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[1] *The views expressed in the paper are responsibility of the author and do not necessarily reflect those of the Central Bank of Paraguay.*

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Bank business models in Paraguay

Zulma Barrail *

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Abstract

I build a large panel of banks and other financial intermediaries for the period 2006-2017 to study which business models exist in the Paraguayan financial system using the statistical methodology of Cluster Analysis. Given the configuration of business models, I find that systemic banks tend to concentrate in a model based relatively more on agriculture lending and starting 2011, not only more banks started to switch to the group of *focused agro banks* but also the group had on average a significant increase in foreign debt liabilities.

JEL Classification: G1, G20, G21
Keywords: banking industry, financial sector, bank business models, Paraguay

Introduction

Paraguay is a small open developing economy that is a striking example of a net agricultural commodity exporter. Commonly observed in most of this type of emerging countries, fluctuations in international financial markets and commodity prices tend to be important drivers of domestic business cycles. In addition, the financial channel typically plays an important role in the transmission of external shocks in these economies. For the case of commodity prices shocks see Fernandez et al. (2018), Ibarlucia et. al. (2013) and Shousha (2016).

In a recent study, Baez et al. (2018) confirm that commodity price shocks are at least the third most important source of shocks for all key macro aggregates in Paraguay. External shocks related to the domestic real interest rate and commodity prices account for more than 50% of investment growth and changes in the trade balance.

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Regarding the relevance of the financial channel in Paraguay and to the extent of my knowledge, there is still no study that aims to quantify it. However, since the financial system in Paraguay is not as linked with the global financial system as other emerging countries in the region, we might expect that the financial channel doesn't play a leading role in international shock transmission. Banks are largely funded through deposits and capital, foreign ownership of deposits is small and foreign equity (mainly from Brazil) represents only 2.5 percent of system assets. At the same time, foreign investors do not hold domestically-issued government bonds and most portfolio inflows to the country are linked to the issuance of sovereign bonds in international markets which only started in 2013 (International Monetary Fund, 2016).

Even though financial linkages between Paraguay and the rest of the world are described as limited, the high reliance of the Paraguayan economy on the agriculture sector may promote among systemic banks the adoption of a common business profile focusing on agriculture lending. If so, a key policy question is whether this may exacerbate economic contractions following a sharp decrease in commodity prices of our exports or adverse productivity shocks in agriculture. In other words, systemic banks sharing a common business profile that focuses in the agriculture sector could be increasing the relevance of the financial channel of commodity price swings.

I build a large panel of banks and other financial intermediaries for the period 2006-2017 to study which business models exist in the Paraguayan financial system using the statistical methodology of Cluster Analysis. Given the configuration of business models, I find that systemic banks tend to concentrate in a model based relatively more on agriculture lending and starting 2011, not only more banks started to switch to the group of *focused agro banks* but also the group had on average a significant increase in foreign debt liabilities. This paper is a first assessment on the configuration of the banking sector in Paraguay and follows previous papers covering European banks - Ayadi et. al. (2016) and references therein. I believe its findings can serve as inputs in the debate on macroprudential policies in Paraguay.

1 Classifying banks: the methodology

In this section, we define and characterize bank's business models in Paraguay using annual data for all individual banks and financial intermediaries. To do this, we follow the literature in selecting variables that reflect strategic management choices by banks and apply a statistical clustering algorithm. The procedure we use to classify banks into distinct business models is primarily driven by data but incorporates judgmental elements. It shares many technical aspects with the procedure employed by Ayadi et. al (2016).

The sample is comprised of 21 bank and financial intermediaries operating since 2005

and covering more than 90% of financial system assets as of december 2017. The sample includes 252 bank-year observations and covers the period 2006-2017. The database used was built by collecting balance sheet data and total private credit by economic sector and bank from the public credit registry.

The inputs to the classification are bank characteristics. These are balance sheet ratios reflecting at some extent strategic management choices. We use six balance sheet ratios expressed in terms of balance sheet size: four from the asset side and two from the liabilities side of the ledger. These six instruments were used to form the clusters:

1. *Consumer loans (as % of assets)*: This indicator identifies the share of customer loans to non-bank consumers and reflects the reliance on more traditional banking activities. Consumer loans include automobile purchases, home purchases, medical care, home repair, vacations, and other consumer uses.

