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Credit Cooperatives: Market Structure, Competition, and Conduct. Exploring the Case of Paraguay

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Abstract: Measures of concentration and competition in the financial sector are important to determine public policies. However, cooperatives, and in particular in the context of small developing countries are largely ignored in economic literature. The empirical analysis is descriptive due to data availability and analysis the loan market of large credit cooperatives. However, findings are indicative and tentative. Results show that, in general, a) the cooperative system is highly concentrated, b) the loan market of large financial cooperatives is not concentrated, c) however, most loan modalities are highly concentrated, some are competitive and some are not, d) there is no indicative evidence of market abuse of the three largest credit cooperatives.

Keywords: Credit Cooperatives, Paraguay, Market structure, Competition, HHI, dual HHI

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1. Introduction

Financial institutions, as banks and non-banks, are crucial in the allocation of resources to the real economy thereby contributing to economic growth and reducing inequalities by converting savings into investments. This function is essentially the same in all economies (Beck et al. 2000; King and Levine 1993; Merton 1990; OECD 2009). Financial stability, where the market can withstand external shocks without major disruption of their primary economic function, occurs through transparency and good governance, which is a core function of supervisory (Barra and Zotti 2017; Jarmuzek 2018). Cooperatives, as a new form of a business society, have not lost strength and are an essential part of the world's economies, in particular, on a regional level where they can spur local economic growth (Hakenes et al. 2015). Cooperative history knows several examples of success of countries that went through a great depression and high unemployment rates such as Germany (1860), the United Kingdom (1840), the United States (1934), Sweden (1930), and Finland (1902). All of them are located today among the countries with the highest GDP in the world and their economic successes correspond largely to cooperatives (Birchall 2009). The cooperative movement, in general, is recognized for its impacts on the development and sustainability of communities in a broad sense, in education and information and when creating jobs (see McKillop et al. 2020 for an overview). In particular, financial cooperatives, as part of the financial sector are of interest for various reasons. First, they take deposits and make loans, which are the same core services that offer banks, but distinguishes them from financial NGOs that are not permitted to take deposits (Westley and Shaffer 1997, p. 4). Second, they serve a market mainly ignored by commercial banks (Westley and Shaffer 1997), due to agency frictions as information asymmetry and contract enforcement (Torre de la et al. 2012). They are also seen as a vehicle to access finance, thereby reducing income inequality (World Bank 2008). Credit unions have a different ownership structure and a unique dual business nature (Mazzarol 2018). Last, but not least, measures of concentration and competition in the financial sector are important to determine

public policies regarding welfare-related issues (Bikker and Haaf 2002). However, despite their potential importance, cooperatives are largely ignored (Kalmi 2007). There is a gap in the literature of economics associated with empirical evidence of the potential and reality of cooperatives, and in particular in the case of small developing countries (Kalmi 2007; Lele 1981). To cope with the limitation of data availability, the empirical analysis will be descriptive and explanatory focusing on large financial cooperatives (type A). The focus on financial cooperative has the advantage of providing specific policy implications. However, despite the raised restriction, the methodology applied reveals some interesting results based on a set of different structural measures commonly – and less commonly – used. To the best of the author's knowledge, this paper is the first in analyzing the market structure and related measures of financial cooperatives in Paraguay.

The remainder of the paper is organized as follows. Section 2 reviews the literature on the link between market structure, competition, and conduct, following a section (3) on credit cooperatives in Paraguay. Methodology and data description are discussed after that in section 4 before concluding with a discussion in section 5.

2. Literature Review

Measures of concentration and competition are important and give a first insight of a given market structure and conduct in a particular market (Bikker and Haaf 2002). The aim of such an exercise should be oriented to public policies and decision-makers to distinguish between healthy and unhealthy market situations (Miller 1955).

Households require loans due to liquidity constraints. In the absence of a developed capital market, entrepreneurs and firms largely depend on the financial system as an external source of funding. A lack of competition due to concentration may result in unfavorable conditions for consumers due to high financial intermediation costs, efficiency losses, and harm the public interest (Bikker and Spierdijk 2009; Poghosyan 2012).

A great number of empirical research on the concentration – performance relationship is based on the traditional structure-conduct-performance (SCP) framework, which posits that concentration determines conduct, and conduct determines performance. The hypothesis is that firms in high concentrated oligopolistic markets may have higher average profit rates than firms in less concentrated or atomistic markets (Bain 1951, p. 294). However, banking literature gives ambiguous results on the relationship between concentration and competition, which makes it even more relevant in practice.[1]

Demsetz (1973) and Maudos and Nagore (2005), for example, suggest that changed cost conditions are the main cause of changes in the market structure, while the market structure is significant in explaining market power differences. Boyd et al. (2006) analyzed two large samples (U.S. sample and an international sample) with different properties. They find that there is a positive and increasing relationship between concentration and bank profits. They further find that bank's loan-to-asset ratios are lower in concentrated markets indicating a lower bank commitment to lending as opposed to holding other assets such as bonds.

Beck et al. (2004) find that concentration increases difficulties for firms to access financing, and in particular in countries with low levels of economic and institutional development. This effect decreases moving from small to larger firms, with larger foreign bank shares, and a smaller share for state-owned banks. In a more competitive banking system financially dependent sectors grow faster (Claessens and Laeven 2005), and in particular small firms have less short-term debt and their debt is of longer maturity

[1] For an excellent literature review on the relationship between concentration and competition, see e.g. Berger et al. (2004) and Lee (2007). For an excellent literature review of measuring competition, see e.g. Leon (2014).

