Complexity in Large U.S. Banks

Linda Goldberg and April Meehl

Complexity in Large U.S. Banks

Linda Goldberg and April Meehl

OVERVIEW

• Bank size and complexity were identified as determinants of systemic importance following the global financial crisis. Research has shown that big U.S. banks have not shrunk in size since then. This article explores the evolution of the complexity—organizational, business, and geographic—of U.S. banking organizations over the period from 2007 to 2017.

• Organizational complexity, or the number of legal entities within a bank holding company (BHC), has decreased as the number of entities within the most complex BHCs has fallen.

• Business complexity, capturing the scope and concentration of industries across BHCs, has shifted more than it has declined, especially within the financial sector; nonfinancial entities within U.S. BHCs continue to tilt heavily toward real estate–related industries.

• Geographic complexity has decreased as fewer large BHCs have global affiliates and the geographic span of the most complex has declined.

In the wake of the global financial crisis, the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (hereafter called Dodd-Frank) identified bank size and complexity as determinants of systemic importance, with both features viewed as contributing to risks to financial stability. Since Dodd-Frank, big U.S. banks have not shrunk in size (Cetorelli and Stern 2015; Avraham, Selvaggi, and Vickery 2012; Goldberg and Meehl 2018). In this article, we ask if U.S. banking organizations have decreased in complexity in the decade since the global financial crisis. This new evidence on the evolving complexity of large U.S. BHCs compares 2007 with 2017.

As a starting point, we note that the complexity of bank holding companies (BHCs) cannot be well-captured by a single metric. The system established to address global systemically important banks[1] views complexity as a combination of balance-sheet and derivatives exposures and the number of distinct legal entities within the BHC. High levels of these components are associated with balance-sheet opacity and greater difficulty in valuing asset portfolios and exposures when BHCs fail.[2] We instead focus exclusively on U.S. BHC structural complexity, using information on all legal entities under the umbrella of each BHC conglomerate. Our work builds on earlier contributions to understanding

Linda Goldberg is a senior vice president and April Meehl a former research analyst at the Federal Reserve Bank of New York. Email: linda.goldberg@ny.frb.org; aimeehl@wisc.edu.

the structure and size of U.S. BHCs by Avraham, Selvaggi, and Vickery (2012) and Cetorelli, Jacobides, and Stern (2017) and of global organizations by Cetorelli and Goldberg (2014) and Carmassi and Herring (2010). We consider both existing and new measures that cover organizational, business, and geographic complexity. We also look more in depth at the industries and geographies of BHC subsidiaries. Our discussion zooms in on the changes that have occurred in complexity from 2007, just prior to the global financial crisis, to ten years later. This period encompasses both the crisis and the implementation of reforms such as Dodd-Frank and guidance around "living wills," and beyond.

We use the term "organizational complexity" to refer to the number of separate legal entities within a BHC, relevant for understanding why banks choose to be complex and how larger numbers contribute to higher resolution and systemic costs if a BHC fails. The term "business complexity" is used to capture the scope and concentration of businesses and industries across these legal entities. Finally, the term "geographic complexity" captures the domestic versus international locations of these entities, using information on their span and dispersion across countries.[3]

Comparing measures of organizational, business, and geographic complexity over the 2007-17 period for the largest U.S. BHCs, we conclude that BHCs have seen mixed outcomes when it comes to simplifying their organizations. Large BHCs remain very complex across organizational, business, and geographic dimensions. Nonetheless, the most organizationally complex have reduced the number of legal entities within their conglomerates and, in some cases, reduced the number of countries in which they have affiliates. The number of broad businesses spanned within BHCs has remained similar across time, while the industries spanned by entities within the BHCs have shifted more than they have declined, especially with respect to the financial industry breakdown. The nonfinancial entities within U.S. BHCs continue to tilt heavily toward real estate–related industries. Many of these subsidiaries are vehicles for community housing investments. Research has also shown that BHC performance tends to improve following expansion into financial businesses that were not previously the BHCs' points of focus (Cetorelli, Jacobides, and Stern 2017).

The number of large U.S. BHCs that have entities in foreign locations declined modestly in the decade following 2007. For those that remain global, geographic complexity is somewhat reduced. The large BHCs that have entities in a variety of countries also tend to have a significant share of those affiliates in locations associated with favorable tax regimes. The continued prominence of countries considered low-tax locations stands in marked contrast to the reduced prominence of affiliated entities in some emerging markets and informationally opaque locations. Many of the nonbank foreign subsidiaries of U.S. BHCs are concentrated in the United Kingdom and the Cayman Islands, while specific industries, such as insurance and real estate, have higher shares of subsidiaries in other locations.

The measures of BHC organizational, business, and geographic complexity are presented in Section 1 of this article. Section 2 compares the evolution of complexity across the fifty largest U.S. BHCs by using observations from 2007 as a pre-crisis snapshot and those from 2017 as a post-crisis snapshot. In Section 3, we delve more deeply into the business complexity of BHCs and provide details on the evolution of the scope of those legal entities, specifically within the financial services and nonfinancial sectors. We present a similar exercise in Section 4, looking at locations of foreign affiliates and their patterns across advanced economies, emerging

markets, tax havens, and financial secrecy locations. We also describe the pattern of locations of subsidiaries operating in specific industries.

Section 5 concludes with observations about the current complexity landscape, noting some potential drivers of this landscape. Regulators have clearly signaled that complexity should be reduced (Haldane 2015). The main argument for this view is that greater complexity, all else equal, can contribute to agency problems and make a failing bank harder to resolve, adding to systemic risk and the "too complex to fail" problem. Within Dodd-Frank, efforts to reduce complexity include the requirement that large BHCs periodically submit resolution plans, also known as living wills. So far, the dominant forms of change have been in the number of legal entities, without wholesale reductions in scope or dispersion. Yet the overall implications for types of BHC risk are not well understood, since diverse business lines and activities across countries can add value, synergies, diversification benefits, and efficiencies. Additional research is needed to further understand these important consequences of organizational, business, and geographic complexity.

1. Defining and Measuring Complexity

Many BHCs are corporate conglomerates with significant ownership positions or controlling interests in a range of legal entities (which we alternatively refer to as affiliates or subsidiaries) that can span bank and nonbank activities. As in the complexity measures of Cetorelli and Goldberg (2014), we use information on the structure, number, location, and industry type of bank and nonbank affiliates under each BHC. The core data set for our analysis is a complete and time-consistent panel of legal entities within all existing U.S. BHCs, created using Federal Reserve form FR Y-6 and FR Y-10 filings, described in Cetorelli and Stern (2015) and updated quarterly. (Form FR Y-6 is the means by which BHCs file their annual reports; each contains a subsidiary organizational chart. Form FR Y-10 is filed when a BHC changes its organizational structure.) Each affiliate within a BHC is coded with information on its primary industry, captured by one of 203 four-digit North American Industry Classification System (NAICS) codes,[4] and its country location.

Respective complexity metrics—organizational, business, and geographic—rely on counts of legal entities in each BHC. These counts are combined in various ways to explore different business or industry types, international versus U.S. locations of entities, and the dispersion of entities across the respective component. Implicit in the notation we use for complexity indexes at the level of the BHC is that an index is both BHC- and time-specific; we only include subscripts to distinguish the number and characteristics of the legal entities within each BHC.

The most basic measure of complexity and the only measure in the organizational complexity category is the total number of legal entities within the BHC, or *Count*.

Measures of business complexity use information on the industries and businesses of entities within the ownership structure of each BHC. These measures are alternatively constructed as counts or as Herfindahl-type indexes normalized and defined to take values between 0 and 1, and they increase in the dispersion of activities within the BHC. *Nonfinancial count share* is the share of legal entities that are not in the more broadly defined financial sector (two-digit NAICS code 52). *CountN* is the number of four-digit NAICS industries spanned by the legal

entities in the BHC. Industry type is indexed by i, or summed over every i for a BHC at a date and denoted by I. *CountB* is the total number of business types (maximum six) spanned by BHC affiliates, where we define business types as Banking, Insurance, Mutual and Pension Fund, Other Financial, Nonfinancial Management Firms, and Other Nonfinancial.[5] The dispersion of affiliate business types within the BHC and across its legal entities is given by a modified Herfindahl-type index, with $BHHI = \frac{CountB}{CountB-1}(1 - \Sigma_{b \in B}(\frac{count_b}{\Sigma_{b \in B} count_b})^2)$, where B is the set of business types, and $count_b$ is the number of a BHC's subsidiaries that are classified in accordance with each business type b. These measures take a value of zero if all entities are in banking and increase as the dispersion of entities across types of businesses rises.

