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Implications of loan portfolio concentration in Cambodia

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Abstract

This paper explores how the composition of banks' loan portfolios affect banks operating in Cambodia. The implications of loan portfolio concentration has begun to attract attention in recent years. However, existing studies remain focus on developed or emerging countries because data in other developing countries are lacking. In this paper, we fill this gap by investigating the effects of loan portfolio concentration on Cambodian banks' return. We find that sectoral diversification is positively related to banks' returns. In addition, foreign banks and commercial banks are less affected by loan concentration than their counterparts.

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1 Introduction

Whether lending specialization hurts or improves banks' return and risk is in itself a much debated question in the economic literature and in policy circles. A recent literature has investigated this issue in the case of industrialized (Acharya et al., 2006; Hayden et al., 2007) and emerging countries such as China (Berger et al., 2010) or Brazil (Tabak et al., 2011). In spite of its importance, there is little evidence for other developing countries due to the lack of data. In this paper, I begin to fill this gap by investigating whether diversification induces poorer performance for banks in Cambodia.

The traditional banking theory argues that banks should be as diversified as possible. Less diversified bank would be more vulnerable to economic downturns, since they expose themselves to few sectors. Furthermore, several models of intermediation theory suggests that diversification makes it cheaper for lenders to achieve credibility in their role as screeners and monitors of borrowers (Diamond, 1984; Boyd and Prescott, 1986).

However, the corporate finance theory argues that firms should concentrate their activity on a specific sector to take benefits of expertise in how business are done in these sectors (Jensen, 1986; Denis et al., 1997). Focused banks will gain expertise in the sectors they lend to, and hence can detect a deterioration of the borrower's business earlier and may react in a timely manner by risk mitigation. According to this view we expect that performance increases with concentration.

The empirical literature on diversification versus concentration is heavily concentrated on US and European markets. Few papers have investigated this issue for emerging countries with mixed results. Several articles document that sectoral diversification reduces the performances of the banks and/or increases the risk of defaults in normal times as in China (Berger et al., 2010) or in Brazil (Tabak et al., 2011). However, Bebczuk and Galindo (2008) document that diversified Argentine banks suffer less than their counterparts during the 2001-2002 Argentine financial crisis. Atahau and Cronje (2015) document that loan concentration has a negative effect, albeit non-significant, on performance of government-owned banks in Indonesia. Using a cross-country study, Beck and De Jonghe (2013) find results in line with the traditional view; sectoral diversification is negatively related to bank risk, while not being associated with higher returns. However,

their results holds mainly for developed economies. Despite their interesting results, these studies provide tiny lights for developing countries because Argentina, China or Brazil are very specific and differ from other developing countries in some aspects.

In this paper, I test whether loan concentration is beneficial for banks in Cambodia. Cambodia is a rapid growth developing countries that did not experience a crisis in the past decade (normal times). The Cambodian banking system has witnessed a rapid development in the past decade; the number of banks operating in the country has risen from 20 in 2006 to 47 in 2015 and assets managed by the banking system have been multiplied by more than ten. In spite of these improvements, financial access remains limited in Cambodia. Investigating the determinants of performance of financial system is of prime importance in Cambodia to pursue rapid growth. In doing so, I follow methodology employed in recent studies (Acharya et al., 2006; Hayden et al., 2007; Tabak et al., 2011).

Results document that loan portfolio concentration decreases returns, in line with the traditional banking theory.[1] This finding is particularly interesting. Previous papers provide evidence that diversification can be helpful during crisis period (Bebczuk and Galindo, 2008) but not during normal times (Berger et al., 2010; Tabak et al., 2011) for emerging countries. This work challenges this view and points out that loan concentration can be also detrimental during normal times, at least in Cambodia. This study also shows that the detrimental impact of loan concentration is mitigated for foreign-owned banks.

Section 2 presents the methodology, Section 3 sums up the main findings and the final section concludes.

[1] In a first version, I also investigated the impact of loan concentration on loan quality (NPLs to loans). Findings suggest that loan concentration does not impact loan quality. However, econometric results were subject to caution (lack of explanatory power and significance for all variables) and results are not reported here.

