二松学舎大学国際政治経済学部

Discussion Paper Series

Real estate prices in Japan and Lewis turning point

Katsushi Tabata and Yuichiro Kawaguchi

August 2013

Discussion Paper (Econ) No.3

FACULTY OF INTERNATIONAL POLITICS AND ECONOMICS

NISHOGAKUSHA UNIVERSITY

Real estate prices in Japan and Lewis turning point

Katsushi Tabata[1]

Yuichiro Kawaguchi[2]

Abstract

This paper has done a model analysis from a long-term perspective about Real estate prices in Japan. In particular, we consider a Lewis turning point with the rise of land prices over time. It is analyzed by state space methods. Using the model, we examined how the real estate transactions were affected by the population growth and the technological progress. Furthermore, we have compared two types of models which consider banking sector and no banking transactions.

In particular, population decline in Japan would have a significant impact to the long term recession since 1990. We are skeptical about the population declining effect using our model. A Summary of our model estimation is as follows.

(1) The Lewis turning point with both technological progress and population growth is confirmed. Japan has passed the Lewis turning point in the second half of '70. (2) Since then, banks played an important role in the formation of real estate prices. (3) A trend that has lowered the price of real estate with declining population cannot be confirmed clearly. (4) In the bubble period, real estate price exceeds the reality of the macro economy due to the bank loan behavior.

The Japanese experience of the rise in land prices is very interesting in considering the future of the Asian countries. Asian countries have made remarkable economic development. However, these benefits of growth would be absorbed by the increase in asset prices and real estate investment. This is very similar to the past experience of Japan.

---

[1]Professor of Policy and Economics at Nishogakusya University

[2] Professor of graduate school of Finance at Waseda University

1 Introduction

With economic growth, real estate prices will rise. On the other hand, the pace of economic growth if down, the pace of rising land prices also decreased. Relevance this long-term, with land prices and economic growth is also true in Asian countries. Recently, Asian countries, has achieved high growth. In its high growth, increase in the land is also observed prominently. Rise in real estate prices in this Asia, has been assessed to be the result of economic growth. On the other hand, looking at the rise of real estate prices in Asia recently, real estate prices in Asian countries, seems to have been an increase in growth over the real economy.

In this paper, we want to consider in the formation of long-term land prices, from the point of view of finance and growth. In Asia, by targeting Japan, we proceed with the analysis. However, I believe this discussion is also applicable in the Asian countries.

The relationships between land and long-term growth or the resume switching are described. For example, Galor and Weil (2000)and Hansen and Prescott (2002), argues that they are divided into three kinds of regime of Malthus (Malthusian regime) Malthus after (post Malthusian regime), the modern growth process. Regimen from the first shift to second regimen, come from the land price formation of Malthus type. A source of regime switch to the formation of land prices after Malthus, is the increase in population density. In addition, the transition to land price formation corresponding to the growth process from modern Malthus after the second, was effected by technological progresses.

The second point is about the process of long-term economic recession in the Japanese economy. We believe in the long-term recession of the Japanese, real estate has played an important role. Since the bubble burst of 1990, Japan fell into recession in the long term. After experiencing a high growth of the economy, Japan is not easy getting out out long-term recession. Meanwhile, production of Japanese companies is reduced and has lost the vitality. Let's call it " Japanisation": the decline of these Japan. The behind of “Japanisation" is a super-aging. In addition, aging forms a trend of decrease in land prices and result in a long-term recession structure of the economy. How real estate prices relate to the decrease trend of long-term productivity.

In fact, this debate is one of the most important themes in the future of Asia. Because the aging phenomenon is observed in Asia countries in general. Following the Japan, South Korea, Taiwan has entered the aging society, and even Southeast Asian countries such as China and Indonesia, the aging of the working population are progressing at a pace considerably. "Japanisation" will become a typical future figure of Asian countries. In fact, it is thought that not due to population decline, there is a nature of the problem with the under-investment. In addition, this phenomenon of under-investment also applies to Asia in general.

In this paper, we consider in connection with the Lewis turning point for the formation of long-term land prices. Lewis (1954) argued the turning point of Lewis. While low-wage workers engaged in agriculture is shifted to the industrial sector by the process of industrialization, the expansion of workforce productivity and manufacturing industrial sector will occur at the same time. As a result, we have experienced the high economic growth. Over time, wage pressures intensified, high growth converges. It is interesting to note that such Lewis turning point is not only observed once in history any country.

In the case of Japan, we have passed the Lewis turning point between 1970-1960[3].Experience in the Lewis turning point passing time, technological progress and population growth, Another feature is that it is also possible to read that both productivity and population density in industrial areas are increased by population growth in the sense of Malthus process . This leads also to increase the real estate prices greatly.

On the other hand, a real estate bubble should be distinguished from the Lewis turning point. By financial acceleration, real estate prices is to soar. On the other hand, compared with the expansion of technological progress and population growth, finance plays an important and quite a different role. Japan has experienced the real estate bubble which occurred through a decade after passage of the Lewis turning point. In other words, we are the experienced real estate bubble in the final phase of the Lewis turning point.

---

[3] UK passed the Lewis turning point in the mid-19th century. The United States has passed the turning point in the first half of the 20th century.

What is this economic mechanism? First, I consider this point. In addition, under the current Asian economic development, What do Asian people have to learn from the lessons of Japan?.

２． Preparations

Here, using the model of Loupias and Wigniolle (2012) and Diamond (1965), we consider the impact of the population, the productivity and the financial sector. See the Details of the model of Loupias and Wigniolle.

2.1. Firms

We set to a CES type production function. First, We define capital (K), labor (L), and owned land (X) as the production factors. In addition, We set technology level (A). Subscript character “t” shows the time t.

