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Unintended Consequences of the Global Derivatives Market Reform

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Abstract: The G-20's global over-the-counter (OTC) derivatives market reform has caused a dramatic shift in the geography of the global derivatives market. Following the early implementation of the reform in the US and associated increase in the cost of trading derivatives, US banks shifted up to 60 percent of their OTC derivatives activity abroad, particularly towards less regulated jurisdictions. This implies an increase in global risk as risk is shifted to jurisdictions that are less prepared to monitor it and deal with the consequences. Further, we find that foreign subsidiaries in more tightly regulated jurisdictions have increased risk-taking overall.

JEL codes: G15, G18, G21, G23, G28.

Keywords: Bank regulation, Regulatory arbitrage, OTC Markets, Derivatives, Cross-border financial institutions, Financial risk.

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"One of the lessons of the crisis is that we must avoid regulatory arbitrage [...], regulators must resist the temptation to offer loopholes creating large regulatory gaps among jurisdictions."

- Former IMF Director D. Strauss-Kahn in 2009 -

1 Introduction

This paper provides evidence on regulatory arbitrage and its harmful consequences in the context of the G-20's global derivatives market reform.[1] The reform is designed to improve transparency and regulatory oversight, and comprises of five building blocks: (i) trade repositories to facilitate surveillance; (ii) central clearing of standardised OTC derivatives to reduce counterparty exposure and facilitate resolution; (iii) exchanges/electronic trading platforms to reduce operational risk; and higher (iv) capital and (v) margin requirements for non-standardised OTC derivatives to buffer losses ex-post and align incentives ex-ante. The new regulation specifically targets interest rate swaps, which make up the bulk of the OTC market activity and have been a trigger of several major crises including the 1994 crisis and the LTCM crisis of 1998.

That the blocks of the regulation have to be separately integrated into (supra)national regulation by participating G-20 governments implies that reform progress is heterogeneous across countries and over time. On a decidedly global market like the derivative market, this enables cross-jurisdictional arbitrage. Because of the significant costs of the reform for banks, incentives to engage in this arbitrage are strong.[2] Goldman Sachs, for instance,

[1] In a testimony to the Financial Crisis Inquiry Commission on June 30, 2010 Michael Greenberger suggested that "*it is now almost universally accepted that the unregulated multi-trillion dollar OTC CDS market helped foment a mortgage crisis, then a credit crisis, and finally a "once-in-a-century" systemic financial crisis*". While this assessment has since been refined (e.g., Stulz (2010)), it does convey the sense of urgency and the prevailing consensus at the time.

[2] Deloitte (2014) estimates the annual costs, for the OTC European derivatives market alone, at 15.5 billion (bn) EUR and attributes 13 bn EUR to non-centrally cleared OTC transactions. See Figure 1 for a

asked its derivatives clients in March 2012 for permission "to move a client's swaps trades to different affiliates around the world, whenever and wherever the bank saw fit."[3]

Consistent with such arbitrage, we find that US dealers systematically exploit a loophole in the Dodd-Frank Act to move their domestically regulated interest rate swap (IRS) activities to less regulated foreign subsidiaries. The pattern appears to be causal, meaning that dealers actively respond to stricter regulation in the US, and directed towards countries with weaker regulation.

From a regulatory perspective, our results highlight the global risks associated with loopholes in national regulation; from a governance perspective, they emphasize the importance of coordinated and swift action. This is because the geographic reallocation of targeted activities during the implementation of the G-20's derivatives market reform is not benign. It increases global financial risk when targeted positions are moved to jurisdictions that are less prepared (or willing) to monitor them.

For our analysis, we collect publicly available data from the Financial Stability Board (FSB) and build indices of regulatory progress, for each of the reform blocks, across 18 countries and the European Union (EU), and from Q1 2010 to Q4 2019. We combine this information with unique data on the interest rate swap (IRS) positions of the largest US dealers' foreign subsidiaries (US Fed Forms 2314). These dealers account for 95% of total US activity and thus represent a significant fraction of the global derivatives market.[4] They were subject to early and stringent domestic regulation under Dodd-Frank, and - suggesting motive and intent to engage in regulatory arbitrage – lobbied heavily for the

broad categorization of costs across the five reform blocks.

[3] See Reuters *Special Report* "U.S. banks moved billions in trades beyond CFTC's reach", Charles Levinson, August 21st, 2015.

[4] According to Calls Report data, 95% of derivatives assets are held by the top five US banks.

exemption of their overseas affiliates.[5]

A key challenge for our identification is the concern that countries might actively delay the reform to attract US dealers' business. In addition, one might also be worried that unobserved country characteristics simultaneously affect reform progress and banks' propensity to invest in a jurisdiction.

To address these challenges, we first show that key drivers of reform progress are structural and broadly associated with predetermined institutional settings (the role of the central bank as regulator) and the cost of the Global Financial Crisis, and then test the robustness of our results to an instrumental variable approach that exploits this exogenous heterogeneity. In our main ordinary least squares analysis, explaining US dealers' foreign IRS activities with reform progress abroad, we also include destination country fixed effects to control for time-invariant country characteristics. While these do not capture time-varying country differences, the omission of any such time-varying factors would – if anything – work against finding evidence of regulatory arbitrage since any innocuous reallocation of activities should be directed towards jurisdictions with better developed institutions and markets.

To strengthen our analysis further, we saturate our model with bank*year fixed effects, to control for bank-time specific reasons to move activities abroad, and compare subsidiaries' IRS activities in countries with differential reform progress, before and after important advances in US regulation. We also perform a placebo analysis, using banks' FXS holdings (to which the reform does not fully apply).

[5]Reuters *Special Report* also highlights that US records show 31 meetings between the then chairman of the Commodity Futures Trading Commission (CFTC) Gary Gensler and representatives of the top 5 US banks in 2010, and 462 with other top CFTC officials between October 2010 and December 2013 as the CFTC worked on the new rules on derivatives. The article also points out that those officials who met most frequently with the banks since moved to the industry.

We further develop the analysis to explore other forms of regulatory arbitrage and the associated unintended consequences of the reform. Interestingly we find that in jurisdictions with a more rigorous implementation of the reform US foreign subsidiaries have less volatile trading portfolios, as intended by the reform, but a higher overall risk profile. This reflects a form of arbitrage by which banks compensate the higher regulatory cost of their trading activities by increasing risk-taking in other areas.

The remainder of the paper is organized as follows. Section 2 relates our analysis to the existing literature on regulatory arbitrage by banks. Section 3 presents our data, Section 4 discusses our econometric setup and identification, and Section 5 presents our results. Section 6 concludes.

2 Related literature

Our paper broadly contributes to the literature on regulatory arbitrage by banks (e.g., Morrison and White (2009); Laeven and Levine (2009); Barth et al. (2015); Mariathasan and Merrouche (2014)). It relates, more specifically, to papers identifying cross-jurisdictional arbitrage (e.g., Buch (2003); Houston et al. (2012); Ongena et al. (2013); Gao and Jang (2018); Temesvary (2018)) and increased risk-taking (Laeven and Levine (2009); Ongena et al. (2013); Barth et al. (2015)) in response to costs from tighter regulation.

The papers from this literature that are most closely related to ours are: (i) Houston et al. (2012), who study the impact of cross-border differences in banking regulation over the period 1996-2007, and show that bank capital flows from more restrictive to less restrictive jurisdictions; (ii) Temesvary (2018), who focuses on US banks' international lending flows from 2003 to 2013, and shows that US banks lend less and are less likely to have

affiliates in more regulated jurisdictions; and (iii) Karolyi and Taboada (2015), who, for the period from 1995 to 2012, show that cross-border bank mergers and acquisitions are more likely to involve acquirers in jurisdictions that are more strictly regulated than those of their targets.

Although none of these papers studies the derivatives market or focuses on transaction costs, which are crucial for banks' derivative trading, as the driver of regulatory arbitrage, they inform and motivate our analysis. We complement their broader message -that banks engage in arbitrage across different regulatory environments– by studying the derivatives market, a decidedly global and liquid market, on which large, international banks trade highly standardized products. The global nature of this market, in many ways, facilitates arbitrage for banks, and thus helps to focus on the role of regulatory differences. It also links our analysis to theoretical predictions, such as by Morrison and White (2009), that emphasize the advantage of a level playing field in international financial regulation, specifically when capital is mobile; i.e., in a case that is particularly applicable to the global derivatives market.

Our paper further adds to the existing literature by focusing on the post-crisis era. The regulatory response to the crisis, including importantly the OTC derivatives market reform, was designed to contain the cross-border propagation of financial risks. By showing that global risk may actually have increased (at least during the implementation phase of the derivatives market reform), we document the continued existence of cross-jurisdictional arbitrage, and identify the regulatory response to the extent that it is unevenly implemented as a source of new, unchecked risks.

In addition, our paper also contributes to the recent literature on the benefits and new risks associated with the recent OTC derivatives market reform; which is still very scarce.

The few existing papers focus primarily on consequences for market efficiency and systemic risk: Benos et al. (2016), for instance, show that the US regulation on electronic trading of swaps reduces execution costs and thus enhances market liquidity. Faruqui et al. (2018), instead, point to the risk of a destabilizing feedback loop between systemically important banks and central clearing counterparties in OTC derivatives markets. Other papers assess the effectiveness of the reform in terms of incentivizing central clearing (Ghamami and Glasserman, 2016) or general financial stability (Duffie, 2017). To the best of our knowledge, however, the literature has neither examined the factors that drive cross-border differences in the implementation of the G-20's derivatives market reform, nor has it linked heterogeneity in adoption to cross-jurisdictional arbitrage and the resulting risks. By filling this gap, we help policymakers to identify and quantify potentially unintended costs of global regulatory action, that may need to be weighed carefully against the predicted benefits. By identifying mitigating factors, such as a stronger rule of law or deeper and more liquid local markets, we also provide a first step towards potential remedies.

3 Data

3.1 Regulatory Indices

We construct indices of regulatory progress from FSB reports tracking the implementation of the OTC Derivatives Market Reforms among the distinct G-20 countries. Consistent with the agenda's main blocks, we separately account for progress in: (i) trade reporting, (ii) central counter party (CCP) clearing, (iii) electronic trading, and (iv) capital as well as

(v) margin requirements. From the information in the reports, we construct quantitative indices by assigning values from 0 to 4 to the following circumstances:

0:	No authority exists to implement the reform and no steps are taken to adopt such an authority.
1:	A legislative framework is either in force or published for consultation.
2:	A legislative framework is in force and requirements – at least for some transactions – are published for public consultation.
3:	Requirements - at least for some transactions – have been adopted.
4:	Requirements have been adopted for over 90% of transactions.