2 Methodology

2.1 Data

For each bank operating in Cambodia, the Central bank provides the individual bank-level data, as well as loans outstanding by economic sectors for each bank. The sample consists of an unbalanced panel data of 57 banks operating between 2006 to 2015.[2] To avoid a survivorship bias, all banks operating in any point of time are present in the database, even if they cease to exist or merge at any point of the period considered.

2.2 Concentration measures

The main variable of interest is sectoral concentration. Loans are classified into 9 categories: Agriculture, manufacturing, trade, construction, real-estate and utilities, financial intermediation, other services, personal consumption and other.[3] I firstly defined the relative exposure of the bank i at time t to each sector j as follows:

$$s_{jit} = \frac{Loans_{jit}}{\sum_{j=1}^{9} Loans_{jit}} \tag{1}$$

Based on relative exposures, I consider the Hirshmann-Herfindahl Index (HHI) as a proxy of concentration. The HHI of bank i at time t is given as:

$$HHI_{it} = \sum_{j=1}^{J} s_{jit}^2 \tag{2}$$

As a robustness check, I also compute the Euclidian distance measure to quantify the divergence between a bank sectoral pattern and the benchmark loan portfolio. In this case, the industry composition of the economy's loan market portfolio is a benchmark for diversification. The Euclidian distance is computed as:

$$ED_{it} = \sqrt{\sum_{j=1}^{J} (s_{jit} - \bar{s}_{jt})^2} \tag{3}$$

[2]Date are available at: http://www.nbc.org.kh/english/economic_research/banks_reports.php

[3]Classification provided by the Cambodian Central Bank has changed from 2006 to 2015. From 2006 to 2008, loans are classified in 11 categories and in 16 categories between 2009 and 2015. I provide a comprehensive classification that overlaps both classifications (for more details, see the Appendix)

where $\bar{s}_{jt} = 1/I \sum_i^I s_{jit}$. Both measures of concentration increase with the level of concentration. Figure A1 in the Appendix shows that loan portfolio concentration has been reduced over time and both measures provide close information.

2.3 Econometric model

I follow methodology employed in previous studies (Acharya et al., 2006; Hayden et al., 2007). The regression framework consists on a panel regression of the performance of bank i in period t on the sectoral diversification measure (SDIV) calculated from the bank's portfolio in the same period and a set of control variables; so that the regression equation is:

$$Y_{it} = \alpha + \beta SDIV_{it} + \sum_{n}^{N} \gamma_n X_{nit} + \nu_t + \mu_i + \varepsilon_{it} \tag{4}$$

where Y is a measure of return (return on assets, RoA). Two measures of sectoral diversification/concentration are considered (SDIV), namely the Hirshmann-Herfindahl Index (HHI) and the Euclidian distance (ED). The set of control variables includes three frequently used variables, namely the logarithm of total assets capturing the size of the bank (SIZE), the equity ratio defined as the ratio of equity to total assets (EQ RATIO), the overhead costs to total assets (COST).[4] In addition, one might expect that sectoral diversification can be related to geographical and income diversification (complementary or substitution). To take into account this possibility, I include two additional control variables: an index for income diversification defined as the ratio of non-interest income to total income (INC DIV); and, a measure of geographical diversification computed as the share of bank branches outside Phnom Penh (GEO DIV). Finally, since I use the two-way fixed-effects panel estimator, I add bank-individual dummies (μ_i) and time dummies (ν_t). The individual dummies control for all characteristics which differ between banks, such as different ownership structures.

It is worth noting that the level of performance may present inertia across time and

[4]The Size variable is included due to potential omitted bias because large banks can reap scale economies but are also more diversified by nature. Equity ratio is often included to control for risk aversion (Maudos and De Guevara, 2004) that could impact bank strategy and therefore their revenues. Finally, the cost variable takes into account differences in efficiency.

therefore dynamic panel data model can be best suited. In this case, I extend the Eq. 5 by adding the lagged dependent variable. In order to control for such endogeneity bias, the difference-GMM estimator (Arellano and Bond, 1991) and the system-GMM estimator (Blundell and Bond, 1998) are employed.[5] It should be noted that results from Difference-GMM are presented for sake of brevity. Indeed, the GMM Difference potentially suffer from an issue of weak instruments, especially when variables are strongly persistent over time (Blundell and Bond, 1998; Alonso-Borrego and Arellano, 1999). Variables in level are poor instruments of variables in difference. Insofar as loan concentration is highly persistent over time, we doubt on the reliability of Difference-GMM to provide unbiased results.

