A new approach to measuring universal banking

Authors

Dr. Carmela D'Avino[a], ***Corresponding author***
[a]ICN Business School and CEREFIGE, Université de Lorraine
Contact email: carmela.davino-dumas@icn-artem.com
Tel.: 0033 354502500

Dr. Mimoza Shabani[b],
[b]University of East London, Royal Docks School of Business and Law, Water Lane, E15 4LZ, London, UK.
Contact email: m.shabani@uel.ac.uk.
Tel.: 0044 208223 2225

Abstract

Noninterest income is widely used in the literature to account for the degree of the universal business model by banks. This paper proposes a novel measure of universal banking constructed using the relative contribution of each operating segment to total assets using an entropy approach. We here propose a novel dataset containing the Universal Banking Index (UBI) at both country and bank levels. Using a sample of international banks, we evaluate the extent to which our proposed metric affects banks' profitability, stability, liquidity and capitalisation. Results suggest that a higher degree of diversification is associated with increased stability. In addition, banks that feature a more diversified business model, as proxied by the UBI, are also better capitalised, as opposed to banks with high noninterest income share. Our results suggest that regulatory-induced restriction on universal banking may indeed reduce the benefits of risk sharing across operating segments, exposing banks to heightened risks.

Keywords: Universal banking, financial products diversification, globalization.
JEL codes: G20, G21, F65, L22.

1. Introduction

Universal banking is a characterising feature of modern banking systems, consisting in the provision of a wide range of financial products and services allowing banks to diversify away from the traditional loan-issuing function. As some countries are underway to adopt structural banking reforms to curb banks' tendency to rely on this business model believed to have facilitated pre-crisis risk-taking, the debate on the implications of universal banking has regained interest.

A number of scholars have set forth several rationales that may justify such reforms highlighting, particularly, the extent to which universal banking enhances risk-taking and reduces performance. Hakenes and Schnabel (2014) find a moral hazard effect arising from banks engaging in riskier and non-traditional activities when a deposit insurance system is in place. Agency problems could also be magnified in universal banking models as insiders have higher incentives to extract private benefits (Jensen and Meckling 1976; Rotemberg and Saloner, 1994). Several contributions stress how universal banking can be detrimental to banks' valuation and performance (Lang and Stulz, 1994; Berger and Ofek, 1995; Denis et al., 1997; Elsas et al., 2010), mainly attributable to agency costs and limited economies of scope (Laeven and Levin, 2007).

On the other hand, some scholars have warned about potential unintended side effects resulting from a regulatory-induced reduction in the latitude of banks' operations. Limiting the degree of universal banking could result in lower economies of scopes and restricted ability to take full advantage of information gathering and monitoring for an efficient provision of financial services (Rajan, 1992; Saunders and Walters, 1994; Stein, 2002). More recently, it has also been argued that structural banking reforms may stimulate the growth of shadow banking and contribute to an economic slowdown as banks may cut down loans in order to meet the high implementation costs of the reforms (Goodhart 2012; Blundell-Wignall and Atkinson 2012; Duffie, 2012; Thakor, 2012; and Blundell-Wignall et al., 2013).

Relying on a meaningful and comprehensive measure of universal banking of banks is of foremost importance when evaluating the pros and cons of such a business model. The degree of universal banking is typically measured by the relative share of noninterest income to total income and, when available, by its components, i.e. investment banking fees and commission income, fiduciary activity income, trading revenue, insurance activities revenue, securitisation income. Such measure and its variants are however unable to capture the mixture and cardinality of activity provisions. Noninterest income measures how much income is

generated by a bank from activities other than loans issuing and deposit taking, bundling all noninterest income generating activities together. This composite feature of the noninterest income constitutes its main drawback. Indeed, two banks with similar noninterest income share may have very different universal business model configurations as one institution might be generating all its noninterest income from one business segment, say investment banking, and the other from a more diversified business model with several operating segments.

In this paper, we propose an indicator of universal banking that captures the degree of diversification of banking activities in one comprehensive and intuitive measure. We propose an entropy-based measure of product diversification based on a novel dataset on activity segmentation, namely the Universal Banking Index (UBI). The underlying data, collected from Bloomberg, allows us to group banks' consolidated activities in operating segments, such as retail banking, insurance services, investment banking and corporate services. We rely whenever possible on relative contribution to total assets of a given operating segment rather than on income data that tends to be quite volatile and presents some challenges (most notably, when it takes negative values). Our measure captures the number and size of substantial operating segments, often grouping classes of products (i.e. retail banking credit products are all confounded), which in turn, reflect the specialisation in a given financial product/service provision. An operating segment here is not intended as a division as large and often-global banks feature very complex multi-layered business models with numerous affiliates within and across countries with overlapping divisions. Rather, an operating segment is conceived as a group of similar activities across the banking group, i.e. across affiliates and countries.

The UBI is constructed at the macro level for 21 countries and at the micro level for 102 banks. A dynamic panel model is then used for bank-level data with the objective to assess the extent to which a universal banking model, as measured by the UBI, relates to banking profitability, stability, liquidity and capitalisation. The share of noninterest income to total income is also considered in the several specifications to allow for a comparative analysis. Results indicate that a universal banking model increases stability when our entropy-based measure is used. Statistical support is very limited when using the noninterest income proxy to measure universal banking, which instead points towards a negative relationship between stability and universal banking. A higher UBI corresponds to banks being more profitable, liquid and well capitalised. We also assess the robustness of these findings by accounting for a more complex business model featured by globalisation and size, i.e. global systematic important institutions (G-SIFI). Furthermore, we investigate the implications of diversifications for those banks relying greatly on non-traditional funding. Results suggest

that a more complex business model featuring financial product provision diversification and foreign activities is negatively related to stability. On the other hand, we find some evidence suggesting that diversification enhances stability for those universal banks listed as G-SIFI.

This paper contributes to the financial intermediation literature in two ways. Firstly, it presents a novel metric for measuring universal banking and an accompanying database with both a country and bank level dimension. Our measure is comprehensive and concise, capturing the diversity of banks' activities by means of a unique intuitive index. Whilst the use of noninterest income as a proxy for universal banking *implicitly* reflects the business model of banks by taking into account the share of noninterest income to total income, the UBI goes one-step further and *explicitly* reflects the degree of diversification of banking activities that characterises banks' business model. Our measure improves the existing proxies of universal banking, both income and assets based, by accounting for the diversity of all banking activities at once, in an attempt to better reflect the very definition of universal banking. Secondly, this paper provides an analysis of the relationship between the UBI and key banking features. Empirical evidence using noninterest income as proxy for universal banking seems to support the view that this business model triggers financial instabilities. Stiroh (2004) and Demirguc-Kunt and Huizinga (2010) show that noninterest income is positively related to banking risk using US and a panel of international banks respectively. Gambacorta and van Rixtel (2013) find a nonlinear relationship between noninterest income and bank profitability. We question here whether using an alternative measure of universal banking sheds a different light on key banking features.

We believe that our dataset can be of interest to many scholars wanting to revisit the relationship between universal banking and banks' performance and stability. This would complement the often-contrasting evidence provided by existing empirical studies using noninteret income proxies in a climate of renewed interest in this topic brought about by recent regulatory initiatives.

This paper is structured as follows: Section II introduces the entropy-based measure of universal banking with related stylised facts. Section III describes the data and the methodological approach and Section IV the empirical results. Section V concludes.

2. Evaluating the extent of universal business model: UBI

2.1 The Universal banking model: Background and measurement

The universal banking model is a key characterising feature of modern banks in response to a deregulated and highly competitive environment. It refers to the diversification of financial products and services offered by banks, translating in a shift away from traditional banking (i.e. deposit taking and loan issuing) towards the provision of insurance, securities and pension products as well as investment banking and other financial services (Saunders and Walter, 1994, Casu et al., 2015, Laeven and Levine 2007).

Portfolio theory literature suggests that diversification in banking activities decreases overall risk exposure due to the imperfect correlations among different business segments (among many: Markowitz, 1952; Lewellen, 1971). A large strand of the literature proposes a number of theoretical models analysing the implications of diversification in banking on risk stressing the conditions under which it is desirable. Earlier research suggests that the benefits arising from diversification in banking are mainly due to risk spreading across assets and sectors (see Berger, et al., 1999, for a survey). For instance, Diamond (1984) shows that full diversification of activities is optimal when delegated monitoring is in place and that diversification of the assets portfolio reduces the probability of default of a bank. Winton (1999) show that diversification is more desirable for those institutions which take a medium level of risk by means of a model in which gains from activities diversification are a function of the riskiness of the bank. More recent post-crisis seminal contributions have, however, questioned the desirability of banking diversification across banks within the banking system. For instance, Stiglitz (2010) argues that the risk of systemic contagion increases when a banking system is characterised by banks that have well-diversified assets, such as universal banks, as opposite to specialised banks. When diversification strategies are correlated across institutions, common macroeconomic shocks may affect all banks at the same time. This mechanism of shock contagion is further exacerbated in the event of fire-sales of common assets holdings (Shleifer and Vishny, 2011).

The Global Financial Crisis (GFC) has brought about a renewed interest in the implications of this type of business model common to global systemically important institutions (G-SIFI), whose regulation is at the core of structural banking reforms in the US, UK and the Euro area (Volkers, Vickers and Liikanen proposals). The degree of universal banking is typically measured by the relative share of noninterest income to total income and, when available, by its components, i.e. investment banking fees and commission income,

fiduciary activity income, trading revenue, insurance activities revenue, securitisation income[1]. Ideally, to account precisely for the true degree of universal banking, intended as the provision of a wide range of financial products and services, one would need segmented data on either assets, revenues or income by type of products and services provision (Laeven and Levine, 2007). However, detailed segmented data on the type and volume of financial assets provisions by banks is not available. Some empirical studies have tried to disentangle the different components of noninterest income, focusing for instance on the effect of income generated from investment banking fees on some banking variables (see, for instance Lepetit et al, 2008 and Geyfman and Yeager, 2009). While these measures are informative on the relative contribution to banks' risk or performance of a certain activity, they cannot be satisfactorily considered as measures of universal banking as they cannot simultaneously capture the overall degree of diversification of banking products.

Elsas et al (2010) employ an income-based approach to measure the diversification index of a sample of large banks in nine well-developed countries. Using the HHI methodology the study takes into account four income types, namely the gross interest revenue; net commission revenue; net trading revenue and all other revenue. Alternatively, some scholars have advanced asset-based measure of universal banking as opposed to an income-based one. Leaven and Levin (2007), for instance, propose a proxy of diversification constructed as the ratio of loans to total earning assets. The authors provide an asset-based measure of banking diversification calculated as the difference between net loans and other earning assets as a share of total earning assets. Their proposed diversity index captures the degree of diversification of banking activities, which takes the value between 0 and 1 with values closer to 1 imply higher diversification, intended as a mixture of lending and non-lending activities. Although this measure is less volatile than an income-based one, it still suffers from the same measurement errors of the noninterest income-based one. Indeed, while informative on the relative importance of the loan issuing activity of a bank, it does not reveal the heterogeneity of the other activities on offer.

