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Local physical capital mobility and persistency in local relative poverty: theoretical framework and a village fund case study♣

*Sunsiree Kosindesha**

Abstract

This study develops a theoretical framework focusing on the different impact having perfect physical capital mobility as on the long term poor, who normally have no access to conventional capital markets, and the long term wealthy, who have human capital. Both groups of people live together in the same sector producing the same product, but they use different modes of production reflecting their different levels of human capital. Compared to the case of autarky, in which there is no physical capital mobility, this analysis shows that capital mobility can impact both the level of steady-state consumption and changes in assets. For instance, both groups of people can either hold more assets and consume more than would be case in autarky, or they can hold the same level of assets but consume more along the way before reaching a steady state of consumption. Having perfect physical capital mobility can also provide a chance for the economy to achieve both more efficiency and more equality, with a reduction in long term poverty.

♣ This paper is a version of thesis submitted in partial fulfillment of the requirement for the degree of Master of Economics (English Language Program) Faculty of Economics, Thammasat University, May 2010. Any short coming is solely my own responsibility. All comments and suggestions are cheerfully welcomed.

* Corresponding author, Faculty of Economics Thammasat University, Prachan Road, Phranakorn, Bangkok 10200 คณะเศรษฐศาสตร์ มหาวิทยาลัยธรรมศาสตร์ Email: sansiree_ko@hotmail.com, sunsiree@econ.tu.ac.th

In addition, a village-fund case study is provided as an example of applying of the theoretical model into a real world situation. The case study helps elaborate some impacts predicted by the theoretical framework, and helps identify some critical exogenous factors which should be useful as the extensions of the model in future.

Keywords: One sector growth model; Physical capital mobility; Inequality
JEL Classification: I32 O24 O41

บทคัดย่อ

การศึกษานี้ได้สร้างกรอบการคิดวิเคราะห์ในเชิงทฤษฎีเศรษฐศาสตร์เพื่อวิเคราะห์บทบาทของการหมุนเวียนทุนในระดับเศรษฐกิจชุมชน โดยเป็นการหมุนเวียนทุนเพื่อการผลิตระหว่างกลุ่มคนที่จนกว่าอย่างเรื้อรังผู้ซึ่งโดยทั่วไปแล้วมักจะไม่สามารถเข้าถึงตลาดเงินตลาดทุนที่เป็นทางการได้ และกลุ่มคนที่รวยกว่าโดยเปรียบเทียบซึ่งในกรอบการวิเคราะห์นี้ให้เป็นผู้ที่มีทุนมนุษย์ที่สามารถนำไปใช้เพิ่มผลิตภาพในการผลิตได้ ในการพิจารณาในการศึกษานี้ เราให้คนทั้งสองกลุ่มอยู่ในภาคการผลิตเดียวกัน ผลิตสินค้าชนิดเดียวกัน แต่มีความแตกต่างกันที่วิถีการผลิต โดยวิถีการผลิตของคนที่รวยกว่าสามารถใช้ทุนมนุษย์ให้เป็นประโยชน์ได้

จากการวิเคราะห์ เราสามารถแสดงได้ว่า โดยเปรียบเทียบกับกรณีที่ไม่มีการพึ่งพิงกันทางด้านเงินทุนเพื่อการผลิต ผลกระทบของการมีทุนหมุนเวียนระหว่างคนสองกลุ่มนี้ จะมีหลายกรณีในแง่ของการเปลี่ยนแปลงในระดับความไม่เท่าเทียมกันในการบริโภคและสินทรัพย์ที่ถือครอง กรณีแรกที่สามารถเกิดขึ้นได้คือ กรณีเมื่อให้เงินทุนสามารถหมุนเวียนไปเพื่อการผลิตระหว่างคนสองกลุ่มนี้จะทำให้ทั้งสองกลุ่มมีสินทรัพย์และมีการบริโภคที่สูงขึ้นโดยเปรียบเทียบกับกรณีที่ไม่ให้มีเงินทุนไหล อย่างไรก็ตามความไม่เท่าเทียมกันระหว่างคนสองกลุ่มนี้ยังคงมีอยู่ต่อไป อีกกรณีหนึ่งที่สามารถเกิดขึ้นได้เช่นกันคือกรณีที่ การมีเงินทุนไหลระหว่างกลุ่มไม่ทำให้ผลในระยะยาวที่ดุลยภาพเปลี่ยนแปลงไปเมื่อเทียบกับกรณีที่ไม่มีเงินทุนไหลโดยการไหลของทุนส่งผลกระทบต่อคนทั้งสองกลุ่มในช่วงเวลาก่อนถึงดุลยภาพเท่านั้น นั่นหมายความว่าการไหลของเงินทุนไม่ทำให้ความไม่เท่าเทียมกันเปลี่ยนแปลงในระยะยาว

นอกจากนี้ในการศึกษานี้ได้ทำการศึกษาหนึ่งกรณีศึกษาจากกองทุนหมู่บ้าน เพื่อเชื่อมโยงกรอบการวิเคราะห์ในเชิงทฤษฎีมายังตัวอย่างที่เกิดขึ้นได้ในโลกของความเป็นจริง ซึ่งจากข้อมูลภาคสนามและการวิเคราะห์ เราพบว่ากรณีศึกษานี้สามารถบ่งชี้ลักษณะบางประการจากกรอบการวิเคราะห์ และบ่งชี้ถึงปัจจัยภายนอกบางประการที่ไม่สามารถอธิบายได้จากกรอบการวิเคราะห์อันจะเป็นปัจจัยเพื่อการศึกษาเพิ่มเติมและปรับปรุงกรอบการวิเคราะห์ต่อไป ทั้งนี้ผลของการศึกษาจากกรณีศึกษานี้ไม่ได้มีเป้าประสงค์เพื่อเป็นการทดสอบนัยสำคัญทางสถิติของกรอบการวิเคราะห์ที่สร้างขึ้นแต่อย่างไร

1. Introduction

One Thailand's economic development success over the past 20 years has been the continual reduction of *extreme* poverty[1]. The overall number of Thai people classified as the poor by designated official poverty line has diminished massively (Krongkaew, 2001). In 1988, 42% of Thai population was classified as poor, by 2007 that number had declined to around 9%. (NESDB, 2007).

While great improvement have been made, these statistics hide real issues. Despite the reduced poverty, income inequality has changed little from its high levels between 1988-2006, with the 2006 income ratio of 20% richest to 20% poorest at about 16 times[2](Jitsuchon and Siamwala, 2007). This pattern can partly be explained by the stagnant share of income held by the poorest 20% of the population, which has varied between 3.5-4.6 % of the country's income over the past 18 years.

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[1] One measure of extreme poverty by the World Bank is $1 a day and $2 a day poverty line. This $1-a-day poverty line has been not far from the national poverty line that has been used. To note, the poverty head count has been averagely decreasing except for a few year of world recession in 1981-1986 and Thailand economic crisis 1997-2000.

[2] The income ratio = %of income in overall country's income hold by the 20% richest / % of income hold by 20% poorest.

By Jitsuchon and Siamwala (2007), it is stated that this income ratio will be even higher if it was for 5% richest to 5% poorest.

