Assessing Outreach and Sustainability of Microfinance Institutions in Cambodia

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This thesis titled

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ABSTRACT

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Microfinance has been playing a vital role to assist the poor with day-to-day living needs to gain access to credit in order to smooth their consumption and start small businesses. The microfinance sector in Cambodia seems to grow fast, and the scale has been increasing rapidly over the last several years. However, it is uncertain that the industry of microfinance is growing with sustainability. This paper analyzes the outreach and sustainability of microfinance institutions (MFIs) in Cambodia. This quantitative research uses descriptive statistics and linear regression analysis to illustrate the trends and determinants of outreach and sustainability level of Cambodian MFIs. To achieve the long-term sustainability and outreach, the conclusion suggests that the MFIs should: 1) diversify profit and risk portfolio by targeting a wide range of clients in addition to the poor, 2) increase the cost efficiency, 3) maintain the growth of the loan at steady rate, and 4) pay attention to institutional experience, and 5) mobilize more savings. DEDICATION

To my family, mentors, and friends

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CHAPTER 1: INTRODUCTION, METHODOLOGY, AND LITERATURE REVIEW

1.1 Poverty in Cambodia

Cambodia, through almost three decades of civil war from 1970s to the late 1990s, is a country that is facing a lot of challenges in development and poverty reduction. Cambodia is situated in a tropical region with dense forest, rich fertility soil and diverse livestock, which are good conditions for agricultural development. While the neighboring and other countries of the region such as Thailand and Malaysia have already become developed countries, Cambodia is still struggling as a developing and poor country due to political cries and the after effects of a long civil war.

According to CIA World Factbook 2012, Cambodia stayed at the 183rd world's rank in terms of GDP per capita. Cambodia's annual GDP/Per capita categorizes it as a poor country, beginning at around \$200 in 1993 (under the poverty line) to \$900 in 2011. Cambodia no longer has an income below the poverty line, but still stays as a third-world country. In 2010, the total population in Cambodia was 14,360,931 people, of which 11,519,238 were rural inhabitants (World Bank, 2014). Furthermore, 41.3% of population was living less than \$2 a day at 2005 international price.



Figure 1. Cambodia's GDP/Capita, 1990-2015

Even though there is a substantial growth in GDP per capita, there is an importance that we should look into the income distribution between the rich and the poor. Mostly, in developing countries after recovering from the civil war, the institutions for economic development are poor, which lead to a big inequality between the rich and the poor. It could overstate the impacts of economic growth over the population as a whole if we take it in general term.

% Population	Lorenz Curve	Line of Equality
0	0	0
10%	3.53	10
20%	7.93	20
40%	22.85	40
60%	34.6	60
80%	55.55	80
90%	70.19	90
100%	100	100

Table 1. Income Distribution of Cambodia

Source: World Bank Data, 2009



Figure 2: Cambodian's Lorenz Curve in 2009

Based on the Table 1 and *Figure 2*, the lowest 10% is the poorest group who shares only 3.53% of the total income, while the highest 10% segment has 29.3% of total income. The Lorenz curve curves away from the line of equality in a significant gap. This

implies an uneven distribution of income in the country, especially between the richest and the poorest people.

Table 2. Gini index across countries

Country	Gini Index (year)
Cambodia	33.55 (2010)
Thailand	39.37 (2010)
Vietnam	39.25 (2010)
Lao PDR	36.22 (2012)
Indonesia	35.57 (2010)
Malaysia	46.21 (2009)

Source: World Bank Data

Table 2 presents the comparison of Gini index between Cambodia and other countries in the region in 2010. The Gini index measures the percentage the Lorenz curve deviates from the line of equality. Because of the missing data of some countries in 2010, Lao's and Malaysia's Gini index are instead from 2012 and 2009, respectively. When comparing Cambodia's income inequality with other countries in the region, it seems the income inequality in Cambodia is less than its neighbors. However, given the low income GDP per capita, it shows how the bottom poor in Cambodia are really struggling to make living.

Owing to this significance, there have been many development programs in helping the bottom income group to promote their standard of living. In this regard, microfinance has been playing a vital role in assisting the poor to gain access to credit in order to smooth their consumption and start small businesses.

1.2 History of Microfinance in Cambodia

After the liberalization of the Cambodian economy in 1993, the Cambodian banking system started in the early 1990s alongside with the economic reforms. Micro credit programs and savings began to emerge with support from Non-governmental organization (NGOs) and foreign donors to help alleviate poverty. Microfinance has been regarded as an important and successful tool in contributing to economic development and poverty alleviation (Kim, 2010). Not only limited to business, microfinance also serve health care, schooling, housing, nutrition, transportation, and unexpected emergencies as they are all daily needs that the poor require to smooth their consumption (Morduch, 2013).

For a person who earns under \$2 a day, it is a misery when they have to face necessary demands like paying school fees for their children or emergencies, such as unexpected health issues. These require them to spend a sum of money that is larger than that what they have. Microfinance allows them to borrow an amount of money and pay back in installments. This is called consumption smoothing. Microfinance is not a guarantee for the poor to get out of poverty, but is a tool to assisting them with day-today living. People who are excluded from formal finance often end up utilizing informal or illegal loans with higher interest rates, hence the term: loans shark. The role of microfinance is to provide this group of people access to microlending and savings instruments at reasonable rates at trustworthy institutions.

According to Cambodia Microfinance Association, in 1995, the Royal Government of Cambodia established the Credit Committee for Rural Development (CCRD) with the financial support from UNDP and AFD to formulate the strategy for rural credit development, strengthen management and manage funding. By 1998, the microfinance industry covered 214,000 individuals. In 2000, a Prakas, a government decree, on microfinance regulation was created and enforced by the National Bank of Cambodia. Since then, there were a series of transformation of microcredit NGOs to commercial Microfinance Institutions (MFIs). Thereafter, there were significant changes on microfinance industry development. The microfinance environment has been healthier, with the amount of loan and the number of borrowers increasing over time (Figure 3 +4) (Cambodia Microfinance Association).



Figure 3: Outstanding Loans of MFIs in Cambodia, 2005-2012



Figure 4. Number of Clients of MFIs in Cambodia, 2005-2013

1.3 Purpose of the Study

However, the growth of microfinance industry and the increase of clients do not actually explain the trends and outreach. One of the important roles of microfinance is to provide financial services to those who are outside of the reach of formal finance. MFIs typically target marginalized groups, such as the poor, and try to reach as many people as possible. Therefore, it is important to study the depth and scale of outreach of microfinance institutions in Cambodia.

