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Business cycle synchronization: The role of US global banks

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Abstract

This paper contributes to our understanding of international financial linkages created by US banks by looking at the geography of the balance sheet of their foreign branches. The empirical investigation presented in this paper shows some preliminary evidence in favor of the fact that the magnitude of operations of foreign branches can significantly explain business cycle synchronization between a host country and the US. The normative suggestions arising from our results highlight the international coordination of caps on intra-office flows.

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1. Introduction

Understanding the extent to which cross-country interconnections contribute to macroeconomic co-movement and the contagion of country-specific shocks is a major focus in the international economics literature. The global dimension of the 2007-09 financial crisis has particularly unveiled the complexity of understanding the extent to which international banks contribute to creating interdependencies across countries.

The literature recognizes a number of determinants of business cycle synchronization. Konstantakopoulou and Tsionas (2014), focusing on OECD countries, advance evidence in support of co-movement of the cyclical component of output, identifying two cycles: the Euro-area cycle and the world cycle, consisting of the business cycles of the United States, Canada and the United Kingdom. European economic integration has been found to be an important driver in aligning cross-countries outputs (Artis and Zhang 1997), mainly due to the adoption of the common currency within the European Monetary Union (Massmann and Mitchell 2003, De Grauwe and Mongelli 2005, Gonçalves *et al.* 2009, Drake and Mills 2010, and Gächter and Riedl 2014).

Another strand of the literature focuses on the implications of financial linkages in the transmission of international shocks and output alignments. In this case, cross-border contagion materializes through international balance sheets of global banks. Allen and Gale (2000) show how cross-border contagion may arise from interconnections established by banks' claims on several countries. They show that systemic contagion is activated by global banks via interbank deposits which in the event of an idiosyncratic shock lead to the erosion of the value of local claims. Devereux and Yetman (2009) propose a model with leverage-constrained international lenders, such as global banks, in which an initial shock to asset value in one country is magnified and transmitted across the borders through deleveraging. Kollmann *et al.* (2011) show that country-specific shocks to loan defaults are transmitted across the borders by global banks facing capital constraints leading to a global recession to the scale of that experienced in 2007-09. Furthermore, Morgan *et al.* (2004) highlight the role of internal capital markets of global banks in shock transmissions. The authors show that financial integration, arising from banks having offices across the borders, stabilizes macroeconomic fundamentals domestically due to capital reallocation across the borders by global banks.

Empirically, the measurement of integration across countries lies at the core of empirical analyses aimed at investigating the international contagion of country-specific shocks via financial markets and banks (among many: Rijckeghem and Weder 2001, Aviat and Coeurdacier 2007, and Shin, 2012). Bilateral country variables, which are rather limited in availability, are typically used as measures of international financial and banking integration and tend to be somewhat composite. For instance, country-level publicly available bilateral statistics on international banking do not contain enough data breakdown to allow for a segmentation of different types of international banking linkages. For the US case, both consolidated bilateral banking statistics, contained in the Country Exposure Lending Survey (CELS) published by the FFIEC, and locational (or unconsolidated) banking statistics, published by the Treasury International Capital System (TICS), confound data for both foreign branches and subsidiaries together. Moreover, these do not report *gross* interoffice positions of US banks by host country hindering an assessment of the actual dependence between foreign and domestic offices.

This paper aims at providing some preliminary evidence on the role foreign operations of US global banks in aligning international business cycles, focusing on the 2007-09 financial crisis. Rather than identifying a given shock in particular, we here focus our attention on business cycle synchronization, which can be thought of as a consequence of shock transmission. That is, if shocks are transmitted between any two countries then a co-movement

of their macroeconomic fundamental might be expected. To this end, we use a dataset based on statistics disclosed by the Federal Financial Institutions Examination Council (FFIEC), containing balance sheet variables of foreign branches of US banks aggregated over by country of location.

This study contributes to the literature by focusing on a previously unexplored channel of cross-border contagion activated by activities of foreign branches. Our investigation is driven by the presumption that various segments of international banking are differently responsible for shocks transmissions. The role of foreign branches in international shock propagation, we believe, is particularly important as operational decisions of branches are typically taken at the headquarter level and are associated with important reallocation of liquidity across the banking group (Fiechter *et al.* 2011)[1]. Thus, foreign branches may be particularly prone to shocks transmission, especially in locations in which these entities have large interoffice positions in internal capital markets.

