

CHAPTER 5

METHODOLOGY

This chapter is composed of four main sections. The first section explains the assumptions underlying the model that is to be simulated. The second section describes briefly the parameter estimation for the base case model. The third section shows the model simulation results that will be focused. The last section describes the data to be used.

5.1 Assumptions

The following simplifying assumptions are made in the model economy presented in Section 4.1:

- Households live for $I = 60$ periods, corresponding to real-life age of 21 to 80 years old. They work for 45 years, before retiring when turning 66, and die with certainty 15 years later. Taxes and social security system as well as pension income is assumed away.

- Production sector produces one aggregate output with standard Cobb-Douglas technology subject to aggregate productivity shock. The aggregate output can be consumed, invested in business capital or invested in housing capital. Investment in business capital yields rental incomes where as investment in housing capital yields housing service.

- Households derive utility from consuming non-housing goods, housing service and leisure. The idiosyncratic productivity shock and aggregate shock, assumed to follow first-order autoregressive processes, is observed before households make consumption, investment and leisure decisions and get labor and capital income. Households are endowed with one unit of time each period to be allocated between working time and leisure.

- It is assumed that housing value (in unit of consumption goods) reflects the housing service that any households can enjoy from owning the house. That is, we

ignore the complication regarding the types of houses and assume that a single detached house, for example, would yield the same housing service to any households as a townhouse or any other type of house if the prices (in unit of consumption goods) are the same.

- To avoid adjustment cost related to housing capital, households have to maintain the housing capital by paying the maintenance expense at an amount equal to the depreciation in each period. Deviating from this strategy implies selling the house and the adjustment cost in the amount of $\Omega(h', h) = 0.5 \tau (h' - h)^2$ will be incurred.

- There is no house rental market – all households are homeowners. And to be consistent, households do not earn rental income on the part of excess housing capital holding. Households cannot choose to consume a fraction of housing capital it owns and rent out the rest for rental income. This assumption helps avoid having to model the choice between investing in business capital versus investing in housing for rent and to model the choice between being a renter versus being a homeowner, which often involves making some restrictive assumptions.

5.2 Parameter Estimation

The following parameters are used in the simulation of the base case model, which is meant to replicate the Thai economy for the period 1980-2005.

5.2.1 Parameters related to preference

- Discount factor: β

The discount factor used in the model is 0.93, which is chosen to match the capital/output ratio of the model to the average capital/output ratio of the Thai economy during 1980-2005. This figure is close to 0.94 which Otsu (2007) used as a discount factor for Thailand. Table 5.1 shows the summary of discount factor used in various studies as compiled by Photphisutthiphong (2007).

TABLE 5.1
Summary of discount factor used in various studies.

Author	Country	Period of study	Discount factor
Bridji (2007)	France	1930s	0.96
Chakraborty (2005)	Japan	1980-2000	0.972
Chari, Kehoe, and McGrattan (2006)	U.S.	1900-2005	0.97
Cociuba and Ueberfeldt (2006)	Canada	1950-2005	0.962
Inaba and Kobayashi (2006)	Japan	1981-2003	0.98
	U.S.	1929-1939	0.97
Lama (2005)	Argentina	1990s	0.88
	Brazil	1990s	0.90
	Mexico	1990s	0.77
Otsu (2007)	Hong Kong	1960-2003	0.942
	Korea	1960-2003	0.889
	Singapore	1960-2003	0.911
	Thailand	1960-2003	0.94

Compiled by Photphisutthiphong (2007)

For the U.S. economy, Prescott (1986) (later followed by Aiyagari (1994), Krusell and Smith (1998), and Krusell and Smith (1997), etc.) estimated the discount factor to be 0.96 in order to achieve the annual real interest rate of 4 percent. In another study, Cooley and Prescott (1995) chose the discount factor to be 0.947 to match the steady-state output/capital ratio. Rios-Rull (1996) chose the discount factor and depreciation rate of capital to deliver simultaneously two conditions: a certain investment-output ratio and a certain capital-output ratio, and got the discount factor of 1.011¹. Villaverde and Krueger (2005) estimated the discount factor jointly with the ratio of expenditures on non-durables and durables so that the interest rate in the steady state equilibrium is 4% and came up with the parameter value of 0.9375 for the discount factor. Nakajima (2005) employed exactly-identified Generalized Method of Moments to choose the discount factor and the aggregation parameter for non-housing goods and housing services to match the ratio of housing asset to output and non-housing asset to output and obtained the value of discount factor of 0.9479.