Tabak et al. (2011) point out that the impact of loan concentration is partially conditional to bank ownership structure. I therefore investigate whether the effect of loan concentration differs by type of banks or ownership structure. The Cambodian banking system is dominated by commercial banks that account for more than 98% of total assets; a share that is similar than that observed ten years ago. A large number of (commercial and specialized) banks are owned by foreigners. In 2015, 37 banks could be classified as foreign-owned banks (foreign capital represents at least 50% of total capital) and foreign banks managed 55% of total assets. If we compare with data for 2006, we observe an increase of the share of foreign-owned banks; in 2006, foreign banks represented only 9 banks to 20 and managed less than half of total assets (48%). Data on financial systems by type and ownership are provided in the Appendix (Table A2). In addition, we show that loan concentration (HHI and ED) does not really differ according to bank type and ownership (see Figures A2 and A3). Nonetheless, to study whether bank type or ownership matters, I add an interaction between SDIV (HHI or ED) with a dummy for foreign-owned banks or for commercial banks as follows:

$$Y_{it} = \alpha + \beta_1 SDIV_{it} + +\beta_2 SDIV_{it} * D_i + \sum_{n}^{N} \gamma_n X_{nit} + \mu_i + \nu_t + \varepsilon_{it} \tag{5}$$

[5]The lagged endogenous variable and other explanatory variables are considered as predetermined (changing the set of lags to instruments variables does not affect results). In order to ascertain the validity of the instrument set, several usual specification tests are implemented (Arellano-Bond tests for serial correlation and overidentification test).

Table 1: Descriptive Statistics

	Descriptive statistics					Correlations							
	Obs	Mean	Std. Dev.	Min	Max	ROA	HHI	ED	SIZE	EQ	COST	INCD	GEOD
RoA	338	0.0122	0.0408	-0.3742	0.1055	1							
HHI	338	0.3703	0.2133	0.1379	1	-0.24	1						
ED	338	0.4013	0.2192	0.0762	0.9786	-0.24	0.9100	1					
SIZE	338	12.818	1.5522	8.6395	16.561	0.27	-0.34	-0.42	1				
EQ	338	0.4202	0.2932	0.0481	1	-0.18	0.24	0.32	-0.84	1			
COST	338	0.0417	0.0354	0.0044	0.3655	-0.64	0.10	0.08	-0.32	0.23	1		
INC DIV	338	0.1829	0.1466	0	0.7209	0.01	0.24	0.18	0.10	-0.22	0.02	1	
GEO DIV	338	0.2513	0.2881	0	0.9575	0.19	-0.13	-0.21	0.46	-0.43	0.07	0.23	1

where D_i is a dummy taken value one if more than 50% of capital is owned by non-Cambodian investors and 0 otherwise or a dummy taken value one for commercial banks and 0 for specialized banks.

3 Results

3.1 Baseline results

Table 1 presents descriptive statistics as well as correlations. The level of concentration is negatively correlated with performance, in line with the traditional banking theory. To confirm results from simple descriptive statistics, I run static and dynamic models presented above.

Table 2 presents the results of the relationship between Herfindhal-Hirschmann Index (HHI) and Return on Assets (RoA). I present results using simple pooled OLS (column [1]), random-effect model (column [2]), within estimator (column [3]), the difference-GMM estimator (column [4]), and the System-GMM estimator (column [5]). There is a strong evidence of a negative relationship between costs and return: higher overheads costs deteriorate performance. In addition, there is evidence of a positive relationship between geographical diversification and return. Other control variables do not seem to affect performance. In particular, the lagged value of dependent variable is not statistically significant, indicating a limited inertia in returns on assets.