The findings presented in this paper suggest that an increase in exposure of foreign branches of US banks in a host country increases output synchronization of this latter with the US. The contagion channel activated via foreign branches' activities results to be particularly important when compared to other direct transmission channels activated by other segments of international banking and by bilateral trade dependency.

The study is closely related to those papers investigating whether direct financial linkages with the US can explain the incidence of the 2007-09 financial crisis in foreign countries. Kalemi-Ozkan *et al.* (2013) find limited evidence in support to the fact that direct linkages with the US have fostered business cycle synchronization during the global financial crisis. Rose and Spiegel (2010) and Rose (2012) using a number of measures of direct financial dependence including foreigners' US asset holdings and composite foreign claims, fail to find a significant relationship between financial linkages to the US and crisis incidence in a panel of 85 countries. This paper is additionally related to existing research proposing the construction of bilateral cross-country datasets with the intent to evaluate international financial linkages and foreign exposure. Forbes and Chinn (2004) are among the first to propose a dataset on bilateral trade, bank lending, foreign investment and competition for the largest five world economies, with which they show that international shocks in the late 1990s have been transmitted mainly via the trade channel. Milesi-Ferretti *et al.* (2010) propose a novel cross-country dataset on bilateral external positions in various financial instruments finding a geographical bipolarization in financial integration between developed and developing countries. Lane and Milesi-Ferretti (2011) construct a dataset of external assets and liabilities focusing on bilateral cross-border transactions of many countries vis-à-vis small financial centers uncovering large exposures especially for the US and the UK. This finding is further confirmed by Kubelec and Sa (2012), who put forward a dataset on outstanding bilateral external assets and liabilities focusing on foreign direct investment, portfolio equity, debt and reserves.

2. Data

International financial linkages created by banks in the US are primarily established by foreign offices who intermediate more than 80% of total foreign operations. These entities, which comprise mainly of branches and subsidiaries, are also the most relevant foreign-based counterparty of domestic banks, rendering the US banking system particularly prone to cross-border shocks transmission via internal capital markets (Cetorelli and Goldberg 2012).

[1] This feature can particularly relevant for US-chartered banks, as their unconsolidated positions vis-à-vis foreign branches are uncapped by the Federal Reserves in contrast to inter-office transactions vis-a-vis subsidiaries, which are limited to 10% of their capital stock.

In the US, the relative role of foreign branches in total foreign claims is particularly important in size, displaying an historical average of 50% of the total[2]. On average total assets of foreign branches of US banks constitute more than 6% of foreign countries' real GDP over the 2005-2014 sample, witnessing a contraction towards the sample-end. There are important cross-sectional variations in the relative importance of foreign branches of US banks in host countries. In some countries such as in Singapore, China, Switzerland, the UK, Canada, Ireland, Hong Kong, Japan and South Africa, their total assets as a percentage of GDP was in the range 20%-40% over the sample considered.

The foreign branch report of condition (FFIEC 030) allows the FFIEC to monitor the structure and geographic distribution of assets and liabilities of foreign branches of US banks. Data is collected quarterly for large branches with assets in excess of $2 billion and annually for medium-sized branches with assets less than $2 billion and in excess of $250 million[3]. Although branch level data is confidential, data of all foreign branches of US global banks located in a given host country is available upon request from the FFIEC. The customized dataset used in this paper contains variables on foreign branches located in 79 host countries over the period 2005q1-2014q4 and includes the following balance sheet items: total assets *(FORB2170),* balances due from US banks *(FORB0033),* balances due from foreign banks *(FORB0034),* deposits of US banks *(FOR2623),* deposits of foreign banks *(FOR2625),* gross due from head office, U.S. branches, and other foreign branches *(FORBC482),* gross due from consolidated subsidiaries *(FORBC483),* gross due to head office, U.S. branches, and other foreign branches *(FORBC485),* gross due to consolidated subsidiaries *(FORBC486).*

One of the main advantages of the FFIEC 030 report is that it allows to reconstruct the full balance sheet of foreign branches of US banks located in a host country. The bilateral variables account for those items not reported elsewhere, such as inter-office (i.e. vis-à-vis branches and subsidiaries) gross positions. Also, this dataset allows to identify interbank transactions (due from/to US and foreign banks) and the liability structure of the aggregated balance sheet of foreign branches of US banks by location country. Furthermore, the FFIEC report allows to focus on a segment of international banking which is typically overlooked elsewhere (due to data limitation) but has a potential role in international shocks transmissions (via internal capital markets).