Values are available for 19 jurisdictions (18 countries + the European Union) and for each quarter between and including Q1 2010 and Q4 2019. We also construct a composite index that is equal to the number of reform blocks for which a country has implemented a fully effective requirement (i.e., for which a sub-index is equal to 4), ranging from 0 to 5. Our indices thus capture depth and scope of reform progress in any given country. Table 1 reports values from Q4 2015 and Q4 2019 for all countries in our sample and Table 2 identifies the quarter, for each country and reform block, in which the respective regulatory requirement became fully effective. These tables primarily provide evidence of substantial heterogeneity across jurisdictions until 2015. We see, for example, that all countries have at least one reform block in full effect by Q4 2015, but that only Japan has completed the implementation of 4 of 5 agenda items. Importantly for our purpose, we also see that Japan and the United States were the first countries to fully implement the reform in 4 out of 5 reform areas: trade reporting, central counterparty clearing, electronic trading, and

margin requirements.

At the same time, it is also clear that the adoption of the different blocks fails to follow a clear sequential pattern: Argentina for instance only has capital regulation in full effect, while the Republic of Korea has only fully adopted the trade reporting block. We observe then a rapid convergence across countries between 2015 and 2019, as Europe and the emerging market countries catch up with Japan and the US.

While these descriptive statistics provide some insight, it is not immediately obvious what drives reform adoption in the different countries. This motivates our more systematic analysis in Section 5.

While our aggregate index treats the different blocks of the reform as homogeneous, it is clear that they differ with respect to their costs for banks. Capital and margin requirements entail significant economic costs for banks, by forcing them to hold positions or raise funding from sources that are not individually optimal. Central clearing regulation, similarly, entails significant costs in terms of collateral and margin requirements, but also imposes requirements in terms of infrastructure investments. The regulation of trade repositories and electronic trading, instead, is less costly, especially for the five large banks in our sample that already had much of the required infrastructure in place. In Figure 1, we broadly categorise the costs of the different reform blocks for banks and list the main cost components.

3.2 Derivative Holdings

To investigate regulatory arbitrage in our main analysis, we combine our reform progress indicators with data on the derivative holdings by foreign subsidiaries of the 5 largest

derivatives traders in the US (Bank of America, Citigroup, Goldman Sachs, JP Morgan, Morgan Stanley). We focus on the top 5 US banks because they are the ones that operate part of their derivatives activity abroad.[6] We collect this information from the Federal Reserve System, which provides us with data on the notional values of the subsidiaries' interest rate swap (IRS) positions (US Fed Forms 2314).

Net positions are not available from the FED data; however, focusing on gross positions allows us to investigate the size of the market and how it is distributed across non-US countries. The notional of the top 5 US banks represents the total size of the market as these banks deal for themselves and intermediate the rest of the market. By focusing on gross positions, we are thus able to identify the total activity that does not abide by the new rules and is being moved abroad.

Our focus on IRS positions is because the regulation fully and mostly applies to these positions. Further, interest rate swaps expose users to important financial risks, notably interest rate risk. During the 1994 bond bear market and the LTCM crisis of 1998, several financial institutions lost hundreds of million dollars on hazardous positions they took in the interest rate swap market.

We also collect foreign exchange swap (FXS) notional values, which constitute the second largest block in value after interest rate swaps, to run a control experiment. Regulation has also been enforced more recently for certain index credit default swaps. However, our data do not allow us to isolate index swaps from other swaps not concerned by the regulation.

Our focus on the US is due to the availability of detailed data on the global derivative activity of US banks. It is further motivated by the fact that the US is not only the first

[6]Three other US banks moved part of their IRS activity in their foreign subsidiaries: Deutsche Bank, GE and John Deere, but the corresponding notional amounts are small and concentrated in very few countries.

country to implement the reform (along with Japan), but also offers a loophole for foreign subsidiaries. US rules, more specifically, apply to overseas branches but not to (de-guaranteed) overseas subsidiaries, which fall under the host country's regulation. More precisely, US regulation stipulates that transaction level requirements do not apply to transactions involving a non-US person that is not a guaranteed or conduit affiliate of a US swap dealer or major swap participant and a non-US swap dealer or major swap participant.[7] This disparate treatment enables the cross-border arbitrage at the centre of our analysis.

Descriptive statistics in Figures 2 and 3 depict the cross-jurisdictional allocation of US dealers' activities, and their changing positions from before to after adoption of the reform in the US. Figure 2 a) shows - for each bank - the fraction of the total consolidated IRS position that is held in foreign subsidiaries, for Q1 2010, Q4 2015, and Q4 2019, i.e., before and after Dodd-Frank becoming effective, and after most countries catch up with the US. It is evident that this fraction has increased between 2010 and 2015, with the change being strongest for Citigroup: their positions were almost entirely concentrated in the US in 2010, before more than 60% were shifted abroad. As expected, there is a slight trend reversal between 2015 and 2019 as other countries align their regulation with the G-20 objective. Hence, the US loose permanently for being the first mover.

Figure 2 b) shows that, similar to the shares, volumes of IRS positions operated abroad in US banks' foreign subsidiaries have increased over the period. The notional value of interest rate swaps operated in Citigroup's foreign subsidiaries has increased by more than 15 trillion dollars between Q1 2010 and Q4 2015. At Goldman Sachs, JP Morgan and Morgan Stanley's foreign subsidiaries, the interest rate swaps notional value has risen by

[7] This loophole applies to clearing and swap processing requirements, to margin requirements for uncleared swaps, to trade execution requirements, and to reporting requirements.

several trillion dollars.

In Figure 3, we further illustrate the geographical distribution of these foreign holdings. Eighteen countries in Asia, America and Europe attracted the 5 top US banks' IRS activity between 2010 and 2019. These countries are: Australia, Brazil, Canada, China, France, Germany, Japan, Korea, Hong Kong, India, Ireland, Luxembourg, Mexico, the Netherlands, Russia, Singapore, Switzerland and the UK.[8] We see that the increase in the average share of US banks' IRS activity operated in a given country – from 2010 to 2015 – was strong in direction to Asia and Latin America, including in Hong Kong, Mexico, Brazil, China and Korea,[9] and persists until 2019. Similarly, a substantial increase in IRS notional amounts (summed over the 5 US banks) – not only in shares – is observed in most of these eighteen countries between 2010 and 2015 (Figure 4). By the end of 2015, total IRS notional amounts of the top 5 US banks' foreign subsidiaries reached more than 45 trillion dollars. Figures 3 and 4 thus suggest that the geographic reallocation of US banks' IRS positions is far from benign in terms of systemic risk.

Finally, Table 3 provides summary statistics for subsidiary-level shares of banks' IRS and FXS positions (our dependent variables). Consistent with Figures 2 and 3, these statistics show (a) that derivatives activity is concentrated in a few countries, with standard deviations being significantly larger than the means, and the 25th and 50th percentile being nil, and (b) that there is substantial heterogeneity, with pooled standard deviations at 9%

[8] In the three additional US banks that moved part of their IRS activity in their foreign subsidiaries, Chile, Italy and Poland also attracted part of their activity abroad but the corresponding notional amounts are small.

[9] Our data do not separate assets by currency or origin of counterparty. However, consistent with the trend in our data and the fact that the loophole applies only to non-US persons, a similar trend is observed in aggregate transaction data from the International Swaps and Derivatives Association (ISDA). Indeed, ISDA (2014) describes a significant fall in the US banks' share of the global inter-dealer market for IRS in euros but not in US dollars. This results from trades with European counterparties being now mostly booked through US banks' EU subsidiaries and therefore showing up as European banks' transactions.

and 14%.

The overall pattern is clearly suggestive of cross-border arbitrage, but not yet conclusive; this motivates our more comprehensive analysis below.

4 Econometric Setup

4.1 Hypotheses & Identification

Our main hypothesis is that tighter regulation induces regulatory arbitrage. We test, more specifically, whether derivative dealers from the US are more likely to hold their IRS positions in foreign jurisdictions that are slow to adopt the G-20 reform. As discussed, US dealers held virtually all of their IRS positions domestically, prior to the Dodd-Frank Act, but moved up to 70% of their positions abroad after its implementation. In identifying whether this reallocation is due to differences in regulatory stringency, we face two main challenges:

1. Because policymakers in the destination countries may choose to relax regulation - or slow down the adaptation of global standards - precisely to attract business from the US, the adoption of the regulation in these jurisdictions might be endogenous.

2. At the same time, it might be the case that an unobserved factor affects both progress of the reform *and* US banks' propensity to book positions in a given country.

To address these challenges, we first show that the drivers of reform progress across countries are primarily structural, which implies that reform progress is unlikely to be affected by (the expectation of) business from the US; this primarily alleviates concerns about reverse causality. Because these structural factors broadly reflect institutional quality and market development, and banks - in the absence of regulatory arbitrage - should move

their assets to jurisdictions with stronger and more developed markets and institutions, this first step of our analysis also suggests that a simple regression explaining foreign shares of US bank holding companies' consolidated swap positions with structural destination country variables would likely underestimate the true magnitude of regulatory arbitrage.

In our second step, we therefore include structural factors, along with bank*year and - importantly - destination country fixed effects, in regressions explaining the foreign shares - in each of the non-US countries of US bank holding companies' consolidated swap positions. The variation in foreign swap shares that is explained by regulatory indices is then ideally net of structural factors and due to differences in regulatory progress and stringency between the US (where Dodd-Frank meant the G-20 agenda was in full effect early) and the destination country.

To strengthen our causal interpretation, we take a number of steps to further alleviate issues of reverse causality and omitted variables. First, we test whether the benefit of less reform progress abroad is more pronounced when more, and more costly, blocks of the reform are adopted in the US.

Second, we draw on the existing literature and our first step analysis, and instrument reform progress. Third, we run a "placebo regression" on subsidiaries' FXS positions, because FX swaps - in most countries - are not concerned by 3 of the 5 reform blocks.

In addition to this main analysis, and to provide further evidence on banks' underlying incentives, we consider a second dimension of regulatory arbitrage: to the extent that banks are unable to move their derivatives trading abroad, they might also respond to tighter regulation of the derivatives market by engaging in other, riskier but more profitable activities. This would enable them to potentially generate higher returns to com-

pensate for the higher transaction costs induced by the reform. We test this by analysing the volatility of foreign subsidiaries' trading portfolios and banks' overall risk measured by the banks' Z-score.

