A new approach to measuring universal banking

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Abstract

This paper proposes a novel measure of universal banking constructed using the relative contribution of each operating segment to total assets. Using a sample of international banks, we evaluate the extent to which our proposed metric affects banks' profitability, stability, liquidity and capitalisation. In addition, we evaluate the implications of a more complex business model, featured by the interaction of universal banking and globalization. Results suggest that a higher degree of diversification enhances financial stability and capitalisation when the Universal Banking Index (UBI) is used as a proxy of universal banking. However, a more complex structure, conceived as the combination of universal and global business models, is associated with lower levels of capital and is less desirable from a financial stability perspective.

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

I. INTRODUCTION

The implications of a universal banking model have recently been in the spotlight of regulatory discussions as some countries are underway to adopt structural banking reforms. Some scholars have warned about potential unintended side-effects resulting from a regulatory-induced reduction in the latitude of banks' operations. Structural banking reforms may, indeed, result in economic slowdown, high financing and implementation costs and stimulation in the growth of shadow banking (Goodhart 2012; Blundell-Wignall and Atkinson 2012; Duffie, 2012; Thakor 2012; and Blundell-Wignall et al., 2013). Moreover, some seminal contributions suggest that limiting the degree of universal banking could result in lower economies of scopes, restricting banks' ability to take full advantage of their information gathering and monitoring for an efficient provision of financial services (Rajan, 1992; Saunders and Walters, 1994 and Stein, 2002).

On the other hand, other scholars set forth several rationales which may justify such reforms. For instance, Hakenes and Schnabel (2014) find a moral hazard effect arising from banks engaging in riskier activities when a deposit insurance system is in place. Also, agency problems could be magnified in universal banking models as insiders have higher incentives to extract private benefits (Jensen and Meckling 1976, Rotemberg and Saloner 1994). A number of contributions further argue that diversification of financial products provision does not enhance banks' valuation and performance (Elsas et al., 2010; Lang and Stulz (1994), Berger and Ofek (1995) and Denis et al. (1997). Most notably, Laeven and Levin (2007) find a negative relationship between diversification of financial firms' activity and market value, attributable to agency costs and limited economies of scope.

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[1]. 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).

In the empirical literature universal banking is usually proxied by noninterest income-based ratios. Financial intermediaries receive noninterest income principally from commissions on new securities issued, derivative contracts and hedge funds and private equity activities. 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. Moreover, Demirguc-Kunt and Huizinga (2010) find a nonlinear relationship between risk diversification and universal banking model, which decreases at low levels of noninterest income. Gambacorta and van Rixtel (2013) also find a nonlinear relationship between noninterest income and bank profitability. Brunnermeier et al (2012) using data for all US commercial banks find that non-interest income to interest income ratio is associated with higher systemic risk. This latter finding confirms previous arguments put forward by Wagner (2010) who also finds that banking diversification reduces the risk of default at bank level. One notable exception to this strand of evidence is advanced by Dietrich and Vollmer (2012) who find that the universal banking business model in Germany, proxied by the share of net commission income to total net revenue, helped mitigate the impact of the global financial crisis.

In this paper we argue that noninterest income is a poor indicator of universal banking as it does not reflect the true degree of diversification of activities. Indeed noninterest income does not take into account the mixture and cardinality of activity provisions as it bundles all noninterest income generating activities together. We question here whether there is a measurement bias in universal banking modelling as there may be some diversification benefits that stem from universal banking that are not captured by noninterest income proxies. Multi-divisional and diversified business models could benefit indeed from internal capital markets that allow liquidity and capital to flow between operating units (Ashcraft, 2006). Also, as argued by Boot and Schmeits (2000) these business models enhance resiliency of banks due to the implicit co-insurance amongst segments. Diversification in operating units also allows eventual losses to be shared among a number of operating segments, easing the pressure on the retail division and containing intra-group contagion. For this reason, from a regulatory point of view, knowing the relative weight of each operating segment in a bank's business model can yield fundamental predictions on the pressure on the retail segment and the potential burden on the taxpayer.

We propose an entropy-based measure of diversification that takes into account the mixture and cardinality of relevant operating segments of banks, namely the Universal Banking Index (UBI). 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, segmented data on the type and volume of financial assets provisions by banks is not available. Our measure can, then, be considered as a *broad* proxy of

universal banking to the extent to which it captures the number and size of substantial operating segments which in turn, reflect the specialisation in a given financial product/service provision.

