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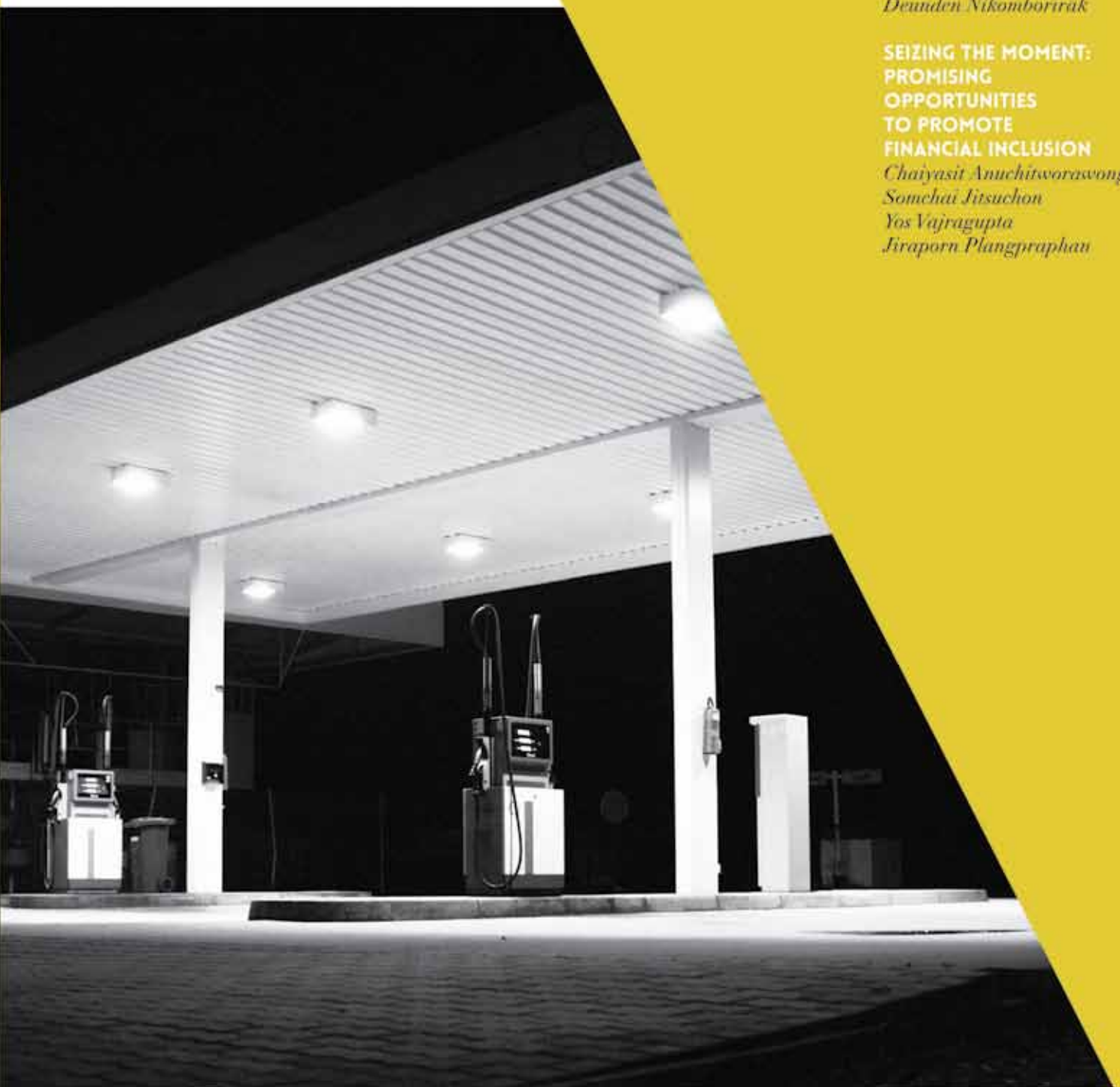

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*Deunden Nikomborirak**

1. INTRODUCTION

Before mid-1970s, Thailand was highly dependent on imported petroleum for its energy needs. The discovery of off-shore gas fields in the Gulf of Thailand altered markedly the landscape of the country's energy industry. Thailand now ranks 26th in terms of natural gas production (36.99 billion m^3 estimated in 2011) and 40th in terms of proven natural gas reserves (284.9 billion m^3 estimated in 2013).[1]

The bulk of the demand for natural gas in Thailand comes from the power generation sector, which relies heavily on natural gas. In 2013, electricity generating plants accounted for more than 70 percent of gas consumption, with the country's six gas separation plants accounting for the remaining 17 percent; those plants produce liquefied petroleum gas (LPG), which is used as a "feedstock" for petrochemical plants, and as fuel for industries and for vehicles (mainly taxis and buses) as well as for household cooking. A small portion of the natural gas is compressed to be used as a fuel for vehicles (NGV), mainly taxis and buses, as can be seen in Diagram 1.

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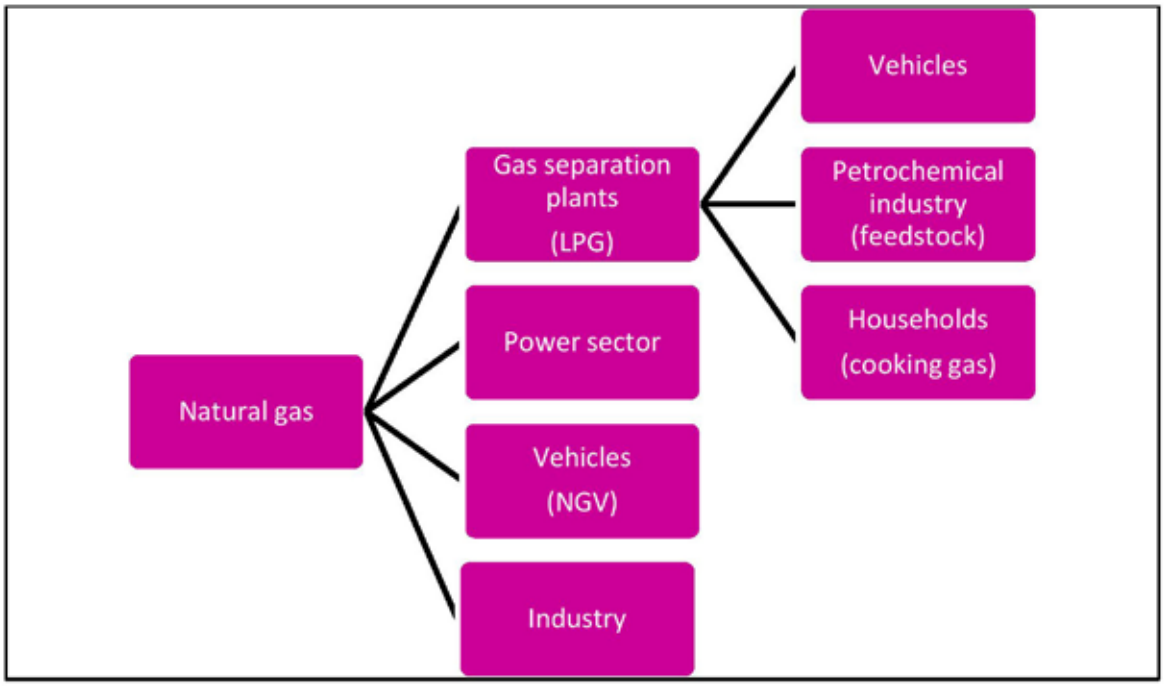
[1] *Central Intelligence Agency (2014), "World Fact Book," downloadable from https://www.cia.gov/library/publications/theworld-factbook/rankorder/2249rank.html.*

Diagram 1: Demand for natural gas



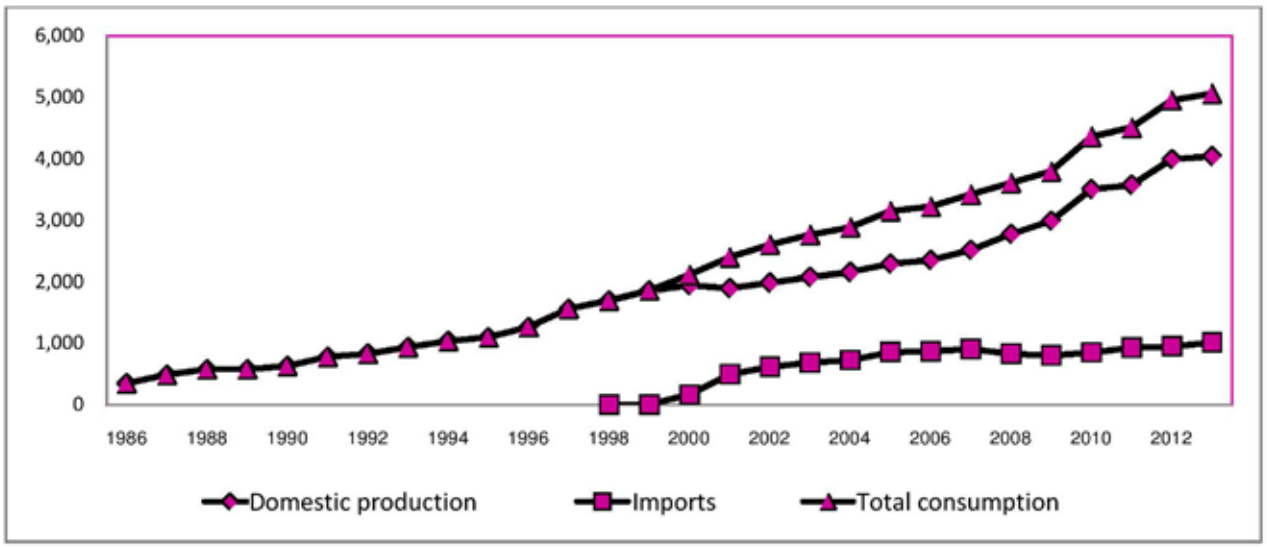
Despite the continual increase in the production of natural gas in the Gulf of Thailand and the Andaman Sea, domestic supply was not able to keep up with the surge in demand prompted by escalating global petroleum prices and state subsidies for the use of LPG as vehicle fuel and as a cooking gas in households. Thailand's policy to promote the use of natural gas as a vehicle fuel and as cooking gas for households through a price subsidy began in 2004 as a result of the abundance of domestic gas supplies at the time. However, as supply eventually was not able to keep up with demand, Thailand became an importer of natural gas starting in 1998, as can be seen in Figure 1.