(1) $$F(A_t, K_t, L_t, X_t) = [\lambda(A_t K_t)^{1-\frac{1}{\varepsilon}} + (1-\lambda)X_t^{1-\frac{1}{\varepsilon}}]^{\frac{\varepsilon\alpha}{\varepsilon-1}} L^{1-\alpha}$$

$0 < \lambda < 1$

Further, rent rate wages (W), capital (R) are also derived from equation (1). In this case, we set k = K / N, and x = X / N. N is the number of young workers, where we assume N = L. Production per capita (y = F / N), rent rate of capital and wages can be expressed as follows.

(1)’ $$y = [\lambda(A_t k_t)^{1-\frac{1}{\varepsilon}} + (1-\lambda)x_t^{1-\frac{1}{\varepsilon}}]^{\frac{\varepsilon\alpha}{\varepsilon-1}}$$

(2) $$w_t = \alpha(1-\lambda)[\lambda(A_t k_t)^{1-\frac{1}{\varepsilon}} + (1-\lambda)x_t^{1-\frac{1}{\varepsilon}}]^{\frac{\varepsilon\alpha}{\varepsilon-1}}$$

(3) $$R_t = \alpha\lambda A_t^{1-\frac{1}{\varepsilon}} k_t^{-\frac{1}{\varepsilon}} [\lambda(A_t k_t)^{1-\frac{1}{\varepsilon}} + (1-\lambda)x_t^{1-\frac{1}{\varepsilon}}]^{\frac{\varepsilon\alpha}{\varepsilon-1}-1}$$

In addition, the price level is assumed to be equal to the marginal productivity of land.

(4) $$\pi_t = \alpha\lambda x_t^{-\frac{1}{\varepsilon}} [\lambda(A_t k_t)^{1-\frac{1}{\varepsilon}} + (1-\lambda)x_t^{1-\frac{1}{\varepsilon}}]^{\frac{\varepsilon\alpha}{\varepsilon-1}-1}$$

Where

(5) $k_t = \frac{K_t}{N_t}$ (6) $x_t = \frac{X_t}{N_t}$

2.2 Technology level

The state of technology is set so that the knowledge is embodied in the technology level (Romer (1986)). In addition, not only through development projects such as irrigation and land, land itself is assumed to contribute to the improvement of the state of the technology level. We call this "land itself" effect as the Boserupian effect (Boserup (1976)).

(7) $$A_t = [\mu(A_N \left(\frac{N}{\overline{X}}\right)^{\beta})^{1-\frac{1}{\nu}} + (1-\mu)\left(A_K^{\frac{1}{\alpha}} K_t^{\left(\frac{1}{\alpha}-1\right)}\right)^{1-\frac{1}{\nu}}]^{\frac{\nu}{\nu-1}}$$

Where $\mathrm{v} > 1$, $0 < \mu < 1$

$\overline{X}$ is the total area of land in the country to utilize economically, for use of both industrial and personal residential. It is in the land available in this economy where young workers more got a job more. In this case, the more population density improves the state of the technology (At).

2.3 Households

We adopt a two period generation model here. While C_t is the consumption of early life, d_{t+1} is the consumption of the next (old man period). We also define m_t as the survival rate η_t as the number of children per adult and V_t as the land consumption for household. The number of children live together, the level of utility obtained from land consumption is assumed to be further reduced. We set the utility of consumer as follows.

(8) $$\begin{aligned} U(c_t, d_{t+1}, m_t, v_t) &= \Gamma_1 \ln c_t + p_t \Gamma_2 \ln d_{t+1} \\ &+ \Gamma_3 \ln \eta m_t + \Gamma_4 \ln\left(V_t - \xi \eta_t m_t\right) \end{aligned}$$

where $\zeta > 0$ $\Gamma_1 + \Gamma_2 + \Gamma_3 + \Gamma_4 = 1$

In addition, we use the following settings for the upbringing of children. Young workers pay the rearing cost for newborn (= ϕ_1w) from wages. It is also assumed that they also pay the cost for the survival of children (= $\eta\ \phi_2$w) (= $(\phi_1+\eta_t\phi_2)$ w). Now, we set m ' as the number of children surviving per adult, where it is m '= ηm. The child needs the support costs of these children to survive (= ϕm'w). Using these definitions, we can derive

(9) $$\phi_t = \frac{\phi^1}{\eta_t} + \phi^2$$

Here, in order to find an optimal consumer behavior, we set a budget constraint as follows.

(10) $$c_t + s_t + \phi_t w_t m_t^{'} + \pi_t V_t + ca_t = w_t$$

(11) $$d_{t+1} = \frac{\rho_{t+1}}{\rho t} s_t + \frac{e_{t+1}}{e_t} ca_t$$

In this case, wages are used for consumption (C_t) , purchasing the house ($\pi_t v_t$) and paying the rearing cost for children. The rest of wages shall be turned to the next period (elderly period) as savings S_t. In addition, ρ is the real rate of return on savings (including principal). To obtain the FOC, we derive the optimal solution with respect to V and m '.

(12) $$m_t^{'} = \frac{\gamma_3 w_t}{(\phi_t w_t + \xi \pi_t)}$$

(13) $$V_t = \frac{\gamma_2 w_t}{(\phi_t w_t + \xi \pi_t)} + \gamma_4 \frac{w_t}{\pi_t}$$

$$\gamma_3 = \frac{\Gamma_2}{(\Gamma_1 + \Gamma_2 + \Gamma_3 + \Gamma_4)} \quad \gamma_4 = \frac{\Gamma_4}{(\Gamma_1 + \Gamma_2 + \Gamma_3 + \Gamma_4)}$$

2.4. Population

We formulate for the population. m´ is the number of children, survived per young workers. Thus, the following relationship is established for young workers (N).

