the regulatory measure specified in the column headline. All specifications include fixed effects as specified in the lower part of the table. Standard errors are clustered by bank. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

Table 8. Inward Transmission of Home Prudential Policy via Affiliates—Cycle Interactions

	HomeP = Prudential IndexC (1)	HomeP = Capital Requirements (2)	HomeP = Sector-Specific Capital Buffer (3)	HomeP = LTV Ratio (4)	HomeP = Reserve Requirements: Foreign (5)	HomeP = Reserve Requirements: Local (6)	HomeP = Interbank Exposure Limits (7)	HomeP = Concentration Ratios (8)
Cumulative Home-Country Regulation $\text{HomeP}_{\text{cum}}$	0.128	0.0278	0.805	0.841*	−0.508	−0.266	−0.651	−0.447
	(0.211)	(1.434)	(0.675)	(0.493)	(0.872)	(0.410)	(0.687)	(1.066)
Log Total Assets_{t-1}	−2.753***	−2.626***	−2.694***	−2.762***	−2.676***	−2.584***	−2.706***	−2.610***
	(0.853)	(0.834)	(0.838)	(0.850)	(0.845)	(0.836)	(0.854)	(0.837)
Tier 1 Ratio_{t-1}	0.106**	0.109**	0.0991**	0.110**	0.110**	0.110**	0.108**	0.110**
	(0.0497)	(0.0494)	(0.0501)	(0.0506)	(0.0497)	(0.0501)	(0.0506)	(0.0491)
Illiquid Assets Ratio_{t-1}	0.0881***	0.0883***	0.0884***	0.0895***	0.0888***	0.0886***	0.0880***	0.0893***
	(0.0241)	(0.0241)	(0.0241)	(0.0243)	(0.0242)	(0.0241)	(0.0244)	(0.0240)
Core Deposits Ratio_{t-1}	−0.0272	−0.0254	−0.0280	−0.0235	−0.0259	−0.0244	−0.0250	−0.0238
	(0.0303)	(0.0309)	(0.0305)	(0.0312)	(0.0306)	(0.0304)	(0.0306)	(0.0307)
BIS Financial Cycle (Home Country)	0.0325	0.0385	0.0421*	0.0209	0.0355	0.0512*	0.0318	0.0447*
	(0.0254)	(0.0260)	(0.0241)	(0.0270)	(0.0243)	(0.0263)	(0.0250)	(0.0256)
BIS Business Cycle (Home Country)	0.402*	0.461**	0.519**	0.387	0.402*	0.430*	0.555**	0.412*
	(0.240)	(0.234)	(0.242)	(0.237)	(0.238)	(0.245)	(0.249)	(0.246)
BIS Financial Cycle*$\text{HomeP}_{\text{cum}}$	0.00504	0.0172	−0.0265	0.0135	0.0648	0.0167	0.0237	−0.0330
	(0.00835)	(0.0403)	(0.0359)	(0.0192)	(0.0585)	(0.0155)	(0.0381)	(0.0590)
BIS Business Cycle*$\text{HomeP}_{\text{cum}}$	−0.0302	−0.869	−0.412*	0.335	−0.221	0.0337	−0.432**	−0.0172
	(0.0865)	(1.004)	(0.233)	(0.222)	(0.405)	(0.161)	(0.220)	(0.240)
Observations	8,848	8,848	8,848	8,848	8,848	8,848	8,848	8,848
R^2	0.019	0.019	0.020	0.020	0.019	0.019	0.020	0.019
Adjusted R^2	0.0125	0.0124	0.0129	0.0133	0.0125	0.0124	0.0127	0.0124
No. of Banks	324	324	324	324	324	324	324	324
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LHS Variable: Other	Total Loans	Total Loans	Total Loans	Total Loans	Total Loans	Total Loans	Total Loans	Total Loans
Sample of Banks: Domestic Owned	1	1	1	1	1	1	1	1