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 a twofold objective. First, we 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. Secondly, we test how a complex business model, featuring both financial products provision diversification and globalization, relates to banking profitability, stability, liquidity and capitalisation. This allows to capture the geographical diversification feature which applies to many banks in our sample and to account for the fact that banks that are both universal and global may have different risk exposures than banks that are universal only. As argued by Calomiris and Mason (2000) and Carlson (2004), geographical diversification in banking is associated with a higher probability of default as it stimulates banks to hold less reserves and to limit their portfolio diversification.

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. Secondly, this paper provides a joint analysis of the degree of diversification in financial products provisions and globalization of a banking sector and their relationship with key banking features, i.e. profitability and risk, whereas existing literature focuses on the former exclusively.

Results indicate that a universal banking model increases financial 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 financial stability and universal banking. When a more *complex* business model is considered, that is, a universal banking model with a global reach component, the latter relationship does not longer hold. Furthermore, a higher UBI corresponds to banks being more profitable, liquid and well capitalised while more complex business models are less liquid and less capitalised.

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.

II. Evaluating the extent of universal business model: UBI

II.I The Universal banking model: On its 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). 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]. One notable exception to noninterest income-based measures of universal banking is found in the seminal paper by Laeven and Levine (2007) in which the authors provide an asset-based measure of banking diversification. 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. This is calculated as the difference between net loans and other earning assets as a share of total earning assets.

Noninterest income-based proxies for universal banking should 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. Two banks with similar noninterest income may, indeed, 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.

A proxy of universal banking that captures the actual diversification of activities can improve our understanding of the risk inherent to a particular financial intermediary for a

[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.

number of reasons. Diversification in product provision and in operating units may better shield a bank from idiosyncratic shocks. Indeed, the impact at the division-level of intra-group contagion in a bank having many established specialised 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[2,3]. Additionally, 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. Furthermore, 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.

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).

II.II The Universal banking model: The Universal Banking Index (UBI)

We propose an entropy-based measure of diversification in operating segments based on balance sheet segmented assets data[4], namely the Universal Banking Index (UBI). This metric can better capture the business model of a bank as it reflects the number and the magnitude of specialised operating segments at once. Bank level data is obtained from Bloomberg where banking assets are segmented by business units. An operating segment is considered as such whenever it contributes to at least 10% of total consolidated revenue of the bank. The unbalanced panel spans over the period 2001-2015 and has an annual frequency. Table 1A in the appendix reports the banks included in the sample for a total of 102 banks

[2] See for instance Gambacorta (2005) for a discussion on bank subsidiaries.
[3] Cetorelli and Goldberg (2012) show that internal capital markets are used by global banks to reallocate liquidity across the borders.
[4] Whenever segmented data is unavailable for total assets, segmentation by revenue is used. For only a few banks, segmentation by total income is used. See Table 2.A for details.

headquartered in 21 countries. The sample of banks considered includes all those institutions for which segmented balance sheet data is available at any point during the sample period considered. These banks are typically the largest banks in each country. The metric is based on the Shannon entropy measure of economic diversification, with its roots in geographical economics (Hackbart and Anderson, 1975) and commonly used in industrial economics. The entropy measure of economic diversification is 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 applying the following formula to bank-level data:

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

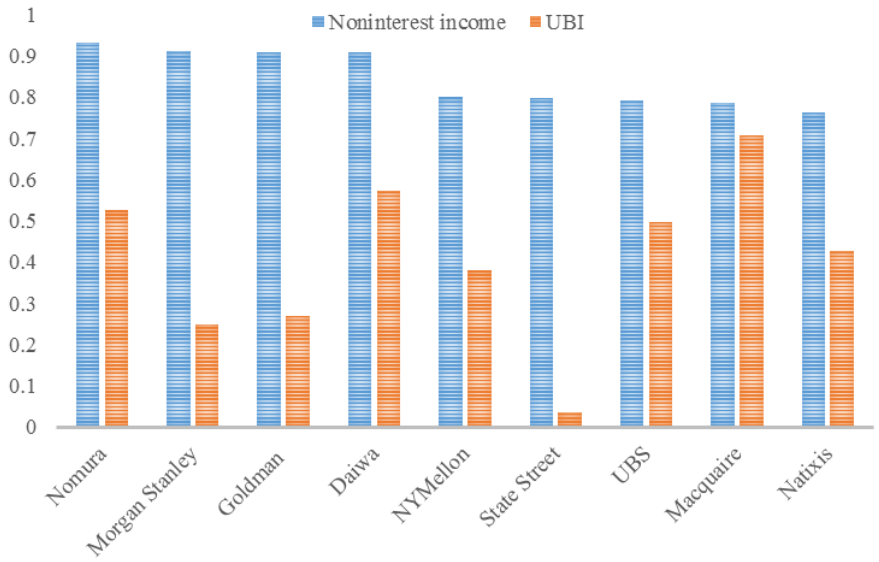
Where i, i=1,…, I are banks, b, b=1, ..., B, are operating segments and $a_{i,b}$ is the relative share of assets of bank *i* in operating unit *b*.