(Demirgüç-Kunt and Maksimovic 1999). Martinez-Peria and Mody (2004) analyzed bank spreads in Latin America during the late 1990s and find that the presence of foreign banks influences the level of spreads. Their interest margins are generally lower, primarily due to lower costs of operation.

However, the alternative efficient structure (ES) hypothesis states that the market share reflects the efficiency of banks. Ben Naceur and Omran (2011) investigated competition and performance across a broad selection of the Middle East and North Africa (MENA) countries. They find that an increase in risk-taking has a positive effect on net interest margin by shifting the risk to the borrower's interest rate, and similarly increase cost-efficiency. They find also that corruption increases net interest margin, thereby reducing social welfare. However, the effect of more risk-taking in a competitive banking sector may result in an increase in banking failure and financial instability (Allen and Gale 2004; Beck et al. 2006; Mishkin 1999). Moral hazard problems due to risk shifting in a competitive environment may even induce excessive risk-taking (Jensen and Meckling 1976).[2] Implementing capital controls are not sufficient to achieve Pareto efficiency (Hellman et al. 2000). In contrast, Kick and Prieto (2013) find strong support that increased competition lowers the riskiness of banks and, in consequence, countries with better-developed institutions that foster competition are less likely to suffer systemic risk (Beck et al. 2006). Extensive regulation and particularly anti-trust policies have a protecting effect against monopolistic behavior and cartel forming, which may improve competition in the sector (Bikker 2007). Rojas-Suarez (2016) finds that a lack of enforcement of the rule of law by weak institutions directly affects the willingness of depositors to use formal financial institutions, and in combination with concentrated markets may discriminate low-income borrowers or small and median enterprises (SMEs). Poor enforcement of contracts increase interest rates, reduce loan amounts, and maturities. Poor enforcement is costly and reduces recovery rates (Bae and Goyal 2009). This is particularly true in the case of cooperatives whose members are risk-averse.[3] Moreover, education and financial intermediation of the banking system are significant for economic growth, which indicates the importance of adequate public policies (Beck et al. 2000). Huangfu et al. (2017) find that an oligopolistic banking structure is welfare-maximizing because with an increasing number of competitors each bank will receive a smaller share of deposits, which in turn leads to a constraint in lending, meaning lower welfare.

Investigating bank profitability in nine Latin American countries between 1997 and 2005 Chortareas et al. (2011) find support for the efficient structure hypotheses, in particular for larger banking markets. The Paraguayan banking market revealed a significant negative relationship between market structure (market power) and profitability (Chortareas et al 2011).

The Center for Global Development (CGD 2016) not just recommended similar regulations for similar financial activities, but also, in particular, “regulations aimed at protecting consumers from fraud, abuse, and discrimination” (p. 16).

In the context of cooperatives and particular credit cooperatives, there is still an ongoing economic discussion due to the dual nature of cooperatives. On the one hand, cooperatives are too profit-oriented to be considered a non-profit organization and too social to be just a for-profit business model (Levi and Davis 2008). Cooperatives are private economic firms and therefore one of many other types of economic firms, organizing economic activities (Ayadi et al. 2010, p.6). The partners own their cooperatives and therefore have an aversion to risk. They do not pursue short-term gains or benefits and they do not respond to the interests of shareholders that could lead to greater risks, motivated by inadequate incentives

2 For example, with deposit insurance, depositors do not have the same incentive to monitor the riskiness of assets. Another example is "too big to fail" bailouts as occurred in the aftermath of the last financial crisis.

3 A simple civil lawsuit in Paraguay may take several years to be settled.

(Birchall and Ketilson 2009; McKillop and Wilson 2014). Credit Unions often state that their primary mission is to offer best services to their customers, as opposed to maximizing cooperative's profits (EACB 2004, p 6), and hence, they might be more focused on market share, rather than profitability. However, robust profit growth is an important condition for cooperatives to safeguard their continuity, financing real economy, credit, and to continue adding value to their customers (Groeneveld and de Vries 2009). A more competitive market structure has a positive relationship on financial stability (Boyd et al. 2006; Fiordelisi and Mare 2014; Barra and Zotti 2017), mostly due to lower volatility of cooperatives' return (Hesse and Čihák 2007). Due to ambiguous results, concentration is not a sole indicator of competition (Bikker et al. 2007; Bos et al. 2009; OECD 2010).

3. Cooperatives in Paraguay

The cooperative movement has existed for centuries and has had a strong impact on the development of societies. The Paraguayan economy depends largely on agriculture and, in particular, soybeans, which determine the sign of GDP growth. However, this growth of the economy is limited by ecological and geographical restrictions. At the end of 2018, almost half (49.9%) of the economically active population (EAP) were a member of at least one cooperative, and penetration at the national level reached 25.6% of the total population, even though, urban and rural areas show different numbers. While applying the same national population distribution for the EAP, the penetration for urban areas reached about 40%, and for the rural population about 24%.[4] The proportion of the urban population to the total population increased by about 5% but decreased by about 7% for the rural population between 2011 and 2018.

The Paraguayan cooperatives were strengthened between 1995 and 2003, where they were able to capture deposits that were lost in the banking circuit as a consequence of a series of banking crises, which culminated in the demise of about 15 banks and 40 finance companies (Franks et al. 2005).