The country's dependence on imported gas is likely to increase as current gas fields in the Gulf of Thailand are gradually depleted. According to the Ministry of Energy, Thailand's production is expected to peak in 2017 and cease in 2030 in the absence of new proven reserves. With the current regulated retail price being below cost however, there is little incentive for new exploration and production and little incentive to curb demand.

Thailand has had to seek new energy sources to meet its insatiable domestic appetite. This includes the import of natural gas transmitted through pipelines from offshore fields in Myanmar as well as liquefied natural gas (LNG) shipped in vessels from the Middle East. Currently, 79 percent of Thailand's natural gas supply is sourced domestically (including from joint development fields with Malaysia), 18 percent is from offshore fields in Myanmar and 3 percent is imported as LNG.[2]

[2] *PTT (2012), "Natural Gas Everyday," downloadable from http://www.pttplc.com/th/Media-Center/Energy-Knowledge/KnowledgeLibrary/Natural%20Gas%20Knowledge/Natural-Gas-Everyday.pdf.*

Figure 1: Thailand's natural gas supply, 1986-2013



Source: Energy Policy and Planning Office.

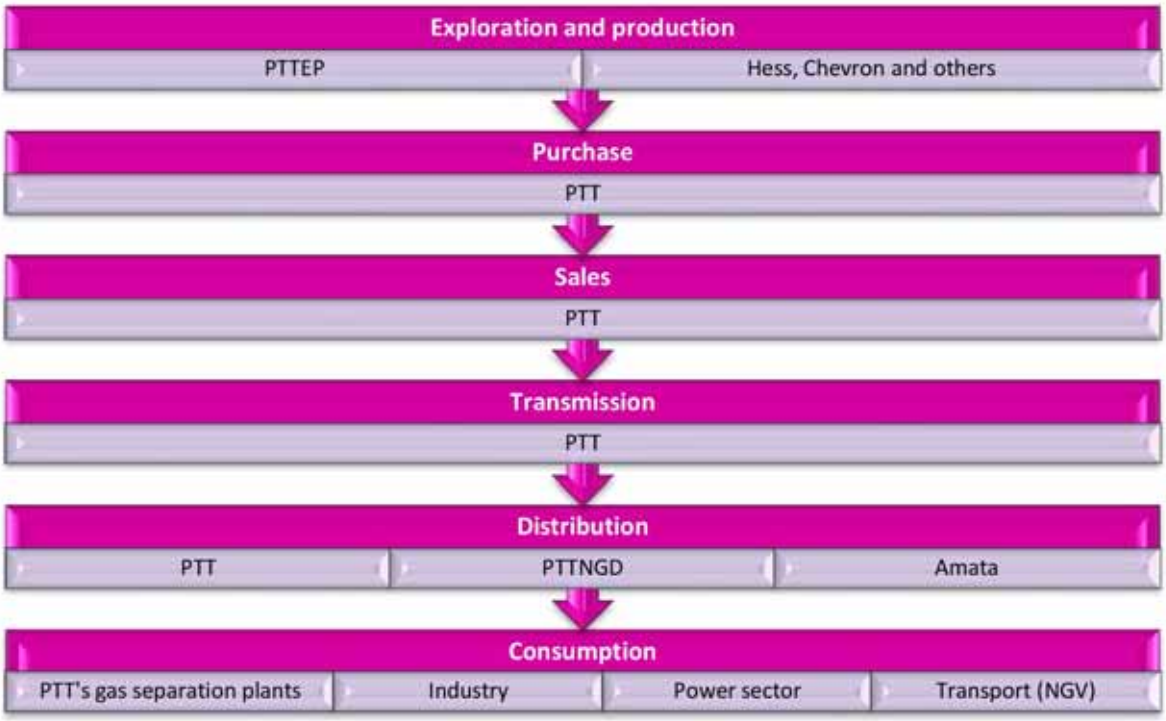
Sourcing gas from overseas has proven to be expensive. The cost of gas from Myanmar is roughly US$ 11-12 per mmbtu[3], approximately 40 percent higher than that of domestic gas from the Gulf of Thailand, which is US$ 8-9 per mmbtu.The price of imported LNG is US$ 16-17 per mmbtu, almost double the cost of domestic gas. Several government administrations in the past recognized that subsidies are both economically inefficient and financially unsustainable, but lacked the courage to abolish subsidies for fear of losing political popularity.

In 2013, the ruling Phua Thai Party, which enjoyed a relatively stable administration at the time, passed a Cabinet decision that prescribed a gradual increase in the price of LPG for households (cooking gas) and NGV (compressed natural gas for vehicles) in order to close the price-cost gap. The move drew heavy criticism from non-governmental organizations (NGOs) and consumer groups and sparked a major debate on a broader issue about the country's energy sector reform agenda.

Views on the issue have been extremely divisive. The NGO groups disapprove of any further increase in household LPG that is advocated by the Ministry of Energy. The main argument is that it is the petrochemical industry, not households, that should shoulder the burden of higher costs for imported natural gas, as the industry accounts for more than a third of the LPG consumed in Thailand. To them, it is unfair to pass on the higher gas acquisition cost to households. As the pricing issue is by nature highly sensitive, the debate about gas price reform has galvanized diverse actors concerning the entire energy reform agenda. The key issues at hand are the following: How should access to relatively inexpensive domestic gas be prioritized across different groups of users, and who should shoulder the cost of the more expensive imported gas?

[3] *A BTU is British standard unit of measurement used to denote both the amount of heat and energy in fuels. Mmbtu or mbtu denotes a million BTU. One BTU is the amount of energy needed to heat or cool one pound of water by one degree Fahrenheit.*

Diagram 2: The current structure of the Thai natural gas industry



This paper contains an examination of the on-going debate about gas price reform in order to delineate the different viewpoints and improve understanding of them, and to propose possible policy directions in order to move forward the country's natural gas reform agenda. Sections 2 and 3 are devoted to explaining the market structure and the current pricing regime of the gas industry.

2. THE CURRENT MARKET STRUCTURE OF THE GAS INDUSTRY

In a nutshell, Thailand's natural gas industry can be described mainly as a vertically integrated monopolistic market dominated by a single conglomerate headed by the PTT Public Company Limited, the partially privatized state-owned energy giant. In the upstream exploration and production market, its subsidiary, PTT Exploration and Production (PTTEP), maintains roughly a 25 percent market share in terms of sales. Although the figure is not high, the company also holds non-trivial equity shares (5-40%) in many of the exploration projects undertaken by its main competitor, Chevron.

As a national energy company, PTT is designated as the sole purchaser of natural gas produced domestically and imported from overseas sources. It is also the sole trader of the natural gas procured, as it has exclusive access to its pipeline system to wholesale and retail consumers. It is also the sole importer of LNG, as it owns and controls both the pipeline and the LNG-receiving terminals, as can be seen in Diagram 2.

PTT's network of pipelines in Thailand currently stretches 3,100 km, linking all commercial offshore gas fields to major power plants and its own six gas separation plants, as well as some 200 industrial users, many of which are petrochemical companies and gas distribution companies in which PTT owns a controlling share.

Currently, there is no mandatory third party access to both PTT's gas transmission pipeline network and LNG-receiving terminals. Thus, there is no competition in the gas trading, import and dis-

tribution markets. Certain power plants or industrial users construct their own distribution pipelines to connect to PTT's main transmission pipeline and transfer the ownership to PTT for maintenance.

Limited private participation in pipeline construction and operation at the distribution level has been introduced. There are currently three distribution companies, in all of which PTT has a significant shareholding, namely PTT itself, PTT Natural Gas Distribution Company (PTTNGD), its subsidiary, and Amata NGD, a joint venture between the Amata Industrial Estate Group and PTTNGD.

PTT is also extensively involved in the downstream petrochemical industry. PTT Global Chemical (PTTGC) enjoys an abundant supply of relatively inexpensive LPG for its feedstock supplied by PTT's gas separation plants. PTT also holds shares in several power generation companies that rely on natural gas as a fuel.