4.2 Determinants of Reform Progress

To identify the determinants of reform progress, we estimate the following discrete-time multilevel logit model with random effects:

$$\log(\frac{p_{i,j,t}}{1-p_{i,j,t}}) = \log(d_{i,j,t}).\alpha + x'_{i,j,t}.\beta + u_i + \varepsilon_{i,j,t}, \quad (1)$$

where $p_{i,j,t}$ is the probability of an event - i.e., reform progress - occurring in country i, during interval t of episode j, i.e., the period during which the index remains unchanged; $d_{i,j,t}$ is the cumulative duration by interval t, and $x_{i,j,t}$ is a vector of potentially time-varying covariates that includes cyclical factors, as well as structural variables.

We specifically include the following cyclical variables: GDP growth, non-performing loans (NPL) and the Z-score, to test whether regulators practice regulatory forbearance, granting delays in reform implementation in bad economic times and for weaker banking sectors.

In addition, we consider a number of structural variables (derivatives market turnover, GDP per capita, banking sector size, regulatory quality, government effectiveness, a dummy indicating whether the central bank shares the responsibility of supervising the banks (1) or is sole supervisor (0), and measures of the cost of the 2007-2008 crisis in a given country), to test whether deeper and more liquid derivatives markets, more developed

countries and better regulatory environments promote an earlier implementation of the reform. We also consider banking sector concentration, defined as the share of assets held by the top 3 largest banks to proxy for lobbying power of the banks.

Macroeconomic data (GDP growth, GDP per capita) are either from the OECD, or IMF or World Bank statistics when not available from the OECD. The turnover of derivatives markets is from the Bank of International Settlement (BIS)'s Triennial Derivatives Survey. Measures of government effectiveness and regulatory quality, instead, are obtained from the World Bank's Governance Indicators Database. Indicators of the size and soundness of the banking sector are taken from the World Bank Financial Development and Structure database available online. Measures of crisis costs are from the Systemic Banking Crisis Database (Laeven and Valencia, 2013).

For the selection of both cyclical and structural variables, we rely on existing work, studying the adoption of trade reforms, as well as financial and labor market reforms.[10]

Finally, the destination country random effects u_i capture unobserved heterogeneity between countries that potentially arises due to the omission of time-invariant variables, and $\varepsilon_{i,j,t}$ is the residual error term. Our coefficient of interest in this model is β, with $\exp(\beta)$ representing the hazard ratio for a one-unit change in the covariates.

4.3 Cross-Jurisdictional Arbitrage

To investigate cross-jurisdictional arbitrage, we use data on the derivatives holdings in non-US subsidiaries of the US' five largest derivatives traders, and the previously mentioned loophole in the Dodd-Frank Act. This loophole allows subsidiary-level swap holdings to be exempted from US regulation and therefore enables regulatory arbitrage. This

[10] See Djankov et al. (2017) for a recent review of this literature.

is particularly true on a global and homogeneous market like the derivatives market, for which the geographic location in which positions are booked does not matter beyond the regulatory treatment. Building on the suggestive evidence in our descriptive statistics, we run maximum likelihood regressions on a three-dimensional panel, and explain, for each year-quarter (t), the share of each bank (i)'s derivative holdings in country j ($S_{i,j,t}$). Our main explanatory variables of interest are our indices of reform progress ($I_{j,t}$), but we further include cyclical and structural country-level variables ($x_{i,j,t}$), as well as bank, time, bank*quarter, and/or destination country fixed effects (FE) to capture unobserved heterogeneity across banks and time, as well as any time-varying but country-invariant reason for a bank to hold swap positions abroad, and/or all time-invariant characteristics of the destination countries:

$$S_{i,j,t} = I_{j,t}.\alpha + x'_{i,j,t}.\beta + FE + \varepsilon_{i,j,t}. \tag{2}$$

In model (2), $x_{i,j,t}$ includes factors that may simultaneously affect the allocation choice of US dealers and the stringency of regulation; they include interest rate volatility, inflation, GDP growth and GDP per capita, log turnover, a measure of political stability, stock market volatility, and banking sector size. Since the dependent variable is a fraction, the regressions are weighted by subsidiary portfolio size to give more weight to larger subsidiaries.

We further extend the model by interacting $I_{j,t}$ with dummies that are equal to one for all periods after the US enforced, respectively, mandatory trade reporting, central clearing, electronic trading, and margin requirements. If the geographic reallocation of US dealers is indeed driven by a higher domestic cost of the reform, the link between reform adop-

tion abroad and subsidiary level IRS positions should be stronger after the US regulation is implemented.

Next, we instrument $I_{j,t}$ in model (2), using measures of regulatory independence and the cost of the Great Financial Crisis (GFC), primarily to alleviate concerns of reverse causality.[11] Our choice of instruments is motivated by the first step of our analysis and existing papers on cross-jurisdictional arbitrage (Houston et al. (2012); Karolyi and Taboada (2015)); it assumes that structural factors, not depending on individual US' dealers swap holdings, and past experience of financial crises, likely contribute to reform progress. We specifically use as instruments the output loss caused by the GFC and a dummy for whether the central bank in a given country shares the supervisions of banks (1) or is sole responsible of the supervision of banks (0). On the one hand, central banks, as the lender of last resort, may be more inclined to accelerate a reform to strengthen the financial sector and curb systemic risk. On the other hand, they may also be more likely to delay a reform that creates further pressure on fragile banks, especially during a crisis.

We focus on the period Q1-2010 to Q4-2015 as our baseline sample period for two reasons. First, as we have described in sections 3.1 and 3.2, disparities in the implementation of the reform persist mostly until 2015. Starting in 2016, most countries start aligning their regulation with the G-20 objectives. Therefore, if there is a change in the geography of the market due to regulatory arbitrage, it can be identified during the period 2010-2015. Second, in 2016, G-20 countries start implementing Basel III rules. Thus, by focusing on the period going to 2015, we obtain estimates clean from this potential confounding factor. Another potential confounding factor is the rise in compression trades which accelerates starting in 2015 (Ehlers and Hardy, 2019). Compression trades replace multiple offset-

[11] The regulatory environment in a given country may respond to changes in flows of foreign activity.

ting positions with a single new trade representing the net position and resulting in a fall in gross notional outstanding positions. Starting in 2016, several regulations explicitly require institutions to compress trades periodically. The leverage ratio regulation in Basel III, which is based on gross notional positions, thus incentivises banks to reduce the size of their balance-sheet to bring down regulatory costs. In addition, central clearing facilitates an acceleration in compression as it channels liquidity in standardized OTC contracts bringing many of the large players together. Although there is no evidence that trade compression has risen more rapidly in the US than elsewhere, by restricting our baseline sample to the pre-2016 period, we avoid that our results could be driven by such trend. However, we show that our findings are unaltered when we extend the sample to 2019.

4.4 Risk-shifting behaviour

Further, we investigate whether exposure to tighter domestic regulation of the derivatives market affects the riskiness of US banks' foreign subsidiaries in the same jurisdiction. We specifically test whether banks compensate for the additional cost of regulation by pursuing a more aggressive investment strategy in the same country. To do this, we repeat our estimation of model (2) with additional controls and replace the share of derivative holdings with the 4-quarter rolling standard deviation of returns on subsidiaries' trading portfolios and the Z-score.[12] As additional controls we include the funding and revenue structure of the banks as determinants of risk-taking, namely leverage, deposit funding,

[12]To give less weight to periods when dealers' derivative activity is smaller, we weight estimates by total derivatives notional by subsidiary and quarter.

and income mix. We expect that market risk falls as intended by the reform, riskier trading assets being charged higher capital requirements with the reform. But that overall bank risk measured by the Z-score increases if banks targeting a constant return on equity strategically shift to unregulated and possibly riskier asset classes or activities to compensate for the higher cost of trading derivatives.

Last, we describe other forms of regulatory arbitrage banks that may develop in the future and discuss how they may trigger higher systemic risk or nullify the intended effects of the reform.

5 Results

5.1 Reform Progress

We first report results for model (1), which explains the determinants of reform progress across our 19 jurisdictions. Table 4 provides discrete time proportional hazard model estimates for factors contributing to the implementation of the G-20 reform. In this baseline specification, GDP growth captures cyclical factors and GDP per capita secular factors. The dependent variable is a dummy for a 1-unit increase in the regulatory indices. Panel A reports results using contemporaneous covariates and Panel B reports results using lagged covariates to alleviate reverse causality. Column 1 reports results for the overall reform index and each subsequent column corresponds to a different reform block.

In Panel A, we find that GDP per capita is an overall more important and robust driver of reform progress than GDP growth. This suggests that differences in reform progress across countries are better explained by secular differences than by economic fluctuations and thus more likely to persist over time. This remains true for several blocks of the re-

form if we use lagged explanatory variables in Panel B. With a one standard deviation increase in GDP per capita corresponding to a 3.05 ($exp(1.448) * 0.716$) times higher probability of reform progress (in Panel A, column 1), the effect is also large in magnitude.
We further observe that an increase in log cumulative duration since the last change of the regulatory index is positively and significantly related to the log-odds of the subsequent change. In other words, reform progress is more likely after a longer period of inertia.
In Table 5, we consider more specific cyclical and structural/secular factors one at a time (to avoid issues of multicollinearity). We find that developed and liquid derivatives markets (as proxied by Log Turnover), as well as better regulatory quality and government effectiveness, are positively associated with reform progress and, more specifically, with a higher likelihood of progress in central clearing, electronic trading, and trade reporting. Further, having a central bank as sole regulator accelerates the implementation of the reform overall. A higher crisis cost is associated with greater progress in central clearing regulation and electronic trading. Banking sector size, measuring the systemic importance of banks, appears relevant as well in accelerating the adoption of central clearing in particular, while banking sector concentration, proxying for the lobbying power of banks, seems irrelevant.
Cyclical factors are less robust across different model specifications and regulatory blocks. A 1-unit increase in GDP growth, for instance, is positively and significantly associated with progress in the electronic trading index, but negatively (and less significantly) with progress in other blocks. The share of non-performing loans (NPLs), on the other hand, is positively but not significantly related to any of the progress sub-indices, except electronic trading, but negatively (insignificantly) related to the overall reform index. While having a broken banking system following a crisis may help to initiate reforms, it may

also delay the actual implementation of reforms and impair enforcement (forbearance). Consistent with that, the Z-score for the banking sector is positively linked to reform progress through the enforcement of electronic trading and central clearing, suggesting that the implementation of reforms is accelerated where banks are healthier and can bear the associated cost. The results are unaltered if we lag the explanatory variables by 1 or 4 quarters (unreported). In the case of capital and margin requirements, the results are weak because the implementation of these blocks has been delayed in all countries.