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 units, 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 Macquire Bank has a much more diversified business model. 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



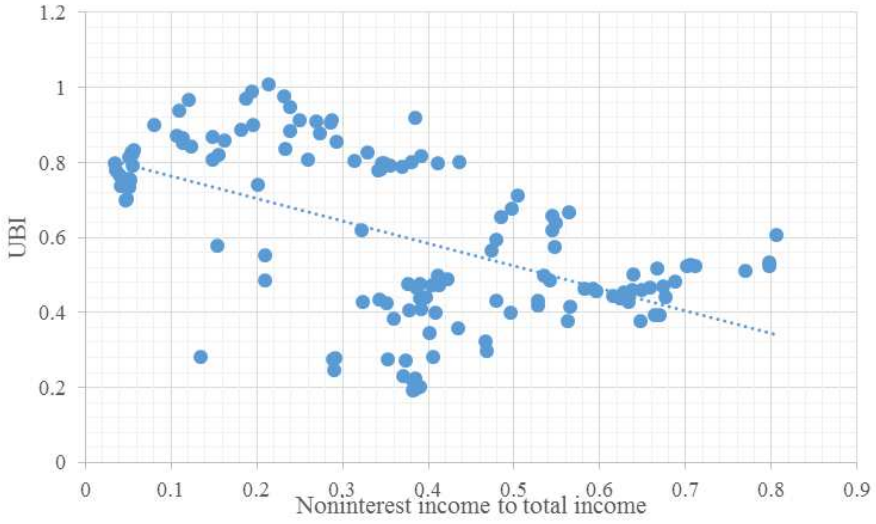
Sources: Authors' computations based on data obtained from Bloomberg.
Notes: Noninterest income is calculated as the share of noninterest income to total income in 2015.

A general tendency is thus 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). The compiling of 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.

The 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 which 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 due to 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.

II.III A country-level UBI

A bottom-up approach allows to obtain 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, two countries in which banking systems feature a relatively limited geographical diversification. 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 1.A 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 UBI has picked up particularly for the UK, depicting its historical high.

III. Data and Methodology

The empirical methodology presented in this paper has a twofold objective. First, the aim is to assess the relative performance of the UBI versus noninterest income as a share of total income (*NonInterest)* with respect to bank profitability, stability, liquidity and capital. Secondly, the implications of a more complex banking configuration are investigated, encompassing a universal business model (as measured by the UBI) with a global reach component. Uneven and limited data availability on the locational composition of banks' assets prevents the construction of an equivalent entropy-based measure of geographical diversification at the bank-level. Ratio of foreign assets to total assets, namely *foreign activities*, are then used to proxy for the relative importance of foreign activities of banks.

A number of proxies are used to account for profitability, stability, liquidity and capital. Return on assets (*roa*) and return on common equity (*roe*) proxy for bank profitability; the z-score[5] (*z-score*), log of nonperforming assets (*lnpa*) and the ratio of nonperforming assets to total assets (*npa_ta*) proxy for bank stability; wholesale funding share (*wholesale*) defined as the ratio of non-deposit liabilities to total assets and loans to deposit ratio (*ldratio*) proxy for bank liquidity; lastly, two measures of capital ratios are considered: tier1 risk-based capital ratio (*tier1*) and total risk-based capital ratios (*rbc*). 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*).

The variables are obtained from Bloomberg on an annual basis. The final unbalanced dataset includes 102 banks from 21 countries over the years 2001-2015. Table 1.A reports the list of banks used in the estimation and Table 3.A the summary statistics of the variables used in the regression. The 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; these institutions are typically the largest listed banks in each country. Banks included in the sample are all diversified, albeit to different degrees. Data limitation prevents from disentangling banks that do not disclose segmented data from multi-division banks. Therefore, the empirical results are conditional on the bank being diversified.

[5] Following Altunbas et al. (2011), Boyd and Runkle (1993) and Demirgüc-Kunt and Huizinga (2010), the z-score 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. The highest the z-score the further away a bank is from default.

The first set of regressions estimated have the intent of evaluating the relative impact of both UBI and noninterest income on the banking proxies of interest. The panel regressions have the following forms:

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

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

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.