2. *Agriculture loans (as % of assets)*: This measure identifies the share of loans to agriculture sector and reflects the exposure to agriculture shocks (weather, commodity prices, trade agreements/conflicts).

3. *Other assets (as % of assets)*: These are defined as assets other than loans to the private sector.

4. *Foreign currency loans (as % of assets)*: This indicator identifies the share of loans in USD. A greater value would reflect greater exposure to foreign exchange rate fluctuations from the asset side perspective.

5. *Customer deposits (as % of assets)*: This measure reflects the reliance on a traditional funding source.

6. *Foreign debt liabilities (as % of assets)*: These are defined as the sum of bonds held by international investors and foreign loans (credit lines from international institutions and foreign headquarter). A greater value would reflect greater linkage with the international financial system.

To form the cluster, we apply Ward's (1963) procedure to calculate the distance between clusters. The algorithm is a hierarchical classification method. This is an agglomerative algorithm, which starts from individual observations and successively builds up groups (clusters) by joining observations that are closest to each other. It proceeds by forming progressively larger clusters, maximizing the similarities within groups and differences across groups. To diagnose the appropriate number of clusters, Calinski and Harabasz's (1974) pseudo-F index was used as the primary stopping rule. The results show that the pseudo-F indices attain a single maximum, pointing to the four-cluster configuration as the most distinct one (see Table 1).

Other studies applied to european banks test a variety of alternative instrument configurations and check whether the chosen set leads to the most consistent and distinct clustering. This is difficult to do in our case, given data limitations. In addition, our much less developed financial system is associated with limited investment options and funding sources for banks. Nevertheless, I tried dropping or adding variables and I either fail to create distinct clusters or have fewer clusters with less obvious differences and one particular cluster with very few bank/year observations.

Table 1: Pseudo-F indices for clustering configurations

Number of clusters	Pseudo-F index (Calinski & Harabasz)	Number of clusters	Pseudo-F index (Calinski & Harabasz)
1	..	6	119.09
2	136.64	7	114.48
3	137.33	8	112.37
4	140.94	9	107.69
5	125.65	10	104.98

2 Which bank business models exist in Paraguay?

This section gives the descriptive statistics of the four models resulting from the cluster analysis on all the sample of banks in Paraguay during the twelve year period of 2006-2017. Results are given in Table 2.

Models 1 and 2 are relatively more active in lending. Assets unrelated with bank loans represent 34% and 20%, respectively. In other words, loans account for 66% and 80% of total assets respectively, on average surpassing or close to sample averages. Both models are also relatively active in the classical deposit-loan intermediation. Customer deposits account for 59% and 61% of total assets. Even though these models are quite similar, three key differences emerge. First, bank loans in foreign currency tends to be higher in Model 1 banks than in those of Model 2. Second, Model 1 is more exposed to other funding sources than Model 2. Debt liabilities for Model 1 banks account for 6% of total assets versus 2.6% for Model 2 banks. Third, Model 1 is more oriented towards agriculture loans while Model 2 is more oriented towards consumer credit. For the latter reason and simplicity, Model 1 will be referred to as *Focused-agro banks* and Model 2 as *Focused-retail banks*. *Focused-agro banks* represents 36.25% of the sample and on average 70.57% of total assets. *Focused-retail banks* represents 37% of the sample and on average 11% of total assets. Figure 2 shows that in 2012 and unlike the rest of banks, *Focused-agro banks* started to increased in its total number.

Similar to Models 1 and 2, Model 3 banks use customer deposits as main funding source.

In fact, customer deposits accounts for 78.6% of total assets, quite above sample average. Unlike previous models, loans account for less than 40% of total assets, meaning these banks tend to be more active in non traditional use of funds. For simplicity and based on their average asset composition, banks in this Model will be referred as *Diversified banks*. These banks represent 11.15% of the sample and on average 11.68% of total assets.

Model 4 banks are the least active in lending to the private sector. Assets unrelated with bank loans reach 70% of total assets and surpasses sample average. These banks are also the least reliant on traditional funding sources; customer deposits account for 40% of total assets, on average. Banks in this model will be referred as *Less traditional banks* and represent 15.6% of the sample and on average 13.25% of total assets.

