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Complexity in large U.S. banks

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Complexity in Large U.S. Banks
Linda Goldberg and April Meehl
Federal Reserve Bank of New York Staff Reports, no. 880
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JEL classification: F32, G11, G20

Abstract

While both size and complexity are important for the largest U.S. bank holding companies (BHCs), specific types of complexity and their patterns across banks are not well understood. We introduce a range of measures of organizational, business, and geographic complexity. Comparing 2007 with 2017, we show that large U.S. BHCs remain very complex, with some declines along organizational and geographical complexity dimensions. The numbers of legal entities within some large BHCs have fallen. By contrast, the multiple industries spanned by legal entities within the BHCs have shifted more than they have declined, especially within the financial sector. Nonfinancial entities within U.S. BHCs still tilt heavily toward real-estate-related businesses and span numerous other industries. Fewer large BHCs have global affiliates, and the geographic span of the most complex has declined. Favorable tax treatment locations still attract a significant share of the foreign bank and nonbank entities, while fewer legal entities are present in informationally opaque locations.

Key words: bank, bank holding company, size, complexity, global bank

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To view the authors’ disclosure statements, visit https://www.newyorkfed.org/research/staff_reports/sr880.html.
1 Introduction

The global financial crisis, and the ensuing Dodd-Frank Wall Street Reform and Consumer Protection Act (hereafter called the Dodd Frank Act or DFA), identified bank size and complexity as determinants of systemic importance, as both features are viewed as contributing to risks to financial stability. In the decade since the Dodd Frank Act, it has already been observed that big banks have not shrunk in size (Cetorelli and Stern (2015), Avraham et al. (2012), Goldberg and Meehl (2018)). Here we consider whether these large banks have simplified in the decade after the global financial crisis. We present new measures of complexity for banking organizations, building on Cetorelli and Goldberg (2014), and explore these measures across the largest U.S. bank holding companies (BHCs) comparing 2007 and 2017.

Complexity is a multidimensional concept. In the system established to address global systemically important banks, complexity is considered to be a combination of balance sheet and derivatives exposures and the number of distinct legal entities within the BHC. The balance sheet components highlighted are associated with asset opacity that enhances the difficulty of valuing asset portfolios and exposures of the bank. The information on legal entities is viewed as important in part because larger numbers are expected to contribute to higher resolution and systemic costs if a BHC fails, as argued in Carmassi and Herring (2016). Our approach constructs complexity measures using information drawn from the structure of the full conglomerate, introducing a range of organizational, business and geographic complexity measures. These measures utilize information from regulatory reporting on the subsidiaries owned by a BHC, discussed in Cetorelli and Stern (2015) and updated quarterly, with counts plus additional attributes that inform the span of a BHC across industries (including nonbank industries) and countries.

Using our organizational, business and geographic complexity measures, we document the changes that have occurred in the decade after the financial crisis, concluding that BHCs have mixed outcomes around simplifying their organizations. Large BHCs still remain very complex across organizational, business and geographic dimensions, although with important caveats: 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 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 US BHCs continue to heavily tilt toward real-estate related types.

In terms of geographic complexity, fewer large US BHCs have entities in foreign locations.

1Structure and size are compared for U.S. BHCs through 2011 by Avraham et al. (2012) and for global banks by Cetorelli and Goldberg (2014). Cetorelli et al. (2017) explores consequences of the changing scope of US BHCs.
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. Many non-bank foreign subsidiaries are located in the UK and the Cayman Islands, although specific industries such as insurance and real estate have higher shares of subsidiaries in other locations.

In Section 2, we present the various measures of BHC organizational, business, and geographic complexity. Section 3 compares the evolution of complexity across the 50 largest US BHCs for 2007 as the pre-crisis snapshot and 2017 as the post-crisis snapshot. Section 4 delves into the business complexity of BHCs, and provides details on the evolution of scope of those legal entities specifically within the financial services and nonfinancial sectors. This evolution also has been the focus of Avraham et al. (2012) and Cetorelli et al. (2017) with the latter study arguing that BHC performances were improved following their expansion into financial businesses that were not previously their focal points. Section 5 explores different aspects of geographic complexity, including the pattern of foreign locations of banking, financial and nonfinancial entities. This latter evidence shows the continued prominence of countries with status as low tax locations, and the reduced prominence in some emerging markets and informationally opaque locations.

Section 6 provides concluding observations about the relevance of the facts on the current complexity landscape, noting the potential importance of external forces and policy as drivers of this landscape. Regulators have clearly signaled that complexity should be lowered (Haldane 2015). 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 the Dodd Frank Act, efforts to reduce complexity include the requirement that large BHCs periodically submit resolution plans or living wills. Yet, balancing costs and benefits are important as diversification in business lines and across countries can add value and efficiencies. Our presentation of a range of metrics supports a deeper analytical effort targeted at understanding these broad consequences.

2 Defining and Measuring Complexity

Our starting unit of observation for creating the complexity metrics is the bank holding company (BHC). Many BHCs are essentially corporate conglomerates with significant ownership positions or controlling interests in a range of legal entities which are alternatively referred to as affiliates or subsidiaries and can span both bank and nonbank activities. We build on the complexity concepts first introduced in Cetorelli and Goldberg (2014) and utilize information on the structure, number, location, and industry type of bank and non-bank affiliates under each BHC. For U.S. BHCs, the core data we use in construction is a complete and time-consistent panel of legal
entities in all existing BHCs created using their Federal Reserve’s form FR Y-6 and FR Y-10 filings, described in [Cetorelli and Stern (2015)]. Each affiliate is coded with information on its primary industry, captured by one of 203 4-digit level NAICS codes, and its host country location. Respective complexity metrics rely on counts of legal entities in each BHC, combined to explore different business or industry types and international versus United States locations of entities, and dispersion of entities across the respective component.