(14) $m_t^{'} = \frac{N_{t+1}}{Nt}$

In addition, available land $(\overline{x}_t = \frac{\overline{X}_t}{Nt})$ per capita young workers is formulated as follows.

(15) $\overline{x}_{t+1} = \frac{\overline{x}_t}{m_t^{'}}$

The available land of the economy as a whole per capita young workers $(\overline{x}_{t+1})$ is composed of the residential land and (house owned by household(=V_t) and the land and industrial house owned by firms (=x_t).

(16) $\overline{x}_t = V_t + x_t$

2.4. Clearing Conditions

Financial Market

From the first-order condition of the household sector, household saving (S_t) is equal to a fraction of the wage ($\gamma_2 W_t$). Through financial institutions, this saving is used of the corporate capital investment available in the next period ($m_t^{'} k_{t+1} = \frac{K_{t+1}}{N_t}$) and purchasing the real estate by household and firms $(Q_t \overline{X}_t)$. Q_t is the real estate price after deducting the inflation rate.

(17) $\gamma_2 (1+R_t) w_t = m_t^{'} k_{t+1} + Q_t \overline{x}_t$

Equation (17) is the basic formula. However, it is modified to incorporate a bank loan with land collateral (17) ‘, which assumed that the banks provide funds to the industrial sector. Banks lend the money, depending on the amount of the collateral real estate held by the industrial sector. In this case, source of bank loan is a friction of factor income (W_t) and company profit (=proft). The bank shall devote to loan some of its sources. The ratio (Lev) is introduced as the corporate lending attitude of the bank where the ratio (Lev) depends on valuations of real estate assets by a bank ((18)) [4].

(17)' $lev_t\left(w_t + prof_t\right) = m_t^{'} k_t + Q_t \overline{x}_t$

(18) $lev\, m_t^{'}\, k_t = Q_t \overline{x}_t$

Where lev_t ($0<lev_t<1$)

Lastly, Rate of return on savings (ρ) was assumed to be equal the marginal productivity of capital (R_t)

(19) $\rho_{t+1} = R_{t+1} = \dfrac{Q_{t+1} + \pi_{t+1}}{Q_t}$

３． **Model analysis**

3.1 setting the state space model

Based on the model above settings, we try to estimate the model. First, the model equations ((1) '(2) (3) (4) (5) (12) (13) (14) (15) (16) (17)' (19)) are formulated into log liberalized. Secondly, we rewrite the state space representation.

We have also added the formula (19) to incorporate banks . In addition, when converting to state space representation, it is assumed some state space variables depend on the AR process. Since these parameters of AR functions change over time, they are also estimated in the state space model[5].

---

[4] It is an enterprise profit per capita.

[5] For example, we set AR parameters

$$Q_{t+1} = AR_Q Q_t + \mu_{Q,t}$$
$$\pi_{t+1} = AR_\pi \pi_t + \mu_{\pi,t}$$
$$AK_{t+1} = AR_{AK} AK_t + \mu_{AK,t}$$
$$W_{t+1} = AR_W W_t + \mu_{W,t}$$
$$\bar{x}_{t+1} = AR_{\bar{x}} \bar{x}_t + \mu_{\bar{x},t}$$
$$x_{t+1} = AR_x x_t + \mu_{x,t}$$
$$prof_{t+1} = AR_{prof}\, prof_t + \mu_{prof,t}$$

First, in the state space model, the state equation and observation equation is converted into the model. In other words, the state space representation consists of state equations and observation equations. The observed variable (Y_t) is defined as the variable that is actually observed. On the other hand, state variable (X_t) is introduced, which indicates the dynamic characteristics of the other phase. State equations show the dynamic characteristics. Its simplest form is expressed as an equation (20)[6].

$$(20)\quad \begin{aligned} X_{t+1} &= AX_t + B\mu_t \\ Y_t &= CX_t + Dv_t \end{aligned}$$

μ , v is assumed to follow a mean 0 and variance σ_μ^2、 σ_v^2 with normal white noise value,

independently. In this paper we define the state variables X_t and the observed variables Y_t as follows.

For example, we set the AR parameter as follows:

$$AR_{Q,t+1} = AR_{Q,tt} + \mu_{ARQ,t}$$

[6] Canova (2007) describes the economic model and the state space representation. In particular, the context of the DSGE model is discussed in detail. In addition, Durbin and Koopman (2001) is a text book in the context of quantitative analysis such as time series analysis and state space. Kim and Nelson (1999) shows applications to economics, for adaptation to the measurement. In particular, applications such as the Kalman filter are used in this document.

$$X_t = [N_t \ , N_{t-1}\ \bar{x}_t, \bar{x}_{t-1}, k_t \ , k_{t-1}, \ R_t, R_{t-1}, Q_t, Q_{t-1}, \pi_t, \pi_{t-1}, \ AK_t, AK_{t-1}, W_t \ , W_{t-1} \ , M'_t, M'_{t-1}. Lev_t, Lev_{t-1}$$
$$x_t, x_{t-1}, prof_t, AR_{Q,t}, AR_{\pi,t}, AR_{AK,t}, AR_{W,t}, AR_{\bar{x},t}, AR_{x,t}, AR_{M',t}]$$

$$Y_t = [A_t \ , V_t, K_t, y_t, dQ_t, dx_t, dN_t, dW_t]$$

We estimated using annual data of Japan from 1955 to 2007. First, based on the model, I set the C matrix and A matrix. To estimate the state variable X_t using the observed value Y_t. See Table 1 for the size of each parameter.

3.2 Kalman filtering

Using the Kalman filter, as a first step, we estimate the state variable X_t and apply the Expectation-maximization (EM) algorithm with these estimated state variables. State variables are backward-estimated from the estimated final time state variables to maximize the log-likelihood.