Overall, these proxies do not particularly reflect the universal banking's narrow definition of a business model featured by a high diversification in financial products and services (Calomiris, 1998).

Noninterest income-based proxies for universal banking or product diversification

[1] A similar caveat arises when considering components of noninterest income as share of total income as these reflect the contribution to total income of a particular activity in isolation rather than in relation to the rest of the business model.

should then be interpreted with caution as while they capture the relative share of income generated from non-traditional banking, they do not reflect the actual overall diversification in financial products provision *per se*. Two banks with similar noninterest income may have very different universal business model configurations as one institution might be generating all its noninterest income from one product or business segment, say investment banking, and the other from a more diversified business model with several operating segments. There are also some practical challenges associated with the use of noninterest income-based proxies of universal banking. Most notably, the observed volatility of this measure is often due to its inherent pro-cyclicality rather than a structural re-dimensioning in banks' operations. Also, interpretational challenges arise when noninterest income is negative as witnessed in 2008 and 2009 for a number of banks, such as Citigroup (US), Imperial bank (Canada), Landesbank (Germany), KBC (Belgium).In the next section, we propose a proxy of universal banking that attempts to capture the diversification of activities of banks and which allows to rank banks by their relative degree of universal banking business model. Our proposed diversification measure, the UBI, differs from the above-mentioned studies in the literature in various ways. For example, the diversification measures proposed in Leaven and Levin (2007) and Elsas et al (2010) are either income based or asset based. The UBI on the other hand can be best described as a product diversification measure. That is, our measure takes into account the different segments of banks at a consolidated level and calculates the relative contribution of each operating segment to total assets. Furthermore, there are no restrictions on the number of activities that banks in our sample undertake. Hence, the UBI reflects the actual product diversification of banks.

2.2 The Universal Banking Index (UBI)

We propose a measure for universal banking based on data on operating segments of banks collected from Bloomberg. An operating segment is a group of related or comparable activities in a banking group[2] that contributes to at least 10% of total consolidated revenues. The identification of operating segment occurs across the banking group, regardless of whether the unit belongs to an incorporated subsidiary. We rely mainly on segmentation of banking

[2] The notion that well-diversified banks are institutions with several operating segments is an underlying assumption in the construction if the UBI. Industrial organisation literature widely recognises the fact that multi-business organisational forms are associated with diversified business model (among many: Cable and Yasuki, 1985; Palmer et al. 1987; Hitt et al. 1997).

assets, whenever this information is not available we use either segmented revenues or net income. Operating segments may differ across banks in terms of classification and cardinality.

The Universal Banking Index (UBI) is computed by using the the Shannon entropy measure of economic diversification, with its roots in geographical economics (Hackbart and Anderson, 1975) and commonly used in industrial economics. Entropy-based and related concentration/dispersion measures, such as the Herfindahl-Hirschman index (HHI), have been previously used in the applied banking literature in a few instances albeit not specifically to calculate the degree of universal banking or diversification in products provision. For instance, Tabak et al. (2011) use this approach to evaluate the concentration in industrial exposures of banks' loan portfolios using micro data on Brazilian banks. More closely related to our approach, Cetorelli and Goldberg (2014) propose a HHI-based business complexity measure based on the type of subsidiaries incorporated to banking groups using Bankscope's classification of institution type (banks, insurance companies, investment funds and other institutions). While this latter better describes business complexity in organisational structure, it cannot be used as a direct proxy for universal banking, most notably because it does not capture product diversification at the headquarter-level. In addition, incorporated subsidiaries may be engaged in overlapping existing activities. Figure A.1 in the Appendix allows us to understand this further by looking at the complexity in operational divisions classifications for the Deutsche Bank AG. Panel *a* shows the activities segmentation at the consolidated level for Deutsche Bank AG. Activities are here grouped into types across the institution as a whole, across affiliates. This approach allows us to free ourselves from the complexity of business models of banks and focus on the actual product (or rather group of products) offerings. As shown in Panel *a*, the activities of Deutsche Bank AG can be grouped into three main categories: Corporate and Investment bank (70% of total assets as of 2015-end), Private Client and Asset Management (26% of total assets as of 2015-end) and Corporate Investment (4% of total assets as of 2015-end). Further breakdown of activities of each of these latter categories are reported in Panel *b* which allows for a more detailed account of activities.

The entropy measure of economic diversification is generally defined as:

$$D(\hat{y}) = -\sum_{i=1}^{N} y_i \ln y_i \qquad (1)$$

Where:

i= 1, ..., N are basic units; y_i are the relative share of unit i of a random variable Y, for which $y_i = \frac{Y_i}{Y}$ and $\hat{y} = (y_1, y_2, \dots, y_N)$; Y is a random variable which is observed for each *i* such as Y=$\sum_{i=1}^{N} Y_i$. The diversification measure $D(\hat{y})$ lays between 0 and ln*N* ($0 < D(\hat{y}) < \ln N$) as

when y_i=1 there is no diversification and $D(\hat{y}) = 0$; when, instead, all basic units have the same relative share, i.e. $y_1 = y_2 = \cdots = y_N = \frac{1}{N}$, then $D(\hat{y}) = \log N$.

The entropy-based UBI is obtained by adapting (1) as follows:

$$UBI_i(\hat{a}_{i,b}) = -\sum_{b=1}^{B} a_{i,b} \ln a_{i,b} \quad (2)$$

Where i, i=1,…, I are banks, b, b=1, ..., B, are operating segments and $a_{i,b}$ is the relative share of assets of bank *i* in operating segment *b*. *B* is allowed to vary across banks (subscript *i* is omitted for simplicity of notation).

This approach to measuring universal banking may permit to capture some diversification benefits that stem from universal banking that are not seized by noninterest income proxies. More specifically, diversification in product provision, translating in specialized operating segments within the same banking group, may better shield a bank from idiosyncratic shocks. Indeed, the impact of intra-group shocks contagion in a bank having many established specialized operating segments is likely to be relatively more contained than in intermediaries with only a few divisions. Internal capital markets might help banks smooth out the impact of an adverse shock in one segment, improving the overall resilience of a bank (Ashcraft, 2006)[3,4]. As theoretically shown by Boot and Schmeits (2000), there is a diversification effect of co-insurance in banks constituted by many divisions suppling differentiated products which results in reduced risk-taking, probability of default and funding costs. As a result, understanding the heterogeneity in diversified business models across banks may be of particular interest for macro-prudential regulators for systemic risk assessment purposes. As argued by Haldane and May (2011), a financial system characterised by financial institutions featuring wide-ranging and well-diversified business models are more stable and protected from systemic contagion. Diversification in products provision and in operating units indeed allows eventual losses to be shared among a number of division, easing the pressure on the retail segment and containing intra-group contagion.

2.3 Sample selection and first look at the UBI

Segmented data at the operating level is disclosed by banks on a voluntary basis. Our starting point for data collection was the choice of countries to include in our sample since we are interested in both a macro and micro measure of universal banking. We decided to restrict

[3] See for instance Gambacorta (2005) for a discussion on bank subsidiaries.
[4] Cetorelli and Goldberg (2012) show that internal capital markets are used by global banks to reallocate liquidity across the borders.

our sample to the 30 BIS reporting countries[5] as these countries have banking systems that share a number of features. Most notably, they feature a high degree of development, internationalisation and interconnection with a variety of financial markets as well as comparable monetary policy strategies and prudential regulations. Including other countries outside this sample may bias our estimations as a large number of controls would be needed and these are not all available at both the macro and micro levels. For each selected sample country we then turned to the selection of the sample of banks. We use the world ranking compiled by The Banker containing the 1000 largest banks worldwide as these banks tend to share the same complexity in business models. We then exclude all banks that over the period 2001-2015: 1) do not belong to the BIS reporting countries; 2) do not have any deposit-taking activities and 3) do not have any segmented data at the operating level. Condition 2) is crucial as we are interested in financial institutions that can be characterised as banks due to their deposit-taking activity. This allows us to separate banks from other financial institutions that are very different in nature from universal banks. Our final sample includes 102 banks headquartered in 21 countries as reported in Table A.1 in the appendix. These banks are typically the largest banks in each country as these are the institutions that tend to disclose more data. We are unable to increase the number of banks in our sample as segmented data at the operating segment level due to lack of data. While our selection strategy attempts to minimise omitted variables problems that may arise in the empirical analysis, it has the limitation that our results cannot be necessarily generalised to banks operating in developing countries with very limited international operations.

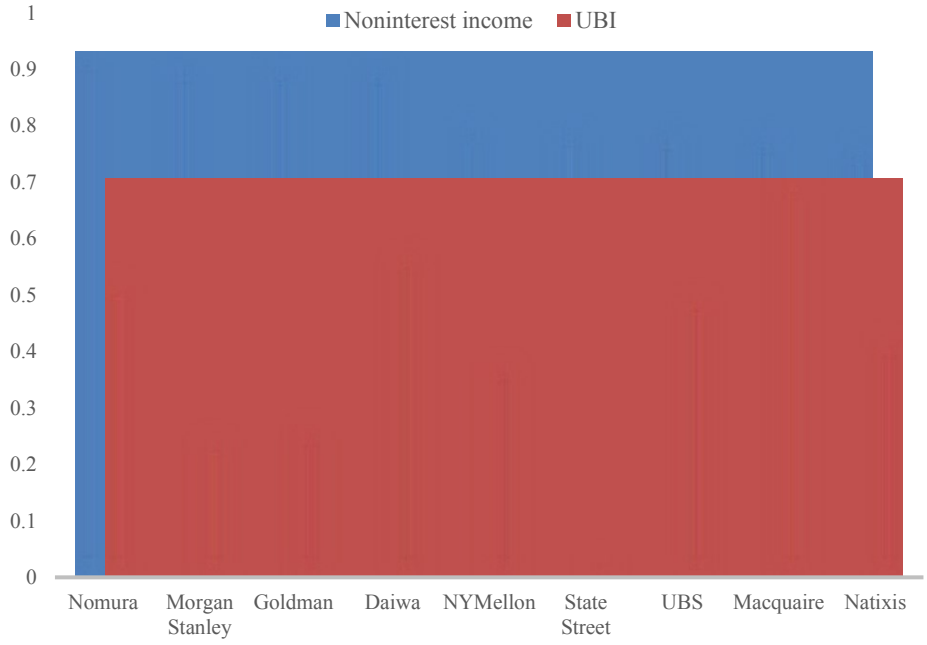
Figure 1 shows the relationship between noninterest income as a share of total income and UBI for those banks with the highest noninterest income in 2015. As it can be noticed, banks with similar noninterest income to total income, i.e. higher than 0.8, have very diverse diversification of operating segments, as suggested by the UBI. Most notably, banks such as Morgan Stanley, Goldman Sachs and UBS, albeit having high noninterest income shares, do not feature business models which are as diversified as Nomura, Macquaire and UBS. Morgan Stanley, for instance, has almost 90% of its income generated from non-traditional banking activities, most of which is generated from its institutional securities activities operations alone. In a similar fashion, State Street generates more than 80% of its income from non-traditional banking but this is concentrated mainly in investment servicing. On the contrary, for a similar level of noninterest income share Macquaire Bank has a much more diversified business model.