The above leads to an interesting observation. As time goes by, generally, even though some people at the bottom rung of economy have improved standard of living according to some specified official criteria such as the poverty line, they have not been able to do better than before compared to others in terms of their capacity to earn a larger income share. This situation is even more worrisome when the people who still live at the bottom rung do so throughout different points in time. In other words, high income inequality with combined with permanent poverty is accepted to be worse, for long term development, than is transient poverty. Unfortunately, we also don't know how much of today's poverty is permanent or transient. [3]

Nonetheless, some recent micro level studies suggest that there are at least some subgroups within Thai economy that are persistently poor through time. Despite some extent of poverty dynamism, Townsend (2006) studied social mobility of people in 4 rural Thai provinces and found that 27.4% of the bottom quintile were continually being among the poorest since 1997 to 2003. In the more detailed picture, there are people called "the ultra poor" existing in Thailand. This group of people have been impoverished between 15 and 20 years, with a little hope to move out from such poverty in the future (Krongkaew, 2001)[4]. Moreover, Saardchom (2006) found the empirical evidence indicating the existence of a chain of reasons that lead to persistent poverty among some of Thai farmers.

Though good econometric studies of the existence of such persistent poverty in Thailand does not exist, the plight of many poor people – for whom time is not a dependable ally for them to improve their own welfare, or in other words, who live in poverty trap: a vicious circle of poverty - can be observed here and there in the economy. In such a highly unequal society as Thailand, it

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[3] This is because the poverty data that Thailand based on have not come from panel data survey so that we cannot know how long that each person has been lived within poverty. In other words, by consecutive cross-sectional data, we will know only the trend of poverty head count of general individuals.

[4] Krongkaew (2001) studied the necessary detailed of the group called ultra poor, sampling from 20 provinces out of 76 provinces in 4 region in the country, mainly in year 1999.

becomes very difficult to deal with, and alleviate, this problem – but one way to help do so is study the significance of *capital* in driving the economy.

Capital market imperfections are one of the fundamental reasons for poverty traps to emerge. In practices, the inability of the poor to access legal capital markets to borrow for investment has long been and still is an acknowledged problem in tackling poverty. To use a Thai example, in Thailand 90.03% of the poor are *un*able to access and reap any benefit from Village and Urban Community funds, etc. (NESDB, 2007, p. v). One possible way to solve the (persistent) poverty problem is that if access to credit can be improved, it is argued, the poor can finance productive activities that will allow income growth, provided that there are no other binding constraints. This is argued to be a route out of poverty for the non-destitute chronic poor (Weiss, Montgomery, Kurmanalieva, 2003). And, this is the part of the problem that this study is based upon and built forward.

With tremendous gaps that can be filled on the issue of persistent poverty and inequality problems, our work is meant to be only a small contribution to an issue that clearly needs more study, the role of borrowing-lending reliance towards explaining long term, persistent poverty. That is, keeping an eye on a sublevel of economy in the same sector and watching attentively at the persistent poor(er) with normally no access to conventional financial institutions, *if* there was perfect physical capital mobility[5] between the persistent poorer and the persistent richer who have human capital and there was no other binding constraints[6], we study how the long-term effect toward these two groups would be theoretically, with a case study in Thailand's context in order to

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[5] Physical capital in this paper means capital, capital goods, or real capital which is the factor of production used to create goods or services. It can be thought of as something that can be convertible back and forth with money or financial capital. The word "physical" is used with the aim to differentiate this type of capital from "human capital", the capital that is embedded in person.

Physical capital here can be mobile only for production purpose, not consumption purpose.

[6] Besides budget constraints

explore such effects in reality. As a consequence, better understanding on this issue might help in poverty-inequality-microfinance-related policy searching or rethinking in some way.

2. Literature Review

The gap of poverty trap literature: an argument for theoretical framework

Many models on poverty traps with financial market imperfection assumption *(e.g. Azariadis and Stachurski, 2005; Banerjee,2005; Galor and Ziera, 1993; Ceroni, 2001; Barham et.al., 1995;* Carter and Barrett, 2006) have been built to explain why poverty traps emerge. Another facet of the problem, besides to explain why, is to think what else can be done if there have some groups of people been living and heading forward in time to stay in poverty trap showing level of persistent poverty, hence persistent relative poverty in an economy.

In theory as well as in reality, the sub-economy of the poor usually lacks of access to credit market. According to this, the gap is that if there happens to be no barrier to trade in capital goods between sub-economies of the richer and the poorer, in other words, if borrowing-lending reliance between capital abundant and capital scarce groups can be established because of assumption of perfect capital mobility, what the short run and long-run effects would be. Would it be better off for both sub-economy or else?

On Relation to Perfect Capital Mobility: Theory and Reality

When considering the issue of perfect capital mobility across units of analysis such as countries, sub-economy, or dynasties, there are various models existing in literature that could be applied. In reality, the closest practical examples to the issue are initiatives such as the initiation of microfinance institutions like the Grameen Bank, a microfinance organization and community development bank started in Bangladesh that makes small loans (known as microcredit or "grameen credit") to the impoverished without requiring collateral.[7]

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[7] See more details at http://en.wikipedia.org/wiki/Grameen_Bank, the referred information retrieved on September, 2009.

Reviewing the theoretical literature, the basic model considering perfect capital mobility with immobile labor is that of Barro and Sala-i-Martin (2004, An Open-Economy Ramsey Model, p. 161-165) and Ruffin (1979) etc. An Open-Economy Ramsey model in *Barro and Sala-i-Martin (2004)* provides the basic understanding when there are many economies with consumers and firms. Each economy is taken as a small economy, hence there is no effect on world interest rates. As a consequence, an asymptotically country that is the most patient one owns all the wealth in the sense of the claims on capital and the present value of wage income in all countries. All other countries own a negligible amount of capital per unit of effective labor in the long run. While Barro and Sala-i-Martin (2004) considered small countries and consumers' behavior, *Ruffin (1979)* considered two big countries with no consumers, i.e. analyzing a two-country version of Solow's one sector growth model. In the model, one kind of output is produced by different forms of production function for each sub-economy, however, none of the human capital related concepts is really addressed. Ruffin displays short-run properties of the model concerning how to settle equilibrium interest rate in physical capital market by using concept from the static theory of capital movement popularized by MacDougall (1960). Ruffin aimed to reveal the relationship between the steady-state solutions under portfolio autarky and perfect capital mobility. He found that the steady-state solutions for per capita incomes and the capital-labor ratios with perfect capital mobility exceeds the steady state solutions with prohibited capital movements for both countries. In addition, perfect capital mobility lowers long-run wages and raises long-run interest rates in the capital-exporting country compared to autarky; the opposite holds in the capital-importing country.

3. Theoretical Framework

The economic model studied here is adapted from an infinite horizon Ramsey model, a natural market-problem benchmark case, developed by Ramsey(1928), Cass(1965), and Koopmans(1965) restated in Romer (2001), whose model avoids all market imperfections and all

issues raised by heterogeneous agents and links among generations. The assumptions of the model, along with the adaptations to Ramsey model, are stated below:

Assumptions of the Model

1. There are 2 sub-economies characterizing by different production functions being adopted. One production function, $F(\cdot)$ in sub-economy "*N*", has no human capital as factor of production, while the other, $G(\cdot)$ in sub-economy "*H*", has human capital and human capital spillover;

2. Agents in sub-economy H are exogenously forced to pay a cost for having human capital;

3. Accordingly, labor in sub-economy H possesses $h_T > 1$, whereas, labor in sub-economy N possesses $h_t = 1 \quad \text{for all} \quad t$. For sub-economy H, h_t grows exogenously.