To conclude, there is little market competition in the vertical structure of the natural gas industry in Thailand. PTT dominates much of the market landscape, from upstream exploration and production to the downstream petrochemical industry. Undoubtedly, the company derives its market power throughout the entire supply chain from its monopolistic hold of the gas transmission facility.

In the absence of effective competition from upstream to downstream gas markets, gas prices at all stages in the supply chain are regulated either by the Ministry of Energy or the Energy Regulatory Commission (ERC), a semi-autonomous regulatory body. The Ministry regulates upstream gas prices– i.e., well-head gas prices and ex-factory LPG, while ERC regulates middle to downstream gas prices– i.e., gas transmission tariffs and electricity prices. The following section contains a discussion of price regulation in detail.

3. THE GAS PRICING SCHEME

Gas price regulation in Thailand is broadly based on a cost-plus regime, which allows producers to pass on all costs to consumers. However, there are many exemptions, as will be elaborated below.

The current gas pricing scheme is relatively complex and opaque with multiple prices designated for different groups of users. First of all, the supply of natural gas is divided into two pools. The first pool, known as "Gulf gas" or "pool 1 gas," consists exclusively of legacy gas from the Gulf of Thailand and the Malaysia-Thailand Joint Development Area, which is relatively inexpensive. Pool 1 gas is dedicated to the gas separation plants which produce the LPG consumed by petrochemical industries, households and the transport sector. Pool 2 gas comes from three main sources, namely the remainder of pool 1 gas, imported gas from Yetagun and Yadana offshore gas fields in Myanmar, and imported LNG. Pool 2 gas is channeled mainly to the power sector.

As the price of gas is determined by the underlying cost, pool 1 gas is priced markedly lower than that of pool 2, which is a weighted average of the price for domestic gas, imported gas from Myanmar and imported LNG. The pool 1 price is currently US$ 8-10 per mmbtu, and that of pool 2 is US$ 10-12 per mmbtu. As the share of imported LNG is rising, the pool 2 gas price will gradually gravitate toward the global price of LNG at US$ 16-17 per mmbtu. The widening price differential will certainly spark discontent among the public, as higher fuel prices translate into higher electricity tariffs.

It is interesting to note however that the lower price for pool 1 gas that is dedicated to gas separation plants for producing LPG does not benefit all users of LPG equally. The retail price of LPG varies across different user groups. This is where the current controversy about gas price reform begins.

First, LPG sold to the petrochemical industry is supposed to be based on a "net-back pricing" basis calculated from the natural gas price at market destinations less the cost of pipeline transportation, regasification, waterborne shipping and liquefaction. Ironically, gas supply contracts between PTT and its commercial customers are considered commercial secrets, so the actual price of LPG sold to

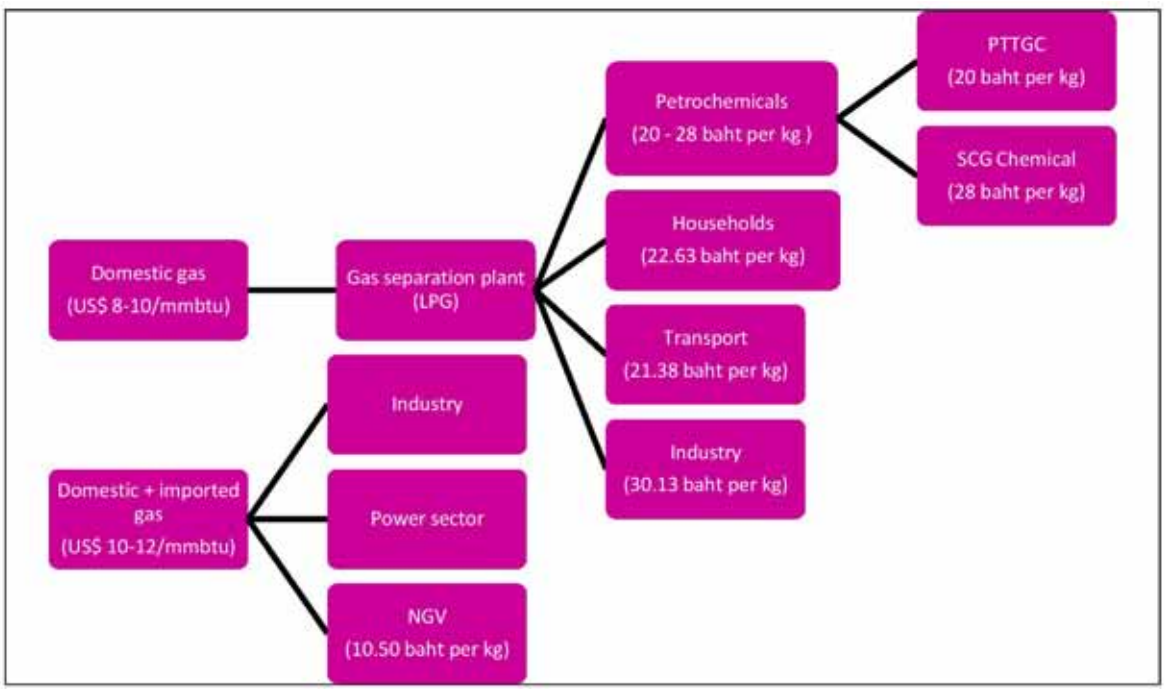
petrochemical clients cannot be verified. However, based on information provided by security houses, PTT sells LPG to its subsidiary, PTTGC, at 19 baht (about US$ 0.59) per kg. As for its only other petrochemical client, Siam Cement Group Chemical (SCG Chemical), LPG is sold at global prices, roughly 28 baht per kg. This glaring price discrimination would certainly constitute a violation of the competition law. Unfortunately, state enterprises such as PTT are exempted from the Trade Competition Act 1999.

Second, the ex-factory price of LPG sold to the household, transport and industrial sectors is fixed at 10.73 baht,[4] a price which is well below actual cost, which is claimed to be 24.82 baht per kg.[5] PTT shoulders the burden of the subsidy on the sale of legacy gas, which was estimated at roughly 36 billion baht per annum in 2013. On the other hand, PTT is fully compensated for imported LNG. It is thus not surprising why the company is loath to sell LPG to other users and tries to channel as much as possible of the product to its own petrochemical company which can transform the gas into petrochemical products sold at market prices.

The retail price that the household, transport and industrial sectors have to pay for LPG however is significantly higher than the ex-factory price of 10.73 baht. This is because it includes a contribution to the "Oil Fund" in order to compensate PTT for the difference between the imported LPG price, roughly 28 baht per kg, and the domestic regulated price at 10.73 baht per kg. The government adjusts the contribution in order to manipulate the retail price of LPG sold to different groups of users, as can be seen from Diagram 3.

As can be seen from the diagram, industrial clients (bar petrochemical producers) pay the highest regulated price of 30.13 baht per kg, which

Diagram 3: Current gas pricing regime



Note: Prices presented are inclusive of contributions to the Oil Fund.

[4] *The original ex-factory LPG price is based mainly on the cost of production in gas separation plants, whereas in practice, approximately 40 percent of LPG supply comes from oil refineries, the production cost of which is higher.*

[5] *The mentioned cost is not yet officially endorsed by the regulator.*

households and the transport sector can purchase at approximately 22 baht per kg. The petrochemical industry, specifically PTTGC, pays the lowest "net-back price" at 19 baht per kg plus 1 baht as a contribution to the Oil Fund, which means that the price is 20 baht per kg. The only other petrochemical client, SCG Chemical, pays the internal price for the same product however, at roughly 28 baht per kg. With such a complicated and seemingly discriminatory pricing regime, it is not surprising that the issue of gas price reform has attracted considerable public attention.

4. ON-GOING DEBATE ABOUT REFORM OF THE ENERGY SECTOR

As mentioned previously, the current debate about gas sector reform seems to be narrowly preoccupied with the issue of LPG price reform. The first group of reform advocates, consisting of bureaucrats and certain academics, perceives the current subsidy for diesel, NGV and LPG used by households and the transport sector to be highly distortionary, leading to excessive domestic demand and widespread smuggling of the cheap subsidized LPG into neighboring countries. Thus, the energy reform agenda of this group is focused on the termination of current gas price subsidies, which implies a significant jump in the prices of household cooking gas and LPG used for transport, from 22 baht to about 25 baht per kg, which is claimed to be the cost price of LPG. Interestingly, this group seems to believe that the petrochemical industry should retain its entitlement to buy LPG at net-back prices (19 baht per kg) because, unlike other industries, it uses LPG as a feedstock rather than as a fuel, which creates a "significant value added" for the product that is beneficial to the Thai economy as a whole. LPG is a relatively expensive fuel alternative compared with petroleum or coal. Thus, that group feels that pricing should discourage the use of LPG as a fuel.

On the other hand, the second group, mainly NGOs, has resisted any LPG price increase for household use for several reasons.

First, PTT's huge profit (roughly US$ 3.5 billion in 2013) indicates that the company is making a healthy profit and so should be financially capable of shouldering the loss of the subsidy. After all, the company belongs to the state and should be obliged to pursue not only commercial objectives but also social ones.

