

Banking and Growth: the Taiwanese case

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Abstract

This paper studies the role of efficiency improvement in capital market on growth for Taiwan from 1961 to 2002. My empirical findings show the long-term declining trend for interest rate spreads between the deposit and loan rates (a bank efficiency indicator). In addition, there are significant distortions in investment decisions of agents operating in otherwise competitive capital markets (by a diagnostic tool developed in recent business cycle literature). Such distortions impact growth of Taiwan during this period. Based upon these two results, I conclude that capital market distortions, which attribute to financial development, may be one of the contributors to growth.

1. Introduction

This paper is a study of Taiwanese growth miracle, looking at its capital market evolution from 1961 to 2002 on growth. In the traditional growth literature, financial market development contributes to growth. For example, Schumpeter (1912), McKinnon (1973), and King and Levine (1993a and 1993b). However, few neoclassical models provide supportive evidence in connecting financial development and growth. In this paper, I adopt the standard neo-classical model to identify how big the contribution of capital market could be on economic growth.

Taiwan is one of the fast growing economies among the newly industrial countries (NICs) since 1951. Figure 1, Figure 2, and Figure 3 show the Real Per Capita GDP of Taiwan relative to the U.S. comparing it with selected economics in Asian¹, Latin America, and Europe. As can be seen, Taiwanese growth is spectacular compare with the rest of the world. Its real GDP per capita relative to the U.S. was 8.27% of the U.S. per capita GDP in 1951 (equivalent to India's relative income to the U.S. in 2002) and was 55.05% of the U.S. in 1998, surpassing economies with real GDP per capita three times of Taiwanese value in 1951, e.g., Spain,

¹ I did not include the data for these two economies because they are city-states. Hong Kong was 23.59% of the U.S. GDP per capita in 1960 and was 78% in 2000; Singapore was 16.7% in 1960 and 80.42% in 2000.

Portugal, Mexico and Greece. Therefore, Taiwanese economic growth is a successful story and investigating its source of growth may clarify why it can manage to grow rapidly and others cannot.

The rest of the paper is organized as follows: First, I review the literatures on the banking efficiency and financial development on growth. Second, I present the results of banking efficiency and financial development indicator for Taiwan. Third, I setup a model and conduct simulation using Cole-Ohanian method to identify the major source of growth and link the bank efficiency with the diagnosis result. Finally, I offer concluding remarks in the last section.

2. Literature Review on Growth and Finance

The role of capital in economic development is under debate. Lucas (1988) addressed the mechanics of economic development and emphasized on capital accumulation, human and physical without discussing the financial development. On the other hand, Levine (1996) argued, “the preponderance of theoretical reasoning and empirical evidence suggests a positive, first order relationship between financial development and economic growth.” (Levine, 1996, p.1) Furthermore, Fry (1995) mentioned that when financial intermediaries perform efficiently, domestic resource mobilization through the financial sector is enhanced.

In the literatures for the U.S. Great Depression, Cole and Ohanian (1999), and Chari, Kehoe and McGrattan (2004) suggest a methodology to diagnose the cause of the economic downturns. Similarly, such an approach can be adopted to diagnose the economic boom.

Therefore, after I show the major indicator for banking efficiency and financial development, I will first use one sector standard neoclassical model to identify how could capital accumulation contributes to growth.

3. Results of Financial Development and Banking Efficiency Indicator

The data used in this paper is downloaded from DataStream, World Penn Table 6.1 and assorted Taiwanese government web pages and statistical data books.

3.1 Banking Development Indicators for Financial Depth:

3.1.1 Ratio of total bank deposit liabilities to nominal GDP (LLY)

This measure is adopted in Demetriades and Luintel (2001), and Christopoulos and Tsionas (2004). “This is a fairly standard measure of financial depth.” (Demetriades and Luintel, 2001, p. 472) The total liability shown below is restricted to banker’s deposit liability to private sector in local currency². The bankers are major financial institutions including postal institutions. Figure 4 shows the LLY for Taiwan. As can be seen, the Banker’s New Taiwan Dollar liability to GDP ratio slopes upward. The series for commercial banks only and those including postal savings and commercial banks make small differences from the series including postal institutions.