Geographic measures begin with an indicator created to identify banks that hold at least one foreign-located subsidiary, *HasForeign*. This metric takes a value of 1 if the BHC has any affiliates in foreign locations and is 0 otherwise. Geographic location is denoted by country c, and the sum over all locations is denoted by C, which takes a minimum value of 1 if all affiliates of the BHC are situated within the U.S. Other measures include the count of countries spanned by the affiliates $CountC$, and a Herfindahl-Hirschman index of location dispersion across countries indicated by $CHHI = \frac{CountC}{CountC-1}(1 - \Sigma_{c \in C}(\frac{count_c}{\Sigma_{c \in C} count_c})^2)$ where C is the set of countries and $count_c$ is the count of a BHC's subsidiaries in each country c. *CHHI* is 0 when all of the BHC's legal entities are within the United States and increases as the dispersion across countries rises.[6]

## 2. Complexity Patterns in the Fifty Largest U.S. BHCs

Asset size and complexity are concentrated within the largest of the thousands of U.S. BHCs. Accordingly, our exploration of the evidence for complexity begins with the BHCs that have more than $1 billion in assets[7] and have a U.S. top holder.[8] The quarterly value of total BHC assets and the number of U.S. domestic BHCs satisfying these criteria are shown in Chart 1 for the period from 2007 through 2017. The red line and right scale show the total number of these BHCs, which gradually increased from about 400 in 2007 to over 500 by 2017. Their total assets rose from about $10 trillion in 2007 to $14 trillion by 2017 (left scale, upper grey contour). The assets of the largest fifty of these BHCs in each quarter, shown by the blue shaded bars, represent over 85 percent of the overall BHC assets. As complexity is also concentrated in the largest BHCs, below we focus solely on the largest fifty BHCs and compare complexity pre-crisis (2007) with that of a decade later (2017).

2.1 Broad Patterns in BHC Complexity

Patterns in complexity across the fifty largest U.S. BHCs are presented in summary form in Table 1, which provides the minimum, median, mean, and maximum values of each complexity metric in the second quarter of 2007 and the second quarter of 2017. On balance, compared to the pre-crisis date, by 2017 the largest U.S. BHCs tended to simplify in organizational, business, and geographic complexity while nonetheless increasing in size. While average BHC assets increased from 2007 to 2017, this increase in size was driven mainly by the largest of the

Total Assets and Number of BHCs Larger Than $1 Billion: 2007:Q2 to 2017:Q2
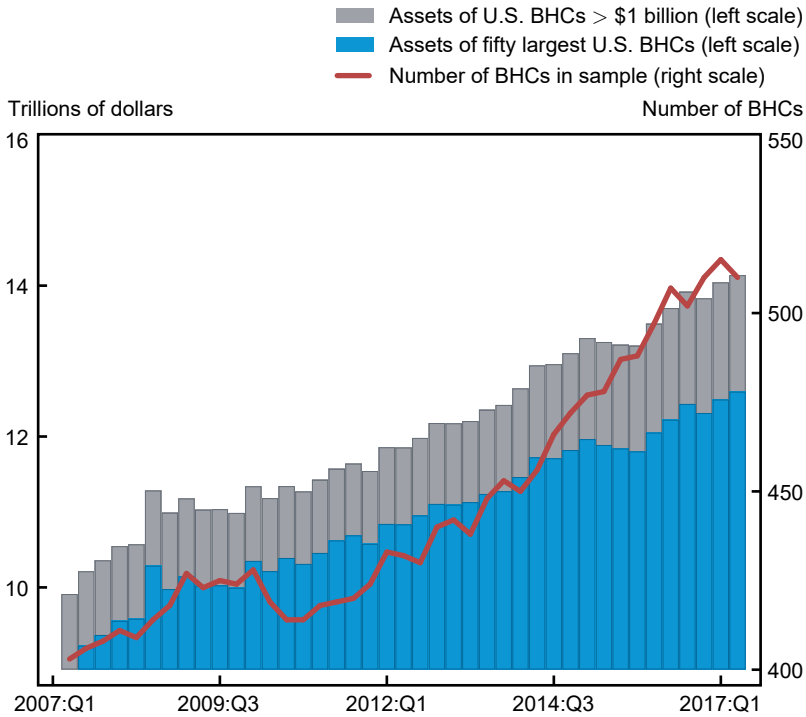
Source: Federal Reserve Board, *Consolidated Financial Statements of Bank Holding Companies* (FR Y-9C data).

Notes: Figures are based on FR Y-9C filings of U.S.-owned BHCs with assets over $1 billion. Asset totals and BHC counts exclude Goldman Sachs, Morgan Stanley, American Express, CIT Group, Ally Financial, Discover Financial Services, and MetLife.

large BHCs. The average number of legal entities within a BHC declined from 232 to 189, demonstrating a clear decline in organizational complexity despite increases in BHC assets. The changes in organizational, business, and geographic complexity between 2007 and 2017 are spread more broadly across the fifty largest BHCs.

Declines in business and geographic complexity are less pronounced than those observed for organizational complexity. On average, the fifty largest BHCs maintained five of the six business types, and marginally reduced the number of NAICS industries spanned by their affiliated entities (by two). The average share of nonfinancial subsidiaries increased only slightly between 2007 and 2017, from 38 percent to 40 percent. The share of BHCs with any foreign affiliates declined from 58 percent to 54 percent, implying that twenty-seven instead of twenty-nine of the fifty largest BHCs had affiliates in foreign locations. The average number of country locations spanned by these affiliates remained between seven and eight with a dispersion rate near 18 percent.

Table 1
Summary Statistics of Complexity Variables

	2007:Q2				2017:Q2			
	Min	Median	Mean	Max	Min	Median	Mean	Max
BHC assets (billions of dollars)	11.61	37.41	178.19	2,220.87	19.53	34.10	251.94	2,563.17
Organizational								
Count	5.00	59.50	231.68	2,834.00	4.00	39.00	189.48	1,258.00
Business								
Nonfinancial count share	0.05	0.36	0.38	0.92	0.05	0.38	0.40	0.97
CountB	4.00	5.00	5.14	6.00	3.00	5.00	4.88	6.00
BHHI	0.24	0.86	0.83	0.99	0.09	0.83	0.77	1.00
CountN	5.00	13.00	13.56	33.00	4.00	10.00	11.52	29.00
Geographic								
Has foreign	0.00	1.00	0.58	1.00	0.00	1.00	0.54	1.00
CountC	1.00	2.00	7.94	80.00	1.00	2.00	7.42	69.00
CHHI	0.00	0.06	0.18	0.84	0.00	0.03	0.17	0.81

Sources: Authors' calculations based on Federal Reserve Board, *Consolidated Financial Statements of Bank Holding Companies* (FR Y-9C data), *Annual Report of Holding Companies* (FR Y-6 data), and *Report of Changes in Organizational Structure* (FR Y-10 data).

Notes: Units are as follows: *Count* is the total number of legal entities in the BHC; *Nonfinancial count share* and *Has Foreign* are share of legal entities; *CountB* is the total number of business types; *BHHI* (dispersion of business types) and *CHHI* (dispersion across countries) use a scale of 0-1; *CountN* is the total number of four-digit NAICS codes; *CountC* is the total number of countries.

The two most organizationally complex BHCs in 2007 held 2,834 and 1,900 subsidiaries, respectively.[9] By contrast, the most complex BHC in 2017 held 1,258 subsidiaries. The number of subsidiaries within the top ten BHCs contrasts sharply with counts in the bottom forty. Business complexity patterns are less differentiated. The count of unique four-digit NAICS codes by BHC size rank shows a generally decreasing pattern as asset size declines. The number of NAICS codes within BHCs tended to decline from 2007 to 2017, especially among the largest BHCs.

Asset size and complexity are correlated but not comparable statistics across U.S. BHCs.[10] Chart 2 shows the relationship between BHC total affiliate count and assets in 2007 (blue dots) and in 2017 (red dots). The positive slopes of the solid fitted lines show that larger BHCs tend to have more legal entities within their organizations. The rightward shift of the line over data for the second quarter of 2017 shows that BHC assets are larger post-crisis and entity counts are smaller, given BHC asset size, in 2017 compared with 2007. Every vertical slice of this chart, regardless of whether we use information from 2007 or 2017, shows the substantial diversity in organizational complexity as represented by numbers of legal entities and conditional on size.