The variables refer to aggregated outstanding amounts across all foreign branches of US banks by country of location. In order to overcome eventual noise in the data due to reporting requirements according to asset size thresholds, variables are winsorized at the 1% and 99% levels**.** Also this concern is attenuated by the fact that, as detailed below, the econometric analysis is based on balanced panel including host countries in which US banks have large activities consistently overtime.

Table I reports a snapshot of amounts outstanding of these series in 2005, 2008 and 2014 aggregated over all host-countries. Non-bank assets (liabilities) include primarily claims due from (to) the local private sector, public sector and other non-bank financial institutions (both local and located in third countries); these are calculated as the difference between total assets and the sum of FORB0033, FORB0034, FORC482 and FORBC483 (FOR2623, FOR2325, FORBC485 and FORBC486).

Assets and liabilities of foreign branches of US banks have reached their peak at the end of 2008 amounting to over $3 trillion, falling drastically, by approximately $1 trillion, by the end of 2014, but still depicting higher levels than those observed in 2005. Large outstanding

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[2] Following the classification of the Bank of International Settlements (BIS), international banking can be broadly viewed as consisting of three segments, making up total foreign claims: cross-border claims of domestic global banks on foreigners, local claims of foreign subsidiaries of domestic global banks and local claims of foreign branches of domestic global banks.

[3]Branches with total assets more than $50 million and less than $250 million file the FFIEC 030S report form.

amounts of assets and liabilities vis-à-vis related offices reveal the importance of internal capital markets for US banks. In particular, gross due from head offices and other branches constitutes the largest claim on the asset side of the balance sheet making up almost 60% of total assets as in 2008. This is also the item, which has experienced the largest contraction in 2014, aligning to pre-crisis, i.e. 2005, levels. Non-bank assets, as well as claims due to foreign and US banks, on the other hand, have increased over the observed sample. On the liability side, non-bank liabilities represent an important source of debt, followed by claims due to related offices, both of which have witnessed a post-crisis inflection, although less severe than the asset side equivalent items.

Table I. Balance sheet of foreign branches of US banks, total amounts outstanding at year-end, $ millions

The amounts below refer to foreign branches' balance sheet data aggregated on a worldwide basis. Author's computations are based on data obtained from the FFIEC030 report.

	2005	2008	2014
Total Assets	**1,646,643**	**3,105,420**	**2,239,836**
Non-bank assets	403,308	686,051	798,266
Balances due from foreign banks	60,031	114,102	168,087
Balances due from US banks	3,465	5,832	7,762
Gross due from subsidiaries	264,837	513,813	326,173
Gross due from head of. and branches	915,002	1,785,622	939,548
Non-bank liabilities	803,576	1,462,242	1,087,432
Deposits of foreign banks	71,994	128,818	106,774
Deposits of US banks	19,747	73,466	25,857
Gross due to subsidiaries	281,831	542,128	472,932
Gross due to head office and branches	469,495	892,379	541,532

The post-crisis reduction in US foreign branches' total assets, as reported in Table I, reflects a general trend observed in international banking using alternative statistics (Claessens and van Horen 2015, IMF 2015). In particular, IMF (2015) reports that the reduction of global banks' activities has not particularly hit local lending extended by affiliates, but has rather impacted cross-border transactions with unaffiliated foreigners. The former trend is also observed in the FFIEC 030 data with post-crisis sustained levels of non-bank assets. A preliminary analysis of the data reported in the foreign branch report of condition, however, seems to suggest that the Global Financial Crisis (GFC) has impacted inter-office positions rather than local claims. This was particularly evident for off-shore financial centres, such as Cayman Islands and the Bahamas: total assets of foreign branches of US banks in these two countries, made up mainly by claims due from the parent office and other branches, have shrank substantially in the last few years.

