Discussion Paper

No. 94

PIER

PUEY UNGPHAKORN INSTITUTE
FOR ECONOMIC RESEARCH

Household Debt and Delinquency over the Life Cycle

by

Sommarat Chantarat, Atchana Lamsam, Krislert Samphantharak, and Bhumjai Tangsawasdirat

Household Debt and Delinquency over the Life Cycle[*]

Sommarat Chantarat, Atchana Lamsam,

Krislert Samphantharak, and Bhumjai Tangsawasdirat

March 26, 2019

Abstract: This paper uses loan-level data from Thailand's National Credit Bureau to study household debt over the life cycle of borrowers. The wide coverage and the granularity of the data allow us to decompose the aggregate, commonly-used debt per capita and delinquency rate into components that unveil the extensive and intensive margins of household indebtedness. This decomposition allows us to analyze debt holding, debt portfolio, and delinquency for each age and cohort. We find the striking inverted-U life cycle patterns of indebtedness as predicted by economic theories. However, peaks are reached at different ages for different loan products and different lenders. We also find that debt has expanded over time for all age groups. In particular, the younger cohorts seem to originate debt earlier in their lives than the older generations. Meanwhile, older borrowers remain indebted well past their retirement age. Finally, we find a downward pattern of delinquency over the life cycle. Our findings have important policy implications on financial access and distress of households as well as economic development and financial stability of the economy.

JEL Codes: D14, D30, G20, H31, J26, O16

Keywords: Household Debt, Delinquency, Life Cycle, Financial Access, Financial Stability, Demography, Aging Economies, Credit Bureau Data

---

"[R]esearch on household debt has lagged behind its sister literatures
on the asset side of the household balance sheet."
Jonathan Zinman (2015)

1. Introduction

Household debt is a crucial component of the financial system. It helps finance household consumption and investment as well as the operation of informal business enterprises. Some debt instruments such as credit cards also serve as a means of payment in the economy. However, high and rapidly rising household debt can lead to debt burden and financial vulnerability of the households, which in turn raise a serious concern over the stability of the financial system. In addition, high level of debt may inhibit household's spending and consumption, a symptom known as debt overhang, which in turn affects long-term growth of the aggregate economy. This concern is of particular relevance today as we observe rising household debt in many countries across the world—including a number of those in Asia, a region long known for its frugality.[1] However, understanding household debt and its implications on the economy is complicated. For one thing, households are diverse so we need to understand the heterogeneous nature of debt across borrowers. The goal of this paper is to contribute to this understanding by dissecting one of the aspects of household debt, namely, indebtedness and delinquency over the life cycle. In particular, this paper aims to answer two questions: (1) does household debt follows a life cycle profile predicted by economic theories, and if so, when does the deleverage start? and (2) does the life cycle pattern change over time across cohorts?

Aggregate data show that household debt has increased in recent decades in many countries. For example, credit to households as a share of total credit has increased from 27 percent in 1980 to 58 percent in 2000 in Korea (Beck et al 2008). More recently, total bank credit to the household sector in the Asia-Pacific region more than doubled relative to GDP between 1995 and 2015 (Schularick and Shim 2017). The expansion is observed in high-income economies such as Australia, New Zealand, Korea, and Singapore, as well as in middle-income countries such as

---

[1] See, for example, "Mutable values: Asian households binge on debt", The Economist, November 2nd 2017.

Malaysia and Thailand.[2] In 2017, Thailand's household debt, at 69 percent of GPD, was the highest among developing Asian economies; the only Asian country with higher household debt was Korea (94). Other Asian economies with similar household debt were Hong Kong (69) and Malaysia (68), while Singapore and Indonesia experienced lower household debt than Thailand (57 and 17, respectively).

Growing household debt is not necessary a bad thing. If borrowers are capable of servicing the debt, it does not pose serious concerns on the vulnerability of the borrowers and the stability of the financial system. However, if debt accumulation is from new loans with lower quality that result in subsequent delinquency, then measures to curb the adverse impacts must be implemented. In order to understand the underlying risk of household debt, we need to go beyond the aggregate statistics and examine the distributional aspect, in particular, who are the debt holders and where the delinquency is. Several studies have identified various characteristics of borrowers that are related to debt holding and delinquency such as income, occupation, and location. This paper focuses on one of such characteristics, namely, borrower's age. More precisely, we examine the distribution of indebtedness and delinquency over the life cycle of the debtholders. The rationales behind our study come in twofold. First, although there are extensive studies of household portfolios, most have focused on savings and investment, i.e., the asset side of the household's balance sheet; fewer studies have looked at debt, i.e., the liability side. Second, many of the economies that experience rising household debt are also confronting a looming challenge on aging society. Understanding how debt and delinquency evolve over the life cycle of borrowers therefore provides insights for relevant policy implications.

Despite its importance, the understanding of household debt across age of borrowers at a granular level has been limited, partly due to the lack of data. Existing literature that uses microdata usually relies on household surveys, which have the advantage of covering all types of household debt in the formal, semi-formal, and informal financial sectors. However, the data are subjected to

---

[2] Table A.1 in the Appendix presents household debt to GDP ratios of selected economies from the Asia-Pacific region based on the data from the Bank for International Settlements (BIS). The only Asia-Pacific economy in the BIS data that did not experience an increase in household debt to GDP is India (10.6 percent in 2007 and 9.4 percent in 2014). Also, although household debt in advanced economies has declined or remained stable after the global financial crisis, the level of the debt is still much larger than decades ago.

misreport, as households may have incentives to under- or over-claim their debt situation. Household surveys are also often small and far from being representative of the entire household sector of the country.

To overcome some of these problems, this paper uses granular administrative data of debt at the account level from Thailand's National Credit Bureau (NCB) from 2009 to 2016. Thailand serves as an ideal country for this study for several reasons. First, it is one of the countries with rapidly rising household debt in recent decades, from 40.2 percent of GPD in 1994 to 69.5 percent in 2014 (Bank for International Settlements, BIS). Furthermore, the country is currently experiencing disruptive penetration of financial technology, or "FinTech", that has a potential to significantly accelerate the process of credit expansion, both to existing debtors and to new borrowers. Meanwhile, growing middleclass population is accompanied by rising consumerism among the population. Finally, the country is experiencing a speedy change in demographic structure, becoming an aging society. Specifically, the percentage of population aged 65 and above to total population of Thailand will increase from 13 percent in 2020 to 26 percent in 2040, making the country one of the world's most rapidly aging economies (UN Population Prospect 2015). Understanding the age profiles of debt and delinquency is therefore important for Thailand and other countries that are facing similar challenges.

Our data cover the majority of formal loans to individuals in the country. More precisely, the data consist of over 60 million accounts from almost 20 million borrowers, representing 87 percent of the total household debt in the system in 2016. The wide coverage and the granularity of the data allow us to decompose the aggregate, commonly-used debt per capita and delinquency rate into components that unveil the extensive and intensive margins of household indebtedness. This decomposition allows us to analyze debt holding, debt portfolio, and delinquency for each age and cohort.[3]

---

[3] Recent availability of credit bureau data in some countries allows researchers to use the data to study various aspects of debt and default of households. See, for example, Mian and Sufi (2015) for the study on the U.S. during 2000-2010. To our best knowledge, our paper is one of the first that uses loan-level credit bureau data to analyze debt and default in an emerging economy.

We find the striking inverted-U life cycle patterns of indebtedness as predicted by economic theories. However, peaks are reached at different ages for different loan products and different lenders. We also find that debt has expanded over time for all age groups. In particular, the younger cohorts seem to originate debt earlier in their lives than the older generations. Meanwhile, older borrowers remain indebted well past their retirement age. Finally, we find a downward pattern of delinquency over the life cycle. Our findings have important policy implications on financial access and distress of households as well as economic development and financial stability of the economy. These are especially relevant for economies with aging population.

The rest of the paper proceeds as follows: Section 2 discusses related literature on household debt and delinquency over the life cycle. It also presents evidence on how rising household debt over time is related to the life cycle pattern. Section 3 provides narratives on the data as well as descriptive statistics. Section 4 presents empirical findings on debt, portfolio, and delinquency, over the life cycle; it also presents a cohort analysis of debt and delinquency. The paper concludes in Section 5 with policy implications on households and the aggregate economy.

2. Related Literature

This study is related to two strands of literature. The first one is related to consumption, savings, and hence indebtedness, of household over the life cycle. The second one is on the rising household debt over time.

2.1 Debt over the Life Cycle

The benchmark conceptual framework commonly used in the study of debt over the life cycle is based on the classic Modigliani's life-cycle hypothesis (Modigliani 1966). Given that a person generally prefers smooth rather than fluctuating consumption over time while his income usually has a hump-shape profile over the life cycle, he is likely to accumulate debt during the early years of his life when his income is insufficient for his consumption. As he approaches middle age and earns higher income, the need to borrow declines. He then begins to pay down his debt, which is eventually paid off towards the end of his life. In other words, there is a leveraging-deleveraging

dynamic over an individual's life cycle, implying an inverted-U pattern between age and indebtedness. In an economy where individuals face debt constraints, especially those at the young age (due to a lack of collateral and credit history) and those at the old age (due to costly liquidation of debt outstanding at the time of death), the inverted-U pattern will be more hump and less flat.

Empirical evidence supports the life-cycle hypothesis, showing that debt level and its composition change substantially over the life cycle. One of the early is Cox and Jappelli (1993) who use the 1983 Survey of Consumer Finance (SCF) in the U.S. and find that the desire for debt increases until the age of household head reaches the mid-30s and then declines. Crook (2001) uses the 1995 SCF and finds a decrease in demand for debt for households with head older than 55 years old. Yilmazer and DeVaney (2005) analyze the 2001 SCF and show that the likelihood of debt holding and the amount of debt compared to total assets decrease with the age of household heads.

More recently, Crawford and Faruqui (2012) analyze household-level data from the Canadian Financial Monitor (CFM) and find an inverted-U pattern between the age of household head and the mean level of debt of household in each year of the data during 1999-2010. For 2010, the indebtedness peaks in the 31-35 age range before gradually declining. Using data from the Equifax/NY Fed Consumer Credit Panel (CCP), Fulford and Schuh (2015) document similar strong life-cycle patterns of various types of debt. First, credit card debt begins to increase earlier in the life cycle until the age of 50 and starts falling after the age of 60. Second, few young people have mortgage but mortgage headcount increases with age until they turn 40 and then begins to decline after the age of 60. Third, individuals start having auto loans at younger age and by 30 years old almost 40 percent of individuals have auto loans; after that auto loan headcount gradually declines and then sharply drops after the age of 60. Finally, student loans present a distinct downward trend with age as individuals take this type of loans early in the life and repay over time as they age. Another debt product whose peak is observed in the young population is overdraft, as reported in a study by the U.S. Consumer Financial Protection Bureau (CFPB) that the propensity to overdraft declines with account holder age: 10.7 percent of the 18-25 age group have more than 10 overdrafts per year while the propensity is only 2.8 percent for population aged 62 and over age group.

Finally, unlike the literature on the life cycle of indebtedness, there are very few studies on delinquency over the life cycle. An exception is Xiao et al (2014) who analyze multiple datasets that are nationally representative of American families and document delinquency pattern by age and other demographic characteristics. They find that younger households are more financially distressed than their older counterparts and presence of children increases the likelihood of delinquency. Their finding suggests that younger households may experience more financial difficulties that result in higher likelihood of delinquency.

2.2 Rising Household Debt

The second strand of related research is on rising household debt. This literature has identified at least two major trends that contribute to the rising household debt in recent decades: an increase in financial access and an increase in consumerism of households.[4] The first trend, including an increase in access to credit by households, has been observed throughout the world—in developed, emerging, and underdeveloped economies. Deregulation of financial systems in several countries brings about new financial institutions and competition, allowing more people to have access to credit and existing borrowers to expand their loans. Innovations in financial products provides new ways of consumer debt financing. Various development initiatives implemented by the government, especially those through specialized financial institutions (SFIs), help underserved households to gain access to loans. The advent of microfinance institutions results in financial inclusion of households that would otherwise be left out. Enhanced financial literacy facilitates household's participation in credit markets. The creation of credit bureaus reduces asymmetric information problems, which is one the most important frictions in the financial markets. More recently, advance in digital technology further speeds up the outreach of finance to more people, creates new financial products that better serve households, and further reduces transaction costs. Altogether, these developments have resulted in the rising household debt we have observed worldwide. Literature on the expansion of financial access and its impacts on the economy is extensive. Dynan (2009) and Karlan and Morduch (2009) provide a survey of studies on this issue.

---

[4] This argument is abstract from short- and medium-term fluctuation. For example, in the medium term Justiniano et al (2013) argue that the rapid rise and fall of the U.S. household debt between 2000 and 2007 cannot be explained by financial liberalization and subsequent tightening. They further argue that the credit cycle was more likely accounted for by factors that impacted house prices through a collateral channel.

The second trend, an increase in consumerism, has been widely documented by researchers focusing on consumer behaviors, including marketing and other social sciences outside economics.[5] Within economics, the idea about social status and conspicuous consumption dates back at least to the century-old "keeping up with the Joneses" argument by Veblen (1899). Alternative mechanisms analyzed in recent studies include expenditure cascades (Frank et al 2014) and status goods (Bursztyn et al 2017). However, most studies that link the role of relative standing in the society to household behaviors focus on the effects on consumption and assets while the studies on the effects on liabilities and financing attract less attention.[6]

The pervasiveness of the consumer society and the stagnant income of the middle and lower social classes imply higher demand of consumer goods and consumer durables by households that do not have sufficient income to finance such purchases, resulting in the origination and accumulation of credit card, personal, auto, and mortgage debt. A few studies that examine the relationship between social status and debt include Georgarakos et al (2014) who analyze data from the Dutch National Bank Household Survey (DNBHS) and find that, everything else equal, higher average income in the social circle, as perceived by a household, increases a household's tendency to borrow and the likelihood of future financial distress, as reflected in the debt service ratio and the loan-to-value ratio. In another study, Bricker et al (2014) link household financial decision data from SCF with neighborhood data from the American Community Survey (ACS) and find that household's position in the income distribution relative to its close neighborhoods is positively associated with its expenditure on high status cars, its level of indebtedness, and the riskiness of its portfolio. Finally, a study of Singaporean household by Lee et al (2017) provides another evidence. All else equal, households residing in condominiums (those who are more likely to care more about social status) spend substantially more on conspicuous goods, have more credit card debt, and have more delinquent debt on their credit cards than their counterparts living in the subsidized public housing. They find no difference in spending on inconspicuous consumption of these two groups.[7]

---

[5] See examples in an edited volume by Goodwin (1997).

[6] One of the reasons is that many households are willing to display their consumption and assets while keeping their indebtedness private.

[7] The relationship between consumerism and indebtedness is also related to inequality since growing income inequality has a potential to further exacerbate the mismatch between household's conspicuous wants and its own funds.

2.3 Implications of Rising Household Debt on the Life Cycle

Although these two major trends are likely to be responsible for the rising household debt for all ages, in theory they may have heterogeneous impacts across age groups, resulting in the change in profile of debt over the life cycle. Compared to individuals in the middle age, younger consumers are likely to face more financial constraints (Attanasio and Weber 2010). For example, they have shorter or nonexistent credit history and fewer collateralizable assets, making it difficult for them to be qualified for loans. Financial development that helps reduce this information barrier will result in a disproportionately increase in credit to the younger generation as compared to their older counterparts when they were at the same age. Likewise, the elderly also experience credit constraints because they have shorter remaining life expectancy than working-age individuals, hence shorter time to pay back loans. Financial innovations such as reversed mortgage allow them to gain access to loans that people in their age generations ago would not otherwise be able. Similarly, increasing longevity and later retirement age contribute to individuals remaining indebted well later in their lives.

Likewise, an upward trend in consumerism can also have impacts on the debt life over the cycle patterns. Not only working-age population may spend more on conspicuous goods using debt financing, the younger may originate debt earlier while the older continue to be indebted when compared to previous generations. These effects could be magnified by other factors such as psychological or cognitive biases. For example, a recent survey shows that younger consumers are more likely to make compulsive purchases (El Issa 2017).

Empirical studies have confirmed these predictions. For example, Crawford and Faruqui (2017) find that mean debt levels of Canadian households are systematically greater for those with heads born in later year or younger cohort. Studies also show that there is an expansion in indebtedness

---

However, the relationship between inequality and indebtedness is challenged by Coibion et al (2016). The authors use household-level debt data over 2000-2012 from the Equifax/NY Fed Consumer Credit Panel (CCP) and show that low-income households in high-inequality areas accumulated less debt relative to their income than low-income households in lower-inequality regions, and the price of credit is higher and access to credit is harder for low-income households in high-inequality regions.

distribution at the both ends of the age spectrum over time, i.e., the youth and the elderly. For the young adult, Houle (2014) uses the data from four waves of the U.S. National Longitudinal Surveys of Youth (NLSY) and analyzes indebtedness of three cohorts of young adults in the 1970s, 1980s, and 2000s. He finds that the most recent cohort began accumulating debt earlier than previous cohorts. In addition, there is a shift in debt portfolio towards non-collateralized and student loans over time. Finally, young adults from lower social class background have disproportionately taken on more unsecured debt over time, compared to their more advantaged counterparts. Similarly, Hodson and Dwyer (2014) study the 1997 wave of the NLSY and the Survey of Consumer Finance (SCF) to investigate indebtedness of the Millennials (defined as those born around 1982 or after). They find that, compared to an earlier generation (Gen X), Millennials took on greater amounts of debt at an earlier age. Their debt increased sharply once they reached 18 years old. By their mid-20s, more than 20 percent of them had education debt and more than 30 percent had auto and credit card debt. Millennials also had historically high rates of homeownership in their early 20s compared to previous generations. Finally, Lee et al (2017) find that the relationship between conspicuous consumption and credit card debt in Singapore is concentrated among younger male, single individuals.