CHART 2

Organizational Complexity versus Assets for the Fifty Largest BHCs: 2007 and 2017
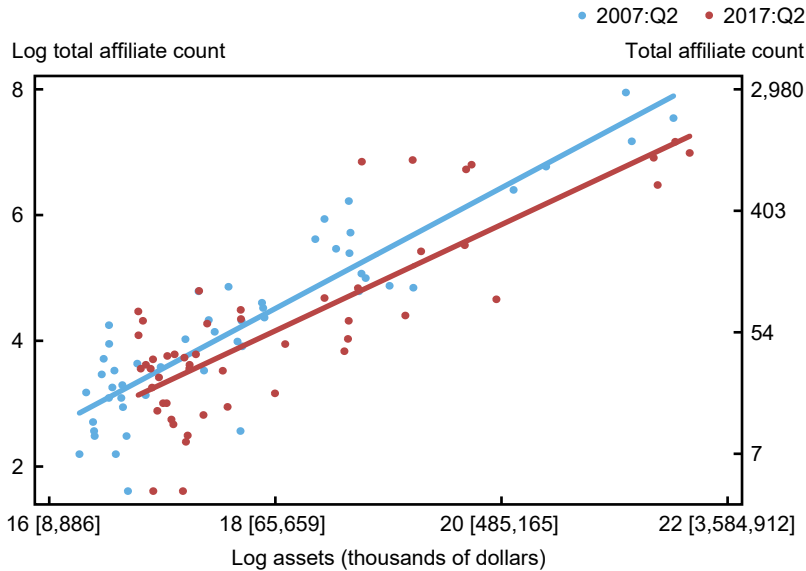
Sources: Authors' calculations based on Federal Reserve Board, *Consolidated Financial Statements of Bank Holding Companies* (FR Y-9C data), *Annual Report of Holding Companies* (FR Y-6 data), and *Report of Changes in Organizational Structure* (FR Y-10 data).

Notes: Observations represent the fifty largest BHCs by assets in 2007 and 2017. The values in brackets are the total assets equivalent of log assets in U.S. dollars. The right vertical axis shows the total affiliate count corresponding to the log total affiliate count on the left vertical axis. The solid lines are linear regressions fitted by date.

Only some forms of complexity are highly correlated with BHC size or with each other, as shown by the Pearson correlations presented in Table 2. The broad patterns by size are further illustrated in Chart 3. At each date, BHCs are sorted into quintiles by size, with quintile 1 capturing the ten largest BHCs and quintile 5 the ten smallest BHCs among this top fifty group. The panels provide box-and-whisker representations of the distribution of the complexity variable within the sample of BHCs and across dates. The larger BHCs tend to have more affiliates that span more industries and more countries. However, size is not strongly correlated with the dispersion of these affiliates across businesses or across locations. When the number of businesses expands, the dispersion of businesses tends to fall. The dispersion of business types, *BHHI*, is negatively correlated with all other complexity variables. There is little correlation between *Nonfinancial count share* and numbers of businesses and countries of affiliates. When a BHC adds more nonfinancial subsidiaries, these tend to be either domestic or in existing foreign locations, business types, and industries. Comparing pre- and post-crisis, the declines in counts of industries spanned and country locations were particularly concentrated in the largest quintiles of U.S. BHCs.

Table 2

Pearson Correlation of Complexity Metrics of Largest U.S. BHCs, 2017

Complexity Metric	BHC assets	Count	Nonfin count share	CountB	BHHI	CountN	Has foreign	CountC	CHHI
BHC assets	1								
Organizational									
Count	0.76	1							
Business									
Nonfinancial count share	0.03	0.27	1						
CountB	0.49	0.53	0.24	1					
BHHI	-0.22	-0.59	-0.30	-0.27	1				
CountN	0.81	0.74	0.21	0.75	-0.34	1			
Geographic									
Has foreign	0.36	0.47	0.15	0.40	-0.43	0.50	1		
CountC	0.84	0.78	-0.02	0.56	-0.23	0.83	0.47	1	
CHHI	0.44	0.41	-0.20	0.47	-0.18	0.54	0.69	0.69	1

Sources: Authors' calculations based on Federal Reserve Board, *Annual Report of Holding Companies* (FR Y-6 data) and *Report of Changes in Organizational Structure* (FR Y-10 data).
Note: Complexity metrics are based on 2017 quarterly data.

3. Business Complexity and BHC Affiliate Scope

BHCs have long operated in sectors outside of banking, including other financial and nonfinancial industries. Drivers and consequences of the decision to expand into or leave these industries are a ripe topic for research. For example, Cetorelli and Wang (2016) emphasize that growth of the BHCs' community housing affiliates has occurred to support obtaining Community Reinvestment Act credits and Low-Income Housing Tax Credits, and Cetorelli, Jacobides, and Stern (2017) find that BHCs saw improved performance on average when they altered their scope to resemble that of the modal BHC. Some BHCs may have first expanded into particular industries in order to seize opportunities to reallocate capital, bring production in-house, or create synergies from combining activities, for example. Other BHCs then diversified similarly to replicate the new modal structure.

Below, we highlight the key changes BHCs have made in their industrial composition from 2007 to 2017, looking separately at financial and nonfinancial affiliates. We document both trends and differences across BHCs. We observe that most BHCs have not decreased

CHART 3

Complexity of the Fifty Largest BHCs by Asset Size Quintile in 2007 and 2017
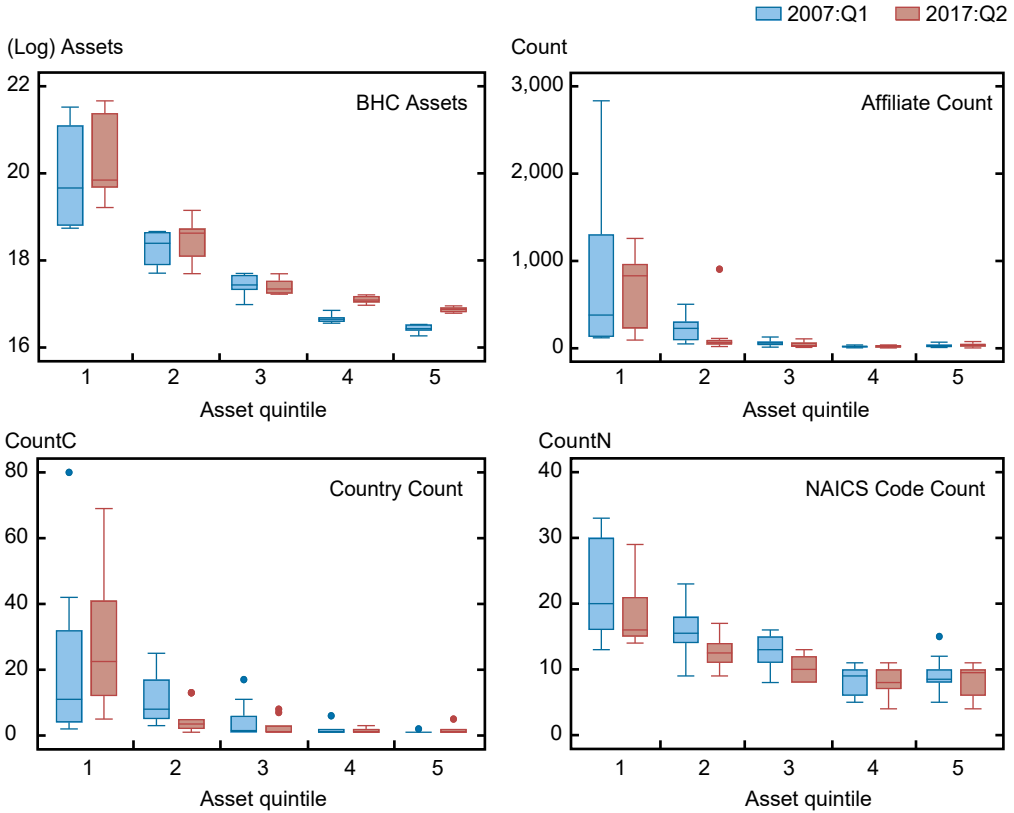
Sources: Authors' calculations based on Federal Reserve Board, *Consolidated Financial Statements of Bank Holding Companies* (FR Y-9C data), *Annual Report of Holding Companies* (FR Y-6 data), and *Report of Changes in Organizational Structure* (FR Y-10 data).

Notes: Box-and-whisker plots represent the distribution of the complexity metric for BHCs falling into each quintile of the size distribution of the largest fifty BHCs as determined by BHC assets. Asset quintile 1 represents the ten largest BHCs. The upper and lower whisker values represent 1.5 times the interquartile range above and below the 75th and 25th percentile, respectively. Values outside of the upper and lower whiskers are shown with dots. Count is the total number of legal entities in the BHC. CountC is the count of countries spanned by the affiliates; CountN is the number of four-digit NAICS industries spanned by the legal entities in the BHC.

their industry scope since 2007; instead, they have shifted their concentration across industries. Correa and Goldberg (2019) show that BHCs' idiosyncratic and liquidity risk exposures decrease with organizational complexity and geographic scope, which may also be providing diversification gains.