Table 2: Descriptive statistics for business models

		Consumer loans (% assets)	**Agriculture loans** (% assets)	**Other assets** (% assets)	**Foreign currency loans** (% assets)	**Customer deposits** (% assets)	**Foreign Debt liabilities** (% assets)
Model 1	**Mean**	7.57%	25.43%	34.05%	31.31%	59.22%	5.97%
Focused	**SD**	0.05	0.07	0.08	0.08	0.06	0.06
Agro	**Min**	0.00	0.08	0.14	0.15	0.45	0.00
(91 obs.)	**Max**	0.20	0.43	0.54	0.50	0.78	0.20
Model 2	**Mean**	27.07%	13.76%	20.41%	15.40%	61.46%	2.61%
Focused	**SD**	0.12	0.12	0.06	0.06	0.10	0.04
Retail	**Min**	0.00	0.00	0.07	0.00	0.35	0.00
(93 obs.)	**Max**	0.63	0.35	0.38	0.30	0.83	0.12
Model 3	**Mean**	2.86%	11.50%	60.58%	21.47%	78.66%	0.39%
Diversified	**SD**	0.03	0.07	0.18	0.12	0.09	0.01
Banks	**Min**	0.00	0.00	0.41	0.04	0.63	0.00
(28 obs.)	**Max**	0.09	0.25	0.95	0.42	0.95	0.03
Model 4	**Mean**	5.44%	8.76%	70.01%	12.72%	39.96%	1.63%
Less	**SD**	0.07	0.06	0.10	0.09	0.10	0.03
Traditional	**Min**	0.00	0.00	0.54	0.00	0.01	0.00
(40 obs.)	**Max**	0.22	0.21	0.95	0.35	0.54	0.14
All	**Mean**	13.90%	16.93%	37.67%	21.39%	59.15%	3.42%
Banks	**SD**	0.13	0.11	0.21	0.11	0.13	0.05
(252 obs.)	**Min**	0.00	0.00	0.07	0.00	0.01	0.00
	Max	0.63	0.43	0.95	0.50	0.95	0.20

Table 3: Size of business models (annual average)

	Assets (% System Assets)	Mean Assets (% System Assets)
Model 1 *Focused Agro*	70.57	8.88
Model 2 *Focused Retail*	11.03	1.41
Model 3 *Diversified Banks*	11.68	3.66
Model 4 *Less Traditional*	13.25	3.95

Figure 1: Assets by bank business model (% financial system assets)