The National Institute of Cooperativism (INCOOP)[5] is the supervisory authority in the cooperative sector. Its main activity is to control and promote cooperatives on the national level. Members how have claims against a cooperative may resort to the INCOOP after paying an administrative fee.[6] Large cooperatives (type A) are subject to regular controls.

In this paper, all cooperatives at the national level are divided by their legal nature into three sectors: savings and credit cooperatives (CAC), production cooperatives (CP), and other cooperatives (OTC, e.g. cooperatives for services and cooperatives for consumption). Within these sectors, the cooperatives are divided by size into type A, type B, and type C. A cooperative type A indicates a large cooperative with assets above USD 11 million (type B, USD 1 – 11 million; type C, under USD 1 million) at the end of each financial year and subject to recategorization according to the regulations of the INCOOP. Therefore, in theory, it would be possible for a cooperative, for example, to be recategorized from type B to type A during the research period. The following Table 1 gives an overview of the evolution of cooperatives in Paraguay. The average debt of a cooperative member reached approximately USD 1,714 at the end of 2018, with an increase of 6.38%, on average. However, this debt can be biased because some members do not have an active credit or some members have multiple credits in different cooperatives at a time and therefore the average debt can be higher. In the period between 2010 and 2018, the average debt per member increased by almost 60% (59.53%).

[4] The proportion of Urban/total population = 0.60, on average.
[5] Instituto Nacional de Cooperativismo.
[6] In recent years, however, the cooperative sector has repeatedly appeared negative in the national media due to charges for sexual abuse of employees, insider lending, or even election fraud.

Table 1. Evolution of cooperatives in Paraguay.

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Quantity	408	488	437	404	407	357	250	385	328
Loans	1,472	1,976	2,343	2,729	2,983	2,996	2,906	3,108	3,382
Members (000)	1,239	1,336	1,405	1,481	1,544	1,610	1,647	1,727	1,785
Quantity (%)	-	19.61	-10.45	-7.55	0.74	-12.29	-29.97	54.00	-14.81
Loans (%)	-	34.24	18.57	16.47	9.31	0.44	-3.00	6.95	8.82
Members (%)	-	7.83	5.16	5.41	4.25	4.27	2.30	4.86	3.36

Notes: Figures reflect the sum of all active cooperatives (Type A, B, C) and all sectors. Gross Loans are in millions of USD. The lower part represents annual changes on a YoY basis. Data: INCOOP, Exchange rates from Paraguay Central Bank data.

3.1. Large credit cooperatives in Paraguay

Paraguay is geographically divided into 17 departments and the capital district Asuncion. About 41% (18) of the large credit cooperatives are located in the country's capital Asuncion. Further 12 cooperatives are located in the central department, and 14 larger credit cooperatives are distributed in 10 departments, while six departments do not have a large credit cooperative at the end of 2018. More than 96% of all members belong to a credit cooperative (CAC) and more than 83% (83.60%) of these members belong to a large financial cooperative. To avoid a sudden shift in loan demands, cooperatives generally use time of affiliation before granting loans.

The following Table 2 shows the evolution of the large financial cooperatives within the period 2011 to 2018. The evolution over time reveals a continuous increase of active cooperatives (on average, +8.15%) and members (+7.66%).

Table 2. Evolution of credit cooperatives type A.

	2011	2012	2013	2014	2015	2016	2017	2018
Quantity	26	27	31	31	38	38	38	44
Loans	1,171	1,343	1,633	1,799	1,836	1,811	1,912	2,127
Members (000)	858	982	1,037	1,131	1,168	1,278	1,330	1,433
Quantity (%)	-	3.85	14.81	0.00	22.58	0.00	0.00	15.79
Loans (%)	-	14.69	21.59	10.17	2.06	-1.36	5.58	11.24
Members (%)	-	14.45	5.60	9.06	3.27	9.42	4.07	7.74

Notes: Figures reflect the sum of all financial cooperatives Type A. Gross Loans are in millions of USD. The lower part represents annual changes on a YoY basis. Data: INCOOP, Exchange rates calculated from Paraguayan Central Bank data.

In contrast, the next Table (Table 3) shows the evolution over time for the smaller credit cooperatives and reveals a different picture. Registered small cooperatives decreased by 4.46% and loans decreased by about 8%, on average.[7] The number of registered small cooperatives for each year does probably not reflect active cooperatives.[8]

Table 3. Evolution of financial cooperatives type C.

[7] The Government implemented a tax for loans in July 2016. The same was repealed with law no. 178/18 about two years later. At first glance, there is no clear evidence that this tax affected loan supplies.

8 According to data provided, INCOOP registered 130 small cooperatives in 2018, but just 73 were active in loan supply.

	2011	2012	2013	2014	2015	2016	2017	2018
Quantity	250	210	189	197	169	106	180	130
Loans	39,689	35,914	32,727	44,381	23,352	17,185	27,301	11,206
Members (000)	116,798	97,259	104,571	79,375	82,881	66,428	70,350	41,580
Quantity (%)	-	-16.00	-10.00	4.23	-14.21	-37.28	69.81	-27.78
Loans (%)	-	-9.51	-8.87	35.61	-47.38	-26.41	58.87	-58.95
Members (%)	-	-16.73	7.52	-24.09	4.42	-19.85	5.90	-40.90

Notes: Figures reflect the sum of all financial cooperatives Type C. Gross Loans are in thousands of USD. The lower part represents annual changes on a YoY basis. Data: INCOOP, Exchange rates calculated from Paraguayan Central Bank data.