For the elderly, Lusardi and Mitchell (2013) use data from the Health and Retirement Study (HRS) and the National Financial Capability Study (NFCS) and examine three different cohorts of U.S. individuals age 56-61 in different time periods: 1992, 2002, and 2008. They find that more recent cohorts have taken on more debt and face more financial insecurity, mostly because they purchased more expensive homes with smaller down payments.[8] Similarly, Kuhn et al (2017) study the oldest data from SCF and find that those born between 1945-1964 experience rising debt-to-income ratios as they age. Kim (2015) analyzes the distributions of household debt in Korea and in the U.S. and finds that the proportion of household debt held by older households has increased.

This paper contributes to the literature on household debt over the life cycle in various ways. First, most existing studies rely on data at the household level and analyze the distribution of debt based

---

[8] Related to growing indebtedness of the elderly, Higgs et al (2009) use nine rounds of data from the UK Family Expenditure Survey collected between 1968 and 2005 and study consumption expenditure by retired households. Their findings show a growing extent of ownership of key goods in retired households.

on the age of household heads. Given that each household consists of members with different ages, household is not an appropriate unit of observation for the study of debt over the life cycle. In contrast, this study uses granular data at the account level that allow us to better study indebtedness of each individual, including the portfolio of his or her debt. In particular, granular data allow us to decompose the aggregate, commonly-used debt per capita and delinquency rate into components that unveil the extensive and intensive margins of household indebtedness. This decomposition in turn allows us to analyze debt holding, debt portfolio, and delinquency for each age and cohort. Second, while other studies only analyze debt holdings, this paper also examines the number of accounts and financial institutions, hence providing insights on both extensive and intensive margins of indebtedness. It also studies loan performance over the life cycle, exploring the relationship between age and delinquency and hence providing new insights on the quality of loans across age groups. Finally, unlike existing studies that use data from developed countries, ours is one of the first that examines this issue in the context of an emerging economy.

3. Background on Credit Market in Thailand

The financial system in Thailand represents what we observe in developing economies where both formal and informal sectors coexist. This is also the case for credit markets where loans are made. At the one end, formal credit providers include (domestic and foreign) commercial banks, special financial institutions (Government Savings Bank, Government Housing Bank, Export-Import Bank, SME Development Bank, Islamic Bank, and Bank for Agriculture and Agricultural Cooperatives), and other non-bank financial institutions (such as credit card, personal loan, insurance, and hire purchase/leasing companies). At the other end, informal credit providers include friends and relatives as well as moneylenders in rural villages. Between this two ends lie semiformal credit providers such as cooperatives, production groups, and village funds.

With development in the financial sector in recent decades, the formal financial sector is becoming more important in Thailand; however, the informal sector remains large. Specifically, in 2016, only one in three of Thai population has debt from the formal financial sector.[9] Meanwhile, the

---

[9] During the period of this study, households with formal debt from the financial institutions covered in this study accounted for approximately 25 percent of total population in 2009, up from 18 percent in 2016.

percentage of households with debt in the informal sector quickly declined from 20 percent in 2007 to under 10 percent in 2013.[10]

However, household debt is concentrated among a small group of borrowers. Specifically, the top 10% borrowers account for over 62% of total formal debt. It is most concentrated among the following loan subcategories: personal and business loans, loans from commercial banks, loans held by borrowers outside the working age groups, loans in urban areas and in Bangkok and vicinity. The top 10% borrowers tend to be homeowner and live in urban areas and in Bangkok and vicinity; as expected, the bottom group has fewer accounts and fewer distinct products than the middle group, which in turn has fewer accounts and products than the top group. Personal loans are highly prevalent, while housing loans appears very limited. Specifically, 17 percent of the Thai population have personal loans, followed by auto and credit card loans, at 9 percent each. Meanwhile, only 4 percent of population have housing loans.

In terms of credit providers, among the formal lenders, loans from special financial institutions are less prevalence relative to those of commercial banks and other institutions with larger outreach, but their average loan size is larger when compared to other types of lenders—the number of borrowers from special financial institutions is only one third when compared to commercial banks while median debt per borrower of loans is almost double of those from commercial banks. This reflects the role of special financial institutions as state-owned enterprises, established with each specific law, so each has their own mandates and offers certain type of loans whereas commercial banks offer a wider range of loan products.

4. Data

This paper uses account-level consumer loan data submitted to Thailand's National Credit Bureau (NCB) by its members from 2009 to 2016.[11] The data cover almost all loans from the formal

---

[10] For details on household debt in Thaland, see Chantarat et al (2017) and Suwanik et al. (2018).

[11] The data are as of the end of each year, except for the data for 2016 which are at the end of July. There are 90 members in total: (1) 19 banks—all 15 Thai commercial banks and four foreign bank branches, (2) six specialized financial institutions (SFIs), and (3) 65 non-bank financial institutions such as credit card, personal loan, insurance, and hire purchase/leasing companies.

financial sector to ordinary persons in Thailand.[12] The NCB data are suitable for our study for various reasons. First, unlike data collected from surveys that tend to miss certain groups such as the very high income households, the NCB data cover a wide range of population, consisting of the majority of formal loans to individuals in the Thai economy. Second, the data contain account-level information that makes possible the analysis of household debt at a granular level and helps unveil the heterogeneity across households. Third, the coverage and the granularity of the data together allow us to study loan portfolios of individuals when they borrow from multiple financial institutions. This analysis would not be possible with the data from each lender separately.

Table 1 shows the coverage of the data. As of July 2016, there are 60.51 million active loan accounts from 19.25 million borrowers that contributes to the total loan outstanding of 9.80 trillion baht or 87 percent of the total household debt in the system. The data also contain information on days past due for each loan account. This information allows us to study delinquent loans, which we define as loans with more than 90 days past due in this paper. With this definition, the total value of delinquent loans is 0.64 trillion baht or 6.5 percent of the total loan outstanding.

[Table 1]

The NCB data contain information that reflects four granular dimensions at the account level: (1) *the information on the borrower* (age and postcode of mailing address); (2) *the information on the loan product* in which we group into six categories: housing, automobile, motorcycle, credit card, business loans,[13] and personal and other loans[14]; (3) *the information on the lender* in which we group into three broad categories: commercial banks[15], specialized financial institutions (SFIs)[16],

---

[12] However, the data do not include loans from the Student Loan Fund, cooperatives, village funds, and loans from the informal financial sector such as money lenders or community-based institutions. The data also do not include loans to juristic persons, which are maintained in a separate database at the bureau.

[13] Business loans include commercial loans and loans for agriculture.

[14] Personal loans include secured loans (e.g. car for cash, home for cash) and unsecured loans or clean loans (e.g. cash card, multipurpose loans). The majority of other loan products include overdraft and other hire purchase/leasing.

[15] A commercial bank is defined by the solo or stand-alone basis. That is, its subsidiaries such as credit card and hire purchase/leasing companies that are also members of NCB are categorized as separate entities under other financial institutions.

[16] Specialized financial institutions include Government Savings Bank, Government Housing Bank, Export-Import Bank, SME Development Bank, Islamic Bank, and Bank for Agriculture and Agricultural Cooperatives.

and other (non-bank) financial institutions[17]; and (4) *quantitative information on credit line, loan outstanding,* and *days past due* (and hence the utilization ratio and delinquency status) that we can use as outcome variables in our analysis.[18] In particular, we define *delinquent loans* as those with days past due more than 90 days. In other words, delinquency is an indicator of financial unhealthiness.[19]

Table 2 provides descriptive statistics about the borrowers. It shows that the median age of borrowers is 43 years. The majority of borrowers live in Bangkok and vicinity (29 percent), alternatively, half of the borrowers are in urban areas.[20] A median borrower holds two loan accounts, has one loan product, and borrowed from one lender. The distributions of credit line and loan outstanding per borrower are very skewed, with the means as high as 0.77 and 0.51 million baht and the medians only at 0.28 and 0.15.[21] Similarly, the mean delinquent amount per borrower is 0.20 million baht while the median is only 0.06. Approximately 7 percent of the borrowers are new clients. The utilization rate, defined as the ratio between current balance and credit line, averages at 0.65 per borrower.

[Table 2]

Table 3 provides summary statistics of loans. The top panel presents the allocation of accounts, outstanding, and delinquency across products and lenders. Personal and other loans occupy the highest delinquency share among all loan products, while commercial banks account for the highest delinquency share among lenders. Personal and other loans raise concerns to the financial

---

[17] Other financial institutions are non-bank financial institutions such as credit card companies, hire purchase/leasing companies, insurance companies, and cooperatives. We thus refer to other financial institution as non-bank financial institution.

[18] A credit line from each borrower is computed as the aggregate of credit lines from all loan products held by the borrower. However, in case of borrowers with multiple credit cards from the same financial institution, all credit cards are collectively under the same credit line.

[19] Our definition of delinquent loans is therefore more stringent than just loans with late payment, but less than non-performing loans (NPLs). Specifically, the classification of NPLs by the Bank of Thailand involves both day past due more than 90 days and other qualitative assessment.

[20] Urban areas are defined by postcode, with more than 50 percent of its area classified as municipality.

[21] The value of the Thai baht fluctuated between 29 and 36 baht per U.S. dollar during 2009-2016. At the end of July, 2016, the exchange rate was about 36 baht per dollar.

system as they occupy the largest share of accounts (35.5 percent), the second largest share of debt (27.8 percent) and the largest share of delinquency (31.8 percent). Auto and housing loans also raise concerns to the financial system as they contribute to the second and the third largest shares of delinquency even though housing loans account for only 5.4 percent of the total number of accounts, due to the large size of each loan.[22] In contrast, credit card occupies the second largest share of accounts (30.7 percent), but they contribute much less to the total debt outstanding and delinquency due to their small sizes. By lender, commercial banks account for the largest share of debt outstanding and delinquency, while non-bank financial institutions account for the largest share of accounts. The bottom panel presents the allocation across borrower's age groups and locations. The shares of borrowers, loan, and delinquency are highest among borrowers in the working age groups (with the highest for those aged 46-60 years, followed by 36-45 and 25-35 respectively) and borrowers in Bangkok and vicinity.

[Table 3]

5. Empirics

This section presents empirical findings on debt holding, debt portfolio, and delinquency over the life cycle. For each issue, we first present simple plot of descriptive statistics by age. We then perform a regression analysis that allow us to control for macroeconomic and individual fixed effects. Finally, we end the section with the cohort analysis of debt and delinquency.

5.1 Debt Holding over the Life Cycle

The granularity of the NCB data allows us to quantify the debt situation at the borrower level. We consider two measures. First, *debt headcount* is defined as the number of individuals with debt divided by the total number of population. It is a measure that provides information on the prevalence of debt across individuals in the economy, i.e., what fraction of the population is

---

[22] For comparison, although housing debt accounts for the largest share of total loan outstanding at 33.2 percent, the number is still lower than those of every G7 economy in which more than 50 percent of the outstanding household debt in 2012 was from mortgages. Other debt products of the 'Big Four' in the U.S. were student loans, vehicle loans, and credit cards. See Zinman (2015).

indebted.[23] Second, *debt per borrower* is defined as the average loan outstanding of each indebted individual. This measure indicates debt intensity that each indebted individual experiences. These two micro-level measures thus decompose the commonly-used, aggregate *debt per capita* into two parts: (1) debt prevalence at the extensive margin and (2) debt intensity at the intensive margin.

$$\frac{\text{Total Outstanding Debt}}{\text{Population}} = \frac{\text{Number of Borrowers}}{\text{Population}} \cdot \frac{\text{Total Outstanding Debt}}{\text{Number of Borrowers}}$$

$$\text{Debt per capita} = \text{Debt Headcount} \cdot \text{Debt per Borrower}$$

We first explore the age profile of debt prevalence and debt intensity, as shown in Figure 1. The top-left chart shows an inverted-U relationship between age and debt headcount: the headcount increases with age, peaks at 50 percent around an early age of 30 years old, remains at 40-50 percent until reaching retirement ages, and then declines sharply afterwards. This is consistent to young and old individuals facing more credit constraints. The top-right chart gives us additional information about debt over the life cycle from the perspective of debt intensity, i.e., debt per borrower. Overall, we observe the expected debt accumulation when individuals are young and enter the labor force, and debt decumulation as borrowers retire. However, their debt intensity remains high well past the retirement age, raising a concern over the indebtedness of aging population.[24]

[Figure 1]

The center-left panel of Figure 1 further presents the age profiles of debt prevalence by loan product. Personal, auto, and credit card debt headcounts peak at 30 percent, 20 percent, and 20 percent when borrowers are in young working ages (around 28-35 years old), respectively. Individuals thus begin having credit card, auto, and especially personal loans at their early age. These patterns are consistent with the large access to loans from non-bank institutions, which include several hire purchase/leasing and credit card companies. The pattern peaks at 40 percent

---

[23] In the household finance literature, this measure is also known as the penetration rate or the participation rate.

[24] The general retirement age for civil servants in Thailand is 60 years.

among the young working age group, as shown in the figure. Similarly, the center-right panel of Figure 1 presents the age profiles of debt intensity by loan product, and further shows high intensity of housing and auto among the young working age group. The median housing debt per borrower is high for the very young working-age group and gradually declines for the older borrowers. This pattern likely reflects the repayment of mortgage for each individual as well as a general increase in housing price over time (i.e., younger homebuyers purchased their home at more recent, higher prices than the older generations who purchased their home a long time ago). The data show that individuals in Thailand start to have high intensity of housing debt at a lot younger age than those in the U.S. where debt per borrower peaked later in the middle of the working ages (Fulford and Schuh 2015). Auto loans exhibit a different pattern, with relatively stable median debt per borrower across all working ages, although the median is higher for the young and declining for the old. Credit cards and business loans, however, show the expected inverted-U patterns in which we find an increase in debt per borrower among young borrowers and a decrease for the elderly. The figure also shows that the prevalence of personal, credit card, and business loans among the retirees remains quite high. The amount of personal loan per borrower also peaks after the retirement age. The high debt prevalence and intensity of personal loans after retirement could also reflect the limited loan choices of the retirees. One possible explanation of the high headcount of credit card debt among the retirees could be due to the use of credit cards as a payment mechanism.

The age profiles of debt further echo the limited housing debt, with only one in ten of working age population in their 40s having housing loans. This is considered very low relative to those in the U.S., where around 40 percent of borrowers in the 40s have mortgage (Fulford and Schuh 2015).[25] Apart from housing loans, access to credit card also appears limited. The credit card debt prevalence peaks at 20 percent, which again is a lot lower than those in the U.S. where 63 percent of population have at least one credit card (Consumer Financial Protection Bureau 2015).[26] Figure

---

[25] There are several factors that contribute to this finding. First, the finding is partly driven by the fact that a large portion of the Thai population live in the rural area with very limited access to mortgage loans. The debt headcount in the urban area is about 20 percent (Chantarat et al. 2019). Second, the land and housing markets in Thailand are less active than those in the U.S. because Thailand has lower job mobility across cities. In addition, extended families remain widespread in Thailand where children live with their parents and inherit their land and house.

[26] Similarly, this finding is partly driven by the debt headcount in the rural area, which was very low (less than 10 percent). Considering only the urban areas, the debt headcount is higher than 30 percent (Chantarat et al. 2019). In

1 further shows that access to business loans appears quite late and peaks among retiring ages. Possible explanations include the difficulty of the young in setting up or expanding business due to their lack of credit history and collateral as well as limited experience. Alternatively, another possible explanation is that formal sector jobs are easier to get for younger people and hence they have limited demand for business loans.

Debt intensity over the age profile is vastly diverse across lenders, reflecting different roles of commercial banks, SFIs, and non-bank financial institutions in the economy. Individuals have access to loans from non-bank financial institutions at younger age as these institutions focus on providing auto and credit card loans. The headcount of debt from SFIs is higher for working age individuals who are also closed to retirement. The median debt per borrower of loans from commercial banks is much higher for the very young borrowers, peaks at 21 years old, and declines afterwards. The median peaks later around the age of 35 years old for loans from SFIs.

Next, we examine the profile of debt over the life cycle over time from 2009 to 2016. There are more borrowers (extensive margin) and larger debt per borrower (intensive margin) for every age, especially among the younger generation. Figure 2 presents the age profiles of debt prevalence and debt intensity by year. Generally speaking, these age profiles are similar to what we see in Figure 1 for 2016. However, Figure 2 reveals additional insights. First, it shows that household debt in Thailand has expanded, as evident from the upward shift of the curve over time. Second, credit expansion is not uniform across age groups, with the younger experiencing the most expansion. More precisely, debt headcount and debt per borrower increase most for individuals around 30 years old. This descriptive finding suggests that the younger generations have accumulated debt earlier in their lives than the older ones. We return to a regression analysis with age and cohort fixed effects later in this section.

[Figure 2]

---

addition, the Thai economy remains largely cash-based due to its large informal sector; the use of credit cards is not widespread.

There is heterogeneity in debt accumulation by loan category, with a remarkable increase in debt headcount of personal, auto, and credit card loans among the young generation. Figure 3 shows that the expansion of debt headcount for auto loans takes place during 2011-13.[27] Debt headcounts for housing and business loans increase over the period of our study, but the magnitudes are relatively small when compared to other loan products. The debt headcounts of loans from commercial banks and non-bank financial institutions increase most for borrowers around 30 years old, while that from SFIs expand most for those around 40 years old. For debt intensity, we find that debt per borrower for housing loans rise tremendously for young borrowers while that for credit card loans increase most for individuals aged 40-60.