The microfinance sector in Cambodia seems to grow fast and the scale has been increasing rapidly over the last several years. However, it is uncertain that the industry of microfinance is growing with sustainability. The microfinance sector still has extensive subsidies and development aid from the government and international donors. This paper examines to what extent microfinance is sustainable in relation to efficiency.

This study could contribute to the development of the microfinance industry in Cambodia. First, it will offer information about the extent of outreach and sustainability of microfinance institutions in Cambodia. Second, it will shed light on the trends and scale of microfinance industry in Cambodia. Third, since there were not much research studies on the outreach and sustainability of MFIs in Cambodia compared to other countries, this study will help determine the sustainability of MFIs in Cambodia.

1.4 Research Questions

This research aims to assess the outreach and sustainability of microfinance institutions in Cambodia. In order to analyze this topic, it is essential to answer the following sub-questions:

 What are the recent trends of outreach and sustainability of microfinance in Cambodia? 2) What are the determinants of sustainability of microfinance in Cambodia?

1.5 Data

For this study, data will be secondary data extracted and gathered from reliable sources such as MIX market database and Cambodian Microfinance Association (CMA). The data to be used will be from 1997 to 2013. These public databases share outreach and sustainability indicators from leading microfinance institutions around the world.

However, Market Mix consists of only some of the leading institutions that have good transparency, accounting standard, and represent industry leaders. There are many smaller NGOs and microfinance institutions that lack the financial sophistication and accounting experience do not appear in the Market Mix database.

1.6 Research Methodology

This study will utilize a quantitative approach to illustrate the trends, outreach and sustainability of MFIs. There will be 1) informal analysis that uses graph, table, and plot for descriptive statistics; and 2) more formal analysis using linear regression to estimate the relationship between variables and to test whether these relationship are positive or negative. Besides the quantitative approach, the analysis also focuses on reviewing reports and other readings to raise the explanation of the relationships between variables after using the quantitative approach.

To demonstrate the growth of the MFIs, I will look at some variables such as assets and age of MFIs. For outreach, it mainly wants to focus on the number of borrowers and the average loan size per borrower. To determine the efficiency of MFIs, there are some components including: operating expense/asset, deposit/gross loan portfolio, growth of gross loan portfolio, and portfolio at risk > 90 days. These data variables would help evaluate the financial performance that MFIs in Cambodia.

1.7 Literature Review

The literature review begins with an overview of the sustainability of MFIs in Cambodia, analyzing the financial situation of MFIs in Cambodia. The section will be followed by a review of the outreach and growth of MFIs in Cambodia. This review will show whether MFIs are growing or not over the years and whether MFIs are reaching the poorest group of the society or not. It will also include methodology used in previous studies. Finally, the last section of the chapter will be devoted to studying the determinants of outreach and sustainability of microfinance in Cambodia in order to highlight the information and variables from the previous studies that examine the same topic.

1.7.1 Sustainability of Microfinance in Cambodia

Hermes, Lensink, and Meesters (2008) focus on determining sustainability by using the measure of cost efficiency. They formulate a cost function, apply stochastic frontier analysis (SFA) to determine a cost frontier, and determine which factors may explain the distance from the best practice cost function (i.e. cost efficiency). Yu, Damji, Vora, and Anand (2014) analyze the profitability of MFIs by hypothesizing that MFIs do not ordinarily profit-maximize and instead focus on their mission of delivering services to the traditionally under-banked. They used the capital adequacy requirements as a proxy measure that higher requirements will enforce a host of other prudential regulations, such as interest caps, liquidity constraints, increased supervision through regular stress tests, and loan guidance.

Farrington (2000) applies accounting ratios (returns on assets, cost per borrower, administration expense ratio and clients per staff member) to evaluate MFIs efficiency. Arsyad (2005) uses a similar approach by using operating cost ratio, cost per unit of currency lent and cost per loan to measure Indonesian MFIs efficiency.

1.7.2 Outreach and Growth of Microfinance in Cambodia

Paxton and Cuevas (2002) mention that in developing countries, the categories of people the outreach of MFIs should cover are (but are not restricted to) the poor, women, rural inhabitants, and the uneducated. They use the categories to define and measure the depth of outreach indicators (DOI) to illustrate the analysis. They use the four variables as the diamonds to provide a simple graphic representation of the four outreach indicators for the clients of microfinance institutions and compare them with overall country averages.

Olivares-Polanco (2005) investigates the determinants of outreach in terms of the loan size of MFIs by using the data from 28 MFIs in Latin America. McIntosh, De Janvry, and Sadoulet (2005) study the effects of increased competition in Microfinance, which in fact hurt the outreach. They empirically found out that the competition benefits the wealthier customers, while decreasing the welfare of the poorer.

Thun, V, Phum, S., & Say, S. (2010) assess the depth of outreach of MFIs in Cambodia by choosing AMK as a case study in two ways: 1) well-being scores; 2) daily food expenditure per capita. Results based on well-being score indicate that AMK reaches more poor and medium level households than in the control group of non-clients, but less better-off clients. The results based on the number of clients spending on food below Food Poverty Line (FPL) emphasized that the clients are poor with 56% of group clients and 58% of individual clients below FPL. Then, the result conclude that AMK achieves the social bottom line in terms of poverty outreach.

Yu et al (2014) study the effects of regulations on outreach of MFIs. They use the percentage of active female borrowers as the metric for MFIs outreach. Given the historical disenfranchisement of women in developing countries and lack of a credit history, they use the percentage of active female borrowers as proxy for MFIs outreach.

1.7.3 Determinants Sustainability of Microfinance in Cambodia

Crawford, Skully, and Tripe (2011) study the relationship between financial efficiency and outreach efficiency of MFIs in Cambodia by applying Data Envelopment Analysis (DEA) methods to 14 MFIs. They found that MFIs improve financial performance but focus less on serving the most clients possible. DEA utilizes input and output data to create a practice efficient frontier that plots a piece-wise representation of the maximum output per input (or minimum input per output).

For outreach analysis, they use personnel, operating expense and equity as the inputs and the number of customers (savers and borrowers) as the outputs. For financial sustainability, the outputs are the total value of savings and loans and the inputs are the same costs needed for the social model: personnel, operating expense and equity.

CHAPTER 2: RECENT TRENDS OF OUTREACH AND SUSTAINABILITY OF MFIS IN CAMBODIA

This chapter will explore the information to explain the trends and relationship between institutional factors, outreach, and the efficiency to the operational selfsufficiency (OSS) of MFIs in Cambodia from 1997 to 2014. It is important to see the trends over the time frame because it will highlight the general picture of indicators and how they change over years. It helps foresee the trends and directions of MFIs will go to in the future. Graphing time-series data and existing literatures will be used to assist the understanding of the relationships and trends.