Second, natural gas resources belong to the Thai people; thus, the benefits obtained from the exploitation of those resources should be distributed equally to all. The fact that the petrochemical industry pays a much lower price for indigenous gas and takes a third of the total supply means that it is reaping benefits disproportionately. Hence, this group feels that any increase in the price of the same product for other users is discriminatory and unfair.

It should be noted that there is deep public distrust of policy makers, as some of them enjoy special benefits from PTT. For example, it is a tradition that the Permanent Secretary of the Ministry of Energy or his or her deputy sits on the PTT Board of Directors, sometimes along with the Director of the Energy Policy and Planning Office, the Secretary General of the Thai National Economic and Social Development Board, which is the main

economic policy body of the government, and even the Attorney General. Appointment of "cronies" of politicians to the Board of Directors of the national energy giant also indicates that not only bureaucrats, but also politicians share special benefits derived from PTT's affluence.

According to the Lantau Group, an energy consulting firm based in Hong Kong that is familiar with the Thai energy industry, the divergent views between the two groups of energy reform advocates may arise from the fact that each group gives different importance to issues of "efficiency" versus "equity." Efficiency is related to the allocation of resources–i.e., the production and consumption of natural gas–at the macroeconomic level, whereas equity is concerned with the distribution of benefits from the exploitation of gas resources among different groups of people. These aspects will be elaborated in greater detail in the section below.

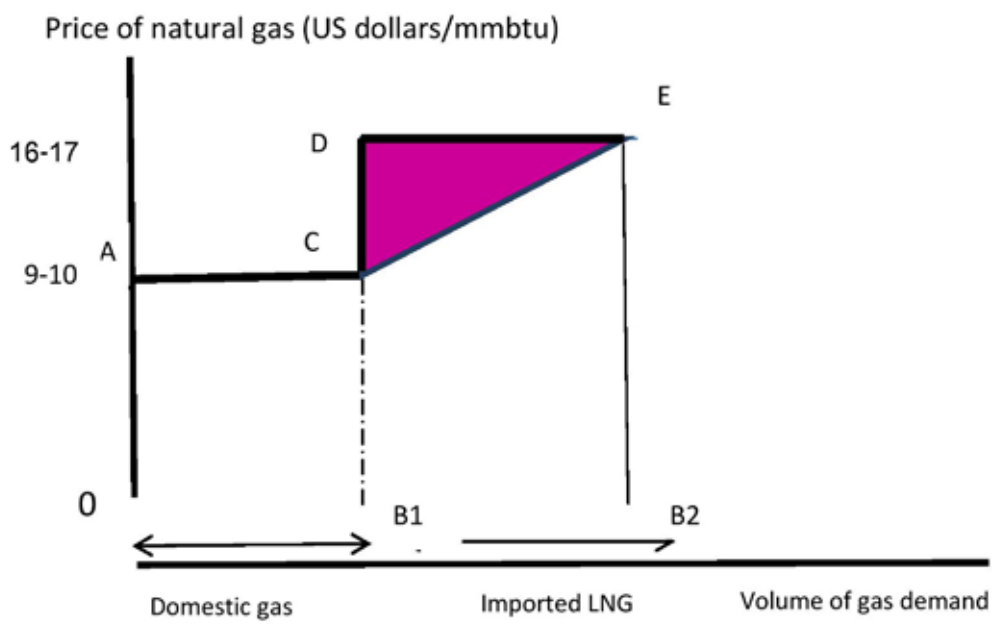
4.1 On "efficiency"

The on-going debate between the two groups of energy reform advocates about who should get access to LPG and at what cost may have diverted the attention of the public from the more fundamental problem facing Thailand's energy policy–the increasing reliance on imported gas that will inevitably lead to a rise in the country's electricity price in the next few years as "cheap gas" from the Gulf of Thailand is quickly running out, and there is no new exploration and production to replace it. The question is: Why can Thailand not produce more lower-cost domestic gas?

As mentioned previously, the current price controls on LPG and NGV provide little incentive to explore for new energy sources in the Gulf of Thailand. As the sole purchaser of gas, PTT is also loath to buy domestic gas if it is forced to sell the product at prices lower than cost. The company no doubt prefers to sell imported gas, for which it is fully compensated, rather than domestically produced gas.

The current natural gas market is illustrated in Diagram 4. As a result of price control, the current natural gas supply curve in Thailand is a "kinked" one, with the price of domestically produced gas (reflected in the straight line A-C) being regulated and that for imported gas (shown in the line from D to E) being made available at the higher global price. If the domestic gas price were to move to parity with the global price, the supply of domestic gas could be boosted, say, from point B1 to B2. Alter-

Diagram 4: The current market supply of natural gas in Thailand



natively, if the price were to be set somewhat lower than the import price, somewhere between US$ 9 and US$ 17 per mmbtu, then domestic supply would be somewhere between B1 and B2. Whatever the case may be, the move would be a win-win proposition for all, as Thailand would be able to reduce the importation of expensive gas and at the same time, produce more domestic gas at a lower price because of the savings realized on transportation costs, as well as on employment, taxes and royalties to boot. This gain is represented by the shaded triangle CDE in the diagram.

However, for Thailand to fully benefit from gas tariff reform in terms of new investment in exploration and production, the concession regime needs to facilitate broad competition to boost exploration and production of natural gas in the Gulf of Thailand. Perhaps the government might consider conducting open bidding for gas exploration and production, with publicly advertised terms of reference in lieu of negotiations behind closed doors where all the negotiated parameters are concealed from the public.

Besides gas exploration and production, downstream gas trade and distribution also have to be liberalized by allowing third parties to buy and sell gas through PTT's gas pipeline and to use PTT's LNG terminals for receiving imports at fair prices. In the longer run, the ownership of the pipeline business, a natural monopoly, should be separated from other competitive markets in order to ensure non-discriminatory access to the pipeline network. Only when there is effective competition in the energy market and prices are determined by the market can all the murky "price regulations" that are at the heart of the current controversy be done away with.

4.2 On "equity"

Advocates of the "efficiency" goal believe that the LPG and NGV price subsidies has led to a shortage in the domestic supply of and an excessive demand for natural gas, a situation that requires the importation of expensive LPG from overseas to bridge the demand gap. An increase in the domestic gas price would stimulate domestic exploration and production of natural gas and other alternative fuels, which would help generate additional employment and extra revenue for the government from taxes and royalties. At the same time, higher prices would help curb demand and thus, imports, which would save valuable foreign exchange.

The proposed price increase does not sit well with those who are more concerned about the "equity" or "fairness" of the gas pricing regime, however. To them, the suggested price rise does not seem "fair" to consumers as they believe that the importation of LPG is due mainly to the surge in LPG demand for the petrochemical industry over the last few years. Hence, the industry, rather than households, should bear the cost of imported gas.

So, the questions boil down to these: Who should get to use the relatively "cheap" domestic gas, and who should bear the cost of its expensive imported counterpart?

It is interesting to observe that all the "hype" about prices is concentrated mainly on the pricing of LPG when the majority of the legacy gas goes to the production of electricity. This is because the benefits associated with cheap domestic gas are widely dispersed when the gas is devoted to producing electricity, but this is not so when it goes to the gas separation plants owned by PTT. Proponents are suspicious that PPT may channel legacy gas at favorable prices to its own petrochemical plants before other groups of users, thereby reaping most of the benefits from the exploitation of national natural energy resources. This view has been vindicated. SCG Chemical, the only other petrochemical producer, has revealed that it has had to resort to the use of naptha (a close substitute for LPG) as a feedstock procured from overseas at the global price of roughly 27 baht per kg. This indicates that the company does not have access to adequate supplies of low-priced LPG.

Thus, PTT appears to be "hogging" cheap domestic gas in compensation for its obligation to subsidize domestic sales of LPG and NGV at regu-

lated prices that are well below cost. Where does this leave Thailand with regard to gas sector reform?

First, the author believes that Thailand needs to do away with all current cross subsidies that distort the choice of energy source. There should be a single price for LPG for all users. This should be the import-parity price if Thailand still needs to import LNG to meet domestic demand. The difference between import price and domestic cost should be collected as a tax that goes directly into state coffers. Without price discrimination, the debate on who should get preferential access to legacy gas would no longer be relevant.

As for the petrochemical industry, while it is true that LPG is a relatively expensive fuel and thus should be dedicated to the petrochemical industry, there is no reason why the industry should not pay the same price for LPG as do other business sectors and households. After all, SCG Chemical was not able to tap LPG produced from domestic gas but it survived by using naptha purchased from overseas at global prices; thus, PTTGC should do the same.

Second, not only should the price of LPG be harmonized, but that of natural gas should be too. The government should abolish pool 1 and pool 2 gas prices and charge a single import parity price for natural gas. Hence, no sector in the economy would have special access to legacy gas.

Third, the government may continue to subsidize low-income households. The "targeted" rather than "blanket" subsidy should be less distortionary but more financially manageable. In fact, the government has already introduced the means-tested subsidy since the introduction of the household LPG price increase last year but many eligible individuals have not been registered; registration procedures have proved cumbersome. With an effective targeted subsidy scheme, the government could diffuse much of the public resistance to LPG price reform.