Geographically disaggregated data reveals asymmetric responses of foreign branches to the GFC. Branches located in England, for instance, have witnessed a relatively contained reduction in total assets. Branches located in Japan on the other hand, have experienced a significant and rapid fall in assets which in 2007q3 fell to $31 billion down from $84 billion at the end of 2006. Furthermore, in Japan, the crisis has brought about a drastic reduction in inter-branch assets and an increase in inter-branch liabilities, therefore implying that these branches have switched from supplying to receiving liquidity in the internal capital markets. This pattern can be explained by the large dollar-funding gap experienced by Japanese banks and Japanese based US branches, which translated into massive dollar-denominated inflows from internal

capital. The most outstanding post-crisis resilience was witnessed by branches located in Hong Kong and Singapore, which have expanded their activities restlessly since 2006, experiencing only a short-lived slowdown in 2012 and 2013.

3. Empirical analysis

The empirical estimation investigates whether the activities of foreign branches of US banks have fostered business cycle synchronization between foreign countries and the US[4]. Operations by foreign branches could exhibit a certain degree of pro-cyclicality with US domestic economic conditions as their operations are centrally managed at the headquarter level. As argued in the previous section, especially before the GFC the activities of foreign branches were important in magnitude, i.e. as % of GDP for some host countries, and constituted an important proportion of foreign claims of US global banks, justifying such investigation.

A few seminal papers in the international business cycle synchronization literature have looked at the role of banking integration in aligning output across countries, advancing limited evidence in support of a significant causal relation. Kalemi-Ozkan *et al.* (2013) analyze whether banking exposure to the US, measured by locational banking assets and liabilities available from the BIS[5], have increased output synchronization between country pairs. The authors find a significant direct effect of US exposure on cycle synchronization only when the exposure is considered in a broader sense by augmenting it with the positions vis-à-vis the Cayman Island. Building on Kalemi-Ozkan *et al*. (2013), Cesa-Bianchi *et al.* (2016) also use bilateral locational banking statistics by the BIS to measure banking integration and find that increased banking integration is associated with a higher business cycle synchronization only when the idiosyncratic part of this latter is considered. Focusing on the GFC, Rose and Spiegel (2010) fail to find a significant relationship between financial linkages to the US and crisis incidence in a panel of 85 countries using a variety of bilateral exposure data[6]. Similarly, Rose (2012) could not find conclusive evidence in support of the fact the fact that a greater banking exposure to the US, as measured by consolidated bilateral BIS claims, has resulted in a more severe crisis incidence in foreign countries.

The business cycle literature proposes different approaches with the intent of measuring business cycle synchronization. Kalemi-Ozkan *et al.* (2013) propose a measure constructed by taking the difference between the changes in the logged output of two countries. Konstantakopoulou and Tsionas (2014) compute cross-correlations of the cyclical components of output using filtering techniques (Hodrick-Prescott, Baxter-King and the Christiano-Fitzgerald filters)[7].

We decide to report our baseline results using the approach proposed by Kalemi-Ozkan *et al.* (2013) as our research question is closely related, thus the conclusions comparable. Still, we also check the robustness of our results by computing cross-correlations of the cyclical component of the output.

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[4] International transmission of shocks via the banking systems are well documented in the papers by Cetorelli and Goldberg (2012) and de Haas and Van Lelyveld (2014) and are due to the cross-border network created by global banks via their foreign offices.

[5]Bilateral Locational Banking statistics database from the BIS is not publicly available.

[6] Three measures of financial linkages are used: US assets holdings, foreign assets and public guaranteed debt denominated in US dollars and Yen.

[7] A number of other papers, such as Crespo-Cuaresma and Fernandez-Amador (2013) and Samba and Mbassi (2020) who obtain their measure of synchronization through the estimation of demand and supply shocks and the use of an index of dispersion.

We thus measure output synchronization as follows:

$$syncr_{i,US} = -\left|\left(logy_{i,t} - logy_{i,t-1}\right) - \left(logy_{US,t} - logy_{US,t-1}\right)\right| \quad (1)$$

So that the higher (less negative) value corresponds to higher output synchronization of country *i* with the US. Output *y* is measured as quarterly real GDP and is collected from the OECD and the IMF World Economic Outlook databases (see data appendix for details). Twenty-six countries are included in the balanced panel, i.e. i=1, …, 26, which constitute the *core* host locations, that is, those countries in which US branches are large enough to compile the FFIEC 030 report on a quarterly basis over the considered sample[8] (see Table A.I in the Appendix for country listing). Offshore locations are excluded from the sample countries.