In defining the notation of complexity indices at the level of the BHC, we keep implicit that an index is both BHC and time specific. The notation instead only includes subscripts that distinguish the number and characteristics of the legal entities within each BHC. Industry type is indexed by $i$, or summed over every $i$ for a BHC at a date and denoted by $I$; business-type is indexed by $b$ and spans 6 types of business activities (Banking, Insurance, Mutual and Pension Funds, Other Financial, Nonfinancial Management, Other Nonfinancial); geographical 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.

2.1 Organizational Complexity

The most basic measure of organizational complexity is the total number of legal entities within the BHC, $Count$. A second organizational complexity measure, $Has Foreign$, indicates whether the BHC has any foreign-located affiliates and takes a value of one if the BHC has any affiliates in foreign locations, and is otherwise zero.

2.2 Business Complexity

Measures of business complexity utilize 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 indices normalized and defined to take values between 0 and 1, and increase in the dispersion of activities within the BHC.

Our first measure, $Nonfinancial count share$, is the share of legal entities that are not in the more broadly defined financial sector (2 digit NAICS code 52). The next business complexity measures use 4 digit NAICS industry codes to capture more details about the composition of industries spanned within the BHC. $CountN$ is the number of 4 digit NAICS industries spanned

2Business types are defined according to 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: 2 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: 2 digit NAICS code is not 52 and 4 digit NAICS code is not 5511.

3As discussed in [Goldberg and Shen (2018)], more dispersion could be associated with greater agency and control problems within a BHC or with enhanced diversification benefits.
by the legal entities in the BHC. \( \text{CountB} \) is the total number of business types spanned by BHC affiliates, where we define business types as Banking, Insurance, Mutual and Pension Fund, Other Financial, Nonfinancial Management Firms, and Other Nonfinancial. The dispersion of affiliate business types within the BHC and across its legal entities is given by \( \text{CountBHHI} = \frac{\text{CountB}}{\text{CountB} - 1} \left( 1 - \sum_{b=1}^{B} \left( \frac{\text{count}_b}{\sum_{b=1}^{B} \text{count}_b} \right)^2 \right) \), where \( B \) is the set of business types, and \( \text{count}_b \) is the number of a BHC’s subsidiaries that are classified in accordance with each business type \( b \). This measure take a value of zero if all entities are in banking, and increases as the dispersion of entities across types of businesses rises.

2.3 Geographical Complexity

The majority of all US BHCs do not have affiliates located outside of the United States, which is already reflected by the organizational complexity measure \( \text{Has Foreign} \). For those BHCs with foreign affiliates (\( \text{Has Foreign} = 1 \)), two additional complexity measures capture the degree and dispersion of geographic complexity. \( \text{CountC} \) is the count of countries spanned by a BHC’s subsidiaries.\(^4\) The dispersion of BHC affiliate locations across countries is indicated by \( \text{CountCHHI} = \frac{\text{CountC}}{\text{CountC} - 1} \left( 1 - \sum_{c=1}^{C} \left( \frac{\text{count}_c}{\sum_{c=1}^{C} \text{count}_c} \right)^2 \right) \) where \( C \) is the set of countries and \( \text{count}_c \) is the count of a BHC’s subsidiaries in each country \( c \). Dispersion is zero when all of the BHC’s legal entities are within the United States, but increases as the dispersion across countries internationally rises.\(^5\)

3 Complexity Patterns in the Largest 50 US BHCs

While there are thousands of U.S. BHCs, asset size and complexity are concentrated within the largest cohort. Even after focusing exclusively on the BHCs that have a U.S. top holder\(^6\) and are over $1 billion in assets, the remaining hundreds of BHCs are very diverse in size and complexity.\(^7\)

The quarterly value of total assets and count of all of these remaining U.S. domestic BHCs for the period from 2007 through 2017 are shown in Figure [1]. Their total assets rose from $10 trillion in 2007 to $14 trillion by 2017 (left scale, upper grey contour). The red line and right

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\(^4\)A variant of this measure could be the counts of locations spanned by banking subsidiaries and branches per se. Moreover, if appropriate data is available, balance sheet and income data for the BHC could be used to construct additional metrics.

\(^5\)This measure 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 interstate banking restrictions through the 1980s and with the Riegle-Neal Act in 1994.

\(^6\)Banking regulatory micro data reference manuals have specific details on the distinctions between BHC top holder and regulatory top holder, [https://www.federalreserve.gov/data/mdrm.htm](https://www.federalreserve.gov/data/mdrm.htm).

\(^7\)Our analysis excludes the seven large BHCs that obtained this status after 2008: Goldman Sachs, Morgan Stanley, American Express, CIT Group, Ally Financial, Discover Financial Services, and Metlife.
scale show the total number of these BHCs. This number gradually increased over time, from 400 in 2007 up to over 500 by 2017. The assets of the largest 50 of these BHCs, as defined by assets in each quarter, is shown by the blue shaded portion of assets. These largest BHCs represent the vast majority of the overall BHC assets, at over 85 percent. As complexity also is concentrated in the largest BHCs in this group, below we focus solely on the largest 50 BHCs and compare pre-crisis (2007) versus a decade later (2017).