¹ In Rios-Rull (1996), the probabilities of surviving at each age are included in the utility function, so the discount factor could exceed one.

With the discount factor of 0.93 used in the base case model, the real interest rate net of depreciation based on the simulation results is ranging from 3.3% to 7.9%, with the mean of 5.5%. Over the period from 1980 to 2005, the average interest rate is around 9.9%² and the average inflation rate is around 4.7%³, leaving the real interest rate at around 5.3%, which is in line with the model result when discount factor of 0.93 is used. Table 5.2 shows the resulting interest rate for different values of discount factor.

TABLE 5.2
Resulting interest rate (net of depreciation) for different values of discount factor -
Base case model.

Interest rate net of depreciation	$\beta = 0.91$	$\beta = 0.92$	$\beta = \mathbf{0.93}$	$\beta = 0.94$	$\beta = 0.95$
<u>Average</u>	<u>7.6%</u>	<u>6.5%</u>	<u>5.5%</u>	<u>4.5%</u>	<u>3.5%</u>
Maximum	10.3%	9.1%	7.9%	6.7%	5.6%
Minimum	5.2%	4.2%	3.3%	2.4%	1.5%

- Preference for leisure: ω

Based on the 2005 (Q1–Q4) Labor Force Survey by NSO, individuals of age 21 and older spent on average 33, 34, 36, and 36 hours per week at work for Q1, Q2, Q3, and Q4, respectively. Assuming as in Imrohoroglu et al. (1995) that individuals have 98 hours of discretionary time (i.e. time not spent sleeping or in personal maintenance) per week, the parameter of preference for leisure is set such that the

² The average of lending rate (MLR) and deposit rate (3-month time deposit) in each month is taken to be the interest rate for the month. The result (9.9%) is the arithmetic mean of the interest rate in each month from 1980 to 2005.

³ 4.7% is the arithmetic mean of the annual change in headline CPI from 1980 to 2005.

households in the model allocate about 35%-36% of their discretionary time at work. This number turns out to be 1.08.

For the U.S. economy, Prescott (1986) set this parameter⁴, in one of the sections, to be two based on the observation of Ghez and Becker (1975) that households allocated approximately one-third of its productive time to market activities and two-thirds to non-market activities. Note that the estimated fraction of time spent at work was similar to our study. One of the reasons that the parameters are different is that our households are not homogeneous in terms of age-dependent efficiency and productivity type. With homogeneous agents, everyone spends the same fraction of time at work, equal to the target. In our study, different households spend different fraction of time at work, with the average equal to the target. To be more specific, all retired households spend no time to work at all. The working households take into consideration their level of wealth, their age-dependent efficiency level, and their different productivity type in deciding the optimal amount of time to spend at work. The parameter ω is set at 1.08 so that the average fraction of time spent at work of all retired households and different working households is close to 35%-36%, as evidenced in the 2005 Labor Force Survey.

The study that is most similarly structured to this study is Silos (2007). This parameter is set at 1.2 in that study to achieve the same goal as Prescott (1986).

- Expenditure share of non-housing goods: θ

This ratio is derived from the 2006 Household Socio-Economic Survey by NSO. The field name ‘EG011: house rent’ is taken to be the monthly expenditure in housing and the field name ‘A08: average monthly consumption expenditure per household’ is taken to be total monthly expenditure. Considering only households who are renters (with the field name ‘HH03: tenure’ = 5), the average of the ratio $(A08 - EG011)/A08$ is computed to be 0.85.

⁴ In Prescott (1986), the utility is of the form $u(c_t, l_t) = (1-\alpha) \log c_t + \alpha \log l_t$ where c_t is consumption at time t and l_t is leisure at time t . The parameter α is set at 2/3, which is equivalent to setting ω in this study at two.