[5] Based on the consolidated banking statistics reporting.

This bank, indeed, features several divisions such as commodities and financial markets, banking and financial services, securities operations, corporate and asset finance, asset management and real estate banking, reflecting product provision specialisation in each of these activities.

At the other end of the spectrum, there are banks with lower noninterest income share and high UBI. This is the case, for instance, for Commerzbank with a noninterest income share equal to 0.462 as of 2010 but a well-diversified range of operating segments specialising respectively in corporates and markets, asset based finance, corporate banking, private and business customers. Also, Lloyds Banking Group has a similar business model, which is well diversified having divisions such UK retail banking, wholesale and international banking, insurance, consumer finance, life pension, asset management and wealth asset finance, but a noninterest income share equal to 0.4 as of 2014. Although these banks have a relatively low noninterest income, they provide a wide range of services most of which generating interest income. This shows that there are some banks that have some degree of diversification mostly within the interest generating activities and this is disregarded by looking at noninterest income alone.

Figure 1: Noninterest income share and UBI

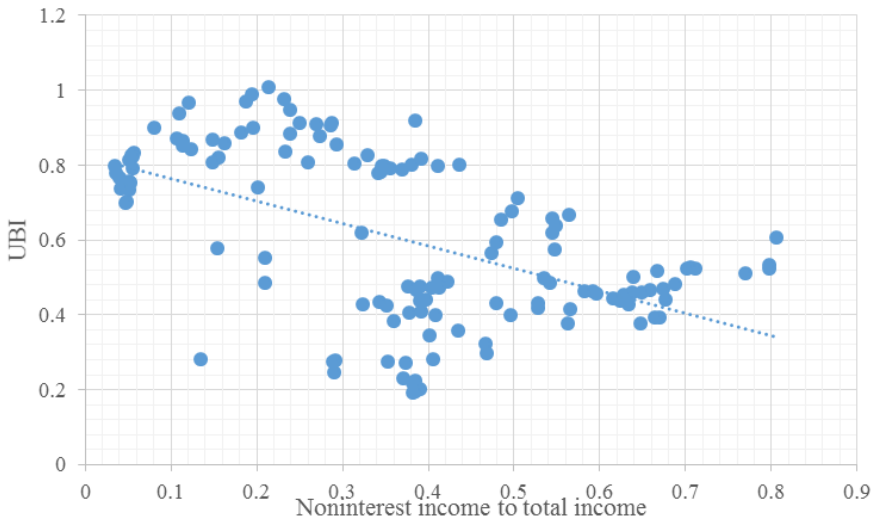


Sources: Authors' computations based on data obtained from Bloomberg.
Notes: Noninterest income is calculated as the share of noninterest income to total income in 2015.

A general tendency is observed when comparing the UBI and noninterest income-to-total income: the UBI tends to be lower for those institutions with high noninterest income, as shown in Figure 1, and vice versa. This evidence reflects how functional differences across institutions stand with respect to product provision diversification. The observed dichotomy can be explained by the fact that diversification in financial products provision has concerned primarily banks with a traditional history in commercial banking that have subsequently started offering other services, such as investment banking and asset management. On the other hand, the diversification observed for established investment banks and asset management firms has been mostly confined to the provision of either asset management services (for investment banks) or investment banking services (for asset management firms). Compiling a classification of banks by their core function is, however, here prevented by data limitation. This is due to the fact that for some banks several activities are bundled into one division, making it difficult to disentangle functional differences. Leaven and Levine (2007) also highlight the difficulties of differentiating between commercial and investment banks due to the fact that these institutions engage in a variety of similar activities.

Figure 2 confirms this trend, showing the relationship between UBI and noninterest income to total income for the US banks case. The overall negative relationship between these two measures suggests that there is a tendency for US banks with the highest levels of noninterest income shares to have a relatively less diversified business model than banks with lower noninterest income share. That is, banks that have a higher noninterest income share tend to be less diversified and depict a lower degree of universal banking, as measured by the UBI.

Figure 2: US banks- relationship between UBI and noninterest income to total income



Sources: Authors′ computations based on data obtained from Bloomberg.
Notes: Each point refers to the relationship between UBI and noninterest income share of US banks in the sample in available years over the 2001-2015 period.

Largest banks do not necessarily have a well-diversified business model: among the top-20 banks by UBI only six are G-SIFI. Instead, the group of banks with the most diversified business model feature large non-G-SIFI with assets in excess of $100bn that depict an average UBI equal to 0.42 in contrast to an average G-SIFI UBI of 0.39. G-SIFI, on the other hand, depict a higher noninterest income share equal to 0.56 on average compared to an average of 0.46 of large non-G-SIFI. Overall, smaller banks in the sample with assets below $100bn still have high levels of noninterest income share, equal to around 0.45, but relatively lower UBI.

Table 1 below reports the UBI average values for banks classified by their degree of globalization, wholesale funding and leverage, as preliminary assessment of how our metric behaves in relation to other business model features. There is an overall negative relationship between diversification of banking activities and globalization, as measured by the ratio of foreign assets to total consolidated assets. This suggests a trade-off between geographical diversification and diversification in financial services provision. More diversified banks seem to rely more on wholesale funding, as shown in the middle panel of Table 1, this may be explained by the fact that these institutions tend to have a lower deposit base arising naturally from the more limited scope of their retail operations. Lastly, there is no clear-cut evidence linking leverage and diversification. Indeed, on average, banks with either a very low, i.e. below 10, or very high, i.e. above 25, assets-to-equity ratio tend to be relatively more diversified.

Table 1: UBI and other business model features

Foreign assets	UBI	Wholesale funding	UBI	Leverage	UBI
[0, 0.2)	0,435	[0, 20)	0,279	[5, 10)	0,485
[0.2, 0.4)	0,424	[20, 40)	0,344	[10, 15)	0,326
[0.4, 0.6)	0,390	[40, 60)	0,390	[15, 20)	0,391
[0.6, 0.8)	0,219	[60, 80)	0,433	[20, 25)	0,354
[0.8, 1)	0,240	[80, 100)	0,479	[25, 30)	0,447

Notes: The above table reports the average values of UBI by variable tabulation using 2014 data on 101 banks. Foreign assets are computed by the share of non-domestic assets to total assets; wholesale funding is equal to non-deposit liabilities to total assets and leverage is calculated as the ratio of assets to equity.

2.4 Country-level UBI

A bottom-up approach allows obtaining a country-level measure of the degree of diversification in the provision of financial services, averaging micro data of banks headquartered in any given country. Table 2 reports the UBI rankings by country and by banks over the sample 2005-2015. The UBI is higher in Sweden and Australia. Many European countries, such as Greece, UK, France, Italy and Ireland have high average levels of UBI. Banking systems in the US, other European countries, Canada and Japan depict comparatively less universal business models. This trend is reflected in the bank-level UBI metrics reported in the second and third columns of Table 2 referring to the top and bottom rankings of UBI respectively. Two Australian banks, Commonwealth Bank and Macquire Bank, have the highest degree of diversification followed by three European banks: Eurobank (Greece), Unicredit (Italy) and Commerzbank (Germany). BNP Paribas, Lloyds and Bancorp are the most diversified banks in terms of financial products provisions as measured by the UBI in France, the UK and the US respectively. Morgan Stanley and State Street are the two US banks with the lowest UBI. Four Japanese banks are among the institutions with less diversified business models; in particular, Yokohoma, Chiba and Shinkin banks depict UBI values less than 0.02.

Table 2: UBI rankings by country and by banks, averages

Country	UBI	Bank	Top UBI ranking	Bank	Bottom UBI ranking
Sweden	0,510	Commonwealth bank	0,718	Deutsche bank	0,215
Australia	0,472	Macquaire	0,717	Santander	0,209
Greece	0,471	Eurobank	0,691	Heta	0,163
UK	0,467	Unicredit	0,682	Morgan Stanley	0,159
France	0,465	JP Morgan Chase	0,660	Immofinanz	0,145
Italy	0,449	Commerzbank	0,640	Julius Baer	0,109
Ireland	0,449	Bancorp	0,640	Mizuho	0,084
US	0,384	BNP Paribas	0,637	Alandsbanken	0,075
Germany	0,382	Lloyds	0,632	Kontrollbank	0,075
Canada	0,368	Immigon	0,630	KBC	0,071
Portugal	0,365	Bank of America	0,623	Erste	0,065
Netherlands	0,322	RBS	0,623	Canadian Western	0,064
Belgium	0,318	Credit Agricole	0,601	State Street	0,048
Spain	0,315	Banca Popolare Romagna	0,594	Yokohoma	0,017
Austria	0,298	PNC	0,585	Liberbank	0,015
Japan	0,275	Banco Popolare Milano	0,575	Queensland	0,011
Finland	0,272	Swedbank	0,561	Chiba	0,011
Switzerland	0,265	Nomura	0,560	Shinkin	0,004

Sources: Authors' computations based on data obtained from Bloomberg.

Notes: UBI for each country is calculating by averaging UBI for all banks available in the sample. UBI for each bank refers to the 2005-2015 averages for each institution.

Figure A.2 in the Appendix reports the time series dynamics of UBI for selected countries. Some countries such as the US and Australia depict a relatively stable UBI over the whole 2005-2015 period. The 2007-2009 crisis period has witnessed a reduction of the degree of universal banking in many countries, such as Austria, Belgium, Canada, Finland, Germany, Italy, Portugal, Ireland, Spain and Switzerland. On the other hand, in the UK, US, Japan and Australia the UBI has kept relatively steady over this period. Only in a few countries such as France, Greece and Sweden there has been a slight increase in the UBI during the GCF. The European Sovereign Crisis (ESC) has brought about a reduction or a freeze in the UBI especially in Greece, Ireland and Italy. Towards the sample-end, the UBI has picked up particularly in the UK, depicting its historical high.

3. Data and Methodology

The empirical methodology presented in this paper has as objective to assess the relative performance of the UBI versus noninterest income as a share of total income with respect to bank profitability, stability, liquidity and capital. Data is obtained from Bloomberg on an annual basis. The final dataset includes 102 banks from 21 countries over the years 2001-2015. As explained in the previous section, banks comprising the sample are those institutions for which assets segmentation by operating unit data is available on Bloomberg enabling the construction of the UBI. That is, banks included in the sample are all diversified, albeit to different degrees as we are here interested in looking at different degrees of universal banking, i.e. rather than comparing traditional banks (UBI=0) versus universal ones (UBI>0). Table A.1 reports the list of banks used in the estimation.