CHART 4
Share of Commercial Banks in Total Financial Affiliates by BHC Asset Size Quintile
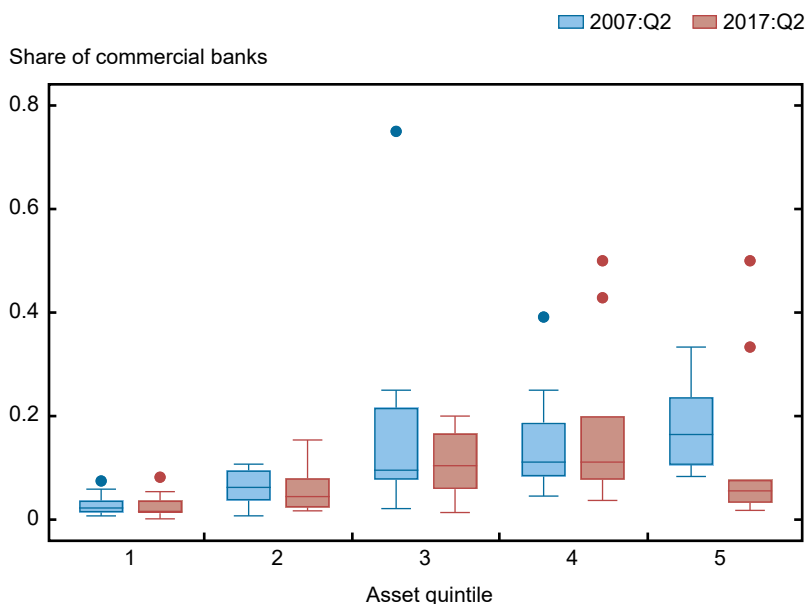

Sources: Authors' calculations based on Federal Reserve Board, *Consolidated Financial Statements of Bank Holding Companies* (FR Y-9C data), *Annual Report of Holding Companies* (FR Y-6 data), and *Report of Changes in Organizational Structure* (FR Y-10 data).

Notes: Box-and-whisker plots represent the distribution of the share of commercial banks for BHCs falling into each quintile of the size distribution of the fifty largest BHCs as determined by BHC assets. Asset quintile 1 represents the ten largest BHCs. The upper and lower whisker values represent 1.5 times the interquartile range above and below the 75th and 25th percentile, respectively. Values outside of the upper and lower whiskers are shown with dots.
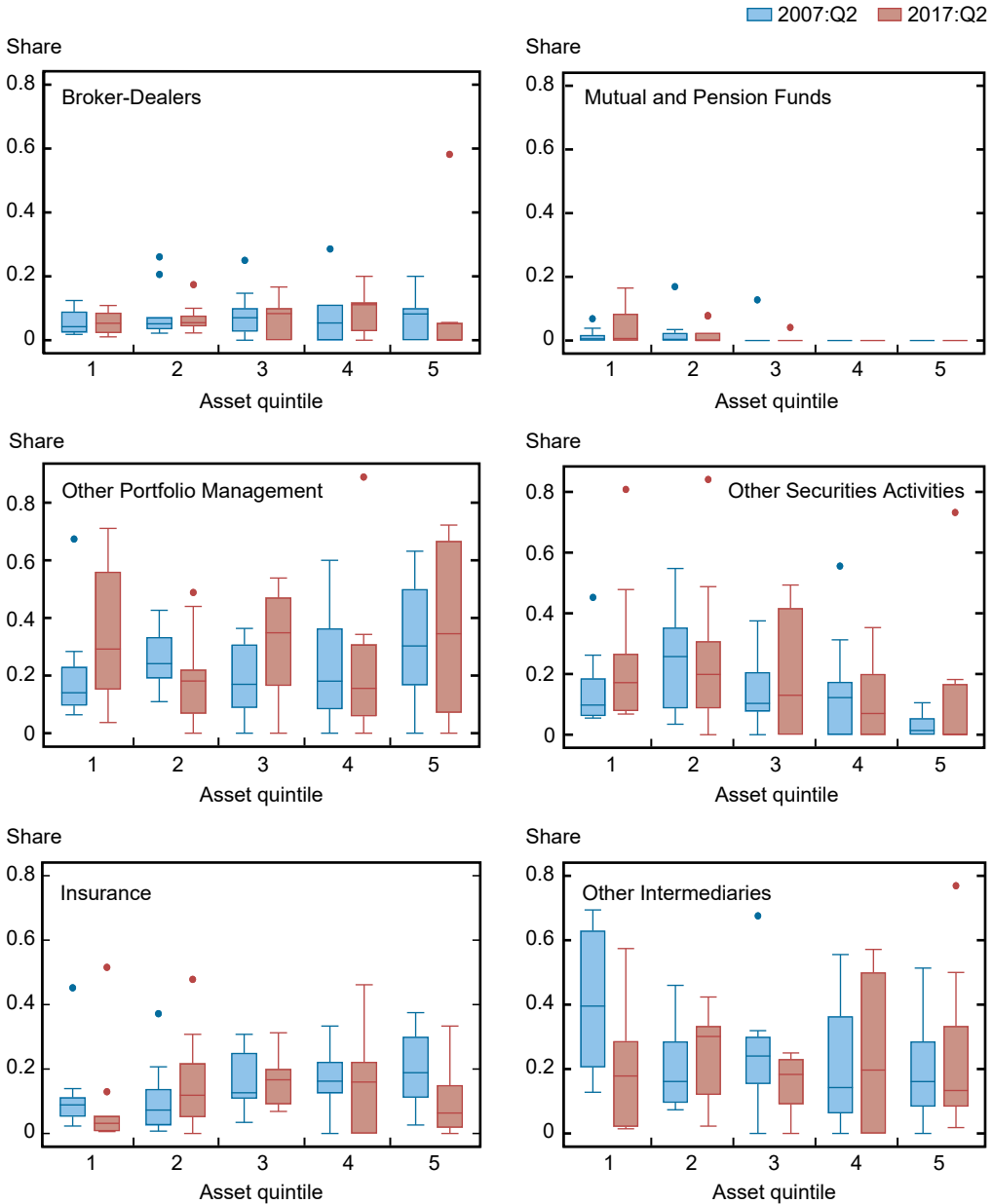
3.1 Financial Entities

Only a small fraction of the legal entities within BHCs are commercial banks, even if these entities account for a large share of BHC total assets. The share of commercial banks in the financial entities of BHCs ranges from less than 1 percent to around 20 percent, both pre- and post-crisis. As shown in Chart 4, which depicts the top fifty BHCs sorted by size into quintiles at 2007 and again at 2017, that share changed in idiosyncratic ways across BHCs. The majority of their subsidiaries fall into the category of "Other Financials" (Table A1).

In the past decade, large U.S. BHCs have shifted the composition of their financial subsidiaries away from bank intermediaries (Chart 5). There has been a large increase in subsidiaries classified as portfolio management, with three large BHCs more than tripling their share of affiliates in portfolio management from 2007 to 2017. The largest five BHCs' average share of portfolio management affiliates is over 40 percent. Also increasing was the share of financial subsidiaries involved in "other securities activities," defined as the catch-all for

CHART 5
Share of Type of Financial Affiliates in Total Financial Affiliates by BHC Asset Size Quintile

Sources: Authors' calculations based on Federal Reserve Board, *Consolidated Financial Statements of Bank Holding Companies* (FR Y-9C data), *Annual Report of Holding Companies* (FR Y-6 data), and *Report of Changes in Organizational Structure* (FR Y-10 data).

Notes: Box-and-whisker plots represent the distribution of the complexity metric for BHCs falling into each quintile of the size distribution of the fifty largest BHCs as determined by BHC assets. Asset quintile 1 represents the ten largest BHCs. The upper and lower whisker values represent 1.5 times the interquartile range above and below the 75th and 25th percentile, respectively. Values outside of the upper and lower whiskers are shown with dots.

other financial investment activities but excluding activity categorized as relating to securities and commodity exchanges, portfolio management, and trust and custody activities. The change in this share of BHC entities in "other portfolio management" is particularly pronounced: One large BHC had a share greater than 50 percent in 2007 compared with four BHCs in 2017 (Table A2). The decline in the share of other types of financial intermediaries is also clear: Five BHCs had shares of over 30 percent in 2007 compared with only one in 2017. Insurance companies make up a greater proportion of financial affiliates for the smaller BHCs both in 2007 and 2017.

3.2 Nonfinancial Entities

All of the large U.S. BHCs have nonfinancial subsidiaries. The biggest categories of nonfinancial subsidiaries tend to fall within the industries for housing, real estate, and management companies (Table A3). The total share of nonfinancial entities within these three categories rose significantly from 2007 to 2017, with considerable differences across the BHCs. Management companies are the most popular nonfinancial affiliate type, with the five largest BHCs holding an average share of all nonfinancial entities of around 30 percent in both 2007 and 2017. Among the largest quintile of BHCs, the minimum share of housing subsidiaries rose from 10 percent in 2007 to 25 percent in 2017. In terms of NAICS codes, some housing entities (code 62422) replaced real estate–related entities (code 53), as the average share of the latter decreased from 20 percent in 2007 to 13 percent in 2017.