Notes: This table reports the effects of changes in regulation and firm characteristics and their interactions on log changes in total loans. $\text{HomeP}_{\text{cum}}$ refers to the cumulative changes in regulation in the home (i.e., parent-bank) country of foreign affiliates. The data are quarterly from 2000:Q1 to 2013:Q4. (Cumulative) foreign-exposure-weighted regulation is calculated as the weighted average of (cumulative) changes in foreign regulation weighted with total assets and liabilities of that bank in the respective foreign country. For more details on the variables, see table 10 in the appendix. Each column gives the result for the regulatory measure specified in the column headline. All specifications include fixed effects as specified in the lower part of the table. Standard errors are clustered by bank. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

Table 9. Sectoral Lending

LHS Variable	ExpP = Prudential IndexC (1)	ExpP = Capital Requirements (2)	ExpP = Sector-Specific Capital Buffer (3)	ExpP = LTV Ratio (4)	ExpP = Reserve Requirements: Foreign (5)	ExpP = Reserve Requirements: Local (6)	Obs.	Sample of Banks
Exposure-Weighted Inward Transmission								
Interbank Loans	−0.155	−0.222*	−0.918	−0.203	0.250	0.177	1,319	Domestic
p-value	0.442	0.0977	0.837	0.326	0.647	0.211		Owned
PNFC Loans	0.131**	0.221**	0.0597	0.126	0.233	0.0278	1,228	Domestic
p-value	0.0380	0.0303	0.403	0.219	0.507	0.756		Owned
Household Loans	0.0212	0.0484	0.0814	0.121	−0.504	−0.0762	1,209	Domestic
p-value	0.658	0.496	0.348	0.327	0.112	0.471		Owned
Wholesale Funding (Domestic)	−0.257*	−0.342	−0.219	−0.535***	−0.390	0.571**	1,267	Domestic
p-value	*0.0920*	*0.191*	*0.251*	*0.00338*	*0.461*	*0.0310*		Owned
Wholesale Funding (Foreign)	0.141	−0.270	0.349***	0.375*	1.104**	0.0179	1,316	Domestic
p-value	*0.315*	*0.332*	*0.00282*	*0.0503*	*0.0411*	*0.905*		Owned
Home Macroprudential Policy via Affiliates								
Interbank Loans	−1.703	−5.215	−2.915	−3.921	−4.732	1.176	7,670	Foreign
p-value	0.442	0.377	0.499	0.256	0.325	0.739		Owned
PNFC Loans	1.725	3.070	2.400	6.251	−5.779***	1.728	4,975	Foreign
p-value	0.400	0.518	0.461	0.318	0.000843	0.559		Owned
Household Loans	3.082*	0.00346	1.633	12.49***	−2.402*	3.980	4,191	Foreign
p-value	0.0532	0.999	0.621	0.00172	0.0958	0.249		Owned
Wholesale Funding (Domestic)	−1.340	0.379	−8.562**	5.154	3.650	−2.363	6,641	Foreign
p-value	0.560	0.948	0.0135	0.211	0.721	0.453		Owned
Wholesale Funding (Foreign)	2.155**	4.589	0.461	−0.506	3.694	2.269	8,760	Foreign
p-value	0.0392	0.128	0.854	0.803	0.519	0.240		Owned
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports the effects of changes in regulation and firm characteristics on log changes in loans to the respective sectors. Dependent variable refers to lending growth in all cases except for "wholesale funding," which refers to the growth in borrowing from wholesale sources. The upper part of the table gives results for specification A on exposure-weighted inward transmission via the foreign exposures of U.K.-owned banks. The lower part of the table gives results for specification B on inward transmission via foreign affiliates exposed to regulation in their home countries. Each row gives the main result from six different regressions using model (1) for the regulatory measure specified in the row headline. The data are quarterly from 2000:Q1 to 2013:Q4. (Cumulative) foreign-exposure-weighted regulation is calculated as the weighted average of (cumulative) changes in foreign regulation weighted with total assets and liabilities of that bank in the respective foreign country. For more details on the variables, see table 10 in the appendix. Each column gives the result for the regulatory measure specified in the column headline. All specifications include fixed effects as specified in the lower part of the table. Standard errors are clustered by bank. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

first to the sectoral lending of U.K.-owned banks (upper panel of table 9), we find that the insignificant aggregate results hide important sectoral heterogeneity. We find that banks cut interbank lending to the United Kingdom following an increase in capital requirements abroad, but increase their PNFC lending; in other words, the negative coefficient on total lending in table 3 appears to be driven by a reduction in interbank lending. The point estimates suggest a similar direction but are not significant for sectoral capital requirements. This is consistent with Aiyar et al. (2014), who document negative spillovers of capital requirement increases to banks abroad but find no response of lending to non-banks abroad—perhaps because relationships with such non-bank customers are longer term and more valuable.

