Three Inter-Related Essays in Applied Economics: A Quasi-Experimental Analysis of Ponzi-Financial Institutions

by

John Mustapha Musah

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Approved by

Valentina M. Hartarska, Chair, Alumni Professor of Finance & Ag. Economics.
James R. Barth, Co-chair, Professor & Lowder Eminent Scholar in Finance
Denis A. Nadolnyak, Member, Professor of Ag. Economics
Duha T. Altingdag, Member, Associate Professor of Economics
Jitka Hilliard, University Reader, Associate Professor of Finance

Abstract

This dissertation consists of three inter-related essays in applied economics, which delves deeper into different research questions with varying econometric models on the recent financial sector crisis in Ghana, sub-Saharan Africa.

The emergence of financial institutions in recent times, coupled with lending models in the field of microfinance is celebrated as significant improvements, which further enhances the perceptive miracle of enabling previously un-bankable households by creating "safe nets" to replace the missing links that excluded them from access to more traditional forms of financial services like savings, credit, and investment. In recent times however, financial opportunists took advantage of the vulnerable households by creating unsustainable investments within Microfinance Institutions, Savings and Loans Companies, commercial banking institutions, and other financial houses that functioned as de facto ponzi schemes. Their ultimate goal was to exploit vulnerable households for selfish monetary advantage. The influx of these ponzi-financial institutions (PFI's) has rendered Ghana's financial sector unstable, leading to loss of confidence in the banking sub-sector. The government of Ghana and supervisory agency have done very little to safeguard depositor's funds.

Chapter 1 determines the impact of PFI's on household savings, using a three-wave pooled cross-sectional dataset from World Bank's Living Standards Measurement survey to analyse this impact by employing a difference-in-differences estimation strategy with regional and time fixed effects. The findings suggest that the activities of these PFI's induced all households to increase

their average savings by 502.00 Ghana cedis ($125). Further evidence shows that the non-poor income group also increased their average savings by 414.50 Ghana Cedis ($103.63). It is interesting to note that urban households increased their annual savings by an average of 914.30 Ghana Cedis ($228.57), relative to rural dwellers. The results in this chapter were further strengthened by a number of robustness checks.

Elasticities of savings and investment in the post-closure of PFI's would be negatively affected. In chapter 2, we employ a two-wave pooled cross-sectional dataset to investigate the post-closure of these PFI's on household savings. We follow the approach adopted by Ravallion et al (2005) to execute a difference-in-difference-in-differences estimation strategy with geographical and time fixed effects. The findings adduced from this chapter suggests that post-closure of PFI's led to a significant reduction in household savings among all households and the non-poor, consistent with previous findings. On the average, all households and non-poor households reduced their average savings by 788.70 Ghana cedis ($157.00) and 888.70 Ghana cedis ($222.18) respectively. Contrary to earlier narrative, previous period savings shows a negative relationship with household savings behavior. The results of this chapter were further strengthened by a number of robustness checks and falsification tests.

And finally, chapter 3 examines the impact of PFI's on household credit acquisition, by employing a Propensity Score Matching technique to test for and measure the treatment effect on the observations of interest. This is done by using the greedy matching approach to run through the list of treated units and select the closest eligible control unit to be paired with each treated unit. The results obtained from the analyses indicate that the presence of PFI's (2006-2013) reduced credit acquisition on the average by a 3-percentage point among households, while the post-

closure effect (2013-2017) increased credit acquisition on the average by a 2-percentage point. The combine effect shows that households reduced their credit acquisition on the average by a 2-percentage point between the period 2006-2017, which thus indicate that activities of PFI's negatively impacted credit-acquisition.

Acknowledgements

In truth, the burden of my life can be summarized in a speech delivered by Theodore Roosevelt, former President of the United States, at the Sorbonne in Paris, France, on April 23, 1910--"It is not the critic who counts; not the man who points out how the strong man stumbles, or where the doer of deeds could have done them better. The credit belongs to the man who is actually in the arena, whose face is marred by dust and sweat and blood; who strives valiantly; who errs, who comes short again and again, because there is no effort without error and shortcoming; but who does actually strive to do the deeds; who knows great enthusiasms, the great devotions; who spends himself in a worthy cause; who at the best knows in the end the triumph of high achievement, and who at the worst, if he fails, at least fails while daring greatly, so that his place shall never be with those cold and timid souls who neither know victory nor defeat." In all things, I have held myself to but one ambition, and that is to make necessary arrangements to pursue a master's degree and PhD in Economics in the United States of America, that I may be better prepared to serve my fellow human. Throughout the pursuit of this ambition, I have held unto faith and discipline. As opined by Marthin Luther King, Jnr, "Faith is taking the first step even when you don't see the whole staircase and "The hope of a secure and livable world lies with disciplined nonconformists who are dedicated to justice, peace and brotherhood."

This time at Auburn has been immensely valuable to my personal growth. Auburn was the final leg of my journey and it taught me the crucial value of love, connection, and personal development along with academic accomplishments. I am grateful to have found a community here that exposed me to different perspectives and showed me different parts of myself. I was able

to fully display my strengths within my department during my time here. The academic community helped my goals to be within reach and to keep me connected.

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Equipped by my training as an economist and with the guidance of the Holy Spirit, I enter the world of my career with inspiration from the letters of Rhian Ellis, ”The worst thing in the world can happen, but the next day the sun will come up. The sun's going to keep rising. And we're going to keep trying. And you will eat your toast. And you will drink your tea.” WAR EAGLE!!!

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Chapter 1

Impact of PFI's on Household Savings: A Double Difference Estimation Technique.

1. Introduction, The PFI Set-up, And Issue of Self Selection

1.1. Introduction

From both a micro and macro perspective, household savings has been envisaged as an important financial instrument in reducing poverty and micro debt accumulation in times of strain. Between the period 1980 and 2001, World Bank reported average household savings in Ghana to be 6.4%, which is by far lower, relative to other economies. Survey from GLSS (2006 and 2013) has shown an increasing penchant of households for acquiring savings account over this period. Opening of savings account has increased from 28% to 82% as of 2017. This unusual significant increase underscores a suspicious activity in the financial sector. It certainly cannot be entirely attributed to financial literacy, population growth, or changes in underlining structures of the economy. Obviously, opening of savings accounts and growth in household savings could be homogenous over time.

Households within the middle class in Ghana save a portion of their income for either precautionary, life cycle, or future asset accumulation purposes. However, the government of Ghana failed in its responsibility to put across prudential financial regulations to protect depositor's funds. Bank of Ghana (BOG), the main supervisory body colluded with ruling government and allowed MFI's, S&L's, Rural banks, and other formal banking institutions to

become Ponzi Schemes[1]. I must also add this assertion firmly emanated from a combination of firsthand insider information by virtue of my work experience in the public sector (Ministry of Finance), and information from relevant authorities in the banking industry. These privileged information makes it imperative to assert accordingly. And it is apparently clear that the combined negligence of supervisory authorities leading to the emergence of PFI's in Ghana has further destabilized the financial sector, leading to loss of public confidence in banking. The era of Charles Ponzi and Madoff sent a caution to economic agents in the United States of America. Hitherto, the recent ponzi schemes in Ghana through financial institutions is not novel. It started with "Pyram" savings and loans in 1995. And later, "The US TILAPIA" in 2005, where victims were promised interest rates between 27% to 50% on a non-existing fish farm investment. Subsequently, others emerged in the form of gold securities to swindle away huge over $5,000,000 from households.

According to Harvard Business School, "A Ponzi scheme is an investment fraud in which clients are promised a large profit at little to no risk. Companies that engage in Ponzi schemes focus all of their energy into attracting new clients to make investments. This new income is used to pay original investors their returns, marked as profit from a legitimate transaction. Ponzi schemes rely on a constant flow of new investments to continue to provide returns to older

[1]https://imaniafrica.org/2017/09/08/case-ghanas-disappearing-banks-test-regulatory-maturity/,https://citinewsroom.com/2018/08/blame-bog-for-collapse-of-banks-pef-boss/, https://www.bloomberg.com/news/articles/2020-02-05/ghana-ex-finance-chief-faces-graft-charges-after-banking-crisis,https://www.modernghana.com/news/950990/bog-previous-govt-blamed-for-banking-crisis.html,https://thebftonline.com/2018/business/banking-finance/bog-partly-to-blame-for-banks-collapse-dr-atuahene/,https://mobile.ghanaweb.com/GhanaHomePage/business/Alex-Mould-writes-Banking-Crisis-Part-1-Bank-of-Ghana-is-to-blame-749635

investors. When this flow runs out, the scheme falls apart." The operations and dealings of these PFI's in Ghana is similar to the above quote. The PFI's in Ghana initially started by applying for licenses to operate as financial institutions. Their business model was to simply attract deposits by promising unsustainable returns on savings. In some cases, however, victims of some of these financial institutions were allowed to even negotiate their returns, conditional on the amount of deposits. Over the period however, these initial depositors benefited from these schemes by earning high returns on their savings. This therefore attracted new depositors to save with these same financial institutions. They eventually run out of liquidity and are unable to sustain the business model, hence the beginning of the end. Based on alarming number of households complaining to authorities, the government of Ghana decided to institute investigation into the actions of these PFI's. thereafter, the findings led to initial revocation of licenses and subsequent collapse of some of these PFI's. This came with huge loses of deposits as enumerated in appendix A. In summary, PFI's lured households by promising unsustainable returns to savings. In the short run, household savings behavior was affected by these PFI's, increasing savings over the period while the long term effects erodes public confidence in the financial sector in Ghana.

This is more fascinating because state institutions and governing bodies colluded with these private investors with the intention of benefiting through funding individual political activities. Random licenses were issued to them to operate in different regions of Ghana. This is not different from the model indicated in Artzrouni and Artzrouni (2009) where they show a business model based on a promise of interest returns beyond the prevailing rates. These promised rates are however unrealistic and cannot be sustainable in the short to medium term. Further from this paper, the case in Colombia was analyzed in Hofstetter et al. (2018) where a similar business model was

underscored. Vulnerable households in Colombia were promised juicy returns if and only if they agreed to invest in selected institutions. Eventually, the commercial banking sector was gravely affected as savings dropped over time in the formal financial institutions.

Allen et al. (2016) came in with a timely empirical work to analyze the importance of enhancing prudential standards and financial regulations following the US financial crisis. In their paper they identify that while the goal of using regulations to maintain financial stability is clear enough, it is however unclear on how to design an effective regulation to maintain this stability while promoting financial innovation and development. Inferring from these papers, it seems to becoming apparently clear that there is a lag between the financial sector and stringent regulations put in place by the government of Ghana. According to BOG in 2017, poor corporate governance has led to a substantial loss of savings and investments of households. The Bank of Ghana further listed out a number of fraudulent financial institutions, cautioning individuals, especially in their transactions in the financial space. This systemic challenges in the financial sector have caused a substantial loss of confidence among economic agents relative to genuine financial institutions.

This paper simply investigates the impact of these PFI's on household savings. I rely on rounds of survey data jointly collected by the World Bank and Ghana Statistical Service. And I employ a difference-in-differences (DID) estimation technique to measure the impact.

In summary, three key reasons motivated this research paper. First, the establishment of micro-finance institutions (MFI's) is to serve as a cushion to start-up businesses and ideas, hence micro-credit provision. But in the case of Ghana in recent past, these MFI's override their mandate and assumed the role deposit collection institutions to generate savings from households. Secondly, they introduced an unsustainable business model which focused on attracting deposits

from households by simply promising unrealistic returns depending on the amount of deposit. Many other financial institutions later joined this approach to generate savings, targeted at gullible households. And finally, just when the business model bubbled, it was evident that households who significantly deposited their monies with these PFI's lost their funds. To them, it was simply an investment negotiation, hence, expected returns. But to the government and supervisory bodies, it was deposits/savings made by gullible households based on unsustainable model. Quantification of these losses were made and validated by PricewaterhouseCoopers (PWC) and has so far reported a total amount of $1.2 billion in deposit losses, 2% of Ghana's GDP as of 2019. IMF has further indicated that Ghana would need a total of 22 billion Ghana cedis ($4.4 billion) to clean up the entire financial sector as a result of the mess in recent years.

The findings suggest that the activities of these PFI's influenced all households to increase their average annual savings by 502.00 Ghana cedis ($125). Further evidence shows that the non-poor income group also increased their savings by 414.50 Ghana Cedis ($103.63). It is interesting to note that urban dwellers increased their annual savings by 914.30 Ghana Cedis ($228.57) as against rural households. . The results in this paper were further strengthened by series of robustness checks.

1.1.2. The PFI Set-up and Issue of Self Selection

Ideally, the registration of all financial institutions begins with BOG, with its office located in the Greater Accra Region, since Ghana runs a centralized governance architecture. And this regional capital is the heart of government business and location of all state institutions. These investors are then basically randomly assigned to region of operation based on the modalities agreed upon. Accordingly, it is impossible for these investors to unilaterally choose a region of

operation. Secondly, the investors then liaise with local authorities in various regions to commence operations with the intention of reaching out to the market pool. Specifically, chiefs, assembly men/women, youth leaders, and influential stakeholders in these regions are consulted to assist in the settlement and establishment process. Obviously, Ghana runs on both democratic processes and traditional institutions. Therefore, investors cannot firmly establish in any region without first of all seeking the prior endorsement and blessings of the chiefs, in some cases, authorities within recognized kingdoms. These chiefs and traditional authorities then hold a durbar to introduce incoming investors as a sign of good faith. Households are then misled into trusting these investors and buying into their business model.

In effect, the issue of self-selection is impossible to establish, given the processes involved. Even if you bribe your way at the political level, traditional authorities may expose you within a desired region of operation. For example, There have been several situations where the president appoints a regional minister of state and the chief/king within the region rejects the appointment of this individual(s). In the worst case, the president would have to reassign the minister of state to a different region. Very recently, as of 01/07/2020, a new managing director for CAL BANK, Mr. Philip Owiredu had to go seek the blessings and approval of the King of the Ashanti Kingdom before beginning to exercise his responsibilities, although CAL BANK is solely a private institution. And thirdly, even after the acceptance and approval in a specific region, the investors would need supervisory approval to randomly open branches in neighboring regions. For instance, it is the case that a PFI like DKM Financial services began its operation in Brong-Ahafo Region and later spread across Ashanti, Northern, Upper East, and the Upper West Regions of Ghana. This is to point out that the choices of these investors do not necessarily reflect the final destination. A

number of factors determine regional establishment to operate. There is no single investor who gets to self-select into a region of choice. Even if approved by the regulatory authorities, the traditional processes would have to be satisfied to begin operations. This makes issue of selection into treatment regions very difficult.

Bank of Ghana as of 2017 collected data based on reported losses of savings/deposits in the to these PFI's. In total, 899 financial institutions, comprising of 347 microfinance, 15 commercial banks, and the remaining cut across savings and loans, finance houses, rural banks, and other special deposit taking institutions. There are 10 regions in Ghana as shown in figure 1.2 under appendix A. The activities of these PFI's were partly located in the 10 regions, with 7 out of 10 showing huge losses. Based on these figures (number of PFI's per region, and estimated losses by BoG), I created a threshold to reflect the regional representation. The figures in the Appendix (Figure 1.1) also gives a breakdown of the financial sector in Ghana. There were a total of 1032 licensed institutions, and only 143 of them are currently active but in distress, while the remaining 889 have collapsed due to unsustainable business models as of 2016. I collected information from Bank of Ghana and classified the PFI's based on the location of their operation following the approach adopted by Hartarska and Nadolnyak (2008) . Bank of Ghana (2017) in its report further stated a percentage of 61.3% of deposits lost in the MFI sub-sector. To aid the design of my estimation technique, I constructed my treatment and control groups using the above information provided.

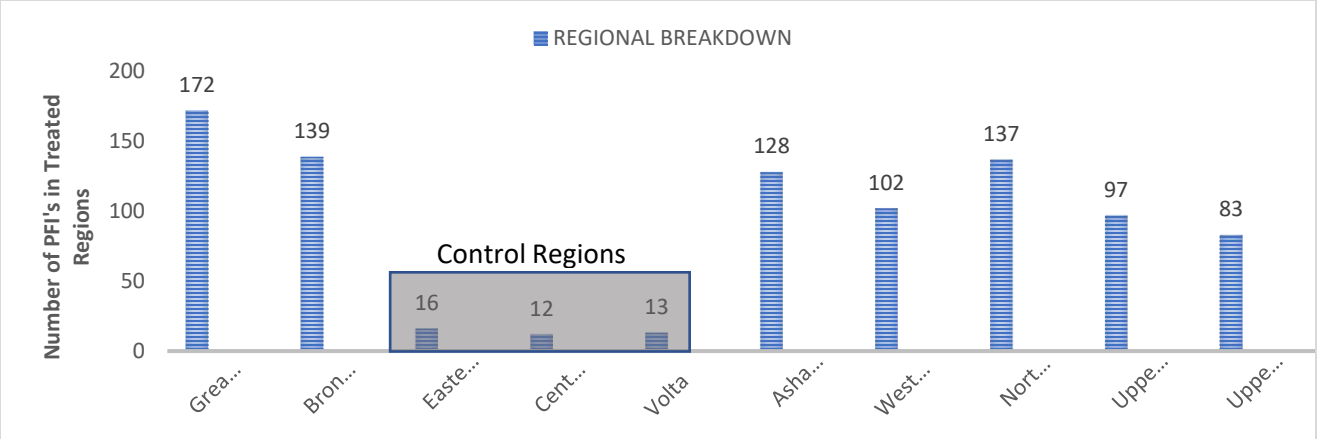

Figure 1.1.—Regional Breakdown of PFI's

1.2. Literature Review

This section focuses on throwing light on ponzi schemes and explain the genealogy of savings. Baidoo, Boateng, and Amponsah (2018) show that improvement in financial literacy among Ghanaians has the potential of increasing household savings if incorporated in a broad policy package. They further argued that financial literacy is a pre-requisite for household investment and sustainable financial growth. This simply means that education among households in Ghana is key to understanding savings and investment options. The import of this literature further underscores the target group of PFI's—gullible and uneducated households in most cases. According to Browning, Lusardi, and Browning (1996), savings among household in US continue to increase until they hit retirement then it begins to decline. The distribution of savings across income groups shows a positive correlation. Their paper also shows a positive correlation between savings and education. Education among household is therefore an important information tool to understand how the financial system works. Horioka and Walanabe (1997) in their paper show that households in Japan save for various reasons, and among these reasons are life-cycle motive,

precautionary, and the bequest motive. The life-cycle motive is to save to take care of temporary imbalances between income and expenditure. Households also save for precautionary reasons due to unforeseen contingencies. Other households also save in the interest acquiring assets/properties to leave behind for their children. In the case of Ghana however, households mostly save to take care of the life-cycle needs. Hence, almost all the incomes generated goes back into payment of household daily expenditures. Only a few savers, if not all, account for unforeseen contingencies and asset accumulation. The middle class are mostly found in this category. Another driving factor to household savings is the nearness to financial institutions or deposit collectors. Mel, Mcintosh, and Woodruff (2013) in their paper show that show that frequent face-to-face deposit collection by financial institutions leads to an increase in savings by households.

To understand the psychology of households towards savings, (Furnham 1985) shows that age and education mostly differentiates subjects' attitudes towards savings. The findings also clearly show that age, income, and alienation correlate with household attitude towards savings in Britain. But sex, age, and income were among the most discriminators of savings habit in Britain. In terms of access to financial institutions and how they impact on household savings culture, Burgess and Pande (2016) find that opening more branches of rural banks in unbanked locations help to reduce poverty levels through savings and credit availability. The licensing of more banks and financial institutions across various districts in India helped to improve savings and credit availability to households. The out-spring of financial institutions in the form of microfinance, savings and loans, and rural banks is significantly increasing in Ghana in the past decade, but most of these are associated with PFI's. BOG reports show an estimated number of over 350 microfinance institutions and other financial houses. However, microfinance institutions in Ghana

have vied from their core mandate of providing credit to households and businesses. They have rather focused on taking deposits and savings by luring households with juicy interest rates. This is the channel through which PFI's were hatched.

Tennant (2011) used an econometric model to examine the factors determining individuals' extent of exposure to Ponzi schemes. This paper finds that Ponzi investors are both gullible and heightened risk takers who are sometimes single managers and supervisors but lack education to understand how the financial system works. Government of different economies are supposed to put in strong measures to protect savings and investments of households. But this is unfortunately not the case in Ghana and most part of developing countries. In most cases, the owners of these financial institutions take advantage of the weakness of state institutions to perpetuate their agenda of swindling households. The world's largest investment fraud known as the Madoff investment fraud took advantage of people's ignorance and swindled clients with over 65billion dollars as for his arrest on December 11, 2008. This was admittedly the world's largest scam.

The size of the loss in Ghana may not be similar to Madoff scam, but the general impact can be felt across the ten regions in Ghana. The closest literature I have identified so far is by Hofstetter et al. (2018). They measure the impact of the operations of two Ponzi schemes in Colombia using a fixed effect identification strategy. Specifically, one of their measurements focused on the impact on savings. The nature of the Ponzi schemes was such that it diverted monies that could have been saved in the commercial financial institutions. Rather, these monies were invested with two ponzi firms in Colombia. They find statistical significance of decline in savings between the period of operation. Therefore, the operation of these Ponzi schemes impacted heavily on the financial sector. This is slightly similar to what my research question seeks to determine.

Governments around the world are tightening measures to protect the depositors, but this is not enough to put an end to this recurring phenomenon as long as individuals continue to fall for new tricks. Artzrouni (2009) describes the Ponzi scheme with a linear mathematical model. They show that, the model is based on unsustainable thresholds. These promised rates are unrealistic. The sustainability of these schemes depends on the withdrawal rate and new accumulated depositors over time.

1.3. Data And Summary Statistics

1.3.1. Data.

This research paper relies on rounds of survey data from the Ghana Living Standards Measurement Survey (GLSMS). The GLSMS is a household level survey established in 1980 by the World Bank in conjunction with Ghana Statistical service (GSS) to explore ways of improving the type and quality of livelihood for the purposes of informing policy and improving the wellbeing of Ghanaians. I used three rounds of the survey: 4 (1999), 5 (2006), and 6 (2013). I used all three rounds to construct my parallel trends assumption while I rely on only the last two rounds to construct my empirical model. These surveys contain relevant questions with a full section focused on financial institutions and services. Specifically, questions related to household savings were asked with total observation between 3,500 to 25,500.

It is however important to note that this dataset contains relevant questions such as household savings across different financial Institutions. Questions such as “Do you have a savings account?”, “How much have you added to your account in the last 12 months?” and “what is the

balance of your savings?", among many other questions. These questions are as relevant as the model in this paper. To properly construct my model, I had to reach out to authorities of BOG for detailed information of the regional operations of these PFI's. The survey also contains other relevant variables such as household income, wealth, consumption, employment, marital status, age, gender, household location, education, among many other useful variables to serve as controls.