Almost half (48%) of the small cooperatives disappeared. Between 2011 and 2018, small financial cooperatives lost more than half of their members with an accelerated annual average of 12%. At the end of 2018, the participation of small cooperatives in loans granted reached an almost insignificant 0.37%. Although the Paraguayan economy shows steady growth in recent years, small cooperatives seem to be disoriented and in free fall.

4. Data and Methodology

This section explains the data selection process of the two samples, the methodology applied, and a description of the structural measures used in this research.

4.1. Data

The National Cooperative Institute (INCOOP) as the solely supervisory authority, provided data regarding the Paraguayan cooperatives. Tables with information on the number of cooperatives, number of members, and loans granted are the results of consolidated and aggregated yearly data. For the purpose of this paper, we asked INCOOP for monthly data, disaggregated by loans granted by modality, e.g. consumption, health, small enterprise among others, for the large cooperatives for the years 2010 to 2018. In general, creditors can be divided into independent companies and individuals, other individuals, and non-profit organizations. Also, active debts can be distinguished in short, medium, and long-term loans. For the purpose of this investigation, these distinctions have been omitted. We received data for 2016, 2017, and 2018. We excluded all data for 2017 due to a large number of cooperatives with missing monthly data. We then selected cooperatives with 12 complete monthly observations and obtained a sample for 2016 with 32 cooperatives and 2018 with 30 cooperatives. To address sample bias, only those were selected which presented 12 monthly observations in both years. We obtained a paired sample of 22 cooperatives for 2016 (≈ 58% of all cooperatives) and 2018 (50% of all cooperatives).[9] Half of the large credit cooperatives in the paired sample (11) are located in the capital Asuncion, further three in the central department, and eight large cooperatives are distributed across seven departments. Besides, for the calculation of the net interest margin (NIM) data from the balance sheets of the three largest cooperatives were used. However, just a few large cooperatives (type A) publish their annual reports on their respective website.

4.2. Methodology

9 Official data received from and published by the INCOOP are not consistent with monthly aggregated data for the two samples. For descriptive purposes, we report these numbers as they are in Table 1 through Table 3, therefore interpretations
should be made with caution.

This paper begins with descriptive statistics of the cooperative system on a national level, to illustrate concentration and trends over time. Next, we focus on large financial cooperatives by applying a set of static structural measures to a sample for the years 2016 and 2018, following the methodology applied in previous research (e.g. Bikker and Haaf 2002; Brown 2018; d'Outreville 1998; Pfingsten and Rudolph 2002; Tabak et al. 2009).

The Lerner index often used to identify market power in the financial sector research, maybe not a good indicator in the case of non-maximizing profit firms such as cooperatives, because it is no guide to determine changes in loan demand (Miller 1955, p. 123).

This research uses a set of different measures to explore the loan market structure and various loan modalities on the institutional and product level in the cooperative sector. In addition, the NIM for the three largest cooperatives, ranked by total loans granted, is calculated for the years 2015 – 2018 using consolidated balance sheet data made available by these cooperatives on their official website.

4.2.1. Concentration ratio (CR)

The most widely used measure of concentration in empirical research is the k-firm concentration ratio (CR_k) because it requires limited data and is easy to interpret.[10] Concentration ratios may be useful as a basis for preliminary market screening (Miller 1955). The Paraguayan law does not mention any measurable criteria defining monopoly, concentration, or dominant position accept the concentration ratio in the case of a merger.[11] This might hamper the role and efficiency of the National Competition Commission (CONACOM), regulating national competition since 2015. The concentration ratio measures the sum of k-largest firms in the market, according to the formula:

$$CR_k = \sum_{i=1}^{k} s_{i,t,} \tag{1}$$

The structural change within the cooperative system may suggest a concentration or diversification. There is also the possibility that the members of their respective cooperatives were happy with the services provided and therefore there was no significant change in the structure during the investigated period. The book value (in the local currency, Guaranies) of the loans granted to members *i* at the end of year *t* in a particular cooperative (type A, B, C) j is defined as X*i*; *t*; *j*. Therefore, the proportion of the loans of partners *i* at point *t* in sector j can be defined as follows:

$$x_{i,t,j} = \frac{x_{i,t,j}}{\sum_{j=1}^{3} x_{i,t,j}} \tag{2}$$

4.2.2. Herfindahl-Hirschman Index (HHI)

A measure of concentration commonly used in the literature, and which comprises a naïve diversification, is the Herfindahl-Hirschman Index. Hirschman in 1945 and Herfindahl in 1950 proposed the index independently as a measure of concentration in an industry

10 The European Union (2004) states that a market share of 50% or more "may in themselves be evidence of the existence of a dominant market position" (Paragraph 17 of the Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings. The UK considers a market share in excess of 40% as a threat to competition.

11 Law 4956/13 and Directive 1490/14. The law 4956/13 in his Art. 14 mention that if the result of any merger is equal or higher than 45% market share or if the gross income of the merger exceeded the amount of 100,000 monthly minimum wages in the last accounting year, the transaction should be registered with the respective authority.