Fourth, as gas prices are to align with costs and as price differentiation is abolished, the government should do away with the highly controversial "Oil Fund" that has been used to cross subsidize

prices of different types of fuel across different types of user. Earmarked funds are often mismanaged and abused given the lax scrutiny in spending. Financing for subsidies or price stabilization could be allocated directly from the national budget.

Fifth, to ensure that higher domestic gas prices will lead to new exploration and production of indigenous gas, the government needs to develop a more transparent concession-granting regime that is based on open rounds of bidding for designated "blocks" with clear qualifications and conditions, as is the case in Brazil.

Finally, this author believes that successful reform of the Thai energy sector requires a delicate balancing of both efficiency and equity goals. Policies that promote greater efficiency in the use of Thailand's scarce energy resources can result in great benefits for the country; however, those policies will not receive public support if a particular group must take a "hit" while another still enjoys special privileges. On this note, the proposed energy reform, including the revision of the LPG price, will have to ensure that all parties share the same burden or enjoy the same benefits associated with the policy changes.

When it comes to human appreciation, fairness or equity trumps efficiency hands down.

SEIZING THE MOMENT: PROMISING OPPORTUNITIES TO PROMOTE FINANCIAL INCLUSION*

Chaiyasit Anuchitworawong
Somchai Jitsuchon
Yos Vajragupta
*Jiraporn Plangpraphan***

1. INTRODUCTION

During the past three decades, Thailand's economy has experienced expedited growth, and the standard of living of Thai people has improved considerably. According to research conducted by Thailand Development Research Institute (2011), the incidence of poverty in 2009, as measured by the proportion of the Thai population whose expenditure fell below the poverty line, declined to 9 percent. Regardless of the improvement in economic growth prospects however, the problems related to inequality in terms of income, savings and asset possession are still issues of pressing concern.

Why is poverty so hard to escape? This is one of the most basic questions asked by development economists. There appear to be two main reasons that could explain why poor Thai people cannot escape from the poverty trap. First, some sections of the Thai population lack access to economic and social resources, particularly credit, capital, skills, and natural resources (Kobsak, 2007; Chaiyasit, 2007; Ashvin, 2007; Adis, 2010). Without sufficient knowledge, capability and finance, those people cannot excel in their profession and cannot earn enough to support their own living. Second, some Thai people still do not have equal access to basic public services provided by the government, especially public health services (Worawan, 2010; Somchai, 2010). Under situations in which the public sector cannot provide adequate and appropriate levels of social welfare benefits or a minimal level of well-being and social support for all citizens, other mechanisms are required to make it possible for poor people to escape the poverty trap.

Microfinance is one of the financial innovations that enable the poor to be capable of lifting themselves out of poverty because, through microfinance institutions, the poor and low-income households have better access to basic financial services,

** This article is based mainly on the study entitled "Microfinance Inclusion Map," which was supported by Thai Universities for Healthy Public Policy, Thai Health Promotion Foundation.*
*** Dr. Chaiyasit Anuchitworawong is Research Fellow; Dr. Somchai Jitsuchon is Research Director, Inclusive Development; Mr. Yos Vajragupta and Ms. Jiraporn Plangpraphan are Senior Researchers, Thailand Development Research Institute.*

such as deposits and loans. Sources of microfinance in Thailand can be largely categorized into three main types, namely formal institutions, semi-formal institutions and informal sources (FPO, 2008). Formal institutions refer to commercial banks and specialized financial institutions (SFIs). Examples of semi-formal institutions are cooperatives and village funds. Informal sources refer largely to informal and self-help groups or community savings groups.

2. GETTING TO KNOW MORE ABOUT FINANCIAL INCLUSION IN THAILAND

What is financial inclusion? Although the definition of this term varies, financial inclusion can be broadly defined as the process of ensuring that the vulnerable or weaker sections in an economy, such as low-income individuals, can access financial services and credit in a timely fashion and at reasonable cost.

The promotion of an inclusive financial system is a policy priority in many countries, including Thailand. An inclusive financial system is desirable for a number of reasons. It not only curtails the growth of exploitative informal sources of credit, but it also provides avenues for efficient allocation of productive resources as well as for secure and safe saving practices (Sarma, 2012). Although the importance of financial inclusion is recognized in Thailand, only a limited number of studies are devoted to measuring the extent of financial inclusion across the country. This article is an attempt to fill this gap. The objectives of this article are twofold. First, we provide an overview of financial inclusion in Thailand classified by provinces by using the composite financial inclusion index developed by Sarma (2012). Second, we analyze the characteristics of credit constrained households and also assess financing gaps for credit constrained households by exploring the extent of their demand for credit being unmet once the credit constraint has been removed.

2.1 An Overview of Financial Inclusion in Thailand

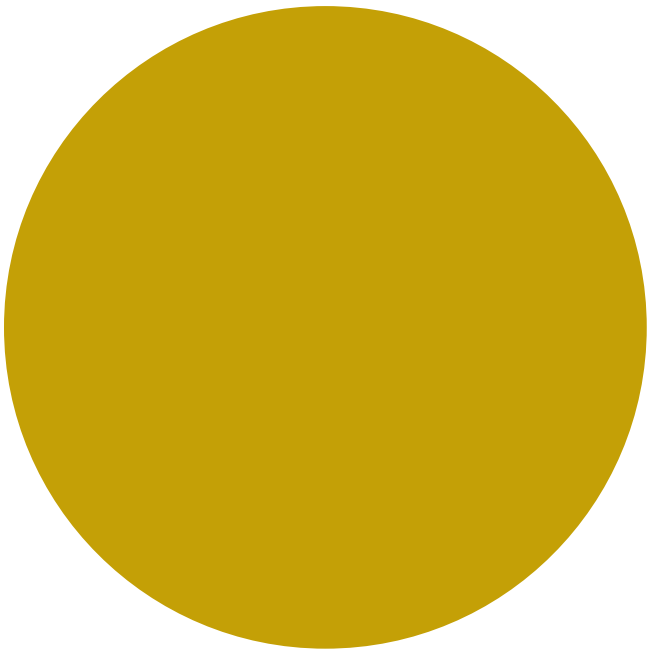
In Thailand, the promotion of an inclusive financial system is a policy priority, yet there is still a lack of comprehensive measures to determine the extent of financial inclusion in the Thai economy. A comprehensive measure for financial inclusion would enable us (a) to take stock of the state of affairs in the Thai economy with respect to people's access to financial services and (b) to monitor the progress of policy initiatives undertaken to promote financial inclusion in the country.

The measure of financial inclusion used in this article is the composite index for financial inclusion first proposed by Sarma (2012). Because this multi-dimensional index combines various banking sector indicators, it incorporates information on different dimensions of an inclusive financial system, including (a) accessibility of banking services, (b) availability of banking services, and (c) usage of banking services. The following are some of the major aspects of such a system:

- An inclusive financial system should be available widely among its users. According to Sarma (2012), an example of indicators which reflect the extent of banking penetra-

tion is the proportion of people having a bank account.

- In an inclusive financial system, banking services should be easily available to the users. Indicators for the availability of banking services consist of the number of bank branches and the number of automatic teller machines (ATMs).
- Under an inclusive financial system, banking services should be adequately utilized. Even though utilization can be in various forms, two basic financial services – credit and deposit – are incorporated into the financial inclusion index and the indicators could be the volume of credit and deposit available to adult individuals as a proportion of GDP.



The formula for computing the financial inclusion index (hereafter, IFI) is given below:

$$IFI = \frac{1}{2}\left[\frac{\sqrt{d_1^2+d_2^2+\ldots+d_n^2}}{\sqrt{w_1^2+w_2^2+\ldots+w_n^2}} + \left(1 - \frac{\sqrt{(w_1-d_1)^2+(w_2-d_2)^2+\ldots+(w_n-d_n)^2}}{\sqrt{w_1^2+w_2^2+\ldots+w_n^2}}\right)\right] \quad (1)$$