As a first observation using the complexity measures it is important to notice that forms of complexity are distinct from, and correlated to different degrees with, BHC size. Figure 2a shows the relationship between BHC total affiliate count and assets in 2007 (blue dots) and in 2017 (red dots). The solid fitted lines show that larger BHCs tend to have more legal entities within their organizations. The rightward shift of the line in the top panel shows that BHC assets are larger post-crisis for a given number of entity counts (or counts are smaller given BHC asset size) in 2017 compared with 2007. Every vertical slice of this chart, regardless of whether using information from 2007 or 2017, illustrates that for any given size BHC there is substantial diversity in organizational complexity as represented by numbers of legal entities. Panel (b) shows that business complexity, as indicated by the share of BHC entities in nonfinancial industries, also is quite diverse across BHCs and less correlated with BHC assets than the counts of entities in the BHCs. The fitted relationship is similar for 2007 and 2017.
Figure 2: Complexity versus BHC Assets: 2007 versus 2017

(a) Organizational Complexity: Log Total Count

(b) Business Complexity: Nonfinancial Count Share

Note: Dots represent the largest 50 BHCs by assets in 2007 and in 2017. In brackets are the total assets equivalent of log assets. (a) right vertical axis shows the total count corresponding to the log total count on the left axis; (b) vertical axis is nonfinancial count share.
3.1 Patterns across BHC Complexity Metrics

Complexity differs substantially among the largest 50 U.S. BHCs. To illustrate this point, we split compare the minimum, median, mean, and maximum values of each complexity metric by date (Table 1).

The mean for every complexity measure, except non-financial count share, decreased from 2007 to 2017. The largest U.S. BHCs that started out relatively less complex generally simplified organizational, business and geographic complexity post-crisis. Across the 50 largest US BHCs, the average number of legal entities declined from 232 to 189. The share of large and complex BHCs with any foreign affiliates declined from 58 percent to 54 percent. There has been a clear decline in organizational complexity despite increases in BHC assets across all banks. By contrast, neither business complexity nor geographical complexity has declined substantially among the 50 largest BHCs. On average, the 50 largest BHCs maintained 5 of the 6 business types, while count of separate NAICs industries decreased by 2. In contrast, the average share of non-financial subsidiaries has increased slightly between 2007 and 2017 across the largest 50 BHCs, from 38 percent to 40 percent. The average number of country locations remained between 7 and 8 with a dispersion rate near 18 percent. While BHC Assets for the largest 50 BHCs increased from 2007 to 2017, this increase in size is driven mainly by the largest of the large BHCs. However, the decrease in organizational, business, and geographical complexity between 2007 and 2017 is seen across all the largest 50 BHCs.

Only some forms of complexity are highly correlated (Table 2). 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. There is little correlation between the Nonfinancial count share and numbers of businesses and countries of affiliates. Indeed, when a BHC adds more non-financial subsidiaries, these tend to be either domestic or in existing foreign locations, business types, and industries. The dispersion of business types, CountBHHI, is negatively correlated with all other complexity variables.

Bar graphs illustrate how complexity measures differ throughout the distribution of the largest 50 BHCs (Figure 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 (a). In 2007 the two most organizationally complex BHCs held 2836 and 1900 subsidiaries, respectively. By contrast, the most complex BHC in 2017 held 1335 subsidiaries. Moreover, the number of subsidiaries within the top 10 BHCs contrasts sharply with counts in the bottom 40. Country count (panel b), shows starkly that even within the 50 largest US BHCs there are large distinctions in geographic complexity.
<table>
<thead>
<tr>
<th>Table 1: Summary Statistics Of Complexity Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BHC Assets</strong></td>
</tr>
<tr>
<td>min</td>
</tr>
<tr>
<td>11.61</td>
</tr>
<tr>
<td><strong>Organizational</strong></td>
</tr>
<tr>
<td>Count</td>
</tr>
<tr>
<td>5.00</td>
</tr>
<tr>
<td>Has Foreign</td>
</tr>
<tr>
<td>0.00</td>
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<tr>
<td><strong>Business</strong></td>
</tr>
<tr>
<td>Non-financial Count Share</td>
</tr>
<tr>
<td>0.05</td>
</tr>
<tr>
<td>CountB</td>
</tr>
<tr>
<td>4.00</td>
</tr>
<tr>
<td>CountBHHI</td>
</tr>
<tr>
<td>0.24</td>
</tr>
<tr>
<td>CountN</td>
</tr>
<tr>
<td>5.00</td>
</tr>
<tr>
<td><strong>Geographical</strong></td>
</tr>
<tr>
<td>CountC</td>
</tr>
<tr>
<td>1.00</td>
</tr>
<tr>
<td>CountCHHI</td>
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<tr>
<td>0.00</td>
</tr>
</tbody>
</table>

* Units are: BHC Assets - billions of $; Count - total number of subsidiaries; Has Foreign and Non-financial count share - share of subsidiaries; CountB - count of business types; CountN - count of 4 digit NAICs codes; CountBHHI and CountCHHI - scale of 0-1; CountC - count of countries.
† The mean of Has Foreign is the share of the largest 50 BHCs that has foreign subsidiaries.
Figure 3: Complexity of the Largest 50 BHCs by Asset Size Rank in 2007 and 2017