3.1.2. Ratio of liquid liability to GDP (DEPTH)

This measure is adopted in King and Levine (1993a & 1993b), and Benhabib and Spiegel (2000). The liquid liability is here defined as either M3 or M2. The practice used in King and Levine is: use M2 only if M3 is not available. In addition, King and Levine suggest using the two-year moving average for measuring the liquid liability so to solve the problem of “deflating financial stock by GDP flow.” (King and Levine 1993a, p. 720) Since Taiwan does not report M3, I adopt M2 in this analysis. Figure 5 shows the DEPTH for Taiwan. As can be seen, this measurement also shows an upward sloping trend. In other words, such indicator shows the same result as the first indicator, ratio of total bank deposit liabilities to nominal GDP.

3.1.3. Other Financial Development Indicators

PRIVY (Bank Credit): This measurement is adopted in King and Levine (1993a & 1993b). The measurement is the ratio of claims on the nonfinancial private sector (IFS line 32d) to GDP. This indicator is for measuring domestic asset distribution. “[This indicator] may reflect the overall size of the public sector and the degree of public sector borrowing and therefore not accurately indicate the level of financial services.” (King and Levine, 1993a, p. 721) Figure 6 shows “PRIVY” for Taiwan from 1961 to 1994. As can be seen, the trend is the same as the previous two indicators.

In sum, the above measurements show that the financial development in Taiwan has been improving since 1961, especially for the banking system. Using different measurement

² Include deposits owned by government and foreign- currency deposit in the total liability does not change the resulted trend.

does not result in different conclusions. The correlation coefficient between ratio of total bank deposit liabilities to nominal GDP, and ratio of liquid liability to GDP for the entire sample is 0.9995, whereas that between the former and PRIVY is 0.9718 and between the latter and PRIVY is 0.9727.

3.2 Banking Efficiency:

3.2.1. Ratio of real loan to number of employees in financial sector

The ratio of real loan to number of employees in Finance sector indicates the efficiency of the banking system. With more loans made per employee, the more efficient of the bank in intermediating funds from savers to investors. Figure 7 shows the ratio of real loan to number of employee in Finance sector. As can be seen, the ratio is at two roughly constant levels with the jump from the late 1980s to the early 1990s.

3.2.2. Spread of loan rate the deposit rate:

The spread between lending rate and deposit rate could reveal the banking efficiency since higher intermediary cost implies higher wedges or spreads. Maxwell Fry, in his book *Money, Interest, and Banking in Economic Development* (1988) mentioned, “ [e]fficient domestic resource mobilization and allocation involve lowering the gross costs of borrowing or investing as close as possible to the net returns to lending or saving. The spread between gross borrowing and net lending rates must cover the costs of financial intermediation. It also covers taxes of various kinds.” (p. 436) Assuming banks are solvent, high intermediation cost pass through to either savers or borrowers and reflects on the interest spread of loan and deposit rates.

Consequently, inefficient bank system results in larger spread of loan and deposit rate than efficient ones. In addition, high intermediation costs impede banks' function as intermediating savers and borrowers and do harm to economic development in capital accumulation. Fry, in his book *Money, Interest, and Banking in Economic Development* (1988) states that “[c]ost of financial intermediation refers to the spread between the gross costs of borrowing and the net return on lending. ...The more efficiently the financial sector carries out its

intermediation role, ... the greater volume of investment will be. More efficient financial intermediation may also increase the average productivity of investment.” (p.237, 267)

High operating costs are prevailing in developing countries as mentioned in Fry (1988). Figure 8 shows the GDP per capita in 2000 international dollar vs. interest spread of loan and deposit rates in 2000. As can be seen, they are negatively related. High- income economies never have high spreads. In term of correlation coefficient, the value is -0.4148 . Therefore, the result shows that a higher income economy usually exist efficient banking system, which is represented by narrow interest rate spread.

Figure 9 show the difference between prime lending rate and deposit rate in Taiwan. I defining the difference, prime lending rate minus deposit rate, as SPREAD. From the argument above, one could expect that the more efficient the financial institutions play as intermediaries, the smaller the wedge. As can be seen, the wedges for Taiwan had been declining from 1961 to early 1980s; remained roughly constant around 2% to 4% until year 2000. One may conclude that the efficiency of banking as intermediaries has been improving.

In sum, the banking system in Taiwan has been developed and the efficiency has been improved since 1961.