Turning to wholesale funding, we find evidence for a reduction in wholesale funding from the United Kingdom after countries take LTV actions. This could be explained by U.K. banks reducing their lending to countries that tighten their LTV requirements, meaning less of a need for wholesale funding (which is out of the scope of this paper). Interestingly, wholesale funding of U.K. banks from foreign sources increases when they are exposed to countries tightening LTV regulations; this suggests that foreign banks might channel more lending to U.K. banks if regulation at home prevents them from expanding lending in their home countries (we would therefore expect banks resident in other countries to experience a similar phenomenon). This would be consistent with the findings of Ongena, Popov, and Udell (2013). Taken together, this is consistent with the possibility that banks shifted the source of their wholesale funding from domestic to foreign sources following LTV tightening in countries to which they have large exposures.[4]

We also uncover evidence for sectoral heterogeneity when we examine prudential policies taken in the parent country (lower panel of table 9). An LTV tightening in the parent country is associated with an increase in the lending to households in the United Kingdom. The point estimate on PNFC lending is also positive

[4]In columns 3 and 5 we find a similar result for U.K.-owned banks which are exposed to countries tightening sectoral capital requirements or reserve requirements in foreign currency. The result is notably different for reserve requirements in local currency.

though insignificant. The point estimate of LTV tightening on interbank lending is, on the other hand, negative though also insignificant. This indicates the possibility that banks rebalance their portfolios, which could lead to the insignificant result on total affiliate lending we observed in table 6. The result is consistent with the findings of Ongena, Popov, and Udell (2013), who show that banks increase their lending abroad to riskier borrowers when faced with restrictions at home. The results are also quantitatively important. The point estimates imply that the average LTV tightening abroad increases foreign affiliates' lending growth to U.K. households by 12 percentage points over a three-quarter period (although this represents a small proportion of their lending, so the impact on the U.K. economy may be small).

Finally, a tightening in foreign-currency reserve requirements is associated with a reduction in both household and PNFC lending, which is consistent with, though stronger than, the results on total lending discussed in the previous section. Again, the intuition is that replacing reserves is costly, and as a result, banks cut back on their lending.

4. Concluding Remarks

Our results suggest that most prudential actions taken abroad do not have a significant spillover effect on the United Kingdom. For total lending to all U.K. sectors, it is perhaps not surprising that prudential policy actions taken by a single foreign jurisdiction do not appear to affect the United Kingdom, given the United Kingdom's role as a major international financial center.

Nevertheless, the aggregate results conceal some sectoral heterogeneity. For example, our results suggest that when a foreign authority takes a lending standards action, U.K.-resident affiliates owned in that jurisdiction expand PNFC and household lending in the United Kingdom. This implies that focusing on aggregate variables may underestimate the spillovers of prudential policies and suggest a role for continued improvement of sectoral-level data. So far, research such as Lim et al. (2011) and Kuttner and Shim (2013) tended to focus on aggregate variables such as total lending. Our results suggest that investigating rebalancing at the domestic level may yield a deeper understanding of the transmission of prudential policies.