To isolate the age effects from macroeconomic and individual fixed factors, we perform a regression analysis of debt per borrower, controlling for year fixed effects, interactions between year and location (postcode) fixed effects, and location or individual fixed effects. Specifically, we run the following two regressions:

$$y_{i,a,j,t} = \alpha + \beta_a + \gamma_j + \delta_t + \kappa_{j,t} + \varepsilon_{i,a,j,t} \tag{1}$$

and

$$y_{i,a,j,t} = \alpha + \beta_a + \lambda_i + \delta_t + \kappa_{j,t} + \varepsilon_{i,a,j,t}, \tag{2}$$

where $y_{i,a,j,t}$ is debt per borrower, α is the constant term, β_a is the age a fixed effect, γ_j is the location j fixed effect, δ_t is the year t year fixed effect, $\kappa_{j,t}$ is the location-year fixed effect for location j and year t, λ_i is the individual borrower i fixed effect, and $\varepsilon_{i,a,j,t}$ is the residual.

Figure 3 presents regression coefficients of age variables estimated by Equation (2). Our results show that, after controlling for individual (hence cohort) and time-location fixed effects, the regression coefficients are increasing with age until approximately 60 and then declining. The interpretation is that, for those aged below 60, older individuals have higher debt than the younger ones, implying debt accumulation over this age range. Likewise, for those aged above 60, the finding implies debt decumulation. The overall pattern is similar to the narrative we discuss earlier.

---

[27] This observation is likely due to the first-car buyer tax rebate scheme. See Muthitacharoen, Samphantharak, and Chantarat (2019) for the impact of the scheme on household debt in Thailand.

However, the regression analysis shows that the life cycle pattern of the overall debt per borrowing peaks at 60 years. In other words, borrowers keep accumulate debt until the retirement age, and then begin to deleverage at retirement. The detailed regression results are presented in Tables A.2-A.4 in the Appendix.

[Figure 3]

In sum, our analysis of the life cycle of debt outstanding shows that there is an inverted-U pattern as predicted by the life cycle hypothesis. The peak estimated by regression analyses is at 60 years, which is also the common retirement age in Thailand. However, the pattern is heterogeneous across loan products and lenders. In particular, the peaks for auto and credit card debt are achieved earlier when borrowers are still young; the patterns by lenders, with the earliest peak for non-bank financial institutions, mirror those for these loan products.

5.2 The Life Cycle of Loan Portfolio

The granularity of the data allows us to study the life cycle of loan portfolio of each individual. Figure 4 plots regression coefficients of age variables estimated by Equation (2). The figure reveals that the life cycle of the number of loan accounts held by each individual also follows the non-linear pattern—a fraction of borrowers with multiple loan accounts increases with age for young groups, then remain relatively stable during the working age of 30-60, and finally decreases with age for the retired borrowers. The age profile of the number of lenders delivers similar pattern.

[Figure 4]

Similar to the analysis of debt over the life cycle, we perform a regression analysis to control for the macroeconomic and individual fixed effects. Specifically, we estimate Equation (2) by using the number of accounts and the number of lenders per borrower as the dependent variable, $y_{i,a,j,t}$, respectively. Figure 5 plots the regression coefficients by age. The overall pattern is similar to the narrative we discuss earlier, with the peak at 57 years for both regressions. The detailed regression results are presented in Tables A.5 in the Appendix.

[Figure 5]

Finally, Figure 6 illustrates the composition of loan portfolio. The left panel presents the portfolio of loan products for each borrower by age. It shows a striking life cycle pattern. Auto loans account for a significant share of total loan outstanding for young borrowers but are almost nonexistent for the older ones; opposite is the case for business loans. Personal loans, however, have constantly contributed to a large portion of the portfolio throughout the life cycle while housing and credit card loans both accounted for relatively smaller portions. The right panel shows the portfolio of lenders for each borrower by age. Again, it shows a clear life cycle pattern. Nonbank financial institutions dominate the portfolio of the younger borrowers while SFIs occupy the largest share of the portfolio of the older borrowers. The portfolio of lenders reflects the portfolio of loan products.

[Figure 6]

In summary, our study confirms an inverted-U pattern that reflects the life cycle profile of debt. Based on the regression analysis, the number of accounts and the number of lenders peak at 57 years, roughly consistent with the peak of debt per borrower found earlier, which is also the common retirement age in Thailand. Our findings also iterate the role of non-bank financial institutions for lending to the young, and SFIs for the old. Finally, we find that the younger generations seem to originate debt earlier in the life cycle than their older counterparts. The older also continue to be indebted well past their retirement age.

5.3 Delinquency over the Life Cycle

Parallel to debt, we study the life cycle of delinquency at the borrower level. *Delinquency headcount* is defined as the number of borrowers with delinquent loans divided by the total number of borrowers. This measure represents prevalence of delinquency among borrowers. *Delinquent debt per delinquent borrower* is defined as the value of delinquent loans that each delinquent borrower has. This measure thus tells us about the intensity, or severity, of delinquency faced by

delinquent borrowers. These micro-level measures give us information beyond what we get from the aggregate delinquency measure, *the delinquency rate*, defined as the percentage of loan outstanding in the economy that is delinquent, which provides us with no information on the distribution of delinquent loans and the burden on borrowers. Parallel to the decomposition of debt outstanding presented earlier, our measures of delinquency can be presented as components of the aggregate delinquency measure.

$$\left(\frac{\text{Total Outstanding Debt}}{\text{Number of Borrowers}}\right) \cdot \frac{\text{Total Delinquent Debt}}{\text{Total Outstanding Debt}} = \frac{\text{Number of Delinquent Borrowers}}{\text{Number of Borrowers}} \cdot \frac{\text{Total Delinquent Debt}}{\text{Number of Delinquent Borrowers}}$$

$$(\text{Debt per Borrower}) \cdot \text{Delinquency Rate} = \text{Delinquency Headcount} \cdot \text{Delinquent Debt per Delinquent Borrower}$$

Figure 7 presents the age profiles of delinquency headcount and median delinquent debt per delinquent borrower. The top-left chart shows the downward-sloping profile that the delinquency headcount is highest at 21 percent for borrowers aged 29 and declines as age increases. The bottom-left chart shows that, with the exception of high delinquent debt per delinquent borrower for the very young borrowers, the overall delinquency intensity increases with age and remains relatively constant around 0.6 million baht for the working age population, and then decline for those older than 60 years old. This pattern mimics what we discussed earlier about the life cycle of debt intensity.

[Figure 7]

The age profiles of delinquency are heterogeneous across loan products. For personal, auto, credit card, and business loans, delinquency headcounts are high for the younger borrowers and later decline, with the highest headcounts at around 30 years old for personal, credit card and business loans, and at 23 years old for auto loans. About 20 percent of the early working age borrowers have delinquent personal loans. Overall, delinquency headcounts show a stable or downward trend over the age profile for most loan products. A possible explanation is that older borrowers have longer credit history and more collateral, allowing for better loan screening and lower incentive to default. Housing debt appears to have low delinquency headcount and uniform across ages, which is what we expect for secured loans.

There are vastly mixed patterns of delinquency intensity over the age profiles for different loan products. Housing and business loans exhibit a decreasing delinquent debt per delinquent borrower as age increases. This finding mirrors what we discuss earlier about debt intensity in Figure 1. In contrast, auto, credit card, and to some extent personal loans show the opposite pattern, i.e., increasing with age. Delinquent debt per delinquent borrower for personal loans deserves a special attention because the intensity increases with age and remains high after retirement while the delinquency headcounts persistently remain high as well. Also alarming is credit card debt—the delinquency intensity continues to stay high past the retirement age (although the decline in their delinquency headcount makes the situation less worrisome than personal loans). These findings raise a concern about debt burden of the retirees. In the case of auto loans, we also find high delinquent debt per delinquent borrower for the elderly, while the delinquency headcount was low, implying that the defaults were likely on expensive cars.

Across lenders, we find large delinquency headcounts of loans from non-bank financial institutions (which also peak at the young working ages), while delinquency headcounts of loans from SFIs remain stable over the age profile and do not decline after retirement. More explicitly, Figure 7 shows that the delinquency headcounts of debt from commercial banks and non-bank financial institutions peak at the borrowers aged 30 (at around 12 percent and 20 percent respectively), while that of SFIs seems to be similar for all borrowers aged 30 and above, at around 10-15 percent. Delinquent debt per delinquent borrower for non-bank financial institutions is also high among old borrowers, while the delinquency headcount declines with age. This finding is likely driven by high delinquency intensity of credit card debt, which exhibits similar pattern.

Figure 8 presents age profiles of delinquency headcounts over time, and further shows that the drop in the delinquency headcount is evident for housing, credit card, and personal loans. However, auto and business loans experience an increase in delinquency prevalence during the same period, especially among young borrowers. If we compare across lenders, we find that delinquency headcounts decrease over time for loans from non-bank financial institutions. Delinquency headcounts, however, increase over time for loans from commercial banks and SFIs among the young working age population. They decline over time among the older population.

[Figure 8]

Similar to earlier analyses, we run probit regressions of Equations (1) and (2) where the dependent variable, $y_{i,a,j,t}$, is an indicator variable that takes the value of 1 if an individual has at least one delinquent loan and 0 otherwise. Figure 9 plots the probit regression coefficients by age, controlling for macroeconomic and individual fixed effects. The overall pattern is similar to the narrative we discuss earlier. The detailed regression results are presented in Tables A.5-A.7 in the Appendix.

[Figure 9]

In summary, our analysis reveals an overall downward-sloping pattern of delinquency over the life cycle. This is consistent to the finding using the U.S. data by Xiao et al (2014). However, the pattern is heterogeneous across loan products and lenders. Business and credit card loans seem to experience an increasing delinquency headcount over time.

5.4 Cohort Analysis of Debt and Delinquency

Given the age of each borrower in the data, we can analyze debt and delinquency by birth cohort. The findings are displayed in Figure 10, where each of the lines represents a unique birth cohort of borrowers over different ages during the period of 8 years from 2009 to 2016 in the data. The advantage of this cohort analysis is that it allows us to examine prevalence and intensity of debt and delinquency from two different approaches. First, for a given age, we can compare debt and delinquency across different cohorts or generations, while controlling for a particular position in their life cycle. Second, we can trace a given cohort over time and examine debt and delinquency over the life cycle of the same cohort, while controlling for cohort specific effects.

[Figure 10]

Figure 10 shows that, over the life cycle debt accumulation implied by debt headcounts follows an inverted-U pattern, while over time individuals start having debt earlier in their lives. First, for a given age, the top chart in Figure 10 shows that the debt headcount of a younger generation is uniformly above that of an older generation. For example, at the age of 30, the cohort born in 1985 has the debt headcount of almost 50 percent, while the cohort born in 1981 has less than 40 percent headcount. This result suggests that the younger generations seem to have more access to credit than the older ones, when they are at the same age. Alternatively, for each level of debt headcounts, we can see that the younger cohorts arrive at that debt level faster than the older cohorts. For example, the cohort born in 1975 reaches the debt headcount of 40 percent when they are about 38 years old, while the cohort born in 1980 and 1990 achieve that same level of debt headcount when they are only 31 and 25 years old. Second, for a given cohort, the chart shows that the lines have positive slopes at the younger ages and become negative for the older ages. This finding suggests the inverted-U dynamic of leveraging and deleveraging over the life cycle. The chart also shows that the peaks of the debt headcounts appear at earlier ages and at higher levels for younger cohorts, further confirming that the younger generations have access to debt faster and earlier than the older generations. Finally, the chart reveals that the cohort-age with the highest debt headcount in the data is the cohort of the borrowers born in 1981 when they were 33 years old. More precisely, this cohort had the highest debt headcount in the entire data, at over 50 percent in 2014.

We also find that debt accumulation and decumulation over the life cycle and over time implied by debt intensity mimic the pattern found in debt headcounts, but the highest debt intensity is reached later than the highest headcount. The middle chart of Figure 10 shows the median debt per borrower. Again, we see the overall inverted-U debt intensity dynamics over the life cycle. The younger cohorts seem to have higher median debt per borrower than the older cohorts when they are at the same age, and the difference is highest at the young ages. Alternatively, the younger cohorts achieve a given median debt per borrower earlier in their lives than the older cohorts.

For delinquency, we find that over the life cycle delinquency headcounts decline with age. They also decline over time for all cohorts. These findings are shown in the bottom chart of Figure 10. For each cohort, we observe a general downward sloping line, implying that delinquency headcounts decrease when borrowers become older. For each age, the delinquency headcounts of

the younger cohorts are lower than the older ones, suggesting that delinquency headcounts have declined over time for all age groups.

Table A.9 in the Appendix provides regression results for debt and delinquency by age and cohort. The results are consistent with our earlier narrative that younger cohorts seem to be more indebted than earlier cohort, controlling for age-specific effects. Similarly, delinquency seems to be lower over time, with younger cohorts being less delinquent. This could reflect technology or knowledge that allow for better loan screening (less severe adverse selection) and better loan collection (less severe moral hazard).

6. Conclusion and Policy Implications

This paper uses loan-level data to study the life cycle of household debt in Thailand. The wide coverage and the granularity of the data allow us to decompose the aggregate, commonly-used debt per capita and delinquency rate into components that unveil the extensive and intensive margins of debt and delinquency. This decomposition allows us to analyze prevalence, intensity, and distribution of indebtedness over the life cycle. We find striking life cycle patterns of indebtedness, but they are heterogeneous across loan products and lenders. We also find the expansion of debt over time while delinquency has been in decline for most loan products. Finally, we find a downward pattern of delinquency over the life cycle. Our findings yield important implications on both individual households and the economy at large. We discuss them in this section.

5.1 Implications for Households

Our findings show that Thai people become indebted earlier in their lives. Delinquency headcounts are also highest among early working age borrowers. This raises a concern that these individuals may face difficulty in getting loans in the future. We also find that debt remains high for many of borrowers after retirement. In this respect, policies that enhance access to necessary credit, such as for housing and for business investment, are thus critical, but such policies need to target individuals with potential to repay. In this respect, the "data revolution" and financial innovations

have already opened up new opportunities in resolving information asymmetry and other inefficiencies in the credit market—a necessary step to unlock access to credit especially among the underbanked population.[28] Policies that promote access to savings in preparation for retirement are also critical, as well as policies that enhance access to necessary credit for high-potential retirees, such as reversed mortgage. These policies are crucial as the country is demographically aging and longevity of individuals is increasing. Financial literacy and planning programs that can effectively raise both financial awareness and discipline among households are especially critical. These programs should target the young population in school before entering labor and credit markets. Our study helps identify the groups of borrowers with delinquency vulnerability. In particular, we raise concerns over the young working-age population with high delinquency headcount and intensity.

5.2 Implications on the Economy: The high debt intensity among households, especially among the young working ages with large propensity to spend could lead to debt overhang, a prolonged sluggish consumption and investment spending among these groups, which in turn deteriorates the domestic aggregate demand—one of the main growth engines of the economy. High debt burden once again implies increasing vulnerability to household and so to the overall financial system and the economy if delinquency is positively correlated across households. These macroeconomic implications thus amplify the importance of policies that balance out access and stability goals.

In conclusion, this study illustrates that debt is very heterogeneous in many dimensions. In order to understand the situation of household debt and design appropriate policies, aggregate data are not sufficient and granular data that cover the majority of the financial system are needed. This paper exemplifies the potential of credit bureau data in generating new knowledge about household debt. The key limitation of the data is the lack of informal and semi-formal debt, e.g., loans from cooperatives, educational loans from the Student Loan Fund, as well as borrower's income and savings data. Augmenting the data to cover this necessary information will open up

---

[28] The data revolution broadly includes the emergence of big data and the advance in computing technology that allows complex analyses of borrowers and loans.

new opportunities for researchers and policymakers in using this dataset to answer relevant policy questions necessary for effective policy design and targeting.[29]

References

Attanasio, O. P. and G. Weber (2010). "Consumption and Saving: Models of Intertemporal Allocation and Their Implications for Public Policy." *Journal of Economic Perspective*, Vol. 48(3): 693-751.

Beck, Thorsten, Berrak Büyükkarabacak, Felix Rioja, and Neven Valev (2008). Who Gets the Credit? And Does It Matter? Household vs. Firm Lending across Countries. Policy Research Working Paper 4661, The World Bank Development Research Group Finance and Private Sector Team, July.

Bricker, J., Ramcharan, and Krimmel (2014). "Signaling Status: The Impact of Relative Income on Household Consumption and Financial Decisions." Finance and Economics Discussion Series, Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board, Washington, DC.

Bursztyn, Leonardo, Bruno Ferman, Stefano Fiorin, Martin Kanz, Gautam Rao (2017). "Status Goods: Experimental Evidence from Platinum Credit Cards" Working Paper.

Chantarat, Sommarat; Atchana Lamsam; Krislert Samphantharak; and Bhumjai Tangsawasdirat (2017). "Thailand's Household Debt through the Lens of Credit Bureau Data: Debt and Delinquency." Discussion Paper No. 61, Puey Ungphakorn Institute for Economic Research.

Chantarat, Sommarat; Atchana Lamsam; Krislert Samphantharak; and Bhumjai Tangsawasdirat (2019). "Thailand's Household Debt through the Lens of Credit Bureau Data: Behavior of Borrowers and Lenders." Working Paper, Puey Ungphakorn Institute for Economic Research.

Coibion, Olivier; Yuriy Gorodnichenko; Marianna Kudlyak; and John Mondragon. (2016) "Does Greater Inequality Lead to More Household Borrowing? New Evidence from Household Data" Federal Reserve Bank of San Francisco Working Paper 2016-20.

Consumer Financial Protection Bureau (2015). "The Consumer Credit Card Market."

Cox, Donald and Tullio Jappelli (1993). "The Effect of Borrowing Constraints on Consumer Liabilities." *Journal of Money, Credit and Banking*, Vol. 25(2): 197-213.

---

[29] We are also unable to study the impacts of wealth on the choice of debt products. Using data from the U.S. Survey of Consumer Finance (SCF), Guiso and Sodini (2013) argue that different types of debt matter at different levels of wealth. Likewise, as Samphantharak and Townsend (2010) argue, in order to understand household finance, we need to consider assets, liabilities, and income of the households.