We conclude that secular or predetermined factors dominate as explanatory variables of reform progress, with the institutional setting and the quality of institutions, market development, and the cost of the last crisis behind most of the reform progress. This motivates the inclusion of destination country fixed effects in the analysis of regulatory arbitrage. As previously discussed, it also suggests that any innocuous reallocation of activities would likely be directed to jurisdictions with more developed markets and institutions and thus *more* reform progress.

5.2 US Loophole, Regulatory Arbitrage, and the Associated Increase in Risk

5.2.1 Benchmark

Table 6 presents the results for our main hypothesis, namely cross-border regulatory arbitrage, which uses the global derivative regulation index as the main regressor to explain foreign subsidiary shares of US traders' global IRS activity. As expected, for our pooled sample, we find reform progress in a given country to be negatively associated with the fraction of US banks' IRS activity in this country. Our results indicate that

more advanced host-country regulation corresponds to less activity from US dealers in this country, which is consistent with the literature on banks' international activity and cross-border regulatory arbitrage (e.g., Houston et al. (2012); Temesvary (2014); Karolyi and Taboada (2015); Temesvary (2015); Temesvary (2018)). The finding is robust to the introduction of control variables, which are motivated by this existing literature, and which capture the demand for derivative products and/or US banks' derivatives activity abroad. The variables include Log GDP per capita, GDP growth, and the size and liquidity of the local derivatives market (Log Turnover), i.e., the variables from our first step, as well as the volatilities of the short-term interest rate (which would provide a motive for trading interest rate derivatives) and the stock market, inflation, measures of political stability, and the size of the banking sector.

The finding is also robust to successively saturating the model with bank and quarter fixed effects, bank*quarter fixed effects, and quarter, bank and host country fixed effects. What changes across specifications is the magnitude of the predicted effect. The most basic specification, with only bank and quarter fixed effects, suggests that a 1-unit increase in the reform index in a given country is associated with a decrease of 0.112 in the fraction of US dealers' IRS activity in that country (column (1)). When we add bank*quarter fixed effects, the estimate barely changes (column (2)). When we add relevant controls, the point estimate falls to -0.091 with bank, quarter, and country fixed effects (column (3)) but remains economically and statistically significant, given that the average fraction of bank's IRS activity in a given country in our sample is 0.022. Note that control variables have the expected signs. More activity is directed to higher income countries with more developed derivatives markets, and less activity is directed to developing countries characterized by higher growth rates but also higher inflation rates. As expected, higher

interest rate volatility is associated with higher IRS activity. The size and concentration of the domestic banking sector has no significant effect on the presence of US dealers, suggesting that higher competition from domestic banks has no effect on the entry decision of US banks.

The specification with bank, quarter, and country fixed effects (and the coefficient of -0.033 on the reform index in column (4)), which includes additional measures of institutional and market development (political stability, stock market volatility, banking sector size and concentration), provides our most conservative point estimate but remains economically sizable. The estimated effect remains economically and statistically significant if we extend the sample period to 2019 (column (5)). Specification (3) is not our preferred specification because it entails the loss of many observations due to missing data for the additional control variables.

In Table 7, we further investigate the link between foreign subsidiary shares and individual reform blocks and find central clearing regulation, capital and margin requirements, arguably the costliest blocks, to be the most relevant ones. A 1-unit increase in the capital requirement index corresponds to foreign subsidiary shares that are 0.150 lower (column (1)). A 1-unit increase in the central clearing requirement index corresponds to foreign subsidiary shares that are at least 0.115 lower (columns (1) to (4)). A 1-unit increase in the margin requirement index corresponds to foreign subsidiary shares that are 0.073 lower (column (4)). Since the margin requirement rule is implemented later than other rules, its effect is best captured when extending the sample to 2019. Note that the effect of central clearing is the most robust across the different specifications as one would expect given the higher cost it entails for the banks.

There is also some evidence that the regulation of electronic trading may actually help

attract rather than deter business from US dealers. The corresponding estimates are not statistically significant but generally plausible, considering that electronic trading is unlikely to impose significant costs on the most advanced US traders, while clearly improving the trading environment through reduced operational risk and higher transparency and market liquidity.

We do not over-control by adding country fixed effects across these different specifications because it makes it more difficult to identify the effect of individual blocks which vary less within country than the aggregate index.

5.2.2 Robustness exercises

For additional robustness, we interact our reform index with dummies that are equal to one after the successive tightening of US regulation. We include such dummies for mandatory trade reporting, central clearing, electronic trading regulation, and margin requirement in the US, as the capital requirement block is still not fully implemented in the US. The results are reported in Table 8, columns (1) and (2). We find that the link between foreign subsidiary shares and the reform index is strongest after the US enforced domestic regulation. When we extend the sample to 2019 to capture the amplifying effect of mandatory margin requirements in the US, we find the interaction to be positive but not large enough to offset outflows caused by the previous cumulative enforcement of other blocks of the regulation. This reversal is explained by the fact that for the margin requirement block of the regulation, the US are not much ahead of other countries, hence the timing of this enforcement coincides more or less with the implementation of the regulation in other countries.

In line with the existing literature on cross-border arbitrage, we also instrument the over-

all reform index using a dummy for when the central bank shares the banks' regulatory oversight, and using the cost of the Global Financial Crisis in terms of loss of GDP. The reported first-stage F-statistic shows that the instruments are strong and the Hansen J-statistic in columns (3) and (4) shows that the instruments are valid. That our results remain robust indicates that our results are not plagued by reverse causality and warrants our (intuitive) causal interpretation.

Further strengthening this interpretation, in columns (5) and (6) we also run a "placebo regression" using the foreign subsidiary share of the US dealers' FX swap activity, to which the reform blocks on electronic trading, CCP clearing and capital regulation do not apply. It appears that neither the overall reform index, nor any of the indices for the individual blocks is associated with the US dealers' foreign subsidiaries' FX swap positions abroad; this helps to eliminate concerns that dealers may have shifted their IRS positions for unobserved reasons that affect swap holdings more generally, and further supports the view that we observe evidence of regulatory arbitrage.

5.2.3 Mitigating Factors

To better understand the systemic implications of our findings, and to clarify the role of institutional quality, we consider the interaction of our progress indicator with different measures of institutional/governance and market quality (Table 9) that we obtain from the World Bank's Governance Indices.[13]

Consistent with our previous observation, we find that a stronger rule of law, stronger

[13] *Government effectiveness* captures perceptions of the quality of public services, the quality of civil service and its degree of independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. *Regulatory quality* captures perceptions of the ability of the government to formulate and implement policies and regulations that permit and promote private sector development. *Rule of law* measures confidence in contract enforcement and property rights.

government effectiveness and stronger regulatory quality curb regulatory arbitrage (columns (1), (2), and (3)). That is, US dealers are less likely to move their IRS positions to destinations with a lax overall regulatory framework and weak institutions. The depth and liquidity of the local IRS market also reduces regulatory arbitrage (column (4)), presumably because higher market liquidity implies lower transaction costs on the local market at any given step of reform progress.

5.2.4 Other Forms of Regulatory Arbitrage and Unintended Consequences of the Reform

So far we have highlighted geographical arbitrage as a cause of increased systemic risk as dealers move their activities to jurisdictions that are less willing and perhaps less equipped to oversee and manage this risk. At the bank level as well the reform may alter risk-taking as banks may rebalance toward less regulated activities to maintain a constant return on equity. We show that in response to host country reforms, even though risk in the foreign subsidiairies' trading portfolio is reduced as intended by the reform, the overall financial stability of the subsidiaries deteriorates, consistent with the presumption that they shift risk-taking to other less regulated activities.

(i) Risk-shifting

On the one hand, certain blocks of the regulation entail higher charges for riskier portfolios and may hence deter risk-taking: central clearing implies higher collateral posting, higher capital and margin requirement imply that banks have to hold more liquid assets. In Table 10, we report estimates of the effect of the reform on a measure of the trading portfolio risk, the 4-quarter rolling standard deviation of return on trading assets. As in-

tended by the reforms, our results show that the reform is associated with reduced risk in the portfolio of US banks' foreign subsidiaries, i.e., that US subsidiaries do not hold riskier but rather less risky trading portfolios in jurisdictions that have progressed further on the derivatives market reform. This is true for the baseline sample (column (1)) and the extended sample (column (2)), and when instrumenting reform progress (columns (3) and (4)). Note that the 2SLS estimates in columns (3) and (4) are higher in magnitude, which is consistent with the fact that measurement error attenuates our benchmark estimates.

When banks have to reduce risk in the asset class targeted by the reform and are not (fully) able to geographically evade stronger regulation, an alternative strategy is to shift risk to other asset classes or activities to maintain a target return on equity. Consistent with banks engaging in this alternative form of regulatory arbitrage, we find that the overall financial stability of the banks' foreign subsidiaries deteriorates as reforms are implemented in their host countries. The results are shown in Table 11 which replicates Table 10 with the subsidiaries' Z-score as dependent variable. The Z-score is a measure of distance to default. In columns (1) through (4), we find that the negative impact of an increase in the reform index on the Z-score is economically significant whatever the specification used given that the average Z-score is 7.76.

While we have so far focused on geographical arbitrage and risk-shifting, other forms of regulatory arbitrage with unintended consequences are starting to emerge, with an acceleration since 2016 as the US and other countries progress with the implementation of margin and capital requirements. We describe them briefly and shed light on potential implications that ought to keep regulators vigilant.

(ii) Migration to shadow banks

Another emerging form of arbitrage is the transfer of activity to unregulated entities.[14] In the US for example, exemptions concern small depository institutions, non-bank financial firms, and captive finance groups. A plausible consequence of such exemption is the migration of derivatives activities away from banks to non-bank market participants. Aggregate data from the Bank of International Settlement (BIS) triennial survey reveal that in 2019, shadow banks, including hedge funds and other non-bank financial institutions, accounted for more than 50 percent of IRS trading, which never happened before (see BIS (2019)). There are multiple inefficiencies associated with such mutations: a reduction of products available to end-users as small dealers are not able to offer the range of products and services previously offered by large institutions, heightened liquidity fragmentation, and reduced liquidity. One positive aspect of such mutation may be that credit risk is now spread across a larger pool of market participants. However, that may be an illusion if few large banks remain the sole provider of liquidity to the second-tier dealers.

(iii) Futurization

As swap markets become more regulated than futures markets, an unexpected innovation is the creation of swap-futures that mimic the service offered by swaps but come in form of exchange-traded futures. Futures have lower margin requirements, softer reporting and compliance obligations, and less frequent reporting. Albeit still at an early stage[15], the migration from swaps to futures may pose several policy problems. This form of regulatory arbitrage undermines the objectives of reaching greater transparency and reducing systemic risk. Indeed, swap-like futures will keep opaque pricing and wider

[14] See *Financial Times* "Derivatives Move from Banks to the Shadows", September 11 2013.