Regarding the interest variable, in all cases, the coefficient associated with HHI is negative and significant in 4 out of 5 specifications. As explained above, results from GMM-Diff suffer from a weak instrumentation issue because loan concentration is highly persistent over time. The relationship between loan concentration and banks' performance is not only statistically significant but also economically relevant. An one-standard deviation of loan concentration induce a decrease of RoA by 1.00% that is far from anecdotal insofar as mean of RoA equals 1.22%.

To confirm this result, I change the interest variable by using the Euclidian Distance instead of HHI. Econometric results, displayed in Table 3, are largely unchanged both statically and economically. This finding indicates that diversification appears to be more

Table 2: Relationship between Herfindhal-Hirschmann Index (HHI) and bank's return

	Dependent variable: Return on assets				
	OLS	RE	FE	GMM-Diff	GMM-Sys
	[1]	[2]	[3]	[4]	[5]
HHI	**-0.037*** **	**-0.041*** **	**-0.047*** **	**-0.027**	**-0.048** **
	(-3.25)	**(-3.38)**	**(-2.85)**	**(-0.98)**	**(-2.41)**
RoA (t-1)				0.020	0.104
				(0.24)	(1.33)
SIZE	0.000	0.004	0.018***	0.003	0.001
	(0.04)	(1.17)	(3.06)	(0.17)	(0.15)
EQ	0.018	0.018	0.021	0.052	0.018
	(1.42)	(1.07)	(1.17)	(1.20)	(0.62)
COST	-0.770***	-0.674***	-0.561***	0.808***	-0.946***
	(-5.76)	(-3.51)	(-2.76)	(-2.83)	(-7.37)
INC DIV	0.010	0.020	0.040*	0.043	0.054**
	(0.63)	(1.16)	(1.96)	(1.39)	(2.09)
GEO DIV	0.033***	0.034***	0.036***	0.050**	0.036**
	(4.41)	(3.56)	(3.54)	(2.39)	(1.64)
Dummies					
- Bank	No	No	Yes	Yes	Yes
- Year	Yes	Yes	Yes	Yes	Yes
# obs	338	338	338	217	275
# bank	57	57	57	44	52
R^2	0.51	0.48	0.32		
- F-test	3.9***		5.0***		
- Wald test		50.9***		56.4***	168.1***
- Hansen test (p-value)				0.910	0.963
- m1 (p-value)				0.157	0.158
- m2 (p-value)				0.276	0.305
# instruments				63	71

Dependent variable is the return on assets. *, ** and *** indicate significance at the 10%, 5% and 1% respectively. OLS refers to Ordinary Least Squares estimator, RE to random-effect model, FE to fixed effect model (within estimator), Diff-GMM to difference GMM estimator (Arellano and Bond, 1991), and Sys-GMM to system GMM (Blundell and Bond, 1998). In column [3], we report the R^2 within. The Hansen test is test of overidentification restrictions. Under the null hypothesis, instruments are exogenous. m1 (resp,. m2) are Arellano-Bond tests for first (second)-order serial correlation, asymptotically N(0, 1). These test the first-differenced residuals in the system GMM estimators. Standards are clustered for fixed effect models and the Windmeijer (2005) finite-sample correction is used for Difference GMM and Sytem GMM models.

advantageous than concentration. This result gives support to the traditional banking theory. However, contrary to Bebczuk and Galindo (2008) that also give support to this view, Cambodia did not experience a crisis during this period. In other words, this result shows that the traditional banking theory can be also valid even in normal times, while existing papers reject this hypothesis (Berger et al., 2010; Tabak et al., 2011).

I run a battery of robustness checks to be sure that results are not driven by spurious correlation.[6] First, I use lagged values of all independent variables (HHI, ED and control

[6]For sake of brevity, tables are not presented but are available upon request.