Note: Each bar is based on the complexity measure for each of the largest 50 US BHCs at the respective dates, ranked by highholder assets, with largest ranked as 1 and smallest ranked as 50.
Table 2: Pearson Correlation, of Complexity Metrics of Largest U.S. BHCs, 2017

<table>
<thead>
<tr>
<th>Complexity Metric</th>
<th>BHC Assets</th>
<th>Count</th>
<th>Has Foreign</th>
<th>Non-fin count share</th>
<th>CountB</th>
<th>CountBHHI</th>
<th>CountN</th>
<th>CountC</th>
<th>CountCHHI</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHC Assets</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td><strong>Organizational</strong></td>
<td></td>
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</tr>
<tr>
<td>Count</td>
<td>0.76</td>
<td>1</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Has Foreign</td>
<td>0.36</td>
<td>0.47</td>
<td>1</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Business</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Non-financial count share</td>
<td>0.03</td>
<td>0.27</td>
<td>0.15</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>CountB</td>
<td>0.49</td>
<td>0.53</td>
<td>0.40</td>
<td>0.24</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>CountBHHI</td>
<td>-0.22</td>
<td>-0.59</td>
<td>-0.43</td>
<td>-0.30</td>
<td>-0.27</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CountN</td>
<td>0.81</td>
<td>0.74</td>
<td>0.50</td>
<td>0.21</td>
<td>0.75</td>
<td>-0.34</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Geographical</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CountC</td>
<td>0.84</td>
<td>0.78</td>
<td>0.47</td>
<td>-0.02</td>
<td>0.56</td>
<td>-0.23</td>
<td>0.83</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CountCHHI</td>
<td>0.44</td>
<td>0.41</td>
<td>0.69</td>
<td>-0.20</td>
<td>0.47</td>
<td>-0.18</td>
<td>0.54</td>
<td>0.69</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Pearson correlations between complexity measures using 2017 quarterly data.

Business complexity patterns are less differentiated (panel c). Even the 50th ranked BHC covered only one less business type in 2007 than the top 10 BHCs. No strong pattern of change in business types is evident during the decade after the recession. However, the count of unique 4-digit NAICS codes by BHC rank (panel d) shows a general decreasing pattern in the count of NAICS codes as rank declines. The number of NAICS codes within BHCs tended to decline from 2007 to 2017, especially among the largest BHCs.

4 Business Complexity and Scope

BHCs have long been operating in sectors outside of banking, including other financial and non-financial industries. While most BHCs have not decreased their industry scope since 2007, they have shifted their concentration across industries. The decision to expand into these industries has been the focus of prior studies, such as Cetorelli and Wang (2016) which emphasized the growth of BHCs into community housing affiliates and Cetorelli et al. (2017) which showed the relationship between BHC performance and expansion of scope. BHCs appeared better off in regards to performance when they expanded their scope to resemble that of the “modal bank”. Some BHCs may have first expanded into various industries in order to seize opportunities, such as reallocating capital, bringing production in-house, or benefiting from synergies from combining
various activities. As the trend continued, other BHCs possibly began to diversify in a similar manner in order 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.

4.1 Financial Entities

In terms of structure, only a small fraction of entities within BHCs are commercial banks while the majority of their subsidiaries fall into the category of “Other Financials” (Table A1). Among the largest 50 US BHCs, 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 (Figure 4). That share changed in idiosyncratic ways across BHCs and over time.

In the past decade, large U.S. BHCs have shifted their composition of financial subsidiaries away from the bank and nonbank intermediaries (Figure 5). There has been a large increase in subsidiaries involved in portfolio management (in addition to those labelled as mutual funds or pension funds), 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%. Also increasing was the share of financial subsidiaries involved in “other securities activities,” defined as the catch-all for other financial investment activities but excluding activity categorized as relating to securities and commodity exchanges, portfolio management, and trust and custody activities.

In 2007 one large BHC had a share of other portfolio management subsidiaries greater than 50% compared to four BHCs in 2017 (Table A2). The decline in the share of other financial
Note: Each bar is based on the complexity measure for each of the largest 50 US BHCs at the respective dates. BHCs are ranked in the according to its highholder assets at the respective dates, with largest BHCs having the lowest rank.
intermediaries is also clear: in 2007, five BHCs had shares over 30% compared to only one in 2017. Insurance companies are held in a greater proportion by the smaller BHCs both in 2007 and 2017.

4.2 Non-Financial Entities

All of the large US BHCs have a substantial share of nonfinancial subsidiaries. In general, the largest categories of nonfinancial subsidiaries are 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, although there is considerable variation in the concentration of such entities across the BHCs. Management Companies are the most popular nonfinancial affiliate with the five largest BHCs holding an average share of around 30% of all nonfinancial entities in both 2007 and 2017. Housing subsidiaries are very popular as these subsidiaries can house activities that count toward Community Reinvestment Act requirements, discussed in Cetorelli and Wang (2016). The minimum share of Housing subsidiaries for the five largest BHCs rose from 10% in 2007 to 25% in 2017. Moreover specific firms evolved with Housing entities replacing Real Estate-related affiliates as the average share of such affiliates for these same BHCs decreased from 20% in 2007 to 13% in 2017.