$$d_i = w_i \frac{A_i - m_i}{M_i - m_i}, \quad (2)$$

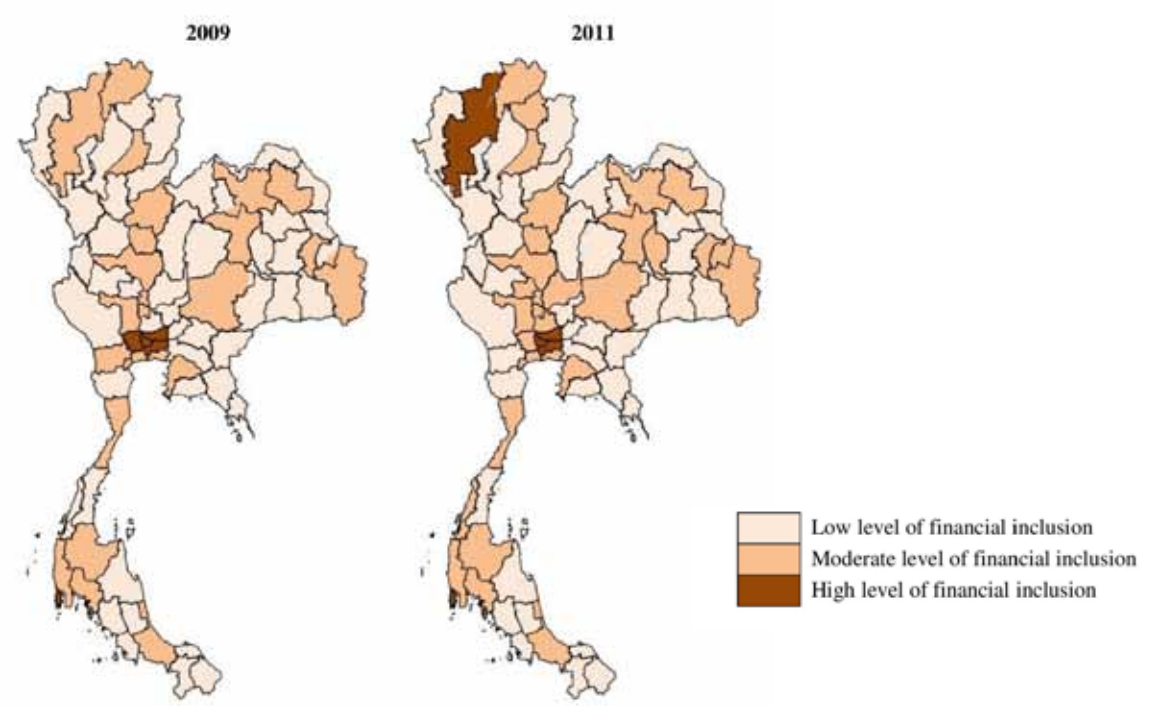
where the composite index, IFI, lies between 0 and 1. As IFI gets closer to 1, this means that the extent of the level of financial inclusion in that particular area is higher than would be indicated by IFI going in the opposite direction. The value of IFI can be used to classify countries into different categories according to level of financial inclusiveness (Sarma, 2012). The countries that have IFI values between 0 and 0.3 are considered as having a low level of financial inclusion; those having IFI values between 0.3 and 0.5 are considered as having a medium level, and those having IFI values between 0.5 and 1.0 are considered as having a high level.

In this article, we apply the assessment approach of Sarma (2012) to measure the level of financial inclusion for each type of financial institution at the provincial level. The sources of secondary data used in our analysis include commercial banks and financial institutions' statistics maintained by the Bank of Thailand, the database on the operation and financial positions of SFIs, which include the Bank for Agriculture and Agricultural Cooperatives (BAAC) and the Government Savings Bank (GSB), the household socio-economic survey, and the report on the operation of the Department of Community Development. Details of the indicators used in the construction of IFI are presented in Table 1. Results from the analysis of the level of financial inclusion through the IFI of commercial banks, SFIs and self-help groups are shown in Figures 1-3.

Table 1: Details of indicators for the main dimensions of the index of financial inclusion

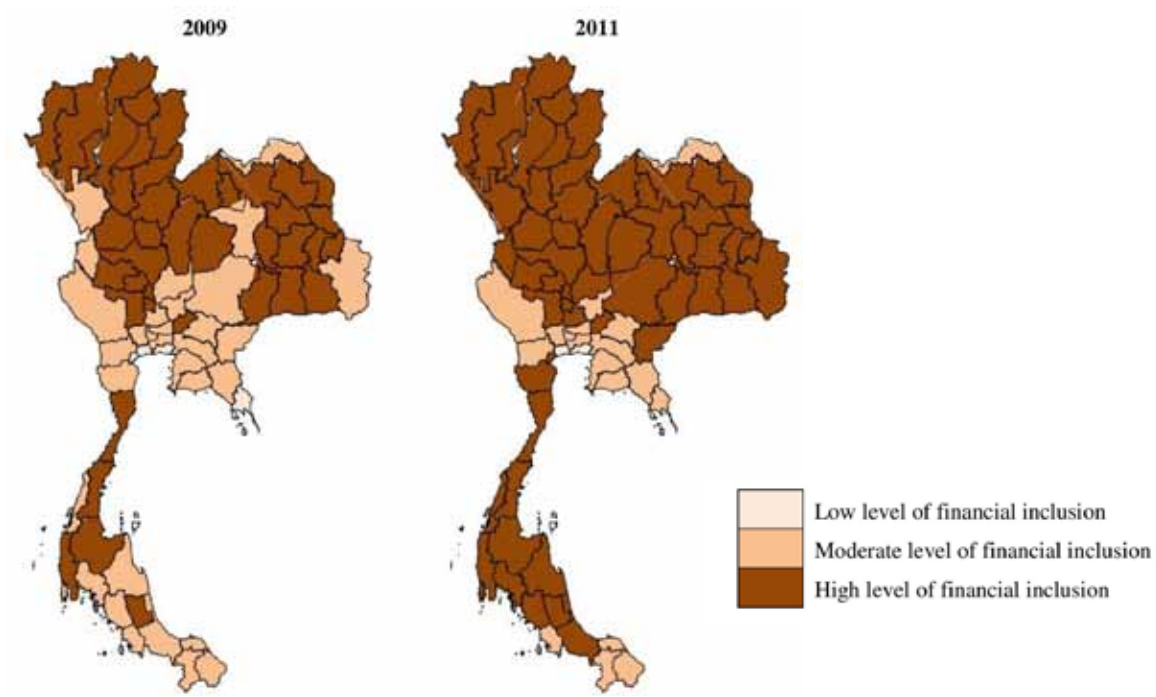
Main dimensions of IFI	Types of financial institution	Indicators
1. Accessibility of banking services (depth/penetration)	Banks	Percentage of households with saving account at commercial banks in each province
	Banks	Percentage of households with outstanding debts in each province
	Specialized financial institutions (SFIs)	Number of saving accounts per capita in each province
	SFIs	Number of loan accounts per capita in each province
	SFIs	Percentage of households with saving account at SFIs in each province
	SFIs	Percentage of households with loan account at SFIs in each province
	Semi-formal and self-help groups	Percentage of borrowers to provincial population
	Semi-formal and self-help groups	Percentage of semi-formal group members to provincial population
2. Availability of banking services	Banks	Number of commercial bank branches per 100,000 people in each province
	Banks	Number of commercial bank branches per 1,000 square kilometers in each province
	SFIs	Number of BAAC branches per 100,000 people in each province
	SFIs	Number of BAAC branches per 1,000 sq km in each province
	Semi-formal and self-help groups	Number of village funds per 100,000 people in each province
	Semi-formal and self-help groups	Number of saving groups per 100,000 people in each province
	Semi-formal and self-help groups	Number of cooperatives per 100,000 people in each province
	Semi-formal and self-help groups	Number of village funds per 1,000 sq km in each province
	Semi-formal and self-help groups	Number of saving groups per 1,000 sq km in each province
	Semi-formal and self-help groups	Number of cooperatives per 1,000 sq km in each province
3. Usage of banking services	Banks	Total bank deposits as a percentage of gross provincial products
	Banks	Total bank credits as a percentage of gross provincial products
	SFIs	SFIs' total deposits as a percentage of gross provincial products
	SFIs	SFIs' total credits as a percentage of gross provincial products
	Semi-formal and self-help groups	Village funds' total credits as a percentage of gross provincial products
	Semi-formal and self-help groups	Saving groups' total credits as a percentage of gross provincial products
	Semi-formal and self-help groups	Saving groups' total deposits as a percentage of gross provincial products
	Semi-formal and self-help groups	Cooperatives' total deposits as a percentage of gross provincial products
	Semi-formal and self-help groups	Cooperatives' total credits as a percentage of gross provincial products

Figure 1: Level of financial inclusion for commercial banks – by province in 2009 and 2011



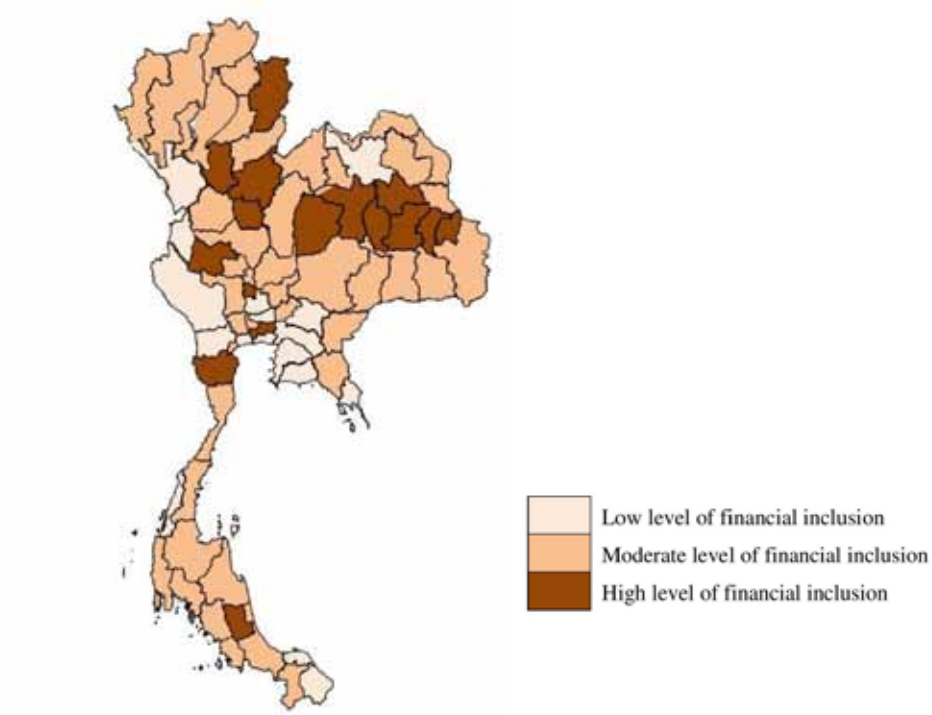
Source: IFIs were computed by TDRI using data compiled from different secondary sources.