The empirical framework is based on a dynamic 2-step GMM panel regression as pioneered by Arellano and Bover (1995) and Blundell and Bond (1998). This instrumental variable methodology allows controlling for the endogeneity by using the lagged differences of the dependent variable and levels of exogenous variables as instruments.

The estimation strategy considers a comprehensive set of bilateral quantitative variables to account for direct US-foreign country dependence. These account for direct exposure of country *i* to the US via (1) banking systems, (2) financial markets and (3) non-financial (and non-banking) sectors[9].

The regression has the following general form:

$$syncr_{i,US,t} = \alpha_{i,US} + \beta_1 syncr_{i,US,t-1} + \beta_2 NF_{i,US,t} + \beta_3 FIN_{i,US,t} + \beta_4 BAN_{i,US,t} + \varepsilon_{i,US,t} \quad (2)$$

Where $\alpha_{i,US}$ is the fixed effect dummy variable which accounts for time invariant country *i*-US unobserved characteristics. $NF_{i,US,t}$, $FIN_{i,US,t}$ and $BAN_{i,US,t}$ refer to the non-financial, financial and banking channels, respectively.

The non-financial channel is captured by bilateral trade interdependence of country *i* with the US, $trade_{i,US,t}$, (proxied by US-country *i* imports plus exports to GDP of country *i*) and non-financial claims on unaffiliated foreigners reported by US non-financial firms, $nonf\_c_{i,US,t}$.[10]

The banking channel is explored using a set of bilateral banking data including linkages created by US banks in country *i* via cross-border claims on unaffiliated foreign counterparties, $cross\_border_{i,US,t}$, (available from the CELS), local claims of *all* foreign offices, $all\_offices\_lc_{i,US,}$, (available from the CELS) and total assets of branches, $branch\_ta_{i,US,t}$, (available from the FFIEC 030 report). $all\_offices\_lc_{i,US}$, in particular, refers to claims of both branches and subsidiaries confounded excluding gross inter-office claims and claims on third countries.

Direct linkages via financial markets are accounted by statistics on transactions in capital and money markets, available from the Treasury International Capital System (TICS). In particular, long-term claims, $lt\_claims_{i,\ US,t,}$ and long-term liabilities $lt\_debt_{i,US,t,}$ proxy for bilateral interdependence arising from capital markets where $lt\_claims_{i,US,t}$ refers to the gross purchase of long term financial securities by foreigners in country *i* from US residents and $lt\_debt_{i,US,t}$ refers to gross sale of long term financial securities by foreigners in country *i* to US residents. Financial linkages created via money markets are captured by short-term securities held by foreigner in country *i*, $st\_claims_{i,US,t}$. All explanatory variables are transformed in logarithms.

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[8] In only a few countries some missing observations are encountered, to which a linear interpolation is applied.

[9] Interest and exchange rates are excluded from the analysis as highly correlated with quantitative variables accounting for direct exposures.

[10] These include both commercial and financial positions, source: TICS.

Table II reports the estimates of (2) for different specifications. The banking channel is captured by cross-border claims, $cross\_border_{i,US,t,}$, entering all specifications and either local claims of foreign offices ($all\_offices\_lc_{i,US}$, columns 1, 3, 5) or total assets of branches located in the host country ($branch\_ta_{i,US,t}$, columns 2, 4, 6).

The estimated coefficient of $branch\_ta_{i,US,t}$ is positive and significant in specifications 2, 4 and 6. On the other hand, the estimated coefficients of $all\_offices\_lc_{i,US,}$ are not significant in specifications 1, 3 and 5. The estimated coefficients of $branch\_ta_{i,US,t}$ suggest that a 1% increase in total assets of branches of US banks reduces the output gap between the US and the host country by 0.02-0.04%. Furthermore, the magnitude of the coefficient of $branch\_ta_{i,US,t}$ reveals that the channel activated via the activities of foreign branches of US banks is relatively more important than the channel activated via capital markets (columns 1-4). Turning to bilateral linkages created via financial markets, from a theoretical viewpoint, financial market integration may foster shock contagion following cross-border de-leveraging of investors, as shown by Devereux and Yetman (2010). The estimated positive coefficients for long term securities (both assets and liabilities) in columns 1-4 seems to support this theory, implying that capital markets transactions vis-à-vis US residents foster output synchronizations with the US. The negative and significant coefficients of short term claims (columns 5-6), on the other hand, indicate that output synchronization is inversely affected by the gross value of transactions in money markets. This evidence can be explained by widening short term interest rate differentials which reinforce the relative attractiveness of a foreign country with respect to the US (Backus *et al.* 1992).