3.2.3. SPREAD and Financial Development

Figure 10 shows the SPREAD from 1961 to 1994 with important event of financial development. As can be seen, opening up new financial market corresponds point to fall in SPREAD. In other words, opening up new financial market may improve banking efficiency. However, officially announcing bankers to set interest rate or abolishing interest rate control does are the exception. The mismatch could be resulted from the fact that financial development is in process before the regulation is officially abolished.

4. The Model for Neoclassical Diagnoses

In the literatures on the U.S. Great Depression, Cole and Ohanian (1999), and Chari, Kehoe and McGrattan (2004) suggest a methodology to diagnose the cause of the economic downturns. Similarly, such an approach can be adopted to diagnose the causes of economic booms. In the following section, I follow closely the method suggested by Cole and Ohanian

(1999), and Chari, Kehoe and McGrattan (2006). First, I will define the economy and the equilibrium conditions for an undistorted economy. Second, since we observe Taiwanese economy deviates up from the balanced growth path, which is defined as 2% growth annually, wedges are introduced for labor market, capital market and productivity shocks to capture how the economy deviates from the world balanced growth path. Third, I calibrate the parameters for the economy assuming no distortion except productivity shocks. Finally, assuming the agent in the economy has perfect foresight, I mimic the growth path for Taiwan when different wedges are introduced in the model with assorted combinations. Given the model can well represent the dynamics in the economy, the method is used to identify the role of efficiency improvement in capital market on growth.

4.1 The Economy

The economy of the model is composed of a representative family, and producers in a perfect foresight environment. Individuals may face shocks but the shock only lasts for one period.

4.1.1 The Representative Family

I adopt a special form of the CES utility function for the family in this economy. Agents value leisure. There is one unit of labor available each period. In addition, they are infinitely lived. Hence, the preferences are as follows:

$$\text{Max} \left\{ u(C) = \sum_{t=0}^{\infty} \beta^t \{ \log(C_t) + \phi \log(1 - \hat{h}_t) \} \right\}$$

In addition, β represents the discount factor.

Finally, the population grows deterministically at rate ν , thus population n at t can be express as follows: $n_t = (1 + \nu)^t$

4.1.2 Production Sector

Firms in this economy adopt labor augmented Cobb-Douglas production technology. For a single firm, $y_t = k_t^\theta (x_t l_t)^{1-\theta}$, $x_t = (1 + \gamma)^t x_0$, where y is output, k is capital input, and l is labor input. In addition, θ is capital share and γ is the growth rate of the labor-augmented

technology. By property of the Cobb-Douglas production function, the production technology for the whole sector can be expressed as equation (1) below:

$$Y_t = K_t^\theta (x_t \hat{L}_t)^{1-\theta} \quad (1)$$

In equation (A1), Y is aggregate output, K is aggregate capital input, and L is aggregate labor input.

4.2 The Equilibrium

A competitive equilibrium is derived as follows (from A to D):

- A) Given the population grows deterministically at rate ν , and $n_t = (1 + \nu)^t$, I divide all the variables by $n_t = (1 + \nu)^t$ so to get rid of the growth effect from population.
- B) Given the labor-augmented technology which grows at rate γ , I detrend all the variables by $(1 + \gamma)^t$.
- C) The stationary version of the model as a competitive equilibrium is presented below after defining the detrended per capita variables as follows:

$$\begin{aligned} \tilde{k}_t &= \frac{k_t}{(1 + \nu)^t (1 + \gamma)^t}; & \tilde{K}_t &= \frac{K_t}{(1 + \nu)^t (1 + \gamma)^t} \\ h_t &= \frac{\hat{h}_t}{(1 + \nu)^t}; & L_t &= \frac{\hat{L}_t}{(1 + \nu)^t} \\ \tilde{Y}_t &= \frac{Y_t}{(1 + \nu)^t (1 + \gamma)^t}; & \tilde{C}_t &= \frac{C_t}{(1 + \nu)^t (1 + \gamma)^t} \\ \tilde{I}_t &= \frac{I_t}{(1 + \nu)^t (1 + \gamma)^t}; & \tilde{w}_t &= \frac{w_t}{(1 + \gamma)^t} \end{aligned}$$