Up to 2012, there were 32 microfinance institutions (MFIs) in Cambodia, all focused on portfolio growth, which resulted in a market penetration and created a strong competition among MFIs. Over the past two decades, Cambodian microfinance industry grew from just 3 millions USD and 50,000 active borrowers in 1995 to 732 millions USD and 1,197,722 active borrowers in 2012 (Dennet, 2013). Eight biggest non-bank MFIs in Cambodia are AMK, Amret, HKL, Kredit, Prasac, Sathapana, TPC and Vision Fund Cambodia (VFC), while the largest commercialized bank MFI is Acleda. Due to the time and data constraint, the sample of the study consists of 17 MFIs in Cambodia.

2.1 Institutional Factors

Age and assets of MFIs will be used as indicators for institutional size. Age shows the duration from establishment, while assets tells the size of institutions. Amongst the 17 Cambodia Microfinance Institution (MFIs) in the sample, most of them were established during the 2000s, while a few of them were created formally earlier in 1990s after the creation of banking system and Microfinance Prakas in 1996. However, many MFIs had already started to serve the underprivileged villagers as the credit programs for some years before even officially transforming into MFIs. *Figure 5* illustrates the institutional age of each of the MFIs in the sample in 2011.



Figure 5. Institutional Age of Cambodian MFIs in 2011

According to the *Figure 5*, Acleda is the oldest MFI in Cambodia, while TPC (Thaneakea Phum Cambodia) is the second oldest institution. These institutions were

founded in 1993 and 1994 respectively, starting as NGOs for micro and small enterprises' development and credit. Thereafter, they transformed into commercialized banks in the early 2000s, with expanded products and scope to provide full banking services to all classes of people in Cambodia.

Over the years of progress, Acleda has become the most successful and largest microfinance institution in the history of Cambodia. It is the biggest commercial microfinance institution and microcredit provider in Cambodia, which later on expanded its operations into Myanmar and Laos. In 2014, it employed 1250 personnel and had 254 offices in all provinces and towns of Cambodia (Acleda, 2015). TPC has also done a great job so far in terms of scale and scope of services. It is now the 5th largest MFI in Cambodia in terms of number of active borrowers and gross loan portfolio. Often, institutions grow larger with age. However, *Figure 6* illustrates that age does not necessarily correlate with the volume of assets in Cambodian MFIs.



Figure 6. Assets Vs Age of MFIs in Cambodia, 2011

Acleda remains the largest institution in terms of assets and age, while TPC is similar in age, its assets are less than several other MFIs that are just around 10 years old or less. Amret, HKL, Prasac, and Sathapana have bigger assets than other older institutions such as CBIRD, CCSF, Chamroeun, Maxima, Samic, and TPC. This means that age does not tell the size and growth of its institutional assets.

However, *Figure 5 and Figure 7* explain the relationship between age and Operational self-sufficiency (OSS). OSS is the ratio that measures the ability of MFIs to generate enough revenue to cover its operating costs, loan loss, and financial costs. MFIs that have more than 100% are considered to be sustainable because they can generate profit. It seems that the older institutions are also more sustainable.



Figure 7. Operational Self-Sufficiency (OSS) of Cambodian MFIs

Graphing and plotting are based on the availability of the data from Market Mix database. To avoid confusion, all MFIs in the sample are still in operation. Missing data in the database will result in incomplete line presented in the graphs and plots.

By observing the time series in *Figure 7*, it can be seen that most MFIs in their early years of establishment have a very low ratio of sustainability, but it improves over time as the operations progress. Perhaps when an institution gets older, it has gained more experience and refined its strategy in coping with risks and generating revenue.

Therefore, in general, an institution that is old tends to have a higher operational self-sufficiency. When an MFI is getting older, it is embracing more experiences and the profiles of customers along the journey. It then should able to be more efficient in managing the transactions, operating costs, training staffs, avoiding risk defaults, and to

be more critical in new project investments, etc. Furthermore, it may improve more networking and credibility to other partners and clients. Of course, some older institutions lose efficiency as their practices become outdated or they become bureaucratic. The extent to which age is associated with operational efficiency will be examined in the econometric analysis.

2.2 Outreach

The two indicators for outreach are the number of active borrowers and the average loan size per borrowers. When the number of active borrowers increases, it is assumed that the MFIs are reaching out many more clients and serving more people who need the financial services. However, it is not clear whether the MFIs are reaching the poor who are excluded from the formal finance services or just the middle class people who already have the access to formal credit. Average loan size is often used as a proxy for depth of outreach to the poor because it is assumed that the poor utilize very small loan instruments. However, it is an imperfect proxy as the small size may reflect shorter loan terms.



Figure 8. Number of Active Borrowers of Cambodian MFIs

Looking at the *Figure 8* alone shows that Acleda and Amret had by far the largest number of active borrowers, amounting to around 300,000 clients in 2013. TPC,

VFC, and Prasac seemed to be the middle group with the number of borrowing clients around 200,000 clients in the 2014. Both groups had a large increase in the number of active borrowers over the time period of 1998 to 2014. In contrast, Sathapana, Samic, Kredit, and Chamreoun had only a slight growth of borrowers to 50,000 in 2013, while the rest few MFIs such as First Finance and Farmer Finance had only hundreds to thousands clients, and the number hardly grew over time.



Figure 9. Average Loan per Borrowers of Cambodian MFIs

Figure 9 show that Acleda has the highest average loan per borrower reaching almost \$5,000 per borrower in 2014. When the GDP per capita in Cambodia is slightly

above \$1,000 per person, it can imply that the average borrowers in Acleda are the middle-income people rather than the underprivileged people. However, Acleda's mission statement is "to provide micro, small and medium entrepreneurs with the wherewithal to manage their financial resources efficiently and by doing so to improve the quality of their lives" (Acleda, 2015). Given its large scale, Acleda, which serves a wide range of clients, can serve more low-income clients than smaller NGOs that only target the poor. The diversification can be an effective strategy for long-term sustainability.

Only Farmer Finance MFI has seen a decrease in average loan per borrower over the years; all others have experienced the increasing trend. This can suggest that Farmer Finance MFI started off with large capital, but had only a few clients who borrowed loans in large amount in its early years; and over time it attracted more clients.

By taking both number of active borrowers and average loan per borrowers into consideration, it appears that Amret is doing the best job in reaching out to both a big number of borrowers and low average poor size. Though Amret is smaller than Acleda in terms of assets, Amret achieves a good operational self-sufficiency (OSS) ratio and has the third largest asset amongst MFIs in Cambodia. By this, Amret is an interesting case study since it reaches out to the poor in scale and still can maintain a high operational-self sufficiency (OSS) level.