5.2.2 Parameters related to production

- Income share of capital: α

Basically, the income share can be computed from the national income account. The problem arises, however, because there is a very large proportion⁵ of income classified as income from unincorporated enterprises. The income of unincorporated businesses is a mixed income category that includes the returns to both capital and labor. Some authors, for example, Tinakorn and Susangkarn (1994) make the estimation by imputing to the self-employed the average wage rate of employees, based on the social accounting matrix 1987, and computing the returns to capital as a residual. With this adjustment, their estimated labor income share is 48.4%. Chandrachai, Tubtimtong, and Chockpisansin (2004) use the employment data in 1977-1999 from the third round of Labor Force Survey conducted by the NSO. The total employment is classified into employers, private employees, government employees, own-account workers, and unpaid family workers. The wage rates for employers, own-account workers, and unpaid family workers are not available; so, they use the private employee wages as a proxy and combined the payment for private employees and government employees to calculate the total payment. The labor share is then calculated from the ratio of total labor payment to GDP at factor cost. Sitthikul (2001) estimates the factor shares by multiplying the number of workers by an estimate of the wage rate⁶, and reports a labor share to be 44% in 1995. Mallikamas, Thaicharoen, and Rodpengsanghaha (2003) use two different approaches to calculate the share of capital. The first estimate is done by excluding ambiguous income (, which cannot be classified as labor income or capital income) and calculating factor income shares from the remaining items of national account. This results in an estimate of capital share ranging from around 30%-35% after the 1997 crisis. The second approach is based on the method developed by Sarel (1997), which involves using cross-national data to compute capital shares for sectors with similar capital intensities. Then internationally-determined shares are applied to sector

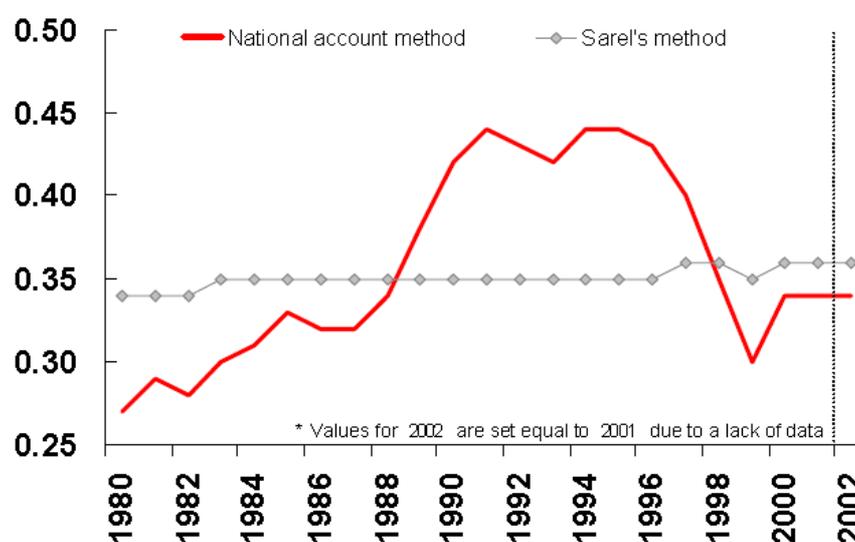
⁵ In the range of 30%-40% of national income in recent years.

⁶ Full details of calculation are not available.

composition of individual countries – that is capital share of a country is a weighted average of sectoral capital shares. This results in a capital share of around 35% from 1980 to 2002.

FIGURE 5.1

Estimated capital share for Thailand for the period 1980-2002*



Source: Mallikamas, Thaicharoen, and Rodpingsangkaha (2003)

Figure 5.1 shows the estimated capital share for Thailand from 1980 to 2002 based on Mallikamas, Thaicharoen, and Rodpingsangkaha (2003). Most of the difference in the estimates of various studies is basically due to different treatment of income from unincorporated enterprises. We follow Mallikamas, Thaicharoen, and Rodpingsangkaha (2003) and take income share of capital (α) and labor ($1-\alpha$) to be 35% and 65%, respectively.

- Aggregate productivity shock: z

The computation of the technology process amounts to fitting a first-order autoregression to the deviations from a linear trend of the logarithm of the Solow residual. The Solow residual is a measure of all influences on output growth other than the contributions of capital and labor through their marginal products. Let GDP_t

$= A_t K_t^\alpha N_t^{1-\alpha}$. This implies the log-linear relationship $\ln(A_t) = \ln(GDP_t) - \alpha \ln(K_t) - (1-\alpha) \ln(N_t)$.

Quarterly data from 1993 to 2005 are used. For this purpose, GDP_t is gross domestic product at 1988 prices. K_t is total net capital stock of both public and private sector at 1988 prices. The net capital stock series are only reported annually, whereas the gross fixed capital formation series are available on a quarterly basis. As a result, the net capital stock at the beginning of each quarter can be estimated by assuming equal depreciation in each quarter of the same year. N_t is average weekly hours worked times total employment based on the Labor Force Survey by NSO. From 1998 to 2005, the survey was conducted every quarter. In 1994 and 1996, the survey was not conducted in the fourth quarter. In 1993, 1995, and 1997, the survey was only conducted in the first and third quarters. Simple linear regression on the complete data from 1998 to 2005 is used to estimate the missing quarters from 1993 to 1997. There are large swings in GDP_t and N_t series from quarter to quarter as shown in solid lines in Figure 5.2 and 5.3, respectively. These series are seasonally adjusted using X-12 method. The seasonally adjusted series are also shown in both figures in dotted lines.