We assume that there is the following relationship between a posteriori estimation （$\hat{X}_t$） and a priori estimation of （$\hat{X}_t^-$）. g_t is what is called a Kalman gain here, posteriori-estimate is modified in response to the information of the latest observations(Y_t). Supposing an appropriate method to estimate the Kalman gain (g_t), it can be estimated after the other state variables by giving an appropriate initial value.

$$\hat{X}_t = \hat{X}_t^- + g_t Y_t$$

The following relationship holds for a posteriori-estimation error($\tilde{X}_t$).

$$\tilde{X}_t = X_t - \hat{X}_t$$

Applying to the Orthogonality Principle, we can obtain the following equations between the observations and the posteriori-estimation error.

$$E\left[\tilde{X}_t Y_i\right] = 0$$
$$i = 1, 2, \cdots t-1$$

Calculating this, Kalman gain g_t is expressed as following equation, where P_t^- is defined as a priori covariance matrix.

$$g_t = \frac{P_t^{-1} C}{C^T P_t^{-1} C + \sigma_v^2}$$

Where $P_t^{-1} = E\left(X_t - \hat{X}_t^-\right)\left(X_t - \hat{X}_t^-\right)^T$

Furthermore, the priori covariance matrix is expressed in the posteriori covariance matrix using the update equation.

$$P_t = \left(I - g_t C^T\right) P_t^{-1}$$

Applying the previously described equation ($\hat{X}_t = \hat{X}_t^- + g_t Y_t$),a posteriori estimation($\hat{X}_t$) is updated to incorporate the information of observations(Y_t). It is possible to infer a priori estimation of （$\hat{X}_{t+1}^-$） from the state equation （$\hat{X}_{t+1}^- = A\hat{X}_t$） using a posteriori estimation ($\hat{X}_t$) .

By repeating the same procedure as before, it is possible to estimate the value of the state variable of the next period and one after another.

3.3 Model estimation

3.3.1 Purpose of model estimation

In this paper, we used the eight annual data as the observed value: Per capita manufacturing production value (y / N), plant and equipment + stock (K),Industrial land stock available per capita (Vt),Previous year difference in house prices index adjusted prices (dQt),Productivity (At), Previous year difference of land and housing per capita by household (dXt), previous year difference in number of 22-55 years old working people (dNt),previous year difference in wage(dw).

Labor force (Nt) is a workforce of up to 22 old to 55 old . All data is converted into logarithmic values and taking the difference between the average values . In addition, productivity was the residual obtained by subtracting the growth rate of capital and labor from the economic growth rate .Our estimation aim is to estimate the state variables such as real estate prices (Q) that derived from the model.

We set the deep parameters and adopt the log-likelihood for model estimations with the EM algorithm (TABLE 1 reference) [7].

[7]See the appendix about state space presentation. Model esimaition was calucurated by MATLAB.

	Deep Parameter	EST1	EST2	EST3	EST4	EST5(no-banking)	Bench Mark
β	discount factor	0.9	0.9	0.9	0.9	0.9	0.9
α	share of capital	0.3	0.3	0.3	0.3	0.3	0.3
э	Production function parameter	20	2	20	20	20	20
λ	share of capital in production function	0.1	0.5	0.5	0.5	0.5	0.5
VV	technology level parameters EQ(7)	2	2	2	2	2	2
μ	share of capital in technology level EQ(7)	0.5	0.5	0.5	0.5	0.5	0.5
ϕ	rearing cost share for household	0.2	0.2	0.2	0.2	0.2	0.2
ε	Production function parameter	0.5	0.5	0.5	0.5	0.5	0.5
γ2	$\gamma_3 = \frac{\Gamma_2}{(\Gamma_1+\Gamma_2+\Gamma_3+\Gamma_4)}$	0.25	0.25	0.25	0.25	0.25	0.25
γ 4	$\gamma_3 = \frac{\Gamma_2}{(\Gamma_1+\Gamma_2+\Gamma_3+\Gamma_4)}$	0.25	0.25	0.25	0.25	0.25	0.25
γ 3	$\gamma_3 = \frac{\Gamma_2}{(\Gamma_1+\Gamma_2+\Gamma_3+\Gamma_4)}$	0.25	0.25	0.25	0.25	0.25	0.25
steady state of LEV		γ 3	γ 3	γ 3	0.4	γ 3	γ 3
steady state of Xbar		10.65	10.65	10.65	10.65	30.65	30.65
steady state of AK		10	10	1	10	10	10
steady state of AN		1	1	1	1	1	1
steady state of π		1	1	1	1	1	1
steady state of W		1	1	1	1	1	1
steady state of K		15.5	15.5	15.5	15.5	15.5	15.5
steady state of Q		0.9	0.9	0.9	0.9	0.9	0.9
steady state of N		12	12	12	12	12	12
steady of AR(Q)		0.99	0.99	0.99	0.99	0.9	0.9
steady of AR(π)		0.9	0.9	0.9	0.9	0.99	0.99
steady of AR(AK)		0.5	0.5	0.5	0.5	0.9	0.9
steady of AR(W)		0.5	0.5	0.5	0.5	0.9	0.9
steady of AR(Xbar)		0.9	0.9	0.9	0.9	0.9	0.9
steady of AR(X)		0.9	0.9	0.9	0.9	0.9	0.9
steady of AR(M)		0.5	0.5	0.5	0.5	0.9	0.9
steady of AR(profit)		0.5	0.5	0.5	0.5	0.9	0.99
Log likelihood		1514.4	1169.5	1038.5	1709.5	890.6	2352.53

Table1 parameter setting and log likelihood

From the estimated state variables, Figure1 shows the profit rate of technical progress (AK), the population increasing or decreasing the ratio (m), property prices (Q), using real estate area (X), the bank attitude for loan (LEV) and wage (W). In particular, the estimated estate prices (solid line) and the actual real estate price (*) showed the real estate prices in Japan which continued to rise in the long term up to 1998, then decreased consistently.