4. To keep the structure of model as simple as possible, population in both sub-economies grows at the exogenous same rate $\frac{L_{t+1}^N - L_t^N}{L_t^N} = \frac{L_{t+1}^H - L_t^H}{L_t^H} = n$. Stock of common technological knowledge, A is a positive constant, thus does not grow overtime.[8]

5. Physical capital is *perfectly* mobile between two sub-economies, in the form of loan and borrowing with no borrowing constraint for agents. Labor is specific to each production function, hence immobile across sub-economies;

6. Loans between these two sub-economies in each period *cannot* be used for consumption, but can only be used for investment in next-period physical capital stock. In other words, we consider only the case of production loan. The equilibrium level of loan/borrowing M_t can be positive, negative, or zero;

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[8] One can also assume stock of technological knowledge to be A_t which exogenously grow at rate g overtime. Either way, there is no difference in the analysis here in this model.

7. The time dimension considered is $T \leq t \leq \infty$, where T is a predetermined time when the free physical capital flow between sub-economies is allowed, and it is time when agents in sub-economy H firstly acquire initial human capital by paying fixed cost *E*;

8. There is no uncertainty in the future. The equilibrium interest rate, r_t, is set to be effective at the beginning of t+1[9];

9. Initial working physical capital stocks in each sub-economy, $K_T^N \geq 0 \quad , and \quad K_T^H \geq 0$ are given.

Assume that people in sub-economy *H* is richer than in *N*, $K_T^H > K_T^N$; furthermore, *H* is richer at least to the extent that they can pay for human capital and still be richer.

10. For simplicity, assume that output price $P_t = P = 1$, for all *t*, or we can think that these two sub-economies produce a single, identical goods that can be either consumed, used as physical capital and loan to the other.

11. Within each sub-economy, productive factors- labor, physical capital, and human capital- are substitutable.

In each sub-economy, the evolution of wealth (productive assets or operating physical capital stock) is from the interaction of maximizing agents and firms. *Firms (in each sub-economy) are owned by agents (in each sub-economy)* (so any profit they earn accrues to the agent, if any). Hence, firms can also be viewed *as working episode of agents*.

Firms rent all physical capital, net off loan/borrowing, from agents and hire labor to produce and sell output, and a fixed number of infinitely lived agents hold capital (physical capital, human capital), inelastically supply labor, consume, save, borrow or loan and settle previous period loan obligation.

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[9] In this model, $r_{t-1}, w_t^N, w_t^H, m_t$ reveal at the same time at time t.

The model will be described first by introducing firms in sub-economy N and H, agents in sub-economy N and H, then by describing behavior of firms in sub-economy N and H and behavior of agents in sub-economy N and H. Lastly, the prime equations of the model are presented.

Firms in sub-economy N and H

In sub-economy N, all firms have access to and operate under a constant-return-to-scale production function $f(\cdot)$ which satisfies Inada condition:

$$f\left(k_t^N\right)=\left(k_t^N\right)^{\alpha},\ k_t^N=\frac{K_t^N}{A\,L_t^N},\ h_t=1\ \ \forall t,\ 0<\alpha<1 \tag{1}$$

k_t^N is *physical capital per effective labor operating in sub-economy N. It* already includes(excludes) the amount of one period loan m_{t-1}^* borrowing from (loaning to) sub-economy H at time t-1.

In sub-economy H, all firms have access to and operate under production function $g(\cdot)$ in which human capital helps increase productivity of labor and *is embedded in the person* who invests in real expense of schooling. Human capital per labor, h_t, plays its role by having both internal and external effects on the overall production of sub-economy H.

$$g\left(k_t^H,h_t\right)=\left(k_t^H\right)^{\eta}h_t^{\gamma}\ \ ,k_t^H=\frac{K_t^H}{A\,h_t L_t^H},\ 0<\eta<1,\ \gamma>0 \tag{2}$$

$$h_{t+1}=h_t+\tilde{b}t^{-a}\quad t\geq T\ \ ,\ \tilde{b}>0,\ a>1,\ h_T>1 \text{ given at time T} \tag{3}$$

k_t^H is *physical capital per effective unit of labor operating in sub-economy H.* Notably, this amount of operating physical capital is net off one-period loan m_{t-1}^* given to sub-economy N at time t-1. Human capital per labor h_t will converge to $h_\infty=h_T+\tilde{b}\sum_{n=T}^{\infty}\frac{1}{n^a}$ and growth of human capital decreases (at a decreasing rate) over time towards zero. Given production function $g(\cdot)$, there remains diminishing marginal product of operating physical capital.

Linkage between two sub-economies through the assumption of perfect physical capital mobility

The force determining equilibrium loans between these two sub-economies at each period is that physical capital will flow between sub-economies until the interest rates are equalized. This conception of capital movement is analogous to the analysis provided in Ruffin (1979) who combines the static theory of capital movement, popularized by MacDougall(1960) into a Solow growth model. Thus, at each period m_t must satisfy *integrated* physical capital market equilibrium condition:

$$r_t = g_{k_{t+1}^H}\left(k_{t+1}^H, h_{t+1}\right) = f_{k_{t+1}^N}\left(k_{t+1}^N\right). \tag{4a}$$

At market equilibrium, the aggregate level of loans received from H (N) must be equal to the aggregate level of loan given to N (H).

This condition will be called here "perfect physical capital mobility constraint" (will be abbreviated as "PPCM constraint"), as it is the constraint present in the perfect physical capital mobility case. The constraint is:

$$k_{t+1}^N - p_{t+1}^N = \lambda_{h_{t+1}}\left(p_{t+1}^H - k_{t+1}^H\right) = \lambda_{h_{t+1}} m_t \tag{4b}$$

where,

$$p_{t+1}^N = \frac{P_{t+1}^N}{AL_{t+1}^N} = \frac{K_{t+1}^N - M_t^N}{AL_{t+1}^N} = k_{t+1}^N - m_t^N \quad ; m_t^N = \frac{M_t^N}{AL_{t+1}^N}$$

$$p_{t+1}^H = \frac{P_{t+1}^H}{Ah_{t+1}L_{t+1}^H} = \frac{K_{t+1}^H + M_t^H}{Ah_{t+1}L_{t+1}^H} = k_{t+1}^H + m_t^H \;\; m_t^H = \frac{M_t^H}{Ah_{t+1}L_{t+1}^H}$$

We can think of p_{t+1}^N (p_{t+1}^H) as the physical capital per effective unit of labor that will belong to people in sub-economy *N (H)* at period t+1 before the mobility of physical capital between sub-economies in period t. And, we can think of m_t^N (m_t^H) as an amount of loan per

effective labor that N (H) will decide to borrow (loan) at time t, and vice versa. *At equilibrium,* m_t^H *must be equal to the amount of loan given to (by) N,* $\lambda_{h_{t+1}} m_t^N$ *, and equal to* m_t^* .

Dynamics of operating physical capital stock in each sub-economy

For sub-economy N and H, the dynamics are as followed respectively:

$$k_{t+1}^N - k_t^N = f\left(k_t^N\right) - c_t^N + \lambda_{h_{t+1}} m_t^N - \left(1 + r_{t-1} - n\right)\lambda_{h_t} m_{t-1}^* - n k_t^N$$

where, (5)

$$k_t^N = \frac{K_t^N}{A\,L_t^N}, c_t^N = \frac{C_t^N}{A\,L_t^N}, \lambda = \frac{L_t^H}{L_t^N} = \frac{L_T^H}{L_T^N},\ \lambda_{h_t} = \frac{A\,h_t L_t^H}{A\,L_t^N} = \lambda h_t,\ m_{t-1}^* = \frac{M_{t-1}^*}{A\,h_t L_t^H},\ k_T^N \ \textit{given}\ , \delta = 0$$

$$k_{t+1}^H - k_t^H = g\left(k_t^H, h_t\right) - c_t^H - m_t^H + \left(1 + r_{t-1} - n - g^{h_t}\right) m_{t-1}^* - \left(n + g^{h_t}\right) k_t^H - b_t$$

where, (6)

$$k_t^H = \frac{K_t^H}{A\,h_t L_t^H},\ c_t^H = \frac{C_t^H}{A\,h_t L_t^H},\ m_{t-1}^* = \frac{M_{t-1}^*}{A\,h_t L_t^H},\ b_t = \frac{\tilde{b}}{A\,h_t}, g^{h_t} = \frac{\tilde{b} t^{-1}}{h_t}, k_T^H \ \textit{given}\ , \quad \delta = 0$$

Equations (5.) and (6.) say that Investment in operating physical capital in each sub-economy is the left of production income after consuming (and paying for human capital nurturing expense for sub-economy H b_t*) and pay for break-even investment plus the '<u>net</u>' flow of loans (borrowing).* To note, m_t^N, m_t^H will be decided and revealed in period t, which then plays role in production in period t+1. Differently, m_{t-1}^* is the equilibrium loan from last period that is needs to be settled. That is, the borrower must pay back to the lender during period t.