Cross-border claims as measure of banking integration also have a positive and significant effect on output synchronization. This result is as expected, as these type of foreign claims have a tendency to be rather volatile and pro-cyclical (IMF, 2015). Non-financial bilateral claims also explain output co-movements with their estimated coefficient being positive and strongly significant in all specifications.

As a robustness check, Tables A.III and Table A.IV (Appendix) extend the specifications presented in Table III to account for the different types of long-term securities claims (Table A.III) and liabilities (Table A.IV), available from the TICS. These securities are segmented in: US treasury bonds and notes ($trea_{i,US,t}$),US government agency bonds ($agency_{i,US,t}$), US corporate bonds ($corp\_b_{i,US,t}$), US corporate stock ($corp\_s_{i,US,t}$), foreign bonds ($for\_b_{i,US,t}$) and foreign stock ($for\_s_{i,US,t}$). Table A.IV also considers non-financial liabilities, $nonf\_l_{i,US,t}$, rather than claims, as alternative proxy for the non-financial channel.

The estimated coefficient of $branch\_ta_{i,US,t}$ is still positive and significant across all specifications. The gross purchase of foreign stock by foreigners in country *i* from US residents is the main driver of output synchronization between the US and a foreign country with a strongly significant and positive coefficient (column 6, Table A.III). A multifaceted picture emerges when looking at the gross sale by foreigners in country *i* to US residents segmented by type of financial products (Table A.IV). Liabilities of foreign countries due to the US in the form of US Treasury bonds and notes, US corporate stock and foreign bonds securities, in particular, are positively and significantly related to output synchronization with the US. On the contrary, sale of US government agency bonds and US corporate bonds by foreigners decrease the degree of business cycle co-movement between foreign countries and the US, supporting the argument advanced by Backus *et al.* (1992).

Table II: Dynamic GMM panel estimation

The table reports the estimates of a two-step difference generalized methods of moments panel regression. Robust standard errors in parenthesis. ***,**,* refer to 1%, 5% and 10% significance levels, respectively.

	Dependent variable: $syncr_{i,US,t}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$syncr_{i,US,t-1}$	0.054**	0.064**	0.059***	0.110***	0.061**	0.041*
	(0.028)	(0.028)	(0.033)	(0.039)	(0.029)	(0.025)
Nonfinancial channel						
$trade_{i,US,t}$	-1.022	-0.083	0.017	-0.087	-0.467	-0.563
	(0.702)	(0.396)	(0.609)	(0.724)	(0.577)	(0.641)
$nonf\_c_{i,US,t}$	0.004***	0.005***	0.006***	0.006***	0.006***	0.007***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Financial channel						
$lt\_claims_{i,US,t}$	0.001**	0.001***				
	(0.000)	(0.000)				
$lt\_debt_{i,US,t}$			0.001***	0.001***		
			(0.000)	(0.000)		
$st\_claims_{i,US,t}$					-0.002***	-0.002***
					(0.000)	(0.000)
Banking channel						
$cross\_border_{i,US,t}$	0.003**	0.003***	0.004***	0.002***	0.004**	0.003**
	(0.001)	(0.000)	(0.001)	(0.001)	(0.002)	(0.001)
$all\_offices\_lc_{i,US,t}$	0.000		0.000		-0.001	
	(0.002)		(0.001)		(0.002)	
$branch\_ta_{i,US,t}$		0.002***		0.004***		0.002**
		(0.001)		(0.001)		(0.001)
n	874	874	874	874	874	874
Sargan test, prob.	0.322	0.210	0.200	0.228	0.232	0.221
AR(2), prob.	0.103	0.555	0.503	0.845	0.997	0.422

4. Conclusions

This paper has shed light on the geographical mapping of foreign branches of US global banks with the intent of gaining further understanding of the international financial linkages created by US banks. The empirical analysis is centered on a customized dataset including balance sheet statistics based on data disclosed by foreign branches of US banks to the FFIEC. Moreover, a large dataset of bilateral variables has been used to model other bilateral transmission channels between the US and the rest of the world capturing interdependencies arising from international banking (i.e. other than via branches), financial positions and trade.