Table 3: Relationship between Euclidian Distance (ED) and bank's return

	Dependent variable: Return on assets				
	OLS	RE	FE	GMM-Diff	GMM-Sys
	[1]	[2]	[3]	[4]	[5]
ED	**-0.038*** **	**-0.038*** **	**-0.032** **	**0.009**	**-0.032***
	(-4.14)	**(-3.22)**	**(-2.29)**	**(0.25)**	**(-1.72)**
RoA (t-1)				0.066	0.126
				(0.79)	(1.54)
SIZE	-0.000	0.003	0.015**	-0.013	0.001
	(-0.17)	(0.82)	(2.46)	(-1.04)	(0.19)
EQ	0.019	0.019	0.020	0.040	0.022
	(1.45)	(1.13)	(1.05)	(1.17)	(1.05)
COST	-0.782***	-0.695***	-0.564***	-0.934***	-0.982***
	(-5.92)	(-3.58)	(-2.71)	(-5.15)	(-9.79)
INC DIV	0.008	0.019	0.039*	0.069**	0.043*
	(0.56)	(1.09)	(1.74)	(1.96)	(1.76)
GEO DIV	0.033***	0.035***	0.038***	0.045***	0.040**
	(4.31)	(3.65)	(3.64)	(2.96)	(2.27)
Dummies					
- Bank	No	No	Yes	Yes	Yes
- Year	Yes	Yes	Yes	Yes	Yes
# obs	338	338	338	217	275
# bank	57	57	57	44	52
R^2	0.51	0.49	0.29		
- F-test	4.4***		5.4***		
- Wald test		58.7***		112.0***	212.0***
- Hansen test (p-value)				0.941	0.981
- m1 (p-value)				0.157	0.144
- m2 (p-value)				0.244	0.257
# instruments				63	71

Dependent variable is the return on assets. *, ** and *** indicate significance at the 10%, 5% and 1% respectively. OLS refers to Ordinary Least Squares estimator, RE to random-effect model, FE to fixed effect model (within estimator), Diff-GMM to difference GMM estimator (Arellano and Bond, 1991), and Sys-GMM to system GMM (Blundell and Bond, 1998). In column [3], we report the R^2 within. The Hansen test is test of overidentification restrictions. Under the null hypothesis, instruments are exogenous. m1 (resp,. m2) are Arellano-Bond tests for first (second)-order serial correlation, asymptotically N(0, 1). These test the first-differenced residuals in the system GMM estimators. Standards are clustered for fixed effect models and the Windmeijer (2005) finite-sample correction is used for Difference GMM and Sytem GMM models.

variables) instead of contemporaneous values because contemporaneous values might lead to bias estimation due to reverse causation. Econometric results are insensitive to this change. Second, I change econometric specification by adding control variable one by one. Results point out that coefficient associated with HHI remains negative and statistically significant in all specifications. Coefficients associated with distance are always negative but only significant when COST variable is included. Finally, I change the sample by excluding outliers (defined as observations for which dependent variable is below the 5 percentile or above the 95 percentile). The econometric results are confirmed.

3.2 Distinction by type and ownership structure

As stated above, banks operating in Cambodia can be divided between commercial and specialized banks and between foreign-owned and domestic-owned banks. I then study whether the impact of loan concentration on performance differs between specialized and commercial banks and between domestic-owned and foreign-owned banks. Results are displayed in Table 4. I firstly test the interaction between the types of banks (specialized banks vs. commercial banks) in columns [1] (using HHI) and [2] (using ED). We observe that the negative impact of loan concentration on performance is exacerbated for specialized banks.

Table 4: Distinction by type and ownership structure

	Type of banks		Structure ownership	
	[1]	[2]	[3]	[4]
SDIV	-0.199***	-0.181***	-0.068*	-0.076**
	(-2.97)	(-2.72)	(-1.94)	(-2.22)
SDIV*Dummy	0.197***	0.171**	0.052*	0.060*
	(3.00)	(2.56)	(1.79)	(1.95)
Control variables	Yes	Yes	Yes	Yes
Dummies				
- Bank	Yes	Yes	Yes	Yes
- Year	Yes	Yes	Yes	Yes
# obs	338	338	338	338
# bank	57	57	57	57
R^2 (within)	0.27	0.22	0.17	0.18

Dependent variable are the return on assets . *, ** and *** indicate significance at the 10%, 5% and 1% respectively. Within estimator is used. Standards are clustered at the bank level. SDIV is the Herfindahl index in columns [1] and [3] and the Euclidian distance in columns [2] and [4]. Dummy is a dummy taken value one for commercial banks and 0 for specialized banks in columns [1] and [2] and a dummy equals to one for foreign banks (more than 50% of capital is owned by foreigners) and 0 for domestic-owned banks in columns [3] and [4]. The list of control variables included: log(Assets), equity ratio, overhead costs to total assets, income diversification index and geographical diversification index.