The estimated models have the following forms:

$$Y_{i,t} = \gamma_i + \beta_0 Y_{i,t-1} + \beta_1 UBI_{i,t} + X_{i,t}\Phi + \varepsilon_{i,t} \quad (3)$$

$$Y_{i,t} = \gamma_i + \beta_0 Y_{i,t-1} + \beta_2 NonInterest_{i,t} + X_{i,t}\Phi + \varepsilon_{i,t} \quad (4)$$

Where Y_{it} is a vector of dependent variables containing different proxies for banking profitability, stability, liquidity and capital for bank i, i=1,...,102. UBI_{it} is our measure of universal banking and $NonInterest_{it}$ is the traditional measures of universal banking, entering

regressions (3) and (4) respectively. X_{it} contains control variables and γ_i is the bank specific unobserved fixed effect.

A number of proxies are used to account for profitability, stability, liquidity and capital[6]. Our account for these banking proxies is informed from the literature and reflect those variables that may be more affected by universal banking. We follow Gambacorta and Van Rixel (2103) and we use return on equity (*roe*) as proxy for bank profitability. In addition, we also consider an alternative measure of profitability, namely the return on assets (*roa*) as suggested by Calomiris (1998). As discussed previously, there are discording views and findings on how a diversified business model may affect banking profitability, we have therefore no *a priori* expectations on the sign of the estimated UBI coefficient in the profitability regressions. We then use a number of variables to account for the banks' propensity to take on risk. We here account for both proxies for banking stability and capitalization. The relationship between universal banking and banks' risk-taking has been investigated in the empirical literature (see for instance, Wagner, 2010) even if even there is no clear consensus on the sign of this relationship when using noninterest income as proxy for universal banking. Following Altunbas et al. (2011), Boyd and Runkle (1993) and Demirgüc-Kunt and Huizinga (2010) we use the z-score as proxy for bank stability. This is calculated as the ratio of the return on assets plus the common capital ratio to the standard deviation of the return on assets over the available sample for each bank, i.e. the highest the z-score the further away a bank is from default. We also use the log of nonperforming assets (*lnpa*) and the ratio of nonperforming assets to total assets (*npa_ta*) as further proxies for bank stability as commonly used in the banking literature (see Demirguc-Kunt and Detragiache, 1998, for a discussion). As for capitalization, two measures of capital ratios are considered: tier1 risk-based capital ratio (*tier1*) and total risk-based capital ratios (*rbc*). Typically, lower levels of capitalizations are associated with higher risk-taking by banks (See Furlong and Keeley, 1989, for a discussion). Lastly, we also consider two proxies for bank liquidity: wholesale funding share (*wholesale*) defined as the ratio of non-deposit liabilities to total assets and loans to deposit ratio (*ldratio*). Literature on the relationship between of universal banking on banking liquidity is rather limited. Demirguc-Kunt and Huizinga (2010), however, find a positive relationship between banking diversification and liquidity, in particular the wholesale one,

[6] See Nosheen and Abdul Rashid (2019) and references therein for a throughout discussion on how credit quality and stability of conventional banks (as opposed to Islamic ones) behave at different stages of the business cycle.

using an international sample of 1334 banks. We thus decide, for completeness to include also these proxies of liquidity in our analysis.

Other control variables are considered in the regressions such as the log of total assets (*size*), net interest margins (*nim*), the log of total loans (*loans*), leverage (*leverage*) computed as the assets to equity ratio, deposits-to-assets ratio (*deposits*) and GDP growth rates (*ΔGDP*). We also include the ratio of foreign assets to total assets (*foreign activities)*, in order to capture the relative importance of foreign activities of banks. This is due to the fact that the great majority of universal banks have large foreign operations which may affect banks′ risk profile and profitability (Calomiris and Mason, 2000, and Carlson, 2004). Table 3.A the summary statistics of the variables used in the regression.

Models (3) and (4) are an extended dynamic version of the regressions found in Demirguc-Kunt and Huizinga (2010). We employ a dynamic panel model for statistical and economic reasons. Within-group error terms tend to be serially correlated when trending variables are used in the panel regression. In our case, most of the banking proxies used display persistent behaviors and serial autocorrelation justifying the use of a dynamic setting. A static model would result in misspecification as it would not capture the fact that past values of banking proxies are expected to explain current behavior in these same variables in most cases. Including as regressor a lagged dependent variable, however, invalidates the strict exogeneity OLS assumption, due to the endogeneity bias due to correlation between the error term and the lagged dependent variable. In order to correct the coefficient estimates for the dynamic estimation, we use the two-step first difference Generalized Method of Moment (GMM) technique as pioneered by Arellano and Bond (1991). This econometric methodology eliminates the fixed effect by first differencing (3) and (4) and corrects for endogeneity among variables by using as instruments lagged differences of the dependent variable. The GMM estimation will also allow us to correct for eventual endogeneity problems arising from reverse casuality, which is a common problem when using bank-level variables (see Varvara, 2014, for a discussion). In all specifications we use as instruments the lagged differences of the dependent variable and we test for their validity by means of a Sargan-Hansen test, or J-statistics, for over-identifying restrictions, reported at the bottom of each regression in the next sections. Standard errors are corrected for heteroscedasticity (White, 1980).

4. Empirical Results

Tables 3 and 4 report the results of estimates of (3) and (4).

Table 3 reports the regression estimates where profitability and stability proxies are used as dependent variables. Columns (1), (3), (5), (7) and (9) consider the UBI as universal banking proxy while columns (2), (4), (6), (8), and (10) use noninterest income share as proxy of universal banking. With regards to profitability, it is found that banks with higher UBI tend to be more profitable, as reported in columns (1) and (3). That applies to both proxies for profitability, namely returns on assets (*roa*) and returns on common equity (*roe*) which have positive and strongly significant coefficients. Limited evidence is found in support of a positive relationship between noninterest income share and profitability. The estimated coefficient of *NonInterest* is positive and significant only in column (4) where *roe* is used as proxy for profitability. These results are overall in line with findings by Elsas et al. (2010) who find a positive relationship between activities diversification and profitability of banks. The regressions in columns (5)-(10) suggest that a higher UBI enhances stability while noninterest income share has either an adverse or no effect on stability. The estimated coefficient associated with the UBI is positive and statistically significant in column (5), implying that banks that have a more diversified business model are less likely to default. A more diversified business model as measured by the UBI is also associated with lower nonperforming assets, as reported in columns (7) and (9). The estimated coefficient of *NonInterest* is not significant in the regressions in which *z-score* and *lnpa* are dependent variables, while it is marginally significant and positive in the regression in which stability is measure by *npa_ta*, implying that as the share of noninterest income increases, nonperforming assets as a share of total assets increase.

Table 4 reports the regression estimates where liquidity and capitalization proxies are used as dependent variables. Estimates in columns (1) and (3) suggest that UBI does not have a predicting power in explaining liquidity, that is for both proxies of liquidity namely loan-to-deposit ratio and wholesale. Non interest income on the other hand is negatively associated with loan-to-deposit ratio, as reported in column (2). With regards to capitalization, our regression estimates suggest that banks featuring a higher degree of UBI are better capitalized than those institutions with lower activities diversification. The UBI indeed enters with a positive and strongly significant coefficient in the regressions in which tier 1 capital and total risk based capital ratios are used as dependent variables in columns (5) and (7). In columns (6) and (8), where *NonInterest* is used as proxy of universal banking, however, the negative and

significant estimated coefficients indicate that higher noninterest income is associated with lower capital ratios.

Table 3: UBI versus noninterest income - profitability regressions, GMM first differences

	Profitability proxies			
Variables	roa		roe	
	(1)	(2)	(3)	(4)
Lagged dependent	0.039 (0.055)	0.006 (0.082)	0.022 (0.096)	0.051 (0.052)
NonInterest	-	0.083 (0.603)	-	64.750*** (11.717)
UBI	0.962*** (0.348)	-	85.309*** (32.969)	-
foreign activities	0.823*** (0.244)	0.915*** (0.304)	0.904 (13.569)	-10.152 (8.301)
roa	-	-	-	-
leverage	0.001 (0.001)	0.002* (0.304)	-0.444 (13.569)	0.408 (0.364)
rbc	0.123*** (0.020)	0.110*** (0.023)	0.011 (0.613)	-0.078* (0.364)
nim	0.437*** (0.171)	0.251* (0.140)	-1.678 (3.373)	5.084* (2.773)
size	-0.009 (0.029)	0.024 (0.044)	-0.153 (0.792)	-0.673 (0.634)
lnpa	-0.454*** (0.051)	-0.378*** (0.053)	-3.491 (1.367)	-0.842 (0.558)
loans	-0.369* (0.204)	-0.638** (0.294)	- 13.453*** (4.951)	-1.496 (3.541)
deposits	-0.011** (0.005)	-0.013* (0.008)	0.004 (0.177)	-0.096 (0.132)
ΔGDP	0.030 (0.026)	0.033* (0.019)	-0.101 (0.465)	0.315 (0.315)
Observations	357	355	347	358
J-Statistics, p-value	0.211	0.382	0.228	0.736
AR(2) test p-value	0.961	0.937	0.953	0.338

Notes: This table reports the estimates of a generalised method of moments two-steps difference panel regressions (Arellano and Bond, 1991). Robust standard errors in parenthesis . ***,**,* refer to 1%, 5% and 10% significance levels, respectively.

Table 3 (continued): UBI versus noninterest income - stability regressions, GMM first differences

	Stability proxies					
Variables	z-score		lnpa		npa_ta	
	(5)	(6)	(7)	(8)	(9)	(10)
Lagged dependent	0.480***	0.441***	0.248***	0.437***	0.614***	0.670***
	(0.020)	(0.019)	(0.079)	(0.015)	(0.059)	(0.048)
NonInterest	-	-0.730	-	-0.025	-	1.0215*
		(1.777)		(0.022)		(0.733)
UBI	15.462***	-	-2.724***	-	-14.106***	-
	(3.929)		(0.868)		(3.008)	
foreign activities	4.254	-0.693	3.137***	0.793***	6.832***	1.705
	(2.790)	(1.690)	(1.013)	(0.119)	(1.876)	(1.846)
roa	4.226***	2.059***	-0.204**	-0.371***	-0.719***	-1.082***
	(0.603)	(0.226)	(0.096)	(0.024)	(0.175)	(0.077)
leverage	-0.025	0.003	0.000	-0.001	-0.003	-0.013
	(0.037)	(0.007)	(0.001)	(0.001)	(0.010)	(0.010)
rbc	0.757***	0.493***	0.017	0.007	-0.119	0.020
	(0.079)	(0.042)	(0.023)	(0.007)	(0.073)	(0.059)
nim	-0.052	0.178	0.767***	0.307***	-0.497***	0.090
	(0.742)	(0.325)	(0.172)	(0.060)	(0.148)	(0.199)
size	0.042	0.277***	0.072**	0.197***	0.151	-0.027
	(0.185)	(0.091)	(0.06)	(0.076)	(0.142)	(0.022)
lnpa	-1.538***	-1.478***	-	-	-	-
	(0.324)	(0.117)				
loans	1.838**	1.339***	1.802***	0.854***	-0.173	0.873*
	(0.882)	(0.443)	(0.289)	(0.091)	(0.093)	(0.469)
deposits	0.011	0.222***	0.006	-0.004	0.134***	0.053***
	(0.049)	(0.021)	(0.012)	(0.003)	(0.022)	(0.019)
ΔGDP	-0.807***	-0.740***	0.002	0.003	-0.101***	-0.203***
	(0.073)	(0.065)	(0.015)	(0.006)	(0.038)	(0.050)
Observations	395	409	384	398	427	441
J-Statistics, p-value	0,801	0,741	0,111	0,541	0.185	0,598
AR(2) test p-value	0.990	0,995	0,183	0,816	0.893	0,478

Notes: This table reports the estimates of a generalised method of moments two-steps difference panel regressions (Arellano and Bond, 1991). Robust standard errors in parenthesis . ***,**,* refer to 1%, 5% and 10% significance levels, respectively.