D) To get the competitive equilibrium, I take the steps as follows (from a to f) :

- a) Given $\{w_t, r_t\}_{t=0}^\infty$, K and L solve the firm's problem:

$$\begin{aligned} & \text{Max}_{K_t, L_t} \{ Z_t K_t^\theta (x_t L_t)^{1-\theta} - w_t L_t - r_t K_t \} \\ \Rightarrow \frac{\partial Y}{\partial K_t} & \equiv r_t = \theta \cdot Z_t K_t^{\theta-1} (x_t L_t)^{1-\theta} = \theta \frac{Y_t}{K_t} \\ \frac{\partial Y}{\partial L_t} & \equiv w_t = (1 - \theta) Z_t K_t^\theta x_t^{1-\theta} (L_t)^{-\theta} = (1 - \theta) \frac{Y_t}{L_t} \end{aligned}$$

- b) Representative family maximized given $\{w_t, r_t\}_{t=0}^\infty$

$$\text{Max}_{h_t, k_{t+1}} \left\{ u(C) = \sum_{t=0}^{\infty} \beta^t \{ \log(C_t) + \phi \log(1 - h_t) \} \right\}$$

$$\text{s.t. } C_t + I_t \leq w_t h_t + r_t k_t \quad ; \quad I_t = K_{t+1} - (1 - \delta)K_t$$

$$\text{F.O.C.: } \frac{\partial \bullet}{\partial h_t} : \frac{w_t}{C_t} = \frac{\phi}{1 - h_t}$$

$$\frac{\partial \bullet}{\partial \tilde{k}_{t+1}} : \frac{C_{t+1}}{C_t} = \beta \cdot (r_{t+1} + 1 - \delta)$$

c) Market clearance conditions

$$\begin{aligned} K_t &= k_t \\ L_t &= h_t \end{aligned}$$

There are two factor-markets in this economy: capital market and labor market. Therefore, I set two market clear conditions at equilibrium. Capital market clears at price r_t ; labor market clears at wage w_t and resource constraint satisfied.

d) Resource Constraint

$$C_t + I_t \leq Z_t K_t^\theta (x_t L_t)^{1-\theta}$$

e) Law of motion

$$\begin{aligned} (1 + \nu)(1 + \gamma)\tilde{K}_{t+1} &= \tilde{I}_t + (1 - \delta)\tilde{K}_t \\ x_t &= (1 + \gamma)^t \end{aligned}$$

f) The System of Equations

Therefore, a competitive equilibrium for an undistorted system is a sequence of quantities $\{h_t, k_t, Y_t, C_t\}_{t=0}^{\infty}$, and a sequence of prices $\{w_t, r_t\}_{t=0}^{\infty}$ such that the representative family and firm optimize and market clear.

The system of equations characterize the equilibrium in terms of the detrended variables is as follows.

$$Y_t = \tilde{k}_t^\theta (x_0 h_t)^{1-\theta} \tag{2}$$

$$\tilde{C}_t = \frac{\tilde{w}_t \phi}{1 - \tilde{c}_t} \tag{3}$$

$$\{(1 + \gamma) \frac{\tilde{C}_{t+1}}{\tilde{C}_t} \cdot \beta\} = 1 + r_{t+1} - \delta \tag{4}$$

$$\tilde{Y}_t = \tilde{C}_t + (1 + \nu)(1 + \gamma)\tilde{k}_{t+1} - (1 - \delta)\tilde{k}_t \tag{5}$$

$$r_t = \theta Z_t \tilde{k}_t^{\theta-1} (x_0 h_t)^{1-\theta} \tag{6}$$

$$\tilde{w}_t = (1 - \theta)Z_t \tilde{k}^\theta h_t^{-\theta} x_0^{1-\theta} \quad (7)$$

The system of equations (2-7) has 6 equations and 6 unknowns. The system expresses the steady state conditions of the economy along the balanced growth path.

4.3 Define Wedges

System of Equations (2-7) is the general equilibrium of the simplified economic system. If all variables remain the same for an economy (if there is any trend, one can detrend the variables and make it stationary), we say the economy is at the steady states and this trajectory is called the balanced growth path. However, the economy does not always stay on this path. If there are shocks, the economy will deviate away from its balanced growth path and we observe boom and bust. Based upon this system of equations, Cole and Ohanian (1999), and Chari, Kehoe and McGrattan (2006) suggest a methodology to diagnose the cause of the economic downturns and recoveries.