In a second step, I follow Tabak et al. (2011) and study whether bank ownership matters. Results in columns [3] and [4] indicate that foreign banks seems to be less affected by the negative impact of concentration on performance. While the net effect of loan concentration remains negative, its impact is reduced for foreign-owned banks.

4 Conclusion

This paper is the first to empirically investigate the implications of lending concentration on banks operating in a low-income country. Using a sample of 57 Cambodian banks from 2006 to 2015 (338 observations), I show that diversification improves bank's performance. These results partially confirm the traditional banking theory and contradict evidence from emerging countries, highlighting the specificity of developing countries. Further research should investigate in details why loan concentration is beneficial in some circumstances and not in others. Interacting country characteristics and economic situation (normal times and crisis times) may be a promising avenue to solve this puzzle.

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Appendix A Additional table and figure

Table A1: Classification by sectors

This paper	2006-2008	2009-2015
Agriculture	Agriculture	Agrigulture
Manufacturing	Manufacturing	Manufacturing
Trade	Wholesale and retail	Wholesale trade Retail trade
Construction	Construction	Construction
Real-estate and utilities	Real-estate and utilities	Real-estate Utilities
Services	Services	Hotels and restaurants Transport and storage Information media & Telecom Other non-financial services
Financial intermediation	Bank and finance	Financial institutions Leasing activities
Personal consumption	Personal consumption	Personal consumption
Others	Other Export Import	Other lending Mining and Quarrying