The control variables in Tables 3 and 4 have overall the expected signs. Since we have applied a dynamic setting for all our regressions, the estimated lagged dependent variable is significant only when the dependent variable is persistent. This is the case for all but the capitalization proxies. The estimated coefficient for foreign activities is positive and strongly statistically when profitability is proxied by *roa,* suggesting that overseas expansion in banking activities increases profitability by around 9%, columns (1-2) of Table 3. Risk based capital ratio is also positively associated with profitability, a finding consistent with Bitar and Walker

(2018). Return on assets has a positive impact on stability, as reported in columns (5)-(10) in Table 3. The risk-based capital ratio estimated coefficient is positive and significant, columns (5-6) of Table 3, implying that well capitalized banks are less likely to default. Such positive relationship is also supported by the literature, arguing that higher capital ratios mean bank shareholder are exposed to higher losses in the event of default, hence banks are less likely to take on more risk (Repullo, 2002). As expected, the higher the non-performing loans the closer banks are to default, as reported in columns (5) and (6) of Table 3. When *lnpa* is used to proxy stability the coefficient on foreign activities is positive and strongly statistically significant. This suggests that whilst expanding abroad is profitable, as stated above, it could have a negative effect on stability by means of increasing the share of nonperforming assets. The negative and significant coefficient of GDP growth in columns (5) and (6) of Table 3 can be explained by the pro-cyclicality of risk taking behavior by banks as well documented in the literature (see Adrian and Shin, 2010). The negative and significant coefficients of GDP growth in columns (9) and (10) in Table 3 also have the expected sign as economic booms are typically associated with lower nonperforming assets. Turning to Table 4, estimates suggest that foreign activities make banks more liquid, as reported in columns (1) and (2). Looking at risk based capital coefficient the results suggest that the higher the ratio the lower the reliance of banks on wholesale funding. Similarly, a higher *roe* ratio is associated with lower wholesale funding. Lastly, as suggested by the estimated coefficients of *size*, larger institutions are associated with higher nonperforming assets (columns (7) and (8), Table 3) and lower liquidity (columns (1) and (2), Table 4).

Table 4: UBI versus noninterest income - liquidity regressions, GMM first differences

	Liquidity proxies			
Variables	ldratio		wholesale	
	(1)	(2)	(3)	(4)
Lagged Dependent	0.086**	0.836***	0.613***	0.3561***
	(0.036)	(0.004)	(0.056)	(0.103)
NonInterest	-	-0.101***	-	-1.013
		(0.005)		(1.019)
UBI	-0.121	-	7.656	-
	(0.362)		(5.289)	
foreign activities	0.677**	2.168***	-5.183	-1.047
	(0.310)	(0.102)	(3.174)	(4.658)
roa	-0.177***	-0.148***	-0.923***	-2.227***
	(0.058)	(0.009)	(0.291)	(0.731)
leverage	-0.004***	-0.002***	-0.004	0 .000
	(0.000)	(0.000)	(0.006)	(0.019)
rbc	-0.009	0.001	-0.828***	-1.320***
	(0.009)	(0.002)	(0.133)	(0.229)
nim	-0.124*	0.003	0.823	-0.014
	(0.069)	(0.014)	(0.917)	(1.758)
size	0.004	0.036***	0.368	0.181
	(0.009)	(0.013)	(0.357)	(0.322)
lnpa	-0.048*	-0.129***	0.183	-0.605
	(0.028)	(0.007)	(0.530)	(0.954)
loans	-	-	0.935	4.446**
			(1.397)	(2.297)
deposits	-	-	-	-
ΔGDP	-0.008	-0.019***	0.002	0.091
	(0.009)	(0.001)	(0.089)	(0.186)
Observations	498	513	395	409
J-Statistics, p-value	0,636	0,39	0,395	0,365
AR(2) test p-value	0,133	0,735	0,618	0,415

Notes: This table reports the estimates of a generalised method of moments two-steps difference panel regressions (Arellano and Bond, 1991). Robust standard errors in parenthesis . ***,**,* refer to 1%, 5% and 10% significance levels, respectively.

Table 4 (continued): UBI versus noninterest income - capitalization regressions, GMM first differences

	Capitalisation proxies			
Variables	tier1		rbc	
	(5)	(6)	(7)	(8)
Lagged Dependent	0.142*** (0.002)	0.152*** (0.002)	0.328*** (0.053)	0.380*** (0.032)
NonInterest	-	-1.495*** (0.178)	-	-1.807*** (0.229)
UBI	6.380** (3.182)	-	8.983*** (3.544)	-
foreign activities	4.305** (1.976)	6.913*** (0.728)	0.665 (1.565)	6.441*** (1.244)
roa	2.647*** (0.320)	2.038*** (0.101)	0.539 (0.343)	0.635*** (0.070)
leverage	-0.009 (0.010)	0.001 (0.002)	0.041** (0.018)	0.007** (0.003)
rbc	-	-	-	-
nim	-2.023*** (0.312)	-2.314*** (0.178)	-0.268 (0.516)	-0.455** (0.206)
size	0.090 (0.092)	0.138** (0.066)	-0.108 (0.319)	-0.119 (0.164)
lnpa	2.397*** (0.470)	1.745*** (0.131)	1.576*** (0.443)	1.543*** (0.069)
loans	-1.900** (0.779)	-1.410*** (0.014)	0.530 (0.859)	-1.647*** (0.243)
deposits	0.138*** (0.035)	0.148*** (0.014)	0.130*** (0.029)	0.126*** (0.015)
ΔGDP	-0.098 (0.093)	-0.152*** (0.035)	0.150 (0.112)	0.157*** (0.026)
Observations	389	403	381	403
J-Statistics, p-value	0,267	0,406	0,153	0,434
AR(2) test p-value	0,365	0,949	0,641	0,997

Notes: This table reports the estimates of a generalised method of moments two-steps difference panel regressions (Arellano and Bond, 1991). Robust standard errors in parenthesis . ***,**,* refer to 1%, 5% and 10% significance levels, respectively.

5. Robustness Checks

The empirical results presented above indicate that a higher UBI enhances stability. We now assess the robustness of these findings by including an interaction variable between UBI and foreign activities, namely *UBI*foreign*. This allows us to capture a more complex business model, in which banks have both a universal and global reach feature, adopted by some banks in our sample. Furthermore, the results in the previous section provide limited evidence on the role of bank size on stability. In an attempt to better assess the implication of bank size on stability, we distinguish those banks that are considered as the most systematic important financial institutions, namely *sifi* and those that do not fall into this category. We obtain the 2018 G-SIFI list published by the Stability Board and construct a dummy variable which takes the value of 1 for banks that are listed as G-SIFI and 0 otherwise. Lastly, we construct a dummy variable to capture the way banks in our sample are funded. In particular, banks can either obtain funding via issuing deposits, which is the traditional way, or via the wholesale market. The 2007-08 financial crisis revealed the vulnerabilities of banks reliance on wholesale funding market (Tarullo 2014) and we here investigate whether diversification renders these institutions more stable. To assess the implications is this type of business model we use the wholesale funding ratio to distinguish between the two different types of funding i.e. traditional or wholesale funding. In particular, the dummy variable takes the value of 1 if the wholesale funding share is greater than 50% and classify them as *wholesale banking* and 0 otherwise. For those banks that in a particular year the wholesale ratio is lower than our threshold we take the average of the period under consideration, that is between 2001-1015, to distinguish their funding reliance.

Table 5 presents the regression results when the interaction variable between UBI and foreign activities is included in the analysis. Overall, we find that our baseline results are robust as we still find that UBI enhances stability, as reported in column (1). Our findings in relation to foreign activities of banks are also consistent suggesting that banks overseas activates enhance stability. However, we find somewhat different implications for stability than when taking into account activities diversification only. Most notably, the results suggests that the higher the degree of complexity the higher the financial instability. Indeed, the estimated coefficient associated with z-score, column (1), is negative and strongly significant and equal to 22.444, suggesting that the higher the complexity the closer the bank gets to failure. Moreover, *UBI*foreign* is positively related to the log of nonperforming assets with a significant coefficient in column (2).

Table 5: UBI and foreign activities - stability regressions, GMM first differences

	Stability proxies		
	z-score	lnpa	npa_ta
	(1)	(2)	(3)
Lagged dependent	0.441*** (0.017)	0.279* (0.146)	0.660*** (0.051)
UBI	6.353*** (2.351)	-5.245** (2.697)	-15.992*** (3.541)
foreign activities	6.483*** (2.090)	6.024** (2.421)	6.028** (2.749)
UBI*foreign activities	-22.444*** (4.061)	18.426** (8.071)	-8.426 (5.155)
roa	1.731*** (0.272)	-0.125 (0.294)	-0.587*** (0.142)
leverage	-0.001 (0.012)	-0.001 (0.003)	0.001 (0.009)
rbc	0.467*** (0.061)	-0.041 (0.076)	-0.116* (0.069)
nim	-0.583 (0.729)	2.004*** (0.655)	-0.681*** (0.179)
size	0.233 (0.245)	0.022 (0.052)	-0.001 (0.237)
lnpa	-1.508*** (0.163)	-	-
loans	0.170 (0.776)	3.944*** (0.853)	0.563 (0.417)
deposits	0.209*** (0.027)	0.072** (0.029)	0.097*** (0.020)
ΔGDP	-0.667*** (0.097)	-0.087 (0.077)	-0.085** (0.039)
Observations	395	384	427
J-Statistics, p-value	0,788	0,792	0.666
AR(2) test p-value	0.984	0,606	0.980

Notes: This table reports the estimates of a generalised method of moments two-steps difference panel regressions (Arellano and Bond, 1991). Robust standard errors in parenthesis . ***,**,* refer to 1%, 5% and 10% significance levels, respectively.