Nevertheless, it is not wise to jump to this conclusion that a commercialized MFI as Acleda focuses only on profit and targets the middle-income clients more than the poor. For example, it could be the case that the commercialized MFI Acleda diversifies its profit portfolio by targeting both the poor and middle-income class to maintain their stability. Average loan size per borrower alone is not good enough for a proxy to measure the outreach. MFIs can serve both the rich and the poor: This is called cross-subsidy. From the overall trend of outreach, MFIs can both serve the exclusive group of people and maintain high sustainability.

2.3 Sustainability

Without sustainability, MFIs are dependent on the whims of donors and governments and most likely cannot become a permanent part of the financial landscape regardless of their dedication to the poor. This section will analyze sustainability of MFIs by focusing on growth of gross loan portfolio, operating expense/asset, deposits/gross loan portfolio, and portfolio at risk > 90 days.



Figure 10. Percentage Growth of Gross Loan Portfolio of Cambodian MFIs, 2011

The growth of gross loan portfolio measures the percentage increase of gross loan portfolio in 2011 compared to the year 2010. *Figure 10* shows that the range of growth of gross loan portfolio of MFIs has big variations between one another. Chameroun had the highest growth at around 90%, followed by HKL and Sethapana that experienced growth at 60% to 70%, while other MFIs had the average growth at around 20% to 50%. The rate of growth of gross loan portfolio is really high for MFIs in Cambodia. The fast growth of gross loan portfolio can be several factors: 1) the expansion of economy; 2) MFIs' scale reach more deeply in rural area; 3) the rural inhabitants are more familiar with MFIs product and service; 4) the previous clients are doing well with the loans and borrow more to expand their activities.

From the table analysis provided in this chapter, it is not certain that fast growth of gross loan portfolio will have a positive or negative impact on the sustainability of MFIs. The next chapter will use regression analysis to test the data and provide results. Now, after seeing the growth of Gross loan portfolio of MFIs, it is important to examine how are the MFIs are doing in terms of obtaining their deposits from clients against lending money to clients.



Figure 11. Deposit/Gross Loan Portfolio of Cambodian MFIs

In *Figure 11*, over the time frame, only Acleda has the highest proportion of deposits/gross loan portfolio to over 100% in the past few years, while other MFIs have the ratio of deposits/gross loan portfolio at less than 40%. This means that only Acleda that appears to be successful at mobilizing savings.

The reason why many MFIs have low deposits/gross loan portfolio is because of the large subsidized grants and loans those MFIs receive. Often larger MFIs mobilize more savings as they act more like commercial banks, while smaller NGOs focus more on outreach and receive subsidies. Also, a question relevant to this research emerges: do small MFIs make efforts to develop savings instruments or not? Savings are important to both the MFIs and the poor. Previous research shows that poor utilize savings and also loans. They push money into savings for reserves, and pull money out from creditors such as microfinance when possible (Collins, Morduch, Rutherford, & Ruthven, 2009). Offering savings not only helps an MFI attain a sustainable source of funds, but it is prodevelopment because the poor can and do save. Only offering loans indebts already poor clients.

Acleda reaches the independence from donors and can finance its loans through commercial transactions, while other institutions except Acleda are heavily dependent on subsidies from the donors and loans from the institutions with cheap interest rates. Acleda has been transformed into a commercial bank, as have been many other MFIs such as Amret, TPC, and others, but it requires the strategies and good services in competing with other private banks. Otherwise, because Acleda has more middle-class income clients, the amount of deposits per client is bigger than that of MFIs who target the poorer clients, which makes Acleda have more liquidity.

Just like any other business operations, MFIs need to look closely at its operating expense/assets because it measures the operational efficiency of the expense to generate revenue. There is a strong negative relationship between operating expense/assets and the sustainability of MFIs in Cambodia.



Figure 12. Operating Expense/Assets of Cambodian MFIs, 2011

Because microfinance institutions operate utilizing smaller financial transactions to many people than the commercial banks do, the cost per dollar transacted is high. Inefficiency of operational activities would harm the sustainability of the institutions a lot. In looking at *Figure 12*, Acleda has the lowest Operating Expense/Assets of MFIs at around 6%, while the average rate is from 10% to 20% for most MFIs in the sample. Chamreoun seems to have the highest ratio amongst all at around 31%. According to the Figure 4, Chamreoun only was able to fully cover its own to generate revenue from 2011. Before 2011, Chamreoun did not have OSS yet. This indicates that Chamreoun has too large an operating expense compared to its own assets, which makes it not yet sustainable yet. It has to come up with new strategy to cut down the cost of transactions and to generate revenue more efficiently. They should look at all personnel expense, depreciation and amortization, and administrative expense.



Figure 13. Total Expense/Assets of Cambodian MFIs

From *Figure 13*, overall Cambodian MFIs have made a good progress in reducing their operating costs relative to assets. Even though Chamreoun has the highest ratio in 2011 compared to other MFIs, it has put a lot of effort into managing the overhead costs more efficiently from more than 100% in 2007 to less than 40% in the last few years.



Figure 14. Portfolio at Risk > 90 days of Cambodian MFIs

Another indicator of the sustainability is the Portfolio at Risk > 90 days. Portfolio at risks refers to the outstanding balance of all loans that have an amount overdue. MFIs

choose to declare the loan portfolio at risk after 90 days of non-payment. Reaching the poor faces the chance of higher rates of delinquency because the poor do not have stable income.

Most MFIs at their early stages of operation were at risk of defaulting their portfolio. However, the risks sharply decreased as their businesses progressed. This can be explained that the longer MFIs age, the better MFIs can avoid the risks, which could be because the MFIs have more information on the type of clients, more experiences on how to reduce risks, and the ability to attract more clients. All of this decreases the percentage of loss rate. Another factor could be that the economy was doing well, so that the clients who made the loans to do business could repay back their debt.

However, it is worth noting that in 2008, Cambodia experienced a large real estate speculation, which continued in 2009, that led to a bubble economy. Many people were too obsessed about borrowing money to short-sell the real estate for opportunistic profit. That made a spike in portfolio at risk in 2010 for some institutions and only a small rise of that to other MFIs. The bubble economy popped and died down, which made the borrowers unable to make money to repay back their debt. There was a distinction between the groups of MFIs in their levels of default rates: some institutions saw the decline coming and would not lend to those who would not have the ability to pay, while other MFIs did not pay attention to the macroeconomic environment and just lent the money to people who were qualified to borrow.