Once $\ln(A_t)$ has been computed, its deviations around a linear trend is the empirical counterpart of the aggregate productivity shock in the model. This shock is modeled as a first-order autoregressive process⁷

$$\ln z_t = \rho \ln z_{t-1} + \varepsilon_t, \quad \varepsilon \sim N(0, \sigma_\varepsilon^2)$$

The parameter ρ and σ is estimated to be 0.901 and 0.0243, respectively, in quarterly frequency. Converting into annual frequency, the ρ and σ is 0.658 and 0.0347, respectively.

⁷ We also try to model the shock with AR(2) but the Akaike information criterion is higher than AR(1).

FIGURE 5.2
GDP and the seasonally adjusted series

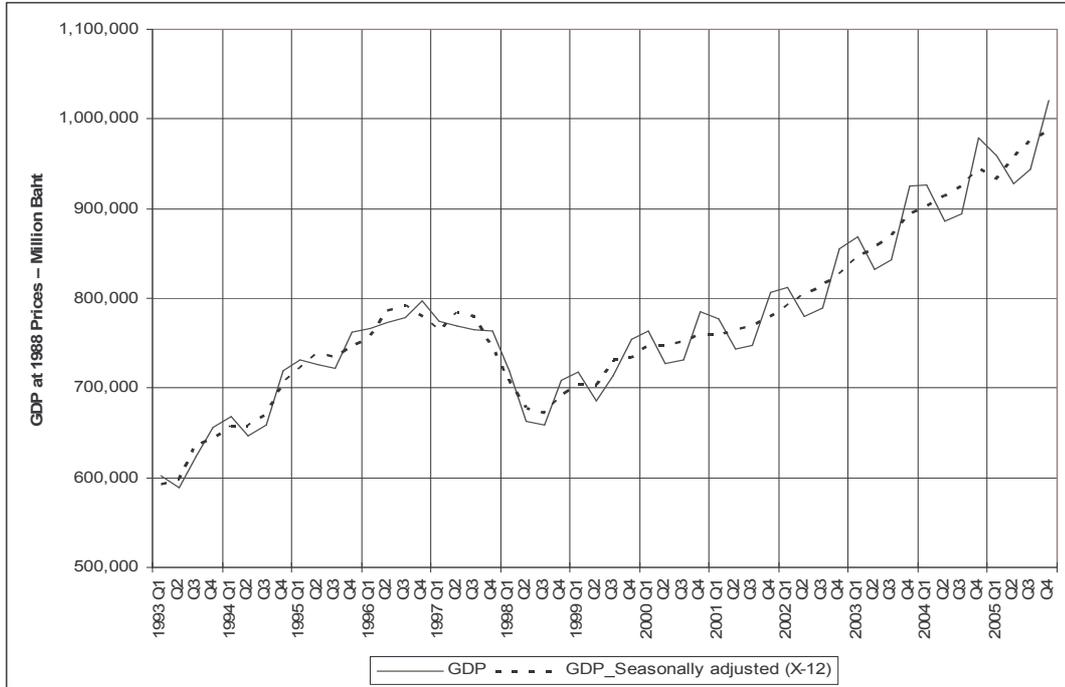
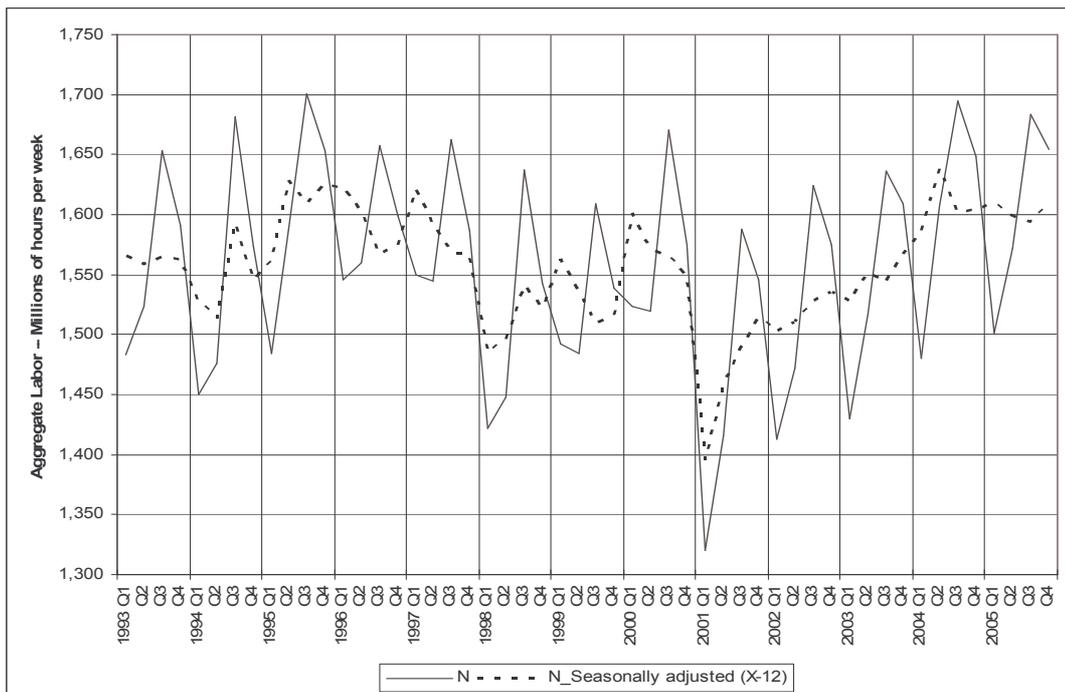