[15] So far, futurization has concerned chiefly the energy sectors (gas and electric power) in North America.

bid/ask spreads, which were an impediment to price discovery before the crisis. Then, with lower futures margins, the stability of futures clearing houses may be increasingly at risk as volumes of transactions cleared soar.

6 Conclusion

Indicators of progress for the implementation of the OTC derivatives market reform, which we build based on FSB Reports, reveal unequal progress of the reform agenda across G-20 countries. These differences in the timing of adoption appear to be mainly explained by secular differences in institutions quality and governance. US banks, for which we observe derivatives holdings at the foreign subsidiary level, appear to have taken advantage of these cross-country disparities and a loophole in the Dodd-Frank Act, and moved their IRS activity to less tightly regulated foreign affiliates. These findings are driven by those blocks of the reform that are costliest for banks, most notably central clearing. They become stronger as regulation in the US tightens, but can be mitigated by a stronger rule of law, more effective governments, and more developed derivative markets in the foreign jurisdictions.

The mutation in the geography of US banks' activity persists even after other major countries start aligning their regulation with the G-20 objectives and differences with the US dissipate, implying that the US' derivative activity has lost permanently from being the first mover.

Our results hold in a battery of robustness checks. The importance and role of structural factors for reform progress eliminates concerns about reverse causality; if one expects that any innocuous reallocation of positions by banks would target jurisdictions with better

developed governance and markets, it also alleviates concerns about omitted variables. Jointly, this suggests that our estimates indeed reflect a causal relationship and may actually provide a lower bound for the true effect. Even at this lower bound, however, our estimates indicate that differences in regulatory tightness have an economically significant effect on banks' geographic reallocation of their IRS portfolio.

Our results provide evidence of regulatory arbitrage in the context of the G-20's OTC derivatives market reform that increase global financial risk on at least two dimensions: (i) the geographic move of risky IRS positions into jurisdictions that are less equipped to oversee them; (ii) higher risk-taking at banks that target a constant return on equity. They therefore suggest: (a) that cross-jurisdictional arbitrage occurs not only in response to bank capital regulation, but also when regulatory action primarily affects transaction costs, as is the case on the derivatives market, (b) that cross-jurisdictional arbitrage and risk-shifting prevail in the post-crisis era, and (c) that global reforms, like the G-20's derivatives market reform, may not only fail to curb regulatory arbitrage, but might bring about new and perhaps unchecked risks.

These risks need to be weighed carefully against the expected benefits of any global reform. Our findings therefore call for increased international coordination and risk-monitoring and suggest that the global regulation of OTC derivatives markets should ideally be accompanied by greater surveillance to identify emerging risks.

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7 Tables and Charts

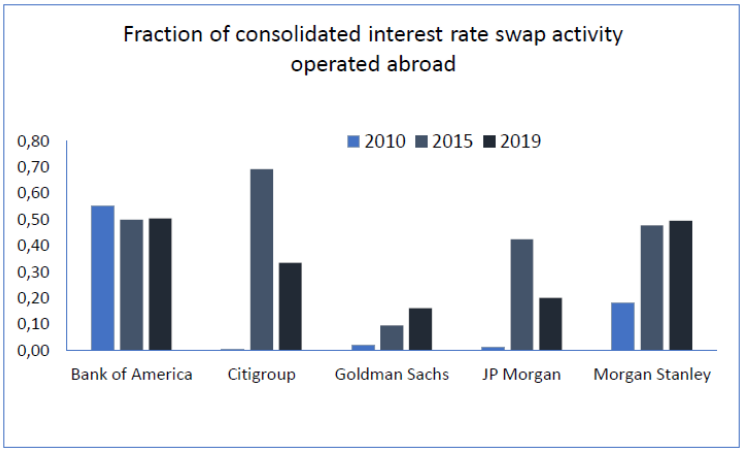
Figure 1: Reform Costs.

Regulatory block	Cost components	Costs
Trade repository	Infrastructure (IT), maintenance, access	$*
Central clearing	Collateral, margins, IT	$$$$
Electronic trading	IT, maintenance, access (transitional and fixed)	$*
Capital requirement	Economic	$$$$
Margin requirement	Economic	$$$$

(*) Can be reduced for small participants.

Figure 2: The shift abroad (Q1 2010-Q4 2019).

a) The evolution in the share of interest rate swap activity operated abroad is shown for the top 5 US dealers. Fractions were calculated with data from the FED Financial Statement of Foreign Subsidiaries of US Banking Organizations and from the FED Consolidated Financial Statement for Holding Companies. They are equal to the sum of the interest rate swap activity by each of the banks' foreign subsidiaries over total consolidated interest rate swap activities of the bank taken from the Calls reports.



b) The evolution of the notional value of interest rate swaps operated abroad is shown for the top 5 US dealers. Data (in billion dollars) is from the FED Financial Statement of Foreign Subsidiaries of US Banking Organizations.

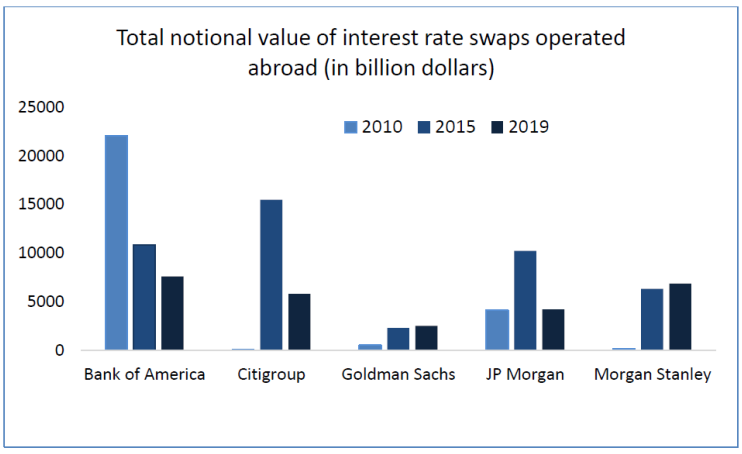
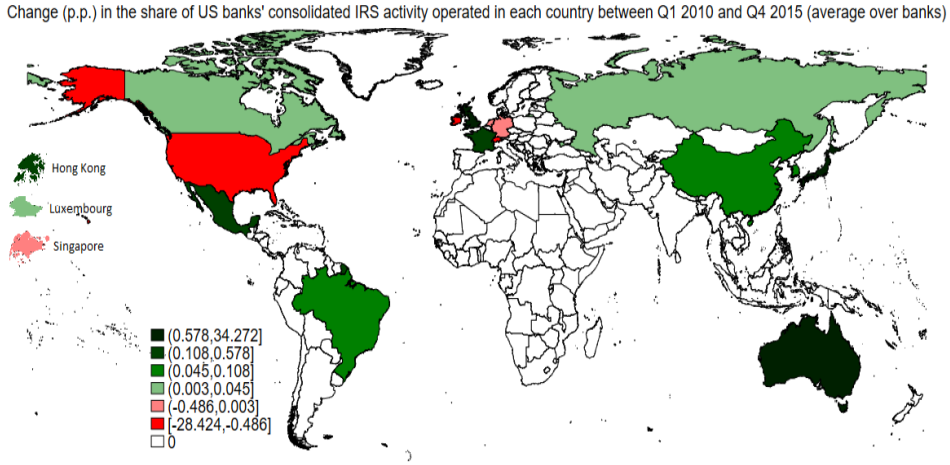


Figure 3: Location of US Banks' Interest Rate Swap Activity (Q1 2010-Q4 2015 and Q1 2010-Q4 2019)

Figure 3 presents the change (in percentage points) in the share of US banks' consolidated interest rate swap activity operated in each country of the world between Q1 2010 and Q4 2015 and between Q1 2010 and Q4 2019. In a given country, this share is calculated as the interest rate swap activity of a given US bank in this country (through its foreign subsidiaries) relative to its total interest rate swap activity multiplied by 100, averaged over the 5 top US banks. Categories are based on quantiles for non-zero data. The two lower quantiles in red include countries for which the change is negative (except for Singapore and Russia) and the four upper quantiles in green include countries for which the change is positive. Source: FED Financial Statement of Foreign Subsidiaries of US Banking Organizations and FED Consolidated Financial Statement for Holding Companies and Calls reports.



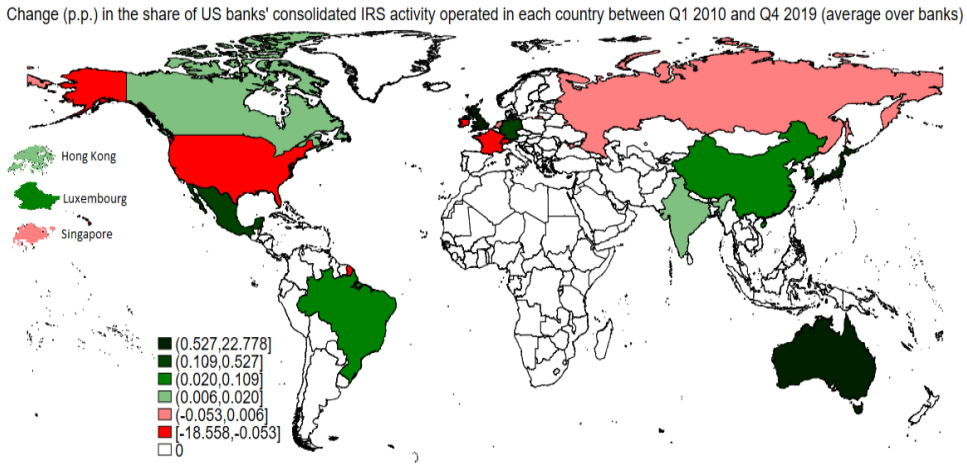
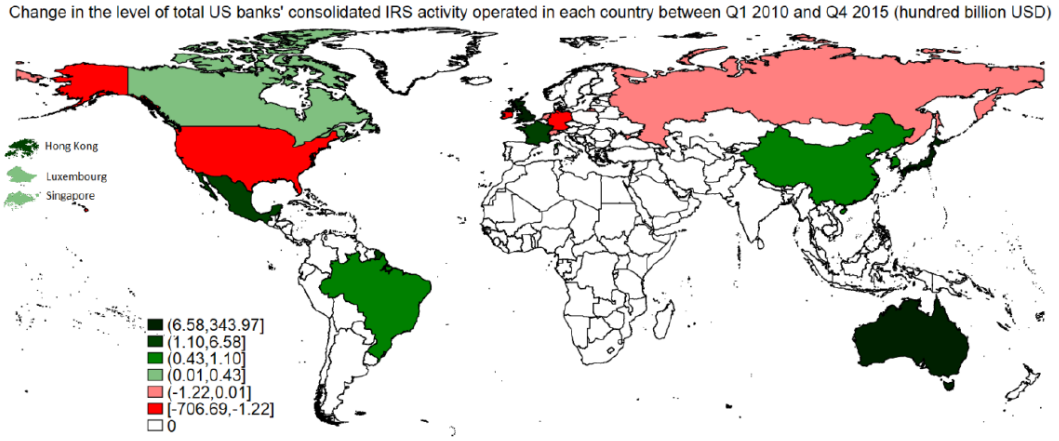


Figure 4: Location of US Banks' Interest Rate Swap Activity – notional values (Q1 2010-Q4 2015 and Q1 2010-Q4 2019)

Figure 4 presents the change (in hundred billion dollars) in the notional value of US banks' interest rate swaps operated in each country of the world between Q1 2010 and Q4 2015 and between Q1 2010 and Q4 2019. In a given country, this notional value represents the total interest rate swap activity of the top 5 US dealers in this country through their foreign subsidiaries. Categories are based on quantiles for non-zero data. The two lower quantiles in red include countries for which the change is negative (except for Russia and India) and the four upper quantiles in green include countries for which the change is positive. Source: FED Financial Statement of Foreign Subsidiaries of US Banking Organizations.