(Hirschman 1945; Herfindahl 1950). The index is calculated as the sum of the squares of a firm's market share *i* at time *t*:

$$HHI_{i,t} = \sum_{j=1}^{n} \left(x_{i,t,}\right)^2 \quad (3)$$

The *HHI* is equal to 1 when all loan exposures are granted to a single type of cooperative and it equals 1/*n* when all three types of cooperatives receive the same amount of loans. More generally, the bound of the index is between $1/n \leq HHI \leq 1$. A high index indicates a concentration, while a low index indicates a diversification of the loan portfolio of cooperatives of different types.[12] In addition to linear trends, non-linear developments of specialization measures over time are also conceivable, due to regulatory changes or events affecting the system as a whole, such as the 2008/2009 financial crisis or, in the particular case of Paraguay, imposing a tax on loans. To identify non-linear trends over time and to quantify diversification, the Spearman's coefficient (Spearman's Rank-Order Correlation, RC) is used (Jahn et al. 2015; Kamp et al. 2005). If the RC takes the value 1, the concentration of the loan portfolio increases with each step of time, regardless of size or amount. On the contrary, if RC = -1 shows a decreasing HHI and a growing diversification over time.

4.2.3. Dual of Herfindahl-Hirschman Index (HHI (d))

In contrast to the *k*-firm concentration, the *HHI* will reflect changes in the market structure among smaller banks (Corvoisier and Gropp 2001). However, the *HHI* can lead to erroneous conclusions, because the index is compatible with different market structures (Marfels 1971), in particular when the number of participants is small. The *HHI* in a single market structure can change because the number of firms changed. The *HHI* does not consider this information. Therefore, and to make the results comparable with other regions, the dual of the *HHI (d)* is constructed in the case of large cooperatives. The dual of the series X is:

$$d = 1 - \frac{1}{n.\,HHI_x} \quad (4)$$

The *HHI (d)* represents the fraction of cooperatives that do not have market participation and varies from 0 to the maximum of 1-1/*n* (Chang et al. 2005; Tabak et al. 2009).

4.2.4. Berry Index (BI)

The inverse of the *HHI* is the Berry Index (1971), which measures diversity directly.[13] The index is bounded between 0 and 1-(1/*n*) (Lee and Brown 1989). The Berry Index (*BI*) is 0 in the case of no diversity and reaches its maximum at 1-(1/*n*) in the case of equal distribution. The general form of the index is:

$$BI_{i,t} = 1 - \sum_{i=1}^{n} s_{i,t}^2 \quad \text{, where s} \quad (5)$$

is the market share of firm *i* at time *t*.

12 The U.S. Department of Justice and the Federal Trade Commission (2010) define an HHI level below 1500 as an unconcentrated market, between 1500 and 2500 as moderately concentrated, and above 2500 as a highly concentrated market.

13 The Berry Index is also known as the Simpson Index, e.g. Lee and Brown (1989).

4.2.5. Entropy (E)

The Entropy measure, a quantity measure with its origin in thermodynamics (Brissaud 2005; Zhou 2013), is nowadays universally related to order or information (Brissaud 2005; Shannon 1948; Williams 2002) and has been used in economic research, as well as in management, marketing, and other sciences to measure dispersion within an industry, brands, or products (Attaran and Zwick 1987). Information in this context may be understood as the inverse of uncertainty quantifying the degree of localization or delocalization (Garbaczewski 2006, p. 2). This makes entropy a natural candidate for measuring diversification (Kirchner and Zunckel 2011).

$$E = -\sum_{i=1}^{n} p_i \, log_2 \, p_i \quad , \tag{6}$$

where p is the probability distribution of firm i in an underlying market. In this paper, we use a relative entropy measure (RE) using the formula $RE = E/\log_2(N)$. This relative measure ranges from [0, 1] and varies inversely to the degree of concentration, making it therefore more interpretable and comparable with other structural measures.

4.2.6. Stenbacka Index (S)

Melnik, Shy, and Stenbacka (2008) introduced a measure to characterize a dominant position of a firm in a particular market. This measure can be calculated using the formula

$$S_D = \frac{1}{2}[1 - \gamma \, (S_1^2 - S_2^2)], \tag{7}$$

where $\gamma > 0$, and is a competition parameter, which reflects market obstacles imposed by the largest firm, powerful buyers, economic regulation or intellectual property rights. In this paper, we set $\gamma = 1$ which can be seen as a natural benchmark "because it coincides with the threshold of 40% below which the OFT Guidelines may not consider a firm to be dominant" (OFT Guidelines 2004, p. 70).

4.2.7. Kwoka's Dominance Index (D)

This index, proposed by John E. Kwoka Jr. (1977), focuses on the pattern of shares in an industry such as the gap between the market share of the largest company and its competitors. Where large gaps occur between consecutive shares dominance is present and the index increases toward unity while values close to 0 mean that no single company dominates the market. The index is calculated as the sum of squares of market shares differences when companies are ranked by size and is given by

$$D = \sum_{\mathrm{i}=1}^{\mathrm{n}-1} (s_i - s_{i+1})^2, \tag{8}$$

where s is the market share of each producer i ranked by size.