4. Geographic Complexity

Comparing pre-crisis with post-crisis dates, two fewer BHCs among the fifty largest have any foreign-located subsidiaries. The relationship between BHC size and the share of foreign affiliates is positive, as geographic complexity is more prevalent in larger BHCs but still highly differentiated even within size buckets among these large BHCs (Chart 6). While the ten largest BHCs in 2017 had a greater foreign share in total entity counts than the ten largest in 2007, some of this change stems from the larger reduction in domestically located entities within BHCs, consistent with the BHCs' broader decline in organizational complexity. Many of the largest U.S. BHCs operated in fewer countries in 2017 than in 2007, another sign of reduced geographic complexity. In 2017, 45 percent of bank entities were outside the United States, up from 34 percent in 2007 (Table 3). Substantially higher shares of mutual and pension funds, and a lower share of insurance entities, are now located outside the United States.

The locational choices of the foreign banking subsidiaries and branches of global banks have long been the subject of academic research and debate.[11] These choices have been linked to international trade in goods and services, country and institution growth rates, and comparative advantage in bank and country productivity rates. The post-crisis period has seen noteworthy waves of contraction in cross-border bank lending volumes, especially in bank-to-bank transactions (Milesi-Ferreti and Tille 2011). Overall, global activities have also

CHART 6

Share of Foreign Affiliates versus Assets for the Fifty Largest BHCs: 2007 and 2017

Sources: Authors' calculations based on Federal Reserve Board, *Consolidated Financial Statements of Bank*
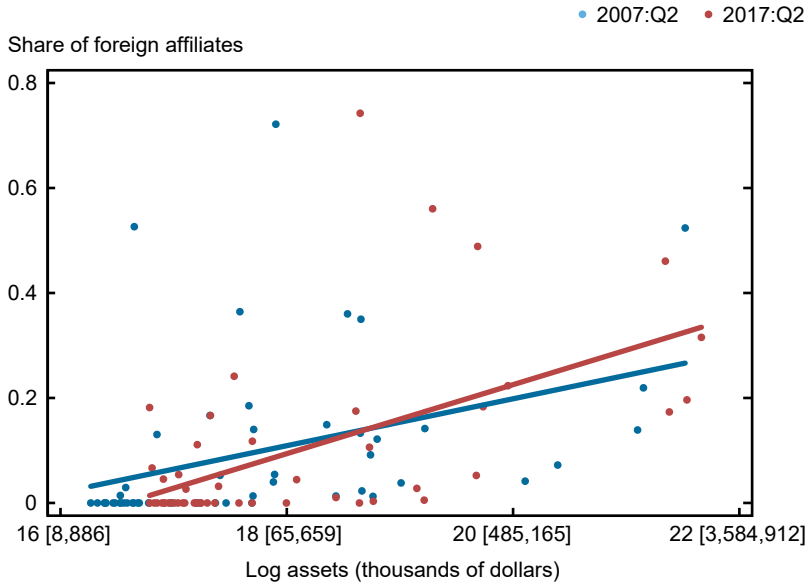
Holding Companies (FR Y-9C data), *Annual Report of Holding Companies* (FR Y-6 data), and *Report of Changes in Organizational Structure* (FR Y-10 data).

Notes: Observations represent the fifty largest BHCs by assets in 2007 and 2017. The values in brackets are the total assets equivalent of log assets in U.S. dollars. The solid lines are linear regressions fitted by date.

been rebalanced toward banking systems that are better capitalized and toward nonbank market-based financing (Avdjiev, Gambacorta, Goldberg, and Schiaffi, forthcoming). The share of U.S. banks has risen around the world, even as fewer U.S. BHCs are involved.

Less attention has been paid to the other nonbank affiliates of these financial conglomerates, which dominate the absolute numbers of foreign affiliates within BHC conglomerates. Location choices could be driven by factors similar to those for the bank affiliates. Additionally, the development of institutions and the size and depth of financial markets could matter, along with potentially favorable tax treatment and the degree of opacity or secrecy locally. Know-your-customer (KYC), anti-money laundering (AML), and compliance costs for combating the financing of terrorism could also play a role, as such concerns have been associated with the derisking of global banks and reduced activity in some foreign markets (Erbenova et al. 2016).

We highlight some of these considerations by sorting the foreign affiliates of U.S. BHCs according to location. The sort has two dimensions. First, it distinguishes between affiliates within advanced economies (AEs) and those within emerging markets (EMs). Second, it distinguishes locations that have low-tax jurisdictions or weak transparency/high secrecy, using two indicators from the Financial Secrecy Index (FSI) of the Tax Justice Network:

TABLE 3

Share of Foreign Affiliates by Business Type

	2007:Q2	2017:Q2
Banks	.34	.45
Insurance	.16	.10
Mutual and Pension Funds	.34	.54
Other Financial	.26	.29
Nonfinancial Management Firms	.33	.36
Other Nonfinancial	.07	.05

Sources: Authors' calculations based on Federal Reserve Board, *Annual Report of Holding Companies* (FR Y-6 data) and *Report of Changes in Organizational Structure* (FR Y-10 data).

Note: The table presents the share of foreign affiliates for each business type across all of the fifty largest BHCs in 2007 and 2017.

Secrecy Score and Tax Credits.[12] The secrecy score is calculated based on the average of twenty different indicators. The score is equal to a percentage between 0 and 100, with 100 representing the greatest amount of secrecy (least transparency). The FSI metric of tax credits, one of the twenty indicators used to create the secrecy score, focuses specifically on a country's level of promotion of tax evasion based on the existence of unilateral tax credits.[13] The secrecy score should capture at least some of the KYC and AML locations that have been the focus of international bank derisking discussions.[14]

Table 4 provides a breakdown of the number of BHCs that have affiliates in foreign locations, in low-tax jurisdictions, and in high financial secrecy locations by BHC size quintile. This table also illustrates the stark positive relationship between size and involvement in low-tax and high financial secrecy locations. The number of BHCs in the top quintiles with affiliates in low-tax jurisdictions was unchanged from 2007 to 2017, while the next quintile registered a decrease. This second quintile also had fewer BHCs in high financial secrecy locations. The shares of total foreign affiliates in these locations also changed. In 2007, the median share of foreign affiliates in low-tax jurisdictions for BHCs in quintile 1 was 50 percent, compared with 40 percent in 2017. For quintile 2, these shares were 42 percent and 27 percent, respectively. Of the few BHCs with affiliates located in high financial secrecy locations, these affiliates make up a very small share of their total foreign affiliates. In quintile 1, the median share of foreign affiliates in these locations was 0.8 percent in 2007 and 0.6 percent in 2017. Out of all BHCs in the top fifty, the maximum share of foreign affiliates in high financial secrecy locations was 100 percent in 2007 and 50 percent in 2017.

Tables 5 and 6 provide a more detailed look at the evolution of affiliate locations, also considering the numbers in low-tax jurisdictions or high financial secrecy locations. In each table, the upper panel provides the total count of BHCs out of the fifty largest BHCs with at least one subsidiary located in advanced economies (AE) or emerging markets (EM). The lower panel provides the count of all affiliates out of the total sample of affiliates held by the fifty largest

Number of BHCs with Affiliates in High Financial Secrecy Countries and Low-Tax Jurisdictions, by Asset Size Quintile

Quintile	2007:Q2			2017:Q2		
	Foreign Affiliates	Low-Tax Jurisdiction	High Financial Secrecy	Foreign Affiliates	Low-Tax Jurisdiction	High Financial Secrecy
1	10	10	5	10	10	7
2	10	10	5	8	6	1
3	5	4	1	3	2	1
4	3	3	0	3	2	1
5	1	1	1	3	1	0

Sources: Authors' calculations based on Federal Reserve Board, *Annual Report of Holding Companies* (FR Y-6 data) and *Report of Changes in Organizational Structure* (FR Y-10 data).

Notes: The table presents the number of BHCs that have foreign affiliates in low-tax jurisdictions and high financial secrecy countries, by asset quintile. The maximum number of BHCs in each quintile is ten.

BHCs that are located in advanced economies or emerging markets. Each panel further enumerates those entities in low-tax or high financial secrecy jurisdictions. Table 5 focuses on all foreign affiliates, banks, and total nonbanks. Table 6 presents the disaggregation by nonbank business type.

In the past decade, the fifty largest BHCs have shifted the balance of locations of their foreign subsidiaries slightly toward advanced economies over emerging markets. Total counts of foreign entities under large U.S. BHCs declined from 2007 to 2017. Bank affiliates significantly contracted in both AE and EM locations (Table 5). The total number of BHCs with banking affiliates in AE locations declined from eleven to eight, while those in EMs remained at only six BHCs out of the fifty largest. Within AEs, these declines were not only in the financial secrecy locations that have received attention around derisking. Indeed, the banking affiliate declines were more substantial in low-tax jurisdictions than in jurisdictions with high financial secrecy ratings. Among EMs, the Cayman Islands remain the most popular secretive location for subsidiaries of large U.S. BHCs.