1.3.2. Descriptive Statistics

As shown in tables 1, 2 and 3 respectively, the outcome variable used in this is represented by savings balance and is defined as the total prevailing balance in the savings account of household after accounting for deductions. I computed my summary statistics for the three different household groups by treatment and control regions: All Households, Non-Poor Households, and Poor Households respectively. For all households, it shows a difference in mean of savings of 364.74 Ghana Cedis ($91.18) in table 1. Table 2 and 3 show a difference in average savings of 312.18 Ghana Cedis ($78.05) and 101.03 Ghana Cedis ($25.25) for the non-poor and poor respectively. The total number of observations of savings balance is 9,848, 8,49, and 1,353 for all households, non-poor, and poor respectively. All of these figures show a statistical significance between the treatment and control group using a t-test. Other measures household savings used were previous savings of households and net savings. Savings @ t-1 (previous savings) shows a difference mean of 307.57 Ghana Cedis ($76.89), 255.42 Ghana Cedis ($63.85), and 68.58 Ghana Cedis ($17.14) for all households, non-poor, and poor respectively. And the net savings equally shows a statistically significance mean difference of 57.34 Ghana Cedis ($14.33), 56.80 Ghana Cedis ($14.20), and 32.42 Ghana Cedis ($8.11) respectively for all households, non-poor, and poor by treatment and control. On the average, prevailing deposit rates as reported by

BoG were not different and shows 10% and 11% respectively among all households, non-poor, poor groups. These rates are available from the world bank between the period 2005 and 2013. It is important to indicate that the operations of these PFI's was such that depositors negotiated their own rate of return subject to how much they were willing to save with these institutions. Thus, the prevailing interest rates only capture the official BoG interest rates over time, but not reflective of what rates of these PFI's. While total expenditure was statistically significant with varying mean, food expenditure on the other hand was not different between control and treatment groups among all the income groups. Household wealth was equally not statistically significant, but with a huge difference in averages. Both employment levels of households and their respective monthly income vary across treatment and control groups among the income groups, and statistically significant as well. Other control variables such as marital status, household size, mother's education, father's education, household education, the different age categories were all statistically significant with varying means across treatment and control groups in all three groups.

Table 1—ALL HOUSEHOLDS

Variables	N	Control Group		Treatment Group		P-value
		Mean	SE	Mean	SE	
Savings Balance	9,848	518.78	31.46	883.52	53.86	0.00
Savings @ (t-1)	9,842	483.59	41.43	791.16	65.97	0.02
Net Savings	9,844	35.49	33.83	92.83	64.85	0.66
Credit Acquisition	25,381	0.12	0.01	0.16	0.01	0.00
Total HH Income	25,459	3790.99	1032.26	6443.04	332.94	0.00
Total HH Wealth	17,097	5959.76	350.94	7238.10	491.02	0.14

HH Expenditur	25,459	5436.46	82.89	6555.21	54.37	0.00
Deposit Rate	25,459	11.18	0.02	10.99	0.01	0.00
HH Location	25,459	1.73	0.01	1.51	0.01	0.00
HH size	25,459	4.73	0.04	4.08	0.02	0.00
Gender	25,459	0.74	0.01	0.71	0.01	0.00
Food Expenditure	25,459	2070.67	27.21	2558.14	18.19	0.00
Housing Expenditure	25,459	320.22	11.14	486.90	10.69	0.00
Mother's Education	24,639	0.11	0.00	0.20	0.01	0.00
Father's Education	24,920	0.16	0.01	0.34	0.01	0.00
Household Education	24,925	0.19	0.01	0.37	0.01	0.00
HH Employment	25,450	0.78	0.01	0.86	0.01	0.00
Total-members between age-0-17	25,459	0.00	0.00	0.00	0.00	0.27
Total-members between age 18-40	25,459	0.38	0.00	0.46	0.01	0.00
Total-members between age 41-59	25,459	0.37	0.01	0.35	0.00	0.14
Total-members between age 60+	25,459	0.25	0.01	0.19	0.00	0.00
Age of Respondent	25,438	47.68	0.21	44.99	0.11	0.00
Marital Status	25,456	0.65	0.01	0.55	0.00	0.00
Monthly Income	16,055	422.94	43.93	369.08	10.73	0.08
Number of Children	25,446	2.62	0.02	2.25	0.01	0.00

Table 2—NON-POOR HOUSEHOLDS

Variables	N	Control Group		Treatment Group		P-value
		Mean	SE	Mean	SE	
Savings Balance	8,495	621.09	42.91	933.27	59.26	0.02
Savings @ (t-1)	8,489	582.12	58.33	837.54	72.63	0.13
Net Savings	8,491	39.48	49.19	96.28	71.46	0.73
Credit Acquisition	19,292	0.14	0.01	0.16	0.01	0.00
Total HH Income	19,353	5111.83	1756.44	7213.84	402.18	0.07
Total HH Wealth	13,145	7559.89	544.08	8207.17	591.98	0.58
HH Expenditur	19,353	7414.97	128.078	7314.25	64.26	0.49
Deposit Rate	19,353	11.25	0.02	10.98	0.01	0.00
HH Location	19,353	1.60	0.01	1.45	0.00	0.00
HH size	19,353	3.78	0.04	3.64	0.02	0.00
Gender	19,353	0.69	0.01	0.69	0.01	0.40
Food Expenditure	19,353	2867.06	39.96	2847.00	21.27	0.67
Housing Expenditure	19,353	470.20	18.32	562.30	12.94	0.00
Mother's Education	18,811	0.14	0.01	0.23	0.00	0.00
Father's Education	18,907	0.24	0.00	0.38	0.00	0.00
Household Education	18,887	0.27	0.00	0.41	0.00	0.00
HH Employment	19,345	0.80	0.00	0.85	0.00	0.00
Total-members between age-0-17	19,353	0.00	0.00	0.00	0.00	0.39
Total-members between age 18-40	19,353	0.42	0.00	0.47	0.00	0.00
Total-members between age 41-59	19,353	0.34	0.00	0.34	0.00	0.71

Total-members between age 60+	19,353	0.23	0.01	0.18	0.00	0.00
Age of Respondent	19,343	46.26	0.27	44.34	0.12	0.00
Marital Status	19,350	0.58	0.01	0.53	0.00	0.00
Monthly Income	13,336	492.67	55.96	399.39	12.24	0.01
Number of Children	19,349	1.98	0.03	1.89	0.01	0.02

Table 3—POOR HOUSEHOLDS

Variables	N	Control Group		Treatment Group		P-value
		Mean	SE	Mean	SE	
Savings Balance	1,353	298.22	34.43	399.25	32.78	0.03
Savings @ (t-1)	1,353	271.33	34.50	339.91	34.84	0.16
Net Savings	1,353	26.88	12.55	59.30	26.24	0.29
Credit Acquisition	6,089	0.08	0.01	0.13	0.01	0.00
Total HH Income	6,106	1927.76	226.84	3000.64	285.61	0.00
Total HH Wealth	3,952	3277.40	208.12	2905.30	449.08	0.51
HH Expenditur	6,106	2645.46	46.39	3165.34	43.98	0.00
Deposit Rate	6,106	11.08	0.02	11.04	0.02	0.36
HH Location	6,106	1.91	0.01	1.80	0.01	0.00
HH size	6,106	6.07	0.06	6.04	0.05	0.75
Gender	6,106	0.79	0.00	0.78	0.01	0.19
Food Expenditure	6,106	947.23	17.13	1268.10	16.75	0.00
Housing Expenditure	6,106	108.65	4.87	150.15	5.68	0.00

Mother's Education	5,828	0.06	0.00	0.07	0.00	0.07
Father's Education	6,013	0.04	0.00	0.13	0.00	0.00
Household Education	6,038	0.09	0.01	0.16	0.01	0.00
HH Employment	6,105	0.76	0.01	0.87	0.01	0.00
Total-members between age-0-17	6,106	0.00	0.00	0.00	0.00	0.31
Total-members between age 18-40	6,106	0.38	0.33	0.01	0.37	0.00
Total-members between age 41-59	6,106	0.38	0.01	0.39	0.01	0.31
Total-members between age 60+	6,106	0.27	0.01	0.23	0.01	0.00
Age of Respondent	6,095	49.68	0.30	47.93	0.25	0.00
Marital Status	6,106	0.76	0.00	0.68	0.01	0.00
Monthly Income	2,719	227.23	56.88	199.08	17.26	0.52
Number of Children	6,097	3.53	0.04	3.85	0.04	0.00

1.4. Identification Strategy And Variable Description.

1.4.1. Model specification

This paper employs a simple DID estimation strategy to investigate the impact of these PFI's on all household savings. The purpose of this sub-section is to explain the estimation technique used. It is worth indicating that the DID estimation technique removes potential time invariant differences between the treatment and control groups, and further eliminates time trends that are common to both. To satisfy an underlining requirement of

DID, I am able to check the parallel trends assumption by including survey data from 1999 to have a three wave—two pre and one post effect.

These institutions were randomly assigned and determined by a combination of factors as enumerated in the introduction. Whereas these institutions registered to commence business in one region, they eventually ended up operating in different regions due to other convoluting factors beyond their control. However, it is important to also state that these PFI's were significantly present in seven out of ten regions per figure 1.1. This conclusion was reached after using data sourced from BOG. A careful quantitative study of the reported losses and asset of these PFI's led to the construction of the treatment and control groups. Accordingly, it is possible to easily defend the issue of random placement since treatment was significantly exogenous. And it further makes it more plausible to study the impact of these PFI's on all households.

My dependent variable is household savings balance, which is defined in this paper as deferred consumption or any unspent amount of money deposited at any formal financial institution, other than home, with friends, or families, in the form of assets or property.

Equation 1 expresses my savings function as:

$S_{it} = f$ (hhwealth, realexfood, dirate, realextotal, education, hhsize, marstatus, employment, montlyincome) **(1)**

I therefore specify my general DID model as:

$$S_{it} = \beta_0 + \beta_1 PFI_{R_i} + \beta_2 T_{0\sim1} + \beta_3 PFI_{R_i} * T_{0\sim1} + \varepsilon_{it} \quad \textbf{(2)}$$

Where equation 2 specifies the general DID model without control variables, with my coefficient of interest as β_3.

In order to avoid any possible bias, I included potentially time varying control variables in my model as shown in equation 3.

$$S_{it} = \delta_0 + \delta_1 PFI_{R_i} + \delta_2 T_{0\sim1} + \delta_3 PF_{R_i} * T_{0\sim1} + X_{it}\beta + \mu_{it} \quad (\mathbf{3})$$

$$S_{it} = \delta_0 + \delta_1 PFI_{R_i} + \delta_2 T_{0\sim1} + \delta_3 PFI_{R_i} * T_{0\sim1} + \delta_4 dirate + \delta_5 hhwealth + \delta_6 realexpfood + \delta_7 realexptotal + \delta_8 educationmum + \delta_9 educationdad + \delta_{10} hhsize + \delta_{11} hhsize + \delta_{12} employment + \delta_{13} monthlyincome + \mu_{it} \quad (\mathbf{4})$$

Equation 4 captures my main model where dirate represents prevailing deposit rate, hhwealth is total household wealth, realexpfood is expenditure on food, educationmum and educationdad is a dummy variable measuring whether the mother or father is education or not, hhsize is household size, marstatus is a dummy variable measuring whether member of the household is married or not, employment is also a dummy measuring where whether household member is employed or not, and monthly income measures total household monthly income as well as total household income. This model was run at three different groups to reflect three hypotheses in this paper.

$$S_{it} = \delta_0 + \delta_1 PFI_{R_i} + \delta_2 T_{0\sim1} + \delta_3 PFI_{R_i} * T_{0\sim1} + \delta_4 dirate + \delta_5 hhwealth + \delta_6 realexpfood + \delta_7 realexptotal + \delta_8 hhsize + \delta_9 martstatus + \delta_{10} employement + \delta_{11} monthlyincome + \delta_{12} agecat_1 + \delta_{13} agecat_2 + \delta_{14} agecat_3 + \delta_{15} agecat_4 + \delta_{16} educationhh + \varepsilon_{it} \quad (\mathbf{5})$$

Equation 5 specifies the model I used for my robustness checks, where I introduced net savings instead of balance of savings. And further introduced other control variables. Also, agecat_1 is members of the household between the ages 0-17years, agecat_2 is members between the ages 18-40years, agecat_3 members between the ages 41-59years, and members of household with the age 60+ years.

Again, my coefficient of interest is $\boldsymbol{\delta_3}$, and if it is statistically significant, then the presence of PFI's affected savings behavior of poor households. And further, I check for what subgroup of savers is statistically significant (non-poor and poor). I run my DID by conditioning my model on all households, non-poor households, and poor households respectively. This allows for a better measure within different income brackets, given the activities of these PFI's.

1.4.2 Variable Description And Measurement

S_{it} is household savings, which is measured by the prevailing balance in the household savings account. This variable is already part of the survey question. This gives the total balance of savings in household account. PFI_{R_i} is a regional dummy of Ponzi-Financial Institutions used as the treatment variable. I assign 1 to if there PFI's in any of the 10 regions, and 0 otherwise. $T_{0\sim1}$ measures the time of operation, which takes the value 1 if the year is 2013 (presence of PFI's) and 0 if the year is 2006 (absence of PFI's). This defines my treatment and control variables. $PFI_{R_i} * T_{0\sim1}$ is the interaction term between the regional dummy and the year $T_{0\sim1}$. [2] PFI_{R_i} and $T_{0\sim1}$ are included separately to pick up the effect of being targeted against not being targeted. X_{it} is a matrix

[2] $R_i$subscript defines region $1-10$. $T_{0\sim1}$ measures the time of operation, which takes the value 1 if the year is 2013 (presence of PFI's) and 0 if the year is 2006 (absence of PFI's). $0\sim1$ is just a dummy definition.

capturing all other control variables that could be correlated with household savings. The variables such as age of households, household monthly income, gender, household education level, household size, expenditure on food, household employment status, marital status among many others as expressed equation (1). All these control variables were contained in the surveys at household levels and their measurement were based on the questions asked.

1.5. Test For Parallel Trends And Econometric Results

1.5.1. Test For Parallel Trends

A key assumption of DID estimation is that the trends in the outcomes without the treatment would have been the same in both the treatment and the control groups. This test is necessary condition for a DID methodology. Therefore, if the trends were the same in the pre-intervention periods, then it is likely that they would have been the same in the post intervention period if the treated regions had not experienced PFI's. In this section I show three different graphs capturing the test for parallel trends assumption. I followed the approach employed by Chakrabarth et al (2018) where they only include a lagged survey year to test for the parallel trends even though they do not include that year in their main model. In my case, I only included 1999 survey from GLSS round 4. So, I used 1999 (pre-PFI's period), 2006 (pre-PFI's period) and 2013 (post-PFI's period). As can be depicted in the three diagrams (figure 1.4, 1.5, and 1.6) below, the parallel trends condition is valid and holds for all households, non-poor, and the poor households, respectively. This trend strengthens the construction of the DID estimation results and gives a better plausibility of the impact measured. It is evident from all three graphs that household savings were moving in the same direction prior to the introduction of the PFI's and took a sharp spike upwards after the

introduction. It is more imperative to assert an unusual development in the financial sector. Obviously, the evidence from the parallel trends could only further strengthen the justification of random selection and removes all doubts regarding issues of selection bias.

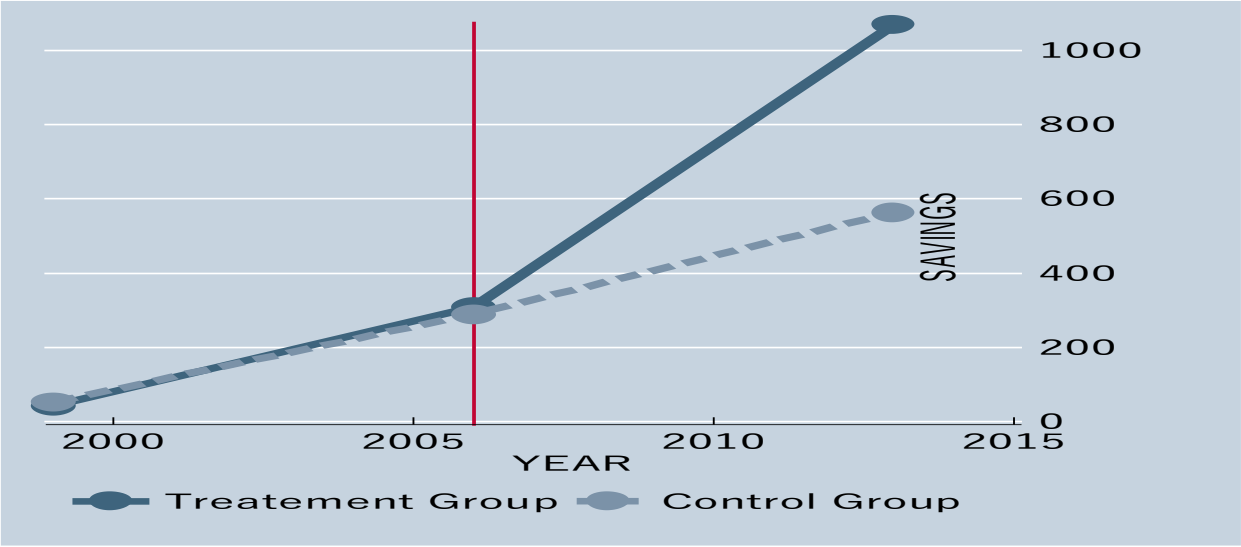

Figure 1.4—Parallel Trends Assumption For All Households

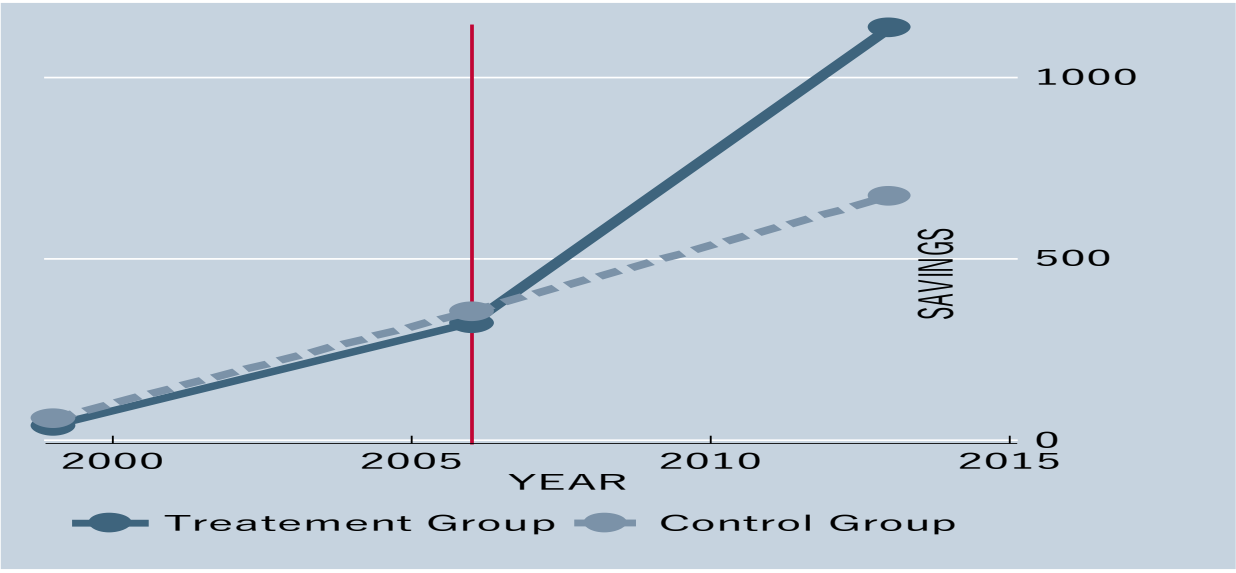

Figure 1.5—**Parallel Trends Assumption For Non-Poor Households**

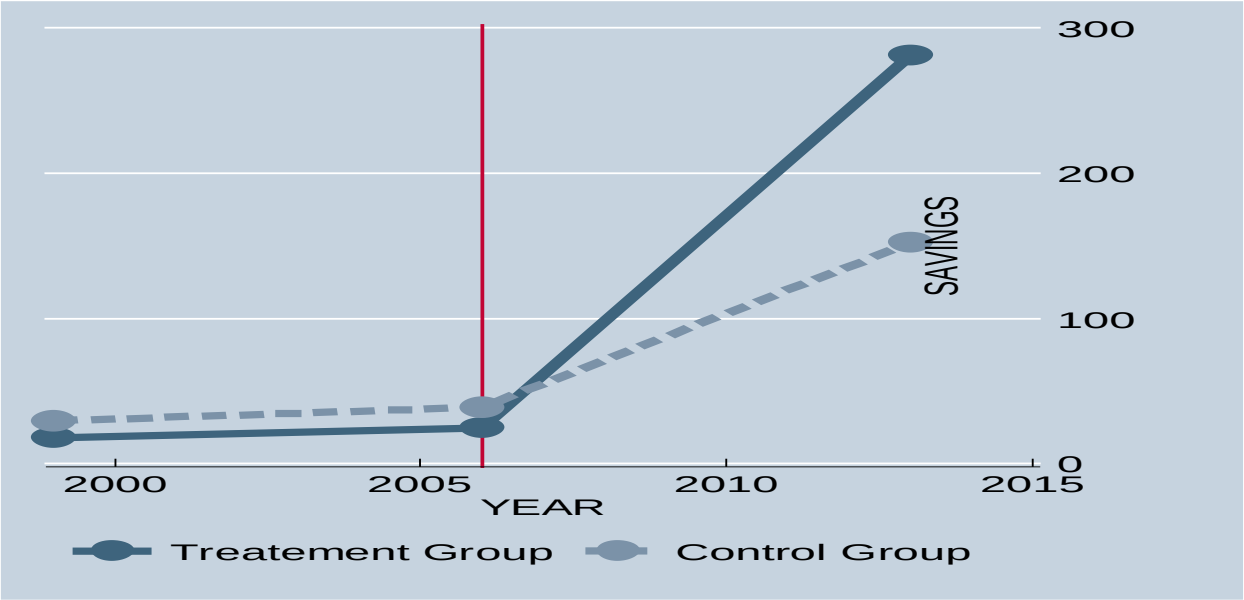

Figure 1.6—Parallel Trends Assumption For Poor Households

1.5.2. Econometric Results

In this section, I present and discuss the empirical results of the different DID specifications. The three columns of table 4 below show results of different groups of households with homogenous control variables. As indicated earlier, the import of this paper is to measure the impact of the activities of these PFI's on savings of household, and for which group significantly, the first column of table 4 shows the results of my general specification, while columns 2, 3, and 4 report the results of the main model. In column 1 the coefficient of PFI*Time measuring the impact of PFI's on household savings is positive and significant at 1% for all households. This shows that the activities of these PFI's increased household savings, even without controlling for household demographics. My main results as reported in columns 2 show that the introduction of the PFI's in Ghana caused all households to increase their average savings level by 502.00 Ghana Cedis ($125.50) per annum at 1% level of significance. For the purposes of heterogeneity, I rerun

my main model to capture different income groups. Column 3 however shows fascinating results for non-poor group. On the average non-poor income group increased their savings by 414.50 Ghana Cedis per annum ($103.63). This was equally statistically significant, but at 5%. The poor income group however did not show any significance using my specified model, albeit the evidence produced from the graphical representation. It is important to note that the results of this model were run on regional clustering as a necessary estimation condition in DID. And these results further indicate that although the activities of the PFI's impacted on all households, the non-poor group were impacted against the poor income group. And this makes sense obviously from the context of ability to save by these income group. The non-poor by far has the capacity to consume and save a portion of their income relative to the poor. Evidence from table 4 further shows that household's ability to save more due to PFI's is negative related to their credit acquisition. In all cases, household's previous savings is positively related to the household's savings with these PFI's. Therefore, if the household saved more in the previous period then their savings with the PFI's also increases. Furthermore, total household income, total household wealth, and deposit rates in column 2, 3 and 4 are positively related to household savings and statistically significant. This is also consistent with literature and safe to highlight that the household ability to save more with the PFI's is dependent on both their asset and income streams, ceteris paribus. The size of the household also lays a significant role in this paper. A decrease in household size relatively increases the household's ability to save more with these PFI's and vice versa. In this paper I also control for the region of operation of these PFI's and it shows households exposed to regional operations of these PFI's increased their savings relative to households not

exposed. The regional variable is a dummy created to capture 1 if household is within the region of operation, and 0 otherwise.