To sum up, institutional factors, outreach, and efficiency all have a relationship with the sustainability of microfinance institutions. However, it is not clear to what extent each factor affects the sustainability of MFIs. The next chapter will quantify the data and determine the estimation correlation between each factor and the level of sustainability of MFIs.

CHAPTER 3: DETERMINANTS OF SUSTAINABILITY OF MICROFINANCE INSTITUTIONS IN CAMBODIA USING ECONOMETRIC ANALYSIS

This chapter examines the indicators of Cambodian MFIs sustainability in order to determine what variables and factors have relationship with the level of sustainability by using an econometrics methodology- Ordinary Least Square (OLS) regression analysis. Factors that can affect the level of MFIs sustainability are institutional size, outreach, and financial efficiency. We will choose variables from each factor as independent variables. The regression model will be a cross-section analysis by focusing on the year 2011 because it is the year with the most recent data across all variables for most of the microfinance institutions.

There are 17 microfinance institutions in Cambodia that will be used as the samples to study. Since this research employs a cross-section model, the samples of 17 might be not large enough to generalize the result of the model; henceforth, I borrow another 16 samples of microfinance institutions from Indonesia to include in the same model. I add a country specific dummy variable to differentiate the results between two countries and see if they show statistically different outcomes between the level of sustainability. However, if they are not shown to be different, I will generalize the result into Cambodian context. Indonesia was selected over other countries because it has more samples available in the database, and Indonesia has a long history of microfinance development, so it would be a good benchmark to compare with Cambodia. The data are

obtained from Market Mix, which is a data hub of microfinance institutions around the world. It aims to provide insights and institution study.

Microfinance	Age	Assets (US\$)	Offices	# Borrowers	OSS
			2 24		1.5.6.7
ACLEDA	21	1,486,653,977	234	272316	156%
АМК	10	68,397,585	22	247747	118%
AMRET	15	119,743,359	60	261300	139%
CBIRD	14	2,006,110	5	2654	112%
CCSF	11	3,879,609	7	8563	134%
Chamroeun	5	4,384,875	20	300	138%
First Finance	5	3,797,023	-	27990	112%
HKL	13	86,785,732	34	62703	131%
IPR	11	5,605,082	7	3561	156%
KREDIT	10	49,037,112	44	56519	123%
Maxima	14	2,762,682	2	2636	122%
PRASAC	9	156,724,190	145	116559	150%
SAMIC-Limited	10	8,058,928	13	10809	152%
Sathapana	11	107,926,524	53	57001	130%
Seilanithih	11	8,626,520	25	13846	107%
TPC	20	46,159,063	32	96542	126%
VFC	11	44,236,309	56	132036	127%

Table 3. Cambodian MFIs in the sample (Market Mix Data 2011)

Microfinance	Age	Assets	Offices	#	OSS
		(US\$)		Borrowers	
Amartha	4	78,274	1	272316	59%
Bina Artha	3	1,509,133	3	275739	5%
BMT Sanama	5	337,624	2	247006	146%
BPR AN	24	2,903,069	6	2654	139%
BPR AK	23	7,391,132	8	8563	137%
BPR DMG	18	1,414,437	1	27990	110%
BPR Hitamajaya	20	2,738,588	3	306	133%
BPR NBP 2	8	6,631,418	7	62703	138%
BPR NSI	22	5,609,287	7	3561	153%
BPR Pinang Artha	24	2,187,803	1	56519	125%
BPR Surya Yudha	22	88,787,777	48	2636	143%
Kencana					
CU Sawiran	25	8,259,088	13	10809	111%
Dian Mandiri	25	3,360,287	18	57001	104%
KOMIDA	10	7,723,349	39	13846	107%
Koperasi SK	8	5,307,707	1	96542	127%
MBK Ventura	11	27,092,626	192	132036	106%

Table 4. Indonesian MFIs in the sample (Market Mix Data 2011)

3.1 Model

Operational Self-sufficiency (OSS) will be used as a proxy for sustainability and will serve as the dependent variable for the model. Institutional age, outreach indicators, efficiency measures, and the Cambodian dummy variable are four categories of independent variables that could influence the sustainability of the microfinance institutions. To study the outreach, two important variables that should be studied are number of active borrowers (scale of outreach) and average loan per borrowers (depth of outreach). For efficiency measures, there are four independent variables- growth of gross loan portfolio, operating expense/asset, deposits/gross loan portfolio, and portfolio at risks > 90 days. Then, there is a dummy variable set to control for the fixed effects between Cambodia and Indonesia microfinance institutions.

Variable	Obs	Mean	Std. Dev.	Min	Max
Age	17	11.82353	4.231361	5	21
Avgloanbor~r	17	922.1765	843.3302	115	3696
NumberofAc~s	17	80769.53	95136.81	300	272316
Depositgro~n	16	.1983429	.286727	.0021839	1.139687
Growthofgr~n	17	1.034927	2.575828	.0749378	11
Operatinge~t	16	. 136875	.0553436	.06	.3
Portfolior~s	17	.0044	.0050014	.0005	.015
055	17	1.313229	.1542853	1.0744	1.5618

Table 5. Summary Statistics of MFIs in Cambodia

Table 6. Summary Statistics of MFIs in Indonesia

Variable	Obs	Mean	Std. Dev.	Min	Max
Age	16	15.75	8.378544	3	25
ofActiveBo~s	16	79389.19	99558.62	306	275739
Avgloanbor~r	16	835.75	706.7896	34	1978
Depositgro∼n	16	.5232481	.3827207	0	1.250199
Growthofgr∼n	14	.5838784	1.071921	.0484375	4.22081
Operatinge~t	16	.20875	.1902236	.06	.75
Portfolior~s	16	.0272375	.0306526	.0001	.1225
055	16	1.15285	.3730994	.0529	1.5306

It is hypothesized that institutional age should have a positive relationship with the sustainability of MFIs. The older the institution is, the more sustainable the institution becomes. For outreach, the number of active borrowers may have a positive relationship with the sustainability of institution because MFIs operate on a basis of fixed costs and variable costs, so the increase of number of active borrowers should decrease the average fixed costs. Another variable of outreach, average loan per borrowers is expected to have a positive relationship with the sustainability, too. When each borrower borrows only a small amount of loan, the institution makes less amount of profit because the cost of each transaction is the same whether it is a big or small amount of loan.