Among the foreign nonbank entities within U.S. BHCs, the number of BHCs declined in both AE and EM locations, with declines in each type of EM location (Table 5). The number of entities in AE low-tax jurisdictions increased from 291 to 300, but spanned a smaller number of BHCs. Affiliates in secrecy locations remained stable. Entities in EM low-tax jurisdictions are far more prevalent than those associated with financial secrecy, but they still declined substantially from 2007 to 2017. The largest share of nonbank affiliates is in "Other Financial," which covers activities such as other portfolio managers, broker-dealers, other intermediaries, and other securities activities (Table A6). Foreign nonfinancial management companies, which perform activities such as financial planning, billing, and recordkeeping, and physical distribution, declined substantially in both AEs and EMs, outside of the secrecy

Table 5

Location of U.S. BHC Foreign Entities, by BHCs and Counts of Entities

	Total Entities		Banking Entities		Nonbank Entities	
A. By BHCs						
	2007	2017	2007	2017	2007	2017
In advanced economies						
All locations	25	22	11	8	25	22
Low-tax jurisdiction	21	13	7	5	21	13
High financial secrecy	5	7	1	1	5	7
In emerging markets						
All locations	25	22	6	6	25	21
Low-tax jurisdiction	24	19	4	3	24	19
High financial secrecy	10	8	1	1	10	8
B. By Affiliate Count						
In advanced economies						
All locations	1,378	1,222	40	26	1,338	1,196
Low-tax jurisdiction	302	307	11	7	291	300
High financial secrecy	29	30	1	2	28	28
In emerging markets						
All locations	884	741	60	43	824	698
Low-tax jurisdiction	531	442	17	10	514	432
High financial secrecy	64	49	5	2	59	47

Sources: Authors' calculations based on Federal Reserve Board, *Annual Report of Holding Companies* (FR Y-6 data) and *Report of Changes in Organizational Structure* (FR Y-10 data).

Notes: The table presents the locational breakdown of U.S. BHCs and their affiliates. Table A7 lists the countries in the low-tax jurisdiction and high financial secrecy categories.

locations of AEs and primarily declining in the EM low-tax locations. The rebalancing of activity away from insurance affiliates and toward pension and mutual funds is again reflected here, with the rise in mutual and pension funds largely occurring through affiliates in low-tax jurisdictions in the decade after the financial crisis.

Table 6
Location of U.S. BHC Foreign Entities by Affiliate Type, by BHCs and Counts of Entities

A. By BHCs

	Mutual Fund		Insurance		Other Financial		Nonfinancial Management		Other Nonfinancial	
	2007	2017	2007	2017	2007	2017	2007	2017	2007	2017
In advanced economies										
All locations	7	6	5	3	23	19	16	14	14	15
Low-tax jurisdiction	2	3	2	0	20	12	11	9	9	7
High financial secrecy	1	0	1	0	4	7	1	3	1	2
In emerging markets										
All locations	4	4	12	9	18	18	12	10	18	12
Low-tax jurisdiction	3	4	12	7	18	15	12	9	14	9
High financial secrecy	0	0	4	1	6	5	4	4	2	3
B. By Affiliate Count										
In advanced economies										
All locations	18	97	31	3	885	793	239	220	165	83
Low-tax jurisdiction	5	42	4	0	205	193	53	50	24	15
High financial secrecy	1	0	2	0	19	19	3	7	3	2
In emerging markets										
All locations	17	41	44	17	448	445	153	115	162	80
Low-tax jurisdiction	11	36	32	12	271	277	109	75	91	32
High financial secrecy	0	0	5	1	33	30	11	8	10	8

Sources: Authors' calculations based on Federal Reserve Board, *Annual Report of Holding Companies* (FR Y-6 data) and *Report of Changes in Organizational Structure* (FR Y-10 data).

Notes: The table presents the locational breakdown of U.S. BHCs and their affiliates. Table A7 lists the countries in the low-tax jurisdiction and high financial secrecy categories.

5. Conclusion

The largest U.S. BHCs entered the global financial crisis with substantial organizational, business, and geographic complexity. We provide metrics of these forms of complexity for U.S. BHCs covering pre-crisis and post-crisis dates. Organizational complexity, captured by the count of legal entities within respective U.S. BHCs, tends to be higher for larger BHCs (as measured by assets), with considerable variation by BHC size. Some of the largest BHCs had significant declines in affiliate counts in the decade after the financial crisis, and the majority of the rationalized affiliates were located within the United States. While the largest BHCs hold a substantial number of subsidiaries in foreign locations, only about half of the top fifty BHCs have even one foreign subsidiary. The number of countries in which a BHC has subsidiaries has tended to decline, especially in locations associated with financial secrecy. Low-tax locations remain popular among the geographically complex large U.S. BHCs.

Business complexity, measured using information on the industries of entities within BHCs, has tended to transform more than simplify. Most large BHCs have entities that span banking, fund management, insurance, and nonfinancial activities, even if they differ substantially in the finer sub-industry composition. The nonfinancial share of entities within BHCs remains large, while the number of industries spanned by these entities is somewhat smaller than it was pre-crisis. Within the financial industries, BHCs shifted toward less traditional financial subsidiaries such as portfolio management firms and other securities activities, resulting in reduced shares of commercial banks, insurance firms, and other intermediaries.

Simplification of bank complexity was one of the policy priorities of the post-crisis period. Regulatory frameworks continue to focus on limiting the risk of failure by improving banks' ability to absorb risk and on improving resolution mechanisms for these BHCs in the event of failure (Stiroh 2018). The concept of optimal complexity in U.S. BHCs still warrants additional analysis. Further research is needed on the implications of complexity for the full bank holding company, for the specific entities within the BHCs, and for financial stability more broadly. Research could establish which forms of business and geographic complexity support diversification, efficiencies, and risk sharing, adding value by increasing performance and potentially enhancing institutional robustness. These positive attributes would contrast with the negative contributions of bank complexity to agency problems and moral hazard, and the systemic externalities that motivated strengthening bank recovery and resolution initiatives. While reducing the costs of bank failure has been targeted by policy initiatives, this additional analysis will better inform the evolving consequences of the different forms of complexity during the lives of these large financial conglomerates.

Appendix

Table A1

Breakdown of Business Types by Asset Size Quintile

Quintile	Banks		Insurance		Mutual and Pension Funds		Other Financial		Nonfinancial Management Firms		Other Nonfinancial	
	2007:Q2	2017:Q2	2007:Q2	2017:Q2	2007:Q2	2017:Q2	2007:Q2	2017:Q2	2007:Q2	2017:Q2	2007:Q2	2017:Q2
1	.015	.012	.038	.015	.008	.035	.453	.504	.109	.103	.377	.330
2	.018	.010	.029	.026	.013	.004	.369	.203	.072	.048	.499	.708
3	.101	.033	.067	.060	.009	.007	.399	.394	.136	.253	.288	.253
4	.093	.115	.098	.081	.000	.000	.498	.488	.149	.115	.163	.201
5	.131	.041	.093	.033	.000	.000	.455	.631	.076	.047	.245	.248

Sources: Authors' calculations based on Federal Reserve Board, *Annual Report of Holding Companies* (FR Y-6 data) and *Report of Changes in Organizational Structure* (FR Y-10 data).

Note: The table presents the breakdown of business types by share for the fifty largest BHCs ranked by assets.

Appendix (Continued)

Table A2

Breakdown of Financial Entities by Asset Size Quintile

Quintile	Commercial Banks		Other Intermediaries		Broker-Dealers		Other Portfolio Management	
	2007:Q2	2017:Q2	2007:Q2	2017:Q2	2007:Q2	2017:Q2	2007:Q2	2017:Q2
1	.032	.022	.360	.122	.067	.050	.235	.430
2	.047	.045	.175	.262	.069	.060	.278	.214
3	.201	.074	.253	.137	.064	.095	.186	.253
4	.159	.180	.206	.180	.063	.068	.254	.346
5	.201	.063	.206	.158	.053	.150	.354	.333

Quintile	Other Securities Activities		Insurance		Mutual and Pension Funds	
	2007:Q2	2017:Q2	2007:Q2	2017:Q2	2007:Q2	2017:Q2
1	.211	.283	.078	.028	.017	.064
2	.324	.286	.076	.114	.032	.018
3	.143	.295	.134	.132	.018	.016
4	.151	.098	.167	.128	.000	.000
5	.042	.246	.143	.050	.000	.000

Sources: Authors' calculations based on Federal Reserve Board, *Annual Report of Holding Companies* (FR Y-6 data) and *Report of Changes in Organizational Structure* (FR Y-10 data).