Figure 2: Level of financial inclusion for specialized financial institutions – by province in 2009 and 2011



Source: IFIs were computed by TDRI using data compiled from different secondary sources.

Figure 3: Level of financial inclusion for self-help groups – by province in 2011



Source: IFIs were computed by TDRI using data compiled from different secondary sources.

The key results from the analysis of overall financial inclusion, measured by access to basic financial services, can be summarized as follows. First, on average, almost 94 percent of all provinces in Thailand have a moderate to low level of access to financial services provided by commercial banks, even though the level of financial inclusion at the provincial level improved between 2009 and 2011. Second, with regard to the access to financial services of SFIs, our results show that citizens in different provinces had better access to financial services offered by BAAC and GSB in 2011 than they did in 2009. Last but not least, the majority of the provinces (about 58 percent) were found to have a moderate level of access to financial services offered by semi-formal and self-help groups.

2.2 Assessment of Credit Gaps for Thai Households

As the results in the previous section show, most of the provinces in Thailand have low to moderate access to commercial bank deposits and credits; however, it might be the case that some people in those provinces still have constrained access to basic deposit and credit services in the formal banking system. Since the lack of access to credit is more prevalent in general, this section is focused more on credit issues.

A number of previous studies revealed that credit constraints impose a negative impact on households and businesses, particularly those enterprises and households that have commercially viable investment projects but cannot access sufficient amounts of credit to respond to the demand. In other words, such households and entrepreneurs experience credit rationing or a situation in which lenders limit the supply of additional credits to borrowers who demand funds.

Despite the attempts made by various institutions such as the World Bank, the Asian Development Bank and the Bank of Thailand, in studying the current situation for financial inclusion in Thailand, to the best of our knowledge, there exists no

study which estimates the size of the credit gap in Thailand. The present study is aimed at filling this gap in the literature by using the econometric approach along the lines of Cox and Jappelli (1993) to estimate the size of the credit gap in four areas surveyed by TDRI, namely Bangkok, Chiang Rai, Nakhon Ratchasima, and Nakhon Si Thammarat.

In this section, we estimate the model for the desired debt level if households are not credit constrained and hold a positive level of debt. We then use the coefficients from such model estimation to estimate the desirable level of debt of constrained households with positive demand for debt. However, the estimates are likely to be biased if a variable that affects a household that is credit constrained or has positive debt also affects the desired level of debt. To address the sample selection bias issue, in this article, we use the Heckman selection approach to deal with such issues (Heckman, 1979) and also take into account two sources of selection bias by adopting the model estimation approach suggested by Catsiapis and Robinson (1982).

We use the two-step approach in estimating the size of the credit gap. In the first stage, we estimate the selection equations (4) and (5) which set apart households that are credit constrained from those that are not constrained, and households that have a positive level of debt, respectively. We then estimate the equation for households' desired level of debt:

$$Y_i^* = \beta_{10} + \sum_{d=1}^{p} \beta_{1d} X_{1d,i} + \varepsilon_{1,i} \quad (3)$$

along with the probit models for credit constrained situation and debt incidence respectively:

$$v_i^* = \beta_{20} + \sum_{c=1}^{q} \beta_{2c} X_{2c,i} + \varepsilon_{2,i}, \text{ where } N_i = \begin{cases} 1 \text{ if } v_i^* > 0 \\ 0 \text{ if } v_i^* \leq 0 \end{cases}, \quad (4)$$

and

$$\eta_i^* = \beta_{30} + \sum_{f=1}^{q} \beta_{3f} X_{3f,i} + \varepsilon_{3,i}, \text{ where } H_i = \begin{cases} 1 \text{ if } \eta_i^* > 0 \\ 0 \text{ if } \eta_i^* \leq 0 \end{cases}, \quad (5)$$

where Y_i^* denotes household i's desired level of debt, a variable which will be observed only among households that are not credit constrained and have a positive level of debt. X_{1d}, X_{2c} and X_{3f} are vectors of explanatory variables that explain household debt, credit constraint and debt incidence, respectively. v_i^* and n_i^* are unobserved latent variables for the presence of credit constraints, N_i and the existence of outstanding debt, H_i, respectively. Empirically, we observe the binary variable N_i that takes a value of one if a household i was denied partial or full credit, or did not apply for a loan due to fear of denial ($v_i^* > 0$) and zero otherwise ($v_i^* \leq 0$), and the variable H_i that takes a value of one if a household i has outstanding debt ($n_i^* > 0$) and zero otherwise ($n_i^* \leq 0$). Examples of explanatory variables are liquidity condition, age of the household head, education level of the household head, assets, traveling time, household size, occupation of the household head, level of risk-taking attitude and amount of debt outstanding. To deal with the two sources of sample selection bias, we compute the inverse Mills ratio (IMR) from the probit models (4) and (5). We then include IMR as one of the variables in equation (1). Equation (1) can be re-written as follows:

$$Y_i^* = \beta_{10} + \sum_{d=1}^{p} \beta_{1d} X_{1d,i} + \sigma_1 \rho_{1,2} IMR_2 + \sigma_2 \rho_{1,3} IMR_3 + \varepsilon_{1,i}, \quad (6)$$

where IMR_2 and IMR_3 are computed from $\frac{\phi(v_i)}{\Phi(v_i)}$ and $\frac{\phi(\eta_i)}{\Phi(\eta_i)}$ from the probit models (4) and (5), respectively. It is hypothesized that IMR_2 will have a negative impact on the households' debt but IMR_3 will have a positive impact on the amount of household debt.

To estimate the credit gap of credit-constrained households, we find the difference between the desired amount of debt of households estimated from equation (6) and the actual amount of debts of households. The data used in the estimation of the credit gap are the data of credit constrained households.

We begin with a discussion on the estimation results for the credit constraint regression.

There are a number of factors that cause households to be credit constrained, namely short-term liquidity and debt payment behavior. In particular, households that have expenditure exceeding income are more likely to be denied partial or full credit. Formal financial institutions are likely to deny credit to households that have a default history (Table 2). In practice, since it is costly for the financial institutions to set aside reserves for non-performing loans (NPLs), many financial institutions are very cautious in granting credit to risky and illiquid customers. As shown in Table 2, the socio-economic characteristics of households were also found to be significant factors that explain the credit constraint condition. Households with a relatively old household head are less likely to be denied credit. Moreover, a household head with a primary education (or less) and a household head that received a secondary education or was awarded a vocational certificate are more likely to be credit constrained. Finally, households whose household head is unemployed or looking for a job were found to be more credit constrained than other households.

Next, we consider the estimation results for the debt incidence regression (Table 3). The results from our analysis show that households' short-term liquidity is still an important factor that explains the debt incidence of households. Households that have low income but high expenditure are more likely to find additional sources of finance. Households that have a lot of fixed assets are more likely to incur debts since they tend to use their fixed assets as collateral in securing more debt. Moreover, transaction cost is also found to be an important factor that explains debt incidence. If households have to spend lots of time in getting from the home to the financial institutions, they would have less incentive to acquire financial services from the financial institutions. Households' socio-economic factors, such as age and the education background of the

Table 2: Estimation results for the credit constraint regression

Variables	Coefficient	Robust clustered S.E.
Financial liquidity	-0.362***	0.141
Age of household head	-0.088	0.063
Age of household head squared	0.001*	0.001
Sex of household head	0.008	0.325
Household size	-0.249	0.327
Default history	1.02***	0.397
Level of education of household head (with tertiary education as a reference group):		
- At most a primary education	-1.294***	0.348
- Secondary education or vocational certificate	-1.255***	0.307
Occupation of household head (with the unemployed as a reference group):		
- Employed in agricultural sector	-0.686***	0.195
- Self-employed	-0.364*	0.210
- Civil servant/state enterprise employee	-0.766*	0.396
- Employee in private company	-1.003***	0.155
Ln (value of fixed assets)	-0.035	0.125
Ln (value of financial assets)	0.184***	0.036
Ln (outstanding debt)	0.042	0.029
Marital status of household head (with single as a reference group):		
- Divorced	5.184***	0.807
- Married	5.412***	0.650
Ln (traveling time from home to financial institution)	-0.092	0.082
Constant	-5.417***	1.554
Other control variables (province dummies)	Yes	
Pseudo R-squared	0.244	
Number of observations	494	

****, ** and * denote statistical significance at 0.01, 0.05 and 0.10, respectively.*

Table 3: Estimation results for debt incidence regression

Variables	Coefficient	Robust clustered S.E.
Financial liquidity	-0.519***	0.169
Age of household head	0.040	0.025
Age of household head squared	-0.001***	0.001
Sex of household head	0.028	0.083
Ln (household size)	0.297**	0.150
Level of education of household head (with tertiary education as a reference group):		
- At most primary education	-0.304*	0.181
- Secondary education or vocational certificate	0.059	0.138
Occupation of household head (with the unemployed as a reference group):		
- Employed in agricultural sector	0.086	0.188
- Self-employed	-0.032	0.122
- Civil servant/state enterprise employee	-0.157	0.127
- Employee in private company	0.095	0.285
Ln (value of fixed assets)	0.134**	0.055
Marital status of household head (with single as a reference group):		
- Divorced	0.316	0.200
- Married	0.372**	0.175
Ln (traveling time from home to financial institution)	-0.092***	0.034
Ln (risk preference)	0.007	0.330
Constant	-2.242***	0.793
Other control variables (province dummies)	Yes	
Pseudo R-squared	0.123	
Number of observations	487	

****, ** and * denote statistical significance at 0.01, 0.05 and 0.10, respectively.*

household head, are also found to be important determinants of debt incidence. Households with older head of household compared to households with younger head of household, and households whose household head has low level of education are less likely to be indebted to formal financial institutions.