For efficiency measures, growth of gross loan portfolio and deposits/gross loan portfolio are predicted to have a positive relationship with the sustainability of MFIs. The growth of gross loan portfolio signifies the increase of active clients and more borrowings. As discussed above, more clients and loans enhance the sustainability level of the institutions. Besides, deposits/gross loan portfolio is the ratio that compares the amount of deposits against the gross loan portfolio. Conventionally, MFIs are sustainable when they can obtain deposits from customers more than they lend to clients. Depending more on loans and subsidy to lend to customers illustrates that the institutions are not sustainable yet.

The other two variables of efficiency include operating expense/assets and portfolio at risk > 90 days which are expected to have a negative relationship with sustainability. Operating expense/assets refers to the costs on daily operation activity compared to their assets, so the MFIs should have relatively small amount of their

operating costs against their assets to consider that they are efficient. The more efficient the institutions, the more sustainable they are. For portfolio at risk > 90 days shows the rate of loan portfolio that is expected to be default. Thus, the higher rate of portfolio at risk, the less sustainable the institutions.

The regression equations can be written as follows:

 $Y_{i} = \beta_{0} + \beta_{1}X_{1i} + \beta_{2}X_{2i} + \beta_{3}X_{3i} + \beta_{4}X_{4i} + \beta_{5}X_{5i} + \beta_{6}X_{6i} + \beta_{7}X_{7i} + \beta_{8}X_{8i} + \varepsilon_{i}$ (1)

- Y_i : Operational Self-Sufficiency (OSS) of the *i*-th microfinance institution (%)
- β_0 : Intercept

 β_n : Correlation Coefficients between the dependent variable and the corresponding independent variable

 X_{1i} : Age of the *i*-th microfinance institution (years/10)

 X_{2i} : Number of active borrowers of the *i*-th microfinance institution (#/100)

 X_{3i} : Average loan per borrowers of the *i*-th microfinance institution (US\$/1,000)

 X_{4i} : Growth of gross loan portfolio of the *i*-th microfinance institution (%)

 X_{5i} : Operation expense/assets of the *i*-th microfinance institution (%)

 X_{6i} : Deposits/gross loan portfolio of the *i*-th microfinance institution (%)

 X_{7i} : Portfolio at risk > 90 days of the *i*-th microfinance institution (%)

 X_{8i} : Dummy variable

1 Cambodia 0 Indonesia

 ε_i : Error terms

3.2 Hypothesis Settings

I divide the independent variables into four groups:

1) Institutional size: Age

2) Outreach: Number of active borrowers and Average loan per borrower

3) Sustainability: Growth of gross loan portfolio, Operating expense/Asset,

Deposits/Gross Loan portfolio, Portfolio at risk > 90 days

4) Dummy

I will test whether each independent variable has is significant with operational self-sufficiency (OSS) or not by using 10% confidence interval.

Table 7. I	Hypotheses	for Model	Variables
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Туре	Independent Variables	Hypothesis Setting
Institution	Age	H_0 : Age does not have relationship with OSS
size	Age	H_1 : Age has relationship with OSS
	Number of active	H_0 : NAB does not have relationship with OSS
Outreach	borrowers (NAB)	H_1 : NAB has relationship with OSS
	Average loans per	H_0 : ALB does not have relationship with OSS
	borrower (ALB)	H_1 : ALB has relationship with OSS
	Growth of gross loan	H_0 : GGLP does not have relationship with OSS
	portfolio (GGLP)	H_1 : GGLP has relationship with OSS
	Deposits/gross loan	H_0 : DGLP does not have relationship with OSS
Efficiency	portfolio (DGLP)	H_1 : DGLP has relationship with OSS
	Operating expense/assets	H_0 : OPEA does not have relationship with OSS
	(OPEA)	H_1 : OPEA has relationship with OSS
	Portfolio at risk > 90	H_0 : Risk does not have relationship with OSS
	days	H_1 : Risk has relationship with OSS
	1	H_0 : There is no difference between the two count
		effects
Dummer		H_1 : There is difference between the two
Dummy		countries effects

The decision rule that will follow is:

If p value > 10% => Do not reject
$$H_0$$

If p value < 10% => Reject H_0

If the p-value is less than the significance level, we can imply the statistical significance and that there is a relationship between the independent variable and the dependent variable. This means that there is a casual relationship which requires that I look at the magnitude and its sign to evaluate to what degree they are correlated and whether this correlation is a positive or negative relationship.

3.3 Quality of Data

To satisfy an assumption of a good regression model, there should be no multicollinearity. Simply put, no explanatory variable has a significant correlation with any other explanatory variable(s) in the model. As follows:

 H_0 : There is no correlation between X_i and X_j H_1 : There is a correlation between X_i and X_j If p value > 10% => Do not reject H_0 If p value < 10% => Reject H_0 and accept H_1 Table 8: Pearson Correlation Coefficients

Prob > |r| under H0: Rho=0

Number of Observations

	OSS	Age	NAB	ALB	GGLP	OPEA	DGLP	Risk90
	1.00000	0.36389	-0.35138	0.42742	-0.12969	-0.82320	0.19497	0.10312
		0.0374	0.0449	0.0131	0.4868	<.0001	0.2769	0.5680
OSS	33	33	33	33	31	32	33	33
	0.36389	1.00000	-0.03039	0.17329	-0.16528	-0.18789	0.31331	0.40000
	0.0374		0.8645	0.3348	0.3660	0.3031	0.0712	0.0211
Age	33	34	34	33	32	32	34	33
	-0.35138	-0.03039	1.00000	0.02453	0.02301	0.27218	-0.04031	-0.28403
	0.0449	0.8645		0.8922	0.9005	0.1318	0.8209	0.1092
NAB	33	34	34	33	32	32	34	33
	0.42742	0.17329	0.02453	1.00000	-0.01891	-0.44161	0.60936	0.26092
	0.0131	0.3348	0.8922		0.9196	0.0114	0.0002	0.1425
ALB	33	33	33	33	31	32	33	33
	-0.12969	-0.16528	0.02301	-0.01891	1.00000	0.25381	-0.22327	-0.22759
	0.4868	0.3660	0.9005	0.9196		0.1759	0.2193	0.2182
GGLP	31	32	32	31	32	30	32	31
	-0.82320	-0.18789	0.27218	-0.44161	0.25381	1.00000	-0.30532	-0.14807
	<.0001	0.3031	0.1318	0.0114	0.1759		0.0893	0.4187
OPEA	32	32	32	32	30	32	32	32
	0.19497	0.31331	-0.04031	0.60936	-0.22327	-0.30532	1.00000	0.67164
	0.2769	0.0712	0.8209	0.0002	0.2193	0.0893		<.0001
DGLP	33	34	34	33	32	32	34	33
	0.10312	0.40000	-0.28403	0.26092	-0.22759	-0.14807	0.67164	1.00000
	0.5680	0.0211	0.1092	0.1425	0.2182	0.4187	<.0001	
Risk90	33	33	33	33	31	32	33	33