Notes: The table presents the breakdown of financial affiliates by share for the fifty largest BHCs ranked by assets. Four-digit NAICS codes are used to sort the financial firms into the seven categories shown.

Table A3

Breakdown of Nonfinancial Entities by Asset Size Quintile

Quintile	Housing		Utilities and Construction		Manufacturing and Wholesale Trade	
	2007:Q2	2017:Q2	2007:Q2	2017:Q2	2007:Q2	2017:Q2
1	.193	.318	.012	.001	.001	.000
2	.324	.424	.001	.000	.001	.000
3	.056	.024	.016	.017	.002	.009
4	.067	.106	.000	.000	.000	.000
5	.022	.117	.000	.000	.000	.000

Quintile	Nonfinancial Management Firms		Other		Real Estate	
	2007:Q2	2017:Q2	2007:Q2	2017:Q2	2007:Q2	2017:Q2
1	.112	.119	.050	.031	.132	.031
2	.063	.032	.051	.021	.059	.023
3	.160	.250	.162	.052	.104	.149
4	.239	.182	.104	.023	.090	.189
5	.118	.079	.210	.136	.151	.168

Sources: Authors' calculations based on Federal Reserve Board, *Annual Report of Holding Companies* (FR Y-6 data) and *Report of Changes in Organizational Structure* (FR Y-10 data).

Notes: The table presents the breakdown of nonfinancial affiliates by share for the fifty largest BHCs ranked by assets. Two-digit NAICS codes are used to sort the nonfinancial firms into the six categories shown.

Appendix (Continued)

Table A4

The Fifty Largest BHCs in 2007 and 2017 (1-25)

	2007:Q2		2017:Q2	
Rank	Highholder Name	Highholder Assets (Billions of Dollars)	Highholder Name	Highholder Assets (Billions of Dollars)
1	CITIGROUP	2,220.87	JPMORGAN CHASE & CO	2,563.17
2	BANK OF AMER CORP	1,535.68	BANK OF AMER CORP	2,256.10
3	JPMORGAN CHASE & CO	1,458.04	WELLS FARGO & CO	1,930.87
4	WACHOVIA CORP	719.92	CITIGROUP	1,864.06
5	WELLS FARGO & CO	539.87	U S BC	463.84
6	U S BC	222.53	PNC FNCL SVC GROUP	372.36
7	SUNTRUST BK	180.31	BANK OF NY MELLON CORP	354.82
8	CAPITAL ONE FC	145.94	CAPITAL ONE FC	350.59
9	NATIONAL CITY CORP	140.65	STATE STREET CORP	238.28
10	REGIONS FC	137.62	BB&T CORP	221.19
11	BB&T CORP	127.58	SUNTRUST BK	207.32
12	BANK OF NY CO	126.46	FIFTH THIRD BC	141.07
13	PNC FNCL SVC GROUP	125.74	KEYCORP	136.36
14	STATE STREET CORP	112.35	NORTHERN TR CORP	125.61
15	FIFTH THIRD BC	101.39	REGIONS FC	124.78
16	KEYCORP	93.49	M&T BK CORP	120.90
17	NORTHERN TR CORP	59.61	HUNTINGTON BSHRS	101.41
18	COMERICA	58.95	COMERICA	71.63
19	MARSHALL & ILSLEY CORP	58.33	ZIONS BC	65.45
20	CHARLES SCHWAB CORP	49.00	SVB FNCL GRP	48.44
21	ZIONS BC	48.70	NEW YORK CMNTY BC	48.34
22	COMMERCE BC	48.23	PEOPLES UNITED FNCL INC	43.02
23	POPULAR	46.99	POPULAR	41.24
24	MELLON FNCL CORP	43.39	EAST WEST BC	35.93
25	FIRST HORIZON NAT CORP	38.40	FIRST CITIZENS BSHRS	34.77

Source: Federal Reserve Board, *Annual Report of Holding Companies* (FR Y-6 data).

APPENDIX (CONTINUED)

TABLE A5

The Fifty Largest BHCs in 2007 and 2017 (26-50)

	2007:Q2		2017:Q2	
Rank	Highholder Name	Highholder Assets (Billions of Dollars)	Highholder Name	Highholder Assets (Billions of Dollars)
26	HUNTINGTON BSHRS	36.42	RAYMOND JAMES FNCL	33.43
27	COMPASS BSHRS	34.94	BOK FC	32.52
28	SYNOVUS FC	33.30	FNB CORP	30.75
29	NEW YORK CMNTY BC	29.64	SYNOVUS FC	30.69
30	COLONIAL BANCGROUP	23.82	CULLEN/FROST BKR	30.23
31	ASSOCIATED BANC CORP	20.85	ASSOCIATED BANC-CORP	29.77
32	BOK FC	19.36	FIRST HORIZON NAT CORP	29.37
33	W HOLD CO	17.83	BANKUNITED	28.99
34	FIRST BC	17.61	WINTRUST FC	26.93
35	INVESTORS FNCL SVC CORP	17.06	HANCOCK HC	26.64
36	WEBSTER FNCL CORP	16.97	WEBSTER FNCL CORP	26.19
37	SKY FNCL GROUP	16.81	UMPQUA HC	25.26
38	FIRST CITIZENS BSHRS	16.01	COMMERCE BSHRS	25.10
39	CITY NAT CORP	15.81	INVESTORS BC	24.33
40	COMMERCE BSHRS	15.53	VALLEY NAT BC	23.45
41	NEW YORK PRIV B&TR CORP	15.10	TEXAS CAP BSHRS	23.12
42	FULTON FNCL CORP	15.08	PROSPERITY BSHRS	22.30
43	TCF FC	15.07	PACWEST BC	22.25
44	FBOP CORP	14.38	TCF FC	22.07
45	SOUTH FNCL GROUP	14.14	IBERIABANK CORP	21.79
46	CITIZENS REPUBLIC BC	13.28	PINNACLE FNCL PTNR	20.89
47	BANCORPSOUTH	13.21	UMB FC	20.35
48	CULLEN/FROST BKR	13.09	MB FNCL	19.97
49	VALLEY NAT BC	12.32	FULTON FNCL CORP	19.57
50	R&G FNCL CORP	11.61	STIFEL FNCL CORP	19.53

Source: Federal Reserve Board, Annual Report of Holding Companies (FR Y-6 data).

Appendix (Continued)

Table A6
Classification of Affiliate Types

	Business Type	Affiliate Type	NAICS Codes
Financial affiliates	Commercial Banks	Commercial Banks	5221
	Mutual and Pension Funds	Mutual and Pension Funds	52511, 52591
	Insurance	Insurance	5242, 5241
	Other Financial	Other Portfolio Managers	52599, 52392, 52590, 52519, 52592
		Broker-Dealers	5231, 5232
		Other Intermediaries	5222, 5223
		Other Securities Activities	5239
Nonfinancial affiliates	Nonfinancial Management Firms	(Nonfinancial) Management Companies	55
	Other Nonfinancial	Real Estate	53
		Housing	62422
		Utilities and Construction	21, 22, 23
		Manufacturing and Wholesale Trade	31, 32, 33, 42, 45
		Other	11, 48, 49, 51, 54, 56, 61, 62 (no 62422), 71, 72, 81

Notes: The table presents the authors' classification for business types, broken down into financial and nonfinancial entities, and the associated NAICS codes. The classification uses four-digit NAICS codes for all financial entities and two-digit NAICS codes for all nonfinancial entities. To further break down portfolio management, the classification uses six-digit NAICS codes to differentiate between mutual and pension funds and other portfolio management. In other nonfinancial entities, NAICS code 62422 is community housing, so it is listed in its own category.

APPENDIX (CONTINUED)

TABLE A7

List of Countries by Low-Tax Jurisdiction and High Financial Secrecy (2018)

Low-Tax Jurisdiction	High Financial Secrecy	None
Aruba	Aruba	Australia
Bahamas	Bahamas	Austria
Bahrain	Bahrain	Belgium
Barbados	Bolivia	Botswana
Bermuda	Brunei	Brazil
Bolivia	Kenya	Bulgaria
British Virgin Islands	Liberia	Canada
Brunei	Liechtenstein	Chile
Cayman Islands	Monaco	China
Costa Rica	Panama	Cook Islands
Czech Republic	Paraguay	Cyprus
France	Saint Lucia	Denmark
Gibraltar	Seychelles	Dominican Republic
Guatemala	Switzerland	Finland
Hong Kong	Taiwan	Germany
Ireland	Thailand	Greece
Kenya	Turks and Caicos Islands	Hungary
Liberia	United Arab Emirates	Iceland
Liechtenstein	Vanuatu	India
Malta		Indonesia
Mauritius		Israel
Mexico		Italy
Netherlands		Japan
New Zealand		Lebanon
Paraguay		Luxembourg
Philippines		Macao
Russia		Malaysia
Saint Lucia		Marshall Islands
Seychelles		Norway
Singapore		Poland
Switzerland		Portugal
Thailand		Romania
Turks and Caicos Islands		Saudi Arabia
Ukraine		South Africa
United Arab Emirates		South Korea
Uruguay		Spain
Vanuatu		Sweden
		Tanzania
		Turkey
		United Kingdom
		United States
		Venezuela

Source: Tax Justice Network, Financial Secrecy Index.