The logic behind the diagnostic tools is: When an economy deviates from the steady state, the right and left hand side of the equation will not equal to each other. Therefore, they define wedges (taxes or gaps) to gauge the right and left hand side of each equation. Then, these wedges quantify the degree an economy deviates away from the balanced growth path and they represent the source of shocks that drives business cycles. They characterize these “wedges” as productivity (Z) for equation 2, labor wages or labor taxes (τ_{lt}) for equation 3, investment wedges or capital taxes (τ_{kt}) for equation 4, and government consumption wedges for equation 5.

These wedges reflect the size of shocks on productivity, labor market; capital market and domestic resources that drive the economy deviate from the balanced growth path. The economy faces positive shock on productivity if Z is greater than one, whereas it faces positive shock on labor and capital market when taxes (τ_{lt} and τ_{kt}) are negative. By construction, introducing all the wedges above will account for the observed trajectory of economic transition. Therefore, the wedges are defined as follows:

$$\begin{aligned}
\text{productivity (productivity wedges): } Z_t &= \frac{\tilde{Y}_t}{\tilde{k}_t^\theta (x_0 h_t)^{1-\theta}} \\
\text{labor tax (labor wedges): } \frac{\tilde{C}_t}{\tilde{w}_t} \frac{\phi}{1-h_t} &\equiv (1-\tau_{lt}) \\
\text{capital tax (investmnt wedges): } \left\{ (1+\gamma) \frac{\tilde{C}_{t+1}}{\tilde{C}_t} \beta \right\} &\equiv (1+r_{t+1}-\delta)(1-\tau_{k,t+1}) \\
\text{government consumption wedges: } gap_t^y &= \tilde{Y}_t - \tilde{C}_t - (1+\nu)(1+\gamma)\tilde{k}_{t+1} + (1-\delta)\tilde{k}_t
\end{aligned}$$

Ideally, introducing all the wedges above plus the wedges for factor prices, which defined as the gap between factor price in the model and factor price in statistics, will well mimic the trajectory of economic transition. In section 5, I show when introducing productivity wedge, labor wedge and capital wedge in my simulation and show the model already well capture the trend and level of the data from statistics.

5. Parameterization

In this section, I show the parameterization and simulation for the model.

5.1 Parameterization

For the firm's production function, the capital share is chosen to be $\{1/3\}$. Since the average per working capita growth rate is 2.63%, I adopt 0.026 as ν . In addition, I assume the balanced growth grow at the rate of 2% and choose γ to be 0.02. Finally, I assume the depreciation rate is 0.07, which is the annual average depreciation rate for aggregated capital stock in Taiwan. To pin down x_0 , I assume the productivity shock, z , equals one in the initial year. Therefore,

$$Z_{initial} = \frac{\tilde{Y}_{initial}}{\tilde{K}_{initial}^\theta (h_{initial} x_0)^{1-\theta}} \equiv 1.$$

In addition, I assume the productivity shocks from 2002 on are the same as that of 2001 detrended.

To pin down ϕ , I assume the labor tax is zero in 2002 and so forth; thus,

$$\phi = (1-L_{2002}) \frac{(1-\theta) \tilde{Y}_{2002} / L_{2002}}{\tilde{C}_{2002}}$$

To pin down β , I assume the capital tax is zero in 2002 and so forth; thus,

$$\beta = \frac{(1+\gamma)}{(r_{2002}+1-\delta)}.$$

Table VIII shows the results of the calibration. Notice that the discount factor is 0.9668, which is above 0.95, the standard assumption. The higher discount factor for Taiwanese economy may imply the agents in the economy is more patient than the standard case- such a presumption is reasonable given the high saving rate in the East Asian economies.

Table I: Results of Calibration

	x_0	ϕ	β
TW Employment (1961 - 2002)	136.8135	0.8383	0.9668

6. Results

6.1 The wedges

In this section, I show Taiwanese wedges, which capture how the economy deviates up from the world 2% balanced growth path. I show the case covering 1961 to 2002 using employment as labor input. Though employment is only a proxy for labor input, I use that to extend my case keeping in mind that I may mitigate the shocks on the labor market since the labor participation ratio is a proxy input less flexible than working hours. Since the focal point of this paper is about capital market, choosing employment rather than labor hour as labor input will not affect or calibrated capital tax.