Aggregate resource constraint of the economy

$$\left(K_{t+1}^H - K_t^H\right) + \left(K_{t+1}^N - K_t^N\right) + C_t^H + C_t^N + \tilde{b} L_t^H = G\left(K_t^H, A\,L_t^H, h_t\right) + F\left(K_t^N, A\,L_t^N\right) \qquad (7)$$

That is, at any time $t \geq T$, overall production income from both sub-economies is divided to total consumption, total investment in physical capital and total investment (in form of real expense) in human capital (of agents in sub-economy H).

Agents in sub-economy N and H

There are a fixed large number of agents (no population changes). This study focuses on a representative agent in each sub-economy N and H. The representative agent in each sub-economy maximizes the lifetime utility of all members within the sub-economy. The objective function of the agent in sub-economy N is:

$$V_T^N\left(k_T^N, k_T^H, h_T\right) \equiv \underset{\left\{c_t^N\right\}_T^\infty}{Max}\left\{A^{1-\theta}\sum_{t=T}^{\infty}\beta^{t-T}\cdot\frac{\left(c_t^N\right)^{1-\theta}}{1-\theta}\right\},\quad 0<\beta<1, c_t^N=\frac{C_t^N}{A\,L_t^N} \tag{8}$$

And, the objective function of the agent in sub-economy H is:

$$V_T^H\left(k_T^N, k_T^H, h_T\right) = \underset{\left\{c_t^H\right\}_T^\infty}{Max}\left\{A^{1-\theta}\sum_{t=T}^{\infty}\beta^{t-T}\cdot\frac{\left(h_t c_t^H\right)^{1-\theta}}{1-\theta}\right\},$$
$$0<\beta<1,\ 0<\beta^{t-T}\left(\prod_{s=T}^{T+(t-1-T)}\left(1+g^{h_s}\right)\right)^{1-\theta}<1,\quad c_t^H=\frac{\tilde{c}_t^H}{A\,h_t}=\frac{C_t^H}{A\,h_t L_t^H} \tag{9}$$

Per effective labor dynamic budget constraint of agents in each sub-economy

For sub-economy N,

$$k_{t+1}^N-k_t^N=r_{t-1}k_t^N+w_t^N-c_t^N-nk_t^N+m_t^N-\left(1+r_{t-1}-n\right)\lambda_{h_t}m_{t-1}^* \tag{10}$$

This means that representative agent of sub-economy N earns its rental income $r_{t-1}k_t^N$ from supplying all operating physical capital at hand k_t^N, and its unskilled wage income w_t^N from supplying unskilled labor. With this income, they must return both the principal and the interest rate income from physical capital that was borrowed from agents in sub-economy H from last period, i.e. returning $\left(1+r_{t-1}-n\right)\lambda_{h_t}m_{t-1}^*$. It's returned with interest rate r_{t-1} realized at period t. Having a net budget like this, agents choose levels of consumption, saving and borrowing.

For sub-economy H,

$$k_{t+1}^{H} - k_t^{H} = \left(r_{t-1} - n - g^{h_t}\right)k_t^{H} + w_t^{H} - c_t^{H} - m_t^{H} + \left(1 + r_{t-1} - n - g^{h_t}\right)m_{t-1}^{*} - b_t \qquad (11)$$

This dynamic budget constraint means that the representative agent of sub-economy H earns his rental income $r_{t-1}k_t^{H}$ from supplying all operating physical capital , per effective unit of labor, at hand k_t^{H}, and its skilled wage income w_t^{H} (per effective labor $A\,h_t L_t^{H}$) from supplying skilled labor. Above than this income, they also receive the principal including interest rate income from physical capital that was loaned from agents in sub-economy H from last period, i.e. returning $\left(1 + r_{t-1} - n - g_{h_t}\right)m_{t-1}^{*}$. Having net budget like this, agents choose levels of consumption, savings and loans, and have to pay for fixed cost E per effective labor as schooling expense at time T and fixed nurturing expense $\tilde{b}$ per person to nurture human capital every period after T.

Looking at (10.) and (11.), it is important to note is that in this model loaners and borrowers are able to fulfill obligation on loan. That is, loaners commit to give the whole amount of loan, and borrower will return it at full amount with market interest. Thus there is no default risk in the lending market.

Behavior of firms

Firms' behavior is relatively simple, compared to agents' behavior. At each point in time, they maximize the profit of that period by choosing operating physical capital and labor. All factors of production are paid their marginal products. And, we have that the unskilled wage per labor in unskilled labor market is:

$$W_t^{N} = (1-\alpha)A\left(k_t^{N}\right)^{\alpha}, \qquad (12)$$

The skilled wage per labor in skilled labor market is:

$$W_t^{H} = (1-\eta)A\,h_t\left(k_t^{H}\right)^{\eta} h_t^{\gamma}, \qquad (13)$$

And, physical capital market equilibrium condition *at time t* requires that equilibrium rental rate (interest rate) in this economy must equals marginal product of physical capital of each sub-economy due to free physical capital mobility:

$$r_{t-1} = \alpha\left(k_t^N\right)^{\alpha-1} = \eta\left[k_t^H\right]^{\eta-1} h_t^{\gamma}. \tag{14}$$

Because of the constant return to scale with respect to labor and physical capital, we can be certain that, with perfect competitive conditions with free physical capital flow between sub-economies and segmented labor market, firms in both sub-economies have zero profit.

Behavior of agents

The representative agent in each sub-economy wants to maximize their lifetime utility subject to their budget constraint by choosing the path of consumption (per effective labor), $c_t^d, d = N,H$, taking one another's consumption and saving decisions to be exogenous and taking equilibrium loan between two sub-economies, decided by integrated physical capital market, as a given. The representative agent in each sub-economy chooses their optimal level of consumption simultaneously.

Accordingly, agents in sub-economy N maximize (8.) subject to (10.) by choosing an optimal level of consumption. At the same time, agents in sub-economy H maximize (9.) subject to (11.) by also choosing an optimal level of consumption. Agents in both sub-economies must take into account perfect physical capital mobility constraint (4.b). With state variables of this model at time t: k_t^H, k_t^N, h_t, endogenous variables of this model at any time t: $c_t^H, c_t^N\ k_{t+1}^H, k_{t+1}^N, m_t$ are determined.