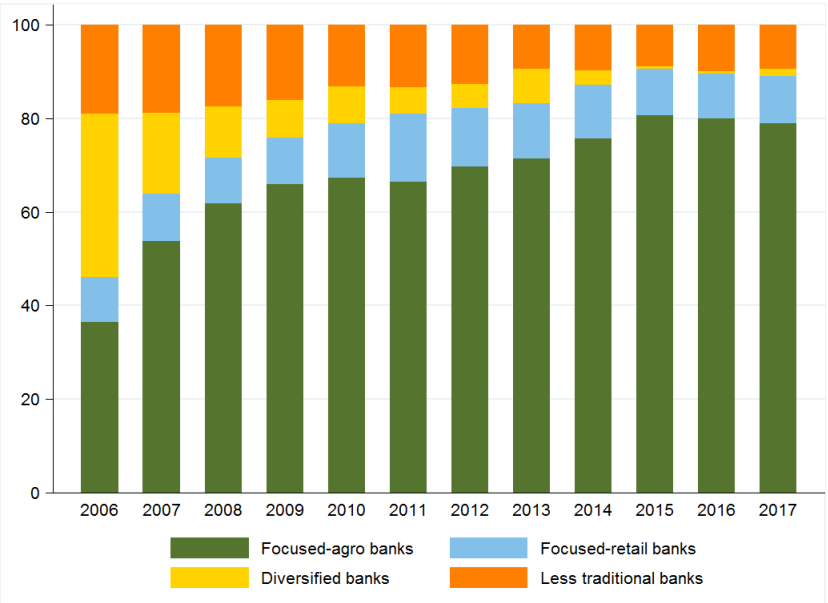
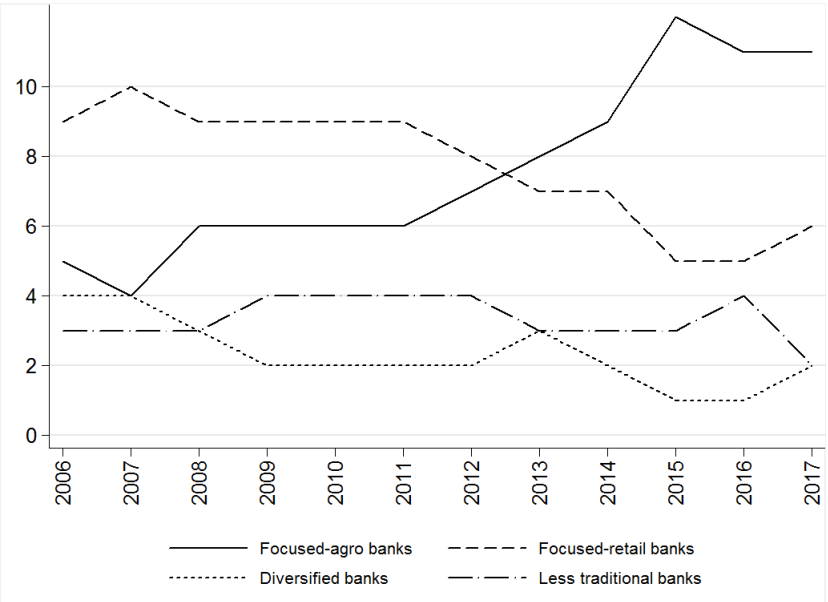


Figure 2: Number of banks by bank business model



Figures 3-8 illustrate that all these key differences across business models remain relatively stable over the entire period. The most interesting graph shows the evolution of Foreign Debt liabilities (as % assets) for Focused Agro Banks (see Figure 8). In 2011,

banks from this cluster experienced on average a significant increase in this ratio that remain much higher than all other banks throughout all subsequent years.

Figure 3: Consumer loans (% assets)

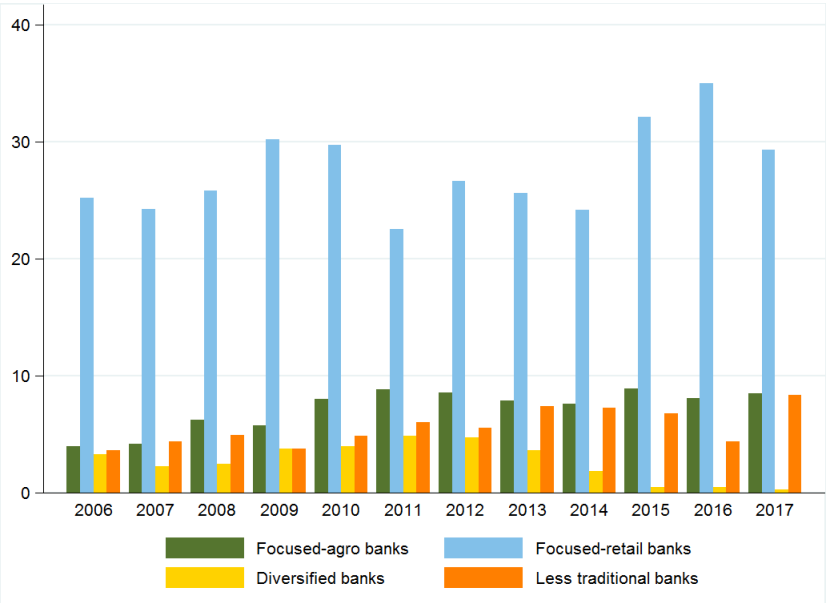


Figure 4: Agriculture loans (% assets)