5 Geographic Complexity

Substantial changes have occurred in the geographic complexity of large US BHCs. As already observed, the share of large US BHCs with any global subsidiaries declined, with 2 fewer BHCs having global entities. The relationship between size and share of foreign affiliates is positive, remaining similar from 2007 to 2017 (Figure 6). Overall the ten largest BHCs in 2017 actually have a greater foreign share in total entity counts than in 2007, yet, some of this change is due to a larger reduction in domestic entities, consistent with the broader decline in organizational complexity. Many of the large U.S. BHCs operated in fewer countries in 2017 than in 2007, another sign of reduced geographical complexity.

The locational choices of the banking subsidiaries and branches has long been the subject of academic research and debate. These choices are tied to trade activity, country and institution growth rates, and comparative advantage in productivity. Less attention has been paid to the other non-bank parts of these financial conglomerates, which dominate the number of bank foreign affiliates. Development of institutions and size and depth of financial markets should matter, along with potentially favorable tax treatment and degree of opacity or secrecy locally (weighed

against associated costs). Additional factors in the post-crisis period are enhanced attention to know-your-customer (KYC), anti-money laundering (AML), and combating the financing of terrorism compliance costs. Such concerns have been associated with derisking of global banks and reduced activity in some foreign markets (Erbenova et al., 2016).

These changes on the extensive margin of locations are consistent with analyses of volumes of cross border flows, which also have changed for the entities that remain involved globally. The post crisis period has seen noteworthy waves of contractions in cross-border banking lending volumes, especially in bank to bank transactions (Milesi-Ferreti and Tille, 2011). Overall, there also has been a rebalance of global activities towards banking systems that are better capitalized and toward nonbank market-based financing (Avdjiev et al., 2017). The share of US banks has risen, even as fewer US BHCs are involved.

Our locational sorting distinguishes between affiliates within advanced economies (AEs) versus within emerging markets (EMs). We further distinguish according to whether locations have low taxes or weak transparency/ high secrecy, using indicators from the Financial Secrecy Index (FSI) of the Tax Justice Network (Secrecy Score and Tax Credits). Secrecy Score is calculated based on the average of 20 different indicators. The score is equal to a percentage between 0 and 100 with 100 representing the greatest amount of secrecy (least transparency). Each component indicator is assigned a percentage based on secrecy, with 100 representing the greatest amount of secrecy. The measure Tax Credits, one of the 20 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
Table 3: Share of Foreign Affiliates by Business Type

<table>
<thead>
<tr>
<th></th>
<th>2007Q2</th>
<th>2017Q2</th>
</tr>
</thead>
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<td>0.45</td>
</tr>
<tr>
<td>Mutual and Pension Funds</td>
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<td>0.54</td>
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<td>0.10</td>
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<tr>
<td>Non-financial Management Firms</td>
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</tr>
<tr>
<td>Other Non-financial</td>
<td>0.07</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Note: This table presents the share of foreign affiliates for each business type across the largest 50 BHCs in 2007 and 2017.

tax credits. We define a country as a secrecy location if their Secrecy Score is greater or equal to 75 or if their Tax Credits score is less than or equal to 10. The Secrecy Score should capture at least some of the KYC and AML locations that have been the focus of international bank derisking discussions.[9]

5.1 Affiliate and BHC locations and Financial Secrecy

The mix of domestic versus foreign locations across different types of businesses evolved between 2007 and 2017, with increasing shares of foreign affiliates largely driven by relatively greater declines in numbers of US entities within each type (Table 3). 45 percent of bank entities were outside the U.S. in 2017, up from 34 percent in 2007. Substantially higher shares of totals for mutual and pension funds are now located outside the U.S. A lower share of insurance entities is located outside of the United States. Tables 4 and 5 provide a more detailed look of the evolution of affiliate locations, also considering the numbers in Tax or Financial Secrecy locations. In each table, the upper panel provides total counts of legal entities in advanced economies and of their U.S. BHCs. The lower panel provides the corresponding breakdown of entities located in emerging markets. Each panel further enumerates those entities in low tax or financial secrecy jurisdictions. Table 4 focuses on all foreign affiliates, banks, and total nonbanks. Table 5 presents the disaggregation by non-bank business type.

In the past decade, the largest 50 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 US BHCs declined from 2007 to 2017. Bank affiliates significantly contracted in both AE and EM locations (Table 4). The total number of BHCs with banking affiliates in AE locations declined from 11 to 8, while those in EMs remained at 6 BHCs.

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

[9]Table A7 provides the country sorting.
Table 4: Location of U.S. BHC Foreign Entities, by Counts of Entities and BHCs

<table>
<thead>
<tr>
<th></th>
<th>Total Entities</th>
<th></th>
<th>Total Banking Entities</th>
<th></th>
<th>Total Non-bank Entities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>by Count</td>
<td>by BHC</td>
<td>by Count</td>
<td>by BHC</td>
<td>by Count</td>
<td>by BHC</td>
</tr>
<tr>
<td></td>
<td>Fin. Secrecy</td>
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<td>2017 30</td>
<td>2007 5</td>
<td>2017 1</td>
<td>2017 1</td>
</tr>
<tr>
<td>EM</td>
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<td>2017 741</td>
<td>2007 25</td>
<td>2017 60</td>
<td>2017 43</td>
</tr>
</tbody>
</table>

Note: This table presents the locational breakdown of US affiliates and BHCs. The by Count column refers to the number of affiliates found in advanced economies and emerging markets, broken down by all locations, low tax jurisdiction locations or financial secrecy locations. The by BHC column refers to the number of BHCs associated with the affiliates in the corresponding row. Bank and non-bank classifications are defined in Table A6. Table A7 details countries within tax and secrecy categories.
tax jurisdictions than in jurisdictions with the worst financial secrecy ratings. Among EMs, the Cayman Islands remains the most popular secretive location for subsidiaries of large U.S. BHCs.