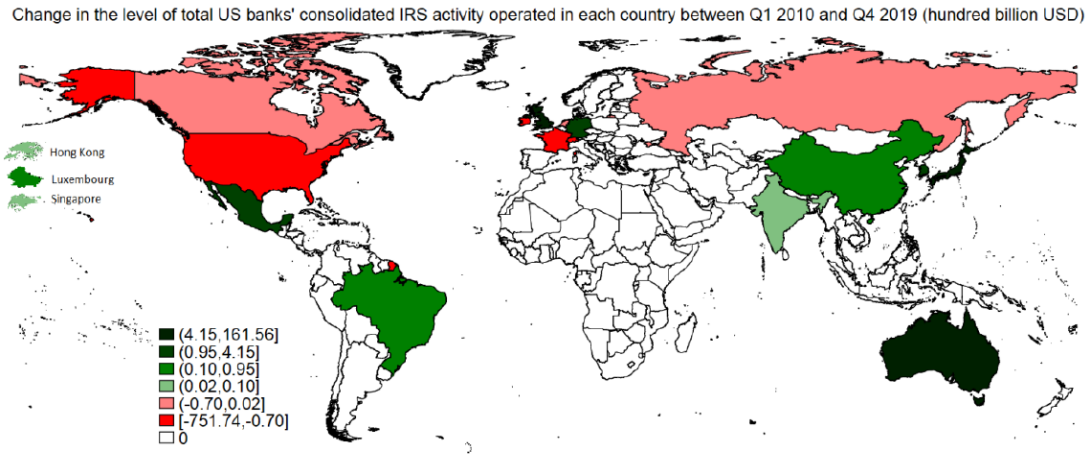


Table 1: Regulatory Indices in Q4 2015 and Q4 2019.

This table presents the values of the regulatory indices for each country as of Q4-2015 and Q4-2019 (in parenthesis). Trade reporting, Central counterparty clearing, Electronic trading, Capital requirements, and Margin requirement are all indices that measure progress in each individual area of the OTC derivative market regulation using FSB progress reports for the G-20 countries. The indices take integer values between 0 and 4, where 0 corresponds to cases in which no authority exists to implement the reform and no steps are taken to adopt such an authority and 4 corresponds to instances with a legislative framework in which standards/requirements are in place for over 90% of all transactions. The Derivreg index is the number of sub-indices that have reached value 4.

Country	Trade Reporting	Central Counterparty Clearing	Electronic Trading	Capital Requirements	Margin Requirements	Derivreg Index
Argentina	3 (4)	1 (1)	3 (3)	4 (4)	1 (1)	**1 (2)**
Australia	4 (4)	4 (4)	3 (4)	4 (4)	1 (4)	**3 (5)**
Brazil	4 (4)	4 (4)	1 (1)	4 (4)	1 (4)	**3 (4)**
Canada	4 (4)	3 (4)	2 (2)	4 (4)	3 (4)	**2 (4)**
China	4 (4)	4 (4)	3 (3)	1 (4)	0 (1)	**2 (3)**
European Union	4 (4)	3 (4)	3 (4)	4 (4)	2 (4)	**2 (5)**
Hong Kong	3 (4)	2 (4)	1 (4)	4 (4)	2 (4)	**1 (5)**
India	4 (4)	3 (3)	1 (3)	4 (4)	1 (2)	**2 (2)**
Indonesia	4 (4)	3 (3)	3 (3)	1 (4)	1 (1)	**1 (2)**
Japan	4 (4)	4 (4)	4 (4)	4 (4)	2 (4)	**4 (5)**
Mexico	4 (4)	2 (4)	2 (4)	4 (4)	1 (3)	**2 (4)**
Republic of Korea	4 (4)	3 (4)	0 (1)	3 (4)	1 (4)	**1 (4)**
Russia	4 (4)	2 (3)	1 (2)	4 (4)	2 (3)	**2 (2)**
Saudi Arabia	4 (4)	1 (1)	1 (1)	4 (4)	1 (4)	**2 (3)**
Singapore	4 (4)	4 (4)	1 (4)	4 (4)	2 (4)	**3 (5)**
South Africa	2 (3)	2 (4)	1 (1)	4 (4)	2 (2)	**1 (2)**
Switzerland	1 (4)	1 (4)	1 (4)	4 (4)	1 (4)	**1 (5)**
Turkey	1 (4)	1 (2)	1 (1)	4 (4)	1 (1)	**1 (2)**
United States	4 (4)	4 (4)	4 (4)	3 (3)	3 (4)	**3 (4)**

Table 2: Quarter of Adoption.

This table presents the quarters in which the regulatory progress (sub-)indices reach value 4 (the maximum). The indices are defined as in Table 1.

Country	Trade Reporting	Central Counterparty Clearing	Electronic Trading	Capital Requirements	Margin Requirements	Date the Derivreg Index reaches 5
Argentina	Q1 2019			Q1 2013		
Australia	Q1 2014	Q4 2014	Q2 2016	Q1 2013	Q1 2017	Q1 2017
Brazil	Q1 2010	Q4 2014		Q1 2013	Q2 2019	
Canada	Q4 2014	Q2 2017		Q1 2013	Q1 2016	
China	Q1 2013	Q3 2014		Q1 2017		
European Union	Q1 2014	Q1 2016	Q1 2017	Q1 2014	Q1 2017	Q1 2017
Hong Kong	Q3 2017	Q2 2016	Q3 2018	Q1 2013	Q1 2017	Q3 2018
India	Q3 2012			Q1 2013		
Indonesia	Q1 2013			Q1 2017		
Japan	Q3 2012	Q3 2012	Q3 2015	Q1 2013	Q1 2016	Q1 2016
Mexico	Q1 2013	Q2 2016	Q2 2016	Q4 2015		
Republic of Korea	Q3 2012	Q1 2017		Q1 2017	Q3 2017	
Russia	Q4 2015			Q1 2013		
Saudi Arabia	Q1 2013			Q1 2013	Q1 2017	
Singapore	Q2 2015	Q4 2014	Q1 2017	Q1 2013	Q1 2017	Q1 2017
South Africa		Q1 2018		Q1 2013		
Switzerland	Q4 2017	Q1 2016	Q1 2016	Q1 2013	Q1 2016	Q4 2017
Turkey	Q4 2018			Q4 2015		
United States	Q1 2012	Q3 2012	Q3 2013		Q2 2016	

Table 3: Descriptive Statistics.

Country-level*bank variables and subsidiary level data are quarterly data extracted from US form 2314 and cover the period Q1 2010 to Q4 2015. Consolidated data are from Calls reports. Country-level macroeconomic data are from the OECD database. Volatility is calculated as the 4-quarter rolling standard deviation of returns on trading assets (ROA). 4-quarters rolling standard deviations are also used to calculate interest rate, exchange rate volatility, and stock market volatility. Z-score is calculated as (ROA+Equity ratio)/std(RoA) using rolling averages and standard deviations over 8 quarters. Turnover is from the BIS derivatives database (in million USD). Indices of political stability and no violence, government effectiveness and regulatory quality are from the World Bank Governance database.

a- Descriptive statistics until Q4 2015.

Variable	Mean	Standard deviation	25th percentile	50th percentile	75th percentile
Dependent variables					
Country-level*bank variables					
Fraction of bank's IRS activity in a given country	0.022	0.095	0.000	0.000	0.001
Fraction of bank's FXS activity in a given country	0.032	0.141	0.000	0.000	0.003
Subsidiary-level variables					
Volatility of ROA (winsorized)	0.033	0.127	-0.012	0.011	0.065
Z-score (winsorized)	8.512	6.732	3.263	6.295	11.687
Explanatory variables					
Country-level variables					
GDP Growth (%)	3.295	3.814	1.381	2.556	4.066
Log(GDP per capita)	10.512	0.703	10.463	10.677	10.880
Inflation (%)	2.558	2.546	0.881	2.156	3.615
Log(turnover) IRS	9.869	1.937	8.171	10.393	11.100
Log(turnover) FXS	11.445	1.375	10.377	11.595	12.427
Interest rate volatility	0.274	0.466	0.043	0.107	0.284
Exchange rate volatility	0.026	0.013	0.018	0.026	0.033
Regulatory quality	1.263	0.806	1.019	1.658	1.789
Rule of law	1.238	0.901	1.312	1.732	1.819
Government effectiveness	1.309	0.760	1.340	1.621	1.784
Political stability and no violence	0.618	0.755	0.161	0.936	1.153
Stock market volatility	18.845	5.442	14.440	18.550	22.076
Banking sector assets/GDP	133.555	50.223	103.910	130.984	169.161
Cost of crisis (output loss)	5.254	9.392	0.000	0.000	11.000
Cost of crisis (public debt rise)	5.935	9.964	0.000	0.000	17.250
Non-performing loans	3.135	3.067	1.100	2.466	3.165
Z-score	14.713	5.820	10.898	14.567	17.840
Concentration	57.562	16.611	44.356	57.626	68.333
Subsidiary-level variables					
Log total assets	15.970	1.745	14.792	15.813	17.190
Equity/assets	0.358	0.284	0.131	0.265	0.524
Deposits/assets	0.083	0.016	0.000	0.000	0.082
Non-interest/interest income (winsorized)	4.633	6.075	0.453	1.709	6.211

b- Descriptive statistics until Q4 2019.