FIGURE 5.3
N and the seasonally adjusted series



After that, we approximate the process as a two-state Markov chain, following the method proposed by Tauchen (1986). In Tauchen (1986), a method for choosing value for the realizations and the transition matrix so that the resulting Markov chain closely mimics the underlying continuous valued autoregressive process is developed.

Consider the process $B_{t+1} = \rho B_t + \varepsilon_t$, $\varepsilon \sim N(0, \sigma_\varepsilon^2)$. The unconditional mean and variance of this process are 0 and $\sigma_B^2 = \sigma_\varepsilon^2 / (1 - \rho^2)$ Tauchen (1986) proposed to choose a grid $\mathbf{B} = [b_1, b_2, \dots, b_m]$ of equidistant points $b_1 < b_2, \dots, < b_m$, whose upper end point is a multiple, say λ , of the unconditional standard deviation of the autoregressive process, $b_m = \lambda \sigma_B$ and whose lower end point is $b_1 = -b_m$. For a given realization $b_i \in \mathbf{B}$, the variable $b := \rho b_i + \varepsilon$ is normally distributed with mean ρb_i and variance σ_ε^2 . Let db denote half of the distance between two consecutive grid points. The probability that b is in the interval $[b_j - db, b_j + db]$ is given by:

$$\text{prob}(b_j - db \leq b \leq b_j + db) = \pi(b_j + db) - \pi(b_j - db)$$

where $\pi(\cdot)$ denotes the cumulative distribution function of the normal distribution with mean ρb_i and variance σ_ε^2 . Equivalently, the variable $v := (b - \rho b_i) / \sigma_\varepsilon$ has a standard normal distribution. Thus, the probability to switch from state b_i to state b_j for $j = 2, 3, \dots, m - 1$, say p_{ij} , is given by the area under the probability density function of the standard normal distribution in the interval:

$$\left[\frac{b_j - \rho b_i - db}{\sigma_\varepsilon}, \frac{b_j - \rho b_i + db}{\sigma_\varepsilon} \right]$$

The probability to arrive at state b_1 is the area under the probability density in the interval $[-\infty, b_1 - db]$. Since $\sum_j p_{ij} = 1$, the probability to go from any state i to the upper bound b_m is simply $p_{im} = 1 - \sum_{j=1}^{m-1} p_{ij}$.