Among the foreign nonbank entities within US BHCs, which account for a large share of the counts of total affiliates, there were likewise declines in both AE and EM locations, and declines in the number of BHCs in each type of location for EM locations (Table 5). The number of entities in AE low tax jurisdictions remained stable at 308, but was associated with a smaller number of BHCs. Affiliates in secrecy locations declined substantially. Entities in EM low tax jurisdictions are far more prevalent than those associated with financial secrecy, and also declined substantially. For the nonbank affiliates, the largest proportion are in Other Financial which covers activities like other portfolio managers, broker dealers, other intermediaries, and other securities activities (Table A6). Foreign Management Companies, which perform activities such as financial planning, billing and recordkeeping, physical distribution, etc., declined substantially in both AEs and EMs, outside of the secrecy locations of AEs and primarily declining in the EM low tax locations. The rebalance 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 occurred through affiliates in low tax jurisdictions in the decade after the financial crisis.

6 Conclusion

The largest U.S. BHCs entered the global financial crisis with substantial organizational, business and geographic complexity. Using a new dataset of BHC structures over time, we introduce and compare various measures capturing the organizational, business, and geographic complexity pre-crisis versus post-crisis. Within the organizational category, our measures include the count of legal entities and whether a BHC has any subsidiaries in foreign countries. The number of legal entities within BHCs tends to rise with BHC size. However, even within the 50 largest US BHCs we show drastic differences between the organizational complexity for smaller and larger BHCs, with the organizational complexity exhibiting more of a step function relationship than a linear one. Some of the largest BHCs had significant declines in affiliate counts in the decade after the crisis. While the largest BHCs hold a substantial number of subsidiaries in foreign locations, only half of this sample of large BHCs had even one foreign subsidiary in 2007, and fewer in 2017. Geographic complexity is measured by the number of countries in which a BHC has subsidiaries located. Over time, declines in foreign subsidiaries tended to be in locations associated with financial secrecy. Low tax locations remain popular.

Business complexity is measured using information on the industries of entities within BHCs. Most large BHCs have entities that span banking, fund management, insurance, and nonfinancial activities. However, they can differ substantially in the finer industry composition. While
Table 5: Location of U.S. BHC Foreign Affiliates by Affiliate Types, by Counts of Entities and BHCs

<table>
<thead>
<tr>
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<th>Insurance</th>
<th>Other Fin.</th>
<th>Non-fin Management</th>
<th>Other Non-fin</th>
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<td>by Count by BHC</td>
<td>by Count by BHC</td>
<td>by Count by BHC</td>
<td>by Count by BHC</td>
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<tr>
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<td>37 5</td>
<td>6 4</td>
<td>950 881</td>
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<td>Low Tax Jur.</td>
<td>6 18</td>
<td>3 3</td>
<td>7 1</td>
<td>3 1</td>
<td>221 227</td>
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<td>2 1</td>
<td>2 0</td>
<td>1 0</td>
<td>18 19</td>
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</tbody>
</table>

<table>
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<th>Other Fin.</th>
<th>Non-fin Management</th>
<th>Other Non-fin</th>
</tr>
</thead>
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<td>by Count by BHC</td>
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<td>by Count by BHC</td>
<td>by Count by BHC</td>
</tr>
<tr>
<td>EM</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>All locations</td>
<td>18 38</td>
<td>5 4</td>
<td>48 15</td>
<td>15 8</td>
<td>478 462</td>
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<tr>
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<td>9 31</td>
<td>4 4</td>
<td>36 11</td>
<td>14 7</td>
<td>298 296</td>
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<tr>
<td>Fin. Secrecy</td>
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<td>0 0</td>
<td>5 1</td>
<td>4 1</td>
<td>33 29</td>
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</tbody>
</table>

Note: This table presents the locational breakdown of US affiliates and BHCs. The by Count column refers to the number of affiliates found in advanced economies and emerging markets, broken down by all locations, low tax jurisdiction locations or financial secrecy locations. The by BHC column refers to the number of BHCs associated with the affiliates in the corresponding row. Other Financial affiliates include other portfolio managers, broker dealers, other intermediaries, and other securities activities. Table A6 details affiliate types. Table A7 details countries within tax and secrecy categories.
organizational complexity generally declined post-crisis, business complexity outcomes are more mixed. The nonfinancial share of affiliates remains large, while the number of industries spanned by the affiliates is somewhat smaller. Within the financial industries, BHCs have shifted towards less traditional financial subsidiaries such as portfolio management firms and other securities activities rather, reducing 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 risk absorption capabilities and on improving resolution mechanisms for dealing with these BHCs in the event of failure (Stiroh 2018). Some forms of BHC complexity significantly declined, even while the largest of the large remain highly complex on organizational, business, and geographic dimensions. Yet, the concept of optimal complexity in US BHCs warrants additional analysis. Further research is needed on the implications of the complexity in the context of the overall BHCs, the specific entities within the BHCs and on 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 negative contributions to agency problems and moral hazard, and externalities that motivated strengthening resolution and resolution initiatives. While reducing the costs of bank failure have been targeted by policy initiatives, this type of analysis informs the consequences of the different forms of complexity during the lives of these large financial conglomerates.
References