Our model is succeeded in capturing the development of estate prices. The rise of these real estate prices can be also seen that the improvement of productivity through technological progress is affected. Our first concern is to explore the long-term formation factors of real estate prices in Japan. The second concern is to make clear how financial institutions are working in the real estate bubble in the 1980s.There should be a clear difference such as the real estate bubble and the long-term price increases due to economic growth. In terms of ultra-long-term, dynamism of real estate prices can be described in technical level and population. On the other hand, the real estate bubble in the 1980s was described by the Japanese banking behaviors. This is our awareness with intuition. We show the results of the estimation in Figure1.

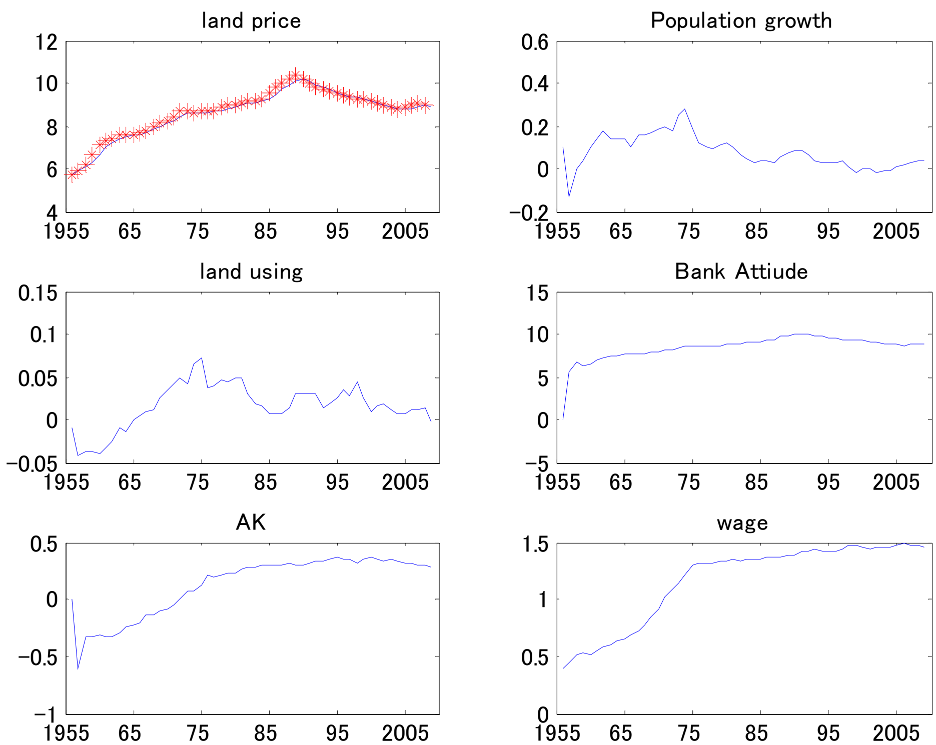


Figure1 Estimation result of benchmark real estate model for Japan

For example, Hansen and Prescott (2002) emphasize the first stage to increase the real estate demand which is due to population density and the population growth. And next stage allows to improve the productivity of enterprises, technological progress to increase the real estate value. In addition, for the real estate formation of long-term view, Yoshikawa (2000) was applied to Japan the Lewis turning point. Lewis (1953) argued the turning point in the counties to modernization where low-wage labor force is absorbed by the industrial sector from the agricultural sector. In the process, the productivity of the industrial sector can be greatly improved. It is intended that this will encourage rapid growth. Another feature of the Lewis transformation is that this industrialization shift does not happen only once in any country. So, encouraging further economic growth, invention of policies is required such as deregulation in domestic to enhance the technological progress. Lewis turning point in Japan was the period of the 1960s and 1970s.

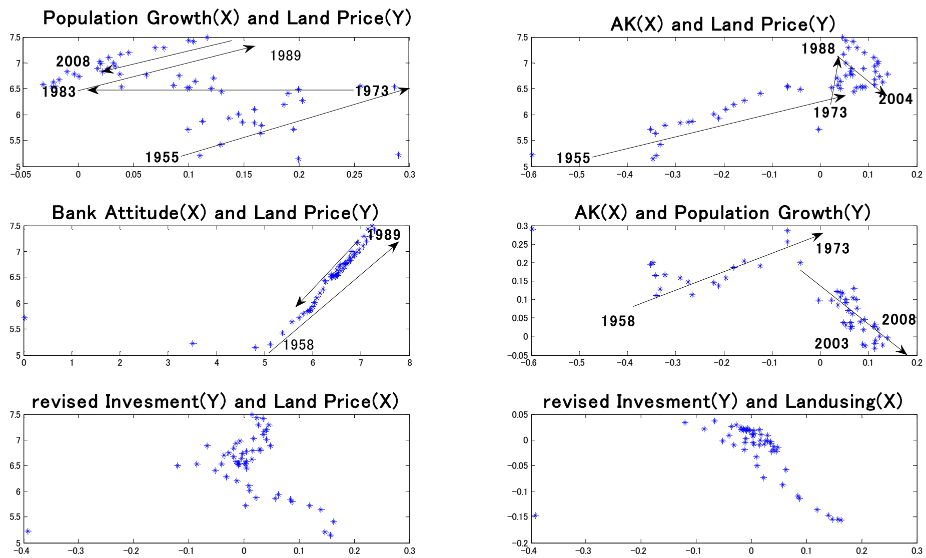
3.3.2 Result of estimation

(1) The Real estate price and productivity, population, banking

We show Figure 2 in order to see the long term relevance of real estate prices and productivity, population and productivity. First, to be associated with the discussion of the Lewis turning point, let's look at the conjunction of population and technology and progress.