Figure A1: Evolution of loan portfolio concentration

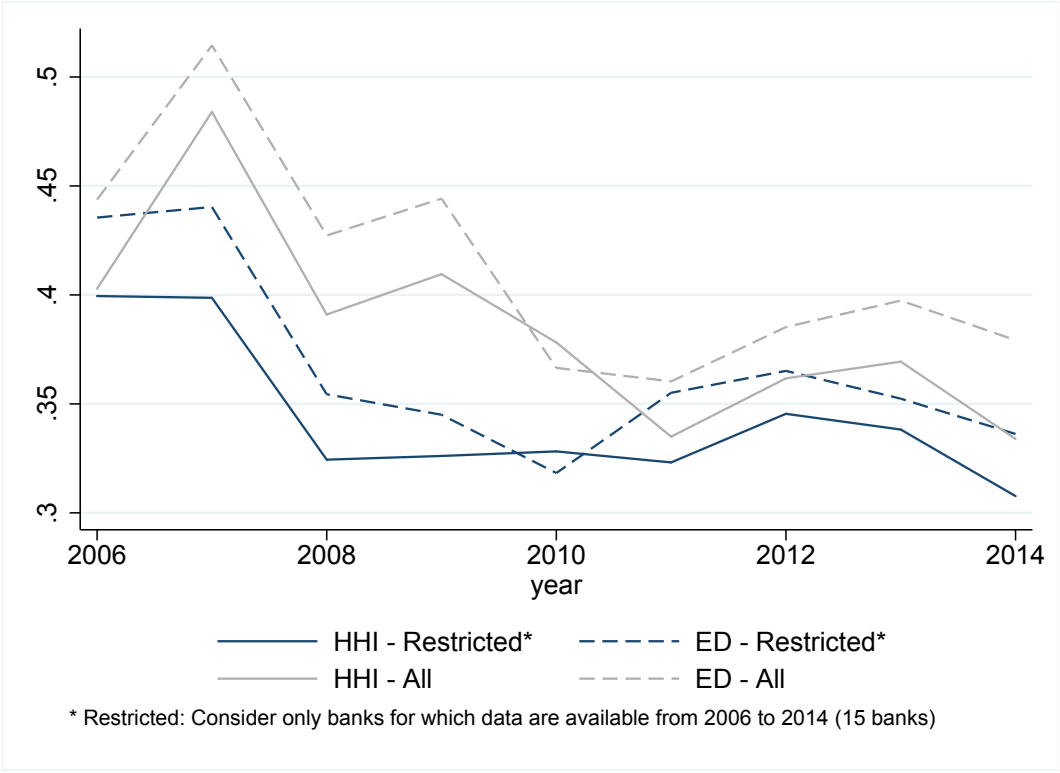

Table A2: Financial system, summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
All financial institutions					
Total assets	338	1060669	1863904	5650	155577246
Total equity	338	204283	297495	4991	2631719
Total loans	338	588774	1149915	126	10004111
Profit (before tax)	338	24362	61082	-14967	541021
Nb. Branches	338	12.40	38.78	1	258
Commercial banks					
Total assets	269	1314116	2012773	55778	155577246
Total equity	269	245388	320472	34306	2631719
Total loans	269	726746	1252312	1295	10004111
Profit (before tax)	269	30227	67237	-14967	541021
Nb. Branches	269	15.20	43.04	1	258
Specialized banks (n=69)					
Total assets	69	72592	77092	5650	382474
Total equity	69	44036	33225	4991	215566
Total loans	69	50885	58388	126	252379
Profit (before tax)	69	1495	2522	-7793	9409
Nb. Branches	69	1.48	1.28	1	6
Domestic banks					
Total assets	234	836112	1145578	5650	6041550
Total equity	234	174730	187206	4991	1451311
Total loans	234	435264	645303	390	388532
Profit (before tax)	234	15150	32425	-14967	237112
Nb. Branches	234	5.48	6.31	1	33
Foreign banks					
Total assets	104	1565923	2832986	9986	155577246
Total equity	104	270778	451487	9946	2631719
Total loans	104	934172	1791756	126	10004111
Profit (before tax)	104	45088	95929	-12176	541021
Nb. Branches	104	27.98	66.91	1	258

Data are in millions KHR (except the number of branches), 1USD = 4,050 KHR

Figure A2: Loan portfolio concentration, by type

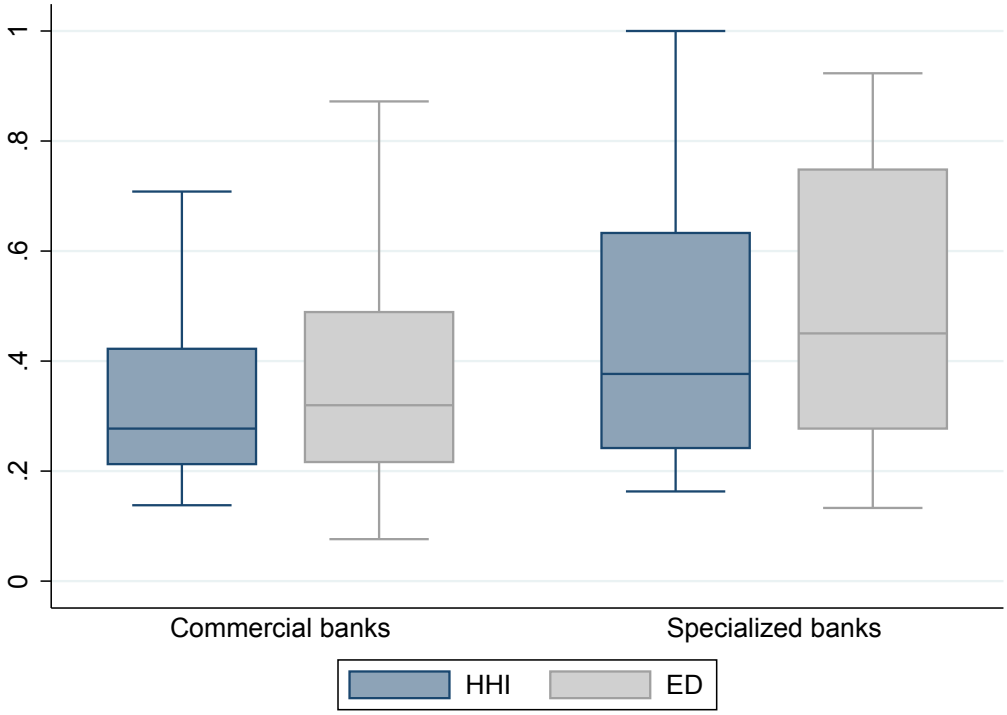

Figure A3: Loan portfolio concentration, by ownership