Haldane, Andrew. 2015. “On Microscopes and Telescopes.” Presented at Lorentz centre workshop on socio-economic complexity, URL: [www.bis.org/review/r150330b.pdf](www.bis.org/review/r150330b.pdf)


A Appendix
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</tr>
<tr>
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<td>0.038</td>
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</table>

Note: This table presents the breakdown of business types by share for a selection of each of the largest 50 BHCs ranked by assets. Business types are categorized into 6 bins: Banks, Insurance, Mutual and Pension Funds, Other Financial, Non-financial Firms, and Other Nonfinancial.
Table A2: Breakdown of Financial Entities

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</table>

Note: This table presents the breakdown of financial affiliates by share for a selection of the largest 50 BHCs ranked by assets. We use the 4-digit NAICS code to breakdown non-financial firms into 7 bins: Commercial banks, other intermediaries, broker dealers, other portfolio management, other securities activities, insurance, and mutual and pension funds.
Table A3: Breakdown of Non-financial affiliates

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<th>2017 Q2</th>
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</table>

Note: This table presents the breakdown of non-financial affiliates by share for a selection of the largest 50 BHCs ranked by assets. We use the 2-digit NAICS code to breakdown non-financial firms into 6 bins: Housing, Utilities and Construction, Manufacturing and Wholesale Trade, Management Companies, Other Non-financials, and Real Estate.
Table A4: Largest 50 (1-25) BHCs in 2007 and 2017

<table>
<thead>
<tr>
<th>Rank</th>
<th>2007 Q2</th>
<th>2017 Q2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Highholder Name</td>
<td>Highholder Assets (billions)</td>
</tr>
<tr>
<td>1</td>
<td>CITIGROUP</td>
<td>2220.866</td>
</tr>
<tr>
<td>2</td>
<td>BANK OF AMER CORP</td>
<td>1535.684</td>
</tr>
<tr>
<td>3</td>
<td>JPMORGAN CHASE &amp; CO</td>
<td>1458.042</td>
</tr>
<tr>
<td>4</td>
<td>WACHOVIA CORP</td>
<td>719.922</td>
</tr>
<tr>
<td>5</td>
<td>WELLS FARGO &amp; CO</td>
<td>539.865</td>
</tr>
<tr>
<td>6</td>
<td>U S BC</td>
<td>222.53</td>
</tr>
<tr>
<td>7</td>
<td>SUNTRUST BK</td>
<td>180.3144</td>
</tr>
<tr>
<td>8</td>
<td>CAPITAL ONE FC</td>
<td>145.938</td>
</tr>
<tr>
<td>9</td>
<td>NATIONAL CITY CORP</td>
<td>140.6482</td>
</tr>
<tr>
<td>10</td>
<td>REGIONS FC</td>
<td>137.6242</td>
</tr>
<tr>
<td>11</td>
<td>BB&amp;T CORP</td>
<td>127.5771</td>
</tr>
<tr>
<td>12</td>
<td>BANK OF NY CO</td>
<td>126.457</td>
</tr>
<tr>
<td>13</td>
<td>PNC FNCL SVC GROUP</td>
<td>125.7367</td>
</tr>
<tr>
<td>14</td>
<td>STATE STREET CORP</td>
<td>112.3458</td>
</tr>
<tr>
<td>15</td>
<td>FIFTH THIRD BC</td>
<td>101.3897</td>
</tr>
<tr>
<td>16</td>
<td>KEYCORP</td>
<td>93.4909</td>
</tr>
<tr>
<td>17</td>
<td>NORTHERN TR CORP</td>
<td>59.60973</td>
</tr>
<tr>
<td>18</td>
<td>COMERICA</td>
<td>58.94573</td>
</tr>
<tr>
<td>19</td>
<td>MARSHALL &amp; ILSLEY CORP</td>
<td>58.32753</td>
</tr>
<tr>
<td>20</td>
<td>CHARLES SCHWAB CORP</td>
<td>49.00381</td>
</tr>
<tr>
<td>21</td>
<td>ZIONS BC</td>
<td>48.70313</td>
</tr>
<tr>
<td>22</td>
<td>COMMERCE BC</td>
<td>48.23133</td>
</tr>
<tr>
<td>23</td>
<td>POPULAR</td>
<td>46.985</td>
</tr>
<tr>
<td>24</td>
<td>MELLON FNCL CORP</td>
<td>43.38906</td>
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<tr>
<td>25</td>
<td>FIRST HORIZON NAT CORP</td>
<td>38.39583</td>
</tr>
</tbody>
</table>

Note: This table presents the largest 25 BHCs based on highholder assets, in billions, in 2007 Q2 and 2017 Q2.
Table A5: Largest 50 (26-50) BHCs in 2007 and 2017