Still, to confirm that whether it will lead to a major issue of multicollinearity in the model or not, let us verify it with another approach called "Variance Inflation (VIF)":

Rule of thumb:

If VIF value < 4 => It is likely that there is no serious multicollinearity issue

If VIF value $> 4 \Rightarrow$ It is likely that there is a serious multicollinearity issue

Variable	Variance Inflation (VIF)
Age	1.29612
NAB	1.70822
ALB	2.25495
GGLP	1.70915
OPEA	1.46072
DGLP	3.13847
Risk 90	2.61570

Table 9. Variance Inflation (VIF)

Based on the Variance Inflation (VIF) approach, no explanatory variables seem to be highly correlated with one another. Thus, there does not appear to be a serious multicollinearity issue that would alter the outcome of the model.

This model also passes the Heteroscedasticity and Normality test and, therefore, satisfies three key assumptions of the Classical Regression Model. Please refer to the appendices for the test details.

3.4 Findings

After running the regression model, I obtained the empirical results:

Variable	Estimating Coefficient	P Value		
Age	0.06782	0.1295		
Number of active borrowers	0.00276	0.4276		
Average loan per borrower	0.08285*	0.0915		
Growth of gross loan portfolio	- 0.13281***	0.0057		
Operating Expense/Asset	- 0.96343***	0.0039		
Deposit/Gross loan portfolio	- 0.20553	0.1207		
Portfolio at risk >90 days	- 0.04394	0.9866		
Dummy	- 0.03755	0.6091		
* Significant at 10% ** Significant at 5% *** Significant at 1%				

Table 10. Regression Analysis

Table 11. Fitness of the Model

R-Square	Adjusted R-Square	F Value	Pr > F Value
0.7051	0.5927	6.27	0.0003

According to Table 10, growth of gross loan portfolio and operating expense/asset are statistically significant at the 1% level, while average loan per borrower is statistically significant at the 10% level, so I reject the null hypothesis and accept the alternative hypothesis. Age and deposit/gross loan portfolio are not statistically significant, but they are close to being significant with a p-value of 0.12 and 0.13. Because they are close to the 10% significance level, the quantitative results weakly indicate that age, an institutional factor, has a positive relationship with operational self-sufficiency (OSS) with a magnitude of 6.78%. This means that the older the institution, the more sustainable it is. An increase in age by 10 years increases the OSS by 6.78%. When an institution lasts longer, it leads to the maturity stage of the firm to generate revenue to cover their costs and risks.

Likewise, deposits/gross loan portfolio is close to being statistically significant with a negative coefficient. A doubling of the deposits/gross loan portfolio decreases the OSS by 20%. MFIs, which receive subsidies of loans from international, governmental, or commercial institutions, may have access to lower and cheaper interest rates compared to what MFIs pay depositors.

Other MFIs are still sustainable though they do not achieve the high ratio of deposit/gross loan portfolio. One can surmise that there is a wide availability of subsidies

and cheap loans for MFIs to borrow in Cambodia for lending purposes. MFIs who focus more on credit programs might not give the priority to receiving deposits from customers rather than borrowing from external donors.

The number of active borrowers is not statistically significant which shows that, when the microfinance institution is trying to reach out to many clients, it does not affect the sustainability of the institution. However, the average loan per borrowers is statistically significant at a 10% level with a magnitude of 8.28%. This implies that when the average loan size per borrower increases by \$1,000, the OSS rises by 8.28%. This shows that the institutions are more efficient when they lend money in a larger proportion of loans to each borrower, which infers that reaching out to the poor clients would hurt the sustainability of the firms.

For sustainability indicators, both growth of gross portfolio and operating expense/asset are both significant at a 1% level, with the coefficients of minus 0.13 and minus 0.96, respectively. The increase by 100% in growth of gross loan portfolio compared to the year before decreases the sustainability by 13%, while the increase of 100% in operating expense/asset reduces the financial efficiency by 96%. These causalities indicate that the annual growth of gross loan portfolio that happens too fast negatively affects the financial stability of the institution. Institutions are more exposed to risks and may not be able to leverage liquidity at the needed times.

A loan portfolio that grows too quickly makes the financial performance of MFIs unhealthy. The MFIs should try to keep their level of gross loan portfolio growing at a moderate pace, so they can manage their cash flow well and keep their default rates at a safe point. In Figure 10, it illustrates that specifically with Chamreoun, HKL and Sethapana each having very high growth of gross loan portfolio in 2011, which as indicated in *Figure 7* have lower OSS rates in comparison to other MFIs in general.

Operating expense indicates the cost of providing services (loans) to generate revenue. Operating expense/assets better measures the average performing assets for those MFIs who mobilize deposits. It covers efficiency of the specific cost elements such as salaries and benefits as well as occupational expenses such as rent and utilities or travel against the total assets. The inefficiency of handling the operations for giving deposits and loans to customers can negatively impact the sustainability of MFIs (World Bank Publication, 1998).

Portfolio at risk > 90 days refers to the outstanding balance of all loans that have an amount overdue. It reflects the true risks of a delinquency problem because it considers the full amount of a loan at risk, which is very important for MFIs since the loans are small and the terms are long (World Bank Publication, 1998). Some MFIs choose to declare the portfolio of loan at risk only a few days after the due date because MFIs hold that the customers are able to make payments only within that period. This regression analysis shows that portfolio at risk > 90 ratio is not statistically significant in the model and would not deteriorate the sustainability of MFIs.

While portfolio at risk may not be an important determinant of the sustainability in this small dataset, it is commonly accepted that portfolio at risk drastically hurts the financial efficiency of the MFI institutions. Several factors can lead to a deteriorating portfolio at risk for MFIs. Firstly, suppose the growth of gross portfolio is growing too fast and the average loan size per borrower increases, arrears can start to become a problem. A rapidly growing portfolio can hide a delinquency problem regardless of which portfolio equality ratios have been used. Secondly, the periods of installments are long. Long loan terms result in payments that represent a relatively small percentage of the loan amount. Payments for loans that are overdue can represent a small percentage of the loan, but the portfolio at risk will be very high relative to the arrears rate, because the majority of the loan outstanding is considered even though it has not become due (World Bank Publication, 1998). Thirdly, in developing countries, institutions may not have universal accounting standards to record and declare the portfolio at risk in the same way, which may understate the ratio when it is calculated. All things considered, this may explain why the portfolio at risk >90 days do not matter to the sustainability of MFIs in Cambodian context.