The most fascinating part of this results is the location of household which is measured by rural/urban. To better understand the nature and impact of these PFI's on household, I created a rural/urban dummy which takes the value 1 if household is within rural area and 0 otherwise. It is interesting in columns 2 and 3 that households dwelling within the urban area increased their savings relative to their counterparts in the rural areas. This result will further be explored and discussed as presented in table 7 under robustness checks. It is however unclear whether these PFI's targeted urban areas but there is enough evidence to suggest that the activities of these PFI's is evident across areas.

1.5.3. Proof of econometric results

From equation (4), my coefficient of interest is δ_3. To mathematically measure the effect of PFI's, we have to take the expected value as follows:

$$\hat{\delta}_3 = \left[\hat{E}\left(S_{it}\middle|PFI_{R_i}=1, T_{0\sim1}=1\right) - \hat{E}\left(S_{it}\middle|PFI_{R_i}=0, T_{0\sim1}=1\right)\right] -$$

$$\left[\hat{E}\left(S_{it}\middle|PFI_{R_i}=1, T_{0\sim1}=0\right) - \hat{E}\left(S_{it}\middle|PFI_{R_i}=0, T_{0\sim1}=0\right)\right] \qquad (\mathbf{4})$$

where PFI_{R_i} is a dummy takes 1 if PFI's were present in any of the 10 regions, and 0 otherwise. While $T_{0\sim1}$is a year dummy that takes 1 if PFI's were present in 2013 and 0 to measure their absence in 2006. I then use equation (4) to go through three steps;

Step 1:First part of equation (4) $\left[\hat{E}\left(S_{it}\middle|PFI_{R_i}=1, T_{0\sim1}=1\right) - \hat{E}\left(S_{it}\middle|PFI_{R_i}=0, T_{0\sim1}=1\right)\right]$

$$== (\delta_0+\delta_1+\delta_2+\delta_3) - (\delta_0+\delta_2) \xrightarrow{after\ cancelling\ out} \delta_1+\delta_3 \qquad (\mathbf{4a})$$

Step 2:Second part of equation (4): $\left[\hat{E}\left(S_{it}\middle|PFI_{R_i}=1,T_{0\sim1}=0\right)-\ \hat{E}\left(S_{it}\middle|PFI_{R_i}=0,T_{0\sim1}=0\right)\right]$

$$==(\delta_0+\delta_1)-(\delta_0)\xrightarrow{after\ cancelling\ out}\delta_1 \qquad (\boldsymbol{4b})$$

Step 3: Combing equations (4a) and (4b) $\xrightarrow{yields}(\delta_1+\delta_3)-(\delta_1)=\delta_3$.[3]

Table 4-- Main Results And Heterogeneity (Using Balance of Savings as Dependent Variable)

Variables	(1) General Model	(2) All Household	(3) Non-Poor Household	(4) Poor Household
PFI's	20.08	-252.5*	-100.1	-73.87
	(83.28)	(133.5)	(153.2)	(113.5)
Time	274.7*	-1,110***	-1,145***	-91.02
	(132.8)	(217.9)	(215.5)	(103.8)
PFI*Time	483.6**	502.0***	414.5**	152.8
	(163.0)	(151.2)	(201.9)	(104.6)
Savings @ (t-1)		0.327**	0.324**	0.765***
		(0.134)	(0.134)	(0.135)
Credit acquisition		-410.8***	-443.7**	-13.41
		(119.9)	(136.5)	(26.56)
Total household income		0.00193*	0.00193*	0.000577
		(0.000924)	(0.000938)	(0.00115)
Total household wealth		0.0128***	0.0128**	0.00193
		(0.00387)	(0.00411)	(0.00252)
Total household expenditure		0.0659**	0.0706**	0.00465
		(0.0243)	(0.0249)	(0.0134)
Deposit rate		148.8**	151.0**	38.87
		(60.78)	(65.04)	(22.96)
Rural/Urban		111.8**	109.2**	14.27
		(43.83)	(43.64)	(84.03)
Household size		-90.42***	-132.8***	9.365
		(22.49)	(29.91)	(7.249)
Region		**YES**	**YES**	**YES**
Gender		80.28	84.29	19.78

[3] The final analysis yields a δ_3 change in savings level by households as a result of the presence of PFI's in Ghana. And the coefficient of δ_3 can be observed from the corresponding values of PFI's*Time in table 4.

		(242.9)	(273.3)	(46.56)
Household education		-325.2**	-344.3**	-149.8*
		(289.0)	(299.1)	(108.2)
Household employment		-15.24	-18.19	18.04
		(113.8)	(134.6)	(52.44)
Age of respondent		4.929***	6.204**	4.122
		(8.853)	(10.21)	(2.824)
Constant	289.5***	-1,238	-1,303	-748.6*
	(76.10)	(973.4)	(1,118)	(333.4)
Observations	9,848	7,527	6,503	1,024
R-squared	0.006	0.222	0.220	0.647

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

1.6. Robustness Checks And Limitations

1.6.1. Robustness Checks

From the main results, my next task is to conduct robustness checks to test the validity of my results and how it withstands other measures. I simply rerun the same model with similar samples but used a different dependent variable in table 5. As indicated earlier, the choice of net savings as a dependent variable is consistent with literature since net savings of households is measured by the difference between what they added to their savings and what they withdrew from their savings. The results from column 1 and 2 of table 5 show the same results as that of columns 2 and 3 of table 4. This reinforces the validity of my results and further corroborates the evidence adduced in my main model. In table 6, I replaced total household income with monthly income. The results in table 6 does not significantly differ from the main results in table 4 and this further sustains the consistency of evidence adduced in this paper

It worth noting that the fascinating results of household location as earlier discussed features in a separate table. In table 7 I equally rerun my main model but this time around I replaced household income group with household location. Using this approach, columns 1 and 2 of the table shows that all households increased their savings on the average by 490.80 Ghana Cedis ($122.70) which is equally statistically significant and close to the results in table 4. Consisting with earlier results, urban dwellers were impacted more relative to their rural counterparts. The activities of the PFI's altered the savings behavior of urban households, hence they increased their savings by 914.30 Ghana cedis ($228.58). These tables, 5,6, and 7 below confirms the results in table 4, and further reinforces the validity of main results.

Table 5—Robustness Checks And Heterogeneity: Using Net Savings as Dependent Variable

Variables	(1) All Household	(2) Non-Poor Household	(3) Poor Household
PFI	-252.5*	-100.1	-73.87
	(133.5)	(153.2)	(113.5)
Time	-1,110***	-1,145***	-91.02
	(217.9)	(215.5)	(103.8)
PFI*Time	502.0***	414.5**	152.8
	(151.2)	(201.9)	(104.6)
Savings @ (t-1)	-0.673***	-0.676***	-0.235
	(0.134)	(0.134)	(0.135)
Credit acquisition	-410.8***	-443.7**	-13.41
	(119.9)	(136.5)	(26.56)
Total household income	0.00193*	0.00193*	0.000577
	(0.000924)	(0.000938)	(0.00115)
Total household wealth	0.0128***	0.0128**	0.00193
	(0.00387)	(0.00411)	(0.00252)
Total household expenditure	0.0659**	0.0706**	0.00465
	(0.0243)	(0.0249)	(0.0134)
Deposit rate	148.8**	151.0**	38.87
	(60.78)	(65.04)	(22.96)
Rural/Urban	111.8**	109.2**	14.27
	(43.83)	(43.64)	(84.03)
Household size	-90.42***	-132.8***	9.365
	(22.49)	(29.91)	(7.249)
Region	**YES**	**YES**	**YES**
Gender	80.28	84.29	19.78
	(242.9)	(273.3)	(46.56)
Household education	-325.2**	-344.3**	-149.8*
	(289.0)	(299.1)	(108.2)
Household employment	-15.24	-18.19	18.04
	(113.8)	(134.6)	(52.44)
Age of respondent	4.929**	6.204**	4.122*
	(8.853)	(10.21)	(2.824)
Constant	-1,238	-1,303	-748.6*
	(973.4)	(1,118)	(333.4)
Observations	7,527	6,503	1,024
R-squared	0.452	0.454	0.139

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6—Further Robustness Checks And Heterogeneity: Replacing Other Variables

Variables	(1) General Model	(2) All Household	(3) Non-Poor Household	(4) Poor Household
PFI	20.08	-285.5	-207.3	-50.17
	(83.28)	(170.5)	(228.6)	(164.2)
Time	274.7*	-973.0***	-969.0***	-164.8
	(132.8)	(174.2)	(195.5)	(115.8)
PFI*Time	483.6**	575.2**	545.6**	97.23
	(163.0)	(187.1)	(258.4)	(91.21)
Savings @ (t-1)		0.289*	0.288*	0.639***
		(0.135)	(0.135)	(0.196)
Credit acquisition		-484.4***	-508.6***	-136.5**
		(138.4)	(153.0)	(55.84)
Monthly Income		0.0792**	0.0798**	0.0277
		(0.0276)	(0.0281)	(0.0251)
Household Total wealth		0.0139	0.0138	0.0225
		(0.0108)	(0.0108)	(0.0203)
Food expenditure		0.151***	0.155***	-0.00911
		(0.0305)	(0.0299)	(0.0582)
Housing expenditure		-0.0749	-0.0739	0.0225
		(0.124)	(0.126)	(0.135)
Deposit rate		148.0*	146.7*	63.89**
		(69.03)	(73.17)	(20.55)
Rural/Urban		71.97	81.78	
		(101.7)	(112.9)	
Household size		-99.78	-120.8	56.70
		(96.30)	(106.9)	(31.35)
Age 18-40		635.2	700.9	421.0*
		(573.5)	(626.7)	(217.4)
Age 41-59		705.1*	789.0*	224.2*
		(361.3)	(388.4)	(119.7)
Region		**YES**	**YES**	**YES**
Gender		115.9**	126.8**	-49.87*
		(277.6)	(297.4)	(73.08)
Mother's Education		202.2	215.5	-63.46*

		(148.6)	(157.1)	(109.3)
Father's Education		-406.8**	-419.7**	-183.3*
		(274.1)	(280.0)	(134.7)
Household Employment		-193.0	-196.0	-42.21
		(270.6)	(296.7)	(209.8)
Number of Children		41.88	49.63	-46.39
		(133.5)	(152.1)	(38.36)
Constant	289.5***	-2,084	-2,224	-1,296*
	(76.10)	(1,408)	(1,530)	(589.5)
Observations	9,848	5,132	4,681	451
R-squared	0.006	0.158	0.157	0.525

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7—**Further Robustness Checks And Heterogeneity: Using Balance of Savings**

VARIABLES	(1) All Household	(2) Urban Dwellers	(3) Rural Dwellers
PFI	-227.0	-828.0***	613.9**
	(133.5)	(183.8)	(243.4)
Time	-1,144***	-982.8**	-332.1
	(216.9)	(346.5)	(315.1)
PFI*Time	490.8**	914.3**	-381.6
	(159.8)	(282.6)	(221.7)
Savings @ (t-1)	0.326**	0.0797**	0.573***
	(0.134)	(0.0329)	(0.127)
Credit acquisition	-399.9***	-178.4**	-626.5**
	(119.3)	(69.26)	(219.2)
Total household income	0.00193*	0.00277	0.00180
	(0.000923)	(0.00159)	(0.00103)
Total household wealth	0.0127***	0.00612**	0.0108***
	(0.00384)	(0.00195)	(0.00309)
Total household expenditure	0.0691**	0.0193	0.0739**
	(0.0249)	(0.0200)	(0.0286)
Deposit rate	142.8**	143.5**	129.6
	(59.95)	(45.31)	(113.6)
Rural/Urban	-106.9***	-28.42	-80.74***
	(26.93)	(24.88)	(16.34)
Household size	22.18	-11.96	17.00

	(13.17)	(20.58)	(19.89)
Region	**YES**	**YES**	**YES**
Gender	0.0196**	-0.00988*	-0.0236*
	(0.0463)	(0.0214)	(0.0612)
Mother's Education	-424.9**	-566.7**	-73.70*
	(249.7)	(540.5)	(97.17)
Father's Education	343.4	634.0	-95.60
	(283.7)	(486.8)	(189.0)
Household Employment	170.2	-311.5	637.0
	(394.8)	(207.7)	(615.0)
Age 18-40	255.1	40.09	357.2
	(260.1)	(173.8)	(433.3)
Age of 41-59	5.074	-6.868	14.18
	(8.949)	(4.682)	(12.97)
Poor/Non-Poor	405.7**	-133.7	340.9***
	(129.1)	(188.9)	(79.31)
Constant	-1,130	73.03	-2,305
	(967.8)	(467.7)	(1,653)
Observations	7,527	3,141	4,386
R-squared	0.222	0.077	0.336

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

1.6.2. Limitations

Inasmuch as I find the results very intriguing, I also recognize the limitations in this paper and that is exactly what my future development of this paper will focus on. Some of these challenges are the possibility of getting enough data to justify the construction of my DID model: Such as getting more data on years that precede the introduction of these PFI's to construct a more robust parallel trend. But I believe the parallel trends shown so far increases the plausibility of this paper. This paper only relies on a three-point rounds of survey. I intend to source more future data to study a longer trend. Another key challenge is how to further dismiss the issue of selection bias,

given the choice of regional distribution of these PFI's, although the narrative clearly shows that the treatment is sufficiently exogenous.

1.7. **Conclusions And Policy Recommendations**

The primary objective of this paper is to investigate the impact of PFI's on all household savings. And to further investigate for which income group was more impacted. In Ghana, fraudulent PFI's lured savers by promising unsustainable returns to their savings. Bank supervisory body colluded with ruling political party and allowed financial institutions to become Ponzi Schemes. In the short term, poor people's savings behavior was affected by these PFI's, increasing savings rate at the expense of total food consumption. Elasticities of savings to returns in the long run (post closure of fraudulent schemes) would be negatively affected.

The findings suggest that the activities of these PFI's influenced all households to increase their annual average savings by 502.00 Ghana cedis ($125). Further evidence shows that the non-poor income group also increased their average savings by 414.50 Ghana Cedis ($103.63). It is interesting to note that urban dwellers increased their annual savings by 914.30 Ghana Cedis ($228.57) as against rural households. . The results in this paper were further strengthened by a number of robustness checks.

Although the financial sector has experienced significant growth over the last decade, the recent infiltration of fraudulent activities has demonstrated how shocks can disrupt existing functioning systems and derail the gains made at improving access to financial institutions. In order for financial institutions in Sub-Saharan Africa to be resilient, research will need to keep pace with innovative approaches, while maintaining prudent international competitive standards

in the financial space. The government and supervisory agency would have to put in place urgent steps to mitigate effects of unforeseen infiltrations which has the tendency of eroding gains.

A. Appendix

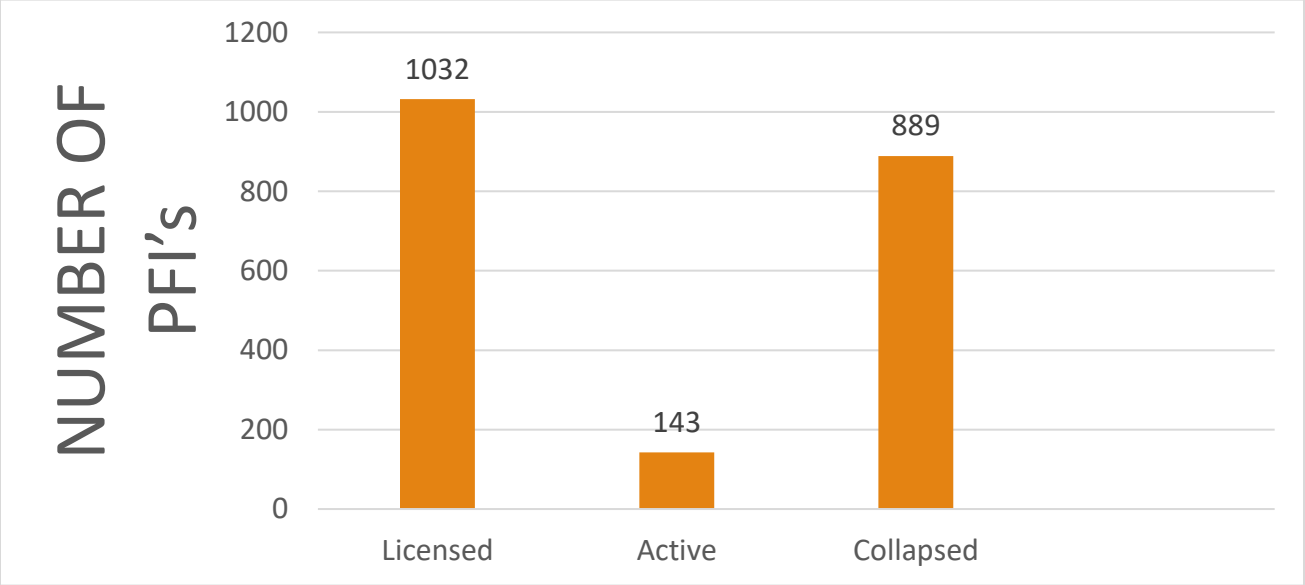

Figure 1.1: BREAKDOWN OF THE FINANCIAL SECTOR IN GHANA.

Figure 1.2: REGIONAL BREAKDOWN SHOWING TREATED AND CONTROL REGIONS.

Chapter 2

Post-Closure Of PFI's: A Triple Difference Approach To Estimating Impact On Household Savings.

2.1 Introduction, The Rise, and Closure of PFI's

The financial sector in Ghana plays the dual role of creating the enabling investment environment while including individuals on the broader income-expenditure spectrum. GLSS (2006 and 2013) has evidenced that households in Ghana have increasingly acquired savings account over time between the period 2006 and 2013. Opening of savings account has increased from 28% to 82% as of 2017. This unusual significant increase underscores a suspicious activity in the financial sector, which can certainly not be solely attributed to financial literacy or population growth. Obviously, opening of savings account has correlation with deposits.

Households within the middle class in Ghana save a portion of their income for either precautionary, life cycle, or future asset accumulation purposes. However, the government of Ghana has failed in its responsibility to put across prudential financial regulations to protect depositors. Bank of Ghana (BOG) supervisory body seemingly colluded with ruling political parties and allowed Microfinance Institution (MFI's), savings and loans institutions (S&L's), rural banks, and other formal banks to become Ponzi Schemes. It is however now clear that the operations and collapse of these PFI's in Ghana has further destabilized the financial sector, leading to loss of public confidence. The era of Charles Ponzi and Madoff sent a caution to economic agents in the United States of America. Hitherto, the recent ponzi schemes in Ghana through financial institutions is not the first of its kind. It started with "Pyram" and "R5" S&L's in 1995.

And later “US TILAPIA” in 2005, where victims were promised interest rates between 27% to 50% on a non-existing fish farm investment. Subsequently, others emerged in the form of gold securities to swindle away huge sums from households. These were however reported cases to financial authorities and the media with no documented figures.

In Ghana, PFI’s lured low-income savers by promising unsustainable returns to savings. In the short term, poor people’s savings behavior was affected by these PFI’s, increasing savings over the period. This is more fascinating because state institutions and political actors colluded with these private investors with the intention of benefiting through funding their political activities. Random licenses were issued to them to operate in different regions of Ghana. A number of gullible households negotiated their returns and proceeded to save monies regardless of the consequences. The earlier savers benefited, while the latter ones suffer the consequences of these fraudulent activities. This scheme is not different from the model indicated in Artzrouni (2009) where they show a business model based on a promise of interest returns beyond the prevailing rates. These rates were however unrealistic and could not be sustainable in the short to medium term. Further to this, the case in Colombia was analyzed in Hofstetter et al. (2018) where a similar business model was used. Households in Colombia were promised juicy returns provided they agreed to invest in established companies. Eventually, the formal banking sector was gravely affected as savings dropped over time in the formal financial institutions. This is not different from the case in Ghana as evidence adduced from this paper show a savings dip.

Allen et al. (2016) analyze the importance of enhancing prudential standards and financial regulations following the US financial crisis. In their paper they identify that while the goal of using regulations to maintain financial stability is clear enough, it is however unclear on how to

design an effective regulation to maintain this stability while promoting financial innovation and development. Inferring from this paper, there is a lag between the financial sector and the regulations put in place by the government of Ghana. According to BOG in 2017, poor corporate governance has led to a substantial loss of savings and investments of households. The Bank of Ghana further listed out a number of fraudulent financial institutions, especially in their transactions with households. This systemic challenges in the financial sector have caused a substantial loss of confidence among economic agents and genuine financial institutions.

This paper investigates the impact of the post-closure activities of these PFI's on all household savings and further delve into the two main income groups. I further This paper relies on a survey data jointly collected by the World Bank and Ghana Statistical Service. I follow the approach of Ravallion et al (2005) to employ a triple difference-in-differences (DIDID) methodology using the round 6 (2013) and 7 (2017) of the survey which randomly selected households across the ten regions of Ghana.

In summary, three key events motivated this paper. First, the establishment of MFI's are set up to be a support system to start-up businesses and ideas, hence credit provision. But in the case of Ghana in recent past, these MFI's override their mandate and assumed the role deposit collection institutions to generate savings from households. Secondly, the PFI's in general introduced an unsustainable business model which focused on attracting a lot of deposits from households by simply promising them an unrealistic return depending on how much they deposited. Many other financial institutions later joined this approach to generate savings in their respective institutions, targeted at gullible households. And finally, just when the business model bubbled out, it was evident that households who deposited significant amount of monies with these PFI's were at a

great loss, leading to a significant reduction in savings as this paper seeks to show. To them, it was just an investment based on negotiated interests, hence, they expected some returns overtime . But to the government and supervisory bodies, they were fraudulent deposits generated since there was no proof of contractual agreement or documented evidence of arrangements made with these gullible households. These loses are still being quantified by PricewaterhouseCoopers (PWC) and has so far reported a total amount of $1.2 billion in deposit losses, 2% of Ghana's GDP as of 2019. IMF has indicated that Ghana would need a total of 22 billion Ghana cedis ($4.4 billion) to clean up the entire financial sector as a result of the shake up in the financial sector in recent years.

The findings suggest that the post-closure of these PFI's altered household savings behavior, specifically, among all households and non-poor households. Evidence adduced from this paper shows that on the average, all households reduced their savings by 788.70 Ghana cedis ($157.00). Further evidence shows that the non-poor reduced their savings by 888.70 Ghana cedis ($222.18) while no changes were seen among the poor households. The results of this paper were further strengthened by a number of robustness checks with justifiable falsification test. This will be discussed into details under econometric results

2.1.1 The Rise And Closure Of PFI's

Bank of Ghana as of 2017 collected data based on reported cases of losses of deposits in the form of investments to these fraudulent schemes. In all, a total of 899 financial institutions, comprising of 347 microfinance, 15 formal banks, and the remaining cut across savings and loans, finance houses, rural banks, and other special deposit taking institutions. Figure 1.1 in the Appendix gives a further breakdown of the financial sector in Ghana. There are 10 regions in

Ghana as shown in figures in the appendix section. As of 2007 the operations of PFI's were randomly spread. The activities of these PFI's were significantly introduced in 7 out of 10. After the 2012 general elections it emerged that there were PFI's in the financial sector which later became a subject of debate in the political landscape. This subsequently began the collapse of these PFI's. Fast forward into the 2016 general elections, the issue of these PFI's resurfaced and the winner of the elections began the banking sector cleanup in 2017. Bank of Ghana (2017) in its report further stated a percentage of 61.3% of deposits were lost in the MFI sub-sector only. This is when the figures became clearer and more apparent. However, only 7 out of 10 had severe reported cases with huge losses. By the end of 2017, 4 out of the 7 significant regions had collapsed, leaving only 3 regions with PFI's still operating. Based on this, I classified my treatment regions as the four collapsed regions and the three as my control regions. I collected information from Bank of Ghana and classified the PFI's based on the location of their operation following (Hartarska and Nadolnyak, 2008).