Table 6: G-SIFI and wholesale banking - stability regression, GMM first differences

	Stability proxies					
Variables	z-score		lnpa		npa_ta	
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Dependent	0.449*** (0.022)	0.459*** (0.022)	0.349*** (0.102)	0.185 (0.169)	0.644*** (0.051)	0.692*** (0.060)
UBI	15083*** (2.273)	25.575*** (6.090)	-1.417 (1.219)	-3.665** (1.856)	-15.248*** (1.830)	-5.477** (2.760)
foreign activities	3.819 (3.556)	-1.004 (2.693)	3.317** (1.557)	3.021** (1.374)	7.683*** (1.685)	6.198*** (2.181)
roa	4.234*** (0.579)	4.488*** (0.546)	-0.237** (0.129)	-0.207* (0.120)	-0.756*** (0.090)	-1.010*** (0.091)
leverage	-0.009 (0.028)	-0.001 (0.016)	0.001 (0.002)	-0.003 (0.004)	-0.005 (0.010)	-0.021*** (0.008)
rbc	0.667*** (0.106)	0.717*** (0.102)	-0.007 (0.040)	0.093** (0.048)	-0.168*** (0.052)	-0.090 (0.066)
nim	-0.447 (1.001)	-0.620 (1.262)	0.788*** (0.216)	0.692*** (0.238)	-0.102 (0.156)	-0.077 (0.196)
size	-	0.126 (0.213)	-	0.069 (0.049)	-	-0.001 (0.112)
lnpa	-1.846*** (0.203)	-2.065*** (0.330)	-	-	-	-
loans	2995*** (0.7280	2.827*** (0.880)	1.936*** (0.346)	1.426*** (0.336)	0.128 (0.375)	0.768* (0.444)
deposits	0.072** (0.033)	-	0.010 (0.018)	-0.023 (0.20)	0.093*** (0.022)	0.076*** (0.014)
ΔGDP	-0.836*** (0.077)	-0.860*** (0.095)	-0.007 (0.020)	0.024 (0.049)	-0.063** (0.027)	-0.102** (0.042)
sifi	9.780*** (3.507)	-	-0.615 (2.320)	-	-7.828*** (0.679)	-
sifi*UBI	-10.896 (7.791)	-	-1.771 (4.086)	-	20.699*** (1.433)	-
wholesale		6.922*** (2.331)		1.600 (2.255)	-	5.852*** (2.196)
wholesale *UBI		-9.386*** (3.410)		0.159 (2.296)	-	-2.592 (2.840)
Observations	392	378	381	367	424	404
J-Statistics, p-value	0,669	0,789	0,357	0,484	0,347	0,761
AR(2) test p-value	0.986	0,688	0,140	0,507	0.949	0,426

Notes: This table reports the estimates of a generalised method of moments two-steps difference panel regressions (Arellano and Bond, 1991). Robust standard errors in parenthesis . ***,**,* refer to 1%, 5% and 10% significance levels, respectively.

Table 6 presents the results when both G-SIFIs and investment banks as well as their interaction with UBI are included in the stability regressions. Our findings suggests that G-SIFIs tend to be more stable than non G-SIFIs, as reported in columns (1) and (5). However, we find limited evidence on the relationship between the interaction variable, *UBI*sifi* and stability. Only when *npa_ta* is used to proxy stability the interaction variable is significant indicating a positive relationship. This can be interpreted as follows: a bank that has a high UBI and is listed as G-SIFI is associated with a higher share of nonperforming assets to total assets than a bank that is less universal and non G-SIFI.

With regards to wholesale banking there is limited evidence on the relationship with stability. The coefficient associated with the interaction variable, UBI**wholesale banking* is significant only in the *z-score* specification. The results suggests that a universal bank that relies on wholesale market to obtain finance is more closer to default that a banks that is less universal and its funded via a more traditional way.

6. Conclusions

This paper has introduced a new measure for universal banking that better captures the actual *modus operandi* of a bank by accounting for the actual diversification in financial products provisions. By using an entropy approach, we use balance sheet data on activities of banks segmented by type of service offered to customers. When comparing this measure with noninteret income, very different patterns arise. More specifically, banks with similar noninterest income share depict different degrees of activity diversification, implying structurally unlike business models.

Regression analyses point to different implications for banking profitability, stability, liquidity and capitalisation arising from using our alternative metric. The two proxies have diverse effects on stability and capitalisation. In particular, when noninterest income share is used as proxy for the universal banking, it has either an adverse or no effect on stability. However, when the UBI is used to proxy for universal banking there is evidence that a higher degree diversification increases stability. Banks having a more diversified business model, as proxied by the UBI, are also better capitalised, as opposed to banks with high noninterest income share.

Our results support, in our regard, important policy recommendations. Post-crisis regulatory focus on structural reforms aimed to break-up banks to impair universal banking are based on the view that this business model encourages bank risk taking. This view is largely

supported by an empirical literature that relies on noninteret income based measures as proxy for universal banking. The pros and cons of universal banking, we argue, should be assessed by means of alternative measures, whenever these are obtainable from available data, alongside the traditional income-based ones. Our analysis has shown that diversification in products provision is not necessarily captured by noninteret income proxies and that while the former may be beneficial to banks the latter is not. Regulatory-induced restriction on universal banking may indeed reduce the benefits of risk-sharing across operating segments, exposing banks to heightened risks.

We hope that our database will be used by other researchers to explore this pressing matter further. While this paper has attempted to establish a relationship between universal banking as measured by the UBI and some banking variables, it has not investigated whether there are some underlying characteristics of banks that make this model more likely. In addition, it would be interesting to assess how the UBI relates to systemic risk or to (re)investigate the economies of scopes of diversified banks in the light of the new metric. We believe these can be interesting research questions to be investigated by future research.

References

Adrian, T. and H. S. Shin (2010). Financial Intermediaries and Monetary Economics, in B.M. Friedman and M. Woodford, eds., *Handbook of Monetary Economics*, 3, Amsterdam: Elsevier.

Altunbas, Y., Manganelli, S. and Marques-Ibanez, D. (2011). Bank Risk During the Financial Crisis – Do Business Models Matter?, ECB Working Paper Series, No. 1394, European Central Bank, Frankfurt.

Ashcraft, A. (2006). New Evidence on the Lending Channel, *Journal of Money, Credit, and Banking*, 38(3): 751-76.

Arellano, M. and S. Bond. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies,* 58: 277 – 297.

Berger, P., and Ofek, E. (1995). Diversification's effect on firm value. *Journal of Financial Economics* 37: 39-65.

Berger, A., Demesetz, R, and Strahan, P. (1999). The Consolidation of Financial Services Industry: Causes, Consequences and Implications for the Future. *Journal of Banking and Finance* 27:135-194.

Bitar, M., and Walker, Th., (2018), The effect od capital ratios on the risk, efficiency and profitability of banks: Evidence from OECD countries, *Journal of International Financial Markets, Institutions and Money*, 53:227-262

Blundell-Wignall, A. and Atkinson, P.E. (2012). Deleveraging, Traditional versus Capital Markets Banking and the Urgent Need to Separate GSIFI Banks. *OECD Journal: Financial Market Trends*, Issue No. 1.

Blundell-Wignall A, Atkinson P. and Roulet C. (2013). Bank business models and the separation issue, 2013/2 *OECD Journal: Financial Market Trends*.

Boyd, J.H. and D.E. Runkle (1993). Size and Performance of Banking Firms: Testing the Predictions of Theory, *Journal of Monetary Economics*, 31 (1): 47-67.

Boot, A. W.A and A. Schmeits (2000). Market Discipline and Incentive Problems in conglomerate Firms with Applications to Banking, *Journal of Financial Intermediation*, 9(3), 240-273

Cable, J., and Yasuki, H., (19985), Internal organization, business groups and corporate performance: an empirical test of the multidivisional hypothesis in Japan, *International Journal of Industrial Organization*, 3(4):401-420.

Calomiris, C.W. (1998), Universal banking "American-Style", *Journal of Institutional and Theoretical Economics (JITE) / Zeitschrift für die gesamte Staatswissenschaft,* Vol. 154, No. 1, The New Institutional Economics Financial Institutions in Transition: Banks and Financial Markets (Mar. 1998), pp. 44-57

Calomiris, C. and J. Mason. (2000). Causes of U.S Bank Distress During the Depression. . *NBER Working Paper* 7919.

Casu, B., Girardone, C. and Molyneux, P. (2015). *Introduction to Banking*, 2nd Edition, Pearson.

Cetorelli N. and L.S.Goldberg, (2012). Banking Globalization and Monetary Transmission, *Journal of Finance*, 67(5): 1811–1843.

Cetorelli, N. and L.S. Goldberg (2014), Measures of global bank complexity, FRBNY Economic Policy Review/ December 2014.

Carlson, Mark. (2004). "Are Branch Banks Better Survivors? Evidence from the Depression Era." *Economic Inquiry,* 42(1):111-126.

Demirguc-Kunt, A. and Detragiache, E. "Financial Liberalization and Financial Fragility," Paper presented at the World Bank's Annual Bank Conference on Development Economics, April 1998.

Demirguc-Kunt A. and Huizinga H. (2010). Bank Activity and Funding Strategy: The impact of Risk and Returns. *Journal of Financial Economics*, 98:626-650.

Diamond, D. W. (1984). Financial Intermediation and Delegated Monitoring. *Review of Economic Studies* 51(3):393-414.

Denis, D., Denis, D., Sarin, A., (1997). Agency problems, equity ownership, and corporate diversification, *Journal of Finance* 52: 135-160.Dietrich D. and Vollmer U. (2012). Are Universal Banks bad for Stability? Germany during the world financial crisis. *The Quarterly Journal of Economics and Finance*, 52:123-134

Duffie, D (2012). Market making under the proposed Volcker rule", mimeo, 16 January.

Elsas R, A Hackethal and M Holzhäuser (2010): The anatomy of bank diversification, *Journal of Banking and Finance*, 34: 1274–87.

Furlong, F.T., Keeley, M.C. (1989). Capital regulation and bank risk-taking: A note. *Journal of Banking and Finance*, 13, 883–891

Gambacorta, L. (2005). 'Inside the bank lending channel', *European Economic Review*, 49: 1737-59.
Gambacorta L. and van Rixtel A. (2013). Structural bank regulation initiatives: approaches and implications, BIS Working Paper No 412, April.

Geyfman, V. and Yeager, J.T. (2009), On the riskiness of universal banking: evidence form banks in the investment banking business pre-and post-GLBA, *Journal of Money, Credit and Banking*, 41(8):1649-1669.

Goodhart, C. A. E., (2012), The Vickers Report: An Assessment, *Law and Financial Markets Review*, 6(1).

Jensen, M., Meckling, W., 1976. Theory of the firm: Managerial behavior, agency costs, and ownership structure. *Journal of Financial Economics* 3: 305-360.