Lastly, we present the estimation results for the households' outstanding debt level (Table 4). We found that the amount of outstanding debt is positively correlated with households' income. In practice, the income of the loan applicant is the key factor in determining the credit limit. A low-income applicant is thus more likely to be granted a small credit limit. Second, the amount of outstanding debt depends on household size, age, educational background and occupation of the household head. Households with an older head are not able to borrow as much as households with a younger head because a younger household head has greater potential to accumulate a large amount of earnings. Large households tend to be characterized by a lot of spending; therefore, the households with more members tend to borrow more relative to other groups. Households headed by an entrepreneur, employee in a private company or a person who works in the agricultural sector tend to have larger outstanding debts compared with households with an unemployed head. The educational background of the household head also matters. If the household head received at least a tertiary education, the amount of outstanding household debt would be less relative to households whose head has a lower educational background. The type of household assets plays a role in explaining the amount of outstanding debt. Households with more fixed assets are more likely to be indebted, while households with a high level of financial assets tend to have a lower amount of outstanding debt.

By considering the estimated coefficients of IMR in the credit constraint and debt incidence regressions, we find that both of the estimated coefficients have the correct signs, i.e., the unobservable factors that tend to increase the likelihood of incurring debt lead to higher desired amount of credit. In addition, the unobservable factors that tend to raise the likelihood of households being credit constrained reduce the desired amount of credit.

From our analysis of the credit gap of households in the four provinces that are in our pilot areas presented above, the results show that, if the credit-constrained households can remove all the factors behind the credit constraint, the average desired debt level of these households in our sample will increase by approximately 440,000 baht (US$1 = about 32 baht) per household. In addition, the size of the financing gap of credit-constrained households in the four pilot provinces varies across households, depending on the sex, educational background and occupation of the household head (Tables 5-7). We find that, if households can deal with the credit constraint condition, the desired debt level of the households with a male head will increase by 505,000 baht or approximately 6.7 times the desired debt level of the households with a female head. The desired debt level of households with a higher than tertiary educated head will increase by 729,000 baht or about twice the level of the desired debt for households with a less educated head. In considering the occupation of the household head, our results show that households whose head is a civil servant or employee in a state enterprise have the highest desired debt level compared with households with a self-employed head or private employee head.

Table 4: Estimation results for households' outstanding debt regression

Variables	Coefficient	Robust clustered S.E.
Ln (household income)	0.416*	0.152
Age of household head	1.177***	0.147
Age of household head squared	-0.014***	0.002
Sex of household head	0.144	0.158
Ln (household size)	4.423***	0.326
Default history	-9.696***	1.215
Level of education of household head (with tertiary education as a reference group):		
- At most primary education	10.457***	1.373
- Secondary education or vocational certificate	11.887***	1.559
Occupation of household head (with the unemployed as a reference group):		
- Employed in agricultural sector	6.879***	0.910
- Self-employed	3.173***	0.448
- Civil servant/state enterprise employee	6.937***	0.897
- Employee in private company	10.314***	1.239
Ln (value of fixed assets)	1.365***	0.147
Ln (value of financial assets)	-1.815***	0.215
Marital status of household head (with single as a reference group):		
- Divorced	-51.144***	5.712
- Married	-52.94***	5.916
IMR (credit constraint)	-10.817***	1.244
IMR (debt incidence)	10.41***	1.341
Constant	37.71***	2.751
Other control variables (province dummies)	Yes	
R-squared	0.607	
Number of observations	302	

****, ** and * denote statistical significance at 0.01, 0.05 and 0.10, respectively.*

Table 5: Average financial gap, by sex of household head

Sex of household head	Financial gap (Thai baht)
Female	75,017
Male	505,072
Total	443,636

Source: Estimated by Thailand Development Research Institute.

Table 6: Average financial gap, by educational background of household head

Educational background of household head	Financial gap (Thai baht)
Primary education	396,074
Tertiary education	729,006
Total	443,636

Source: Estimated by Thailand Development Research Institute.

Table 7: Average financial gap, by occupation of household head

Occupation of household head	Financial gap (Thai baht)
Civil servant or state enterprise employee	729,006
Private company employee	42,340
Self-employed	466,821
Total	443,636

Source: Estimated by Thailand Development Research Institute.

3. CONCLUSION AND POLICY IMPLICATIONS

Based on the analysis of aggregate level of financial inclusion across provinces in Thailand, it is apparent that most of the provinces in Thailand have low to moderate access to basic financial services, suggesting that some people in these provinces are still not in a formal banking environment that would help them to get easy access to basic deposit and credit services. Although SFIs, semi-formal and self-help groups, which are aimed at helping community people and the underserved in particular are, to some extent, able to help fill the gap, they still face some limitations.

In the study, we further conduct an empirical exercise to see what happens if impediments to financial access are removed by focusing on credit side issues, meaning that we analyze the extent of demand for credit by credit-constrained households if all the credit-constrained factors, such as information asymmetry between lenders and borrowers and credit history, are hypothetically removed. Overall, by studying the credit constraint condition that causes a number of households to be denied credits, we find that the following problems need to be tackled to improve financial inclusion of the people, especially when it comes to access to credit from formal financial institutions.

First, with regard to short-term liquidity issues, from our survey of households in the four pilot provinces, we find that the average proportion of household expenditure to household income is about 76 percent. A decline in liquidity over a short-term horizon does not cause households to face financial difficulty; however, if the lack of liquidity persists, households might face severe financial constraint and liquidity problems. To address these

issues, the responsible government agencies, private organizations along with community-based institutions need to cooperate in equipping the low-income households with understanding and knowledge of personal financial management, including income and expenditure management, as well as the concept of household accounting so that households can do financial planning and budgeting more effectively. Bearing in mind that a large number of Thai citizens still lack awareness and knowledge of the importance of personal financial management, as well as new financial products and services, it is high time to promote financial literacy in Thailand, especially among low-income earners. Since the financial world is becoming more and more complex, without proper education and knowledge about financial matters, people will be likely to make poor decisions with negative consequences, such as getting themselves into financial difficulty and experiencing financial instability. It is therefore indispensable that people should be taught about finance from a young age so that they can become financially stable when they grow up. Even though many agencies are developing financial literacy programs, current efforts are not sufficient for creating a substantial impact, as there is a lack of coordination. This situation calls for holistic development and promotion of financial literacy at all levels of education.

Second, the information asymmetry between borrowers and financial institutions is one of the key factors that explain why financial institutions require borrowers to pledge assets or collateral as a guarantee for loans. By using collateralized loans, financial institutions take less risk. Yet, many households, especially low-income households, face difficulty in finding assets to pledge as collateral. To address this problem, we should encourage the development and implementation of the joint credit guarantee system, particularly among rural households and micro-entrepreneurs via the linkage between banks, specialized financial institutions, semi-formal and self-help groups, to promote rural development and transformation through the provision of loans and guarantees on loans for agriculture and rural development projects. An example of a credit guarantee system that currently exists in Thailand is the one under the responsibility of the Thai Credit Guarantee Corporation (TCG), which was established to support SMEs in obtaining a greater amount of credit from financial institutions.

Third, with an unfavorable credit history, such as failure to repay a loan in a timely manner or defaulting on debts, borrowers will face difficulty in obtaining credit from financial institutions. In order to help such groups of potential borrowers, it is important that a debtor-friendly debt restructuring scheme be established.

Next, many of the requirements and conditions of formal financial institutions are the key obstacles that limit the access of low-income households to financial services. With this in mind, it is a matter of urgency to improve the financial institution's development plan to lessen or minimize the exclusion of low-income households from accessing credit. One of the measures to be revised is that concerning the issuance of new licenses for microfinance institutions.

Last but not least, we are all aware that elderly people are often excluded from accessing financial services, particularly credit, for some reasons. Based on general understanding, the elderly in general are experiencing a decline in physical capabilities and lower opportunity to earn and save for the future compared to what they used to do. In addition, those particularly from low-income families and the families with generation gap are normally considered to be at particular risk as they fail to accumulate wealth and assets that can generate them passive income upon retirement. With this problem in mind, it is important that there should be a good and reliable welfare scheme for elderly people or other disadvantaged groups to reduce their need to borrow from informal sources of credit. To help lessen the fiscal burden in the long-term, people should be educated starting at an early age about necessary financial-related matters, knowledge and skills to become financially independent and responsible adults.

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