Crawford, Allan and Umar Faruqui (2012). "What Explains Trends in Household Debt in Canada?" *Bank of Canada Review*, Winter 2011-12.

Crook, Jonathan (2001). "The Demand for Household Debt in the USA: Evidence from the 1995 Survey of Consumer Finance." *Applied Financial Economics*, Vol. 11(1): 83-91.

Dynan, K. E. (2009). "Changing Household Financial Opportunities and Economic Securities." *Journal of Economic Perspective*, Vol. 23(4): 49-68.

El Issa, E. (2017). NerdWallet Survey: nearly half of Americans emotionally overspend. NerdWallet. Available at: https://www.nerdwallet.com/blog/ credit-cards/credit-card-debt-stigma-2017/.

Epanding Prosperity Impact Collaborative, EPIC (2017). *Consumer Debt: A Primer*. The Aspen Institute.

Frank, Robert H., Adam Seth Levine, and Oege Dijk (2014). "Expenditure Cascades." *Review of Behavioral Economics*, Vol. 1(1-2): 53-73.

Fulford, Scott L. and Scott Schuh. "Consumer Revolving Credit and Debt over the Life Cycle and Business Cycle." Federal Reserve Bank of Boston Working Paper No. 15-17, October 2015.

Goodwin, Neva R., Frank Ackerman, and David Kiron (1997) eds. *The Consumer Society,* edited by Washington, DC: Island Press.

Guiso, Luigi and Paolo Sodini (2013). "Household Finance: An Emerging Field." Chapter 21 in *Handbook of the Economics of Finance*, Volume 2 Part B, Edited by George M. Constantinides, Milton Harris, and Rene M. Stulz, Elsevier-North Holland: 1397-1532

Higgs, P.F., M. Hyde, C.J. Gilleard, C.R. Victor, R.D. Wiggins, and I.R. Jones (2009). "From Passive to Active Consumers? Later Life Consumption in the UK from 1968-2005." *The Sociological Review*, 57(1): 102-124.

Hodson, Randy and Rachel E. Dwyer (2014). Financial Behavior, Debt, and Early Life Transitions: Insights from the National Longitudinal Survey of Youth, 1997. Report to the National Endowment for Financial Education, June.

Houle, Jason (2014). "A Generation Indebted: Young Adult Debt Across Three Cohorts" *Social Problems*, Vol. 61(3): 448-465.

Justiniano, Alejandro, Giorgio Primiceri, and Andrea Tambalotti (2013). "Household Leveraging and Deleveraging." *Review of Economic Dynamics* Vol. 18(1): 3-20.

Karlan, Dean and Jonathan Morduch. "Access to Finance: Credit Markets, Insurance, and Saving." Chapter 71 in *Handbook of Development Economics*, Volume 5, Edited by Dani Rodrick and M.R. Rosenzweig, Elsevier-North Holland, 2009.

Kim, Jiseob (2015). "Analysis of the Structural Changes in Household Debt Distributions by Householder Age in Korea and in the US." *KDI Journal of Economic Policy*, 37(4): 21-34.

Kuhn, M., Schularick, M., & Steins, U. (2017). The great American debt boom, 1949-2013. Federal Reserve Bank of St. Louis.

Lusardi, Annamaria and Olivia S. Mitchell (2013). "Older Adult Debt and Financial Frailty." Ann Arbor, MI: University of Michigan Retirement Research Center (MRRC) Working Paper, WP 2013-291.

Mian, Atif and Amir Sufi. "Household Debt and Defaults from 2000 to 2010: Facts from Credit Bureau Data." *Kreisman Working Paper Series in Housing Law and Policy*. Paper 33, 2015.

Modigliani, Franco (1966). "The Life Cycle Hypothesis of Saving, the Demand for Wealth and the Supply of Capital." *Social Research,* 33 (2): 160–217.

Muthitacharoen, Athiphat, Krislert Samphantharak, and Sommarat Chantarat (2019). "Fiscal Stimulus and Debt Overhang: Evidence from Thailand's First-Car Buyer Tax Rebate." Puey Ungphakorn Institute for Economic Research Discussion Paper No. 60.

Samphantharak, Krislert and Robert M. Townsend. *Household as Corporate Firms: An Analysis of Household Finance Using Integrated Household Surveys and Corporate Financial Accounting*. Cambridge University Press, 2010.

Schularick, Moritz and Ilhyock Shim (2017). "Household credit in Asia-Pacific," in: Bank for International Settlements (ed.), *Financial Systems and the Real Economy* Vol. 91: 129-144.

Veblen, Thorstein (1899). *The Theory of the Leisure Class: An Economic Study in the Evolution of Institutions*. Macmillan.

Xiao, J. J., R. Yao, and L. Liao (2014). "Consumer Debt Delinquency by Family Lifecycle Categories." *International Journal of Bank Marketing*, 32(1): 43-59.

Yilmazer, Tansel and Sharon A. DeVaney (2005). "Household Dent over the Life Cycle." *Financial Services Review* 14: 285-304.

Zinman, Jonathan (2015). "Household Debt: Facts, Puzzles, Theories, and Policies." *Annual Review of Economics*, Vol. 7: 251-276.

Figure 1 Life cycle of debt prevalence and intensity
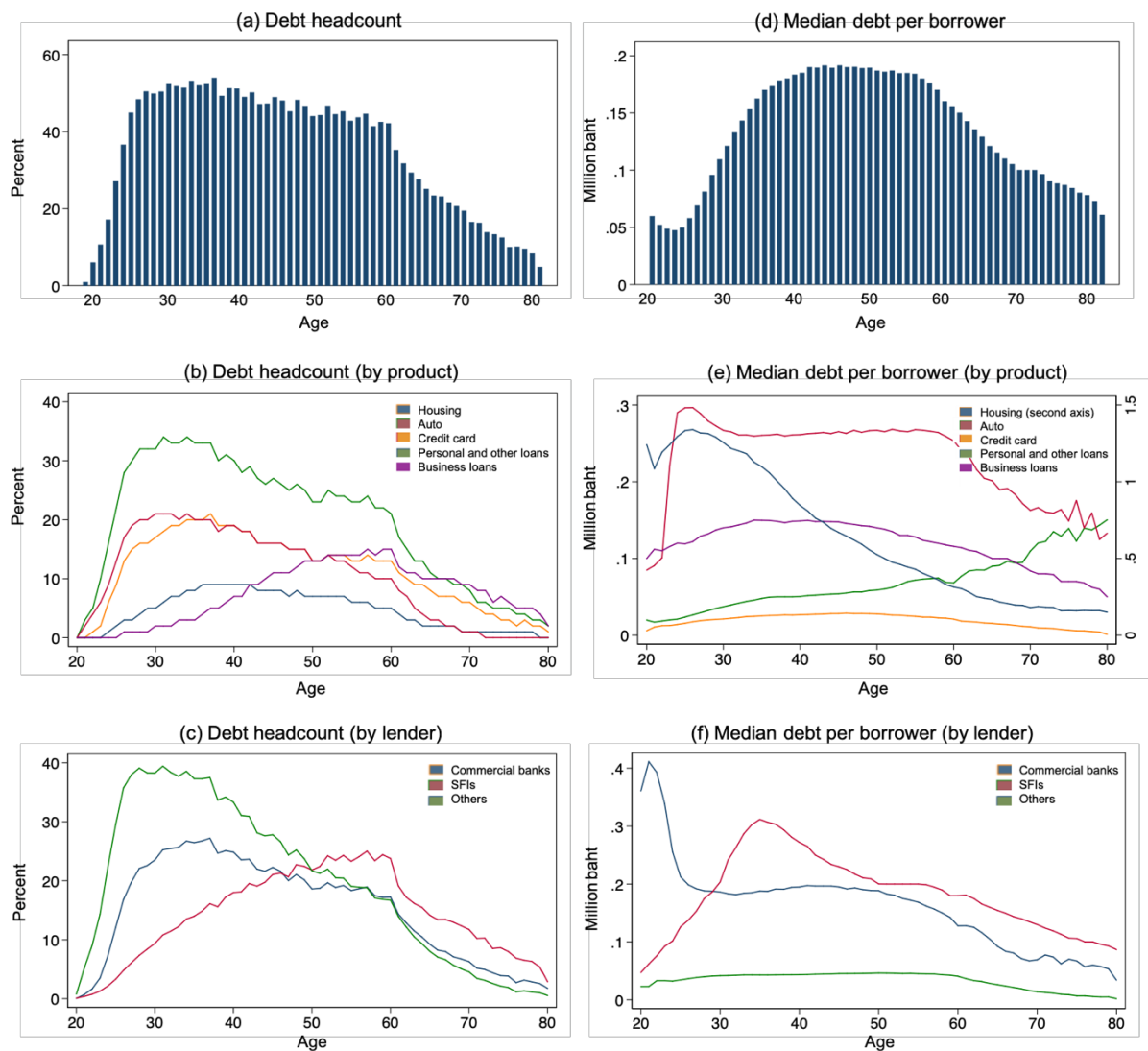
Figure 2 Life cycle of debt prevalence and intensity over time
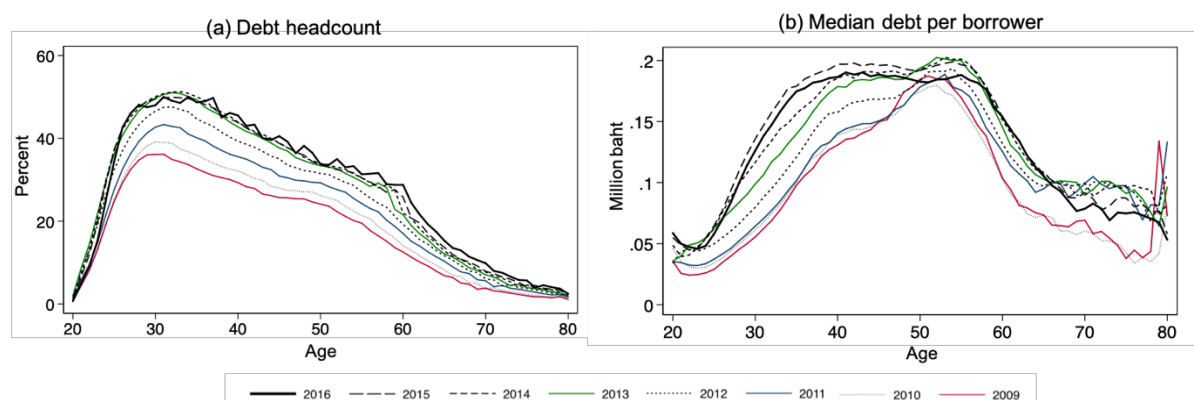
(a) Debt headcount

(b) Median debt per borrower

Legend: 2016, 2015, 2014, 2013, 2012, 2011, 2010, 2009

Figure 3 Age regression coefficients of debt per borrower (controlling for cohort effect)
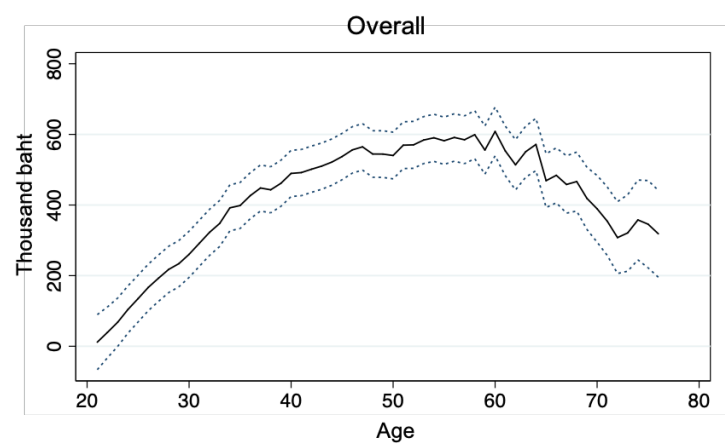
Figure 3 Age regression coefficients of debt per borrower (controlling for cohort effect), continued
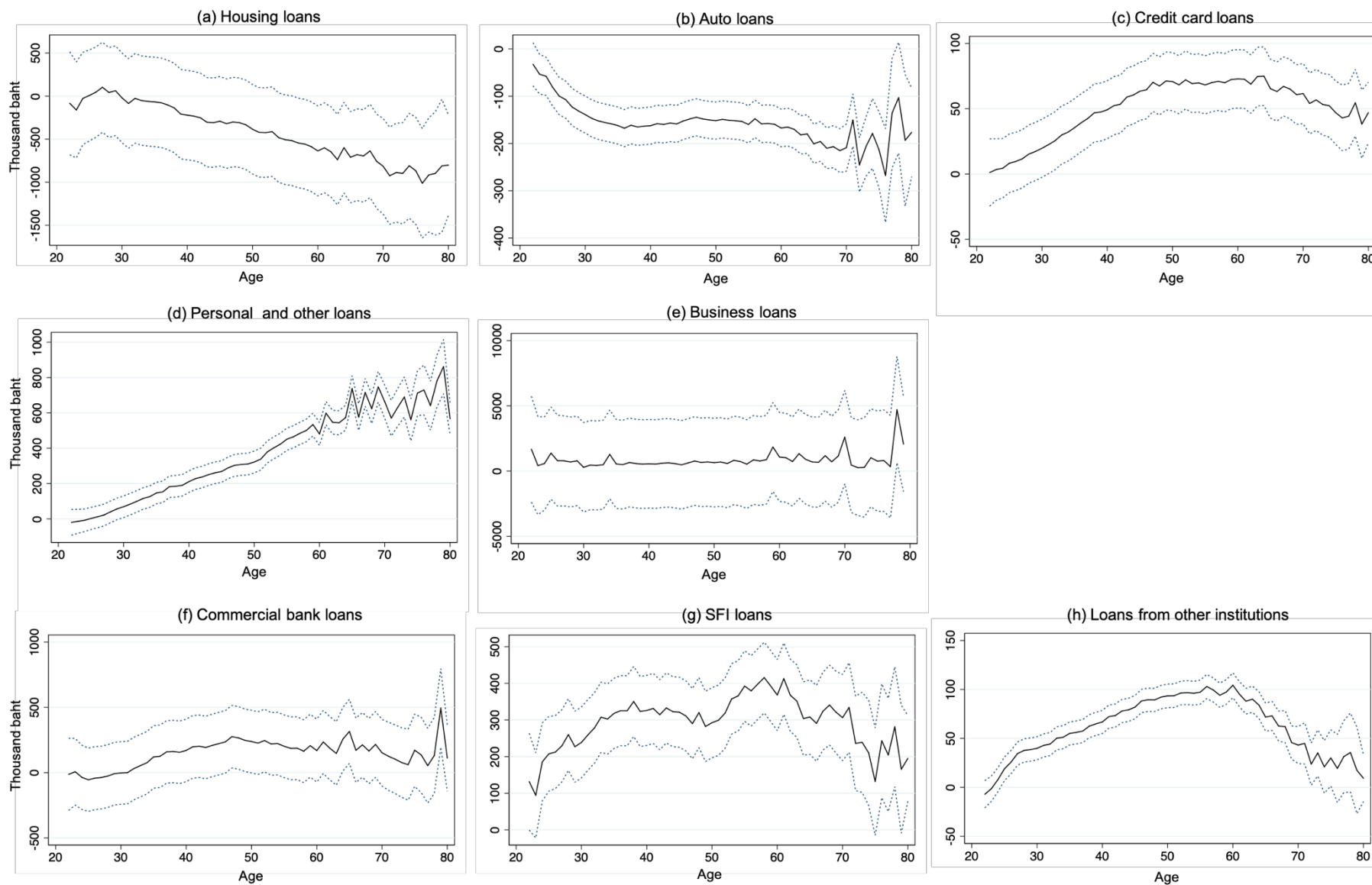
Note: We keep y-axis scaling varies across loan products and lenders so that we can still reflect variation in life cycle pattern for each loan

Figure 4 Number of accounts and lenders

(a) Number of accounts

1 account 2 accounts 3 accounts 4 accounts 5 accounts >5 accounts

(b) Number of lenders

1 FI 2 FIs 3 FIs 4 FIS 5 FIS >5 FIs
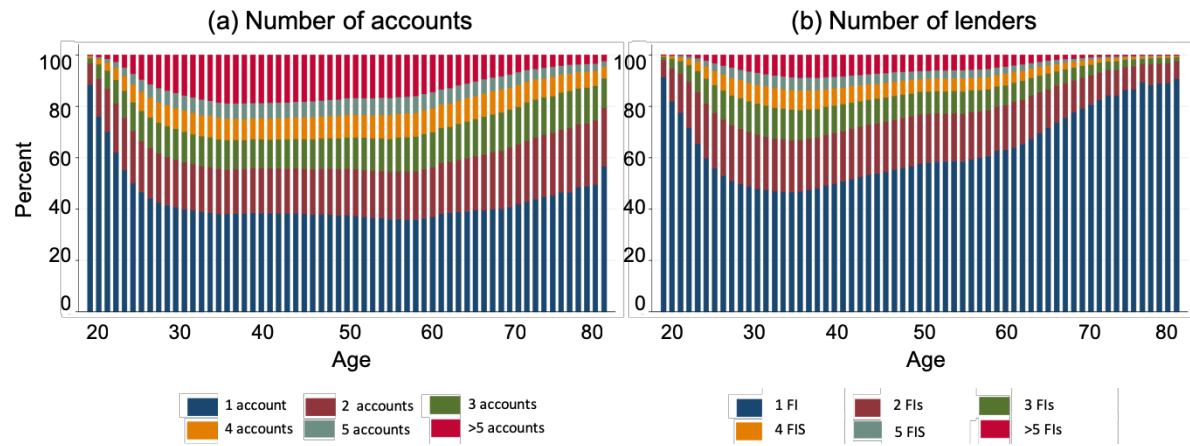
Figure 5 Age regression coefficients of number of accounts and lenders (controlling for cohort effect)
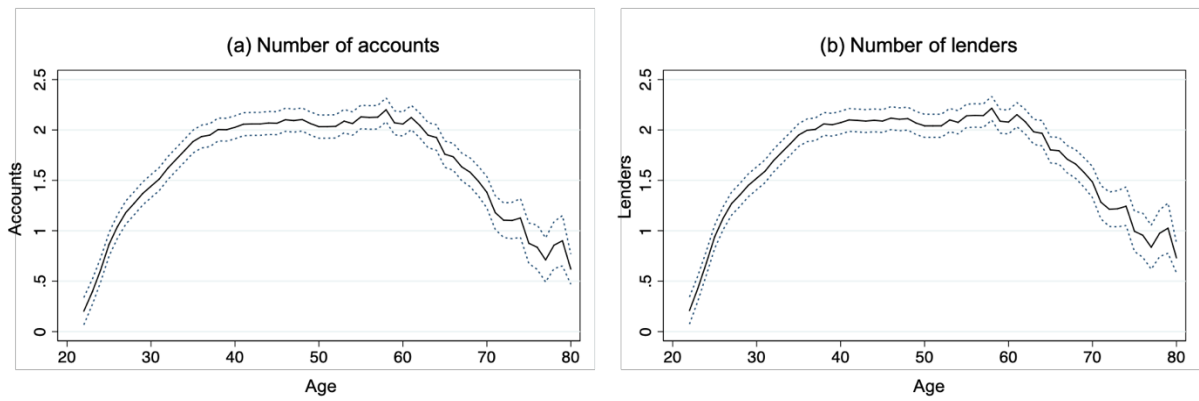
Figure 6 Life cycle of loan portfolio