2.2. Literature Review

This section focuses on giving a background knowledge of ponzi schemes and liken their impact on individual/household savings. Baidoo, Boateng, and Amponsah (2018) show t(hat improvement in financial literacy among Ghanaians has the potential of increasing household savings if incorporated in a broad policy package. They further argued that financial literacy is a pre-requisite for household investment and sustainable financial growth. This simply means that education among households in Ghana is key to understanding savings and investment options. According to Browning, Lusardi, and Browning (1996), savings among household in US continue

to increase until they hit retirement then it begins to decline. And the distribution of savings across income groups shows a positive correlation. Their paper also shows a positive correlation between savings and education. Education among household is an important information tool to understand how the financial system works. Horioka and Walanabe (1997) in their paper show that households in Japan save for various reasons, and among these reasons are life-cycle motive, precautionary, and the bequest motive. The life-cycle motive is to save to take care of temporary imbalances between income and expenditure. Households also save for precautionary reasons due to unforeseen contingencies. Other households also save in the interest acquiring assets/properties to leave behind for their children. In the case of Ghana however, households mostly save to take care of the life-cycle needs. Hence, almost all the incomes generated goes back into payment of household daily expenditure. Only a few savers account for unforeseen contingencies and asset accumulation. The middle class are mostly found in this category. Another driving factor to household savings is the nearness to financial institutions or deposit collectors. Mel, Mcintosh, and Woodruff (2013) in their paper show that show that frequent face-to-face deposit collection by financial institutions leads to an increase in savings by households.

To understand the psychology of households towards savings, (Furnham 1985) shows that age and education most differentiated subjects' attitudes towards savings. The findings also clearly show that age, income, and alienation correlate with household attitude towards savings in Britain. But sex, age, and income were among the most discriminators of savings habit in Britain. In terms of access to financial institutions and how they impact on household savings culture, Burgess and Pande (2016) find that opening more branches of rural banks in unbanked locations help to reduce poverty levels through savings and credit availability. The licensing of more banks and financial

institutions across various districts in India helped to improve savings and credit availability to households. The out-spring of financial institutions in the form of microfinance, savings and loans, and rural banks is significantly increasing in Ghana in the past decade, but most of these are associated with PFI's. BOG reports show an estimated number of over 350 microfinance institutions and other financial houses. However, microfinance institutions in Ghana have vied from their core mandate of providing credit to households and businesses. They have rather focused on taking deposits and savings by luring households with juicy interest rates. This is the channel through which PFI's were hatched.

Tennant (2011) used an econometric model to examine the factors determining individuals' extent of exposure to Ponzi schemes. This paper finds that Ponzi investors are both gullible and heightened risk takers who are sometimes single managers and supervisors but lack education to understand how the financial system works. Government of different economies are supposed to put in strong measures to protect savings and investments of households. But this is unfortunately not the case in Ghana and most part of developing countries. In most cases, the owners of these financial institutions take advantage of the weakness of state institutions to perpetuate their agenda of swindling households. The world's largest investment fraud known as the Madoff investment fraud took advantage of people's ignorance and swindled clients with over 65billion dollars as for his arrest on December 11, 2008. This was admittedly the world's largest scam so far.

The size of loss in Ghana may not be similar or close to that of Madoff investment, but the general impact can be felt across the ten regions in Ghana. The closest literature I have identified so far is by Hofstetter et al. (2018). They measure the impact of the operations of two Ponzi schemes in Colombia using a fixed effect identification strategy. Specifically, one of their

measurements focused on the impact on savings. The nature of the Ponzi schemes was such that it diverted monies that could have been saved in the formal financial institutions. Rather, these monies were invested with two ponzi firms in Colombia. They find statistical significance of decline in savings between the period of operation. Therefore, the operation of these Ponzi schemes impacted heavily on the formal financial sector. This is slightly similar to what my research question seeks to determine, except that I intend to use a difference-in-difference identification strategy to determine the impact of these PFI's on households.

Governments around the world are tightening measures to protect the deposits of households, but this is unfortunately not enough to put an end to this recurring phenomenon as long as individuals continue to fall for new tricks. Artzrouni (2009) describes the Ponzi scheme model with a linear mathematical model. They show that, the model is based on a promise return of interest rates more than it can deliver. These promised rates are unrealistic. The sustainability of these schemes depends on the withdrawal rate and new accumulated depositors.

2.3. Data And Descriptive Statistics

2.3.1 Data.

This research paper relies on a survey data from the Ghana Living Standards Measurement Survey (GLSMS). The GLSMS is a household level survey established in 1980 by the World Bank to explore means and ways of improving the type and quality of data collected by governments in developing countries for the purposes of informing policy. I used rounds 6 (2013), and 7(2017).

The round 7 is the latest available surveys, which makes it plausible to analyze the post-closure of the PFI's. I relied on these surveys to accurately construct my estimation strategy.

This survey contains relevant questions such as household savings across different financial Institutions. Questions such as "Do you have a savings account?", "How much have you added to your account in the last 12 months?" and "what is the balance of your savings?", among many other relevant questions on household credit acquisition. They survey also contains relevant household demographics which serves a control variable. Variables such as household income, total expenditure, marital status, age of household, number of children, age of respondent, household location, education levels, employment, among many others.

2.3.2 Descriptive Statistics

As shown in table 1, 2, and 3 respectively, the outcome variable, household savings is represented by the savings balance and defined as the amount of savings in the household account. In all I constructed descriptive statistics for all households, non-poor, and poor households respectively. All households have 11,648 total number of observations and the data shows a difference in mean of household savings balance of -287.07 Ghana Cedis (-$57.41) in table 1. Table 2 and 3 show a difference in average savings of -256.22 Ghana Cedis (-$51.24) and -173.10 Ghana Cedis (-$34.62) for the non-poor and poor with 10,295 and 1,353 number of observations respectively. These figures show varying statistical significance between the treatment and control groups. Net Savings and savings @ (t-1) also show a similar statistic except for slightly different magnitude. While total expenditure was statistically significant with varying mean, food expenditure on the other hand was not different between control and treatment groups among the income groups. Household wealth was equally not statistically significant, but with a huge

difference in averages. Both monthly income and employment levels of households vary across treatment and control groups among the income groups, and statistically significant as well. Other control variables such as marital status, household size, mother's education, father's education, household education, different age sub-groups were all statistically significant with varying means across treatment and control groups in all the three income groups.

Table 1—ALL HOUSEHOLDS

Variables	N	Control Group		Treatment Group		P-value
		Mean	SE	Mean	SE	
Savings Balance	11,648	1171.41	69.73	884.34	54.39	0.00
Savings @ (t-1)	11,647	1124.93	66.98	855.99	118.68	0.04
Net Savings	11,647	46.65	59.38	28.35	88.85	0.86
Credit Acquisition	22,234	0.09	0.00	0.08	0.01	0.03
Total HH Income	12,324	12983.08	736.36	6301.46	720.62	0.00
Total HH Wealth	12,055	9405.52	880.66	5527.32	530.29	0.00
HH Expenditur	22,277	12060.78	110.28	8433.62	70.56	0.00
Education Expenditur	22,277	1400.33	34.66	747.24	17.62	0.00
Health Expenditure	22,277	89.75	2.73	79.71	2.24	0.00
Deposit Rate	22,277	12.40	0.01	12.38	0.01	0.17
HH Location	22,277	1.35	0.01	1.62	0.01	0.00
HH size	22,277	3.59	0.02	4.46	0.02	0.00
Gender	22,277	0.68	0.00	0.72	0.01	0.00
Food Expenditure	22,277	5081.62	37.25	3690.42	31.07	0.00
Housing Expenditure	22,277	1193.29	25.14	636.24	15.06	0.00

Mother's Education	15,061	0.45	0.30	0.01	0.01	0.00
Father's Education	22,175	0.39	0.00	0.21	0.00	0.00
Household Education	22,220	0.41	0.00	0.23	0.00	0.00
HH Employment	22,220	0.85	0.00	0.88	0.00	0.00
Total-members between age-0-17	22,277	0.00	0.00	0.00	0.00	0.98
Total-members between age 18-40	22,277	0.47	0.00	0.42	0.00	0.00
Total-members between age 41-59	22,277	0.35	0.00	0.35	0.00	0.26
Total-members between age 60+	22,277	0.16	0.00	0.22	0.00	0.00
Age of Respondent	22,270	43.91	0.14	46.61	0.14	0.00
Marital Status	22,275	0.49	0.00	0.58	0.00	0.00
Monthly Income	10,726	655.49	17.02	508.19	19.54	107.6251
Number of Children	22,276	1.90	0.01	2.51	0.02	0.00

Table 2—NON-POOR HOUSEHOLDS

Variables	N	Control Group		Treatment Group		P-value
		Mean	SE	Mean	SE	
Savings Balance	10,295	1195.09	73.42	938.87	65.39	0.01
Savings @ (t-1)	10,294	1144.18	69.96	917.74	144.04	0.12
Net Savings	10,294	51.10	62.90	21.13	107.62	0.80
Credit Acquisition	18,066	0.09	0.00	0.09	0.00	0.62
Total HH Income	10,002	13910.37	797.44	7089.72	975.23	0.00

Total HH Wealth	9,857	10021.19	964.54	6653.18	709.71	0.00
HH Expenditur	18,101	12762.65	117.88	9839.12	90.55	0.00
Education Expenditur	18,101	1482.32	37.75	887.31	23.57	0.00
Health Expenditure	18,101	94.73	2.95	90.04	2.96	0.26
Deposit Rate	18,101	12.39	0.00	12.37	0.01	0.09
HH Location	18,101	1.31	0.00	1.54	0.01	0.00
HH size	18,101	3.41	0.02	3.75	0.02	0.00
Gender	18,101	0.67	0.00	0.69	0.01	0.01
Food Expenditure	18,101	5340.17	39.46	4255.12	39.63	0.00
Housing Expenditure	18,101	1275.31	27.33	786.83	20.23	0.00
Mother's Education	12,528	0.47	0.30	0.34	0.00	0.00
Father's Education	18,042	0.41	0.00	0.26	0.00	0.00
Household Education	18,071	.43	0.01	0.28	0.00	0.00
HH Employment	18,071	0.43	0.00	0.28	0.00	0.00
Total-members between age-0-17	18,101	0.00	0.00	0.00	0.00	0.86
Total-members between age 18-40	18,101	0.48	0.00	0.44	0.00	0.00
Total-members between age 41-59	18,101	0.35	0.00	0.33	0.00	0.04
Total-members between age 60+	18,101	0.15	0.00	0.21	0.00	0.00
Age of Respondent	18,097	43.63	0.15	45.86	0.17	0.00
Marital Status	18,099	0.48	0.00	0.54	0.00	0.00
Monthly Income	9,352	672.56	17.91	558.46	23.729	0.00
Number of Children	18,101	1.74	0.01	1.95	0.02	0.00

Table 3—POOR HOUSEHOLDS

Variables	N	Control Group		Treatment Group		P-value
		Mean	SE	Mean	SE	
Savings Balance	1,353	807.60	170.40	634.50	48.20	0.18
Savings @ (t-1)	1,353	829.25	214.15	573.09	56.65	0.11
Net Savings	1,353	-21.64	102.79	61.41	53.20	0.43
Credit Acquisition	4,168	0.11	0.01	0.07	0.01	0.00
Total HH Income	2,322	4053.80	1461.63	4143.73	351.80	0.93
Total HH Wealth	2,198	3167.18	721.65	2341.16	288.471	0.21
HH Expenditur	4,176	4671.57	88.19	4648.88	50.00	0.82
Health Expenditur	4,176	37.31	4.42	51.88	2.23	0.00
Education Expenditur	4,176	537.14	26.65	370.04	12.12	0.00
Deposit Rate	4,176	12.47	0.02	12.42	0.01	0.09
HH Location	4,176	1.76	0.01	1.84	0.01	0.00
HH size	4,176	5.48	0.09	6.38	0.05	0.00
Gender	4,176	0.71	0.01	0.78	0.01	0.00
Food Expenditure	4,176	2359.55	49.58	2169.79	28.50	0.00
Housing Expenditure	4,176	329.71	17.58	230.72	7.60	0.00
Mother's Education	2,533	0.20	0.01	0.16	0.00	0.07
Father's Education	4,133	0.19	0.01	0.09	0.00	0.00
Household Education	4,149	0.20	0.01	0.09	0.00	0.00
HH Employment	4,170	0.89	0.01	0.89	0.00	0.72
Total-members between age-0-17	4,176	0.00	0.00	0.00	0.00	0.98
Total-members between age 18-40	4,176	0.368	0.01	0.35	0.00	0.39

Total-members between age 41-59	4,176	0.44	0.01	0.39	0.00	0.01
Total-members between age 60+	4,176	0.19	0.01	0.25	0.00	0.00
Age of Respondent	4,173	46.80	0.49	48.64	0.27	0.00
Marital Status	4,176	0.58	0.01	0.70	0.01	0.00
Monthly Income	1,374	438.22	50.02	294.99	17.38	0.00
Number of Children	4,175	3.616	0.08	4.02	0.05	0.00

2.4. Identification Strategy And Variable Description.

2.4.1 Model specification

This paper employs a DIDID estimation strategy to investigate the post-collapse impact of PFI's on savings of all households in the urban area as against those in the rural areas. I choose this method because it is more robust than the simple DD and does not require the satisfaction of parallel trends assumption to justify exogeneity. For the avoidance of doubt however, I account for differences between rural households and the urban dwellers by running a double difference estimation as shown in equation 2. This is to exclude the possibility of similarity that rural households and the urban savings are subject to systematically different changes that have nothing to do with the PFI's as empirically shown in my first chapter. Therefore, having untreated households in other areas allows us to take out this potential household savings trend among rural households that might be different from the household's savings trend among urban households. And

this further makes it more plausible to study the post-closure impact of these institutions between all households and non-poor. Given that these PFI's collapsed in the post 2016. I can simply construct time dummies of 1 if a PFI collapsed in the region of treatment and 0 otherwise. Out of the seven regions in the previous paper that experienced the infiltration of PFI's, three collapsed as of 2017. These three regions became my treatment group while the remaining four serve as control group. The breakdown of these regions can be found in figure 1.4 under appendix.

The DIDID method potentially accounts for the unobserved trends in household savings across the urban and rural areas and the changes in savings of both poor and non-poor households in the treatment regions. In effects, my treatment will still be the effect of the PFI's on households in the urban area relative to those in the rural areas respectively.

My dependent variable is household savings, which is defined in this paper as deferred consumption or any unspent amount of money deposited at any formal financial institution, other than home, with friends, or families, in the form of assets or property.

Equation 1 expresses my savings function with control variables as:

S=f(hhwealth,realexfood,realexhealth,realexedu,dirate,realextotal,educationmum, educationdad,hhsize,marstatus,employment,montlyincome,agecat_1…..5) **(1)**

I then specify my general DID and DIDID model respectively:

$$S_{it} = \delta_0 + \delta_1 PFI_{R_i} + \delta_2 T_{0\sim1} + \delta_3 PF_{R_i} * T_{0\sim1} + X_{it}\beta + \mu_{it} \quad (\mathbf{2})$$

$$S_{it} = \gamma_0 + \gamma_1 PFI_{it} + \gamma_2 Time_{it} \gamma_3 urban/rural_i + \gamma_4 PFI_{it} * Time_{it} + \gamma_5 PFI_{it} * urban/ rural_i + \gamma_6 Time_{it} * urban/rural_i + \gamma_7 PFI_{it} * Time_{it} * urban/rural_i + \varepsilon_{it} \quad (3)$$

Where equation (2) specifies my general DID and equation (3) model and my coefficient of interest is δ_3 and γ_7 respectively.

And in order to avoid any possible bias, I included potentially time varying control variables in my second model as shown in equation 4.

$$S_{it} = \beta_0 + \beta_1 PFI_{it} + \beta_2 Time_{it} + \beta_3 urban/rural_i + \beta_4 PFI_{it} * Time_{it} + \beta_5 PFI_{it} * urban/ rural_i + \beta_6 Time_{it} * urban/rural_i + \beta_7 PFI_{it} * Time_{it} * urban/rural_i + X_{it} + \mu_{it} \quad (4)$$

In the case of equation (4), the coefficient of interest is $\boldsymbol{\beta_7}$, and if this is statistically significant, then the post-closure of these PFI's affected savings behavior of all households. And further to this, I check for what subgroup of savers is statistically significant (non-poor or poor households). I run my DIDID by conditioning my model on households in urban/rural areas. This allows for a better measure of the impact on the location of households.

2.4.2 Variable Description And Measurement

S_{it} is household saving, which is measured by the balance in a household savings account. PFI_{it}= Ponzi-Financial Institutions used as the treatment variable and measured by checking if there were PFI's in the region or not. That is, all the fraudulent financial institutions located in the seven regions of my treatment group (see figure 1.1 and 1.2). $Time_{it}$ measures the year of

operation. It represents the year within which the PFI's operated and the year where there were no PFI's in my treatment and control regions respectively. $urban/rural_i$ is a dummy which takes the value of 1 if household lives in the urban area within the region of treatment, and 0 otherwise. This was included to ensure that the effect of the PFI's on the households in urban area relative to those in the rural centers. $PFI_{it} * Time_{it}$ is the interaction term between the program dummy and the time **,** where t=1 . . .n. $PFI_{it} * urban/rural_i$ is included to show an interaction between the PFI's and the household location, the rural folks relative to the rural folks. $Time_{it} * urban/rural_i$ is equally an interaction between year of operation and the location of the household. Also, $PFI_{it} * Time_{it} * urban/rural_i + X_{it}$ is the main interaction term that expresses the main parameter of DIDID. It captures the interaction of PFI's within the region and year of treatment as well as the location of the household (urban/rural). X_{it}= is a matrix capturing all other control variables that could be correlated with household savings. Such as age of household, household monthly income, gender, household education level, household size, expenditure on food, household employment status, marital status among many other relevant covariates. All of these control variables were contained in the surveys.

$$S_{it} = \psi_0 + \psi_1 PFI_{it} + \psi_2 Time_{it} + \psi_3 urban/rural_i + \psi_4 PFI_{it} * Time_{it} + \psi_5 PFI_{it} * urban/rural_i + \psi_6 Time_{it} * urban/rural_i + \psi_7 PFI_{it} * Time_{it} * urban/rural_i + \psi_8 dirate + \psi_9 sumeducationmum + \psi_{10} sumeducationdad + \psi_{11} hhsize + \psi_{12} summarstatus + \psi_{13} sumhhemployment + \psi_{14} sumhhmonthlyincome + \psi_{15} realexpfood + \psi_{16} realexphealth + \psi_{17} realexped + \psi_{18} realtotal + \varepsilon_{it} \quad (5)$$

Equation 5 is my main regression model where dirate represents annual deposit rate, hhwealth is total household wealth, realexpfood is expenditure on food, educationmum measures whether mother is educated or not, educationdad is whether father is educated in the household, hhsize is household size, marstatus is a dummy variable that takes the value 1 if married and 0 otherwise, employment is also a dummy variable that takes the value 1 if household is employed and 0 otherwise, and monthly income measures total household monthly income. This model was run at three separate levels for the purposes of the investigations of this paper.

$$S_{it} = \eta_0 + \eta_1 PFI_{it} + \eta_2 Time_{it} + \eta_3 urban/rural_i + \eta_4 PFI_{it} * Time_{it} + \eta_5 PFI_{it} * urban/rural_i + \eta_6 Time_{it} * urban/rural_i + \eta_7 PFI_{it} * Time_{it} * urban/rural_i + \eta_8 dirate + \eta_9 sumeducationmum + \eta_{10} sumeducationdad + \eta_{11} hhsize + \eta_{12} summarstatus + \eta_{13} sumhhemployment + \eta_{14} sumhhmonthlyincome + \eta_{15} realexpfood + \eta_{16} realexphealth + \eta_{17} realexpedu + \eta_{18} realexptotal + \eta_{19} sumagecat_1 + \eta_{20} sumagecat_2 + \eta_{21} sumagecat_3 + \eta_{22} sumagecat_4 + \mu_{it} \quad (6)$$

Equation 6 specifies the model I used for my robustness checks, where I replace savings balance with net savings and further introduced other covariates. Also, agecat_1 is members of household between the ages 0-17years, agecat_2 is members of household between the ages 18-40years, agecat_3 is members of household between the ages 41-59years, and agecat_4 represents members of household age 60+years.

$$S_{it} = \psi_0 + \psi_1 PFI_{it} + \psi_2 Time_{it} + \psi_3 urban/rural_i + \psi_4 PFI_{it} * Time_{it} + \psi_5 PFI_{it} * urban/rural_i + \psi_6 Time_{it} * urban/rural_i + \psi_7 PFI_{it} * Time_{it} * urban/rural_i + \psi_8 dirate +$$

$$\psi_9 sumeducationmum + \psi_{10} sumeducationdad + \psi_{11} hhsize + \psi_{12} summarstatus +$$
$$\psi_{13} sumhhemployment + \psi_{14} sumhhmonthlyincome + \psi_{15} realexpfood +$$
$$\psi_{16} realexphealth + \psi_{17} realexped + \psi_{18} realtotal +$$
$$\varepsilon_{it} \qquad (7)$$

Equation (7) is used for my falsification test where I simply a re-estimated version of equation (4) above. I reclassified my treatment and control groups by maintaining the original treatment group while using a different control group. This different group captures the three regions that never exposed to PFI's in Ghana. Figure 1.5 under appendix shows this classification accordingly. I used this as my falsification test to show that any alternative construction of the treatment and control group would yield an opposite result from my main findings. This further strengthens my argument and affirms my results.

2.5. Econometric Results And Discussions

In this section I begin by presenting a preliminary result of my simple double difference estimation. Tables 4 and 5 presents evidence to account for the switching difference between rural/urban and poor/non-poor respectively. The essence of table 4 is to justify the use of my third difference in my main model while table 5 further strengthens my rejection of poor/non/poor. Columns 2 and 3 of table 4 shows that all households and rural dwellers reduced their average savings by 1,471 Ghana cedis ($294.2) and 1,636 Ghana Cedis ($327.2) at a statistical significance of 5% and 1% respectively. Column 4 however shows no statistical evidence of reduction of household savings in the case of urban households. This sharp difference between the savings

behavior of households in the rural and urban areas reinforces the need to further investigate the activities of PFI's in these two zones by applying a third difference. This makes it more compelling to further test if same can be deduced between poor and non-poor income groups. Columns 3 and 4 of table shows statistical significance of average reduction of savings by 1,376 Ghana Cedis ($274.4) and 1,026 Ghana Cedis between poor and non-poor households respectively. And this does not satisfy the minimum threshold of introducing a triple difference model. This makes it imperative to use the former evidence to estimate my main model in this chapter.

Table 6 in this paper presents the empirical results of my main triple difference model as specified above. Columns 2, 3, and 4 of table 6 below show the main results and heterogenous tests.. To measure the impact of the post-closure of PFI's on household savings, I introduced a third specification between rural and urban dwellers. My main results as reported in columns 2 show that the post-closure of the PFI's in Ghana caused a reduction of savings among all households by 788.70 Ghana cedis ($157.00). Column 3, and 4 however shows interesting heterogenous results when I decided to investigate for which income sub-group were more impacted. This showed that non-poor households reduced their savings on the average by 888.70 Ghana cedis ($222.18) relative to the poor counterparts. It must however be noted that the results are not significant in terms of poor households. These results underscore a significant point in the earlier paper.