In the Lewis turning point, an increase in the labor force and technological progress should be observed at the same time. We confirmed that AK-Population Growth in Figure 2 was the simultaneous expansion of technological progress and labor force during the period of 1973 – 1958.On the other hand, later, Japan has turned into a downward trend of the labor force. It has passed through the Lewis turning point. In addition, real estate prices and technological progress for (Figure2 AK and Land price) is of obvious positive relationship from 1955 to 1973. Real estate prices in Japan after the war, has been rising along with the rise of productivity. Since 1973, the increase of technological progress has remained relatively modest and prices are up and down swing big. Even less, since the bursting of the bubble (1989-), the relationship between productivity and real estate prices is not observed clearly.

We also confirm that the demographics are closely related to the formation of land prices and real estate prices (Figure2 Real estate prices and population growth). However, in the case of Japan, the relationship between land prices and population is divided into two periods: high-growth period (1955 - 1973) and the bubble period (1983-2007) including the current period. The relationship between land prices and population is not observed in the period (1983 - 1973). In those days, a quantitative adjustment in the labor market has progressed greatly. Nevertheless, real estate price had remained firm. Until recently, a trend which real estate prices are reduced in the decrease in population cannot be observed.



Figue2 Estimations of benchmark model

Banking sector probably affects the real estate price. The lending attitude of banks, have affected sensitive to real estate prices. (Bank Attitude and Land Price of Figure 2). The bank lending attitude and long-term trend in real estate prices is consistent at all. Figure2 shows the aggressive bank lending in a period of high economic growth - the collapse of the bubble. As a result, real estate prices have been increasing steadily.

Since 1989, it has acted to lower real estate prices by bank loans. The positive relationship between the bank attitude and real estate prices is a robust, which relationship is sustained today.

（2） bank behavior

In this paper, I called Lewis turning point of economic growth that occurs in technological innovation and population growth are simultaneous. When the simultaneous conditions are lost, the country will be beyond the Lewis turning point. We should experience the convergence to stable growth. In case of Japan, over a decade after exceeding the Lewis turning point, upward trend of real estate prices has not disappeared. It is a problem that real estate prices differ significantly from the actual situation of macro economy in this period. In particular, the role of financial markets is serious. Even beyond the Lewis turning point, banks did not change the lending stance. In order to examine the bank behavior impact given to real estate prices in Japan, let's compare the model which incorporates the bank and No-Bank Model which do not include the bank[8]. By the No-Bank Model that does not incorporate a bank, it is not possible to capture most of the movement of the long-term real estate prices having a peak in 1989. In the case of Japan, loans secured by real estate was basic loan transactions before 1990. The bank plays the role of accelerator to increase the amplitude of real estate prices [9](Kiyotaki and Moore (1997)).

In summary, (1) The Lewis turning point with both technological progress and population growth is confirmed. Japan has passed the Lewis turning point in the second half of '70. (2) Since then, banks played an important role in the formation of real estate prices. (3) Trend that has lowered the price of real estate with declining population cannot be confirmed clearly. (4) in the bubble period, real estate price exceeds the reality of the macro economy due to the bank loan behavior.

Based on these arguments, what of the Japanese experience is serious?

(3) Lewis turning point and low investment[10]

Japan has passed the Lewis turning point during the period of high growth. Its features were simultaneously technological progress and population influx in urban areas and industrial areas. Rise in real estate prices result in suppressing the substantial investment.

We focus on the relationship between the land price and investment (See Figure2 the revised Investment and land price the revised Investment-land using). Investments can be characterized by the decrease with the expansion of the real estate transaction. In particular, during the 1960s-1970s of Lewis turning point passing, the expansion of real estate transactions is made to reduce the private investment.

The cost of land acquisition has the effect, such as delaying the investment. The delay in capital accumulation was affected to delay the growth of productivity. And it seems to be encouraging the termination Lewis turning point

---

[8] Instead of equation (17) ', (17) equation was introduced. the No-Bank model does not incorporate a loan leverage effect of the bank.

[9]Rising(decreasing) in real estate prices lead to a collateral value ⇒Expansion(reduction) of bank loan facility ⇒ real estate prices rising (decreasing) ⇒ ---. By the bank accelerator function, amount of loan is accelerated (decelerated).

[10] A fixed investment by the amount obtained by subtracting the real estate transactions(X) from capital (K).

４． Remaining Issues

Our remaining Issues are an extension of the model. One is to apply to the Asian countries. In spite of economic prosperity, Asian countries have not accumulated enough capital. This phenomenon is none other than Japanisation. In Asia, the rise in real estate prices would drive out the investment. We want to verify this point. The second direction of extension is to be extended to the open economy model. After Lewis turning point, Japanese banks maintained its aggressive loan secured by real estate. Why? It seems as international factors that are not described in our model. The Bretton Woods system collapsed in the early 1970s. Due to the international credit expansion of the dollar, we can no longer maintain a constant dollar currency value in the international currency market. In an environment of increasing international liquidity of the 1970s, Japanese financial institutions were adhering to the lending attitude. By incorporating the model a mechanism to pass the flow of domestic and international liquidity, it is possible to validate this point. We are expected to advance the research to this point as the next step.

References

Luca Benati and Charles Goodhart. "Monetary Policy Regimes and Economic Performance: The Historical Record, 1979-2008." Handbook of Monetary Economics

Benjamin M. Friedman & Michael Woodford (Ed.), Handbook of Monetary Economics, vol. 3, ch. 21,Pp. 1159-1236, 2011.