The wedges are shown in Figure 11. As can be seen, the economy faces positive productivity shocks since 1961 assuming the productivity shocks (Z) in 1961 equals one. For capital market, the economy faces negative shocks in the early periods and positive shocks (negative capital tax in graph) during 1961-1973, and the positive shocks persist during 1986 to 1999.

6.2 The Diagnoses for Economic Growth in Taiwan

In this section, I diagnose Taiwanese economy using the model set up in section IV, controlling the presence of different wedges, and identifying the extend capital market wedges can explain the performance of the economy. The underlying algorithm is as follows: Without any of the shock, the economy is on the balanced growth path, which grows at 2% annually. Since the model presented is for detrended variables, the simulated data should show no growth at all if the economy is initially at the steady state and remains on the balanced growth

path. If there are any economy specific shock that make the economy deviate from the balanced growth path, one can measure the degree of such deviation for productivity, capital market and labor market in terms of productivity shocks (also viewed as TFP), capital wedges and labor wedges. For example, if TFP improvement is the only explanation for the observed output deviation from the balanced growth path, introducing productivity shock in the model will perfectly generate the simulated results that are the same as the real statistics.

I show the Output, Labor, C/Y, and I/Y for Model with different combinations of wedges in Figure 12 and Figure 14 with TFP (Z), Z and labor wedges (L TAX) and Z, L TAX and capital wedges (K TAX).

Figure 12 shows the result of simulation introducing productivity shocks (Z). As revealed by the graph, productivity shock is crucial in explaining Taiwanese long-term trend of growth. However, other wedges are also important in explaining the output the economy achieved. Figure 13 shows the results of model adopting Z plus L wedges. As is shown, the model could well mimic the economy for output and labor until the early 1980s. Therefore, I cannot deny the importance of productivity shock over the period. However, the Labor wedges and productivity shocks are not complete in explaining Taiwanese growth miracle. As shown in Figure 14, the gap mitigates when introduce K TAX in addition to L TAX and Z. Therefore, capital market evolution also plays a role in explaining the growth path.

6.3 Banking Development Indicator versus Calibrated K TAX

Indicator of banking system development (BANK) measures the relative level of an economy's soundness of banking system. BANK can be LLY, DEPTH or PRIVY. The larger number of the indicator implies higher level of financial development. The calibrated capital market tax (K TAX) is the wedge measuring the degree of capital market disequilibrium. Positive tax reflects negative shocks on capital market, whereas negative tax reflects positive shock on the market. Therefore, small K TAX implies that capital market development significantly contributes to the economic growth. I summarize the relationship of degree of financial development with the variables in the table below:

	BANK	K TAX
Degree of financial Development	Positive relationship	Negative relationship

One would expect strong negative correlation coefficient between BANK and K TAX if banking system development is the major cause of capital market disequilibrium. The following table shows the correlation coefficient for these three financial development indicators versus capital market tax for different periods:

	<i>Bank liability vs. Tax</i>	<i>Liquidity vs. Tax</i>	<i>PRIVY vs. Tax</i>
1961-2002	-0.5320	-0.4755	-0.5238
1961-1980	-0.8293	-0.8280	-0.8192

As can be seen, banking development indicator highly negatively correlates with capital market tax, especially when one look at the period from 1961 to 1980. The correlation coefficients were high for all the indicators, especially when the period of study ends before 1990.

On the other hand, the indicators are positively correlated with capital market distortion when the period starts from early 1980s, rather than 1961. In other word, the banking development may be highly related to the capital market disequilibrium before 1980. The development of banking systems since 1980 has small effect on the measured capital market distortion, which deviates Taiwanese growth upward relative to the 2% balanced growth path.

6.4 Banking Efficiency indicator (Interest rate Spread) vs. K Tax

Figure 15 shows the interest rate spread and K Tax from 1961 to 2002. As can be seen, the two series shows the same pattern with long term falling trend and up in the later periods. The correlation coefficient of the two series is 0.8148 for the entire period. Notice that higher interest rate spread implies inefficiency whereas high K tax implies high degree of capital market wedges.