The prime equations characterizing the model and its dynamics

Given the maximizing behavior of firms and agents, the model is characterized by:

- Euler's equation of agents in sub-economy N:

$$\left(c_t^{N*}\right)^{-\theta} - \frac{r_t}{A^{1-\theta}} = \beta\left(1 + r_t - n + \frac{\partial r_t}{\partial k_{t+1}^N} k_{t+1}^N - \frac{\partial r_t}{\partial k_{t+1}^N} \lambda_{h_{t+1}}\left(p_{t+1}^H - k_{t+1}^H\right)\right)\left(c_{t+1}^{N*}\right)^{-\theta} \tag{15}$$

- Euler's equation of agents in sub-economy H:

$$\left(c_t^H\right)^{-\theta} - \frac{r_t\,\lambda_{h_{t+1}}}{\left(Ah_t\right)^{1-\theta}} = \beta\left(1 + r_t - n - g^{h_{t+1}} + \frac{\partial r_t}{\partial k_{t+1}^H} \cdot k_{t+1}^H + \frac{\partial r_t}{\partial k_{t+1}^H} \lambda_{h_{t+1}}^{-1}\left(k_{t+1}^N - p_{t+1}^N\right)\right)\left(1 + g^{h_t}\right)^{1-\theta}\left(c_{t+1}^H\right)^{-\theta} \tag{16}$$

- Dynamic budget constraint of agents in sub-economy N and H: Equation (10.) and (11.) respectively
- The physical capital market equilibrium condition: Equation (4.a), (4.b)

4. The Analysis of Theoretical Framework

The analysis will compare the impact of relaxing our assumption of perfect physical capital mobility between the two sub-economies, which will be called as the case of autarky.

From time T to ∞, if there were no physical capital mobility and all factors of production were immobile,, the interest rate at each period will not be equalized, and there will be no lending or borrowing, i.e. zero level of loans for every period. And, the steady state of physical capital for *the case of autarky for sub-economy N is :*

$$k_{ss,au}^{N} = \alpha^{1/(1-\alpha)}\left[\frac{1}{\beta}-(1-n)\right]^{1/(\alpha-1)}$$ and *for sub-economy H* is:

$k_{ss,au}^{H}\Big|_{h_t,h_{t+1}} = \eta^{1/(1-\eta)} h_t^{\gamma/(1-\eta)}\left[\frac{1}{\beta\left(1+g^{h_t}\right)^{1-\theta}}-\left(1-n-g^{h_{t+1}}\right)\right]^{1/(\eta-1)}$ for given level of h_t. This will be $k_{ss,au,\infty}^{H} = \eta^{1/(1-\eta)} h_\infty^{\gamma/(1-\eta)}\left[\frac{1}{\beta}-(1-n)\right]^{1/(\eta-1)}$ when human capital stops growing.

The time when the system is in the neighborhood of the convergent

Since in the case of mobility sub-economy *N* and *H* are tied together through equilibrium loan and equilibrium interest rate determining from the interplay between N and H, the system stops when sub-economy *N* and *H* simultaneously stop.

Taking into account the nature of the convergence of human capital, we denote the time when the system is in the neighborhood of the convergent as t^*.

Notably, t^* can be more than or equal to τ, exogenously determined time when human capital starts to converge. However, t^* can never be less than τ because the (almost) convergence must be the first condition for the system to start to converge.

The analysis will provide some cases that could happen within this framework where perfect physical capital mobility is allowed and there are competitive markets in goods and all factors of production, i.e. physical capital and labor.

Case 1: Increases in N and H's steady-state assets with uncertain impact on asset inequality

In this case, regardless of whether N or H is a borrower, there is an increase in both N and H's steady-state level of their assets.

It is the case when:

$$r_{t^*} < r^N_{ss,au} \text{ and } r_{t^*} < r^H_{ss,au}\Big|_{h_\tau, h_{\tau+1}} \text{, where } r^N_{ss,au} \cong r^H_{ss,au}\Big|_{h_\tau, h_{\tau+1}} \quad (17)$$

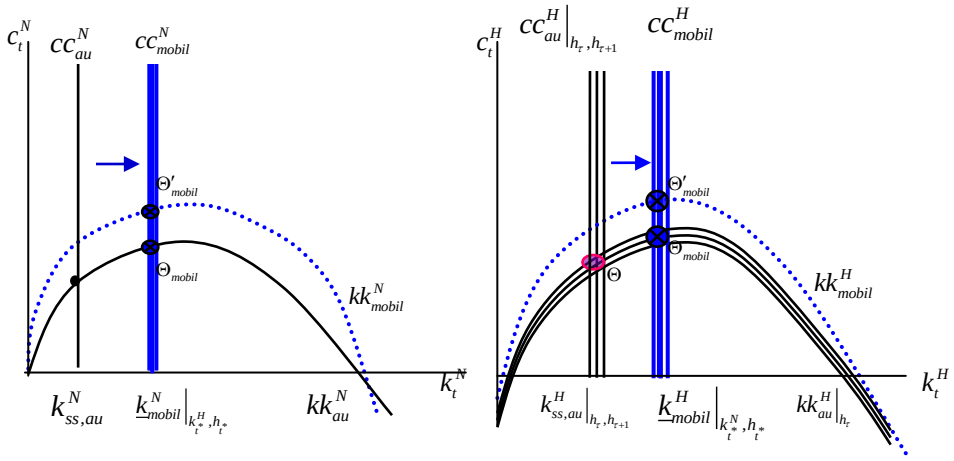
(17) says that the interest rate of the system when it starts to converge at time t^* is less than the autarkic steady state interest rate of sub-economy *N* and *H*, which are approximately the same since human capital already started to converge since time τ. Note that $t^* \geq \tau$.

That is, having perfect physical capital mobility eventually drives each economy to have more physical capital, hence more for overall economy as well.

Corresponding to this, both $cc^N_{mobil}\left(k^N_{t^*}, k^H_{t^*}, h_{t^*}\right)$ and $cc^H_{mobil}\left(k^N_{t^*}, k^H_{t^*}, h_{t^*}\right)$ curve (band) are to the right of the (band of the) curve in autarky.

Figure 1

Case 1: Increases in N and H's steady-state assets with uncertain impact on asset inequality



Please note that the bands of the curves in the figure cause the intersections between bands and line (band) to show the neighborhood around true steady states at infinity.

Since both cc_{mobil} curves shift to the right of the autarky's, this is the case when having perfect physical capital mobility allows both more efficient usage of physical capital resources and the *inclination* of people's behavior *to save more* along transitional paths. The decision on whether to save more compared to the state of autarky depends also on what happens to both of kk_{mobil} curves.

What would ordinary happen when perfect physical capital mobility is allowed is that the loaner receives higher interest income in each period compared to the case of autarky because of law of diminishing marginal product. Additionally, borrowers can invest more in each period through having production loan, hence they gain more income in the future, while encountering lower interest expense.

In this case, both lenders and borrowers benefit from having mobility, they approach the golden rule level of physical capital. And, this is possible because of the higher income opportunity and changing consumption-saving behavior. This can be analyzed as followed:

$$If\ t^* < t_{au}^{*N}\ and\ t^* < t_{au}^{*H}$$

That is, the time the system starts to stop or is in the neighborhood of steady state at infinity comes sooner than that in autarky for both sub-economies.

Considering time t^*, two prime factors determining whether this time is going to be shorter or longer than in autarky are the exogenous time τ when human capital starts to converge and the accelerating (or decelerating) time effect from having perfect physical capital mobility. The accelerating (or decelerating) time effect means whether having mobility helps economy reach the neighborhood sooner (or later).

The possibility of having $t^* < t_{au}^{*N}$ and $t^* < t_{au}^{*H}$ could be when τ is short enough and/or the accelerating effect is large enough, given that t^* must be more than or equal to τ. This means that human capital could have a low boundary level with a low level of real resource expense in each period, and the evolution of equilibrium loan approaches the neighborhood of zero soon. The second could be because there is no massive difference in initial physical capital between sub-economies, and all the benefit from having mobility such as higher income are invested in next periods physical capital continually.