4.2.8. Dominance index (P)

Pascual Garcia Alba (1993) proposed an index to measure dominance in a given market. This index is also known as the concentration of the concentration index and indicates the distribution of the HHI. The Mexican Federal Competition Commission (COFECE) used this index until 2015 to measure concentration. The Commission, however, argued that the index is essentially a measure of the asymmetry of market participants and has no clear theoretical

foundation (COFECE 2015, p. 3). However, in this paper, we present the results of this index to give some practical insights. The index is given by the formula:

$$P = \sum_{i=1}^{n} h_i^2 \ , \tag{9}$$

where $h_i = \frac{s_i^2}{HHI}$.

5. Results

5.1. Cooperative system on a national level

Table 4 shows that the cooperative sector is almost identically mirrored by the large credit unions and reveals a clear concentration in the cooperative system at the end of 2018 with an HHI of 0.8807, and in particular for large cooperatives (type A). In turn, the small cooperatives (type C) lost about 86% (86.59%) of their loan market share at an average rate of -14.71%. The distribution of the Spearman coefficient of the HHI reveals that the cooperative system has still a larger share of a diversified system (55.55%) at the end of 2018, however, with a clear trend towards an increase in concentration. The same situation can be observed for the large cooperatives, while medium and smaller cooperatives (type B and C) with an HHI of 0.00358 and 0.00001, respectively, experienced a tremendous loss in participation by about 88.89% (type B) and type C by almost 100% over time.

Table 4. Evolution of financial cooperatives.

	Herfindahl-Hirschman Index (HHI) – loans			
Year	System	Type A	Type B	Type C
2010	0.76359	0.75168	0.01116	0.00075
2011	0.76003	0.74673	0.01277	0.00052
2012	0.76615	0.75287	0.01293	0.00035
2013	0.79025	0.77932	0.01074	0.00018
2014	0.81231	0.80466	0.00735	0.00030
2015	0.87412	0.87067	0.00337	0.00008
2016	0.87182	0.86792	0.00386	0.00004
2017	0.86081	0.85654	0.00418	0.00010
2018	0.88070	0.87711	0.00358	0.00001
RC Coefficient	0.9167	0.9167	-0.8167	-0.9333
with RC < 0	0.5555	0.5555	0.1111	0.0000

Note: The calculation of the index is based on the loan portfolio for credit, production, and other cooperatives. Data from INCOOP.

The trend of losing participation and the significance of medium and small cooperatives in the loan market is undoubted. The largest increase in concentration occurred in 2015. The RC coefficient supports the trend towards a concentration for large cooperatives and divergence for medium and small cooperatives. As the complementary 1-d of the HHI (d) reveals, the Paraguayan cooperative system is in the hands of about 0.5% of all cooperatives, that is, 2 large cooperatives are responsible for the most of all loans in the system (see Table A1 in the appendix).

5.2. Samples with firm-level data

However, a market structure can change due to more or fewer cooperatives. The HHI does not consider this information. Therefore, in addition to the HHI, the dual of the HHI – HHI (d) – is calculated as a more robust measure (Cheng 2005; Tabak et al. 2009) with a focus on the two samples on large credit cooperatives with firm-level data.

Table 5. Concentration in the large cooperative sector (type A) – part 1.

	2016				2018			
	CR3	HHI	HHI (d)	BI	CR3	HHI	HHI (d)	BI
Total Loans	0.550	0.122	0.627	0.878	0.556	0.123	0.632	0.877
Consumption	0.629	0.158	0.713	0.842	0.762	0.150	0.696	0.850
Health care	0.624	0.186	0.615	0.814	0.888	0.645	0.897	0.355
Housing	0.708	0.229	0.782	0.771	0.701	0.259	0.797	0.741
Micro enterprise	0.579	0.217	0.730	0.783	0.752	0.328	0.809	0.672
Small enterprise	1.000	0.349	0.044	0.651	0.948	0.445	0.625	0.555
Median enterprise	0.000	0.000	0.000	0.000	0.802	0.274	0.392	0.726
Education	0.654	0.257	0.741	0.743	0.693	0.208	0.700	0.792
Other	0.646	0.168	0.574	0.832	0.739	0.234	0.695	0.766
Farming	0.904	0.558	0.776	0.442	0.916	0.528	0.790	0.472
Industrial	0.931	0.610	0.727	0.390	0.996	0.489	0.488	0.511
Refinancing	0.590	0.149	0.647	0.851	0.572	0.145	0.638	0.855
Credit cards	0.780	0.224	0.721	0.776	0.794	0.275	0.786	0.725

Note: The table shows the concentration ratio of the three largest cooperatives, the concentration index, and the dual of the concentration index within different loan modalities for the samples of 2016 and 2018.

The loan market within the large financial cooperative sector is generally unconcentrated in both samples and shows almost no variation between 2016 and 2018, as indicated by the HHI (Table 5, first row). The Wilcoxon nonparametric statistic reveals no significant difference between the two samples (w = 124 and w_critical = 66). However, not all cooperatives participate in each loan submarket, therefore, the market structure within different loan modalities shows that 8 out of 12 modalities in 2018 are highly concentrated while four are moderately concentrated. Most notable increases in concentration in 2018 are in health care, micro-enterprise, and the category other.[14] The HHI for health care jumped from 0.186 in 2016 to 0.645 in 2018. The complementary 1-d of the HHI (d) reveals that loans for health care, for example, are in the hands of about 10.3% of all cooperatives in the sample, that is, two cooperatives are responsible for most of the loans in this modality. Small enterprise (2016) and industrial loans (2018) illustrate the practical usefulness of the HHI (d). Small enterprise loans in 2016 indicate a high concentration of 0.349. However, the dual of HHI indicates a highly competitive market where all cooperatives (n = 3) have more or less equal market shares. The same for industrial loans in 2018. The HHI indicates a highly concentrated market (0.489), however, the HHI (d) also indicates a competitive market (n = 4) where about two cooperatives hold competitive market shares.