(a) By loan product

(b) By lenders

From bottom to top:
Housing, Auto, Motorcycle, Credit card,
Personal and others, Business

From bottom to top:
Commercial banks, SFIs, Others
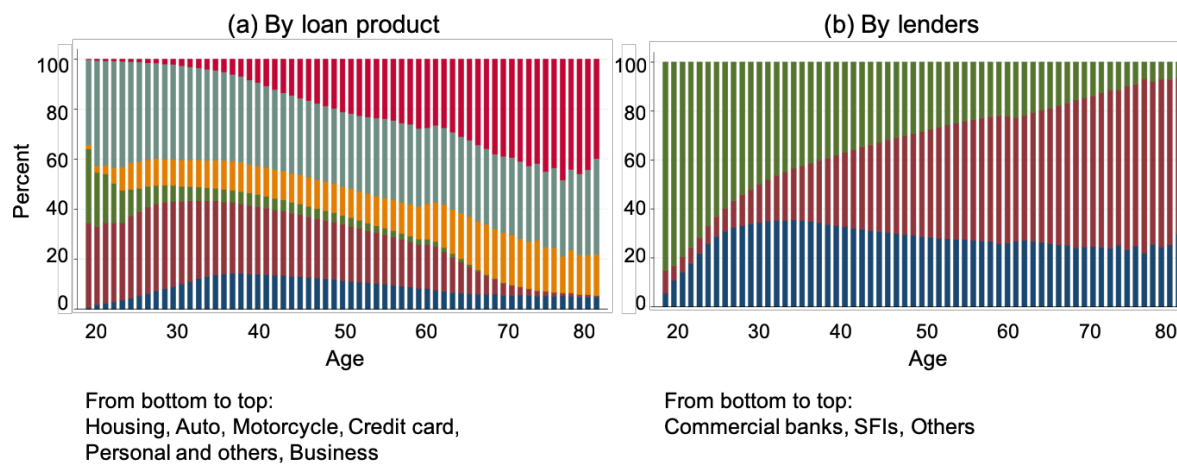
Figure 7 Life cycle of delinquency prevalence and intensity

(a) Delinquency headcount

(d) Median delinquent debt per borrower

(b) Delinquency headcount (by product)

(e) Median delinquent debt per borrower (by product)

(c) Delinquency headcount (by lender)

(f) Median delinquent debt per borrower (by lender)
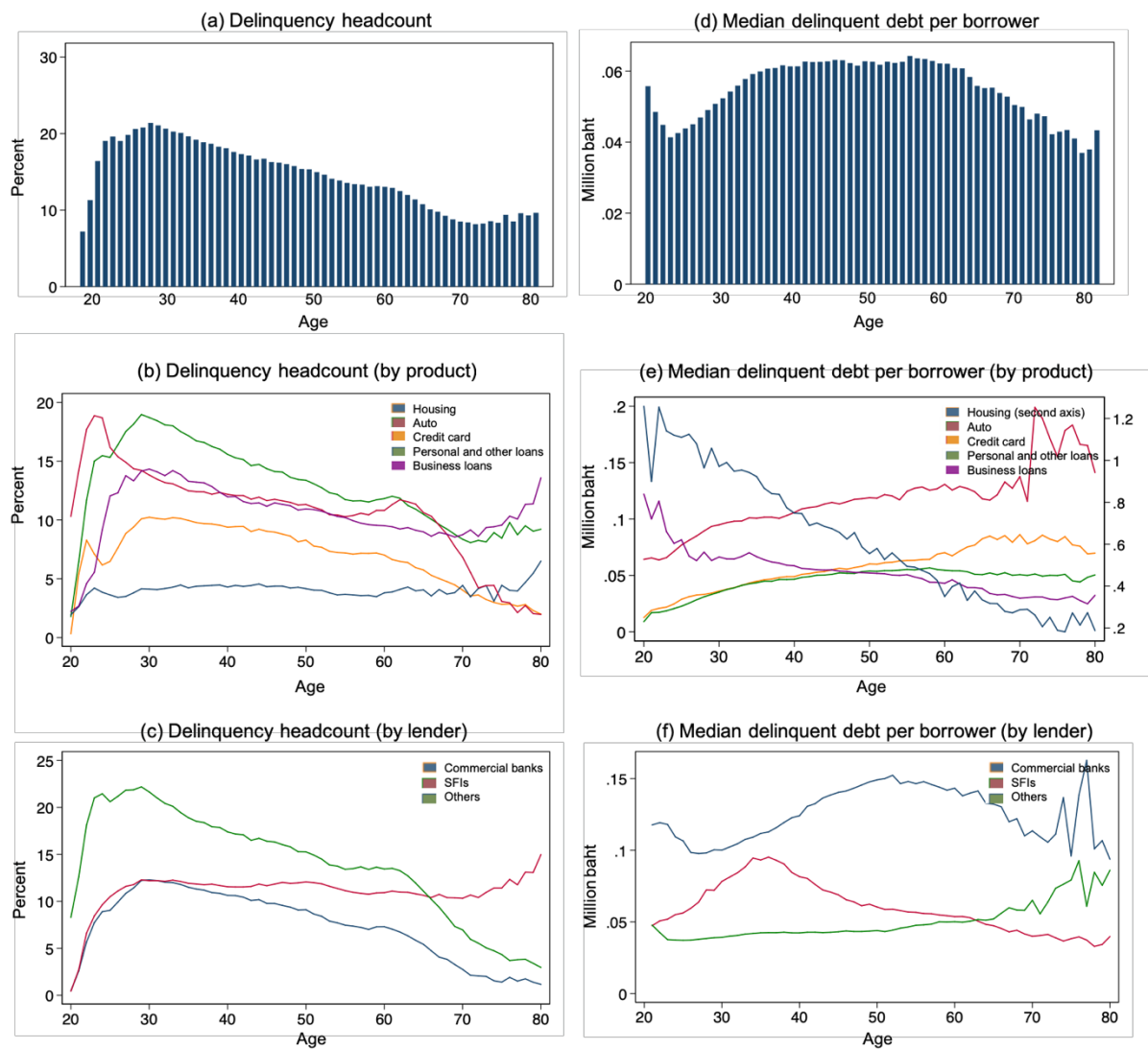
Figure 8 Life cycle of delinquency prevalence over time
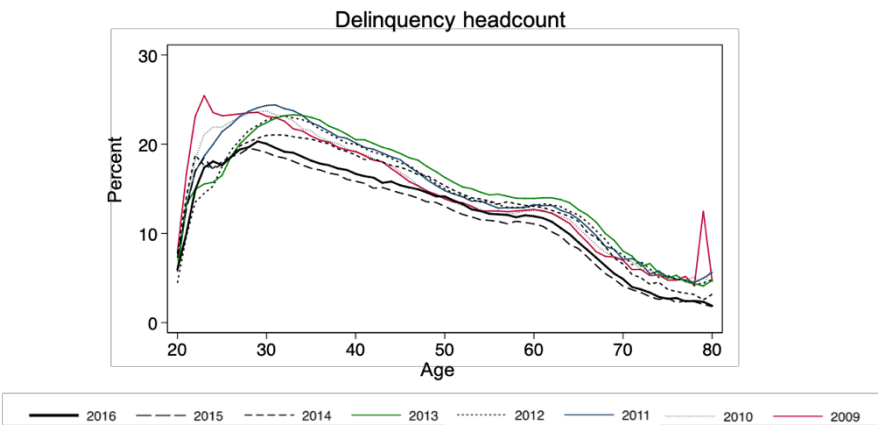
Figure 9 Age regression coefficients of delinquency probability (controlling for cohort effect)
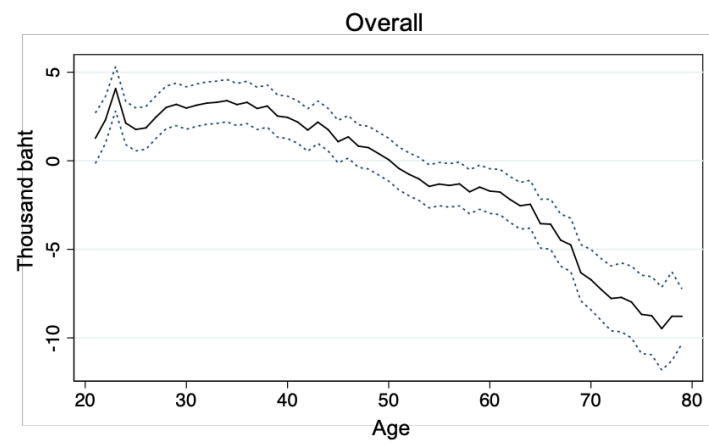
Figure 9 Age regression coefficients of delinquency probability (controlling for cohort effect), continued
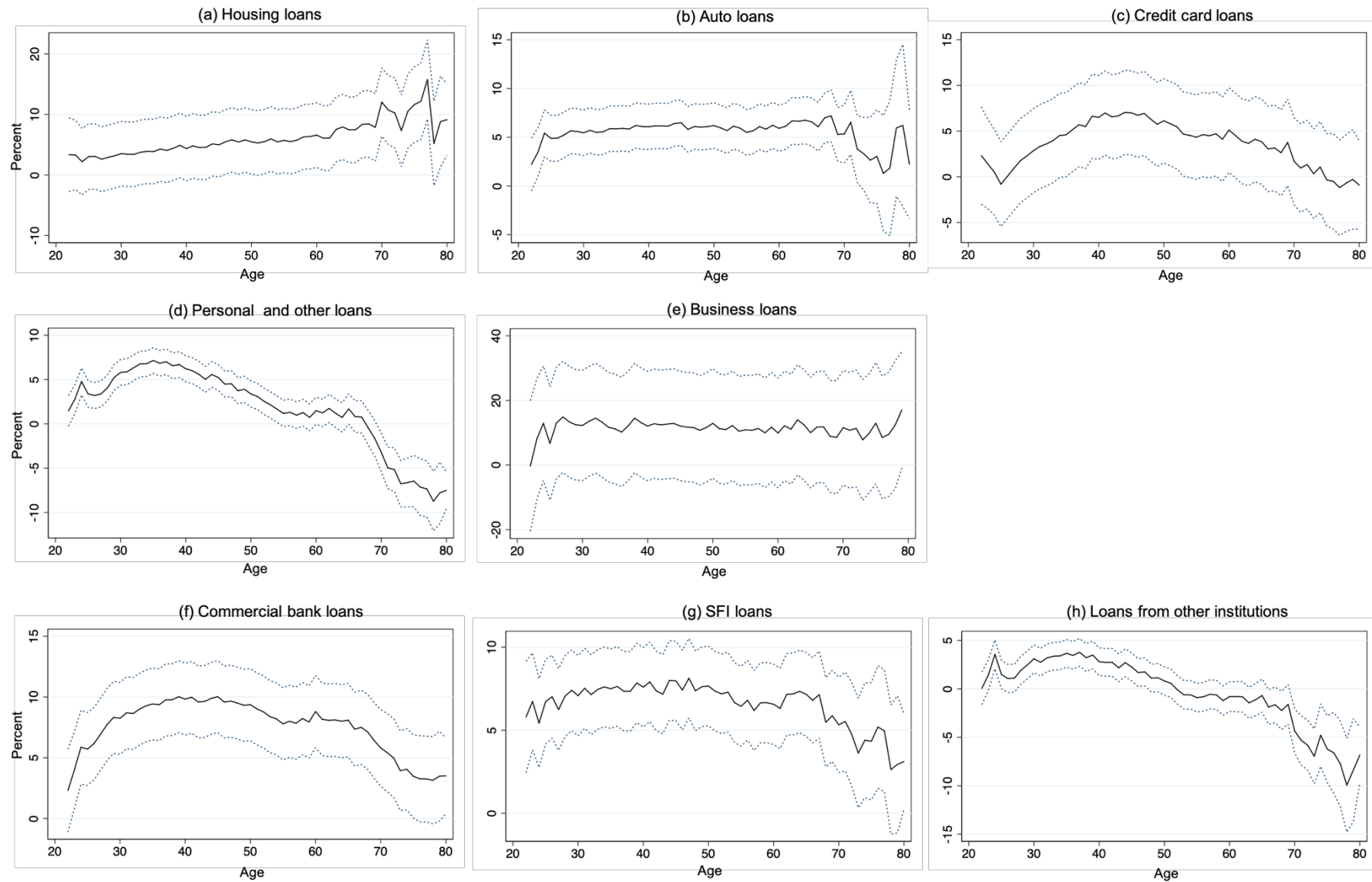
Note: We keep y-axis scaling varies across loan products and lenders so that we can still reflect variation in life cycle pattern for each loan

Figure 10 Life cycle of debt and delinquency by cohort

(a) Debt headcount by age and birth cohort

(b) Median debt by age and birth cohort

(c) Delinquency headcount by age and birth cohort
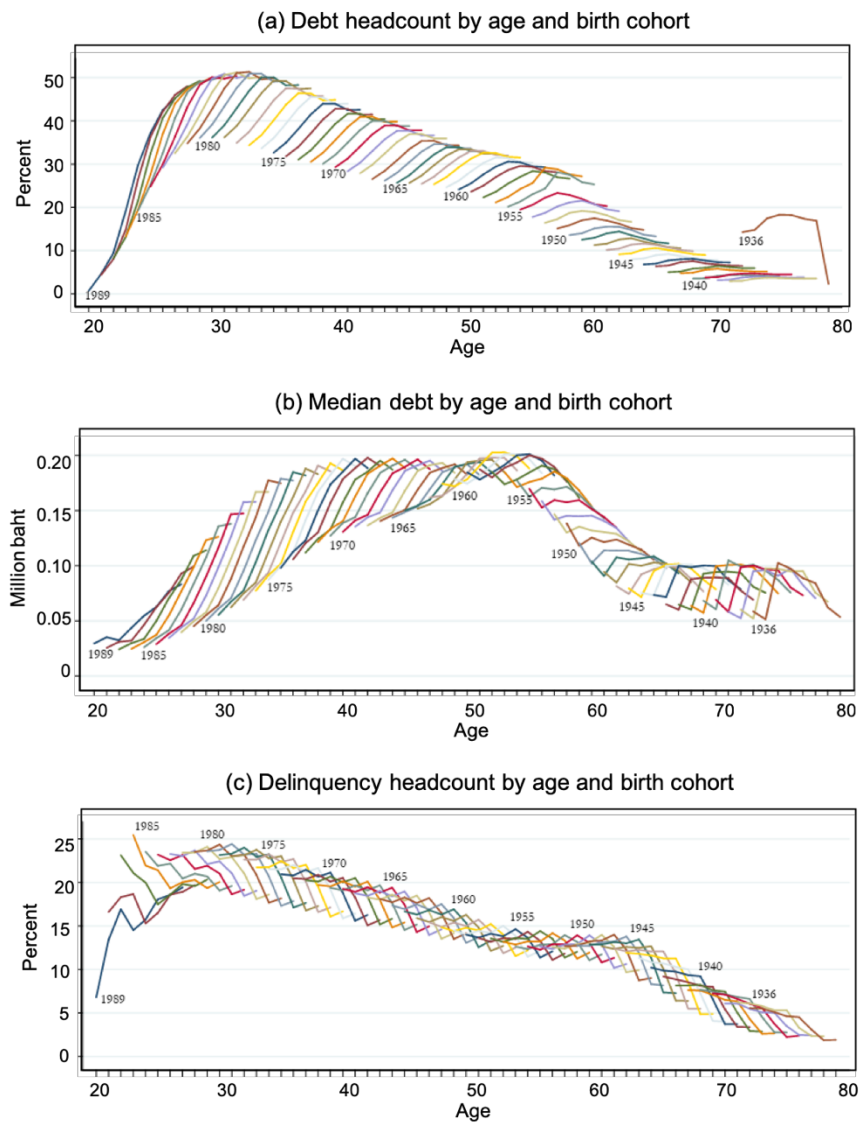
Table 1 Overview of Credit Bureau Data

Coverage	Year							
	2009	2010	2011	2012	2013	2014	2015	July 2016
Number of financial institution members	68	69	75	78	78	80	86	90
Number of account (million)	32.63	33.93	37.86	41.99	46.63	47.63	48.47	60.51
Number of borrowers (million)	11.65	12.29	13.36	14.73	15.98	16.07	15.94	19.25
Total loan outstanding (trillion baht)	4.39	4.92	6.05	7.14	8.11	8.44	8.69	9.80
- Less than 30 days past due	3.85	4.39	5.32	6.40	7.24	7.63	7.86	8.78
- 31-60 days past due	0.08	0.08	0.10	0.12	0.16	0.20	0.26	0.28
- 61-90 days past due	0.04	0.03	0.05	0.05	0.08	0.08	0.07	0.11
- 91-120 days past due	0.02	0.02	0.02	0.02	0.04	0.04	0.04	0.04
-121-300 days past due	0.11	0.09	0.10	0.12	0.14	0.12	0.13	0.18
- Greater than 300 days past due	0.30	0.31	0.45	0.44	0.44	0.37	0.32	0.42
Total delinquent loan[*] (trillion baht)	0.42	0.42	0.57	0.57	0.62	0.53	0.50	0.64
Number of credit review for new loan (million)	8.70	9.90	11.44	13.90	13.76	12.75	9.48	7.12
Number of credit review for existing loan (million)	5.27	6.95	9.00	7.63	17.66	30.04	24.61	23.76

[*] Delinquent loans are loans with more than 90 days past due.