And, if this faster speed of convergence happens, having mobility might even induce lower consumption in the early periods, for both borrowers and lenders. This should be possible and still be optimal behavior because, when having production loans mobile across sub-economies and the speed of convergence is faster, they can bear lower consumption in the early periods for the sake of a higher level of consumption in later periods, which will come sooner, giving a higher level of lifetime utility for both. Consistently, this is the case when the kk_{mobil} curves of both sub-economies *do not shift* from the autarky in the way that it can shift the level of consumption on saddle paths. In this case, the neighborhood of steady state at infinity is at Θ_{mobil}, which have higher levels of assets and consumption.

$$If\ t^* > t_{au}^{*N}\ and\ t^* > t_{au}^{*H}$$

The possibility of having $t^* > t_{au}^{*N}$ and $t^* > t_{au}^{*H}$ could be when τ is long and/or there is decelerating time effect from having mobility, given that t^* must be more than or equal to τ.

Unlike the above case, human capital in this case could have high boundary level with higher level of real resource expense in each period, and the evolution of equilibrium loan approaches the neighborhood of zero later. Massive difference in initial physical capital between sub-economies and smaller benefits from having mobility being invested in each period could explain the late arrival to the point zero of equilibrium loan.

In this case of slower speed of convergence, it must correspond to upward shifting of $kk_{mobil}^{H}\left(k_{t^*}^{N}, k_{t^*}^{H}, h_{t^*}\right)$ and $kk_{mobil}^{N}\left(k_{t^*}^{N}, k_{t^*}^{H}, h_{t^*}\right)$ curve, as shown by the dotted lines in the figures, and the neighborhood of steady state at infinity is at Θ'_{mobil}, with a higher level of consumption and assets than autarky.

This is because, such upward shifting corresponds to higher level of optimal consumption on the saddle path, agents are unwilling to forgo consumption today when the future payoffs are more distant. If the curves do not shift up, then agents have lower lifetime utility since there will be more periods with lower consumption given the slow rate of progress towards the steady state, compared to the case of autarky.

In the same way, higher levels of optimal consumption on the saddle path also helps explain late arrival to the neighborhood of steady state. In this case, capital mobility induces and allows people who are very poor, and who are poorer than in the above case, to consume more in each period along the transitional path. Hence, less resources are invested in each period, yielding the late arrival. Nonetheless, compared to the same situation but in the next case, mobility induces more saving. This will be explained shortly.

Higher lifetime utility

Compared to the state of autarky, for either slower or faster speed of convergence to the steady state, perfect physical capital mobility provides higher lifetime utility for both lenders and borrowers, regardless of the identification of N and H as borrower or lender.

With no upward shift in $kk^{N}_{mobil}\left(k^{N}_{t^*},k^{H}_{t^*},h_{t^*}\right)$ and $kk^{H}_{mobil}\left(k^{N}_{t^*},k^{H}_{t^*},h_{t^*}\right)$ but with faster speed to higher level of consumption in the neighborhood of steady state, agents have more periods with higher consumption, hence a higher level of lifetime utility. The faster speed of growth helps to compensate for the lower consumption in the early periods.

Despite slower speed to higher level of consumption in the neighborhood of steady state but with upward shift in $kk^{N}_{mobil}\left(k^{N}_{t^*},k^{H}_{t^*},h_{t^*}\right)$ and $kk^{H}_{mobil}\left(k^{N}_{t^*},k^{H}_{t^*},h_{t^*}\right)$, agents possibly live with higher consumption in every period compared to autarky, hence higher level of lifetime utility.

Nonetheless, we cannot compare lifetime utility between the case with the upward shift of kk_{mobil} curve and without it, because of the difference in the speed.

Asset inequality

In these cases, however, we cannot tell much about change in inequality of physical capital at steady state because it will depend on relative change of the steady state compared to the case of autarky in each sub-economy. Nonetheless, there is a possibility that the inequality will decrease because the poorer can move up more than the richer move, since it can be the case that the richer is already at or near the golden rule level.

Last but not least, this case is similar to the analysis by Ruffin (1979) who showed that perfect physical capital mobility between two-Solow economies causes an increase in steady-state level of asset, for both borrowers and lenders.

Case 2: No increases in N and H's steady-state assets and no change in asset inequality in the long run

In this case, regardless of N or H being borrower, there is no increase in either N or H's steady-state level of their assets, and the long run inequality in assets also will not change as a result of having perfect physical capital mobility.

Given that: $r_{t^*} \cong r^{N}_{ss,au} \cong r^{H}_{ss,au}\Big|_{h_\tau,h_{\tau+1}}$ (18)

Given the above, as shown in figure 4.9 below, both $cc^{N}_{mobil}\left(k^{N}_{t^*},k^{H}_{t^*},h_{t^*}\right)$ and $cc^{H}_{mobil}\left(k^{N}_{t^*},k^{H}_{t^*},h_{t^*}\right)$ are around the same points as the curves in autarky.

What has changed due to perfect physical capital mobility is the speed of convergence and the possibility of increased levels of consumption both during the transitional phase, and at the steady state.

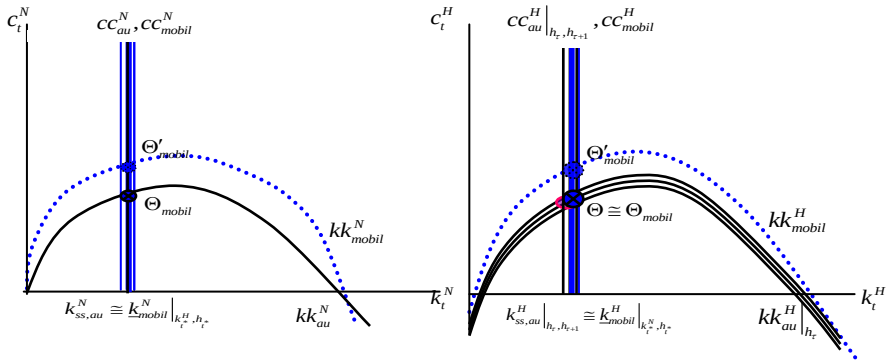
Case 2 is different from case 1 in that having mobility does not incline people to save more. Given this, the following analysis is parallel to case 1.

If $t^* < t_{au}^{*N}$ *and* $t^* < t_{au}^{*H}$

In accordance with a faster speed of convergence, $kk_{mobil}^{N}\left(k_t^N, k_t^H, h_t\right)$ and $kk_{mobil}^{H}\left(k_t^N, k_t^H, h_t\right)$ does not shift up. The system follows the same saddle paths as in autarky, but reaches the steady state neighborhood Θ_{mobil} sooner. That more physical capital can be invested in each period for borrower and that higher interest income can be received by the lender while consuming at about the same level as in autarky results in the faster speed.

Figure 2

Case 2: No increases in N and H's steady-state assets and no change in asset inequality



If $t^* > t_{au}^{*N}$ *and* $t^* > t_{au}^{*H}$

In this case $kk_{mobil}^{N}\left(k_t^N, k_t^H, h_t\right)$ and $kk_{mobil}^{H}\left(k_t^N, k_t^H, h_t\right)$ also shift upward in order to increase consumption along saddle path and at the steady state, while agents endure the costs of a slower speed to converge to the neighborhood Θ'_{mobil} of steady state at infinity.