Appendix

Table 10. Construction of Variables

Variable Name	Definition	Source
Dependent Variables (Exchange-Rate-Adjusted Log Changes)		
Total Loan Growth	Loans to all U.K.-resident sectors (resident positions of BT23 and BT29)	Form BT and AL
Interbank Loan Growth	Loans to other U.K. banks (resident positions of BT23 plus ALL15, ALL16, and ALL17)	Form BT
Household Loan Growth	Loans to U.K. Households (ALL18)	Form AL
PNFC Loan Growth	Loans to U.K. PNFCs (ALL1 to ALL14)	Form AL
Short-Term Wholesale Funding Growth (Domestic or Foreign)	Deposits from the U.K. Monetary Financial Institutions + certificates of deposits and commercial paper issued + Repos ex. public sectors from domestic/resident or foreign/ non-resident sources (Foreign: BT2J + BT3J + BT6J. Domestic: BT2B + BT2C + BT2D + BT3B + BT3C + BT3D + BT4 + BT5A + BT6B + BT6C + BT6D + BT6H)	Form BT
Independent Variables		
Illiquid Assets Ratio	1 minus holdings of liquid assets [(BT21 + BT23 + BT32D)/ (BT20-BT19)]	Form BT
Commitments Ratio$_{t-1}$	Commitment ratio: Ratio of total commitments divided by total assets [BT43/BT40]. Includes overdraft, loan, acceptance, and other facilities outstanding.	Form BT
Log Real Assets$_{t-1}$	The log of a bank's total assets in levels (£1000s), deflated by CPI inflation [BT40]	Form BT
Core Deposits Ratio $_{t-1}$	[Total time and sight deposit from domestic residents]/(Liabilities – balance sheet capital)	Form BT
Tier 1 Ratio$_{t-1}$	(Tier 1 capital)/Assets	Form BT
BIS Financial Cycle	Country-specific credit gap	BIS
BIS Business Cycle	Country-specific output gap	BIS

Notes: "Form (BT/AL)" refers to the relevant Bank of England reporting form. See http://www.bankofengland.co.uk/statistics/Pages/reporters/defs/default.aspx for full definitions.

Table 11. Including All Instruments Jointly

	P = ExpP Inward A1 (1)	**P = HomeP Inward B1 (2)**
Log Total Assets$_{t-1}$	1.057	−2.397***
	(1.306)	(0.633)
Tier 1 Ratio$_{t-1}$	0.0145	0.106**
	(0.0652)	(0.0540)
Illiquid Assets Ratio$_{t-1}$	0.0971***	0.0939***
	(0.0366)	(0.0213)
International Activity$_{t-1}$	0.0884	
	(0.0694)	
Core Deposits Ratio$_{t-1}$	0.124***	−0.0282
	(0.0469)	(0.0383)
BIS Financial Cycle		0.0404
		(0.0308)
BIS Business Cycle		0.387
		(0.295)
P = Capital Requirements	−0.139	4.019
	1.203	0.681
	0.273	0.409
P = Sector-Specific Capital Buffer	0.872	0.160
	0.597	0.00222
	0.440	0.962
P = Loan-to-Value Ratio	0.0625	−0.458
	0.242	0.0232
	0.623	0.879
P = Reserve Requirements: Foreign	0.345	2.509
	0.443	0.223
	0.506	0.637
P = Reserve Requirements: Local	0.159	−1.121
	1.083	0.229
	0.298	0.632
P = Interbank Exposure Limits	−0.0206	−1.735
	0.00337	0.0955
	0.954	0.757
P = Concentration Ratios	−0.466*	−11.14*
	3.159	3.195
	0.0758	0.0739

(*continued*)

Table 11. (Continued)

	P = ExpP Inward A1 (1)	**P = HomeP Inward B1 (2)**
Observations	1,360	8,613
R^2	0.117	0.022
Adjusted R^2	0.0195	0.000
No. of Banks	53	312
Time Period	2000:Q1–2013:Q4	2000:Q1–2013:Q4
Destination-Country Fixed Effects	No	No
Time Fixed Effects	No	Yes
Bank Fixed Effects	Yes	Yes
LHS Variable: Loans	1	1
LHS Variable: Other	Total Loans	Total Loans
Sample of Banks: Domestic Owned	1	0
Sample of Banks: Foreign Owned	0	1
Sample of Banks: Domestic and Foreign	0	0

Notes: This table reports the effects of changes in regulation and firm characteristics on log changes in total loans by destination country. The columns report results on the different specifications Inward A1 and Inward B1. For each prudential measure P, the reported coefficient is the sum of the contemporaneous term and two lags, with the corresponding F-statistics for joint significance in parentheses.

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