Table 2 Descriptive statistics of borrowers (July 2016)

	Mean	Median	SD	Min	Max	N
Borrower characteristics						
Age (years)	44.16	43.00	12.36	20	80	18,813,985
Region - Bangkok and vicinity (=1)	0.29	na	na	0	1	16,039,856
- Central (=1)	0.18	na	na	0	1	16,039,856
- North (=1)	0.15	na	na	0	1	16,039,856
- Northeast (=1)	0.25	na	na	0	1	16,039,856
- South (=1)	0.11	na	na	0	1	16,039,856
Urban (=1)*	0.51	na	na	0	1	16,039,856
Portfolio characteristics						
Number of accounts	3.14	2.00	3.11	1	167	19,245,461
Number of distinct loan products	1.60	1.00	0.81	1	6	19,245,461
Number of financial institutions used	2.08	1.00	1.66	1	8	19,245,461
Total credit line (million baht)	0.77	0.28	3.84	0	4220	19,245,461
Total loan outstanding (million baht)	0.51	0.15	3.07	0	8990	19,245,461
Total delinquent loan (million baht)	0.20	0.06	1.10	0	973	3,189,527
Credit history and utilization						
Number of years in NCB data	5.02	5.00	2.73	1	8	19,245,461
New borrower (=1)	0.07	na	na	0	1	19,245,461
Have delinquent loan this year (=1)	0.17	na	na	0	1	19,245,461
Have delinquent loan in the past year (=1)	0.16	na	na	0	1	15,252,626
Utilization rate** (%)	0.65	0.71	0.36	0	1	19,245,461

* A postcode is defined as urban area if more than 50% of its area belong to municipalities.

** Utilization rate is defined as a ratio of current balance to credit line.

Data for age and location have some missing, hence the drop of sample with these identifiers.

Table 3 Dissecting aggregate debt and delinquency by loan product, lender, and borrower

By loan product and lender	Share of account (%)	Share of loan outstanding (%)	Share of delinquent loan (%)
	July 2016	July 2016	July 2016
By Loan product			
- Housing	5.4%	33.2%	19.8%
- Auto	11.2%	20.8%	23.4%
- Motorcycle	2.2%	0.5%	2.7%
- Credit card	30.7%	3.8%	8.1%
- Personal loan and others	35.5%	27.8%	31.8%
- Loan for business	15.0%	13.9%	14.0%
By Lender			
Commercial banks	35.2%	51.7%	45.6%
SFIs	26.6%	33.9%	29.4%
Other financial insitutions[*]	38.2%	14.4%	25.0%

By borrowers	Share of borrowers (%)	Share of loan outstanding (%)	Share of delinquent loan (%)
	July 2016	July 2016	July 2016
By Age			
- Younger than 25	3.2%	1.1%	1.3%
- Between 25-35	27.6%	22.6%	24.8%
- Between 36-45	27.9%	33.0%	34.2%
- Between 46-60	32.2%	36.1%	34.0%
- Older than 60	9.1%	7.2%	5.7%
By Region			
- Bangkok and vicinity	29.4%	36.4%	35.4%
- Central	18.3%	17.2%	18.1%
- North	15.4%	13.7%	13.7%
- Northeast	25.4%	21.0%	18.7%
- South	11.4%	11.7%	14.1%
Urban	51.0%	58.8%	58.1%

[*] Other financial institutions include credit card companies, hire purchase companies, insurance companies and co-operative.

Appendix

Table A.1 Household debt to GDP of Selected Asia-Pacific Economies (Percent)

	1984	1994	2004	2014
Australia	39.9	51.5	95.8	118.3
New Zealand		41.9	75.5	88.8
Korea	26.1	47.3	62.6	84.3
Thailand		40.2	44.2	69.5
Malaysia			54.1*	68.9
Japan	54.7	71.6	68	66
Hong Kong		38.6	57.7	65.6
Singapore		28.9	46.3	60.6
China			10.9*	36.1
Indonesia			10.9	17.1

Remark: * Data for Malaysia and China are for 2006.

Table A.2 Regression of debt per borrower by age

Age	Debt per Borrower (thousand baht)			
	OLS (1)		OLS (2)	
	Coef.	S.E.	Coef.	S.E.
21	26113	(34814)	11592	(39753)
22	50548	(31775)	39401	(36739)
23	73512*	(30261)	68040	(34934)
24	111925***	(29645)	103910**	(34141)
25	143462***	(29344)	134931***	(33759)
26	174241***	(29213)	166683***	(33628)
27	200350***	(29123)	192774***	(33534)
28	231045***	(29062)	217594***	(33484)
29	246222***	(28994)	233973***	(33409)
30	266145***	(28949)	260328***	(33354)
31	299413***	(28922)	291490***	(33328)
32	340916***	(28899)	322526***	(33300)
33	356206***	(28876)	347803***	(33262)
34	415296***	(28872)	392024***	(33262)
35	427232***	(28863)	398568***	(33248)
36	455689***	(28869)	426557***	(33265)
37	482769***	(28885)	448211***	(33309)
38	471431***	(28884)	443110***	(33304)
39	491448***	(28891)	461464***	(33323)
40	525122***	(28910)	489477***	(33379)
41	531524***	(28914)	491818***	(33383)
42	546868***	(28931)	501420***	(33424)
43	556876***	(28930)	510165***	(33428)
44	576803***	(28932)	521660***	(33433)
45	564297***	(28945)	537257***	(33479)
46	601503***	(28962)	556045***	(33528)
47	626826***	(28958)	564789***	(33518)
48	591568***	(28994)	544466***	(33615)
49	588014***	(29024)	544290***	(33709)
50	572002***	(29032)	540189***	(33731)
51	613920***	(29040)	569521***	(33757)
52	603190***	(29079)	570349***	(33884)
53	613386***	(29098)	584061***	(33927)
54	622599***	(29131)	590340***	(34050)
55	619494***	(29165)	582043***	(34137)
56	625488***	(29201)	591304***	(34262)
57	608701***	(29288)	584822***	(34519)
58	643354***	(29356)	599178***	(34700)
59	574795***	(29390)	555683***	(34835)
60	657097***	(29505)	608320***	(35202)
61	569679***	(29704)	553175***	(35822)
62	519474***	(29868)	513892***	(36277)
63	572604***	(30052)	551013***	(36895)
64	464990***	(30345)	571475***	(37798)
65	443207***	(30677)	468949***	(38811)
66	409072***	(30930)	484089***	(39691)
67	431015***	(31494)	458156***	(41400)
68	391796***	(31909)	466424***	(42611)

69	356777***	(32603)	418901***	(44950)
70	365446***	(33773)	389249***	(48176)
71	306879***	(34137)	353997***	(49453)
72	270819***	(34984)	307704***	(51913)
73	261832***	(36249)	320953***	(55259)
74	317750***	(37177)	357791***	(57650)
75	333322***	(39301)	345671***	(63080)
>75	296028***	(39035)	318554***	(62815)
Year effect	Yes		Yes	
Location effect	Yes		No	
Location*Year effects	Yes		Yes	
Individual effect	No		Yes	
Observation	5,885,972		5,885,972	
Pseudo R-Square	0.0081		0.0094	

Table A.3 Regression of debt per borrower by age by product

Age	Debt per Borrower (thousand baht)									
	Housing loan		Auto loan		Credit card		Ploan and other unsecured		Commercial loan	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
21	-83950	(305022)	-32463	(23234)	1126	(13130)	-19555	(37243)	1674516	(2068985)
22	-161134	(284480)	-53457*	(21353)	3431	(12038)	-13358	(34421)	418781	(1917823)
23	-26688	(273593)	-57852**	(20610)	4430	(11595)	-8036	(32722)	581342	(1821695)
24	7570	(269542)	-81044***	(20269)	8229	(11456)	2551	(31990)	1381159	(1801800)
25	45973	(267597)	-99639***	(20150)	9618	(11404)	12038	(31603)	796584	(1776855)
26	103089	(266753)	-107313***	(20095)	11691	(11386)	22188	(31470)	787828	(1761208)
27	42048	(266214)	-123023***	(20064)	15292	(11375)	40347	(31364)	697110	(1760087)
28	62801	(265914)	-131546***	(20047)	17246	(11370)	56916	(31291)	789683	(1750129)
29	-20224	(265630)	-138989***	(20029)	19727	(11364)	68969*	(31205)	292829	(1747834)
30	-85543	(265300)	-146891***	(20014)	22478*	(11358)	83507**	(31147)	456440	(1743397)
31	-25949	(265149)	-152291***	(20008)	25481*	(11354)	99069**	(31117)	432239	(1740571)
32	-52150	(265006)	-155627***	(19999)	29837**	(11352)	115787***	(31091)	490177	(1738576)
33	-61148	(264879)	-158523***	(19993)	32087**	(11348)	126080***	(31047)	1282228	(1736859)
34	-67361	(264808)	-162147***	(19990)	35521**	(11347)	146218***	(31043)	545442	(1736793)
35	-76998	(264767)	-167786***	(19988)	39238***	(11345)	153090***	(31042)	496313	(1735537)
36	-102469	(264751)	-161442***	(19991)	42498***	(11346)	182276***	(31065)	658451	(1735001)
37	-137407	(264752)	-165024***	(19995)	46798***	(11347)	184735***	(31120)	579738	(1734146)
38	-208735	(264742)	-163382***	(19996)	47476***	(11347)	190533***	(31123)	536141	(1733328)
39	-221130	(264754)	-162418***	(19999)	49205***	(11347)	210918***	(31150)	561930	(1733164)
40	-232499	(264765)	-158106***	(20006)	52299***	(11350)	228180***	(31219)	536535	(1732590)
41	-251344	(264776)	-159733***	(20006)	53473***	(11350)	236632***	(31224)	605692	(1732632)
42	-303295	(264793)	-156738***	(20012)	58934***	(11352)	250521***	(31289)	631002	(1732425)
43	-308552	(264782)	-158673***	(20014)	60531***	(11352)	260916***	(31296)	574612	(1732145)
44	-292016	(264794)	-152460***	(20016)	63430***	(11352)	267979***	(31310)	481352	(1731969)
45	-319436	(264813)	-148191***	(20023)	64525***	(11354)	289097***	(31370)	624812	(1731617)
46	-300823	(264844)	-144466***	(20033)	70228***	(11357)	302981***	(31421)	772520	(1731786)
47	-308590	(264832)	-148129***	(20031)	67440***	(11356)	307957***	(31421)	666761	(1732030)
48	-334613	(264948)	-150185***	(20046)	71277***	(11361)	310490***	(31535)	703874	(1732436)
49	-385109	(264976)	-151658***	(20061)	70774***	(11366)	322012***	(31636)	649430	(1732372)
50	-420575	(265020)	-149014***	(20069)	68324***	(11367)	338155***	(31676)	701613	(1732331)

51	-424550	(265065)	-150872***	(20071)	72136***	(11368)	378821***	(31693)	581296	(1732813)
52	-412446	(265175)	-151829***	(20095)	69277***	(11371)	402277***	(31866)	824340	(1733294)
53	-481934	(265210)	-153491***	(20102)	69797***	(11375)	422678***	(31878)	734972	(1733948)
54	-506790	(265300)	-159728***	(20124)	68269***	(11377)	450894***	(32028)	533678	(1734416)
55	-516743	(265422)	-147693***	(20150)	70010***	(11382)	464700***	(32105)	857639	(1735605)
56	-544057*	(265537)	-158537***	(20166)	70989***	(11386)	484189***	(32250)	774702	(1736893)
57	-557484*	(265741)	-157718***	(20215)	69925***	(11393)	501109***	(32527)	875012	(1737001)
58	-587253*	(266021)	-159473***	(20254)	72382***	(11404)	533923***	(32786)	1845873	(1737117)
59	-636804*	(266198)	-167246***	(20279)	72865***	(11406)	480419***	(32972)	1079512	(1739247)
60	-599726*	(266525)	-165406***	(20357)	72628***	(11415)	598308***	(33487)	1027471	(1741376)
61	-646774*	(267308)	-170025***	(20492)	68871***	(11435)	547085***	(34267)	732462	(1742607)
62	-738054**	(267899)	-181777***	(20600)	74654***	(11452)	543791***	(34884)	1337409	(1746776)
63	-598567*	(268686)	-179897***	(20797)	74932***	(11473)	573258***	(35701)	902306	(1750962)
64	-709968**	(269869)	-200719***	(21106)	65346***	(11502)	737456***	(36973)	702364	(1757039)
65	-680173*	(271352)	-195691***	(21481)	63204***	(11532)	575870***	(38492)	679460	(1763643)
66	-694804*	(273579)	-210094***	(21949)	67130***	(11557)	715870***	(39962)	1184601	(1775429)
67	-636204*	(276891)	-206685***	(22760)	65063***	(11617)	623020***	(42603)	714180	(1779525)
68	-756834**	(279245)	-215168***	(23587)	60803***	(11648)	747442***	(44395)	1154051	(1807435)
69	-814218**	(283032)	-208861***	(25485)	61644***	(11747)	662722***	(47819)	2604727	(1824916)
70	-925026**	(287808)	-150509***	(28187)	54037***	(11908)	570435***	(51753)	459662	(1850338)
71	-887640**	(292106)	-245257***	(29357)	56779***	(11935)	632155***	(54434)	266508	(1869449)
72	-897372**	(300346)	-206611***	(31880)	53296***	(12029)	689946***	(57995)	286161	(1944503)
73	-808509**	(310533)	-178728***	(37592)	52321***	(12265)	560616***	(60931)	1024815	(1913955)
74	-866695**	(317220)	-213258***	(40945)	46937***	(12392)	711700***	(64853)	766163	(1961282)
75	-1012296**	(324261)	-267807***	(50574)	42963***	(12854)	729674***	(72015)	807381	(1984097)
>75	-914859**	(338244)	-135582*	(59089)	281720***	(58977)	289178***	(39953)	341370	(2005472)
Year effect	Yes		Yes		Yes		Yes		Yes	
Location effect	No		No		No		No		No	
Location*Year effects	Yes		Yes		Yes		Yes		Yes	
Individual effect	Yes		Yes		Yes		Yes		Yes	
Observation	935,953		1,819,960		2,001,322		3,361,971		127,708	
Adjusted R-Square	0.0069		0.0516		0.0259		0.0093		0.0030	

Table A.4 Regression of debt per borrower by age by financial institution

	Debt per Borrower (thousand baht)					
	Commercial banks		SFIs		Non-banks	
Age	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
21	-13534	(140860)	131626	(67410)	-7092	(7106)
22	6737	(130375)	94350	(59214)	-1408	(6596)
23	-35585	(125681)	185590***	(54357)	7782	(6293)
24	-54738	(123747)	207455***	(51963)	18877**	(6162)
25	-42551	(123064)	212302***	(50855)	25627***	(6094)
26	-37669	(122780)	229402***	(50242)	34416***	(6073)
27	-26270	(122618)	260158***	(49864)	37694***	(6057)
28	-8185	(122515)	226920***	(49540)	38507***	(6047)
29	-2504	(122418)	238731***	(49346)	39863***	(6033)
30	-191	(122329)	259379***	(49153)	42813***	(6024)
31	31243	(122277)	278376***	(49062)	44159***	(6020)
32	53867	(122236)	307531***	(48976)	50084***	(6015)
33	75927	(122190)	302571***	(48884)	51171***	(6009)
34	120205	(122173)	318117***	(48847)	55085***	(6009)
35	124964	(122163)	325316***	(48818)	56067***	(6007)
36	158834	(122167)	325163***	(48806)	57483***	(6012)
37	161734	(122190)	350369***	(48804)	62470***	(6022)
38	155930	(122195)	323280***	(48778)	64813***	(6023)
39	170156	(122198)	325975***	(48773)	66767***	(6029)
40	197442	(122232)	331489***	(48798)	72237***	(6042)
41	202007	(122230)	314224***	(48792)	73344***	(6044)
42	192752	(122252)	332918***	(48804)	77931***	(6057)
43	208703	(122257)	322656***	(48792)	79139***	(6060)
44	221919	(122254)	321188***	(48800)	81904***	(6064)
45	235520	(122274)	311026***	(48822)	88233***	(6077)
46	275561*	(122313)	289928***	(48827)	89450***	(6089)
47	266017*	(122303)	320163***	(48815)	89260***	(6088)
48	247372*	(122359)	282300***	(48884)	92191***	(6115)
49	238207	(122428)	292604***	(48922)	93366***	(6138)
50	225980	(122434)	299364***	(48930)	93534***	(6148)
51	246137*	(122442)	318670***	(48925)	96354***	(6156)
52	219689	(122518)	357387***	(48996)	96788***	(6189)
53	222610	(122539)	365671***	(48992)	96146***	(6203)
54	201876	(122596)	392515***	(49054)	97242***	(6236)
55	186245	(122665)	379417***	(49084)	103008***	(6260)
56	187088	(122720)	397782***	(49150)	99390***	(6295)
57	164008	(122870)	415617***	(49283)	94032***	(6355)
58	206650	(123009)	392405***	(49391)	97426***	(6410)
59	168887	(123086)	367928***	(49506)	104312***	(6446)
60	234931	(123316)	412750***	(49761)	95135***	(6542)
61	186932	(123685)	367342***	(50218)	87980***	(6700)
62	146613	(124007)	351563***	(50495)	90025***	(6822)
63	256406*	(124407)	303943***	(51096)	83930***	(7002)
64	315576*	(125090)	307947***	(51812)	71775***	(7264)
65	170877	(125810)	290775***	(52839)	72996***	(7553)
66	212489	(126462)	323981***	(54185)	62559***	(7795)
67	165262	(127642)	340702***	(55661)	62021***	(8335)