Regression (5) below accounts for foreign activities of banks as well as the product of foreign activities and UBI. This latter interaction variable allows for an assessment of the implication of both a universal and global business model.

$$Y_{i,t} = \gamma_i + \beta_{0,t} Y_{i,t-1} + \beta_1 UBI_{i,t} + \beta_2 Foreign\ activities_{i,t} + \beta_3 Foreign\ activities_{i,t} * UBI_{i,t} + X_{i,t}\Phi + \varepsilon_{i,t} \quad (5)$$

The above regression are estimated via a two-step first difference Generalized Method of Moment (GMM) estimation technique as pioneered by Arellano and Bond (1991). This econometric methodology eliminates the fixed effect by first differencing (3), (4) and (5) and corrects for endogeneity among variables by using as instruments lagged differences of the dependent variable. Standard errors are corrected for heteroscedasticity (White, 1980).

IV. Empirical Results

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

Table 3 reports the regression estimates where profitability and financial stability proxies are used as dependent variables. Columns (1), (3), (5), (7) and (9) consider the UBI as universal banking proxy (regression (3)) while columns (2), (4), (6), (8), and (10) use noninterest income share as proxy of universal banking (regression (4)).

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 financial stability while noninterest income share has either an adverse or no effect on financial 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). In contrast, the estimated coefficient of *NonInterest* is not significant in the regressions in which *z-score* and *lnpa* are dependent variables. It is, however, marginally significant and positive in the regression in which financial 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 3: UBI versus noninterest income - profitability and stability regressions

	Panel Generalised Method of Moments, First Differences									
	Profitability				***Stability***					
	roa		roe		z-score		lnpa		npa_ta	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lagged dependent	0.039	0.006	0.022	0.051	0.480***	0.441***	0.248***	0.437***	0.614***	0.670***
	(0.055)	(0.082)	(0.096)	(0.052)	(0.020)	(0.019)	(0.079)	(0.015)	(0.059)	(0.048)
NonInterest	-	0.083	-	64.750***	-	-0.730	-	-0.025	-	1.0215*
		(0.603)		(11.717)		(1.777)		(0.022)		(0.733)
UBI	0.962***	-	85.309***	-	15.462***	-	-2.724***	-	-14.106***	-
	(0.348)		(32.969)		(3.929)		(0.868)		(3.008)	
foreign activities	0.823***	0.915***	0.904	-10.152	4.254	-0.693	3.137***	0.793***	6.832***	1.705
	(0.244)	(0.304)	(13.569)	(8.301)	(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	0.001	0.002*	-0.444	0.408	-0.025	0.003	0.000	-0.001	-0.003	-0.013
	(0.001)	(0.304)	(13.569)	(0.364)	(0.037)	(0.007)	(0.001)	(0.001)	(0.010)	(0.010)
rbc	0.123***	0.110***	0.011	-0.078*	0.757***	0.493***	0.017	0.007	-0.119	0.020
	(0.020)	(0.023)	(0.613)	(0.364)	(0.079)	(0.042)	(0.023)	(0.007)	(0.073)	(0.059)
nim	0.437***	0.251*	-1.678	5.084*	-0.052	0.178	0.767***	0.307***	-0.497***	0.090
	(0.171)	(0.140)	(3.373)	(2.773)	(0.742)	(0.325)	(0.172)	(0.060)	(0.148)	(0.199)
size	-0.009	0.024	-0.153	-0.673	0.042	0.277***	0.072**	0.197***	0.151	-0.027
	(0.029)	(0.044)	(0.792)	(0.634)	(0.185)	(0.091)	(0.06)	(0.076)	(0.142)	(0.022)
lnpa	-0.454***	-0.378***	-3.491	-0.842	-1.538***	-1.478***	-	-	-	-
	(0.051)	(0.053)	(1.367)	(0.558)	(0.324)	(0.117)				
loans	-0.369*	-0.638**	-13.453***	-1.496	1.838**	1.339***	1.802***	0.854***	-0.173	0.873*
	(0.204)	(0.294)	(4.951)	(3.541)	(0.882)	(0.443)	(0.289)	(0.091)	(0.093)	(0.469)
deposits	-0.011**	-0.013*	0.004	-0.096	0.011	0.222***	0.006	-0.004	0.134***	0.053***
	(0.005)	(0.008)	(0.177)	(0.132)	(0.049)	(0.021)	(0.012)	(0.003)	(0.022)	(0.019)
ΔGDP	0.030	0.033*	-0.101	0.315	-0.807***	-0.740***	0.002	0.003	-0.101***	-0.203***
	(0.026)	(0.019)	(0.465)	(0.315)	(0.073)	(0.065)	(0.015)	(0.006)	(0.038)	(0.050)
Observations	357	355	347	358	395	409	384	398	427	441
J-Statistics, p-value	0.211	0.382	0.228	0.736	0.801	0.741	0.111	0.541	0.185	0.598
AR(2) test p-value	0.961	0.937	0.953	0.338	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.

Table 4 reports the regression estimates where liquidity and capitalization proxies are used as dependent variables.