Interestingly and consistent with literature, households who acquire credit reduce their savings drastically to reflect the loss of confidence in the financial sector. Previous period savings (savings @ (t-1) is negatively related to the household savings. This implies that an increase in period savings reduces household savings in the current period. This negatively relation also points

to the impact of the post-closure of these PFI's. Deposit rate is equally negatively related to household savings, hence high deposit rate attracts lower household savings. Increase in monthly income and food expenditure also reduces household savings in the post-closure of PFI's. The results in the table 5 also shows that an increase in household size also reduces household savings. This is consistent with literature as households tend to cut down on savings as their number grows. household health expenditure is shown to be positively related to household savings. This result is driven by a number of factors, but key among them is the loss in public confidence in the financial sector. The credibility of government and BOG supervisory bodies has come under scrutiny, hence, the confidence to save with financial institutions has eroded. More so, households now find it difficult to separate wheat from the chaff, that is, they can no longer differentiate the genuine financial institutions from the Ponzi's.

Table 4: Preliminary Results and Heterogeneity Test (Accounting for the Rural/Urban)

VARIABLES	(1) General Model	(2) All Households	(3) Rural Households	(4) Urban Households
PFI	525.3***	30.33	280.4**	-263.2**
	(126.4)	(109.2)	(112.6)	(81.91)
Tim	210.2	187.1	297.4	68.94
	(131.9)	(324.3)	(258.6)	(412.0)
PFI*Time	-491.0***	-1,471**	-1,636***	-442.9
	(180.7)	(475.2)	(226.4)	(476.4)
Savings @ (t-1)		0.325*	0.593***	0.0643*
		(0.144)	(0.131)	(0.0286)
Credit Acquisition		-499.7**	-729.4**	-214.8*
		(148.0)	(259.4)	(87.87)
Total wealth		0.0141**	0.0122**	0.00563**
		(0.00500)	(0.00410)	(0.00216)
Total expenditure		0.0698**	0.0621*	0.0287
		(0.0265)	(0.0268)	(0.0309)
Deposit rate		168.0*	151.7	155.4**
		(85.99)	(148.7)	(52.50)

Household size		-107.9***	-81.42***	-39.75
		(20.74)	(16.91)	(33.45)
Region		YES	YES	YES
Gender		100.7	-154.8	364.2**
		(296.0)	(379.5)	(116.0)
Food expenditure		0.0331	0.0106	-0.00712
		(0.0604)	(0.0666)	(0.00980)
Household education		-104.5	-199.8	43.61
		(125.4)	(191.6)	(56.85)
Household employment		-33.56	-48.06	-145.7
		(154.6)	(170.6)	(134.5)
Age 41-59		14.16	-426.1	386.7**
		(221.5)	(261.6)	(133.1)
Age 60+		-459.8	-1,010	228.1
		(531.9)	(814.9)	(177.2)
Age of Respondent		11.76	25.14	-7.558
		(12.57)	(18.29)	(5.050)
Poor/Non-Poor			362.7**	-61.36
			(118.8)	(277.1)
Constant	777.7***	-2,336	-2,764	-739.2
	(93.94)	(1,235)	(1,859)	(681.3)
Observations	11,648	5,977	3,789	2,188
R-squared	0.002	0.223	0.347	0.064

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Preliminary Results and Heterogeneity Test (Accounting for the Poor/Non-Poor)

VARIABLES	(1) General	(2) All Households	(3) Poor Households	(4) Non-Poor Households
PFI	525.3***	56.03	59.35	45.58
	(126.4)	(94.37)	(105.2)	(51.85)
Time	210.2	164.0	-58.64	786.5***
	(131.9)	(319.7)	(188.5)	(206.2)
PFI*Time	-491.0***	-1,451**	-1,372***	-1,026***
	(180.7)	(459.6)	(306.7)	(241.7)
Savings @ (t-1)		0.325*	0.324*	0.637***
		(0.144)	(0.144)	(0.156)
Credit Acquisition		-502.0**	-540.0**	-21.68
		(151.0)	(163.1)	(37.75)
Total wealth		0.0141**	0.0141**	0.00362
		(0.00502)	(0.00534)	(0.00467)
Total Expenditure		0.0702**	0.0744**	-0.0180
		(0.0265)	(0.0274)	(0.0239)
Deposit Rate		171.9*	178.4*	39.75
		(84.95)	(88.23)	(23.03)
Household size		-113.4***	-155.1***	21.98*
		(20.78)	(33.17)	(10.46)
Region		YES	YES	YES
Gender		88.81	87.28	45.25
		(294.3)	(322.1)	(84.33)
Food expenditure		0.0383	0.0486	0.00373
		(0.0608)	(0.0603)	(0.0337)
Household Education		-93.47	-95.42	-86.70
		(130.1)	(142.2)	(76.55)
Household employment		-46.86	-55.97	25.29
		(152.8)	(170.1)	(73.93)
Age between 41-59		16.14	25.50	-126.5
		(221.7)	(263.8)	(92.26)
Age 60+		-463.5	-530.2	-372.3*
		(530.3)	(616.2)	(173.4)
Age of Respondent		11.69	13.30	8.111*
		(12.52)	(14.46)	(4.043)
Rural/Urban		151.6**	144.0**	32.36
		(55.64)	(51.45)	(100.7)
Constant	777.7***	-2,449*	-2,528*	-689.6
	(93.94)	(1,232)	(1,292)	(363.1)

Observations	11,648	5,977	5,371	606
R-squared	0.002	0.223	0.222	0.490

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Main Results and Heterogeneity Test (With Regional Clustering)

Variables	(1) General Model	(2) All Households	(3) Non-Poor Households	(4) Poor Households
Treat	-1,299***	-929.3***	-998.2***	212.2
	(369.8)	(359.4)	(387.3)	(313.9)
Post	-1,294***	-1,244***	-1,253***	911.7
	(374.5)	(473.8)	(481.1)	(607.9)
Rural/Urban	-776.8***	-270.0**	-270.8**	56.95
	(168.7)	(125.4)	(130.5)	(108.6)
Treat*Post	1,765***	1,283**	1,396**	-937.3
	(601.1)	(533.9)	(563.1)	(725.6)
Treat*Rural/Urban	641.8***	613.6**	669.2**	-112.0
	(205.2)	(247.6)	(274.0)	(183.3)
Post*Rural/Urban	805.3***	449.1**	432.2*	-456.4
	(215.8)	(220.3)	(224.6)	(356.8)
Treat*Post*Rural/Urban	-957.2***	-788.7**	-888.7**	507.7
	(331.5)	(337.2)	(371.8)	(431.5)
Savings @ (t-1)		0.341**	0.340**	0.520***
		(0.166)	(0.166)	(0.0958)
Credit Acquisition		-302.3**	-319.0**	-84.77
		(131.3)	(142.9)	(77.64)
Deposit Rate		162.1***	166.8***	55.28*
		(60.91)	(64.56)	(30.53)
Household Size		-50.87**	-58.27**	33.27
		(23.79)	(28.15)	(30.13)
Monthly Income		0.101***	0.101***	-0.00181
		(0.0381)	(0.0385)	(0.0722)
Health Expenditure		-0.260*	-0.267*	-0.242*
		(0.135)	(0.138)	(0.140)
Food Expenditure		0.115**	0.116**	0.00275
		(0.0451)	(0.0459)	(0.0549)
Education Expenditure		-0.00728	-0.00714	-0.0472
		(0.0260)	(0.0264)	(0.0599)

Housing Expenditure		-0.0247	-0.0246	0.00554
		(0.0261)	(0.0264)	(0.0884)
Household Education		45.68	42.75	61.10
		(136.4)	(144.4)	(77.67)
Age 18-40		-45.48	353.2	383.7**
		(391.2)	(327.6)	(173.3)
Age 41-59		44.64	467.2	176.8
		(504.8)	(524.1)	(229.9)
Age 60+		-479.3	-102.7	7.347
		(805.5)	(847.3)	(306.3)
Constant	2,279***	-1,585*	-2,059**	-1,193**
	(320.0)	(853.5)	(856.2)	(549.8)
Observations	11,648	5,995	5,545	450
R-squared	0.003	0.184	0.183	0.420

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

2.6. Robustness Checks, Falsification Test, And Limitations

2.6.1 Robustness Checks

In this section, my interest is to corroborate my results by running a number of robustness checks to test its validity. First, I run the main model with similar samples but changed my dependent variable. In this model I used net savings instead of savings balance. Net savings was computed by taking the difference between additions made to savings and the withdrawals over the period. This is also a valid dependent variable because it accounts for the changes made to savings overtime. Second, I use only additional savings as my dependent variable The results in the first instance as shown in table 7 is similar in the main findings with exact magnitude of change in parameter estimates. In the second instance however, table 8, the magnitude of change is higher as all households reduce their savings by 2,458 Ghana Cedis ($491), while non-poor households reduce their savings by 2,565 Ghana Cedis ($513) in columns 1 and 2 of table 6 respectively. These

results strengthen the outcome of my main model and makes it more imperative to assert that the post-closure of these PFI's negatively impacted the financial sector of Ghana.

Table 7—Robustness Checks: Using Net Savings

Variables	(1) All Households	(2) Non-Poor Households	(3) Poor Households
Treat	-929.3***	-998.2***	212.2
	(359.4)	(387.3)	(313.9)
Post	-1,244***	-1,253***	911.7
	(473.8)	(481.1)	(607.9)
Rural/Urban	-270.0**	-270.8**	56.95
	(125.4)	(130.5)	(108.6)
Treat*Post	1,283**	1,396**	-937.3
	(533.9)	(563.1)	(725.6)
Treat*Rural/Urban	613.6**	669.2**	-112.0
	(247.6)	(274.0)	(183.3)
Post*Rural/Urban	449.1**	432.2*	-456.4
	(220.3)	(224.6)	(356.8)
Treat*Post*Rural/Urban	-788.7**	-888.7**	507.7
	(337.2)	(371.8)	(431.5)
Savings @ (t-1)	-0.659***	-0.660***	-0.480***
	(0.166)	(0.166)	(0.0958)
Credit Acquisition	-302.3**	-319.0**	-84.77
	(131.3)	(142.9)	(77.64)
Deposit Rate	162.1***	166.8***	55.28*
	(60.91)	(64.56)	(30.53)
Household Size	-50.87**	-58.27**	33.27
	(23.79)	(28.15)	(30.13)
Monthly Income	0.101***	0.101***	-0.00181
	(0.0381)	(0.0385)	(0.0722)
Health Expenditure	-0.260*	-0.267*	-0.242*
	(0.135)	(0.138)	(0.140)
Food Expenditure	0.115**	0.116**	0.00275
	(0.0451)	(0.0459)	(0.0549)
Education Expenditure	-0.00728	-0.00714	-0.0472
	(0.0260)	(0.0264)	(0.0599)
Housing Expenditure	-0.0247	-0.0246	0.00554

	(0.0261)	(0.0264)	(0.0884)
Household Education	45.68	42.75	61.10
	(136.4)	(144.4)	(77.67)
Age 18-40	-45.48	353.2	383.7**
	(391.2)	(327.6)	(173.3)
Age 41-59	44.64	467.2	176.8
	(504.8)	(524.1)	(229.9)
Age 60+	-479.3	-102.7	7.347
	(805.5)	(847.3)	(306.3)
Constant	-1,585*	-2,059**	-1,193**
	(853.5)	(856.2)	(549.8)
Observations	5,995	5,545	450
R-squared	0.435	0.436	0.371

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8—Robustness Checks: Using Additional Savings

VARIABLES	(1) General Model	(2) Non-Poor Households	(3) Poor Households
Treat	-2,719**	-2,960**	116.4
	(1,325)	(1,465)	(624.6)
Post	-4,259***	-4,026***	-277.7
	(1,390)	(1,398)	(1,738)
Rural/Urban	-795.1*	-770.5*	-214.4
	(421.2)	(438.3)	(277.6)
Treat*Post	3,618**	3,745**	-383.0
	(1,699)	(1,882)	(1,775)
Treat*Rural/Urban	1,929*	2,143*	-59.06
	(1,012)	(1,144)	(343.1)
Post*Rural/Urban	1,816***	1,529**	899.1
	(643.2)	(647.3)	(1,054)
Treat*Post*Rural/Urban	-2,458**	-2,565*	-445.3
	(1,202)	(1,398)	(1,085)
Savings @ (t-1)	-0.865	-0.868	-0.0656
	(0.793)	(0.795)	(0.0778)
Credit Acquisition	-49.46	-31.88	-111.9
	(366.3)	(401.0)	(203.4)
Deposit Rate	369.0**	377.5**	45.33

	(171.1)	(178.7)	(68.03)
Household Size	-151.1*	-164.9*	38.71
	(85.75)	(98.02)	(42.24)
Monthly Income	0.303**	0.299**	0.0780
	(0.132)	(0.132)	(0.0692)
Health Expenditure	-0.462	-0.472	-0.539*
	(0.434)	(0.444)	(0.317)
Food Expenditure	0.287*	0.289*	0.0123
	(0.155)	(0.158)	(0.0898)
Education Expenditure	-0.0226	-0.0253	0.241
	(0.0733)	(0.0745)	(0.165)
Housing Expenditure	0.176	0.176	0.0627
	(0.115)	(0.116)	(0.179)
Household Education	418.4	448.8	-167.1
	(480.7)	(507.6)	(127.5)
Age 18-40	-240.2	1,271	229.7
	(1,327)	(1,219)	(316.9)
Age 41-59	457.1	2,075	-135.1
	(1,804)	(2,111)	(399.2)
Age 60+	-1,678	-282.1	-553.8
	(2,507)	(2,739)	(621.8)
Age of Respondent	37.54	39.77	15.40
	(40.27)	(43.00)	(10.67)
Constant	-3,397	-5,102**	-720.2
	(2,366)	(2,343)	(1,075)
Observations	5,995	5,545	450
R-squared	0.119	0.119	0.109

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

2.6.2 Falsification Test

In this section I seek to present evidence in table 9 by changing the construction of my model using a different control group other than the actual group, while maintaining the original treatment group. I used the three regions that were never exposed to the PFI's as my control group. This strategy was intended to test whether control variables used in this model were probably classified and whether they reflect the real outcomes. The results of this test however show a counter result

from the main findings in this paper. While the results were not significant at different levels, the figures rather show an increase in savings by households. This further justifies my main model and the main findings in this paper.

Table 9: Falsification Test: Alternative Results Using A Different Previous Group

VARIABLES	(1) All Households	(2) Non-Poor Households	(3) Poor Households
Treat	1,048***	1,090***	511.0**
	(311.3)	(340.4)	(251.3)
Post	-165.5	-155.1	340.6
	(380.3)	(427.2)	(259.4)
Rural/Urban	361.6*	389.1*	159.9**
	(186.7)	(213.3)	(79.20)
Treat*Post	-925.8**	-956.5*	879.9
	(455.0)	(488.9)	(854.2)
Treat*Rural/Urban	-592.7***	-621.1**	-282.8*
	(216.7)	(246.1)	(146.6)
Post*Rural/Urban	-21.54	-40.31	-165.3
	(288.4)	(334.4)	(160.7)
Treat*Post*Rural/Urban	379.0	387.0	-432.2
	(323.0)	(364.1)	(481.4)
Savings @ (t-1)	0.211*	0.210*	0.617***
	(0.117)	(0.117)	(0.0892)
Credit Acquisition	-217.8*	-224.5*	-88.07
	(112.4)	(124.1)	(60.34)
Deposit Rate	137.5***	141.7***	52.48**
	(47.94)	(51.90)	(23.02)
Household Size	-53.35***	-60.37***	27.26
	(16.86)	(20.66)	(22.85)
Monthly Income	0.104***	0.104***	-0.0178
	(0.0305)	(0.0312)	(0.0562)
Health Expenditure	-0.257**	-0.267**	-0.128
	(0.121)	(0.124)	(0.146)
Food Expenditure	0.111***	0.111***	0.00339
	(0.0406)	(0.0413)	(0.0435)
Education Expenditure	-0.00308	-0.00327	-0.0412
	(0.0238)	(0.0242)	(0.0551)
Housing Expenditure	-0.0115	-0.0116	-0.0293

	(0.0231)	(0.0234)	(0.0654)
Household Education	28.52	23.83	41.49
	(113.7)	(120.8)	(71.09)
Age 18-40	212.5	476.5	330.5**
	(306.4)	(460.5)	(146.7)
Age 41-59	271.1	549.8	151.9
	(393.5)	(355.9)	(196.5)
Age 60+	-211.3		-13.84
	(657.5)		(275.8)
Age of Respondent	12.63	14.46	4.922
	(11.13)	(11.86)	(4.849)
Constant	-2,440***	-2,831**	-1,290***
	(851.9)	(1,421)	(411.8)
Observations	7,144	6,538	606
R-squared	0.117	0.116	0.514

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

2.6.3 Limitations

I also recognize the limitations in this paper and that is exactly what my future development would focus on. Some of these challenges are the unavailability of enough data to further investigate post-closure of these PFI's. I intend to source more data from future surveys to address the issue of a longer trend analysis. The best way to capture the impact of a program or a shock significantly lies in the womb of time.

2.7. Conclusions and Policy Recommendations.

The primary objective of this paper is to investigate the post-closure of PFI's on household savings, and further delve into what income group is impacted.. In Ghana, fraudulent PFI's lured households by promising unsustainable returns to their savings. Bank supervisory body colluded

with ruling political party and allowed financial institutions to become Ponzi Schemes. In the short term, savings behavior of households was affected, increasing savings. Elasticities of savings to returns in the long run (post-closure of PFI's) would be negatively affected, hence a reduction in average savings of households.

Results of this paper suggest that the post-closure of these PFI's altered household savings behavior of all households. On the average, all households reduced their savings by 788.70 Ghana cedis ($157.00), while non-poor reduced their savings by 888.70 Ghana cedis ($222.18). Contrary to earlier narrative, previous period savings is negatively related to household savings behavior, hence, increase in savings @ t-1 reduces household savings on the average.

While this research (as have many others) so far paid attention to how strengthening financial regulations interacts with multiple factors, a lot remains to be known regarding how exogenous shocks such as the cleanup of Ghana's financial sector affects the culture of savings and investment. And I am convinced that the knowledge of this relationship can help inform policies aimed at creating a resilient financial sector in Ghana and the sub-Saharan Africa in general. Accordingly, state actors must act in sync with technological trends to exercise a better financial sector monitoring and regulation. In my next chapter, I will delve in how these PFI's impacted on credit acquisition, a key component of investment.

Appendix B

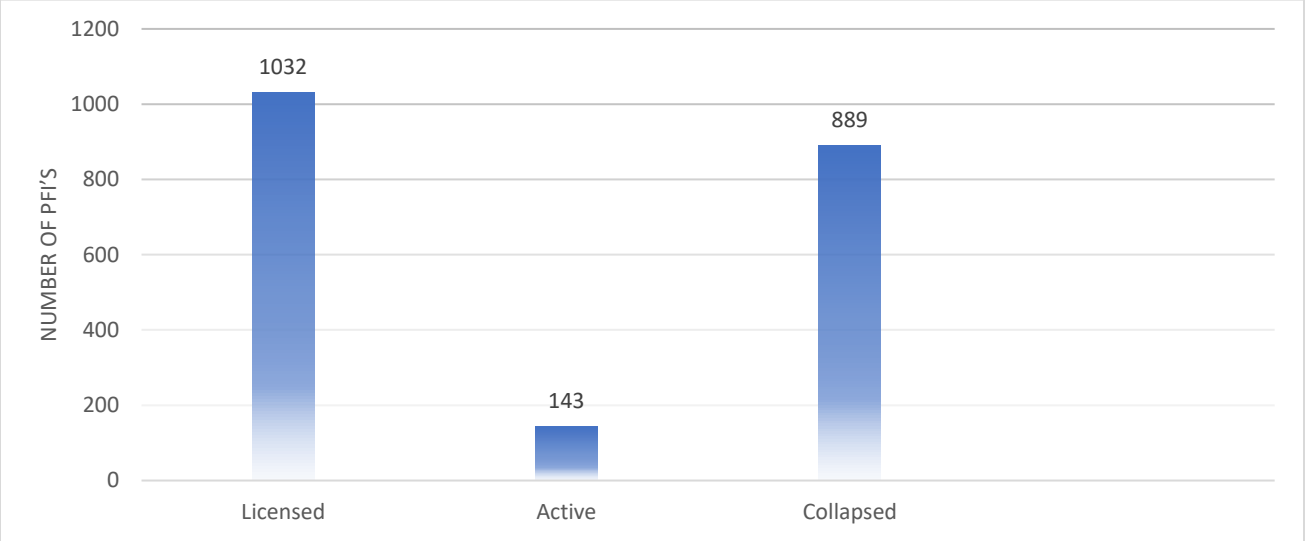

Figure 1.3: Breakdown Of The Financial Sector In Ghana.

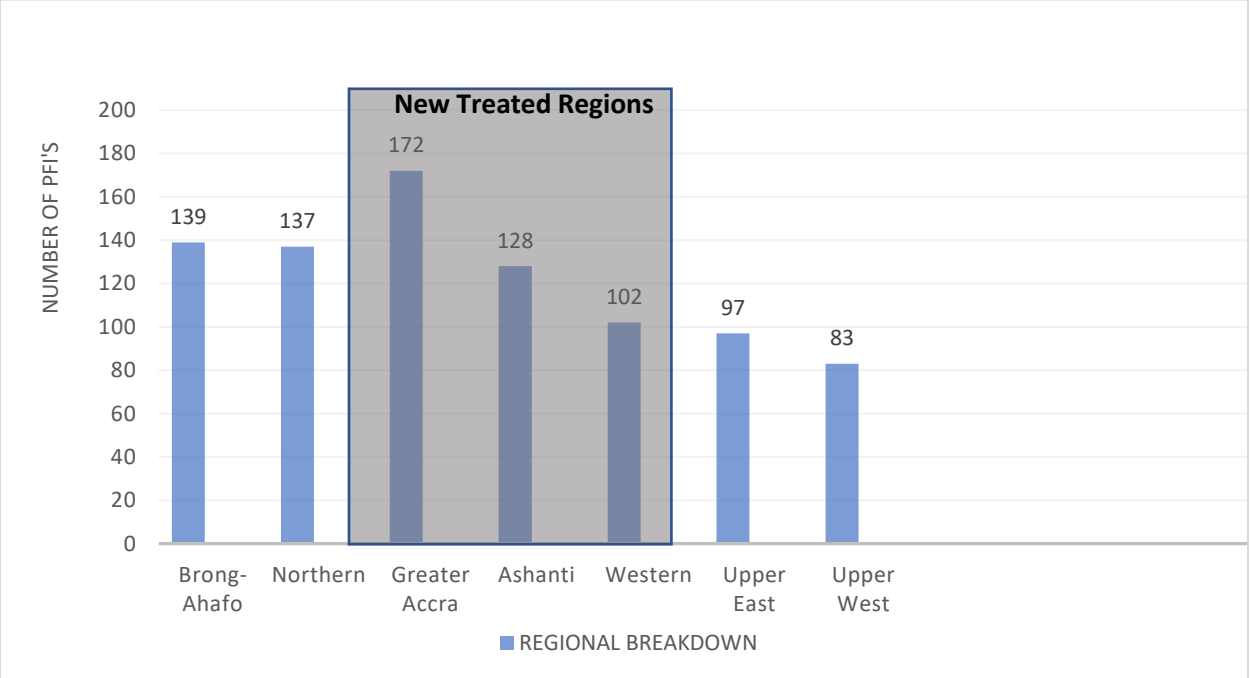

Figure 1.4: Regional Breakdown of Collapsed PFI's and New Treated Regions.