The paper shows that an increase in exposure of foreign branches of US banks in a host country increases the output synchronization of this latter with the US. The contagion channel activated via foreign branches' activities results to be particularly important when compared to other transmission channels.

From a policy viewpoint, our results highlight the challenges faced by domestic policymakers in stabilizing business cycles across national borders in the presence of foreign

banks. The activities of foreign branches in particular, are outside the regulatory perimeter of local policymakers who are unable to influence the flows of global liquidity via the global network of branches. A regulatory-induced cap of these intra-office flows coordinated at the international level would contain the international output synchronization arising from this important segment of international banking.

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Appendix

TABLE A.I: Core host locations used in the estimation

ABU DHABI	INDONESIA
ARGENTINA	IRELAND
AUSTRALIA	ISRAEL
BAHRAIN	ITALY
BELGIUM	JAPAN
CANADA	KOREA
CHILE	PHILIPPINES
CHINA	SINGAPORE
ENGLAND	S.AFRICA
FRANCE	SPAIN
GERMANY	SWITZERLAND
H. KONG	TAIWAN
INDIA	THAILAND

Notes: Cayman Islands, the Bahamas and Channel Islands are excluded from the regressions.

Table A.II. Descriptive Statistics

	Mean	Maximum	Minimum	Std. Dev.	Observations	Source
$agency_{i,US,t}$ (claims)	6.101	11.249	0.000	2.493	907	TICS
$agency_{i,US,t}$ (liab.)	5.979	10.872	0.000	2.473	912	TICS
$all\_offices\_lc_{i,US,t}$	9.310	13.178	5.700	1.533	1040	CELS
$branch\_a_{i,t}$	7.470	13.275	-2.273	2.091	1039	FFIEC030
$branch\_ta_{i,US,t}$	9.256	14.238	6.109	1.554	1040	FFIEC030
$corp\_b_{i,US,t}$ (claims)	5.850	11.341	0.000	2.325	923	TICS
$corp\_b_{i,US,t}$ (liab.)	5.693	11.186	0.000	2.384	927	TICS
$corp\_s_{i,US,t}$ (claims)	7.296	12.488	2.565	2.157	960	TICS
$corp\_s_{i,US,t}$ (liabilities)	7.291	12.514	3.135	2.118	960	TICS
$credit_{i,t}$	9.252	14.238	6.109	1.557	1040	FFIEC030
$cross\_border_{i,US,t}$	9.749	13.158	5.956	1.545	1040	CELS
$for\_b_{i,US,t}$ (claims)	6.888	12.405	0.000	2.052	959	TICS
$for\_b_{i,US,t}$ (liabilities)	6.839	12.389	0.000	2.053	958	TICS
$for\_s_{i,US,t}$ (claims)	7.585	12.013	3.497	1.687	960	TICS
$for\_s_{i,US,t}$ (liabilities)	7.630	12.049	3.584	1.667	960	TICS
$ib\_f\_l_{i,t}$	5.103	11.320	-6.908	2.531	960	FFIEC030
$Ln(gdp)_{i,t}$	13.692	16.715	10.412	1.173	1040	OECD/IMF
$Ln(gdp)_{US,t}$	16.533	16.610	16.474	0.034	1040	OECD
$lt\_claims_{i,US,t}$	8.974	14.503	0.693	2.143	960	TICS
$lt\_debt_{i,US,t}$	8.623	14.046	1.386	2.056	960	TICS
$non\_bank\_l_{i,t}$	8.283	13.281	1.914	1.827	1040	FFIEC030
$nonf\_c_{i,US,t}$	7.189	10.539	4.143	1.246	920	TICS
$nonf\_l_{i,US,t}$	6.918	10.284	3.664	1.391	920	TICS
$st\_claims_{i,US,t}$	8.094	12.190	1.386	1.881	960	TICS
$sub\_a_{i,t}$	5.418	12.833	-6.908	3.585	966	FFIEC030
$sub\_l_{i,t}$	5.608	12.772	-6.215	2.817	1015	FFIEC030
$syncr_{i,US,t-1}$	-0.010	0.000	-0.068	0.008	1040	-
$trade_{i,US,t}$	0.006	0.041	0.001	0.007	1040	US Census
$trea_{i,US,t}$ (claims)	8.281	13.552	1.792	2.189	959	TICS
$trea_{i,US,t}$ (liabilities)	8.229	13.539	0.000	2.212	959	TICS