Caroline M Betts and Michael B Devereux. ”Exchange rate dynamics in a model of Pricing-to-market.” Journal of International Economics, Vol.50, No.1, pp. 215-244, February 2000.

Ester Boserup. "Environment, Population, and Technology in Primitive Societies." Population and Development Review, Vol. 2, No. 1, pp. 21-36, March 1976.

Fabio Canova. *Methods for Applied Macroeconomic Research ,* Princeton University Press,

2007.

Peter A. Diamond. "National Debt in a Neoclassical Growth Model."

The American Economic Review, Vol. 55, No. 5, Part 1, pp. 1126-1150, December, 1965

James Durbin and Seim Koopman .Time Series Analysis by State Space Methods, Oxford University Press , 2001

Oded Galor and David N. Weil. "Population, Technology, and Growth: From Malthusian Stagnation to the Demographic Transition and beyond ." The American Economic Review Vol. 90, No. 4, pp. 806-828, September 2000.

Gary D. Hansen and Edward C. Prescott. "Malthus to Solow." The American Economic Review

Vol. 92, No. 4, pp. 1205-1217, September 2002.

Chang-Jin Kim and Carles Nelson*. State Space with Regime Switching*, MIT press 1999.

Kiyotaki Nobuhiko and John Moore . "Credit Cycles." Journal of Political economy 105, pp211-248,1997.

Robert Kollmann, Zeno Enders, and Müller J. Gernot. "Global banking and international Business cycles." European Economic Review, Vol.55, No.3, pp. 407-426, April 2011.

Arthur Lewis ." Economic Development with Unlimited Supplies of labor." Manchester school of economics and social studies, 1954

Claire Loupias, and Bertrand Wigniolle. " Population, land, and growth." Economic Modelling, Volume 31, pp. 223-237, March 2013.

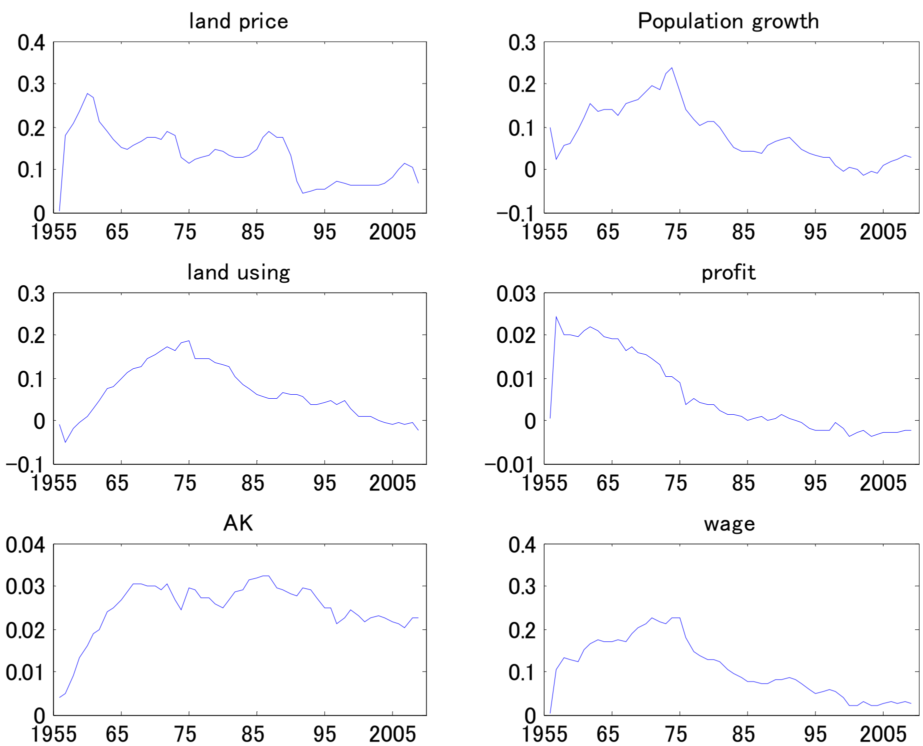
Paul Romer. "Increasing Return and Long-Run Growth." Journal of political economy 98, PP 10002-1037, 1986

Frank Smets and Raf Wouters. "An Estimated Dynamic Stochastic General Equilibrium Model of the Euro Area. " Journal of the European Economic Association, Vol.1, No.5, Pp. 1123-1175, September 2003.

Jan In't Veld , Rafal Raciborski, Marco Ratto and Werner Roeger. " The recent boom–bust Cycle: The relative contribution of capital flows, credit supply and asset bubbles." European Economic Review, Vol. 55, No. 3, pp. 386-406, April 2011.

Hiroshi Yoshikwa. Modern macroeconomic theory (in Japanese) 2000.