Therefore, from the above indicators for banking development and banking efficiency, the banking development and improvement of its efficiency is highly related with capital market evolution in Taiwan from 1961 to the late 1980s.

7. Conclusion

In this paper, I study the financial development and banking efficiency improvements in Taiwan after the Second World War. The financial development indicators show that the banking system in Taiwan has been developing. In addition, the banking efficiency indicator shows that the efficiency has been improving as well, especially from 1961 to 1980. This result implies that financial development and intermediation efficiency occur simultaneously.

Furthermore, I introduced business cycle accounting (i.e. Cole-Ohanian method in the neoclassical literature) to identify the major source of growth for Taiwan from 1961 to 2002. Such method allows analyzing the dynamics of the economy by observing agents' and firms' choices about factor inputs and the resulted production outcome. The preliminary diagnosis for the source of growth for Taiwan shows that the investment wedges also play a role in influencing the growth trajectory. Compared with the technology improvement, though the role of capital market shocks is small, one could learn about the dynamics of an economy when facing capital market shocks through the lens of neoclassical model and.

The preliminary results show that the results for the diagnosis coincide with the indicators for financial development and bank efficiency. Therefore, the banking system in Taiwan has been developing and its efficiency has been improving. Such long-term trend of improvement in the financial market is consistent with the trend for the K Tax, which generates capital market distortions which were negatively and then positively affect the economic growth. The high correlation coefficients of these indicators lead to further research on conducting theoretical verification of the relationships among financial development, banking efficiency and economic growth.

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<http://www.stat.gov.tw/ct.asp?xItem=11979&CtNode=3561>

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http://db.eiu.com/report_dl.asp?issue_id=1289490114&mode=pdf

Penn World Table

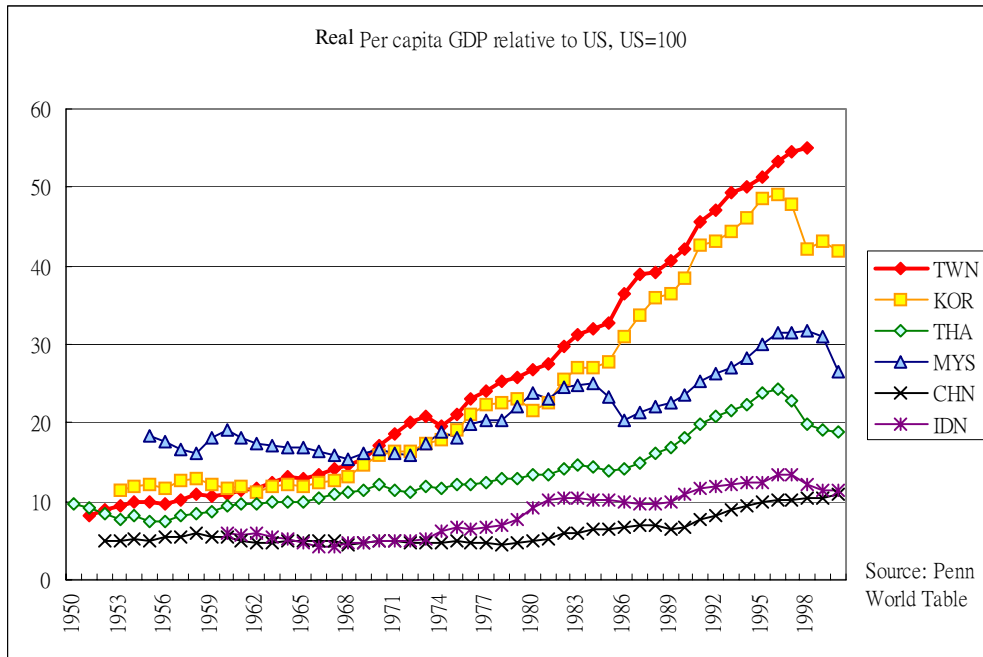


Figure 1: Real GDP per capita relative to U.S., 1950 – 2000, Taiwan vs. Asian Countries