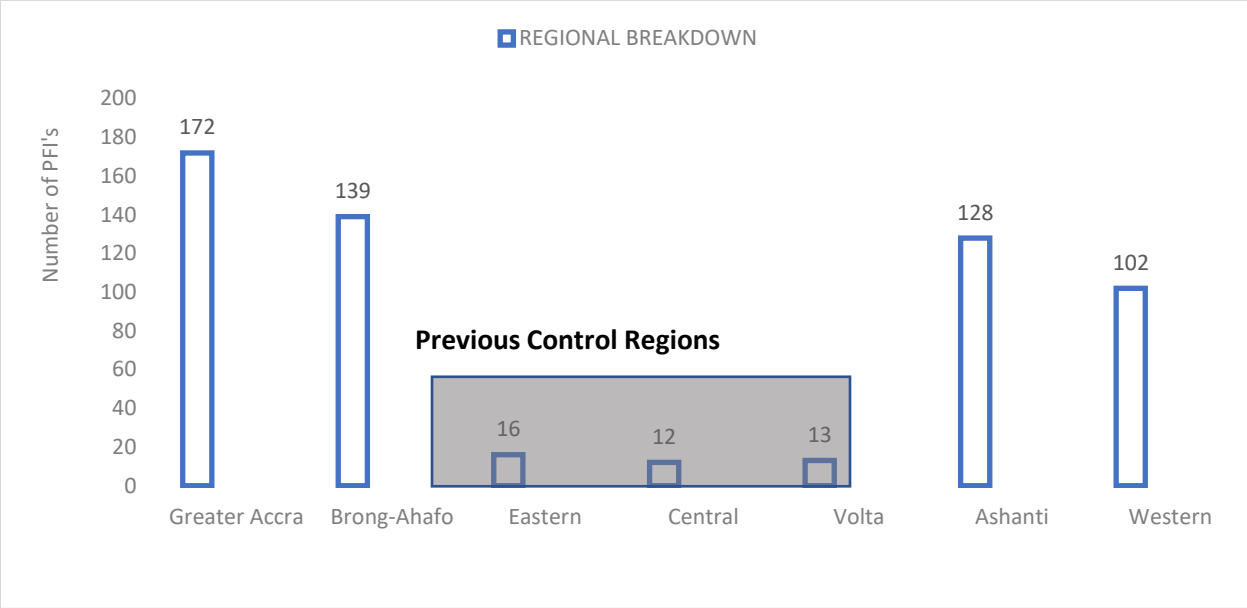

Figure 1.5: Regional Breakdown of Collapsed PFI's and Old Control Regions.

Chapter 3

Credit Acquisition And PFI's: Applying A Propensity Score Matching Estimation Technique On Household Observations

3. Introduction, The Rise & Collapse of PFI's, And Issues of Self Selection

3.1. Introduction

Household credit acquisition is a key component in alleviating poverty and supporting micro-businesses. Households' ability to save in Ghana serves as a security/collateral factor to secure credit among financial institutions. The amount of savings balance reflects an individual's ability to service a loan, hence, credit guarantee. Between the period 1980 and 2001, World Bank reported the average household savings in Ghana to be 6.4%, which is far lower in comparison to other African countries. GLSS (2006 and 2013) have shown that households in Ghana have increasingly acquired savings account over the period. Opening of savings account has increased from 28% to 82% as of 2017. This unusual significant increase underscores a suspicious activity in the financial sector. It certainly cannot entirely be attributed to financial literacy or population growth. Obviously, opening of savings accounts could be linked to growth in savings.

Households within the middle class in Ghana save a portion of their income for either precautionary, life cycle, or future asset accumulation purposes. However, the government of Ghana has failed in its responsibility to put across prudential financial regulations to protect depositors. Bank of Ghana (BOG) supervisory body seemingly colluded with ruling political parties and allowed Microfinance Institution (MFI's), savings and loans institutions (S&L's), rural banks, and other formal banks to become Ponzi Schemes. It is however now clear that the

operations and collapse of these PFI's in Ghana has further destabilized the financial sector, leading to loss of public confidence. The era of Charles Ponzi and Madoff sent a caution to economic agents in the United States of America. Hitherto, the recent ponzi schemes in Ghana through financial institutions is not the first of its kind. It started with "Pyram" and "R5" S&L's in 1995. And later "US TILAPIA" in 2005, where victims were promised interest rates between 27% to 50% on a non-existing fish farm investment. Subsequently, others emerged in the form of gold securities to swindle away huge sums from households. These were however reported cases to financial authorities and the media with no documented figures.

In Ghana, PFI's lured low-income savers by promising unsustainable returns to savings. This development propelled households to acquire loans to invest with these PFI's. In the short term, household savings behavior was affected by these PFI's, increasing savings over the period. This is more fascinating because state institutions and political actors colluded with these private investors with the intention of benefiting through funding their political activities. Random licenses were issued to them to operate in different regions of Ghana. A number of gullible households negotiated their returns and proceeded to save monies regardless of the consequences. The earlier savers benefited, while the latter ones suffer the consequences of these fraudulent activities. This scheme is not different from the model indicated in Artzrouni and Artzrouni (2009) where they show a business model based on a promise of interest returns beyond the prevailing rates. These rates were however unrealistic and could not be sustainable in the short to medium term. Further to this, the case in Colombia was analyzed in Hofstetter et al. (2018) where a similar business model was used. Households in Colombia were promised juicy returns provided they agreed to invest in established companies. Eventually, the formal banking sector was gravely

affected as savings dropped over time in the formal financial institutions. This is not different from the case in Ghana as evidence adduced from this paper show a savings dip.

Allen et al. (2016) analyze the importance of enhancing prudential standards and financial regulations following the US financial crisis. In their paper they identify that while the goal of using regulations to maintain financial stability is clear enough, it is however unclear on how to design an effective regulation to maintain this stability while promoting financial innovation and development. Inferring from this paper, there is a lag between the financial sector and the regulations put in place by the government of Ghana. According to BOG in 2017, poor corporate governance has led to a substantial loss of savings and investments of households. The Bank of Ghana further listed out a number of fraudulent financial institutions, especially in their transactions with households. This systemic challenges in the financial sector have caused a substantial loss of confidence among economic agents and genuine financial institutions.

This paper investigates the impact of these PFI's on household credit acquisition and their investment decisions. This paper relies on a survey data jointly collected by the World Bank and Ghana Statistical Service. I follow a propensity score matching methodology (PSM) using the round 5 (2006), 6 (2013) and 7 (2017) of the survey which randomly selected households across the ten regions of Ghana.

In summary, a key factor motivating this chapter of my dissertation stems from the mandate of MFI's to SME's. The establishment of MFI's are set up to be a support system to start-up businesses and ideas, hence credit provision. It however appears that available evidence does not support this mandate. MFI's overrode their mandate and assumed the role deposit collection institutions. This in turn would definitely affect credit acquisition. The more compelling it becomes

to investigate these activities. I intend to comparatively measure the impact of the presence and post-collapse of PFI's, relative to credit acquisition, applying a propensity score matching technique (PSM).

3.1.1 The Rise And Closure Of PFI's And The Issues Of Self Selection..

Bank of Ghana as of 2017 collected data based on reported cases of losses of deposits to these fraudulent schemes. In all, a total of 899 financial institutions, comprising of 347 microfinance, 15 formal banks, and the remaining cut across savings and loans, finance houses, rural banks, and other special deposit taking institutions. Figure 1.1 in the Appendix gives a further breakdown of the financial sector in Ghana. There are 10 regions in Ghana as shown in figures in the appendix section. As of 2007 the operations of PFI's were randomly spread. The activities of these PFI's were in all the 10 regions but significantly represented in 7 out of 10. After the 2012 general elections it emerged that there were PFI's in the financial sector which later became a subject of debate in the political landscape. This subsequently began the collapse of these PFI's. Fast forward into the 2016 general elections, the issue of these PFI's resurfaced and the winner of the elections began the banking sector cleanup in 2017. Bank of Ghana (2017) in its report further stated a percentage of 61.3% of deposits were lost in the MFI sub-sector only. This is when the figures became clearer and more apparent. However, only 7 out of 10 had severe reported cases with huge losses. By the end of 2017, 4 out of the 7 significant regions had collapsed, leaving only 3 regions with PFI's still operating. Based on this, I classified my treatment regions as the four collapsed regions and the three as my control regions. I collected information from Bank of Ghana and classified the PFI's based on the location of their operation following (Hartarska and

Nadolnyak, 2008) to write my first and second papers. I rely on these same classifications in this chapter. The issue of self-selection is addressed by the model I relied on in this paper, a PSM estimation technique. This model captures the effects of different observed covariates, say X, on participation in a single propensity score or index

3.2. Literature Review

This section focuses on giving a background knowledge of ponzi schemes and liken their impact on households. Baidoo, Boateng, and Amponsah (2018) show t(hat improvement in financial literacy among Ghanaians has the potential of increasing household savings if incorporated in a broad policy package. They further argued that financial literacy is a pre-requisite for household investment and sustainable financial growth. This simply means that education among households in Ghana is key to understanding savings and investment options. According to Browning, Lusardi, and Browning (1996), savings among household in US continue to increase until they hit retirement then it begins to decline. And the distribution of savings across income groups shows a positive correlation. Their paper also shows a positive correlation between savings and education. Education among household is an important information tool to understand how the financial system works. Horioka and Walanabe (1997) in their paper show that households in Japan save for various reasons, and among these reasons are life-cycle motive, precautionary, and the bequest motive. The life-cycle motive is to save to take care of temporary imbalances between income and expenditure. Households also save for precautionary reasons due to unforeseen contingencies. Other households also save in the interest acquiring assets/properties to leave behind for their children. In the case of Ghana however, households mostly save to take care of

the life-cycle needs. Hence, almost all the incomes generated goes back into payment of household daily expenditure. Only a few savers account for unforeseen contingencies and asset accumulation. The middle class are mostly found in this category. Another driving factor to household savings is the nearness to financial institutions or deposit collectors. Mel, Mcintosh, and Woodruff (2013) in their paper show that show that frequent face-to-face deposit collection by financial institutions leads to an increase in savings by households.

To understand the psychology of households towards savings, (Furnham 1985) shows that age and education most differentiated subjects' attitudes towards savings. The findings also clearly show that age, income, and alienation correlate with household attitude towards savings in Britain. But sex, age, and income were among the most discriminators of savings habit in Britain. In terms of access to financial institutions and how they impact on household savings culture, Burgess and Pande (2016) find that opening more branches of rural banks in unbanked locations help to reduce poverty levels through savings and credit availability. The licensing of more banks and financial institutions across various districts in India helped to improve savings and credit availability to households. The out-spring of financial institutions in the form of microfinance, savings and loans, and rural banks is significantly increasing in Ghana in the past decade, but most of these are associated with PFI's. BOG reports show an estimated number of over 350 microfinance institutions and other financial houses. However, microfinance institutions in Ghana have vied from their core mandate of providing credit to households and businesses. They have rather focused on taking deposits and savings by luring households with juicy interest rates. This is the channel through which PFI's were hatched.

Tennant (2011) used an econometric model to examine the factors determining individuals' extent of exposure to Ponzi schemes. This paper finds that Ponzi investors are both gullible and heightened risk takers who are sometimes single managers and supervisors but lack education to understand how the financial system works. Government of different economies are supposed to put in strong measures to protect savings and investments of households. But this is unfortunately not the case in Ghana and most part of developing countries. In most cases, the owners of these financial institutions take advantage of the weakness of state institutions to perpetuate their agenda of swindling households. The world's largest investment fraud known as the Madoff investment fraud took advantage of people's ignorance and swindled clients with over 65billion dollars as for his arrest on December 11, 2008. This was admittedly the world's largest scam so far.

The size of loss in Ghana may not be similar or close to that of Madoff investment, but the general impact can be felt across the ten regions in Ghana. The closest literature I have identified so far is by Hofstetter et al. (2018). They measure the impact of the operations of two Ponzi schemes in Colombia using a fixed effect identification strategy. Specifically, one of their measurements focused on the impact on savings. The nature of the Ponzi schemes was such that it diverted monies that could have been saved in the formal financial institutions. Rather, these monies were invested with two ponzi firms in Colombia. They find statistical significance of decline in savings between the period of operation. Therefore, the operation of these Ponzi schemes impacted heavily on the formal financial sector. This is slightly similar to what my research question seeks to determine, except that I intend to use a difference-in-difference identification strategy to determine the impact of these PFI's on households.

Governments around the world are tightening measures to protect the deposits of households, but this is unfortunately not enough to put an end to this recurring phenomenon as long as individuals continue to fall for new tricks. (Artzrouni and Artzrouni 2009) describes the Ponzi scheme model with a linear mathematical model. They show that, the model is based on a promise return of interest rates more than it can deliver. These promised rates are unrealistic. The sustainability of these schemes depends on the withdrawal rate and new accumulated depositors.

3.3. Data And Descriptive Statistics

3.3.1 Data.

This paper relies on the surveys from the Ghana Living Standards Measurement Survey (GLSMS). This s a survey routinely collected from 1980 by the World Bank with support from the Ghana Statistical Service to explore means of improving data collection in developing countries for the purposes of informing policy direction. I will rely on rounds 5 (2006), 6 (2013), and 7(2017). Specifically, I will rely on the section 7 and 8, which relates to household credit acquisition and savings in Ghana's financial sector. Each survey used unambiguous method for identifying credit acquisitions at the household level. The data contains relevant questions such as whether household acquired credit in the last 12 months or not, what is the outstanding credit, and total credit acquired by the household. Given the structure of Ghana's financial sector, the survey was designed to capture questions on credit from both traditional and non-traditional sources such as "susu" collection agencies and individuals, providing a comprehensive approach to identifying credit applicants. Information on household savings across different financial Institutions,

household demographics, employment, total income, household expenditure, total wealth, education levels and many other relevant variables to aid the construction of my identification strategy. I sub-divided the three rounds of survey into three components and used round 5 and 6 for the analysis on how the presence of PFI's influenced household credit acquisition and rounds 6 and 7 to measure the post-closure effect, while I combine all three rounds (5, 6, and 7) to analyze the combine impact of PFI's on household credit acquisition. At this point, my focus is on the statistics of the sub-groups created—*descriptive statistics.*

3.3.2 Descriptive Statistics

As shown in tables 1, 2, and 3 above, the outcome variable, credit acquisition is credit acquisition while the rest serve as control variables. Based on the survey responses, the outcome variable was classified into two groups. In this case it is defined as a dummy variable which takes the value 1 if household applied for credit and acquired same, and 0 otherwise. Tables 1 was constructed using rounds 5 and 6, table 2 using rounds 6 and 7, while the combine survey data was used to compute table 3. For a better comparative analysis, the summary statistics is computed by treatment and control regions to reflect all households. Between 2006-2013, credit acquisition shows a mean of 0.12 and 0.15 between the control and treatment group respectively, with 25,381 total observations. Another variable of interest is the balance of savings which shows a total observation of 9,848, with a mean of 518.78 ($52) and 883.53 ($74) respectively. And the rest of the variables show reasonable number of observations to aid my model specification. As indicated above, table 2 shows a computation of summary statistics between 2013-2017 by treatment and control. Interesting enough, the total number of observations are not different from table 1.

However, the mean difference of 0.09 and 0.08 between the control and treatment group narrowly differs, while savings balance with a total observation of 11,648 indicates a slightly higher average balance of 1171.41 ($108) relative to the treatment group.

In table 3 however, I computed a separate summary statistic by combining all the three rounds of survey. The import of this is to reconstruct my model in a separate analysis to combine effect. The inclusion of this round of survey also makes it more imperative to appreciate to appreciate the trend of events. As such, table 3 shows a much higher observations among all the variables. But the average credit acquisition shows 0.12 in both control and treatment group.

Evidently, figure 1 below gives a better in-depth breakdown of the outcome variable before the match. In 2006 (control year), 18.7% of the households applied for credit and were denied while 46.4% of the households acquired credit, which reflects a substantial difference. Interestingly, the prevalence of PFI's in 2013 shows 44.8% of households who applied for credit but were not successful while 30% succeeded in acquiring credit. This striking difference relative to 2006 underscores an important suspicious phenomenon. In the post-PFI activities (2017) however, 36% and 24% of the households did not acquire and acquired credit respectively. Again, this striking difference is relatively lower, compared to the era of PFI activities. It must however be noted that these descriptive statistics are preliminary values preceding the assignment of propensity scores as would be further discussed under the empirical methodology. This would lead to a new computation of summary statistics to reflect the assignment.

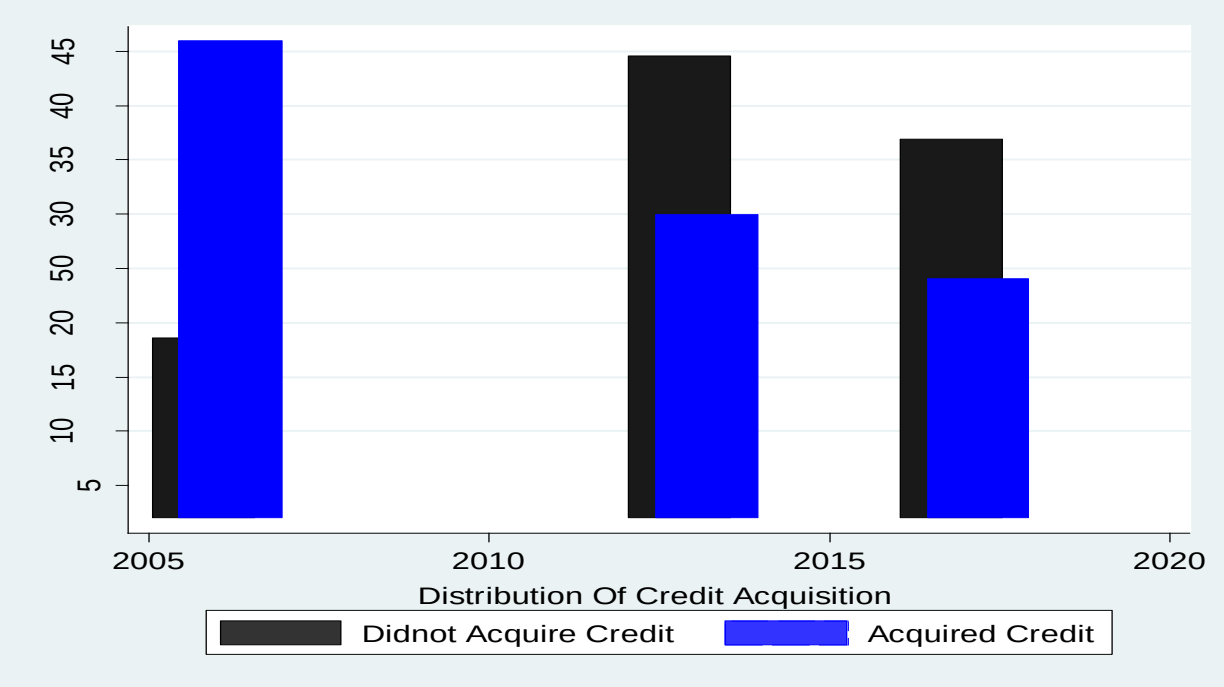

Figure 1: Graphical distribution of households who acquired credit before the match.

Table 1—HOUSEHOLDS BETWEEN 2006—2013.

Variables	N	Control(n=6,246)		Treatment(n=19,213)	
		Mean	SD	Mean	SD
Credit Acquisition	25,381	0.12	0.32	0.15	0.36
Credit Outstanding	3,676	6146.96	1643.89	3326.19	82366.37
Savings Balance	9,848	518.78	1388.07	883.53	4787.72
Savings @ (t-1)	9,842	483.59	1827.70	791.16	5861.62
Total Income	25,459	3790.99	81580.79	6443.04	46148.66
Total Wealth	17,079	5959.76	23100.86	7238.10	55474.84
Total Expenditure	25,459	5436.46	6551.13	6555.21	7535.91

Deposit Rate	25,459	11.18	1.41	10.99	1.44
Urban/Rural	25,459	0.73	0.44	0.51	0.50
HH size	25,459	4.73	3.02	4.08	2.70
Gender	25,459	0.73	0.44	0.71	0.45
Food Expenditure	25,459	2070.67	2150.76	2558.14	2521.19
Housing Expenditure	25,459	320.22	880.73	486.90	1481.93
Household Education	24,925	0.19	0.39	0.37	0.48
HH Employment	25,450	0.78	0.41	0.86	0.35
Total-members between age-0-17	25,459	0.00	0.02	0.00	0.03
Total-members between age 18-40	25,459	0.38	0.48	0.46	0.49
Total-members between age 41-59	25,459	0.37	0.48	0.35	0.47
Total-members between age 60+	25,459	0.25	0.43	0.19	0.39
Age of Respondent	25,438	47.68	16.27	44.99	15.57
Marital Status	25,456	0.66	0.47	0.56	0.49
Number of Children	25,446	2.62	2.33	2.25	2.25

Table 2—HOUSEHOLDS BETWEEN 2013—2017.

Variables	N	Control(n=10,087)		Treatment(n= 12,190)	
		Mean	SD	Mean	SD
Credit Acquisition	22,234	0.09	0.29	0.08	0.28
Credit Outstanding	1,853	10779.36	90930.90	1046.43	113527.90

Savings Balance	11,648	1171.41	5498.16	884.34	4008.36
Savings @ (t-1)	11,647	1124.93	5281.36	855.99	8746.35
Total Income	12,324	12983.08	55217.83	6301.46	58989.76
Total Wealth	12,055	9405.52	65572.94	5527.32	42790.01
Total Expenditure	22,277	12060.78	11076.41	8433.62	7791.43
Deposit Rate	22,277	12.40	0.88	12.38	0.90
Urban/Rural	22,277	1.35	0.47	1.62	0.48
HH size	22,277	3.59	2.33	4.46	3.04
Gender	22,277	0.68	0.46	0.72	0.44
Food Expenditure	22,277	5081.62	3741.17	3690.42	3430.60
Housing Expenditure	22,277	1193.29	2525.52	636.24	1663.21
Household Education	22,220	0.41	0.49	0.23	0.42
HH Employment	22,220	0.85	0.34	0.88	0.31
Total-members between age-0-17	22,277	0.00	0.03	0.00	0.03
Total-members between age 18-40	22,277	0.47	0.49	0.42	0.49
Total-members between age 41-59	22,277	0.35	0.47	0.35	0.47
Total-members between age 60+	22,277	0.22	0.41	0.24	0.43
Age of Respondent	22,270	43.91	14.85	46.61	16.08
Marital Status	22,275	0.49	0.49	0.58	0.49
Number of Children	22,276	1.90	1.98	2.51	2.49

Table 3— HOUSEHOLDS BETWEEN 2006, 2013, & 2017.