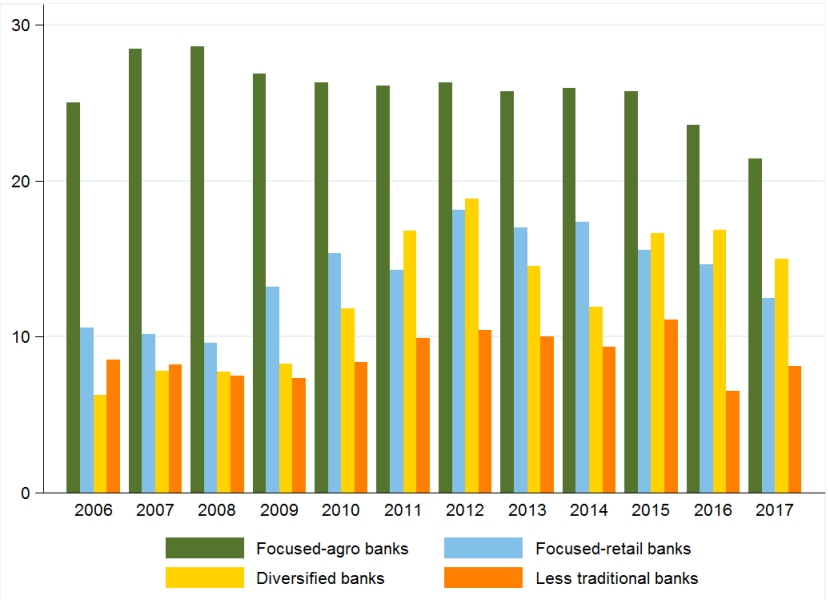


Figure 5: Other assets (% assets)

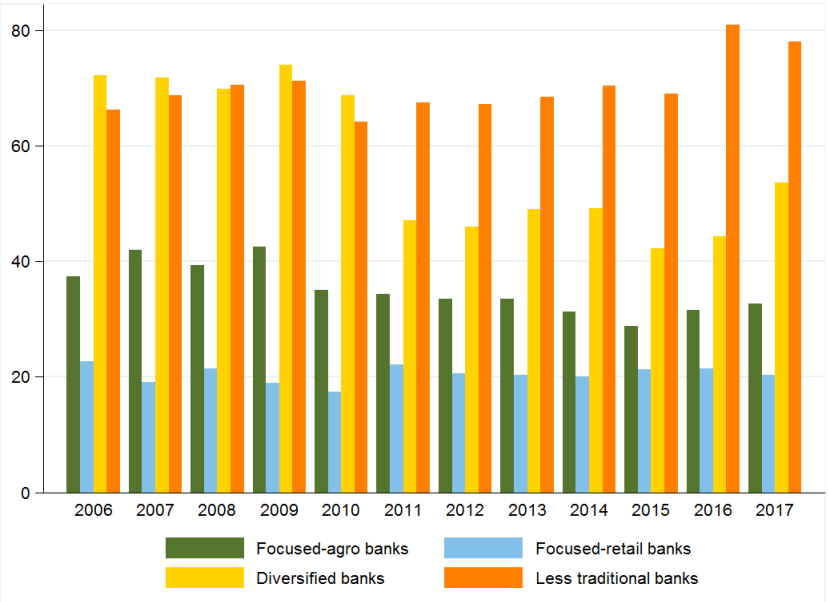


Figure 6: Foreign currency loans (% assets)