In this case, we set the number of state to 2 and set $[0.955 \ 1.047]$ to be the support for z . The transition probability matrix is given by:

$$\pi(z' | z) = \begin{bmatrix} 0.809 & 0.191 \\ 0.191 & 0.809 \end{bmatrix}$$

- Idiosyncratic productivity shock and age efficiency profile: ζ and η

Similar to Huggett and Ventura (1999), a labor endowment process where the log of the labor endowment of an age j agent in efficiency units (y_j) regresses to the mean log endowment function of age j agents (\bar{y}_j) at rate ρ^ζ is assumed. This process can be written as:

$$y_j - \bar{y}_j = \rho^\zeta (y_{j-1} - \bar{y}_{j-1}) + \varepsilon_j \quad (5.1)$$

where $\varepsilon \sim N(0, \sigma_y^2)$, $y_1 \sim N(\bar{y}_1, \sigma_{y1}^2)$

Since the long-enough panel data of income at the household level are not available for Thailand, the indirect method for estimating these parameters ρ^ζ , σ_{y1}^2 , and σ_y^2 are considered. σ_{y1}^2 will be set so that the Gini coefficient of the youngest households in the model economy matches the observed data. ρ^ζ and σ_y^2 will then be chosen to match the age profile of Gini coefficient for all households in the model economy, which is simulated using a random number generator, to the actual data.

The field name ‘IW10: wages and salaries’ in the 2006 Household Socio-Economic Survey by NSO of the household head is taken to represent efficiency unit of individuals. In the survey, as many as three occupations may be included for each

individual. The sum of the field name ‘IW10: wages and salaries’ for all three occupations is used.

To better capture the pattern in the data, the individuals aged 21 to 65⁸ are classified into 15 three-year age groups, with the first age group for individuals aged 21-23. The mean income for each age group is shown in Table 5.3.

TABLE 5.3

Mean income of Thai households in each age group and the GINI coefficient, based on 2006 Household Socio-Economic Survey by NSO.

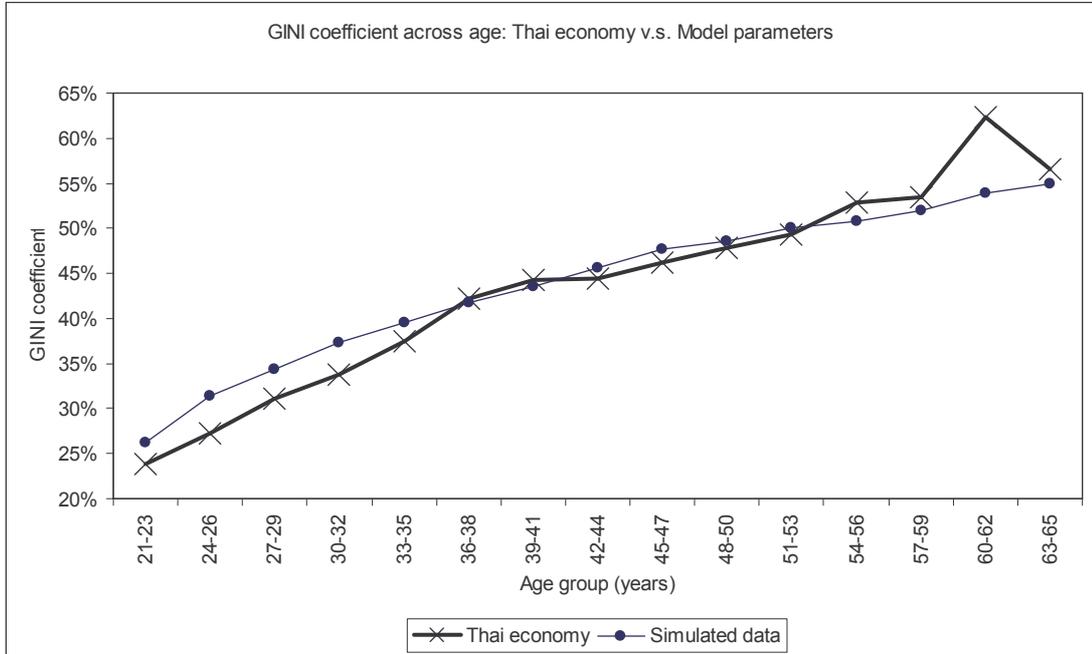
Age group	Age range	Mean income (Baht)	Age efficiency profile: η	GINI coefficient
1	21-23	5,381	0.554	24%
2	24-26	6,454	0.664	27%
3	27-29	7,162	0.737	31%
4	30-32	7,539	0.776	34%
5	33-35	8,280	0.852	37%
6	36-38	8,808	0.906	42%
7	39-41	9,399	0.967	44%
8	42-44	9,997	1.029	44%
9	45-47	11,757	1.210	46%
10	48-50	13,557	1.395	48%
11	51-53	14,977	1.541	49%
12	54-56	14,013	1.442	53%
13	57-59	13,981	1.439	53%
14	60-62	8,012	0.824	62%
15	63-65	6,456	0.664	57%

Since the wage rate per efficiency unit of labor is common to all households, the labor endowment process is equivalent to an individual-specific wage process. The age efficiency profile⁹ (η), also shown in Table 5.3, is calculated by normalizing the mean income across all age groups to one. The GINI coefficient for households within each age group is computed and shown in the same table. The GINI coefficient for all households aged 21-65 is computed to be 45.1%.