Ceteris paribus, compared to case 1 when $kk^{N}_{mobil}\left(k^{N}_{t},k^{H}_{t},h_{t}\right)$ and $kk^{H}_{mobil}\left(k^{N}_{t},k^{H}_{t},h_{t}\right)$ also shift up, this case shows higher consumption but no capability increases in the end result of steady state asset.

Comparing to case 2 itself but with no shift of the kk_{mobil} curves, besides the long haul before human capital comes near the neighborhood of convergent point, the low initial assets and high inequality in initial assets could help explain the slow speed and the behavior of higher consumption in each period, it being worse to have a hen tomorrow than an egg today.

Higher lifetime utility

Lifetime utility in both cases should be higher because mobility allows more periods with higher consumption in the first case with the shift, and more consumption in each period in the second with no upward shift. Nevertheless, lifetime utility between the case with and without shift in kk_{mobil} curves cannot be compared and judged which one has higher level. This is because of different in speed, the number of periods and amount of higher consumption cannot be counted explicitly within this analysis.

Synthesis from 2 cases

In these two cases of analysis, it does not matter whether *N* or *H* is the borrower or lender. Whether the influence of scarcity is more than the influence of human capital spill over in lifting up interest rate is not the crucial component determining the benefit from having mobility as long as the process of mobility occurs and productive loans are made.

Due to no-ponzi game condition, eventually the equilibrium loan/borrowing between sub-economy *N* and *H*, under perfect physical capital mobility, will be zero.
However, the beneficial outcomes of having mobility does not depend on the necessity to have non-zero equilibrium loan and borrowing till infinity.

In all cases, the process of having mobility in the form of production loans allows for more efficient usage of physical capital resources among sub-economies, and allows opportunities of having dynamic pareto improvements.

It is also shown that perfect physical capital mobility presents the possibility of higher steady states of consumption per effective unit of labor of in both sub-economies than would be the case of autarky (in which there is no physical capital mobility between two sub-economies), as well as the possibility to have higher steady state asset levels. And even though loans are not used for consumption, consumption when having loans can be higher because of the increase in production, yielding higher lifetime utility.

Lastly, because of the existence of mobility, persistent inequality in steady-state asset levels between the two sub-groups of people can be changed, with the possibility of permanently reduced inequality.

Also note, if we break the assumption of equal time preferences among people in N and H, there can be more cases to be analyzed. In those cases, whether N or H is the borrower or lender does matter.

A Case Study of One Village Fund in Thailand. *How does the role of Village Fund relate to the essence of model?*

Although the initial working capital came from the central government, the village fund can be *straightly* regarded as a fund of the village belonging to every person who has been census registered within the village. This is because all villagers registering in the census are eligible to be the Fund's member with the right to borrow from it.

Village Funds are locally run, and have discretion in setting interest rates within a determined band, in setting maximum loan amounts, and in setting the terms of loans. Some require, or at least encourage, savings deposits as a condition for borrowing. The Village Fund Committees process loan applications; agents borrow and repay with interest; and the money is lent out again.

The way the program placed the money into each village – it positioned the fund as the central asset of the village belonging to all villagers, let the village manages its fund by itself, and encouraged borrowing-lending activities among villagers – is similar to the introduction of capital mobility between two groups of people, those who borrow and those who don't.

According to this, the lender in the model can be compared to the group of people in the Village who are not willing to borrow from the VF, both who are fund's members and who aren't even if they are eligible. This is because all villagers mutually and equally own the Village fund and have the right to borrow. If they do not borrow, it is comparable to them depositing their own money into the village fund and receiving principal and interest from their money back when borrowers settling their loan from the fund. Moreover, what really happens is that there are villagers who don't wish to borrow from the fund, but are members who only deposit their money into the fund. The fund lets the money move to borrowers. This fact reinforces the idea that having a village fund is a means to create local capital mobility.

The Village fund is (still) limited to only the villagers thus the idea is comparable to the closed two-big-sub-economy model with the same product setting of the model.

Village funds perform usually only the main role, which is to lend out short term loans for production. The minor role of being cooperatives or insurance institutions is usually out of the picture. Therefore, we can focus on the role of having physical capital mobility in the village.

5. To study the implication of the model through the operating outcome of Village Fund

To be consistent with the assumptions of model, this paper will limit its empirical focus to *cases that the loans are not used for consumption*, hence we limit ourselves to the case of Village Funds that have high repayment rate.

For the direction of this case study, similar to Boonperm, Haughton, Khandker (2009), we can ask a narrowly focused question: *Has the VRF had an impact on relatively poor and/or relatively non-poor agent incomes, spending, and asset accumulation, and, if so, which direction are these effects?*

Choosing a village to be a case study

To study the implication of the model, the example to be studied must have an environment that corresponds with model's assumption as closely as possible.

The critical assumption that model in theoretical framework constructed upon is that there are two sub-economies. More importantly, these two sub-economies must be different from each other in ways consistent with the posited production functions.

The production functions must produce the same output, but the production function of sub-economy H must have 'human capital' as another factor of production.

Accepting selection bias

The assumptions from theoretical framework frame the criteria for selecting a village to study.. However, the way the studied village is chosen, and the fact that only one non- random village is chosen, does increase the chance of selection bias.

Therefore, the following case study only serves as an example of real world situations that can be captured by theoretical framework constructed in this study. Thus, any conclusion drawn from the case study is not qualified to be generalized. The case study is not for the purpose of statistical inference.

The chosen village, "Tossatispattana" village ("Khlong Soi 11" village), Khlong Soi 11, Moo. 2, Tambol Bueng Thonglang, Amphoe Lam Luk Ka, was chosen for its suitability, eligibility and its willingness to cooperate.

What are sub-economy N and H in the case study?

We can separate rice production in this village into two sub-economies, according to the size of rice field farmers operate on. This is because differences in size leads to differences in the structure of production.

Sub-economy N is rice production with smaller rice field. Sub-economy H is rice production with larger rice field and better skill and capability to do "Lodged stubble ratooning" technique which is treated as human capital in the model.

The complicated realities

In the idealized model, people within the same sub-economy share the same behavior, as shown by the representative agent. Thus, in the model all people in sub-economy H are lenders and all people in sub-economy N are borrowers.

However, in this sample, there are following complications:

(1) Out of 28 rice farmer households[10] in the village, there are about 10 households who hold paddy ranging from 10 to 38 Rais and are eligible to be members of the village fund but refuse to be. Thus, these households can be regarded as lenders in the model.

(2) There are 2 individuals (2 households[11]) who operate 28 and 35 Rais of rice paddy and are members of village fund who have never borrowed from the village fund.

(3) There are 8 individuals (5 households) who operate 55, 61, 70, 70, 120, 120, 120, 120 Rais of rice paddy and are members of village fund who borrowed only once or never from village fund. Among these household, there are 2 individuals (2 households) who do *lodged stubble ratooning* technique regularly.

(4) There is 1 member (1 household) of the village fund and operating 70 Rais paddy farm, who does *lodged stubble ratooning* technique, who has borrowed from the village fund every year.

(5) There are 11 individuals (10 households) who operate 15, 20, 20, 26, 30, 35, 37, 40, 50, 50, 50 Rais of rice paddy who are members of the village fund who borrow from the village fund almost every year.

Analyzing the complication

From the interview with the key informants, (1.) and (2.) are actually farmers who once held large rice field, but sold their fields out. Currently their households gain relatively high income from their educated children. Rice farming now provides supplementary income to the households.

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[10] The total number of farmer in this village is counted in household unit in BMN database.

[11] Households are counted based on same house identification number.

Therefore, these households will be taken as households in sub-economy H, since if they hadn't sold out their land, they would have operated large rice paddies.