The following Table (Table 6) shows alternative concentration measures for large financial cooperatives. All measures (Table 5 and Table 6) are easy to interpret, except the Kwoka Dominance Index (D).

[14] Other is a loan modality that is not further specified and includes loans that do not belong to one of the modalities (consumer, housing, health, etc.) mentioned above.

Table 6. Concentration in the large cooperative sector (type A) – part 2.

	2016				2018			
	P	E (norm)	S	D	P	E (norm)	S	D
Total Loans	0.273	0.802	0.493	0.008	0.290	0.802	0.492	0.010
Consumption	0.349	0.722	0.484	0.016	0.353	0.746	0.490	0.021
Health care	0.493	0.764	0.446	0.051	0.980	0.335	0.183	0.547
Housing	0.527	0.657	0.453	0.054	0.704	0.659	0.409	0.096
Micro enterprise	0.746	0.735	0.409	0.125	0.813	0.591	0.358	0.192
Small enterprise	0.398	0.980	0.446	0.101	0.772	0.593	0.324	0.200
Median enterprise	0.000	0.000	0.000	0.000	0.417	0.790	0.439	0.063
Education	0.762	0.695	0.393	0.144	0.440	0.691	0.463	0.033
Other	0.306	0.763	0.393	0.013	0.541	0.696	0.439	0.052
Farming	0.926	0.457	0.239	0.381	0.877	0.453	0.268	0.297
Industrial	0.944	0.462	0.209	0.443	0.574	0.581	0.405	0.167
Refinancing	0.373	0.793	0.499	0.030	0.371	0.802	0.499	0.031
Credit cards	0.397	0.676	0.499	0.034	0.581	0.596	0.418	0.074

Notes: The table indicates different alternative structural measures for total loans and submarkets on an institutional level.

In general, all indices of concentration measures are rather similar and point in the same direction, which raises confidence in the appropriateness of these measures. However, a short glance reveals the widespread in these values. Microenterprise loans in 2016, for instance, show a low concentration ratio, a moderate HHI, and a relatively high HHI (d). The dominance index (P), however, indicates a high value, which points to a dominant position of a market participant. Furthermore, the Stenbacka index (S) indicates a market share threshold of about 41%. Further analysis of this submarket reveals a market share of more than 43% for the largest concentration ratio. Loans for education in 2016 show the same characteristics, a relatively low concentration ratio, a moderate HHI, and a relatively high HHI (d). While, in turn, the dominance index (P) reveals a high value and the Stenbacka index (S) indicates a market share threshold of about 40%. An individual analysis reveals a market share of more than 47% for the largest concentration ratio, while the next largest competitor holds about 9.6% of the market. Therefore, the use of a small set of concentration measures may facilitate decision-making, and in particular, in the case of cooperatives, where other measures of dominance or market power, e.g. the Lerner Index, maybe no good indicators.

5.3. Product dimension

On the sub-product dimension (Table 7), the HHI reveals a persistent highly concentrated market at the end of 2018 compared to 2016 but decreased from 0.357 (2016) to 0.289 (2018). The normalized Entropy measure (E) indicates a moderately diversified portfolio (2016: 0.596; 2018: 0.681), while the Dominance index (P) points to a dominant product (2016: 0.774; 2018: 0.751). Consumption is still the preferred loan modality in large financial cooperatives (2016: 55.9%, 2018: 50.0%). We do not observe any significant increase in productive loans, but a slight increase in the share of loan refinancing. We assume that the decrease in loans for consumption might be due to a decrease in GDP (from 4.31% to 3.36%) and GDP per capita (from 2.94% to 2.35%) since GDP per capita can be viewed as a proxy for the size of the banking market. A simple correlation matrix (Table A2) reveals

a negative relationship between the HHI and the GDP per capita (-0.23)[15], indicating that richer countries have less concentrated banking systems, confirming previous research (e.g. Boyd et al. 2006). Furthermore, the correlation matrix reveals a positive correlation between the HHI and urban population, indicating that countries with a more geographically distributed population have less concentrated banking systems.

Table 7. Market share and **c**oncentration in the product dimension.

	2016	2018
	Market Share	Market Share
Consumption	0.559	0.500
Health	0.003	0.008
Housing	0.122	0.114
Microenterprise	0.146	0.104
Small enterprise	0.000	0.023
Median enterprise	0.000	0.012
Education	0.002	0.003
Other	0.048	0.050
Farming	0.019	0.037
Industrial	0.013	0.001
Refinancing	0.067	0.077
Credit cards	0.020	0.070
CR3	0.828	0.719
HHI	0.357	0.289
HHI (d)	0.745	0.712
Dominance index (D)	0.774	0.751
Entropy (E)	0.596	0.681
Stenbacka index (S)	0.354	0.382

Notes: CR3 is the concentration ratio of the three largest cooperatives, HHI (Herfindahl-Hirschman Index), HHI (d) is the dual of the HHI.