⁸ As mentioned earlier, we assume, for simplicity, that all households retire at age 65 (model age = 45).

⁹ Note that $\bar{y}_j = \ln(\eta_j)$ and $y_j = \ln(\xi \cdot \eta_j)$

FIGURE 5.4
Age profile of GINI coefficients



The value of parameter ρ^ξ , σ_{y1}^2 , and σ_y^2 is estimated to be 0.9899, 0.186, and 0.0366, respectively, in annual frequency. These parameters result in GINI coefficient of overall economy of 45.5% with the age profile of GINI coefficients as shown in Figure 5.4.

We then approximate the process for $\xi = \exp(y_j - \bar{y}_j)$ as a three-state Markov chain, using the method described in the previous part of this section. We set [0.510 1.000 1.963] to be the support, and the transition probability matrix is given by:

$$\pi(\xi' | \xi) = \begin{bmatrix} 0.958 & 0.042 & 0.000 \\ 0.039 & 0.922 & 0.039 \\ 0.000 & 0.042 & 0.958 \end{bmatrix} \quad (5.2)$$

To match the variance of the youngest generation, the proportion of household in the model (in the first period) is set at 0.205:0.590:0.205 for the low:medium:high value of ξ .

5.2.3 Other parameters

- Depreciation of business capital and housing capital: δ_k and δ_h

In a non-stochastic steady state, the capital accumulation equations in the model imply the following relationship between output, business investment I_k , housing investment I_h , business capital K , housing capital H , and the depreciation rates for business capital and housing capital δ_k and δ_h :

$$\frac{I_k / output}{K / output} = \delta_k, \quad \frac{I_h / output}{H / output} = \delta_h$$

Calculating these ratio for 1980-2005, we get the depreciation rate of 12.8% and 8.5% for business capital and housing capital, respectively.

- Down payment: γ

The maximum fraction of the house value that most commercial banks in Thailand allow homeowners to borrow ranges from 70% to 90%. Recently, competition among commercial banks has tended to push this loan-to-value ratio to as high as 90%. However, considering the period against which we are comparing the model results (1980 – 2005) and the fact that some households do not have full access to borrowing, we assume 70% loan-to-value ratio and take the value of γ to be 0.3.

- Transaction costs: τ

The coefficient for transaction costs is set at 0.25, which is found to be the level that results in positive correlation between output and investment in housing capital¹⁰ and that best matches the business cycle fact of investment.

¹⁰ If the coefficient for transaction costs is set too low, it could be optimal for household to reduce holding of housing capital as the aggregate shock to the economy is turning from negative to positive to take advantage of higher return on business capital. Reduced housing investment in a good economy would be contrary to the reality.

Table 5.4 summarizes the parameters that will be used in the simulation of the base case model. Note that most of the parameters are derived from the empirical data of the Thai economy from 1980 to 2005 except for β , ω , and τ , which will be freely set to achieve the desired outcome.

TABLE 5.4
Summary of parameters for base case

Parameter	Value	Target/Source
β	0.93	capital/output ratio
ω	1.08	time spent at work
θ	0.85	Household Socio-Economic Survey
α	0.35	Mallikamas, Thaicharoen, and Rodpingsangkaha (2003)
ζ	-	Section 5.2.2
η	-	Table 5.3
z	-	Section 5.2.2
δ_k	0.128	national income account
δ_h	0.085	national income account
γ	0.3	Thai commercial banks
τ	0.25	business cycle fact of investment in housing capital

5.3 Model simulation results to focus

The results from the model that will be focused and compared with observations in the Thai economy are:

Ratio of aggregate variables to output: The ratio of total investment¹¹, business investment, housing investment, consumption, business capital and housing capital to output will be derived and compared with actual data.

¹¹ Total investment refers to the sum of business investment and housing investment.

Business cycle facts: Correlation of consumption, business investment, housing investment, and employment with output will be derived and compared with actual data. Note that the data will be logged and detrended using Hodrick- Prescott filter and the deviations of variables around trend are what we will consider.