In sum, individuals in (1.), (2.), (3.) will be regarded as households in sub-economy H with capability to do ratoon cropping of lodged stubble. And, according to existing member's borrowing-lending record since 2001, these households have borrowed once or neverone. Thus, in this sample, sub-economy H is the lender.

To summarize, the average area of rice fields of households in sub-economy H, calculating from the available data, is 79.9 Rais/individual.[12] Their average estimated income is 8,200 Baht/person/month.

Their rice productivity rates range from 500 kg./rai to 1,200 kg./rai. The farmers who gain 1,000 -1,200 kg./rai. use lodged stubble ratooning technique.

For (4.), this rice farmer earns about 10,000 baht/month, operates 70 Rais of rice field, adopts lodged stubble rationing technique, borrows 7 times from village fund, and owns 4,900 baht saving at village fund. This is outlier from the pattern studied here.

Furthermore, households in (5.) will be regarded as households in sub-economy N, since they share the same characteristics of operating smaller rice field. Also, they all have been continuous borrowers from village fund.

Averaging from 11 individuals in (5.), they operate 33.9 rais/individual and earn average estimated income at 6,273 Baht/person/month.

Their rice productivity rates range from 500 kg./rai to 1,050 kg./rai. with no using of lodged stubble ratooning technique.

Thus, persons in sub-economy N are poorer than persons in sub-economy H on average. Their monthly income is less than H by 1,927 Baht/person/month. They also hold smaller rice

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[12] Ones living in same household may own different size of paddy rice but they operate the whole rice field of household together. Therefore, household's paddy field is counted for each individual in the same household.

paddy field, with 46 Rais/person less than H, and finally the farmers in N do not practice lodged stubble ratooning technique.

Analysis of the effect of the Tossati spattana village fund

Based on the classification of sub-economy N and H above, 2 informants in each sub-economy were interviewed, and the village fund's saving record was analyzed.

For households in sub-economy N

The interviews with 2 members of sub-economy N revealed the following:

1) Loans from village fund have been used for pesticide and fertilizer expenses. Practicing typical methods to grow rice without pesticides and fertilizer results in farmers being able to barely gain rice from the field.

2) If there is no loan from village fund, the amount available is too low, they finance these particular expenses by mostly using credit from local pesticide/fertilizer stores or from private agricultural credit unions.

3) Both sources of credit charge higher interest rates. Prevailing interest rates at local pesticide/fertilizer store is about 2-2.5%/month, which is equal to 24-30% / year. The repayment period is every 4 months.

4) One informant also still has an outstanding 10,000 baht loan with a pesticide/fertilizer store.

5) Sometimes, loans from the village fund are used for emergency loans when the fields flood, and new seed rice is needed.

6) Being able to save with the village fund does not help promote savings significantly, but being able to borrow from village fund helps ease constraints when deciding to consume. One informant told that since he had 20,000 Baht from village fund, he roughly thought that he can count his saving equal to half of the loan in budget for consumption, taking into account that repayment at the end of the year is obligatory. . Additionally, he told that he actually had more consumption.

7) From 2001, the two informants have borrowed 7 and 8 times, respectively. They informed me that their asset have increased, compared to 10 years ago, but it is hard to see whether this change is the result of being able to access loans from the village fund because of its small amount.

Given the above, it indicates some consistencies with case 1 in the analysis of theoretical framework in that:

a.) In these periods, they used loans to exchange for productive factors of production. In spite of the fact that if they couldn't access village fund, they would receive loans from local agrochemical stores, with village fund there is possibility that they put relatively more productive factor of production into production.

b.) In this situation, the unnecessary production expense of an excessively expensive interest rate is the expense that is not productive, because it is only the expense for the purpose of gaining credit when there is no village fund. Thus, it can be viewed as a non-productive consumption expense. *Accordingly, with village fund, this regarded consumption is reduced.* Therefore, if this process keeps going on there is possibility that with access to the village fund, poor farmers will end up with more assets and more consumption, consistent with the shift to the right of cc^{N}_{mobil} curve.

However, from the interview, the optimal decision making on real consumption might result in a higher level of consumption. Therefore, in this case, there are possibilities both for higher or lower level of consumption, compared to the case of autarky. Thus, this might be the indication of the possibility of upward shift of kk^{N}_{mobil} curve.

For households in sub-economy H

According to the interview with two farmers categorized as individuals in sub-economy H, some important findings are as followed:

1) Participating village fund, one economic benefit is dividend and one social benefit is to have community participation. The interviewed farmers seemed to value the social benefit highly.

2) The main financial institution they depend on is not the village fund. They have actual income each year of around 300-400 thousands baht with no debt. But, they own village fund pledged saving share only 4 and 10 shares. And, one of them borrowed only once for fertilizer.

3) Their main saving institution is Siam Commercial Bank and BAAC, while the main lending institution, if necessary, is credit cooperative which can be borrowed up to 500 thousands, SCB, and BACC. Normally, they use their own saving for investment, the stated reason for doing so was to avoid unnecessary interest expenses.

These findings show the role of exogenous factors not existing in the model which are the openness of the whole local economy to outside financial system. That is to say that in the village, aside from the two sub-economies, there exists an external credit market that has a significant impact on physical capital mobility.

Accordingly, the level of consumption and the benefits from the village fund is hard to captured. The explicit benefit of perfect physical capital mobility exhibited in case 1 in the analysis of the framework cannot be verified in the case study.

This shows that once one has enough assets, one can gain access to the formal financial system. Microfinance and within community financial reliance may not be necessary.

Exogenous factors outside the model but existing in the case study

Small village economy is open to the formal financial system.

In the model, there are two sub-economies within the village. When perfect capital mobility exists, all saving from richer agents flies to poorer agents. In the real world, saving of richer agents in the village flies out of the village to more secure formal financial institutions, hence to borrower who can access such formal services.

Production risk could change behavior of agents borrowing and lending from village fund

Since the scope of occupation studied here is rice farmer, aggregate risk such as weather risk, flood risk could change the pattern of lending and borrowing and affect the role of village fund as a provider of emergency loans.

6. Conclusions and Implications

The framework constructed here has shown that perfect physical capital mobility allows more efficient usage of physical capital resources among sub-economies. The mobility causes change in optimal consumption and optimal physical capital holding levels at each point in time and at the steady state. And, at the end of time, steady state of physical capital per effective labor and consumption per effective labor of both sub-economies in the case of perfect mobility can be higher than the case of autarky in which mobility is not allowed. The possibilities and opportunities to have dynamic pareto improvement are presented.

It widely accepted in the poverty and inequality literature that better access to credit for the purpose of production, here in the form of having perfect physical capital mobility theoretically and in the form of microfinance in reality, can be a useful tool to tackle poverty and inequality. Here, this useful tool,, is not a magic wand, making persistent poverty and inequality disappear. Its role is basically to provide the chance for the poor to be better off, to become less poor, thus breaking the cycle of poverty. Given that both the wealthy and poorer farmers stand to gain in this model, it can be argued that we may not have to trade off equality for efficiency. Thus, ceteris paribus, for such chance to be provided, less friction on physical capital mobility in reality can be a way of achieving greater wealth for all.

From the study of this theoretical framework and a case study as an example of real situation, there is tremendous room for this model to be further developed. The consideration of production loan and switching occupation options, the incorporation of uncertainty into the model,

and the rethinking about village as small open economy with the mobility of physical capital across villages, are all extensions to the model that would better fit the actual conditions of the studied village. These further studies should provide more opportunities to be better captured with important aspects of the livelihood of the poor.

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