Variable	Mean	Standard deviation	25th percentile	50th percentile	75th percentile
Dependent variables					
Country-level*bank variables					
Fraction of bank's IRS activity in a given country	0.023	0.090	0.000	0.000	0.001
Fraction of bank's FXS activity in a given country	0.033	0.148	0.000	0.000	0.003
Subsidiary-level variables					
Volatility of ROA (winsorized)	0.042	0.133	-0.013	0.015	0.083
Z-score (winsorized)	7.761	6.759	2.723	5.208	10.618
Explanatory variables					
Country-level variables					
GDP Growth (%)	3.029	3.282	1.394	2.374	3.647
Log(GDP per capita)	10.554	0.716	10.267	10.734	10.955
Inflation (%)	2.315	2.258	0.792	1.840	3.068
Log(turnover) IRS	9.729	2.054	8.086	10.264	10.996
Log(turnover) FXS	11.434	1.442	10.434	11.362	12.427
Interest rate volatility	0.245	0.409	0.032	0.099	0.269
Exchange rate volatility	0.024	0.013	0.016	0.023	0.031
Regulatory quality	1.224	0.862	0.426	1.664	1.801
Rule of law	1.158	0.929	0.026	1.650	1.808
Government effectiveness	1.260	0.777	0.477	1.596	1.784
Political stability and no violence	0.546	0.765	-0.133	0.890	1.087
Stock market volatility	18.346	5.447	14.070	17.593	21.462
Banking sector assets/GDP	129.207	51.122	101.326	128.789	157.976
Cost of crisis (output loss)	4.828	9.086	0.000	0.000	0.000
Cost of crisis (public debt rise)	5.625	9.675	0.000	0.000	6.443
Non-performing loans	3.165	3.158	1.127	2.400	3.600
Z-score	14.973	5.951	10.605	14.966	18.579
Concentration	57.372	16.214	44.030	57.129	68.333
Subsidiary-level variables					
Log(total assets)	16.042	1.696	14.885	15.881	17.202
Equity/assets	0.350	0.282	0.133	0.252	0.511
Deposits/assets	0.100	0.187	0.000	0.000	0.121
Non-interest/interest income (winsorized)	4.050	5.779	0.354	1.347	5.072

Table 4: Timing of the Reform.

This table reports discrete time proportional hazard model estimates of factors that affect the timing of derivatives markets reforms between Q1 2010 and Q4 2019. Each column corresponds to results relating to the global reform index (DERIVREG) or to each of the blocks of the reform: trade repositories (TR), central counterparties (CCP), electronic trading platforms (ETP), capital requirements (KA), and margin requirements (MA). Standard errors (in parentheses) are clustered by country*year; * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Panel A

	(1) DERIVREG	(2) TR	(3) CCP	(4) ETP	(5) KA	(6) MA
GDP Growth (%)	-0.040	-0.393	-0.126	0.394**	-0.581	-0.075
	(0.257)	(0.353)	(0.435)	(0.182)	(1.292)	(0.251)
Log(GDP per capita)	1.448**	1.985	2.708	2.208***	2.367	1.558**
	(0.675)	(1.629)	(9.223)	(0.734)	(2.331)	(0.754)
Log(duration)	3.984***	7.987***	4.567	1.834***	14.621	2.575***
	(1.160)	(1.663)	(19.297)	(0.435)	(29.907)	(0.931)
Constant	-28.028***	-40.810**	-43.667	-32.673***	-63.693	-25.782***
	(9.559)	(17.761)	(167.991)	(7.478)	(88.111)	(9.427)
N	760	398	610	725	391	706

Panel B

	(1) DERIVREG	(2) TR	(3) CCP	(4) ETP	(5) KA	(6) MA
GDP Growth t-1	-0.297	-0.183	-0.060	0.270	-0.857	-0.340*
	(0.257)	(0.579)	(0.192)	(0.181)	(1.518)	(0.205)
Log(GDP per capita) t-1	0.761	1.232	1.787*	1.790***	1.651	1.303*
	(0.536)	(2.852)	(1.052)	(0.693)	(4.170)	(0.676)
Log(duration)	3.942***	8.976	4.045*	2.011***	11.394	2.599***
	(1.116)	(16.318)	(2.321)	(0.451)	(23.820)	(0.965)
Constant	-20.634***	-36.119	-32.180*	-28.808***	-48.119	-22.968***
	(7.837)	(63.339)	(18.604)	(7.072)	(102.093)	(8.677)
N	759	397	609	724	390	705

Table 5: Determinants of the timing of reform: additional explanatory variables.

This table reports estimates of variables added one at a time in the regressions reported in Table 4. Log(turnover) is the log of the turnover in million USD of derivatives markets in each country. Regulatory quality and government effectiveness are from the World Bank governance indicators database. Central bank regulator is a dummy indicating whether the central bank shares the responsibility of supervising the banks (1) or is sole supervisor (0). Crisis cost proxies, based on output loss and public debt rise, are from the Laeven and Valencia database. Banking sector assets over GDP is a proxy for the size of the banking sector. Concentration is the proportion of total banking sector assets accounted for by the top 3 banks in a country. The non-performing loan ratio (NPL) is the ratio of banks total overdue loans divided by total assets. Z-score is an accounting-based measure of the distance to default of the banking sector. Higher Z-score means greater stability. Results for lagged NPL and Z-score are presented in parentheses. Standard errors (not reported) are clustered by country*year; $*p < 0.1$; $**p < 0.05$; $***p < 0.01$.

	(1) DERIVREG	(2) TR	(3) CCP	(4) ETP	(5) KA	(6) MA
Secular factors						
Log(turnover)	0.487**	2.096	1.907**	0.990***	0.253	0.213
Regulatory quality	1.619***	2.948*	5.482	2.037***	-0.086	0.546
Central bank regulator	-2.293**	-2.288	-1.319	-2.365**	-0.534	-0.524
Government effectiveness	1.577***	3.358**	4.876***	2.013***	-0.353	0.218
Crisis cost (public debt rise)	0.019	0.234	0.204***	0.107***	0.076	-0.013
Crisis cost (output loss)	0.020	0.203	0.167***	0.092***	0.017	-0.009
Banking sector assets/GDP	0.016**	0.040	0.040***	0.010	0.003	-0.009
Concentration	-0.008	-0.019	0.005	0.006	0.047	-0.002
Cyclical factors						
NPL	-0.075	0.153	0.175	0.196*	0.287	0.015
	(-0.014)	(0.202)	(0.116)	(0.197**)	(0.712)	(0.038)
Z-score	0.191***	0.597	0.314*	0.206***	0.114	0.055
	(0.172**)	(0.550)	(0.303***)	(0.203***)	(0.101)	(0.067)

Table 6: Regulatory Arbitrage.

The dependent variable is a dealer's IRS activity in a given foreign country divided by total (consolidated) interest rate swap activity in a given quarter. The sample covers the foreign subsidiary activity of the top 5 US dealers over 2010 Q1-2015 Q4. Activity is measured by notional. The Derivreg index covers 5 areas: trade reporting, central clearing, electronic trading, and capital and margin requirement. Inflation is measured as the year-on-year growth rate of the CPI. Log(GDP per capita) is the logged gross domestic product at purchasing power parity divided by population. GDP growth is measured as the year-on-year percent change in GDP at constant prices. Log(turnover) IRS is the logged daily average turnover of OTC interest rate swaps (in million USD), i.e., the total amount of IRS contracts traded in a day at the country level. Interest rate volatility is calculated as the 4-quarter rolling standard deviation of the 3-month money market rate. Political stability and no violence is a World Bank indicator that measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. Stock market volatility is calculated as the 4-quarter rolling standard deviation of the stock market price index. Banking sector assets over GDP is a proxy for the size of the banking sector. Concentration is the proportion of total banking sector assets accounted for by the top 3 banks in a country. Estimates are weighted by dollar amounts of interest rate swap notional to give more weight to larger subsidiaries. Standard errors clustered by country*year are reported in parentheses. ***, **, * respectively indicate statistical significance at 1%, 5% and 10% level.

	(1)	(2)	(3)	(4)	(5)
					2010-2019
Derivreg index	**-0.112****	**-0.106****	**-0.091*****	**-0.033*****	**-0.031*****
	(0.045)	(0.053)	(0.030)	(0.011)	(0.008)
Inflation (%)			-0.076***	-0.017	-0.029***
			(0.022)	(0.011)	(0.007)
Log(GDP per capita)			0.282*	-0.437***	-0.692***
			(0.148)	(0.141)	(0.185)
GDP Growth (%)			-0.033**	-0.005	0.001
			(0.013)	(0.008)	(0.006)
Log(turnover) IRS			0.051***	-0.050	0.031
			(0.009)	(0.048)	(0.045)
Interest rate volatility			0.863**	-0.063	-0.076**
			(0.385)	(0.043)	(0.038)
Political stability and no violence				0.266**	0.024
				(0.105)	(0.089)
Stock market volatility				-0.011	-0.009
				(0.009)	(0.006)
Banking sector assets/GDP				-0.004***	-0.001
				(0.001)	(0.001)
Concentration				0.087	-0.183
				(0.204)	(0.240)
Bank FE	yes	no	no	yes	yes
Quarter FE	yes	no	no	yes	yes
*Bank*quarter FE*	no	yes	yes	no	no
Country FE	no	no	no	yes	yes
R^2	0.56	0.70	0.81	0.84	0.82
N	946	946	939	626	963

Table 7: Regulatory arbitrage: response to individual regulatory blocks.

The dependent variable is a dealer's IRS activity in a given foreign country divided by total (consolidated) interest rate swap activity in a given quarter. The sample covers the foreign subsidiary activity of the top 5 US dealers over 2010 Q1-2015 Q4. Activity is measured by notional. Trade reporting, Central clearing, Capital requirements, Electronic trading and Margin Requirements are the regulatory blocks' progress indices. The indices take integer values between 0 and 4 with higher values meaning greater progress. The other variables are defined as in Table 6. Estimates are weighted by dollar amounts of interest rate swap notional to give more weight to larger subsidiaries. Standard errors clustered by country*year are reported in parentheses. ***, **, * respectively indicate statistical significance at 1%, 5% and 10% level.