Variables	N	Control(n=11,383)		Treatment(n=28,085)	
		Mean	SD	Mean	SD
Credit Acquisition	39,214	0.12	0.33	0.12	0.33
Credit Outstanding	4,846	3439.76	98282.08	2995.45	46051.86
Savings Balance	16,847	1034.65	5894.83	916.34	4441.49
Savings @ (t-1)	16,841	992.04	10037.88	883.58	4663.98
Total Income	25,459	3380.78	75135.22	6762.44	47655.31
Total Wealth	17,241	5695.03	47897.93	7351.16	49620.13
Total Expenditure	39,468	7601.38	7922.10	7811.25	9023.62
Deposit Rate	39,468	11.80	1.44	11.72	1.51
Urban/Rural	39,468	1.60	0.48	1.55	0.49
HH size	39,468	3.88	2.56	4.36	2.91
Gender	39,468	0.64	0.47	0.73	0.44
Food Expenditure	39,468	3460.24	3251.04	3304.21	3433.45
Housing Expenditure	39,468	589.74	1303.80	657.39	1887.99
Household Education	38,872	0.33	0.47	0.26	0.44
HH Employment	39,382	0.87	0.33	0.85	0.34
Total-members between age-0-17	39,468	0.00	0.03	0.00	0.03
Total-members between age 18-40	39,468	0.39	0.48	0.45	0.49
Total-members between age 41-59	39,468	0.37	0.48	0.34	0.47
Total-members between age 60+	39,468	0.23	0.42	0.19	0.39

Age of Respondent	39,447	47.46	16.22	45.21	15.62
Marital Status	39,465	0.50	0.49	0.59	0.49
Number of Children	39,455	2.15	2.15	2.41	2.35

3.4. Identification Strategy And Matching Technique.

3.4.1 Theoretical framework and model specification

This paper relies on PSM technique, which was first suggested by Rosenbaum and Rubin (1983). This is used to draw on a class of estimators by evaluating the effect of PFI's household credit acquisition. Theoretically, the PSM approach tries to capture the effects of different observed covariates, say X, on participation in a single propensity score or index. Rosenbaum and Rubin (1983) identify an outcome of interest as described in equation 1. Outcomes of participating and nonparticipating individuals with similar propensity scores are compared to obtain the effect of PFI's on individuals' ability to acquire credit. This is a preferred method because if selection bias from unobserved characteristics is likely to be negligible, then PSM may provide a good comparison with randomized estimates. This method would help me to construct a statistical comparison group that is based on a model of the probability of households participating in the PFI's, say T, conditional on observed characteristics, X, or the propensity score: $P(X) = Pr(T=1|X)$ Rosenbaum and Rubin (1983).

The matching techniques are available to equate treatment groups with respect to baseline characteristics. In this paper my treatment variable is the activities of the PFI, which is a dummy variable taking the value 1 if PFI's were present in a particular reason and 0 otherwise. PSM has been used in recent finance research as an alternative method to estimate causal treatment effects.

PSM is a useful tool that intuitively achieves the goal of balanced treatment groups for an assessment of the treatment effect on the outcome with reduced bias. The outcome variable (Y) as discussed already is credit acquisition. In this methodology, D_i denote as a dummy variable equal to 1 if individual i is a treated household (i.e., household were within the PFI region) and 0 otherwise. Y_{i0} and Y_{i1} are the outcome variables describing household's credit acquisition patterns for unit i conditional on the presence and absence of treatment, respectively. The treatment effect for individual i measures the difference between the relevant outcome indicator with the treatment and the relevant outcome indicator without the treatment. It is given by:

$$\Delta Y_i = E(Y_{i1}/D_i = 1) - E(Y_{i0}/D_i = 1) \text{.....equation (1)}$$

While the post-treatment outcome is observed, its value in the absence of treatment (i.e., the counterfactual) is not. In household surveys, it is impossible to simultaneously observe someone in two different states. Consequently, the components $E(Y_{i1}/D_i = 1)$ and $E(Y_{i0}/D_i = 0)$ are observable outcomes, whereas $E(Y_{i1}/D_i = 0)$ and $E(Y_{i0}/D_i = 1)$ are non-observable outcomes. By filling in the missing data on the counterfactual, propensity score matching provides a potential solution to the evaluation problem. More precisely, PSM is based on the conditional independence assumption, which states that the outcome in the untreated state is independent of treatment participation conditional on a particular set of household observable characteristics as described in tables 1—3, denoted by X Rosenbaum and Rubin (1983). This assumption is equivalent to the absence of selection bias based on unobservable heterogeneity (Heckman and Robb 1985) and can be expressed as:

$$(Y_{i0}, Y_{i1}) \perp D_i/X_i$$

This means that, given X_i, the outcomes of nontreated units can be used to approximate the counterfactual outcome of treated units in the absence of treatment.

$$E(Y_{i0}/D_i = 1, X_i) = E(Y_{i0}/D_i = 0, X_i)$$

Rosenbaum and Rubin (1983) show that it is possible to condition participation on the propensity score denoted $P(X_i)$ rather than on observable characteristics X. The propensity score is the conditional probability of receiving a treatment given pre-treatment characteristics, X (or household characteristics).

$$P(X_i) = \Pr\{D_i = 1|X_i\} = E\{D_i|X_i\}$$

where D = {0, 1} is the binary variable on whether a household credit acquisition was influenced by the PFI's (1) or not (0) and X is the multidimensional vector of pre-treatment characteristics or time-invariant or relatively stable household characteristics in the framework. Rosenbaum and Rubin (1983) established the following conditions in order to be able to estimate Average Treatment on the Treated (ATT) effect based on the propensity score:

Condition 1: The Balancing Hypothesis

$$D_i \perp X_i \mid P(X_i)$$

This means that for observations with the same propensity score, the distribution of pre-treatment characteristics must be the same across control and treated groups. That is, conditional on the propensity score, each individual has the same probability of assignment to treatment, as in a randomized experiment.

Condition 2: Unconfounded given the Propensity Score:

$$Y_{i0}, Y_{i1} \perp D_i | X_i \Rightarrow Y_{i0}, Y_{i1} \perp D_i | P(X_i)$$

If assignment to treatment is unconfounded conditional on the variables pre-treatment, then assignment to treatment is unconfounded given the propensity score. After computing the propensity score, the ATT effect (τ) is estimated as follows:

$$\tau = \{Y_{i1} - Y_{i0} \mid D_i = 1\}$$

$$\tau = E\{E\{Y_{i1} - Y_{i0} \mid D_i = 1, P(X_i)\}\}$$

$$\tau = E\{E\{Y_{i1} \mid D_i = 1, P(X_i)\} - E\{Y_{i0} \mid D_i = 0, P(X_i)\} \mid D_i = 1\}$$

where *i* denotes the *i-th* household, Y_{i1} is the potential outcome in the two counterfactual situations with the effect of PFI's and without.

3.4.2 Matching technique.

According to Ho et al (2007), matching is nonparametric in the sense that the estimated weights and pruning of the sample are not direct functions of estimated model parameters but rather depend on the organization of discrete units in the sample; this is in contrast to propensity score weighting (also known as inverse probability weighting), where the weights come more directly from the estimated PSM and therefore are more sensitive to its correct specification. PSM does not require bias correction, because it uses a model for the treatment. If the treatment model is reasonably well specified, PSM will perform at least as well as NNM. Different matching methods are used in calculating the effect since the propensity score is a continuous variable. The greedy or nearest neighbor matching was used in this study. The nearest neighbor consists of matching each treated household to the nearest untreated household, that is household with closest propensity scores are matched. It involves running through the list of treated units and selecting the closest eligible control unit to be paired with each treated unit. It is greedy in the sense that

each pairing occurs without reference to how other units will be or have been paired, and therefore does not aim to optimize any criterion. Nearest neighbor matching is the most common form of matching used Thoemmes and Kim (2011) and has been extensively studied through simulations Zakrison et al (2018).

With propensity score matching, the default is to go in descending order from the highest propensity score; doing so allows the units that would have the hardest time finding close matches to be matched first Rubin (1973). Other orderings are possible, including random ordering, which can be tried multiple times until an adequate matched sample is found. When matching with replacement (i.e., where each control unit can be reused to be matched with multiple treated units), the matching order doesn't matter. This paper however relies on the NNM with non-replacement, as such, matching order is important. Figure 2—7 depicts the outcome of the selected matching technique aforementioned. These figures were constructed to reflect the distribution of the matching process. While figures 2—4 shows a graphical distribution of households who acquired credit of matched sample after matching for variables, figures 5—7 gives a more vivid description of the balance density plot of the propensity score before and after matching for treated and control Groups. It is evident from these graphs that the balancing matching property assumptions (BMPS) were satisfied. Accordingly, visually inspecting the density distribution of the propensity score shows a sufficient overlap between the two groups , hence, satisfies the required overlap condition of the PSM method.

To lend further credence to the matching process, tables 4—6 were computed. These tables show computations of the average differences for households who acquired credit of matched sample after matching for the different classifications in this study. One underlining challenge of the PSM is to begin with a large sample size. This is because the matching process eventually

shrinks the number of observations. This is consequently evident from the tables below, relative to tables 1—3. The number of observations in the summary statistics preceding the match is significantly less than the ones after the match. It is now trite to turn attention to preliminary results before and after the matching process.

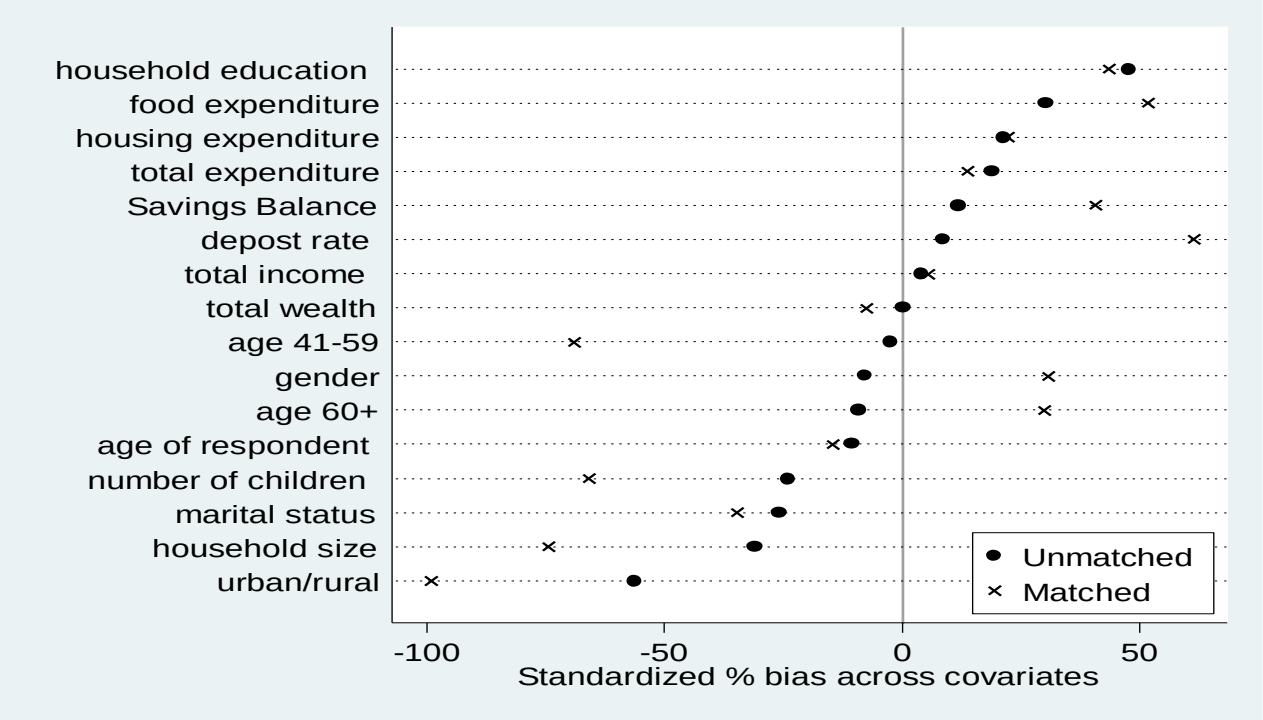

Figure 2: Graphical Representation of households who acquired credit of matched sample after matching for variables using nearest neighbor matching (2006-2013).

Table 4— Mean differences for households who acquired credit of matched sample after matching for variables using greedy matching technique (2006-2013)

Variables	Matched (n= 1,633)			T-test	
	Treated	Control	% bias	t	p>t
Savings Balance	2169.90	581.55	40.50	6.32	0.00
Savings @ (t-1)	1673.40	531.17	24.1	4.47	0.00
Total Income	13683	8283.70	5.30	1.57	0.11
Total Wealth	6583.10	9529.80	-7.70	-3.28	0.01
Total Expenditure	10605	9366.70	13.5	4.02	0.00
Deposit Rate	12.32	11.68	61.20	23.74	0.00
Urban/Rural	0.16	0.63	-99.0	-31.80	0.00
HH size	3.00	5.14	-74.30	-23.85	0.00
Gender	0.91	0.79	30.6	10.56	0.00
Food Expenditure	4649.40	3191.40	51.40	13.08	0.00
Housing Expenditure	896.03	575.75	22.0	7.42	0.00
Household Education	0.44	0.24	43.40	12.42	0.00
Total-members between age 41-59	0.04	0.38	-69.00	-25.39	0.00
Total-members between age 60+	0.29	0.18	29.70	7.45	0.00
Age of Respondent	43.13	45.28	-14.80	-3.77	0.00
Marital Status	0.56	0.72	-34.70	-9.84	0.00
Number of Children	1.34	2.89	-65.90	-21.33	0.00

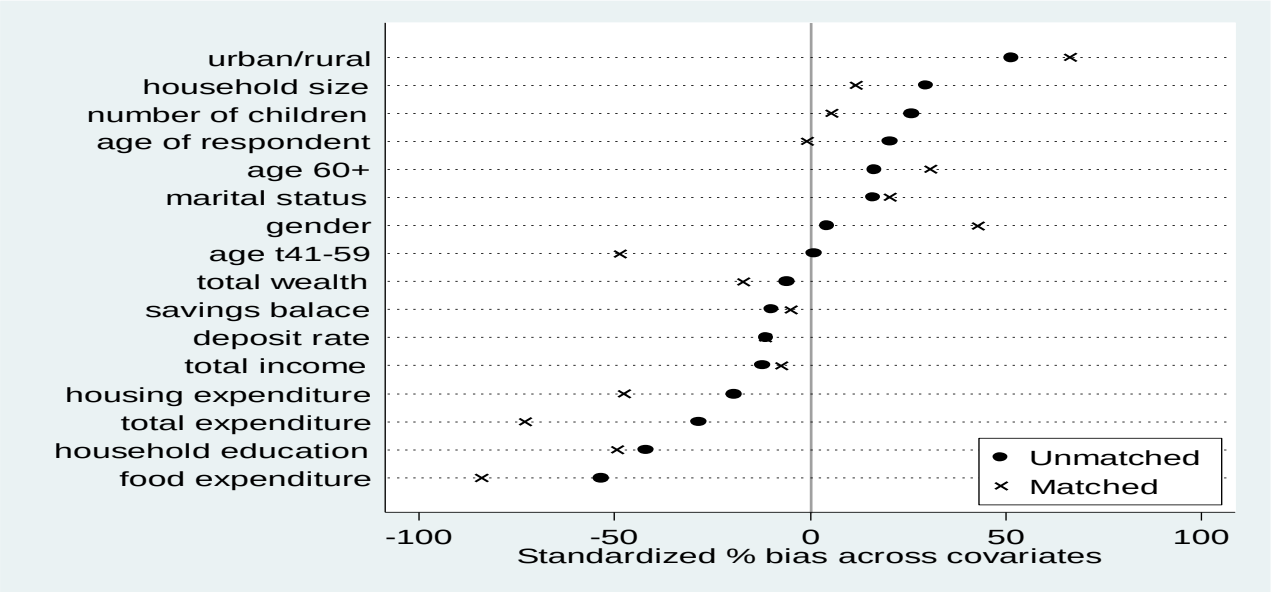

Figure 3: Graphical Representation of households who acquired credit of matched sample after matching for variables using nearest neighbor matching (2013-2017).

Table 5— Mean differences for households who acquired credit of matched sample after matching for variables using greedy matching technique (2013-2017)

Variables	Matched (n= 1,633)			T-test	
	Treated	Control	% bias	t	p>t
Savings Balance	782.90	1021.20	-4.50	-2.71	0.00
Total Income	7577.60	15106	-9.70	-3.68	0.00
Total Wealth	8526.7	12719	-9.60	-3.22	0.01
Total Expenditure	9937.80	13548	-38.80	-13.78	0.00
Deposit Rate	11.82	11.911	-9.70	-3.51	0.00
Urban/Rural	1.49	1.23	56.50	20.81	0.00
HH size	4.64	3.94	25.90	9.38	0.00

Gender	0.76	0.68	17.70	6.22	0.00
Food Expenditure	3306.90	5086.90	-61.50	-21.84	0.00
Housing Expenditure	741.28	1171.30	-25.40	-8.91	0.00
Household Education	0.34	0.62	-57.50	-21.18	0.00
Total-members between age 41-59	0.36	0.44	-15.60	-5.56	0.00
Total-members between age 60+	0.18	0.08	27.00	10.45	0.00
Age of Respondent	45.19	42.53	18.70	7.03	0.00
Marital Status	0.64	0.53	21.40	7.76	0.00
Number of Children	2.61	2.13	21.20	7.69	0.00

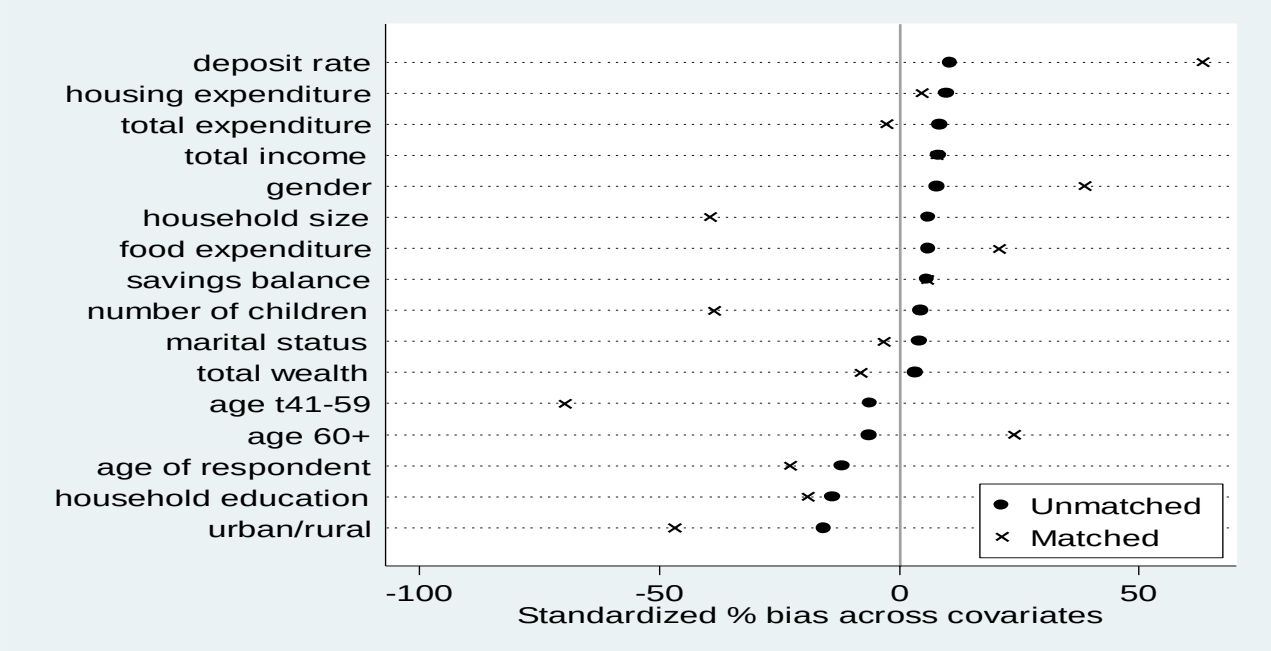

Figure 4: Graphical Representation of households who acquired credit of matched sample after matching for variables using nearest neighbor matching (2006-2013-2017)

Table 6— Mean differences for households who acquired credit of matched sample after matching for variables using greedy matching technique (2006-2013-2017)

Variables	Matched (n= 1,633)			T-test	
	Treated	Control	% bias	t	p>t
Savings Balance	902.02	543.26	5.70	1.96	0.05
Total Income	12935	5727.30	7.60	2.58	0.10
Total Wealth	5512.30	8633.50	-8.10	-4.22	0.00
Total Expenditure	9896.10	10151	-2.80	-0.95	0.34
Deposit Rate	12.33	11.67	63.10	26.82	0.00
Urban/Rural	1.24	1.48	-47.10	-15.54	0.00
HH size	3.22	4.31	-39.70	14.49	0.00
Gender	0.90	0.79	38.60	13.86	0.00
Food Expenditure	4335.90	3735.70	20.70	5.92	0.00
Housing Expenditure	783.39	718.92	4.50	1.90	0.05
Household Education	0.37	0.46	-19.30	-6.04	0.00
Total-members between age 41-59	0.05	-0.39	-69.90	-27.67	0.00
Total-members between age 60+	0.26	0.17	23.90	6.69	0.00
Age of Respondent	42.04	45.36	-23.00	-6.53	0.00
Marital Status	0.60	0.61	-3.40	-1.05	0.29
Number of Children	1.49	2.37	-38.80	-14.05	0.00

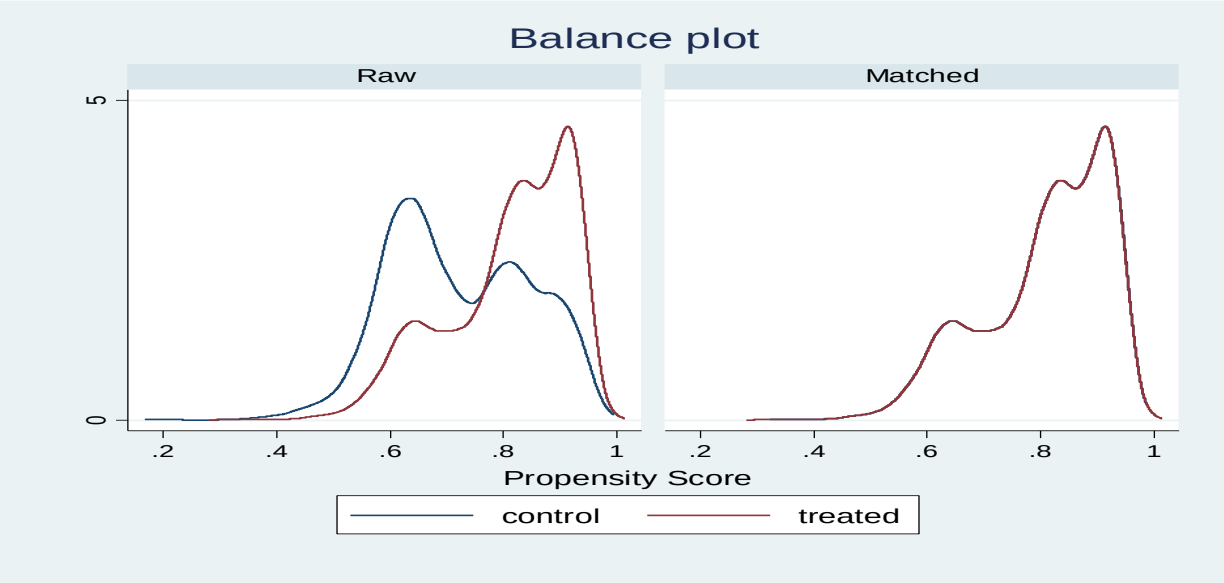

Figure 5. Balance density plot of the propensity score before and after matching for treated and control Groups between the period 2006 and 2013.