Hackbart, M.M. and Anderson, D.A. (1975), Measuring economic diversification, *Land Economics*, 51(4): 374-378.

Hakenes, H., and Schnabel, I., (2014), Regulatory by Sophistication, CEPR Discussion Paper No.DP10100

Haldane, A.G. and May. R.M. (2011). Systematic Risk in Banking Ecosystem, *Nature*, *469*: 351-355

Hendrik, H. (2014). Bank Bonuses and Bailouts, *Journal of Money, Credit and Banking*, 46(1):259-288

Hitt, M.A., Hoskisson, E.R. and Kim, H., (1997), International diversification: effects on innovation and firm performance in product-diversified firms, *The Academy of Managerial Journal*, 40(4): 767-798.

Jensen, M. C. and Mecklin, H.W. (1976), Theory of the firm: Managerial behavior, agency costs and ownership structure, *Journal of Financial Economics*, 3(4):305-306.

Laeven, L. and R. Levine (2007). Is there a diversification discount in financial conglomerates? *Journal of Financial Economics*, 85:331–67.

Lang, L., and Stulz, R.(1994). Tobin's Q, corporate diversification, and firm performance. *Journal of Political Economy* 102:1248-1280.

Lepetit, L., Nys, E., Rous, Ph., and Tarazi, A. (2008), The expansion of services in European banking: implications for loan pricing and interest margins, *Journal of Banking and Finance*, 32(11):2325-2335.

Lewellen, W. (1971). A Pure Financial Rationale for the Conglomerate Merger. *Journal of Finance* 26:521-573.

Markowitz, H. (1952). Portfolio Selection. *Journal of Finance* 7(1):77-91.

Nosheen and Abdul Rashid (2019) Business orientation, efficiency, and credit quality across business cycle: Islamic versus conventional banking. Are there any lessons for Europe and Baltic States?, *Baltic Journal of Economics*, 19(1), 105-135.

Palmer, D., Friedland, R., Jennings, P.D. and Powers, M.E. (1987), The economics and politics of structure: the multidivisional form and the large U.S. corporation, Administrative Science Quarterly, 32:25-48.

Rajan, G. R. (1992), Insiders and outsiders: The choice between informed and arm's-length debt, *Journal of Finance*, 47(4):1367-1400.

Repullo, R., (2002). " Capital Requirements, Market Power and Risk-Taking in Banking", CEMFI and CEPR .

Rotemberg, J. and Saloner, G. (1994). Benefits of narrow business strategies. *American Economic Review* 84:1330-1349.

Saunders, A. and Walter, I. (1994). *Universal banking in the United States: What could we gain? What could we lose?*, Oxford University Press.

Shleifer, A. and Vishny R. W. (2011). Fire Sales in Finance and Macroeconomics. *Journal of Economic Perspectives* 25(1):29-48.

Stein, J., (2002). Information production and capital allocation: Decentralized versus hierarchical firms. *Journal of Finance* 57: 1891-1921.

Stiglitz, J. (2010). Risk and the Global Economic Architecture: Why Full financial Integration May be Undesirable. *The American Economic Review* 100(2):388-392.

Stiroh, K. (2004). Diversification in banking: Is noninterest income the answer?, *Journal of Money, Credit and Banking*, 36(5): 853-82.

Tabak, M.B., Fazio, M.D. and Cajueiro, O.D. (2011), The effects of loan portfolio concentration on Brazilian banks' return and risk, *Journal of Banking and Finance*, 35(11):3065-3076.

Tarullo, D., (2014), Liquidity regulation, *Speech at the Clearing House 2014 Annual Conference (New York)*.

Thakor, V. A. (2012). The Economic Consequences of the Volcker Rule, US Chamber's Center for Capital Markets Competitiveness Working Paper

Varvara I., (2014). Resuming bank lending in the aftermath of the Capital Purchase Program, Documents de travail du Centre d'Economie de la Sorbonne 14062, Université Panthéon-Sorbonne (Paris 1), Centre d'Economie de la Sorbonne.

Wagner, W. (2010). Diversification at Financial Institutions and Systemic Crises. *Journal of Financial Intermediation* 19:373-386.

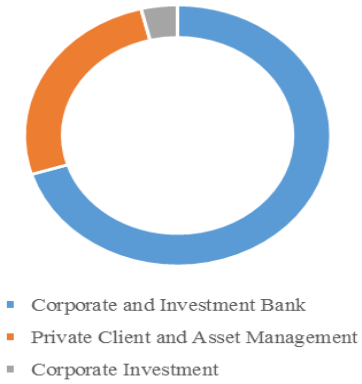
White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity, *Econometrica*, 48: 817–838.

Winton, A. (1999). Don't Put All Your Eggs in One Basket? Diversification and Specialization in Lending. Working Paper n. 9903, University of Minnesota.

Appendix

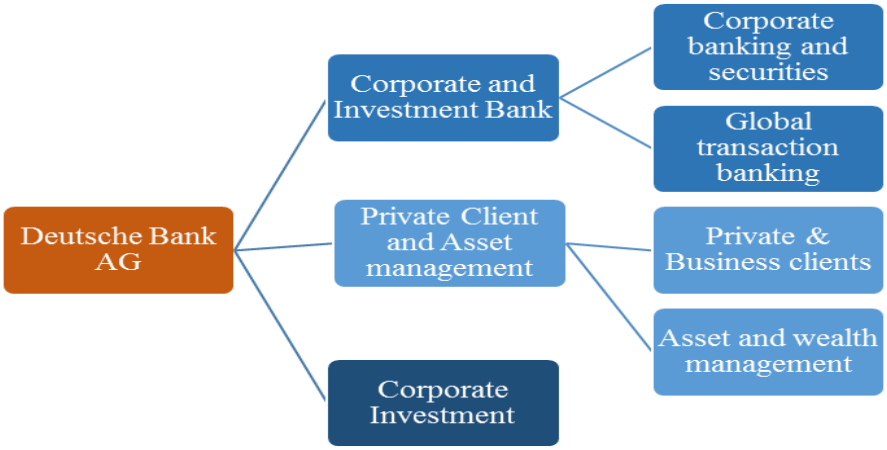
Figure A.1: Bloomberg activity segmentation ("by measure") – DEUTSCHE BANK AG

a): *Broad activity classification, assets by operational divisions as at 2015*



Source: Authors' computation based on data obtained from Bloomberg.

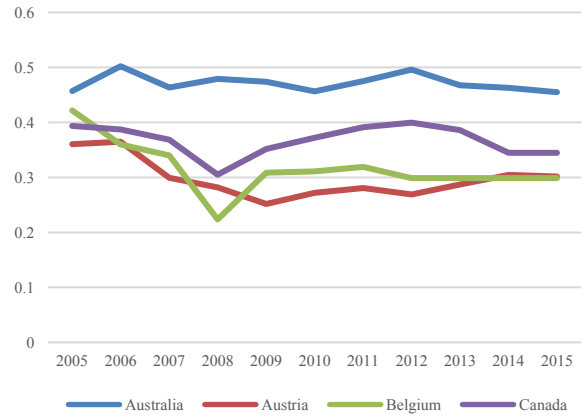
b): *Further breakdown*

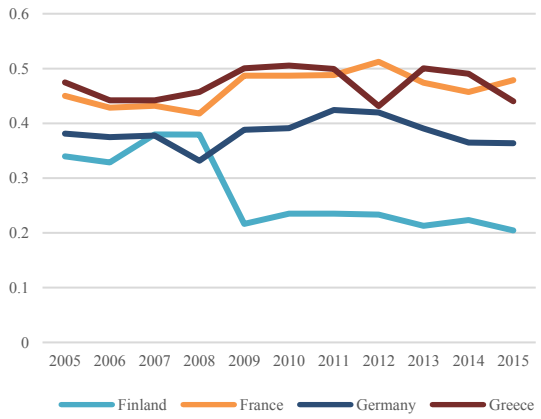


Source: Authors' computation based on data obtained from Bloomberg.

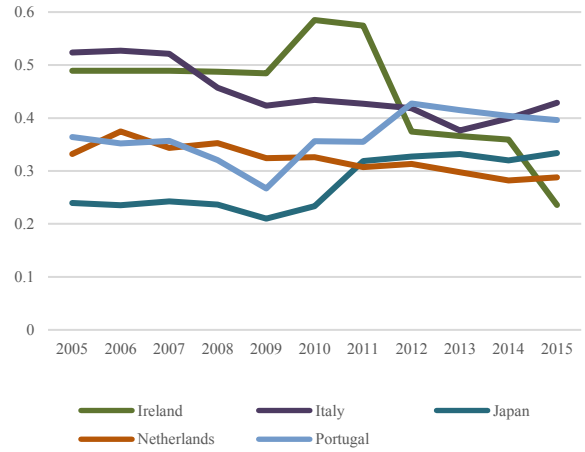
Figure A.2: UBI by country, averages

A.2.1)





A.2.2)



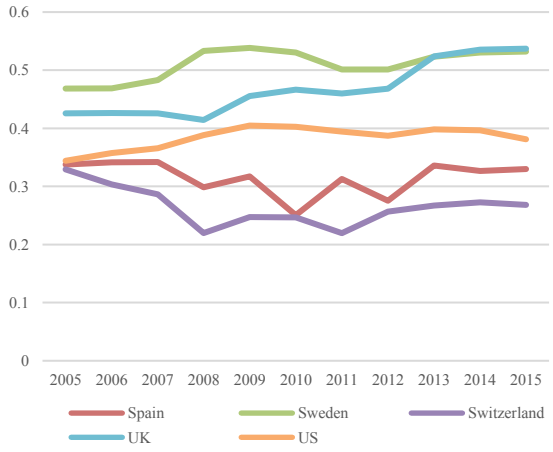


Table A.1: Banks contained in the sample

Bank name	Country	Bank name	Country
Bank of Australia	Australia	Intesa Sanpaolo	Italy
Bendigo	Australia	Mediobanca	Italy
Commonwealth bank	Australia	Unicredit	Italy
Macquaire	Australia	Unione di Banche	Italy
Queensland	Australia	Chiba	Japan
Suncorp	Australia	Daiwa	Japan
Westrpac	Australia	Mitsubishi	Japan
BankTirol	Austria	Mizuho	Japan
Erste	Austria	Shinkin	Japan
Heta	Austria	Sumitomo	Japan
Immigon	Austria	Nomura	Japan
Immofinanz	Austria	Norinchukin	Japan
Kontrollbank	Austria	Resona	Japan
Landensbank	Austria	Yokohoma	Japan
Oberbank	Austria	ABNAmro	Netherlands
Raiffeissen	Austria	ING	Netherlands
Dexia	Belgium	BancoBPI	Portugal
KBC	Belgium	BancoCommercial	Portugal
Bank of Montreal	Canada	BancoEspirito	Portugal
Canadian Western	Canada	Banif	Portugal
Dominion	Canada	Banco Bilbao	Spain
Imperial Bank	Canada	Banco de Sandabell	Spain
Laurentian	Canada	Bankiter	Spain
National Bank of Canada	Canada	Liberbank	Spain
Nova Scotia	Canada	Santander	Spain
Royal Bank	Canada	Nordea	Sweden
Aktia	Finland	Skandinaviska	Sweden
Alandsbanken	Finland	Svenka	Sweden
Evli	Finland	Swedbank	Sweden
BNP Paribas	France	Credit Swisse	Switzerland
BPCE	France	Julius Baer	Switzerland
Credit Agricole	France	UBS	Switzerland
Credit Mutuel CIC	France	Vontobel	Switzerland
Natixis	France	Barclays	UK
Societe Generale SA	France	Cooperative	UK
Commerzbank	Germany	HSBC	UK
Deutsche Pfandbriefbank	Germany	Lloyds	UK
DZ Bank	Germany	Nationwide	UK
Landersbank	Germany	RBS	UK
Aareal	Germany	Standard Chartered	UK
Deutsche bank	Germany	Bancorp	US
Rentenbank	Germany	Bank of America	US
Attica	Greece	Capitalone	US
Eurobank	Greece	Citigroup	US
Allied	Ireland	Goldman	US
Permanent	Ireland	Morgan Stanley	US
Banca Monte	Italy	NYMellon	US
Banca Popolare Romagna	Italy	PNC	US
Banca Popolare SC	Italy	State Street	US
Banco Popolare Milan	Italy	WellsFargo	US
Banco Popolare Vicenza	Italy	JPMorgan	US