68	215973	(128681)	321168***	(57013)	45682***	(8663)
69	151965	(130425)	306412***	(59973)	43151***	(9625)
70	125032	(133273)	334033***	(62422)	44883***	(10752)
71	102808	(134175)	236006***	(65711)	23773*	(10986)
72	77377	(135925)	239109***	(69782)	35098**	(12014)
73	60604	(138643)	210170**	(73307)	20899	(13711)
74	171509	(141415)	131976	(74808)	30030*	(14661)
75	135621	(147526)	243384**	(79256)	19285	(17707)
>75	53529	(145919)	204317**	(78717)	31395	(18759)
Year effect	Yes		Yes		Yes	
Location effect	No		No		No	
Location*Year effects	Yes		Yes		Yes	
Individual effect	Yes		Yes		Yes	
Observation	593,069		291,418		745,833	
Pseudo R-Square	0.0041		0.0145		0.0074	

Table A.5 Regression of number of account and financial institution by age

Age	Number of accounts		Number of Fis	
	Coef.	S.E.	Coef.	S.E.
21	0.203**	(0.069)	0.209**	(0.069)
22	0.393***	(0.064)	0.429***	(0.064)
23	0.612***	(0.061)	0.678***	(0.060)
24	0.865***	(0.059)	0.940***	(0.059)
25	1.041***	(0.059)	1.123***	(0.058)
26	1.181***	(0.059)	1.268***	(0.058)
27	1.273***	(0.058)	1.355***	(0.058)
28	1.369***	(0.058)	1.450***	(0.058)
29	1.442***	(0.058)	1.521***	(0.058)
30	1.514***	(0.058)	1.590***	(0.058)
31	1.621***	(0.058)	1.694***	(0.058)
32	1.708***	(0.058)	1.779***	(0.058)
33	1.796***	(0.058)	1.862***	(0.057)
34	1.885***	(0.058)	1.949***	(0.057)
35	1.934***	(0.058)	1.996***	(0.057)
36	1.948***	(0.058)	2.006***	(0.057)
37	2.004***	(0.058)	2.060***	(0.058)
38	2.002***	(0.058)	2.051***	(0.058)
39	2.026***	(0.058)	2.072***	(0.058)
40	2.057***	(0.058)	2.099***	(0.058)
41	2.060***	(0.058)	2.094***	(0.058)
42	2.060***	(0.058)	2.088***	(0.058)
43	2.069***	(0.058)	2.095***	(0.058)
44	2.066***	(0.058)	2.088***	(0.058)
45	2.101***	(0.058)	2.117***	(0.058)
46	2.092***	(0.058)	2.105***	(0.058)
47	2.103***	(0.058)	2.112***	(0.058)
48	2.063***	(0.059)	2.068***	(0.058)
49	2.033***	(0.059)	2.041***	(0.058)
50	2.033***	(0.059)	2.041***	(0.058)
51	2.036***	(0.059)	2.041***	(0.058)
52	2.087***	(0.059)	2.098***	(0.059)
53	2.063***	(0.059)	2.075***	(0.059)
54	2.129***	(0.059)	2.140***	(0.059)
55	2.124***	(0.060)	2.144***	(0.059)
56	2.126***	(0.060)	2.141***	(0.059)
57	2.200***	(0.060)	2.215***	(0.060)
58	2.071***	(0.061)	2.086***	(0.060)
59	2.059***	(0.061)	2.078***	(0.060)
60	2.123***	(0.061)	2.151***	(0.061)
61	2.046***	(0.063)	2.081***	(0.062)
62	1.948***	(0.063)	1.981***	(0.063)
63	1.925***	(0.065)	1.967***	(0.064)
64	1.759***	(0.066)	1.802***	(0.066)
65	1.733***	(0.068)	1.794***	(0.068)
66	1.634***	(0.070)	1.709***	(0.069)
67	1.581***	(0.073)	1.661***	(0.072)
68	1.491***	(0.075)	1.578***	(0.075)
69	1.382***	(0.079)	1.483***	(0.079)

70	1.180***	(0.085)	1.284***	(0.085)
71	1.105***	(0.087)	1.214***	(0.087)
72	1.102***	(0.092)	1.219***	(0.091)
73	1.127***	(0.098)	1.243***	(0.098)
74	0.877***	(0.102)	0.995***	(0.102)
75	0.837***	(0.112)	0.955***	(0.112)
>75	0.711***	(0.112)	0.837***	(0.111)
Year effect	Yes		Yes	
Location effect	No		No	
Location*Year effects	Yes		Yes	
Individual effect	Yes		Yes	
Observation	5,885,972		5,885,972	
Pseudo R-Square	0.0543		0.0356	

Table A.6 Regression of delinquency rate by age

| Age | Delinquency Probability (%) | | | |
| | Probit (1) | | Probit (2) | |
	Coef.	S.E.	Coef.	S.E.
21	0.020**	(0.006)	0.013	(0.007)
22	0.029***	(0.006)	0.023***	(0.007)
23	0.053***	(0.005)	0.041***	(0.006)
24	0.029***	(0.005)	0.021***	(0.006)
25	0.022***	(0.005)	0.018**	(0.006)
26	0.017**	(0.005)	0.019**	(0.006)
27	0.018***	(0.005)	0.025***	(0.006)
28	0.020***	(0.005)	0.030***	(0.006)
29	0.020***	(0.005)	0.032***	(0.006)
30	0.018***	(0.005)	0.030***	(0.006)
31	0.019***	(0.005)	0.031***	(0.006)
32	0.017**	(0.005)	0.033***	(0.006)
33	0.017***	(0.005)	0.033***	(0.006)
34	0.017**	(0.005)	0.034***	(0.006)
35	0.016**	(0.005)	0.032***	(0.006)
36	0.017***	(0.005)	0.033***	(0.006)
37	0.015**	(0.005)	0.029***	(0.006)
38	0.019***	(0.005)	0.031***	(0.006)
39	0.012*	(0.005)	0.025***	(0.006)
40	0.010*	(0.005)	0.024***	(0.006)
41	0.007	(0.005)	0.022***	(0.006)
42	0.002	(0.005)	0.017**	(0.006)
43	0.009	(0.005)	0.022***	(0.006)
44	0.004	(0.005)	0.018**	(0.006)
45	-0.001	(0.005)	0.011	(0.006)
46	0.000	(0.005)	0.013*	(0.006)
47	-0.004	(0.005)	0.008	(0.006)
48	-0.006	(0.005)	0.007	(0.006)
49	-0.009	(0.005)	0.004	(0.006)
50	-0.014**	(0.005)	0.001	(0.006)
51	-0.016**	(0.005)	-0.004	(0.006)
52	-0.019***	(0.005)	-0.008	(0.006)
53	-0.023***	(0.005)	-0.010	(0.006)
54	-0.027***	(0.005)	-0.014*	(0.006)
55	-0.023***	(0.005)	-0.013*	(0.006)
56	-0.027***	(0.005)	-0.014*	(0.006)
57	-0.025***	(0.005)	-0.013*	(0.006)
58	-0.031***	(0.005)	-0.018**	(0.006)
59	-0.023***	(0.005)	-0.015*	(0.006)
60	-0.028***	(0.005)	-0.017**	(0.006)
61	-0.030***	(0.005)	-0.018**	(0.007)
62	-0.034***	(0.005)	-0.022***	(0.007)
63	-0.034***	(0.005)	-0.025***	(0.007)
64	-0.036***	(0.005)	-0.025***	(0.007)
65	-0.045***	(0.005)	-0.036***	(0.007)
66	-0.050***	(0.006)	-0.036***	(0.007)
67	-0.053***	(0.006)	-0.045***	(0.007)
68	-0.061***	(0.006)	-0.048***	(0.008)

69	-0.074***	(0.006)	-0.063***	(0.008)
70	-0.075***	(0.006)	-0.067***	(0.009)
71	-0.080***	(0.006)	-0.073***	(0.009)
72	-0.088***	(0.006)	-0.078***	(0.009)
73	-0.086***	(0.006)	-0.077***	(0.010)
74	-0.090***	(0.007)	-0.080***	(0.010)
75	-0.091***	(0.007)	-0.087***	(0.011)
>75	-0.092***	(0.007)	-0.087***	(0.011)
Year effect	Yes		Yes	
Location effect	Yes		No	
Location*Year effects	Yes		Yes	
Individual effect	No		Yes	
Observation	5,885,972		5,885,972	
Pseudo R-Square	0.0159		0.0257	

Table A.7 Regression of delinquency rate by age by product

	Delinquency Rate (%)									
	Housing loan		Auto loan		Credit card		Ploan and other unsecured		Commercial loan	
Age	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
21	0.034	(0.031)	0.022	(0.014)	0.023	(0.027)	0.015	(0.009)	-0.003	(0.103)
22	0.033	(0.029)	0.035**	(0.013)	0.014	(0.025)	0.028***	(0.008)	0.081	(0.095)
23	0.022	(0.028)	0.054***	(0.012)	0.005	(0.024)	0.048***	(0.008)	0.129	(0.091)
24	0.030	(0.028)	0.049***	(0.012)	-0.008	(0.024)	0.034***	(0.008)	0.067	(0.090)
25	0.031	(0.027)	0.049***	(0.012)	0.001	(0.024)	0.032***	(0.008)	0.130	(0.088)
26	0.026	(0.027)	0.052***	(0.012)	0.009	(0.024)	0.034***	(0.007)	0.149	(0.088)
27	0.029	(0.027)	0.057***	(0.012)	0.018	(0.024)	0.041***	(0.007)	0.133	(0.088)
28	0.032	(0.027)	0.056***	(0.012)	0.023	(0.024)	0.052***	(0.007)	0.124	(0.087)
29	0.035	(0.027)	0.055***	(0.012)	0.029	(0.024)	0.058***	(0.007)	0.122	(0.087)
30	0.034	(0.027)	0.057***	(0.012)	0.033	(0.023)	0.059***	(0.007)	0.135	(0.087)
31	0.034	(0.027)	0.055***	(0.012)	0.036	(0.023)	0.063***	(0.007)	0.145	(0.087)
32	0.038	(0.027)	0.056***	(0.012)	0.040	(0.023)	0.068***	(0.007)	0.133	(0.087)
33	0.039	(0.027)	0.059***	(0.012)	0.045	(0.023)	0.068***	(0.007)	0.117	(0.087)
34	0.039	(0.027)	0.059***	(0.012)	0.046	(0.023)	0.072***	(0.007)	0.112	(0.087)
35	0.043	(0.027)	0.059***	(0.012)	0.052*	(0.023)	0.068***	(0.007)	0.102	(0.086)
36	0.041	(0.027)	0.058***	(0.012)	0.057*	(0.023)	0.070***	(0.007)	0.121	(0.086)
37	0.044	(0.027)	0.062***	(0.012)	0.055*	(0.023)	0.066***	(0.007)	0.145	(0.086)
38	0.049	(0.027)	0.061***	(0.012)	0.066**	(0.023)	0.067***	(0.007)	0.131	(0.086)
39	0.044	(0.027)	0.061***	(0.012)	0.065**	(0.023)	0.062***	(0.007)	0.120	(0.086)
40	0.048	(0.027)	0.062***	(0.012)	0.070**	(0.023)	0.060***	(0.007)	0.128	(0.086)
41	0.045	(0.027)	0.062***	(0.012)	0.066**	(0.023)	0.056***	(0.007)	0.124	(0.086)
42	0.046	(0.027)	0.061***	(0.012)	0.067**	(0.023)	0.050***	(0.007)	0.127	(0.086)
43	0.051	(0.027)	0.064***	(0.012)	0.070**	(0.023)	0.056***	(0.007)	0.129	(0.086)
44	0.050	(0.027)	0.065***	(0.012)	0.070**	(0.023)	0.052***	(0.007)	0.121	(0.086)
45	0.055*	(0.027)	0.058***	(0.012)	0.067**	(0.023)	0.045***	(0.007)	0.117	(0.086)
46	0.058*	(0.027)	0.061***	(0.012)	0.069**	(0.023)	0.045***	(0.007)	0.116	(0.086)
47	0.054*	(0.027)	0.060***	(0.012)	0.063**	(0.023)	0.037***	(0.007)	0.108	(0.086)
48	0.058*	(0.027)	0.061***	(0.012)	0.058*	(0.024)	0.039***	(0.007)	0.116	(0.086)
49	0.055*	(0.027)	0.062***	(0.012)	0.061**	(0.024)	0.034***	(0.008)	0.129	(0.086)
50	0.053	(0.027)	0.060***	(0.012)	0.058*	(0.024)	0.031***	(0.008)	0.113	(0.086)
51	0.055*	(0.027)	0.057***	(0.012)	0.055*	(0.024)	0.025***	(0.008)	0.110	(0.086)
52	0.060*	(0.027)	0.061***	(0.012)	0.047*	(0.024)	0.021**	(0.008)	0.122	(0.086)

53	0.055*	(0.027)	0.059***	(0.012)	0.045	(0.024)	0.017*	(0.008)	0.105	(0.086)
54	0.057*	(0.027)	0.055***	(0.012)	0.043	(0.024)	0.012	(0.008)	0.109	(0.086)
55	0.055*	(0.027)	0.057***	(0.012)	0.046*	(0.024)	0.013	(0.008)	0.108	(0.086)
56	0.058*	(0.027)	0.061***	(0.012)	0.045	(0.024)	0.010	(0.008)	0.113	(0.087)
57	0.063*	(0.027)	0.058***	(0.012)	0.047*	(0.024)	0.013	(0.008)	0.100	(0.087)
58	0.064*	(0.027)	0.062***	(0.012)	0.041	(0.024)	0.007	(0.008)	0.117	(0.087)
59	0.066*	(0.027)	0.059***	(0.012)	0.051*	(0.024)	0.015	(0.008)	0.099	(0.087)
60	0.061*	(0.027)	0.061***	(0.012)	0.045	(0.024)	0.012	(0.008)	0.121	(0.087)
61	0.061*	(0.027)	0.067***	(0.012)	0.039	(0.024)	0.017*	(0.008)	0.111	(0.087)
62	0.075**	(0.027)	0.066***	(0.012)	0.037	(0.024)	0.012	(0.008)	0.140	(0.087)
63	0.079**	(0.027)	0.068***	(0.012)	0.041	(0.024)	0.007	(0.008)	0.124	(0.087)
64	0.074**	(0.028)	0.066***	(0.013)	0.039	(0.024)	0.017	(0.009)	0.100	(0.087)
65	0.075**	(0.028)	0.061***	(0.013)	0.030	(0.024)	0.008	(0.009)	0.118	(0.088)
66	0.084**	(0.028)	0.070***	(0.013)	0.032	(0.024)	0.008	(0.009)	0.118	(0.088)
67	0.084**	(0.028)	0.072***	(0.014)	0.026	(0.024)	-0.005	(0.010)	0.089	(0.088)
68	0.079**	(0.028)	0.053***	(0.014)	0.038	(0.024)	-0.016	(0.010)	0.086	(0.090)
69	0.120***	(0.029)	0.053***	(0.015)	0.017	(0.024)	-0.032**	(0.011)	0.115	(0.090)
70	0.107***	(0.029)	0.065***	(0.017)	0.010	(0.025)	-0.050***	(0.012)	0.108	(0.091)
71	0.103***	(0.030)	0.038*	(0.018)	0.013	(0.025)	-0.052***	(0.013)	0.113	(0.092)
72	0.073*	(0.030)	0.033	(0.019)	0.003	(0.025)	-0.068***	(0.013)	0.078	(0.096)
73	0.105***	(0.031)	0.026	(0.022)	0.011	(0.025)	-0.066***	(0.014)	0.098	(0.094)
74	0.116***	(0.032)	0.030	(0.024)	-0.003	(0.026)	-0.065***	(0.015)	0.129	(0.096)
75	0.122***	(0.032)	0.013	(0.030)	-0.005	(0.027)	-0.071***	(0.016)	0.085	(0.097)
>75	0.158***	(0.033)	0.018	(0.035)	-0.012	(0.027)	-0.073***	(0.016)	0.095	(0.098)
Year effect	Yes		Yes		Yes		Yes		Yes	
Location effect	No		No		No		No		No	
Location*Year effects	Yes		Yes		Yes		Yes		Yes	
Individual effect	Yes		Yes		Yes		Yes		Yes	
Observation	935,953		1,819,960		2,001,322		3,361,971		127,708	
Adjusted R-Square	0.0035		0.0486		0.0330		0.0451		0.0813	