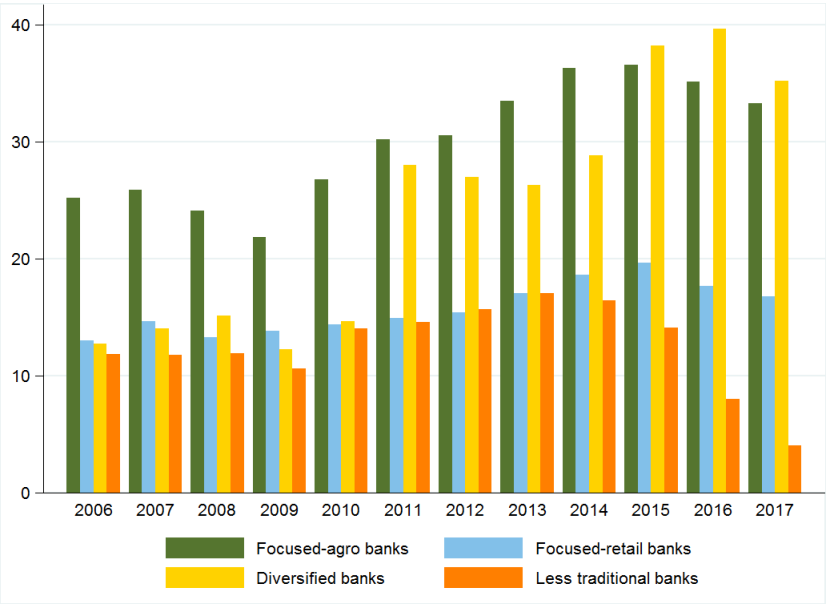


Figure 7: Customer deposits (% assets)

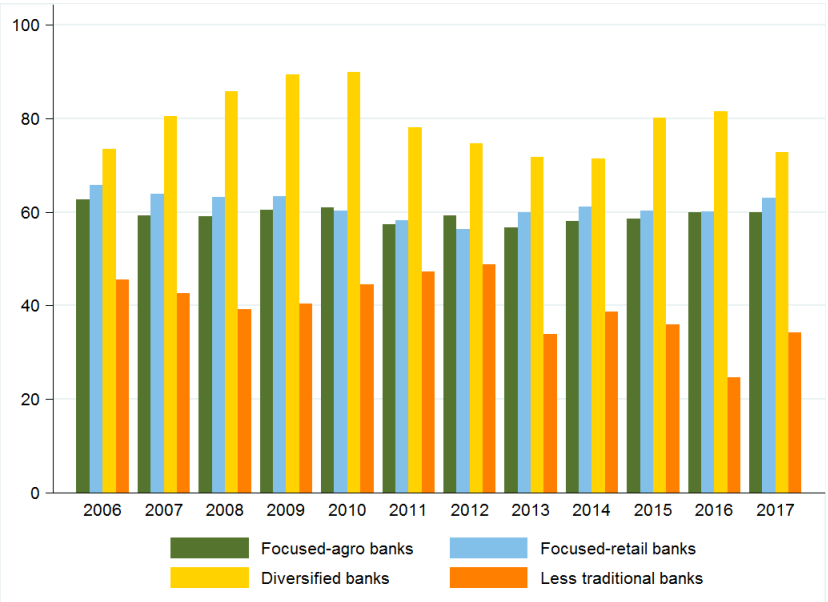
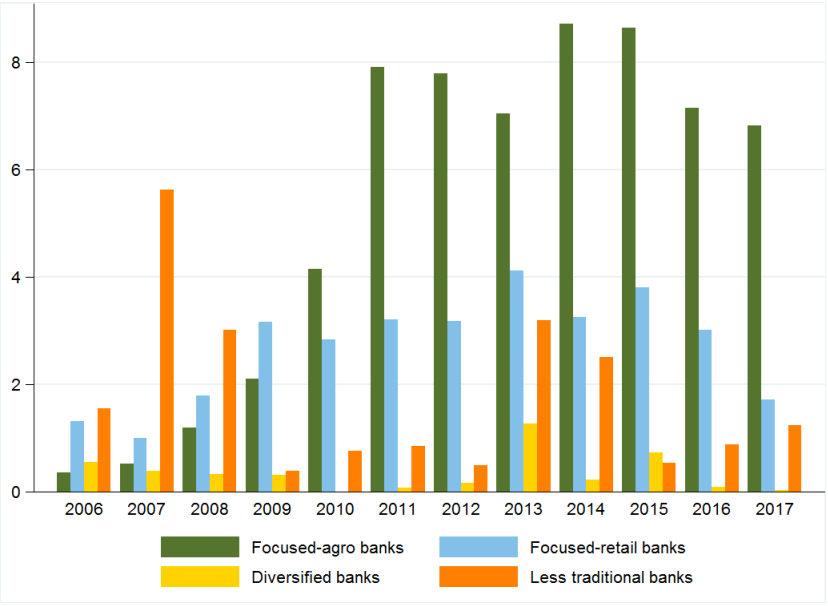


Figure 8: Foreign Debt liabilities (% assets)



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