Table A.III: Dynamic GMM panel estimation

The table reports the estimates of a two-step difference generalized methods of moments panel regression. Robust standard errors in parenthesis. ***,**,* refer to 1%, 5% and 10% significance levels, respectively.

	Dependent variable: $syncr_{i,US,t}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$syncr_{i,US,t-1}$	0.072***	0.087*	0.106***	0.084***	0.082***	0.074***
	(0.018)	(0.046)	(0.022)	(0.023)	(0.022)	(0.022)
Nonfinancial channel						
$trade_{i,US,t}$	-0.275	-0.794	-1.369**	-0.480	-0.573	-1.404***
	(0.597)	(0.808)	(0.620)	(0.540)	(0.689)	(0.494)
$nonf\_c_{i,US,t}$	0.005***	0.003*	0.003**	0.006***	0.006***	0.003***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Financial channel						
Long-term securities $claims_{i,US,t}$:						
$trea_{i,US,t}$	0.000					
	(0.000)					
$agency_{i,US,t}$		0.000				
		(0.001)				
$corp\_b_{i,US,t}$			0.000			
			(0.000)			
$corp\_s_{i,US,t}$				0.000		
				(0.000)		
$for\_b_{i,US,t}$					0.001	
					(0.001)	
$for\_s_{i,US,t}$						0.006***
						(0.001)
Banking channel						
$cross\_border_{i,US,t}$	0.003***	0.003***	0.002**	0.003***	0.002***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$branch\_ta_{i,US,t}$	0.003***	0.002*	0.004***	0.002***	0.002**	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
n	874	825	849	851	873	828
Sargan test, prob.	0.241	0.277	0.314	0.223	0.232	0.412
AR(2), prob.	0.919	0.637	0.437	0.313	0.072	0.461

Table A.IV: Dynamic GMM panel estimation

The table reports the estimates of a two-step difference generalized methods of moments panel regression. Robust standard errors in parenthesis. ***,**,* refer to 1%, 5% and 10% significance levels, respectively.

	Dependent variable: $syncr_{i,US,t}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$syncr_{i,US,t-1}$	0.048***	0.131***	0.132***	0.075***	0.047**	0.037
	(0.017)	(0.026)	(0.024)	(0.021)	(0.024)	(0.024)
Nonfinancial channel						
$trade_{i,US,t}$	0.162	-0.662	-1.344	-0.581	0.016	-0.334
	(0.439)	(0.472)	(0.943)	(0.399)	(0.225)	(0.709)
$nonf\_l_{i,US,t}$	0.004***	0.005***	0.004***	0.005***	0.005***	0.003***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Financial channel						
Long-term securities $debt_{i,US,t}$:						
$trea_{i,US,t}$	0.001***					
	(0.000)					
$agency_{i,US,t}$		-0.001***				
		(0.000)				
$corp\_b_{i,US,t}$			-0.002***			
			(0.001)			
$corp\_s_{i,US,t}$				0.002***		
				(0.000)		
$for\_b_{i,US,t}$					0.002***	
					(0.000)	
$for\_s_{i,US,t}$						0.000
						(0.001)
Banking channel						
$cross\_border_{i,US,t}$	0.002***	0.002***	0.001*	0.001*	0.001	0.003***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$branch\_ta_{i,US,t}$	0.002**	0.003***	0.003***	0.002***	0.003**	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
n	874	832	847	805	873	874
Sargan test, prob.	0.23	0.277	0.449	0.306	0.232	0.412
AR(2), prob.	0.101	0.289	0.127	0.446	0.446	0.524