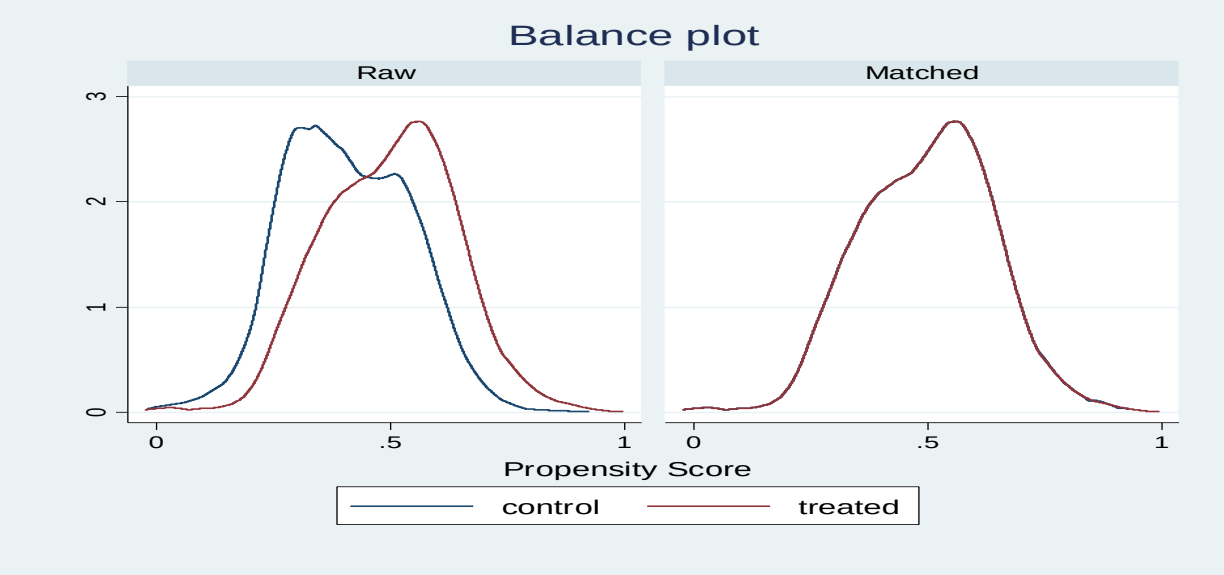

Figure 6. Balance density plot of the propensity score before and after matching for treated and control Groups between the period 2013 and 2017

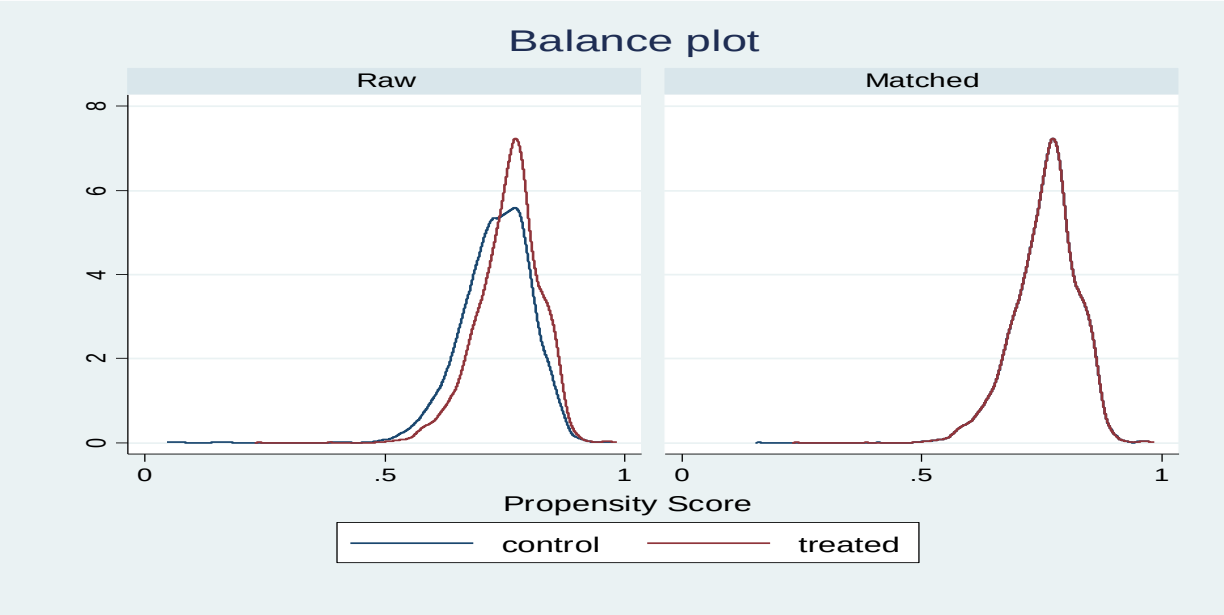

Figure 7. Balance density plot of the propensity score before and after matching for treated and control Groups between the period 2006, 2013 and 2017.

3.5. Main Results, T-test, And Alternative Outcome

3.5.1 T-test and Preliminary Results.

First, I begin by running a probit model to examine the relationship between the treatment and outcome variable. In this case the outcome variable is credit acquisition while the treatment is included in the model as a regressor. As stated earlier, the treatment is represented by PFI's allocation which is measured by dummy variable indicating whether a region was exposed to Ponzi-schemes or not. It takes the value 1 if exposed and 0 otherwise. The outcome variable is credit acquisition which takes the value 1 if household applied for credit and acquired same and 0 otherwise. Tables 7—9 probit results for the three groups of datasets (2006-2013, 2013-2017, and 2006-2013-2017).

Columns 1 of each table shows results for probit regressions with standard errors in the parenthesis, while column shows the t-test. Tables 7 and 9 evidentially suggests a negative relationship between the outcome variable and the treatment, and table 8 shows a positive relationship. Hence, in table 7 and 9, households within the treated regions (exposed to PFI's) decreases the predicted probability of acquiring credit.by 0.10 and 0.09 respectively, holding all other regressors constant. The results in table 8 shows a negative relationship with a value of 0.11. This means that households exposed to PFI's were less likely to acquire credit relative to those who are not. These estimates are preliminary but suggest the expected narrative.

Table 7— BEFORE PROPENSITY SCORE (2006 & 2013).

VARIABLES	(1) Coefficient (Std. Errors)	(2) T-test
Treatment	-0.102**	-2.09
	(0.0475)	
Savings balance	-2.058**	-0.01
	(8.3606)	
Rural/Urban	0.0686*	1.78
	(0.0410)	
Gender	-0.115**	-2.47
	(0.0493)	
Marital status	-0.00314	-0.22
	(0.0465)	
Household education	0.0473	1.25
	(0.0408)	
Total expenditure	4.069*	1.07
	(2.9106)	
Food expenditure	-2.005**	-2.40
	(8.906)	
Housing expenditure	-1.3806	0.13
	(1.105)	

Household size	0.0282*	1.71
	(0.0165)	
Total income	3.21e-08	0.03
	(1.907)	
Total wealth	1.406***	3.63
	(3.907)	
Deposit rate	-0.1000***	-6.35
	(0.0166)	
Number of children	-0.0139	-0.55
	(0.0194)	
Age of respondent	0.000269	0.05
	(0.00333)	
Age 41-59	0.113*	1.67
	(0.0672)	
Age 60+	-0.0898	-0.67
	(0.131)	
Constant	-0.116	7.45
	(0.231)	
Observations	7,831	
LR chi2(17)	105.02	
Prob > chi2	0.0000	
Pseudo R2	0.0175	
Log likelihood	2946.5033	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8— BEFORE PROPENSITY SCORE (2013 & 2017).

VARIABLES	(1) Coefficient (Std. Errors)	(2) T-test
Treatment	0.113**	2.58
	(0.0465)	
Savings balance	-2.205**	2.39
	(8.806)	
Urban/rural	0.0450	0.97
	(0.0483)	
Gender	-0.106*	-2.01
	(0.0562)	
Marital status	-0.0342	-0.79
	(0.0535)	

Household education	0.0538	1.14
	(0.0469)	
Total expenditure	7.306**	1.90
	(3.506)	
Food expenditure	-3.706	-0.55
	(1.005)	
Housing expenditure	6.606	0.82
	(1.205)	
Household size	-0.000922	-0.07
	(0.0210)	
Total income	-2.307	-1.07
	(2.507)	
Total wealth	1.106***	2.83
	(4.307)	
Deposit rate	0.00233	0.06
	(0.0232)	
Number of children	-0.00231	0.00
	(0.0241)	
Age of respondent	0.00312	0.78
	(0.00392)	
Age 41-59	0.113	1.46
	(0.0789)	
Age 60+	-0.137	-0.90
	(0.155)	
Constant	-1.467***	1.07
	(0.317)	
Observations	5,913	
LR chi2(16)	55.27	
Prob > chi2	0.0000	
Pseudo R2	0.0128	
Log likelihood	-2126.8854	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9—BEFORE PROPENSITY SCORE (2006, 2013 & 2017).

VARIABLES	(1) Coefficient (Std. Errors)	(2) T-test
Treatment	-0.0940**	-2.14
	(0.0434)	
Savings balance	-2.105**	-2.17
	(8.406)	
Urban/rural	0.0636	1.62
	(0.0408)	
Gender	-0.111**	-2.38
	(0.0493)	
Marital status	-0.00893	-0.33
	(0.0465)	
Household education	0.0677*	1.62
	(0.0407)	
Total expenditure	4.806*	1.28
	(2.9206)	
Food expenditure	-1.9505**	-2.26
	(8.8906)	
Housing expenditure	-9.707	0.06
	(1.105)	
Household size	0.0242	1.47
	(0.0165)	
Total income	2.1908	0.06
	(1.9507)	
Total wealth	1.406***	3.83
	(3.907)	
Deposit rate	-0.101***	-6.35
	(0.0167)	
Number of children	-0.0109	-0.46
	(0.0194)	
Age of respondent	0.000852	0.24
	(0.00333)	
Age 41-59	0.113*	1.69
	(0.0673)	
Age 60+	-0.0986	-0.76
	(0.131)	
Constant	-0.180	6.94
	(0.238)	

Observations	7,831
LR chi2(17)	105.13
Prob > chi2	0.0000
Pseudo R2	0.0175
Log likelihood	-2946.4452

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

3.5.2 Main results and alternative approach

To delve further into the main results, table 10 presents the output of the average treatment effects on treated after matching. These estimates were conducted for the same outcome variable (credit acquisition) for three separate year groups. Between 2006 and 2013, the difference in mean shows a value of -0.03, implying that households who were exposed to PFI's were 3% less likely to acquire credit. However, between the period 2013-2017, the shows a positive value of 0.02, which also signifies that the post-closure of PFI's led to a 2% increase in household credit acquisition. And finally, the third group shows the combine effect of both all the two earlier groups discussed (during and post-closure of PFI's). This combines effect indicates that the overall activities of PFI's (during and post-closure) led to a 2% reduction in households acquiring credit in the financial sector.

To put these results in perspective, the activities of PFI's marginally affected the ability of households to acquire credit. This is consistent with the narrative because these PFI's had ultimate aim of attracting deposits, instead of providing credit to households and small businesses.

Table 10— Average Treatment Effects On Treated For The Outcomes After Matching.

Variable	Year	Group		Effect	
		Treatment	Control	Difference	T-stat (SE)
Credit Acquisition	2006-2013	0.09	0.12	-0.03	2.26(0.010)
Credit Acquisition	2013-2017	0.13	0.11	0.02	2.07(0.089)
Credit Acquisition	2006-20013-2017	0.10	0.12	-0.02	1.96(0.098)

3.5.3 Alternative approach

An alternative measure of the effect of PFI's on households' ability to acquire credit, I used the treatment-effect estimators (TEFFECTS). The treatment-effect estimators allow us to estimate the efficacy of treatments using observational data. And the goal is to utilize covariates to make treatment and outcome independent once we condition on those covariates. The TEFFECTS estimates average treatment effects (ATEs), average treatment effects among treated subjects (ATETs), and potential-outcome means (POMs) using observational data.

Table 11 shows results of the ATE estimations. These estimates are similar to the results obtained form ATT, comparing the coefficients in table 11 to the difference in mean in table 10. This underscores significant conclusions and corroborates the results in the apriori expectations.

Table 11— Treatment-Effects Estimation For Observational Data.

Outcome Variables	Year	Observations =7,827		Effect	
		Coefficient	Robust SE	z	p>|z|
Credit Acquisition	2006-2013	0.034	0.010	3.35	0.001
Credit Acquisition	2013-2017	0.031	0.011	2.82	0.005
Credit Acquisition	2006-20013-2017	0.018	0.009	1.84	0.066

3.6. Conclusions, Policy Recommendations.

3.6.1 Conclusions

First, this paper examines the impact of PFI's on household credit acquisition in Ghana. The study used survey of 2006, 2013, and 2017 from World Bank Living Standards Measurement, and employs a PSM technique to test for and measure the treatment effect on the observations of interest. This is done by using the greedy matching approach. Secondly, the paper conducted a t-test and probit regression which applies generalized linear model and find expected outcome. And finally, the main results obtained from the analyses indicate that the presence of PFI's reduced credit acquisition on the average by a 3% point among households between 2006-2013, while the post-closure effect (2013-2017) increased credit acquisition on the average by a 2% point. The combine effect also shows that households reduced their credit acquisition on the average by a 2% point between the period 2006-2013-2017, which thus indicate that activities of PFI's negatively impacted the credit sub-sector in Ghana. This result is consistent with alternative estimations.

3.6.2 Policy Implications

This result is imperative to policy makers and underscores significant implications for development, especially for banking supervisory agencies and the government of Ghana. It underscores the fact that PFI's stifle growth by negatively impacting on credit acquisition. It is no stretch of imagination that credit is needed to aid business activities and household consumption. Urgent measures should be put in place to ensure management of the financial operations, and regulatory reporting of banking, investment banking, and securities' firm's activities. This includes managing the preparation and analysis of monthly financial statements and other financial reporting requirements to keep pace established standards.

Appendix C

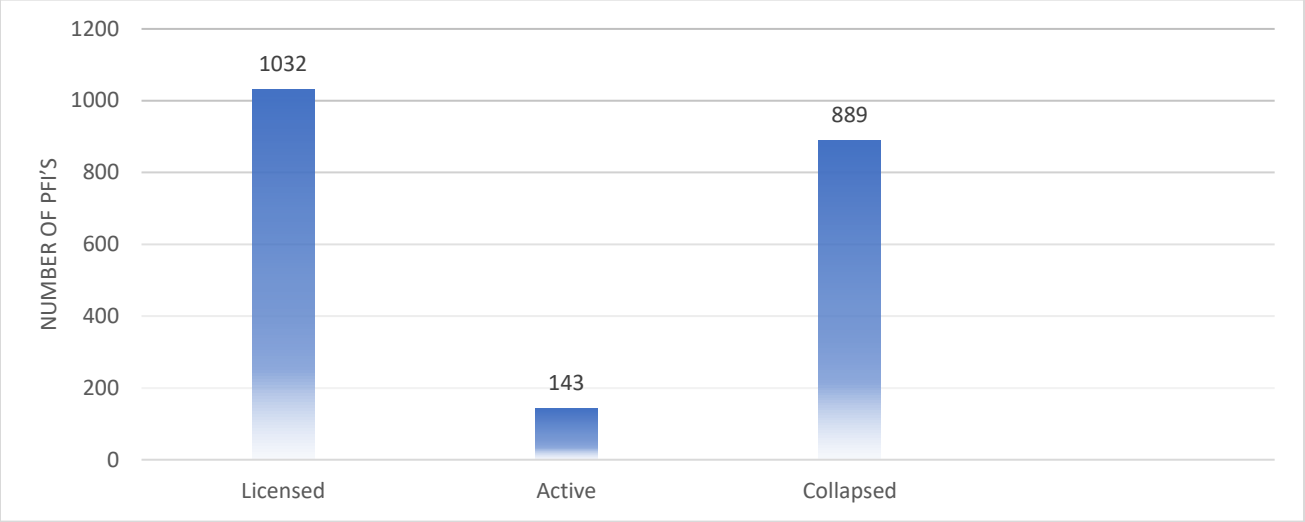

Figure 1.3: Breakdown Of The Financial Sector In Ghana.

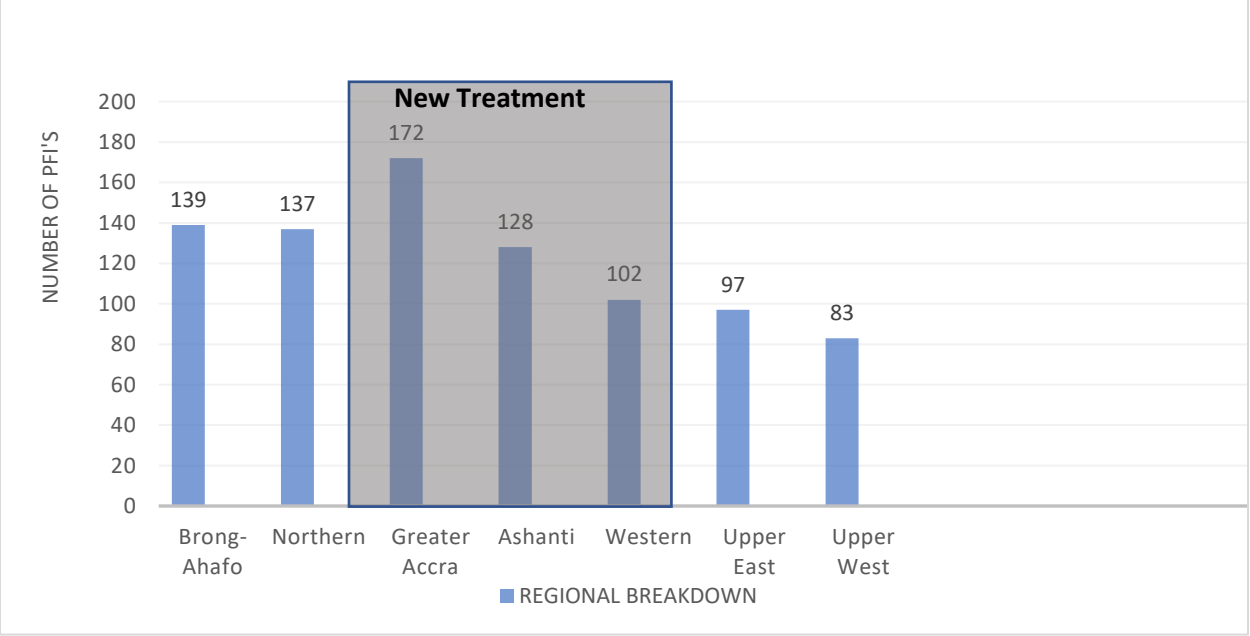

Figure 1.4: Regional Breakdown of Collapsed PFI's and New Control Regions.

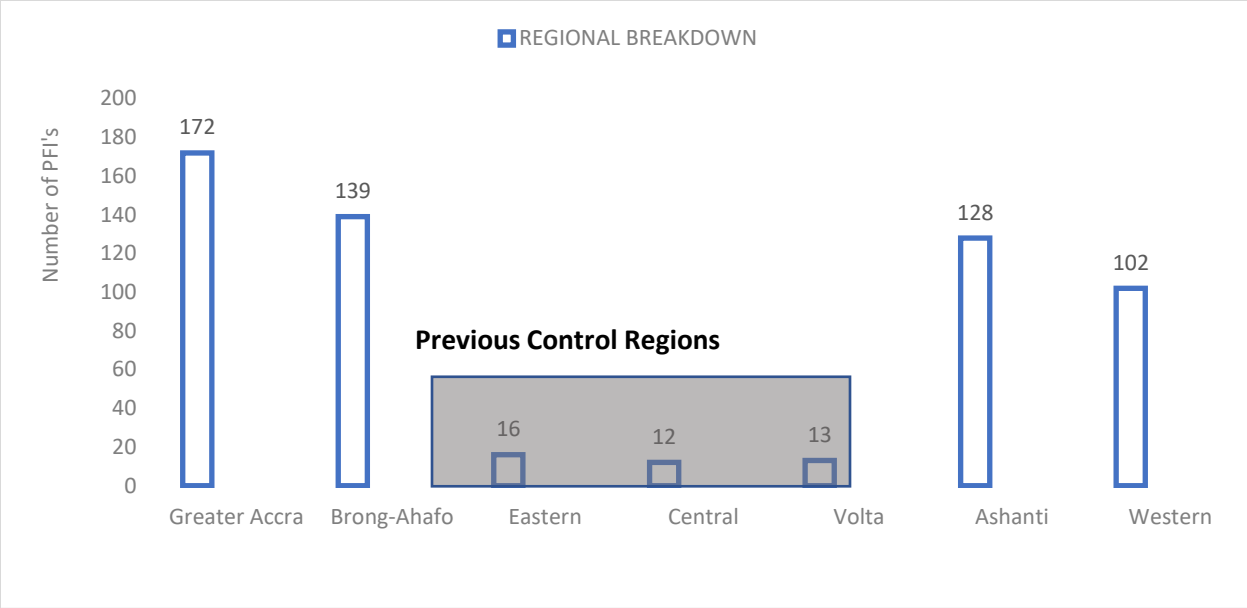

Figure 1.5: Regional Breakdown of Collapsed PFI's and Old Control Regions.

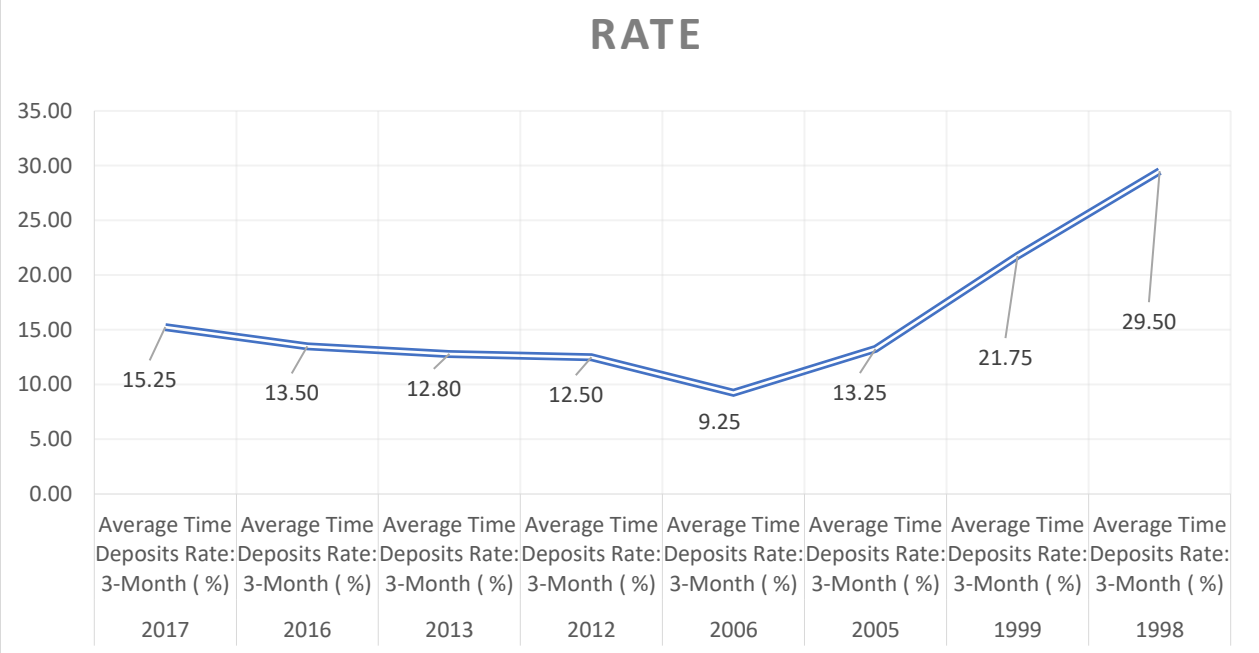

Figure 1.6: Average Time Deposits Rate Overtime (1998—2017)

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