Portfolio choice over the life cycle and business cycle: Mean housing-to-wealth ratio will be plotted against age. The shape of the graph will be compared with the plot of actual data.

Business cycle dynamics: Impulse responses to aggregate productivity shock of capital, employment, and consumption will be computed. The results will be compared with the case where housing capital is not explicitly modeled.

5.4 Data description

5.4.1 National accounting data

Most of the aggregate data can be taken from the National Economic and Social Development Board (NESDB). The data are annual from 1980 to 2005. The output, investment, consumption, and capital stocks data to be used are in real terms (at 1988 price) and will be transformed into per capita terms through dividing by the Thai population.

- Output: Output is defined as gross domestic product minus consumption expenditures in durable goods minus expenditures in housing services minus net exports minus government consumption and investment expenditures.

- Investment: Total investment is the gross private fixed capital formation. Housing investment is the residential private construction. Business investment is the total investment minus housing investment.

- Consumption: Consumption is defined as private consumption expenditure minus expenditures in durable goods minus expenditures in housing services.

TABLE 5.5
National accounting data at 1988 prices

(Million Baht)

Year	Output	Housing investment	Business investment	Consumption	Housing capital	Business capital
1980	701,536	35,398	151,409	508,819	323,938	1,175,221
1981	716,334	46,797	152,750	520,097	360,770	1,227,090
1982	706,531	53,733	151,623	531,515	404,030	1,273,339
1983	828,086	66,539	173,078	567,675	458,510	1,336,211
1984	850,381	72,194	177,300	593,338	517,374	1,399,114
1985	823,292	71,899	157,413	608,266	574,489	1,436,980
1986	849,127	85,293	152,513	629,147	642,915	1,470,298
1987	986,626	106,662	201,178	679,193	730,240	1,544,246
1988	1,188,100	113,575	286,246	727,053	823,317	1,689,890
1989	1,346,736	144,965	355,706	798,824	945,675	1,888,633
1990	1,537,103	167,639	478,015	891,495	1,088,951	2,186,181
1991	1,650,937	188,447	523,007	943,301	1,249,163	2,505,603
1992	1,703,748	163,990	565,908	1,008,419	1,382,622	2,844,352
1993	1,879,023	173,298	632,953	1,110,208	1,521,921	3,213,682
1994	2,033,911	194,904	681,912	1,196,295	1,677,940	3,610,160
1995	2,275,056	202,853	770,223	1,272,991	1,839,113	3,968,311
1996	2,406,922	198,254	802,308	1,344,212	1,990,588	4,417,515
1997	2,110,138	90,424	605,582	1,360,384	2,033,054	4,654,872
1998	1,535,438	37,477	294,641	1,234,355	2,020,696	4,601,135
1999	1,612,420	27,658	293,404	1,278,683	1,998,004	4,564,917
2000	1,778,099	35,524	339,486	1,342,387	1,982,107	4,582,691
2001	1,837,229	44,563	349,002	1,398,676	1,974,061	4,591,338
2002	1,946,001	58,650	387,639	1,454,655	1,978,926	4,631,471
2003	2,117,989	70,864	454,226	1,527,626	1,994,844	4,724,998
2004	2,291,332	86,645	523,603	1,602,488	2,025,520	4,878,951
2005	2,461,807	96,340	580,729	1,690,286	2,063,315	5,043,155

Source: NESDB, calculated according to the definition in the text.

- Capital stocks: The stocks of both housing and business capital come from the net capital stock of private sector table. Housing capital is the ‘ownership of dwellings’ section of the table. Business capital is defined as total net capital stock of private sector minus housing capital. Employment: Employment is measured as a product of average working hours per week and total employment, from Labor Force Survey conducted by the NSO.

5.4.2 Wealth and income data

Data on the wealth distribution and income data of households could be obtained from the Household Socio-Economic Survey in 1992-2006 (every other year). NSO has regularly conducted this kind of survey since 1957 (every 5 years from 1957 to 1986, every 2 years from 1988 to 2006 and every year starting 2007 onward).

In 2006 survey, there are specific questions about the estimated value of housing assets and financial assets that households own. This is not the case in the previous surveys. In principle, the wealth distribution could be estimated based on the response of households to questions about interest incomes and imputed rent on owner-occupied home. However, judging from the 2006 survey where both direct answers to the questions of wealth and the questions of interest incomes and imputed rent are available, it seems that the answers to the questions of interest incomes and imputed rent can not be relied on in inferring the level of wealth. As a result, only wealth data from the 2006 survey will be used to compare with the model results.