<table>
<thead>
<tr>
<th>Rank</th>
<th>2007 Q2</th>
<th>2017 Q2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Highholder Name</td>
<td>Highholder Assets (billions)</td>
</tr>
<tr>
<td>26</td>
<td>HUNTINGTON BSHRS</td>
<td>36.42208</td>
</tr>
<tr>
<td>27</td>
<td>COMPASS BSHRS</td>
<td>34.93894</td>
</tr>
<tr>
<td>28</td>
<td>SYNOVUS FC</td>
<td>33.29582</td>
</tr>
<tr>
<td>29</td>
<td>NEW YORK CMNTY BC</td>
<td>29.6384</td>
</tr>
<tr>
<td>30</td>
<td>COLONIAL BANC GROUP</td>
<td>23.82348</td>
</tr>
<tr>
<td>31</td>
<td>ASSOCIATED BANC CORP</td>
<td>20.84953</td>
</tr>
<tr>
<td>32</td>
<td>BOK FC</td>
<td>19.3636</td>
</tr>
<tr>
<td>33</td>
<td>W HOLD CO</td>
<td>17.8292</td>
</tr>
<tr>
<td>34</td>
<td>FIRST BC</td>
<td>17.60505</td>
</tr>
<tr>
<td>35</td>
<td>INVESTORS FNCL SVC CORP</td>
<td>17.05827</td>
</tr>
<tr>
<td>36</td>
<td>WEBSTER FNCL CORP</td>
<td>16.96741</td>
</tr>
<tr>
<td>37</td>
<td>SKY FNCL GROUP</td>
<td>16.80729</td>
</tr>
<tr>
<td>38</td>
<td>FIRST CITIZENS BSHRS</td>
<td>16.01204</td>
</tr>
<tr>
<td>39</td>
<td>CITY NAT CORP</td>
<td>15.81365</td>
</tr>
<tr>
<td>40</td>
<td>COMMERCE BSHRS</td>
<td>15.53111</td>
</tr>
<tr>
<td>41</td>
<td>NEW YORK PRIV B&amp;TR CORP</td>
<td>15.09547</td>
</tr>
<tr>
<td>42</td>
<td>FULTON FNCL CORP</td>
<td>15.07842</td>
</tr>
<tr>
<td>43</td>
<td>TCF FC</td>
<td>15.06538</td>
</tr>
<tr>
<td>44</td>
<td>FBOP CORP</td>
<td>14.38196</td>
</tr>
<tr>
<td>45</td>
<td>SOUTH FNCL GROUP</td>
<td>14.13968</td>
</tr>
<tr>
<td>46</td>
<td>CITIZENS REPUBLIC BC</td>
<td>13.28319</td>
</tr>
<tr>
<td>47</td>
<td>BANCORPSOUTH</td>
<td>13.21191</td>
</tr>
<tr>
<td>48</td>
<td>CULLEN/FROST BKR</td>
<td>13.09257</td>
</tr>
<tr>
<td>49</td>
<td>VALLEY NAT BC</td>
<td>12.31909</td>
</tr>
<tr>
<td>50</td>
<td>R&amp;G FNCL CORP</td>
<td>11.61087</td>
</tr>
</tbody>
</table>

Note: This table presents the largest 26-50 BHCs based on highholder assets, in billions, in 2007 Q2 and 2017 Q2.
<table>
<thead>
<tr>
<th>Business Type</th>
<th>Affiliate Type</th>
<th>NAICS Codes</th>
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</thead>
<tbody>
<tr>
<td>Financial Affiliates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial Banks</td>
<td>Commercial Banks</td>
<td>5221</td>
</tr>
<tr>
<td>Mutual and Pension Funds</td>
<td>Mutual and Pension Funds</td>
<td>52511, 52591</td>
</tr>
<tr>
<td>Insurance</td>
<td>Insurance</td>
<td>5242, 5241</td>
</tr>
<tr>
<td>Other Financial</td>
<td>Other Portfolio Managers</td>
<td>52590, 52591, 52592</td>
</tr>
<tr>
<td></td>
<td>Broker Dealers</td>
<td>5231, 5232</td>
</tr>
<tr>
<td></td>
<td>Other Intermediaries</td>
<td>5222, 5223</td>
</tr>
<tr>
<td></td>
<td>Other Securities Activities</td>
<td>5239</td>
</tr>
<tr>
<td>Non-financial Affiliates</td>
<td>(Non-financial) Management Companies</td>
<td>55</td>
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<tr>
<td>Non-financial Management Firms</td>
<td>Real Estate</td>
<td>53</td>
</tr>
<tr>
<td>Other Nonfinancial</td>
<td>Housing</td>
<td>62422</td>
</tr>
<tr>
<td></td>
<td>Utilities and Construction</td>
<td>21, 22, 23</td>
</tr>
<tr>
<td></td>
<td>Manufacturing and Wholesale Trade</td>
<td>31, 32, 33, 42, 45</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>11, 48, 49, 51, 54, 56, 61, 62 (no 62422), 71, 72, 81</td>
</tr>
</tbody>
</table>

Note: This table presents our classification for Business Types, broken down into financial and non-financial entities, and the associated NAICS codes. The classification uses 4-digit NAICS codes for all financial entities and 2-digit NAICS codes for all non-financial entities. To further break down portfolio management, the classification uses 6-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. The NAICS codebook can be found [here](#).
Table A7: List of Countries by Low Tax Jurisdiction and High Financial Secrecy (2018)

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

Note: This table presents the countries that have low tax jurisdiction (tax credit < 10), high financial secrecy (secrecy score > 75), or neither (high tax jurisdiction or low financial secrecy) based on a time-invariant cutoff. The tax jurisdictions and secrecy scores 2018 data are from the Tax Justice Network [https://www.financialsecrecyindex.com/introduction/fsi-2018-results].