Estimates in columns (1) and (2) suggest that an increase of both proxies of universal banking are associated with higher liquidity when this is proxied by loan-to-deposit ratio, depicting negative and significant coefficients. In contrast, the two proxies do not seem to have predicting power in explaining wholesale funding liquidity in columns (3) and (4).

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.

The control variables in Tables 3 and 4 have overall the expected signs. For instance, return on assets has a positive impact on financial stability, as reported in columns (5)-(10) in Table 3. The risk-based capital ratio has positive and significant coefficients in columns (5) and (6) in Table 3 implying that well capitalized banks are less likely to default. 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. 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 and capitalization regressions

	Panel Generalised Method of Moments, First Differences							
	Liquidity				*Capital*			
	ldratio		wholesale		tier1		rbc	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged Dependent	1.247***	0.836***	0.613***	0.3561***	0.142***	0.152***	0.328***	0.380***
	(0.019)	(0.004)	(0.056)	(0.103)	(0.002)	(0.002)	(0.053)	(0.032)
NonInterest	-	-0.101***	-	-1.013	-	-1.495***	-	-1.807***
		(0.005)		(1.019)		(0.178)		(0.229)
UBI	-0.507***	-	7.656	-	6.380**	-	8.983***	-
	(0.074)		(5.289)		(3.182)		(3.544)	
foreign activities	1.583***	2.168***	-5.183	-1.047	4.305**	6.913***	0.665	6.441***
	(0.162)	(0.102)	(3.174)	(4.658)	(1.976)	(0.728)	(1.565)	(1.244)
roa	-0.140***	-0.148***	-0.923***	-2.227***	2.647***	2.038***	0.539	0.635***
	(0.016)	(0.009)	(0.291)	(0.731)	(0.320)	(0.101)	(0.343)	(0.070)
leverage	-0.003***	-0.002***	-0.004	0 .000	-0.009	0.001	0.041**	0.007**
	(0.000)	(0.000)	(0.006)	(0.019)	(0.010)	(0.002)	(0.018)	(0.003)
rbc	0.010***	0.001	-0.828***	-1.320***	-	-	-	-
	(0.003)	(0.002)	(0.133)	(0.229)				
nim	-0.027	0.003	0.823	-0.014	-2.023***	-2.314***	-0.268	-0.455**
	(0.019)	(0.014)	(0.917)	(1.758)	(0.312)	(0.178)	(0.516)	(0.206)
size	0.037***	0.036***	0.368	0.181	0.090	0.138**	-0.108	-0.119
	(0.010)	(0.013)	(0.357)	(0.322)	(0.092)	(0.066)	(0.319)	(0.164)
lnpa	-0.128***	-0.129***	0.183	-0.605	2.397***	1.745***	1.576***	1.543***
	(0.012)	(0.007)	(0.530)	(0.954)	(0.470)	(0.131)	(0.443)	(0.069)
loans	-	-	0.935	4.446**	-1.900**	-1.410***	0.530	-1.647***
			(1.397)	(2.297)	(0.779)	(0.014)	(0.859)	(0.243)
deposits	-	-	-	-	0.138***	0.148***	0.130***	0.126***
					(0.035)	(0.014)	(0.029)	(0.015)
ΔGDP	-0.024***	-0.019***	0.002	0.091	-0.098	-0.152***	0.150	0.157***
	(0.002)	(0.001)	(0.089)	(0.186)	(0.093)	(0.035)	(0.112)	(0.026)
Observations	498	513	395	409	389	403	381	403
J-Statistics, p-value	0.401	0.39	0.395	0.365	0.267	0.406	0.153	0.434
AR(2) test p-value	0.356	0.735	0.618	0.415	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.

Table 5 reports the regression estimates of (5) which includes the interaction variable between UBI and foreign activities, namely *UBI*foreign*. As discussed previously, this latter aims to capture a more complex business model adopted by some banks in our sample, featuring both universal banking and globalization.

Results suggest that a higher degree of complexity is associated with heightened financial fragility. Indeed, the estimated coefficients of *UBI*foreign* in columns (3) and (4) suggest that greater complexity is associated with a higher probability of default and a greater proportion of non-performing assets, respectively. Although this complex business model is associated with a significant and positive return on assets (column (1)), it depicts lower liquidity and lower tier 1 capital ratio. The estimated coefficient of *UBI*foreign* in column (1) is indeed positive and strongly significant, while it is negative and strongly significant in column (8).