Notes: The table shows the countries with low-tax jurisdictions (tax credit score below 10), high financial secrecy (secrecy score above 75), or neither (high-tax jurisdiction or low financial secrecy) based on 2018 scores.

Notes

[1] The classification of these banks and the criteria used can be found at https://www.bis.org/bcbs/publ/d445.htm.

[2] Demsetz and Strahan (1997) and Chernobai, Ozdagli, and Wang (2018) evaluate complexity using balance-sheet measures such as nonbank assets and noninterest income in order to capture the effects on operational and firm-specific risk, respectively.

[3] Herring and Carmassi (2010) and Carmassi and Herring (2016) focus on shares of the total number of entities that fall into categories such as foreign-located, size larger than $10 billion in assets or $1 billion in operating income, or within a given financial industry. Cetorelli and Goldberg (2014) create metrics for the count of nonbank entities to bank entities and of general business types, including nonfinancial industries, while Cetorelli, Jacobides, and Stern (2017) count the number of NAICS codes that a bank's subsidiaries span. Avraham, Selvaggi, and Vickery (2012) generate a measure of the number of countries and the regions of the world in which a bank has subsidiaries.

[4] See https://www.naics.com/business-lists/counts-by-naics-code/?#countsByNAICS.

[5] Business types are defined according to four-digit NAICS codes as follows: (1) Bank: NAICS code = 5221; (2) Insurance: NAICS code = 5241, 5242; (3) Mutual and Pension Fund: NAICS code = 52511, 52591; (4) Other Financial: two-digit NAICS code 52, but subsidiary does not fall into the categories of Bank, Insurance, or Mutual and Pension Fund; (5) Nonfinancial Management Firms: NAICS code = 5511; (6) Other Nonfinancial: two-digit NAICS code is not 52 and four-digit NAICS code is not 5511.

[6] These measures of geographic complexity do not address the concept of dispersion of branch locations or businesses within the United States, a topic considered in some research on the consequences of the historic elimination of interstate banking restrictions through the 1980s and with the Riegle-Neal Act in 1994.

[7] All analysis in this article excludes the seven large BHCs that were designated as BHCs after 2008: Goldman Sachs, Morgan Stanley, American Express, CIT Group, Ally Financial, Discover Financial Services, and MetLife.

[8] Banking regulatory micro data reference manuals have specific details on the distinctions between BHC top holder and regulatory top holder. See https://www.federalreserve.gov/data/mdrm.htm.

[9] Box plots illustrate how complexity measures differ throughout the distribution of the fifty largest BHCs (Chart 3). BHC rank at each date is determined using BHC assets. The decline in the mean subsidiary count, previously shown in Table 1, is further elaborated in Panel B of the chart.

[10] Cetorelli and Goldberg (2014) reached a similar conclusion for large non-U.S. global banks.

[11] See, for example, Berger et al. (2003), Buch (2005), Claessens and Van Horen (2014), Claessens, Hassib, and Van Horen (2017), Russ and Valderrama (2012), and Niepmann (2015).

[12] The tax jurisdictions and secrecy scores using 2018 data from the Tax Justice Network are located at https://www.financialsecrecyindex.com/introduction/fsi-2018-results.

[13] We define a country as a secrecy location if its secrecy score is greater than or equal to 75 and as a low-tax jurisdiction if its tax credits score is less than or equal to 10.

[14] Financial Stability Board (2017) provides statistics and related discussion of the status of international correspondent banking activity. Table A7 provides the country sorting for financial secrecy and low-tax jurisdictions.

References

Avdjiev, S., L. Gambacorta, L. Goldberg, and S. Schiaffi. Forthcoming. "The Shifting Drivers of Global Liquidity." Journal of International Economics.

Avraham, D., P. Selvaggi, and J. I. Vickery. 2012. "A Structural View of U.S. Bank Holding Companies." Federal Reserve Bank of New York Economic Policy Review 18, no. 2 (July): 65-81.

Berger, A., Q. Dai, S. Ongena, and D. C. Smith. 2003. "To What Extent Will the Banking Industry Be Globalized? A Study of Bank Nationality and Reach in 20 European Nations." Journal of Banking and Finance 27, no. 3 (March): 383-415.

Buch, C. 2005. "Distance and International Banking." Review of International Banking 13, no. 4 (September): 787-804.

Carmassi, J., and R. Herring. 2016. "The Corporate Complexity of Global Systemically Important Banks." Journal of Financial Services Research 49, no. 2 (June): 175-201.

Cetorelli, N., and L. Goldberg. 2014. "Measuring Complexity in Global Banks." Federal Reserve Bank of New York Economic Policy Review 20, no. 2 (March): 107-26.

Cetorelli, N., M. Jacobides, and S. Stern. 2017. "Transformation of Corporate Scope in U.S. Banks: Patterns and Performance Implications." Federal Reserve Bank of New York Staff Reports, no. 813.

Cetorelli, N., and S. Stern. 2015. "Same Name, New Business: Evolution in the Bank Holding Company." Federal Reserve Bank of New York Liberty Street Economics, September 28. https://libertystreeteconomics.newyorkfed.org/2015/09/same-name-new-businesses-evolution-in-the-bank-holding-company.html.

Cetorelli, N., and R. Wang. 2016. "Bank Regulation and Bank Complexity." Federal Reserve Bank of New York Liberty Street Economics, April 6. https://libertystreeteconomics.newyorkfed.org/2016/04/bank-regulation-and-bank-complexity.html.

Chernobai, A., A. Ozdagli, and J. Wang. 2018. "Business Complexity and Risk Management: Evidence from Operational Risk Events in U.S. Bank Holding Companies." Society for Economic Dynamics 2018 Meeting Reports, no. 1146.

Claessens, S., O. Hassib, and N. Van Horen. 2017. "The Role of Foreign Banks and Trade." CEPR Discussion Papers, no. 11821.

Claessens, S., and N. Van Horen. 2014. "Foreign Banks: Trends and Impacts." Journal of Money, Credit, and Banking 46, no. S1 (February): 195-316.

Correa, R., and L. Goldberg. 2019. "Bank Complexity, Risk, and Governance." Unpublished paper, Federal Reserve Bank of New York.

References (Continued)

Demsetz, R., and P. Strahan. 1997. "Diversification, Size, and Risk at Bank Holding Companies." Journal of Money, Credit, and Banking 29, no. 3 (August): 300-13.

Erbenova, M., Y. Liu, N. Kyriakos-Saad, A. Lopez Mejia, G. Gasha, E. Mathias, M. Norat, F. Fernando, and Y. Almeida. 2016. "The Withdrawal of Correspondent Banking Relationships: A Case for Policy Action." IMF Staff Discussion Note, no. SDN/16/06.

Financial Stability Board. 2017. "FSB Correspondent Banking Data Report."

Goldberg, L., and A. Meehl. 2018. "Have the Biggest U.S. Banks Become Less Complex?" Federal Reserve Bank of New York Liberty Street Economics, May 9. https://libertystreeteconomics.newyorkfed.org/2018/05/have-the-biggest-us-banks-become-less-complex.html.

Haldane, A. 2015. "On Microscopes and Telescopes." Speech given at Lorentz Centre Workshop on Socio-Economic Complexity, March 27. www.bis.org/review/r150330b.pdf.

Herring, R., and J. Carmassi. 2010. "The Corporate Structure of International Financial Conglomerates: Complexity and Its Implications for Safety and Soundness." In A. N. Berger, P. Molyneux, and J. O. S. Wilson, eds., Oxford Handbook of Banking, 1st edition. Oxford: Oxford University Press.

Milesi-Ferreti, G. M., and C. Tille. 2011. "The Great Retrenchment: International Capital Flows during the Global Financial Crisis." Economic Policy 26, no. 66 (April): 285-342.

Niepmann, F. 2015. "Banking Across Borders." Journal of International Economics 96, no. 2 (July): 244-65.

Russ, K., and D. Valderrama. 2012. "A Theory of Bank Versus Bond Finance and Intra-industry Reallocation." Journal of Macroeconomics 34, no. 3 (September): 652-73.

Stiroh, K. 2018. "Supervisory Implications of Rising Similarity in Banking." Remarks at the Financial Times U.S. Banking Forum: Charting the Course for Stability and Success, New York City, November 1. https://www.newyorkfed.org/newsevents/speeches/2018/sti181101.