The dummy variable does not show statistically significance with the sustainability in the model. This means that the MFIs in two countries are not statistically different between their levels of sustainability. Thus, the result I obtain for the relationship between the independent and dependent variable can be generalized in the context of both Indonesia and Cambodia.

CHAPTER 4: CONCLUSION

To sum up, microfinance is a tool to allow poor people to smooth consumption by using loans and savings instruments. In Cambodia, a number of MFIs have been providing financial services over the past couple of decades. This analysis finds three important determinants of sustainability for Cambodian and Indonesian MFIs: 1) growth of gross loan portfolio; 2) operating expense/asset; and 3) average loan size per borrower. One important finding is that when the gross loan portfolio grows too fast, the MFI is not sustainable. Each institution has its ability to handle the risks and lending based on its liquidity and assets. Therefore, they should not allow the gross of loan portfolio to grow too fast. They should examine the appropriate growth rate, which they can manage to maintain the sustainability, given the unexpected incidents, for example, the economy recession in 2010

Another determinant of sustainability is operational expense as a proportion of institutional assets. Microfinance institutions try to serve the poor people who are excluded from formal finance and it is more costly to generate revenue serving low-income clients, since the cost per dollar transacted is higher. Consequently, it is very important for MFIs to reduce the cost of their operations and services to the clients.

Average loan size is another important variable that is related to operational selfsufficiency. As average loan sizes increased, Indonesian and Cambodian MFIs increased their sustainability. However, maintaining small average loan sizes is an outreach goal for many MFIs. For outreach, using only the average loan size per borrower as an indicator for depth of outreach can be misleading. An MFI institution can target a wide range of clients including both middle-income and low-income people to diversify their profit and risk portfolio. Therefore, a higher average loan size per borrower does not necessarily imply that the MFI is targeting only the middle-class.

It is true that there is a trade-off between the outreach and the sustainability of MFIs. However, the original goal of MFIs is to serve the low-income people to address their challenges in daily life. This cannot be ignored, and MFIs should still continue to target the low-income group of individuals. At the same time, MFIs should include a wider range of client classes to increase the sustainability.

An obvious case in this study implies that an MFI, Acleda, can achieve both outreach and sustainability by attaining a sufficient scale, diversifying portfolio, and dedicating itself to low-income clients. Acleda is the biggest microfinance institution in Cambodia in terms of assets, gross loan portfolio, active clients, and largest amount of branches in all provinces. It is also the only MFI that is successful at mobilizing savings without dependence on donors' subsidies. With the lowest operating cost/assets and small portfolio at risk, Acleda has a high efficiency,

Econometric results show that age is not necessarily associated with the sustainability of MFIs. The maturity of sustainability depends more on efficiency, diversification of profit portfolio, and mobilization of savings. However, age seems to be related to portfolio at risk, where the older institutions have more experience in managing risks based on the time series graphs (*Figure 14*). Age might not have a linear relationship with OSS, so the OLS regression might not able to capture the significant results. Thus, the results suggest an unclear reading for the expected sign because it can

be a positive or negative relation. For further purpose, a non-linear least square may be needed to test the relationship between age and OSS.

For portfolio at risk, it was not found to be significant in the regression analysis. Among young institutions, portfolio at risk might improve with age as the institution finds ways of monitoring and evaluating risk. However, some older institutions may improve delinquency rates while others may become inefficient as the institutional bureaucracy increases. Sample selection, delinquency, and accounting report problems can drive results to be insignificant in the findings.

It is possible that microfinance institutions can achieve both outreach and sustainability. In the short run, MFIs may still be dependent on subsidies in order to continue targeting the poor. However, in the long run, MFIs should mobilize more savings from customers in order to be less dependent on subsidies and loans from donors and government to remain sustainable. MFIs could promote sustainability through such means as to diversify the risk portfolio by targeting different classes of clients, achieve high efficiency, and pay attention to institutional experiences, etc.

Finally, it should be noted that not everyone needs loans, but when the loans are cheap because of subsidies, people might tend to borrow more. This increase in the volume of loans does not reflect the real demand that would occur at market interest rates. Easy access to cheap credit can lead to over-indebtedness amongst low-income people. Therefore, it is important to educate the poorer people on how not to burden themselves with high debt and to also teach them the importance of saving. Providing a framework that would allow low-income individuals to save a portion of their incomes could be an important factor in poverty alleviation in the longer run. As the microfinance sector in Cambodia develops, other financial products may be equally or more desirable to the poor including savings, remittances, and microinsurance. The microfinance sector will be well positioned to serve Cambodia's poor through strong, sustainable institutions.

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APPENDICES A: HETEROSCEDASTICITY TEST

I will use White's Test to see if the heteroscedasticity exists in the model. We set:

H₀: There is no heteroscedasticity

H₁: There is heteroscedasticity

If p value > 0.05 => Do not reject H_0 and conclude that there is no heteroscedasticity

If p value < 0.05 => Reject H₀ and do not reject H₁

Heteroscedasticity Test						
Equation	Test	Statistic	DF	Pr > ChiSq	Variables	
OSS	White's Test	30.00	29	0.4140	Cross of all vars	
					1, Age, activeb,	
					averagelb, Gloan,	
					OPEA, DGLP, Risk90,	
					dummy	

Since the p-value is 0.4140 > 0.05, we do not reject H₀ and conclude that there is no heterodasticity in the model. Therefore, the assumption of heterodasticity is sastified.

APPENDICES B: NORMALITY TEST

To see whether the errors are normally distributed or not, I will use: 1) Shapiro-

Wilk; 2) Kolmogorov-Smirnov; 3) Cramer-von Mises; and 4) Anderson-Darling.

I set:

H₀: Errors are normally distributed

H₁: Errors are not normally distributed

If p value $> 0.05 \Rightarrow$ Do not reject H₀ and conclude that errors are normally distributed

If p value < 0.05 => Reject H₀ and do not reject H₁

Tests for Normality					
Test	Statistic	p Value			
Shapiro-Wilk	W 0.955842 Pr < W	0.2417			
Kolmogorov-Smirnov	D 0.103318 Pr > D	>0.1500			
Cramer-von Mises	W-Sq0.058681Pr > W-S	Sq >0.2500			
Anderson-Darling	A-Sq0.415063 Pr > A-S	Sq >0.2500			

Because all the p-value of each test > 0.05 => We do not reject H₀ and assume that the error terms are normally distributed, which makes the normality assumption of the model fulfilled.



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