Table A.2: UBI and Foreign exposure share construction

Bank	UBI	Foreign assets share
Aareal Bank AG	Net Revenues	Based on foreign share of net revenues
ABN AMRO Group NV	Total Assets	Based on foreign share of net revenues
Aktia	Total Assets	Based on foreign share of assets
Alandsbanken	Total Assets	Based on foreign share of net revenues
Allied Irish Banks	Total Assets	Based on foreign share of net revenues
Attica Bank SA	Total Assets	Based on foreign share of assets
Banca Monte dei Paschi di Siena Spa	Net Revenues	Based on foreign share of net revenues
Banca Popolare dell'Emilia Romagna SC	Total Assets	Based on foreign share of assets
Banca Popolare SC	Net Revenues	Based on foreign share of net revenues
Banco Bilbao SA	Total Assets	Based on foreign share of assets
Banco BPI	Total Assets	Based on foreign share of assets
Banco Comercial Portugues	Total Assets	Based on foreign share of assets
Banco de Sandabell	Net Revenues	NA
Banco Espirito Santo SA	Total Assets	Based on foreign share of assets
Banco Popolare di Milano Scarl	Total Assets	Based on foreign share of assets
Banco Popolare Vicenza	Total Assets	Based on foreign share of assets
Banco Santander Sa	Net Revenues	Based on foreign share of assets
BANIF	Total Assets	Based on foreign share of assets
Bank fuer Tirol und Vorarlberg AG	Net Revenues	Based on foreign share of assets
Bank of America Corp	Total Assets	Based on foreign share of assets
Bank of Montreal	Net Revenues	Based on foreign share of net revenues
Bank of New York Mellon Corp	Total Assets	Based on foreign share of assets
Bank of Novia Scotia	Net Revenues	Based on foreign share of net income
Bank of Queensland Ltd	Total Assets	Based on foreign share of assets
Bankiter	Net Revenues	Based on foreign share of net revenues
Barclays PLC	Total Assets	Based on foreign share of net revenues
Bendigo & Adelaide Bank Ltd	Total Assets	Based on foreign share of assets
BNP Paribas SA	Total Assets	Based on foreign share of assets
Canadian Imperial Bank of Commerce	Net Revenues	Based on foreign share of net revenues
Canadian Western Bank	Net Revenues	Based on foreign share of net revenues
Capital One Financial Corp	Net Revenues	Based on foreign share of assets
Chiba	Total Assets	Based on foreign share of assets
Citigroup Inc	Total Assets	Based on foreign share of net revenues
Commerzbank	Net Revenues	Based on foreign share of net revenues
Commonwealth Bank of Australia	Total Assets	Based on foreign share of revenues
Co-operative Bank PLC	Total Assets	Based on foreign share of assets
Credit Agricole SA	Total Assets	Based on foreign share of assets
Credit Mutuel-CIC Group	Total Assets	Based on foreign share of revenues
Credit Suisse Group AG	Total Assets	Based on foreign share of assets
Daiwa	Revenue	Based on foreign share of assets
Deutsche bank	Total Assets	Based on foreign share of net revenues
Deutsche Pfandbriefbank	Net Revenues	NA
Dexia SA	Total Assets	Based on foreign share of revenues
DZ Bank AG D. Zentral-Gen.	Total Assets	NA
Erste Group Bank AG	Net Revenues	Based on foreign share of net revenues
Eurobank	Total Assets	Based on foreign share of assets
Evli	Net Revenues	Based on foreign share of assets
Goldman Sachs Group Inc	Total Assets	Based on foreign share of revenues
Groupe BPCE	Operating Income	NA
Heta	Net Revenues	Based on foreign share of net revenues
HSBC Holdings PLC	Total Assets	Based on foreign share of assets

Source: Authors' computation based on data obtained from Bloomberg.

Table A.2 (continued): UBI and Foreign exposure share construction

Bank	UBI	Foreign assets share
Immigon Portfolioabbau AG	Total Assets	Based on foreign share of net revenues
Immofinanz AG	Total Assets	Based on foreign share of assets
ING Groep NV	Total Assets	Based on foreign share of assets
Intesa Sanpaolo	Net Revenues	Based on foreign share of net revenues
Julius Baer Group Ltd	Total Assets	Based on foreign share of assets
JP Morgan Chase	Total Assets	Based on foreign share of assets
KBC Groep NV	Total Assets	Based on foreign share of assets
Landwirtschaftliche Rentenbank	Net Revenues	Based on foreign share of net revenues
Laurentian Bank of Canada	Net Revenues	Based on foreign share of net revenues
LBBW	Total Assets	Based on foreign share of assets
Liberbank	Total Assets	NA
Lloyds Banking Group PLC	Total Assets	Based on foreign share of assets
Macquarie Group Ltd	Total Assets	Based on foreign share of revenues
Mediobanca Spa	Net Revenues	Based on foreign share of net revenues
Mitsubishi UFJ Financial Group Inc	Total Assets	Based on foreign share of revenues
Mizuho Financial Group	Total Assets	Based on foreign share of revenues
Morgan Stanley	Total Assets	Based on foreign share of assets
National Australia Bank Ltd	Total Assets	Based on foreign share of assets
National Bank of Canada	Net Revenues	Based on foreign share of net revenues
Nationwide Building Society	Total Assets	Based on foreign share of assets
Natixis SA	Total Assets	Based on foreign share of assets
Nomura	Net Revenues	Based on foreign share of net revenues
Nordea Bank AB	Total Assets	Based on foreign share of assets
Norinchukin Bank	Total Assets	Based on foreign share of revenues
Oberbank AG	Total Assets	Based on foreign share of assets
Oesterreichische Kontrollbank AG	Total Assets	NA
Permanent TSB Group Holdings	Total Assets	Based on foreign share of assets
PNC Financial Services Group Inc	Total Assets	Based on foreign share of assets
Raiffeisen Bank International AG	Total Assets	Based on foreign share of assets
Resona Holdings Inc	Net Revenues	Based on foreign share of net revenues
Royal Bank of Canada	Total Assets	Based on foreign share of assets
Royal Bank of Scotland Group PLC	Total Assets	Based on foreign share of assets
Shinkin Central Bank	Total Assets	Based on foreign share of revenues
Skandinaviska Enskilda Banken AB	Total Assets	Based on foreign share of assets
Societe Generale SA	Total Assets	Based on foreign share of assets
Standard Chartered PLC	Total Assets	Based on foreign share of assets
State Street Corp	Total Assets	Based on foreign share of assets under management
Sumitomo Mitsui Financil Group Inc	Revenues	Based on foreign share of revenues
Suncorp Group Ltd	Total Assets	Based on foreign share of assets
Svenska Handelsbanken AB	Total Assets	Based on foreign share of assets
Swedbank AB	Total Assets	Based on foreign share of assets
Swiss Life Holding AG	Total Assets	Based on foreign share of assets
Toronto-Dominion Bank	Total Assets	Based on foreign share of assets
UBS Group AG	Total Assets	Based on foreign share of net revenues
UniCredit Spa	Net Revenues	Based on foreign share of assets
Unione di Banche Italiane Spa	Net Revenues	Based on foreign share of assets
US Bancorp	Total Assets	Based on foreign share of assets
Vontobel Holding AG	Total Assets	Based on foreign share of assets
Wells Fargo & Co	Total Assets	Based on foreign share of assets
Westpac Banking Corp	Total Assets	Based on foreign share of revenues
Yokohoma	Total Assets	Based on foreign share of assets

Source: Authors' computation based on data obtained from Bloomberg.

Table A.3: Summary statistics

Variable description	Notation	Mean	Median	Std. Dev.	Skewness	Kurtosis	Obs.
Assets-to-equity	*leverage*	18,037	17,273	41,635	-29,089	915,402	1066
Deposits-to-assets*100	*deposit*	47,570	48,706	20,132	-0,118	2,319	1049
Foreign assets-to-total assets	*foreign act.*	0,250	0,201	0,254	0,413	4,699	858
GDP growth rate, annual	*ΔGDP*	1,157	1,688	2,369	-1,210	4,944	1098
Loans-to-deposits	*ldratio*	1,291	1,136	1,115	7,254	87,525	1022
Log of non-performing assets	*lnpa*	7,217	7,822	2,933	-1,138	4,034	834
Log of total assets	*size*	11,644	12,157	2,422	-1,087	3,722	1097
Log of total loans	*loans*	11,221	11,758	2,138	-2,098	9,409	867
Net interest margin	*nim*	1,951	1,549	3,956	19,984	464,862	1044
Non-deposit liabilities-to-total assets*100	*wholesale*	52,430	51,294	20,132	0,118	2,319	1049
Noninteret income-to-total income	*NonInterest*	0,382	0,461	2,706	-30,028	940,849	1067
Nonperforming assets-to-total assets	*npa a*	2,352	0,898	4,071	3,528	17,474	913
Return on assets	*roa*	0,361	0,482	1,503	-17,792	448,550	1045
Return on common equity	*roe*	6,994	8,866	15,791	-4,160	33,272	1034
Risk-based capital ratio	*crb*	14,374	13,500	3,789	1,404	5,413	978
Tier 1 capital ratio, risk-based	*tier1*	11,653	10,900	6,839	13,216	244,447	987
UBI	*UBI*	0,375	0,397	0,216	-0,143	2,385	995
Z-score	*z-score*	21,744	15,994	19,081	2,439	13,081	1053

Source: Authors' computation based on data obtained from Bloomberg.