	(1)	(2) 2010-2019	(3)	(4) 2010-2019
Trade reporting	-0.012	0.064	0.002	0.079
	(0.049)	(0.055)	(0.046)	(0.048)
Central clearing	-0.115***	-0.151***	-0.158***	-0.151***
	(0.041)	(0.033)	(0.043)	(0.040)
Capital requirements	-0.150**	-0.142**	0.005	-0.019
	(0.059)	(0.063)	(0.066)	(0.064)
Electronic trading	0.029	0.024	0.048	0.015
	(0.034)	(0.020)	(0.030)	(0.020)
Margin requirements	0.108	-0.075**	0.052	-0.073**
	(0.077)	(0.037)	(0.064)	(0.034)
Inflation (%)	-0.077***	-0.063***	-0.083***	-0.055***
	(0.015)	(0.013)	(0.017)	(0.017)
Log(GDP per capita)	0.330***	0.361***	0.233*	0.265**
	(0.114)	(0.098)	(0.136)	(0.112)
GDP Growth (%)	-0.038***	-0.040***	-0.043***	-0.034***
	(0.009)	(0.008)	(0.012)	(0.012)
Log(turnover)	0.042***	0.041***	0.050***	0.049***
	(0.008)	(0.007)	(0.009)	(0.008)
Interest rate volatility	0.785***	0.576***	0.823**	0.498***
	(0.253)	(0.159)	(0.371)	(0.188)
Bank FE	yes	yes	no	no
Quarter FE	yes	yes	no	no
*Bank*quarter FE*	no	no	yes	yes
R^2	0.71	0.70	0.83	0.83
N	946	1,667	946	1,667

Table 8: Robustness to alternative methods.

The dependent variable is a dealer's IRS activity in a given foreign country divided by total (consolidated) interest rate swap activity in a given quarter. The sample covers the foreign subsidiary activity of the top 5 US dealers over 2010 Q1-2015 Q4. Activity is measured by notional. US TR, US CCP, US ETP and US MA are dummy variables that take value one after the US enforced mandatory trade reporting, central clearing, electronic trading and margin requirements, respectively. The other variables are defined as in Table 6 and Table 7. Exchange rate volatility is calculated as the 4-quarter rolling standard deviation of the exchange rate with USD. Estimates are weighted by dollar amounts of interest rate swap notional (or fx swap notional) to give more weight to larger subsidiaries. Standard errors clustered by country*year are reported in parentheses. ***, **, * respectively indicate statistical significance at 1%, 5% and 10% level.

	(1) US adoption	(2) US adoption 2010-2019	(3) 2SLS	(4) 2SLS 2010-2019	(5) FX Swaps	(6) FX Swaps 2010-2019
Derivreg	0.035	0.026	-0.121***	-0.121***	0.033	0.083
	(0.027)	(0.024)	(0.028)	(0.020)	(0.095)	(0.079)
Derivreg*US TR	-0.019*	-0.018*			-0.062	-0.038
	(0.010)	(0.009)			(0.068)	(0.047)
Derivreg*US CCP	-0.035	-0.031			0.075	0.026
	(0.025)	(0.023)			(0.047)	(0.041)
Derivreg*US ETP	-0.032*	-0.042***			-0.057	-0.032
	(0.017)	(0.012)			(0.038)	(0.041)
Derivreg*US MA		0.039***				0.046
		(0.015)				(0.031)
Inflation	-0.020**	-0.025***	-0.037***	-0.028***	-0.019	-0.022
	(0.009)	(0.009)	(0.009)	(0.007)	(0.022)	(0.020)
Log(GDP per capita)	-1.108***	-0.663***	-0.241***	-0.190***	-0.560	0.171
	(0.332)	(0.215)	(0.053)	(0.052)	(1.009)	(0.649)
GDP Growth	-0.018	-0.019*	0.001	0.002	-0.045**	-0.031
	(0.011)	(0.010)	(0.011)	(0.008)	(0.017)	(0.021)
Log(turnover) IRS	0.343***	0.234***	0.086***	0.085***		
	(0.062)	(0.057)	(0.011)	(0.007)		
Interest rate volatility	0.134	0.173**	-0.071	-0.002		
	(0.119)	(0.080)	(0.059)	(0.044)		
Log(turnover) FXS					0.171*	0.305***
					(0.094)	(0.101)
Exchange rate volatility					-5.256	-3.596
					(6.105)	(3.433)
Bank FE	yes	yes	yes	yes	yes	yes
Quarter FE	yes	yes	yes	yes	yes	yes
Country FE	yes	yes	no	no	yes	yes
First stage F-statistic			10.41	17.59		
Hansen test p-value			0.19	0.79		
R^2	0.83	0.82	0.82	0.80	0.88	0.85
N	939	1,667	826	1,448	754	1,422

Table 9: Mitigating factors.

The dependent variable is a dealer's IRS activity in a given foreign country divided by total (consolidated) interest rate swap activity in a given quarter. The sample covers the foreign subsidiary activity of the top 5 US dealers over 2010 Q1-2015 Q4. Activity is measured by notional. Rule of law measures confidence in contract enforcement and property rights. Government effectiveness measures the quality of public services and policy. Regulatory quality measures perception of government capacity to implement sound regulations. The other variables are defined as in Table 6 and Table 7. Estimates are weighted by dollar amounts of interest rate swap notional to give more weight to larger subsidiaries. Standard errors clustered by country*year are reported in parentheses. ***, **, * respectively indicate statistical significance at 1%, 5% and 10% level. All regressions include dealer, year-quarter, and country fixed effects.

	(1)	(2)	(3)	(4)
Derivreg index	-0.162***	-0.131***	-0.111***	-0.360***
	(0.026)	(0.037)	(0.026)	(0.053)
Inflation	-0.042***	-0.052***	-0.037***	0.002
	(0.006)	(0.006)	(0.007)	(0.007)
Log(GDP per capita)	-0.388***	-0.485***	-0.488***	-0.931***
	(0.115)	(0.125)	(0.127)	(0.252)
GDP Growth	-0.007	-0.006	-0.005	-0.009
	(0.007)	(0.007)	(0.007)	(0.008)
Log(turnover) IRS	0.025	0.015	-0.012	0.341***
	(0.069)	(0.064)	(0.054)	(0.054)
Interest rate volatility	-0.060	-0.054	-0.052	0.063
	(0.042)	(0.041)	(0.035)	(0.086)
Derivreg*Rule of law	0.077***			
	(0.020)			
Rule of law	-0.132			
	(0.270)			
Derivreg*Government effectiveness		0.055**		
		(0.025)		
Government effectiveness		-0.114		
		(0.135)		
Derivreg*Regulatory quality			0.046**	
			(0.019)	
Regulatory quality			0.330**	
			(0.159)	
Derivreg*Log(turnover) IRS				0.028***
				(0.004)
R^2	0.83	0.83	0.83	0.84
N	801	801	801	939

Table 10: Trading Portfolio Risk.

The dependent variable is the 4-quarters rolling standard deviation of the return on the trading portfolio of a dealer's subsidiaries in each foreign country. The baseline sample covers the foreign subsidiary activity of the top 5 US dealers over 2010 Q1-2015 Q4. Estimates are weighted by dollar amounts of interest rate swap notional to give more weight to larger subsidiaries. Standard errors clustered by country*year are reported in parentheses. ***, **, * respectively indicate statistical significance at 1%, 5% and 10% level.

	(1) WLS	(2) WLS 2010-2019	(3) 2SLS	(4) 2SLS 2010-2019
Derivreg index	-0.024**	-0.020**	-0.055***	-0.073***
	(0.011)	(0.009)	(0.014)	(0.022)
Inflation (%)	0.005	-0.004	0.001	-0.008
	(0.004)	(0.007)	(0.005)	(0.009)
Log(GDP per capita)	0.545	-0.064	-0.027	0.035
	(0.330)	(0.110)	(0.034)	(0.036)
GDP Growth (%)	-0.003	-0.004	-0.005	-0.022**
	(0.003)	(0.005)	(0.005)	(0.010)
Equity/assets	0.141**	0.400***	0.069*	0.287***
	(0.060)	(0.132)	(0.041)	(0.104)
Log(assets)	-0.032*	-0.079***	-0.013**	-0.040***
	(0.018)	(0.018)	(0.005)	(0.008)
Deposits/assets	0.224***	0.348***	0.152**	0.041
	(0.055)	(0.057)	(0.066)	(0.078)
Non-interest/interest income	0.014***	0.003	0.024***	0.009
	(0.004)	(0.005)	(0.002)	(0.006)
*Bank*quarter FE*	yes	yes	yes	yes
Country FE	yes	yes	no	no
First stage F-statistic			7.49	16.81
Hansen test p-value			0.51	0.38
R^2	0.73	0.67	0.51	0.32
N	820	1,530	714	1,330

Table 11: Overall Bank Risk.

The dependent variable is the z-score calculated as (RoA+Equity/Assets)/std(RoA) using 8-quarters rolling averages and standard deviation. The baseline sample covers the foreign subsidiary activity of the top 5 US dealers over 2010 Q1-2015 Q4. Estimates are weighted by dollar amounts of interest rate swap notional to give more weight to larger subsidiaries. Standard errors clustered by country*year are reported in parentheses. ***, **, * respectively indicate statistical significance at 1%, 5% and 10% level.

	(1) WLS	(2) WLS 2010-2019	(3) 2SLS	(4) 2SLS 2010-2019
Derivreg index	-0.981*	-1.706	-5.551***	-3.800***
	(0.572)	(1.290)	(1.371)	(1.405)
Inflation (%)	-2.178***	-0.875*	-2.166***	-0.101***
	(0.386)	(0.505)	(0.393)	(0.410)
Log(GDP per capita)	22.752	-5.314	0.257	4.002***
	(20.943)	(11.151)	(2.219)	(1.350)
GDP Growth (%)	0.262	-0.011	0.182	-0.047
	(0.309)	(0.359)	(0.421)	(0.497)
Equity/assets	-1.931	-8.746	4.165	-12.221***
	(6.717)	(5.393)	(2.641)	3.920
Log(assets)	-1.746**	-1.987**	-0.359	-0.462
	(0.769)	(0.832)	(0.314)	(0.343)
Deposits/assets	26.689***	1.689	20.858***	-12.602**
	(7.838)	(12.362)	(5.305)	(4.969)
Non-interest/interest income	-1.040***	-0.783***	-0.669***	-0.573***
	(0.353)	(0.177)	(0.104)	(0.169)
*Bank*quarter FE*	yes	yes	yes	yes
Country FE	yes	yes	no	no
First stage F-statistic			7.41	16.73
Hansen test p-value			0.98	0.27
R^2	0.94	0.89	0.52	0.28
N	875	1,641	766	766