Table 5: Universal and global business model

Panel Generalised Method of Moments, First Differences									
	Profitability		***Stability***			***Liquidity***		***Capital***	
	roa	roe	z-score	lnpa	npa_ta	ldratio	wholesale	tier1	rbc
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Lagged dependent	0.148***	-0.018	0.441***	0.279*	0.660***	1.212***	0.572***	0.390***	-0.036
	(0.014)	(0.106)	(0.017)	(0.146)	(0.051)	(0.029)	(0.168)	(0.015)	(0.133)
UBI	1.830***	124.252***	6.353***	-5.245**	-15.992***	-1.715***	19.732	31.611***	15.249**
	(0.396)	(43.799)	(2.351)	(2.697)	(3.541)	(0.370)	(13.943)	(11.34)	(7.496)
foreign activities	0.880***	-21.521	6.483***	6.024**	6.028**	0.227	-19.895**	0.702	-2.497
	(0.132)	(19.058)	(2.090)	(2.421)	(2.749)	(0.306)	(9.956)	(6.606)	(6.833)
UBI*foreign activities	2.400***	-119.181	-22.444***	18.426**	-8.426	5.992***	-55.139	-36.946***	-1.514
	(0..609)	(79.036)	(4.061)	(8.071)	(5.155)	(0.869)	(37.983)	(12.930)	(17.136)
roa	-	-	1.731***	-0.125	-0.587***	-0.142***	0.719	1.076**	1.217*
			(0.272)	(0.294)	(0.142)	(0.019)	(1.307)	(0.538)	(0.705)
leverage	-0.022***	-0.622	-0.001	-0.001	0.001	-0.002***	0.001	0.005	-0.007
	(0.002)	(0.791)	(0.012)	(0.003)	(0.009)	(0.000)	(0.020)	(0.020)	(0.021)
rbc	0.043***	-0.030	0.467***	-0.041	-0.116*	0.023***	-1.225***	-	-
	(0.007)	(0.820)	(0.061)	(0.076)	(0.069)	(0.004)	(0.467)		
nim	0.353***	-1.180	-0.583	2.004***	-0.681***	0.060**	-2.659	-4.372***	-2.842**
	(0.067)	(3.331)	(0.729)	(0.655)	(0.179)	(0.028)	(2.167)	(0.842)	(1.288)
size	0.003	-0.324	0.233	0.022	-0.001	0.044**	0.831	1.883	-0.778
	(0.005)	(0.789)	(0.245)	(0.052)	(0.237)	(0.018)	(1.116)	(4.584)	(0.654)
lnpa	-0.362***	-4.066***	-1.508***	-	-	-0.093***	1.205	0.963	2.393***
	(0.026)	(1.356)	(0.163)			(0.011)	(1.627)	(0.596)	(0.772)
loans	0.082	-9.389*	0.170	3.944***	0.563	-	-0.307	-7.849**	0.131
	(0.108)	(5.216)	(0.776)	(0.853)	(0.417)		(3.293)	(3.525)	(2.703)
deposits	-0.008***	-0.049	0.209***	0.072**	0.097***	-	-	0.059	0.111
	(0.003)	(0.242)	(0.027)	(0.029)	(0.020)			(0.136)	(0.075)
ΔGDP	-0.004	0.001	-0.667***	-0.087	-0.085**	-0.017***	-0.597	-1.722***	-0.217*
	(0.006)	(0.339)	(0.097)	(0.077)	(0.039)	(0.003)	(0.362)	(0.580)	(0.180)
Observations	285	351	395	384	427	498	395	227	389
J-Statistics, p-value	0.392	0.450	0.788	0.792	0.666	0.560	0.151	0.698	0.405
AR(2) test p-value	0.0707	0.952	0.984	0.606	0.980	0.193	0.355	0.959	0.846

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.

V. 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. When comparing this measure with non-interest 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 financial 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 financial stability. However, when the UBI is used to proxy for universal banking there is evidence that a higher degree diversification increases financial 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.

In an attempt to capture a more complex business model, we consider the implications of a universal business model with a global reach. Regression estimates suggest that the higher the degree of complexity the higher the financial fragility. Although this more complex business model is associated with a significant and higher return on assets, it depicts lower liquidity as measured by the loan-to-deposit ratio and lower tier 1 capital ratio.