Table A.8 Regression of delinquency rate by age by financial institution

	Delinquency Rate (%)					
	Commercial banks		SFIs		Non-banks	
Age	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
21	0.023	(0.017)	0.058***	(0.017)	0.001	(0.009)
22	0.040*	(0.016)	0.067***	(0.015)	0.014	(0.008)
23	0.059***	(0.016)	0.054***	(0.014)	0.036***	(0.008)
24	0.057***	(0.015)	0.067***	(0.013)	0.015*	(0.007)
25	0.062***	(0.015)	0.070***	(0.013)	0.011	(0.007)
26	0.069***	(0.015)	0.063***	(0.013)	0.011	(0.007)
27	0.077***	(0.015)	0.071***	(0.012)	0.019**	(0.007)
28	0.083***	(0.015)	0.074***	(0.012)	0.025***	(0.007)
29	0.083***	(0.015)	0.071***	(0.012)	0.031***	(0.007)
30	0.087***	(0.015)	0.075***	(0.012)	0.027***	(0.007)
31	0.086***	(0.015)	0.071***	(0.012)	0.032***	(0.007)
32	0.090***	(0.015)	0.075***	(0.012)	0.034***	(0.007)
33	0.093***	(0.015)	0.076***	(0.012)	0.034***	(0.007)
34	0.094***	(0.015)	0.075***	(0.012)	0.037***	(0.007)
35	0.094***	(0.015)	0.076***	(0.012)	0.035***	(0.007)
36	0.098***	(0.015)	0.073***	(0.012)	0.038***	(0.007)
37	0.098***	(0.015)	0.073***	(0.012)	0.032***	(0.007)
38	0.100***	(0.015)	0.078***	(0.012)	0.035***	(0.007)
39	0.098***	(0.015)	0.076***	(0.012)	0.028***	(0.007)
40	0.100***	(0.015)	0.079***	(0.012)	0.027***	(0.007)
41	0.096***	(0.015)	0.074***	(0.012)	0.027***	(0.007)
42	0.096***	(0.015)	0.072***	(0.012)	0.022**	(0.007)
43	0.099***	(0.015)	0.080***	(0.012)	0.027***	(0.007)
44	0.100***	(0.015)	0.080***	(0.012)	0.022**	(0.007)
45	0.096***	(0.015)	0.074***	(0.012)	0.017*	(0.007)
46	0.097***	(0.015)	0.081***	(0.012)	0.018*	(0.007)
47	0.095***	(0.015)	0.074***	(0.012)	0.011	(0.007)
48	0.093***	(0.015)	0.076***	(0.012)	0.011	(0.007)
49	0.094***	(0.015)	0.077***	(0.012)	0.008	(0.007)
50	0.090***	(0.015)	0.074***	(0.012)	0.006	(0.007)
51	0.088***	(0.015)	0.072***	(0.012)	-0.001	(0.007)
52	0.084***	(0.015)	0.073***	(0.012)	-0.006	(0.007)
53	0.082***	(0.015)	0.067***	(0.012)	-0.006	(0.008)

54	0.078***	(0.015)	0.064***	(0.012)	-0.009	(0.008)
55	0.080***	(0.015)	0.068***	(0.012)	-0.008	(0.008)
56	0.078***	(0.015)	0.062***	(0.012)	-0.006	(0.008)
57	0.082***	(0.015)	0.067***	(0.012)	-0.006	(0.008)
58	0.079***	(0.015)	0.067***	(0.012)	-0.012	(0.008)
59	0.088***	(0.015)	0.066***	(0.012)	-0.008	(0.008)
60	0.082***	(0.015)	0.063***	(0.012)	-0.008	(0.008)
61	0.081***	(0.015)	0.072***	(0.013)	-0.008	(0.008)
62	0.081***	(0.015)	0.072***	(0.013)	-0.015	(0.008)
63	0.080***	(0.015)	0.073***	(0.013)	-0.011	(0.008)
64	0.081***	(0.015)	0.072***	(0.013)	-0.007	(0.009)
65	0.074***	(0.016)	0.068***	(0.013)	-0.019*	(0.009)
66	0.075***	(0.016)	0.071***	(0.013)	-0.016	(0.009)
67	0.071***	(0.016)	0.055***	(0.014)	-0.022*	(0.010)
68	0.064***	(0.016)	0.059***	(0.014)	-0.016	(0.010)
69	0.058***	(0.016)	0.053***	(0.015)	-0.044***	(0.012)
70	0.054***	(0.016)	0.055***	(0.015)	-0.053***	(0.013)
71	0.050**	(0.017)	0.047**	(0.016)	-0.058***	(0.013)
72	0.039*	(0.017)	0.036*	(0.017)	-0.070***	(0.014)
73	0.041*	(0.017)	0.044*	(0.018)	-0.048**	(0.016)
74	0.035*	(0.017)	0.043*	(0.018)	-0.062***	(0.018)
75	0.033	(0.018)	0.052**	(0.019)	-0.066**	(0.021)
>75	0.033	(0.018)	0.050**	(0.019)	-0.077***	(0.023)
Year effect	Yes		Yes		Yes	
Location effect	No		No		No	
Location*Year effects	Yes		Yes		Yes	
Individual effect	Yes		Yes		Yes	
Observation	593,069		291,418		745,833	
Pseudo R-Square	0.0336		0.0212		0.0500	

Table A.9 Regression of debt and delinquency rate by age and cohort

Age	Debt per Borrower (thousand baht)				Delinquency Probability (%)			
	OLS (1)		OLS (2)		Probit (1)		Probit (2)	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
21	26113	(34814)	11592	(39753)	0.020**	(0.006)	0.013	(0.007)
22	50548	(31775)	39401	(36739)	0.029***	(0.006)	0.023***	(0.007)
23	73512*	(30261)	68040	(34934)	0.053***	(0.005)	0.041***	(0.006)
24	111925***	(29645)	103910**	(34141)	0.029***	(0.005)	0.021***	(0.006)
25	143462***	(29344)	134931***	(33759)	0.022***	(0.005)	0.018**	(0.006)
26	174241***	(29213)	166683***	(33628)	0.017**	(0.005)	0.019**	(0.006)
27	200350***	(29123)	192774***	(33534)	0.018***	(0.005)	0.025***	(0.006)
28	231045***	(29062)	217594***	(33484)	0.020***	(0.005)	0.030***	(0.006)
29	246222***	(28994)	233973***	(33409)	0.020***	(0.005)	0.032***	(0.006)
30	266145***	(28949)	260328***	(33354)	0.018***	(0.005)	0.030***	(0.006)
31	299413***	(28922)	291490***	(33328)	0.019***	(0.005)	0.031***	(0.006)
32	340916***	(28899)	322526***	(33300)	0.017**	(0.005)	0.033***	(0.006)
33	356206***	(28876)	347803***	(33262)	0.017***	(0.005)	0.033***	(0.006)
34	415296***	(28872)	392024***	(33262)	0.017**	(0.005)	0.034***	(0.006)
35	427232***	(28863)	398568***	(33248)	0.016**	(0.005)	0.032***	(0.006)
36	455689***	(28869)	426557***	(33265)	0.017***	(0.005)	0.033***	(0.006)
37	482769***	(28885)	448211***	(33309)	0.015**	(0.005)	0.029***	(0.006)
38	471431***	(28884)	443110***	(33304)	0.019***	(0.005)	0.031***	(0.006)
39	491448***	(28891)	461464***	(33323)	0.012*	(0.005)	0.025***	(0.006)
40	525122***	(28910)	489477***	(33379)	0.010*	(0.005)	0.024***	(0.006)
41	531524***	(28914)	491818***	(33383)	0.007	(0.005)	0.022***	(0.006)
42	546868***	(28931)	501420***	(33424)	0.002	(0.005)	0.017**	(0.006)
43	556876***	(28930)	510165***	(33428)	0.009	(0.005)	0.022***	(0.006)
44	576803***	(28932)	521660***	(33433)	0.004	(0.005)	0.018**	(0.006)
45	564297***	(28945)	537257***	(33479)	-0.001	(0.005)	0.011	(0.006)
46	601503***	(28962)	556045***	(33528)	0.000	(0.005)	0.013*	(0.006)
47	626826***	(28958)	564789***	(33518)	-0.004	(0.005)	0.008	(0.006)
48	591568***	(28994)	544466***	(33615)	-0.006	(0.005)	0.007	(0.006)
49	588014***	(29024)	544290***	(33709)	-0.009	(0.005)	0.004	(0.006)
50	572002***	(29032)	540189***	(33731)	-0.014**	(0.005)	0.001	(0.006)
51	613920***	(29040)	569521***	(33757)	-0.016**	(0.005)	-0.004	(0.006)
52	603190***	(29079)	570349***	(33884)	-0.019***	(0.005)	-0.008	(0.006)
53	613386***	(29098)	584061***	(33927)	-0.023***	(0.005)	-0.010	(0.006)

54	622599***	(29131)	590340***	(34050)	-0.027***	(0.005)	-0.014*	(0.006)
55	619494***	(29165)	582043***	(34137)	-0.023***	(0.005)	-0.013*	(0.006)
56	625488***	(29201)	591304***	(34262)	-0.027***	(0.005)	-0.014*	(0.006)
57	608701***	(29288)	584822***	(34519)	-0.025***	(0.005)	-0.013*	(0.006)
58	643354***	(29356)	599178***	(34700)	-0.031***	(0.005)	-0.018**	(0.006)
59	574795***	(29390)	555683***	(34835)	-0.023***	(0.005)	-0.015*	(0.006)
60	657097***	(29505)	608320***	(35202)	-0.028***	(0.005)	-0.017**	(0.006)
61	569679***	(29704)	553175***	(35822)	-0.030***	(0.005)	-0.018**	(0.007)
62	519474***	(29868)	513892***	(36277)	-0.034***	(0.005)	-0.022***	(0.007)
63	572604***	(30052)	551013***	(36895)	-0.034***	(0.005)	-0.025***	(0.007)
64	464990***	(30345)	571475***	(37798)	-0.036***	(0.005)	-0.025***	(0.007)
65	443207***	(30677)	468949***	(38811)	-0.045***	(0.005)	-0.036***	(0.007)
66	409072***	(30930)	484089***	(39691)	-0.050***	(0.006)	-0.036***	(0.007)
67	431015***	(31494)	458156***	(41400)	-0.053***	(0.006)	-0.045***	(0.007)
68	391796***	(31909)	466424***	(42611)	-0.061***	(0.006)	-0.048***	(0.008)
69	356777***	(32603)	418901***	(44950)	-0.074***	(0.006)	-0.063***	(0.008)
70	365446***	(33773)	389249***	(48176)	-0.075***	(0.006)	-0.067***	(0.009)
71	306879***	(34137)	353997***	(49453)	-0.080***	(0.006)	-0.073***	(0.009)
72	270819***	(34984)	307704***	(51913)	-0.088***	(0.006)	-0.078***	(0.009)
73	261832***	(36249)	320953***	(55259)	-0.086***	(0.006)	-0.077***	(0.010)
74	317750***	(37177)	357791***	(57650)	-0.090***	(0.007)	-0.080***	(0.010)
75	333322***	(39301)	345671***	(63080)	-0.091***	(0.007)	-0.087***	(0.011)
>75	296028***	(39035)	318554***	(62815)	-0.092***	(0.007)	-0.087***	(0.011)
Birth year								
1937	282498***	(36490)	235783**	(73732)	-0.067***	(0.013)	-0.019*	(0.009)
1938	36737	(34853)	7505	(79337)	-0.140***	(0.015)	-0.051***	(0.014)
1939	-59480	(34272)	-91570	(91103)	-0.197***	(0.018)	-0.065***	(0.019)
1940	-40754	(35801)	-89174	(108833)	-0.261***	(0.022)	-0.088***	(0.025)
1941	-38416	(34882)	-106780	(125309)	-0.320***	(0.025)	-0.111***	(0.031)
1942	-93408**	(35575)	-167751	(144702)	-0.382***	(0.030)	-0.132***	(0.037)
1943	-126874***	(35986)	-208416	(164575)	-0.449***	(0.034)	-0.159***	(0.043)
1944	-94005*	(36743)	-187704	(185287)	-0.511***	(0.038)	-0.177***	(0.049)
1945	-57314	(37368)	-178020	(206589)	-0.570***	(0.043)	-0.196***	(0.056)
1946	-49649	(37184)	-175752	(227689)	-0.631***	(0.047)	-0.221***	(0.062)
1947	-1663	(37246)	-151935	(249182)	-0.680***	(0.052)	-0.232***	(0.068)
1948	-29080	(37517)	-183290	(270986)	-0.741***	(0.056)	-0.248***	(0.074)
1949	-22605	(37580)	-178266	(292796)	-0.795***	(0.061)	-0.268***	(0.080)
1950	-49781	(37775)	-217329	(314780)	-0.856***	(0.065)	-0.285***	(0.086)

1951	58618	(37862)	-135646	(336788)	-0.906***	(0.070)	-0.297**	(0.092)
1952	17747	(37930)	-177947	(358844)	-0.966***	(0.075)	-0.314**	(0.098)
1953	-47545	(38021)	-237794	(380954)	-1.021***	(0.079)	-0.333**	(0.104)
1954	-17536	(38120)	-216454	(403098)	-1.075***	(0.084)	-0.347**	(0.111)
1955	37918	(38155)	-174638	(425244)	-1.131***	(0.088)	-0.362**	(0.117)
1956	-31651	(38225)	-237535	(447423)	-1.184***	(0.093)	-0.374**	(0.123)
1957	15169	(38332)	-198366	(469629)	-1.242***	(0.098)	-0.397**	(0.129)
1958	-12261	(38406)	-213678	(491840)	-1.293***	(0.102)	-0.407**	(0.135)
1959	-8681	(38457)	-204239	(514052)	-1.349***	(0.107)	-0.425**	(0.141)
1960	-20489	(38529)	-207449	(536279)	-1.402***	(0.111)	-0.436**	(0.147)
1961	-10185	(38602)	-189170	(558513)	-1.458***	(0.116)	-0.456**	(0.153)
1962	-8673	(38662)	-183379	(580749)	-1.509***	(0.121)	-0.467**	(0.160)
1963	-22252	(38735)	-182338	(602993)	-1.560***	(0.125)	-0.479**	(0.166)
1964	-6540	(38784)	-165283	(625236)	-1.610***	(0.130)	-0.491**	(0.172)
1965	-33973	(38854)	-174715	(647487)	-1.659***	(0.135)	-0.505**	(0.178)
1966	-17981	(38920)	-148487	(669741)	-1.709***	(0.139)	-0.515**	(0.184)
1967	-2918	(38967)	-123743	(691994)	-1.759***	(0.144)	-0.528**	(0.190)
1968	34746	(39010)	-77233	(714249)	-1.811***	(0.148)	-0.541**	(0.196)
1969	38549	(39077)	-58310	(736511)	-1.859***	(0.153)	-0.552**	(0.203)
1970	29255	(39126)	-47013	(758772)	-1.914***	(0.158)	-0.568**	(0.209)
1971	38614	(39176)	-31034	(781035)	-1.960***	(0.162)	-0.579**	(0.215)
1972	42584	(39232)	-9119	(803301)	-2.008***	(0.167)	-0.589**	(0.221)
1973	57383	(39287)	18144	(825568)	-2.064***	(0.172)	-0.610**	(0.227)
1974	71222	(39332)	46435	(847835)	-2.111***	(0.176)	-0.620**	(0.233)
1975	97080*	(39386)	83279	(870104)	-2.160***	(0.181)	-0.632**	(0.239)
1976	97327*	(39426)	96128	(892373)	-2.211***	(0.185)	-0.644**	(0.245)
1977	111935**	(39474)	120363	(914643)	-2.256***	(0.190)	-0.652**	(0.252)
1978	152504***	(39526)	170163	(936916)	-2.307***	(0.195)	-0.670**	(0.258)
1979	167123***	(39567)	195052	(959188)	-2.354***	(0.199)	-0.680**	(0.264)
1980	178987***	(39613)	215487	(981461)	-2.404***	(0.204)	-0.694*	(0.270)
1981	214985***	(39666)	258536	(1003736)	-2.450***	(0.209)	-0.705*	(0.276)
1982	209917***	(39718)	264135	(1026012)	-2.497***	(0.213)	-0.715*	(0.282)
1983	231693***	(39781)	288581	(1048289)	-2.543***	(0.218)	-0.726*	(0.288)
1984	241395***	(39845)	305712	(1070566)	-2.587***	(0.223)	-0.733*	(0.295)
1985	252415***	(39913)	320944	(1092844)	-2.630***	(0.227)	-0.741*	(0.301)
1986	269292***	(39997)	338220	(1115123)	-2.668***	(0.232)	-0.747*	(0.307)
1987	289743***	(40098)	363269	(1137403)	-2.707***	(0.236)	-0.754*	(0.313)
1988	302686***	(40206)	378655	(1159682)	-2.747***	(0.241)	-0.762*	(0.319)
1989	311953***	(40348)	390563	(1181968)	-2.785***	(0.246)	-0.767*	(0.325)

1990	315069***	(40530)	395911	(1204247)	-2.812***	(0.250)	-0.767*	(0.331)
1991	316629***	(40857)	398621	(1226534)	-2.828***	(0.255)	-0.762*	(0.337)
1992	306554***	(41448)	390671	(1248838)	-2.819***	(0.260)	-0.740*	(0.344)
1993	304643***	(42728)	382655	(1271146)	-2.838***	(0.264)	-0.763*	(0.350)
1994	302138***	(45180)	372901	(1293223)	-2.835***	(0.269)	-0.761*	(0.356)
1995	306550***	(52126)	377070	(1315000)	-2.798***	(0.273)	-0.738*	(0.361)
1996	333936***	(72672)	401892	(1320954)	-2.796***	(0.274)	-0.779*	(0.362)
Year effect	Yes		Yes		Yes		Yes	
Location effect	Yes		No		Yes		No	
Location*Year effects	Yes		Yes		Yes		Yes	
Individual effect	No		Yes		No		Yes	
Observation	5,885,972		5,885,972		5,885,972		5,885,972	
Pseudo R-Square	0.0063		0.0112		0.0169		0.0368	