The following Table (Table 8) aims to identify possible market abuse of the three largest cooperatives by calculating the Net Interest Margin (NIM). The NIM is calculated using the following formula: (interest income from loans – interest paid to depositors)/total loans. This formula does not consider other income from fees or administrative charges. However, the NIM may also depend on other factors than market power. Maudos and de Guevara (2004) find a positive and significant effect on NIM and credit risk, indicating that a higher NIM implies a higher credit risk. In other words, if a bank's NIM decreases, this may induce a bank to accept more risky loans and indirectly increase credit risk (Angbazo 1997).

The ranking by market share (total loans) did not alter between 2016 and 2018. At first glance, results are ambiguous and do not give a clear indication of market abuse due to market power. Two of the largest cooperatives increased market share, but just one also increased his net interest margin. One cooperative lost market share, however, increased its net interest margin. The market share distribution of the dominant product (consumption) indicates that the largest cooperative (cooperative 1) lost market share between 2016 and 2018 and at the same time the net interest margin decreased. The second-largest credit cooperative increased its market share as well as their NIM. However, the third-largest lost market share, but increased their NIM. To analyze market abuse more in detail it would be appropriate to

[15] Boyd mentions a negative correlation of -0.30 between HHI and GDP per capita.

evaluate each sub-product individually with more data. Market share for refinancing loans, as a proxy for credit risk, decreased slightly for two cooperatives.

Table 8. Comparison of Market share and NIM of the three largest cooperatives.

	2015	2016	2017	2018
NIM				
Cooperative 1	9.81%	11.60%	10.29%	10.32%
Cooperative 2	6.04%	7.34%	8.49%	7.85%
Cooperative 3	19.61%	18.90%	21.33%	20.69%
Market share Total loans				
Cooperative 1	-	22.07%	-	22.85%
Cooperative 2	-	18.55%	-	18.98%
Cooperative 3	-	14.37%	-	13.78%
Market share Consumption				
Cooperative 1	-	28.05%	-	26.67%
Cooperative 2	-	21.69%	-	22.82%
Cooperative 3	-	5.82%	-	4.62%
Market share Refinancing				
Cooperative 1	-	25.18%	-	24.82%
Cooperative 2	-	4.79%	-	5.84%
Cooperative 3	-	25.46%	-	25.11%

Notes: NIM (Net Interest Margin), Cooperative 1, 2, 3 indicate the three largest cooperatives ordered by market share for total loans. This order will remain constant for comparison.

6. Results and Discussion

This paper has analyzed the market structure and competition of the cooperative system on a national level and, in particular, the credit cooperatives in Paraguay. The cooperative system, on a national level, is highly concentrated with an increasing trend between 2010 and 2018. At the end of 2018, the system was in the hands of about two large cooperatives. However, analyzing a paired sample of large financial cooperatives reveals, in general, no concentration in the loan market. This result changes looking at different loan modalities: 8 out of 12 submarkets are highly concentrated. Some of these are competitive others are not. We do not find indicative evidence of market abuse in the general loan market of the three largest cooperatives. Consumer credits, which account for about 50% of all loans granted, are the preferred product rather than productive investments. In line with Boyd et al. (2006), we find that GDP per capita is negatively correlated with concentration, while the urban population shows a positive relationship. Interestingly, the correlation matrix indicates a negative relationship between NIM and concentration. We account this to the fact that the NIM is based on the CR3, therefore inducing new entries due to expectations. However, we expect that this relationship will change with new entries or including more cooperatives in the calculation.

The INCOOP should not charge any fee neither to cooperative members nor to non-members for claims or complaints against cooperatives to promote democratic principles and transparency.

However, it can be argued that most of the credits of large financial cooperatives are directed to consumption or housing (mortgage) and therefore, in the sense of Tirole (1985), crowding out funds for more productive investments, and in consequence have a negative effect on growth. Therefore, liquidity constraints on households may favor a higher growth rate (Jappelli and Pagano 1992). The negative growth effect may be worsening in times of economic shocks when households experience liquidity constraints and cooperatives compete for funds in the financial system. In consequence, cooperatives should shift away from mobilizing savings toward improving their efficiency of productive investments. These indicative results call for more research on the cooperative' role in national economies.

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Appendix A

Table A1. HHI and dual HHI of the cooperative system and large cooperatives.

	System			Type A		
	n	HHI	HHI (d)	n	HHI	HHI (d)
2010	408	0.76359	0.99679	52	0.75168	0.97442
2011	488	0.76003	0.99730	49	0.74673	0.97267
2012	437	0.76615	0.99701	50	0.75287	0.97344
2013	404	0.79025	0.99687	54	0.77932	0.97624
2014	407	0.81231	0.99698	54	0.80466	0.97699
2015	357	0.87412	0.99680	62	0.87067	0.98148
2016	250	0.87182	0.99541	60	0.86792	0.98080
2017	385	0.86081	0.99698	64	0.85654	0.98176
2018	328	0.88070	0.99654	69	0.87711	0.98348

Table A2. Correlation matrix.

	HHI	GDPpC	GDP	PopUrban	PopRural	NIM
HHI	-					
GDPpC	-0.23	-				
GDP	-0.25	1.00	-			
PopUrban	0.93	-0.32	-0.35	-		
PopRural	-0.93	0.32	0.35	-1.00	-	
NIM	-0.44	0.86	0.74	0.82	-0.82	-

Note: NIM includes data from 2015-2018 and is calculated as a yearly average of the CR3 in the loan market. All other variables include data from 2010-2018 of the cooperative system.

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