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Appendix

Figure 1.A: UBI by country, averages

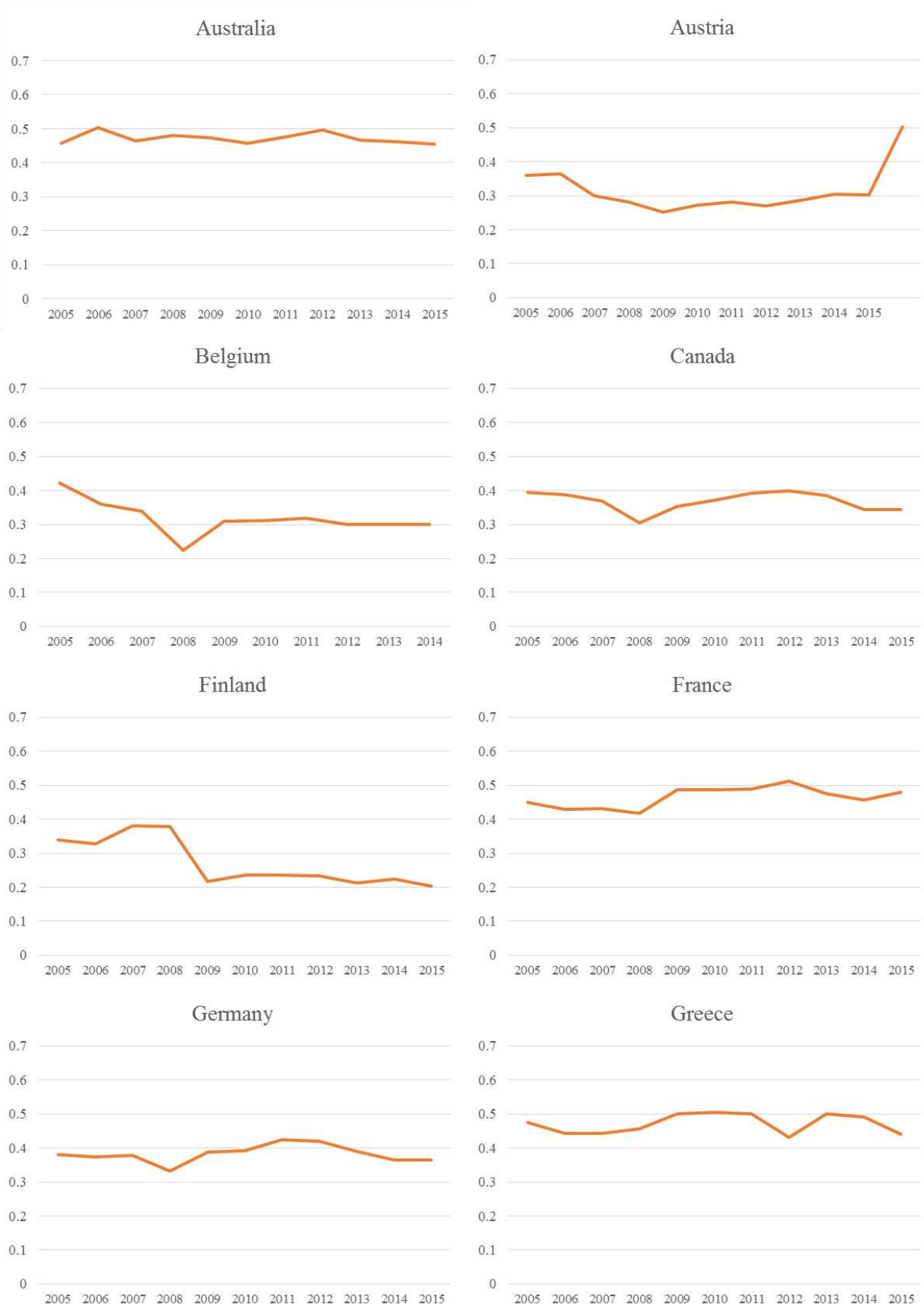

Figure 1.A (continued): UBI by country, averages

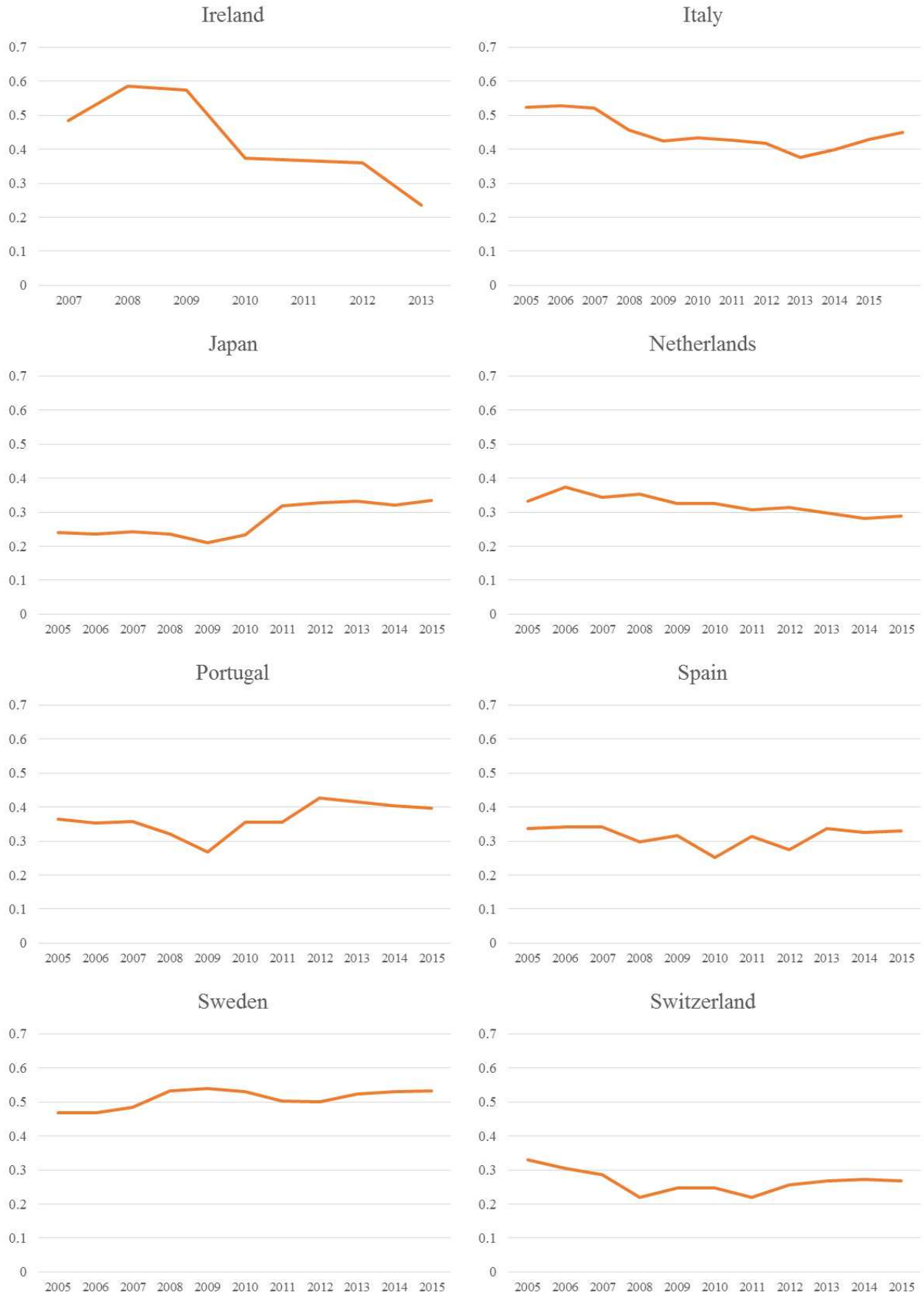

Figure 1.A (continued): UBI by country, averages

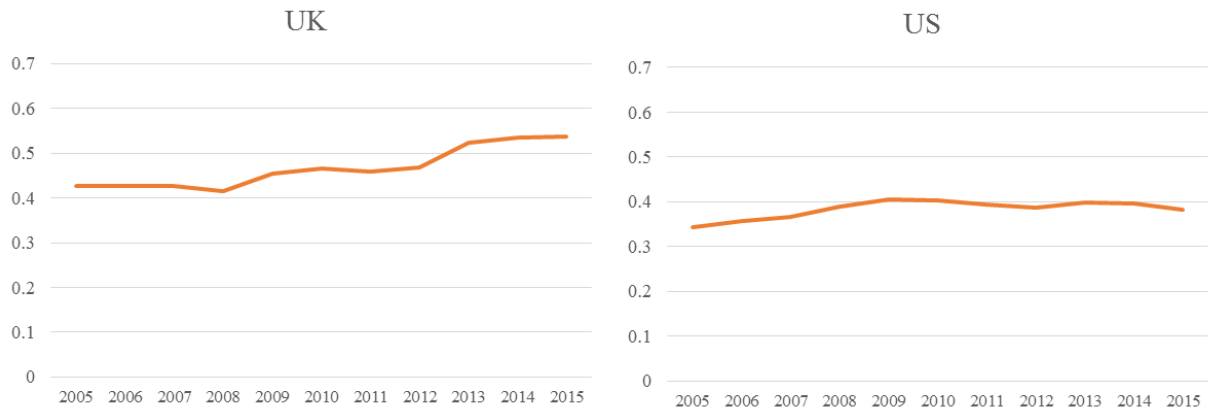

TABLE 1.A: Banks contained in the sample

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 2.A: 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 Deutsche Zentral-Genossensch	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

TABLE 2.A (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

TABLE 3.A summary statistics

Variable description	Notation	Mean	Median	Std. Dev.	Skewness	Kurtosis	Observations
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 activities*	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