Appendix - figure1 no-banking model



Appendix; Model Descrition

$$X_{t+1} = AX_t + B\mu_t$$
$$Y_t = CX_t + D\nu_t$$

Where $C = G_0 G_1^{-1}, B = I, D = I$

A =

1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0 $\overline{x}$		0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	-1	0 $\overline{lev}\,\overline{w}(1+\overline{R})/(\overline{m}\,\overline{k})$		0 $-\overline{q}\,\overline{x}/(\overline{m}\,\overline{k})$		0	0	0	0	0	$\overline{lev}\,\overline{w}(1+\overline{R})$
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0 $\left(\overline{\mathrm{q}}-1\right)\overline{\mathrm{q}}/\overline{R}$		0 $\left(\overline{\mathrm{q}}-1\right)\overline{\mathrm{q}}/\overline{R}$		0	0	0	0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0 $\overline{Q}$		0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0 $\overline{\pi}$		0	0	0	0
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0 $\overline{AK}$		0	0
0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0 $\overline{w}$	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	-1	0	0	0	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0 $\overline{X}$		0	0	0	0	$\overline{X}$	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	-1	0 $\overline{lev}\,\overline{w}(1+\bar{R})/(\bar{m}\bar{k})$		0 $-\bar{q}\,\bar{x}/(\bar{m}\bar{k})$		0 $-\overline{lev}\,\overline{w}(1+\bar{R})/(\bar{m}\bar{k})$)			0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0 $\bar{Q}$		0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0 $\overline{\pi}$		0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0 $\overline{AK}$		0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0 $\overline{w}$		0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0 $\overline{m}$		0	0	0	0	0	0	0	0	0	0	0	0	$\overline{m}$
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	-1	0	0	0	1	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0 $\overline{x}$		0	0	0	0	0	0	0 $\overline{x}$		0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0 AR_{pof}		0	0	0	0	0	0	0
0	0	0	0	0	0	0	0 AR_Q		0	0	0	0	0	0
0	0	0	0	0	0	0	0	0 AR_π		0	0	0	0	0
0	0	0	0	0	0	0	0	0	0 AR_{AK}		0	0	0	0
0	0	0	0	0	0	0	0	0	0	0 AR_w		0	0	0
0	0	0	0	0	0	0	0	0	0	0	0 $AR_{\overline{X}}$		0	0
0	0	0	0	0	0	0	0	0	0	0	0	0 AR_x		0
0	0	0	0	0	0	0	0	0	0	0	0	0	0 $AR_{M'}$	

G1=

1	0	0	0	$1/\eta$	0	1	0	0	0	0	0	0	0	0
0	0	0	0	a1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
-A4	0	a4	0	$1/\alpha-1$	0	0	0	0	0	0	0	a5	0	0
$-(\bar{x}+\bar{v})/\bar{N}$	0	$-(\bar{x}+\bar{v})/\bar{N}$	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	-1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	a7	0	0	a6
0	0	0	0	0	0	0	0	0	0	0	-a9	0	0	a9
0	0	0	0	$\bar{R}\,\bar{K}$	0	$\bar{R}\,\bar{K}$	0	0	0	-a10	0	0	0	$\bar{w}$
1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	-A3	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	$1/\eta$	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	$-\bar{x}$	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	-1	0	0	0	0	0	0	0	0
0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	$\varepsilon\,\bar{m}$	0	$-\overline{lev}\,a9$	0	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	$-\overline{prof}$	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

G0 = [

$1-1/\eta$	0	0	$\eta\alpha/(\eta-1)-1$	0	0	0	0
a1	0	0	$\bar{y}$	0	0	0	0
0	0	0	$\eta\alpha/(\eta-1)$	0	0	0	0
0	0	0	$\eta\alpha/(\eta-1)-1$	0	0	0	0
1	0	0	0	0	0	0	0
0	$\bar{v}$	0	0	0	0	0	0
0	0	1	0	0	0	0	0
0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0
0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0
0	0	0	$a10\,\bar{y}$	0	0	0	0
0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	1

];

$$a1 = \lambda\left(1-1/\varepsilon\right)\overline{A}^{(1-1/\varepsilon)}K^{(1-1/\varepsilon)}$$

$$a3 = \left(1-\lambda\right)\left(1-1/\varepsilon\right)\overline{x}^{(1-1/\varepsilon)}$$

$$a4 = \left(-\beta\mu\left(\overline{AN}^{(1/\alpha)}\overline{x}^{(1-1/\alpha)}\right)^{(1-\nu)}\right)$$

$$a5 = -(1-\mu)(\overline{AK}^{(1/\alpha)}\overline{K}^{(1-1/\alpha)})^{(1-1/\nu)}(1/\alpha)$$

$$\mathrm{a}6 = 1-\phi\overline{\mathrm{w}}/\left(\phi\overline{\mathrm{w}}+\eta\overline{\pi}\right)$$

$$a7 = (-\eta/(\phi\overline{\mathrm{w}}+\eta\overline{\pi}))\overline{\pi}$$

$$a8 = (1-\overline{lev})(\gamma_4\overline{\mathrm{w}}/\overline{\pi})$$

$$a9 = \gamma_4\overline{\mathrm{w}}/\overline{\pi}$$

$$a10 = \overline{\pi}(\alpha\varepsilon/(\varepsilon-1)-1)\overline{y}^{(\alpha\varepsilon/(\varepsilon-1)-2)}$$

Steady state

$$\overline{A} = (\mu(\overline{AN}/\overline{x}^{(\beta)})^{(1-1/\nu)}+(1-\eta)*(AK^{(1/\alpha)}*k^{(1/\alpha-1)})^{(1-1/\nu)})^{(\nu/(\nu-1))})$$

$$\overline{y} = \lambda\overline{A}^{(1-1/\varepsilon)}*\overline{k}^{(1-1/\varepsilon)}+(1-\lambda)\overline{x}^{(1-1/\varepsilon)}$$

$$\overline{R} = \alpha\lambda\overline{A}^{(1-1/\varepsilon)}*\overline{k}^{(1/\varepsilon)}(\lambda(\overline{A}\overline{k})^{(1-1/\varepsilon)}+(1-\eta)*\overline{x}^{(1-1/\varepsilon)})^{(\varepsilon\alpha/(\varepsilon-1)-1)}$$

$$\overline{m} = \gamma_3\overline{\mathrm{w}}/(\phi\overline{\mathrm{w}}+\eta\overline{\pi})$$

$$\overline{v} = \eta\overline{m}+\gamma_4\overline{\mathrm{w}}/\overline{\pi}$$

$$\overline{prof} = \overline{\pi}\overline{y}-\overline{\mathrm{w}}-\overline{R}\overline{K}$$