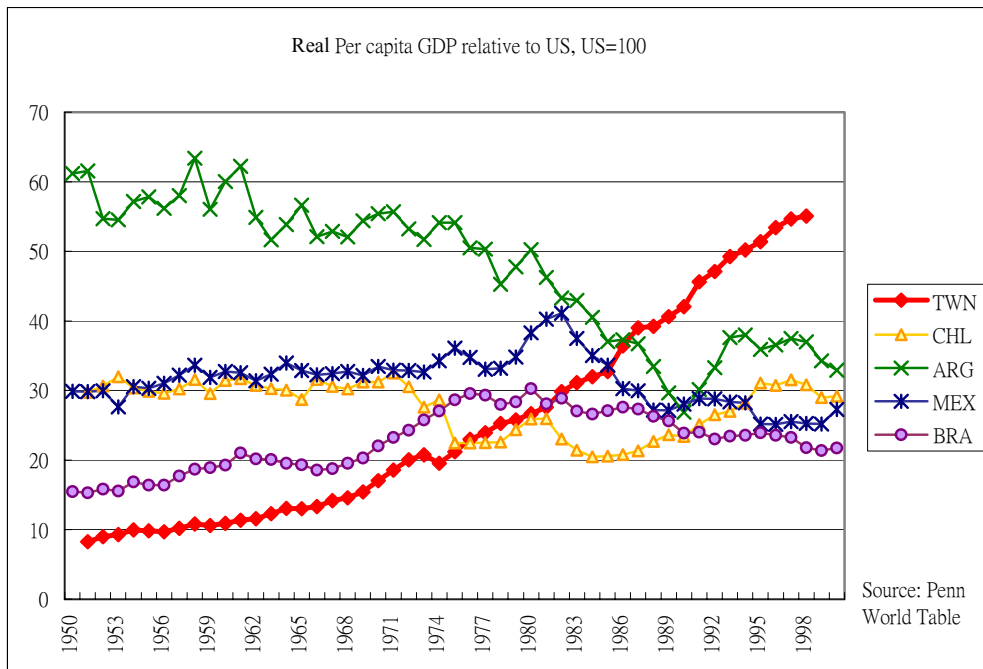


Figure 2: Real GDP per capita relative to U.S., 1950 – 2000, Taiwan vs. Latin American Countries

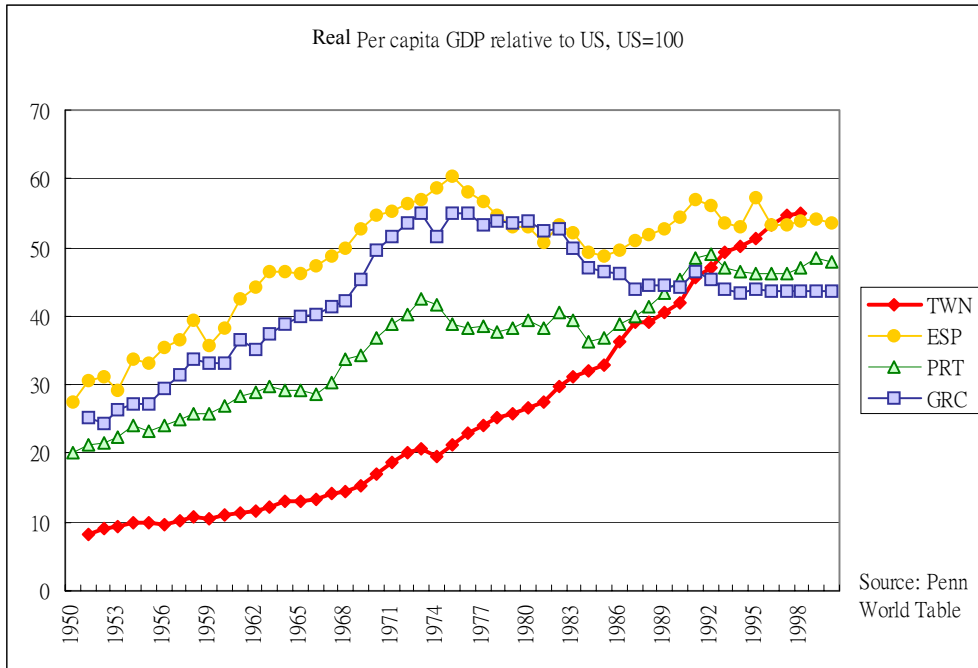


Figure 3: Real GDP per capita relative to U.S., 1950 – 2000, Taiwan vs. European Countries

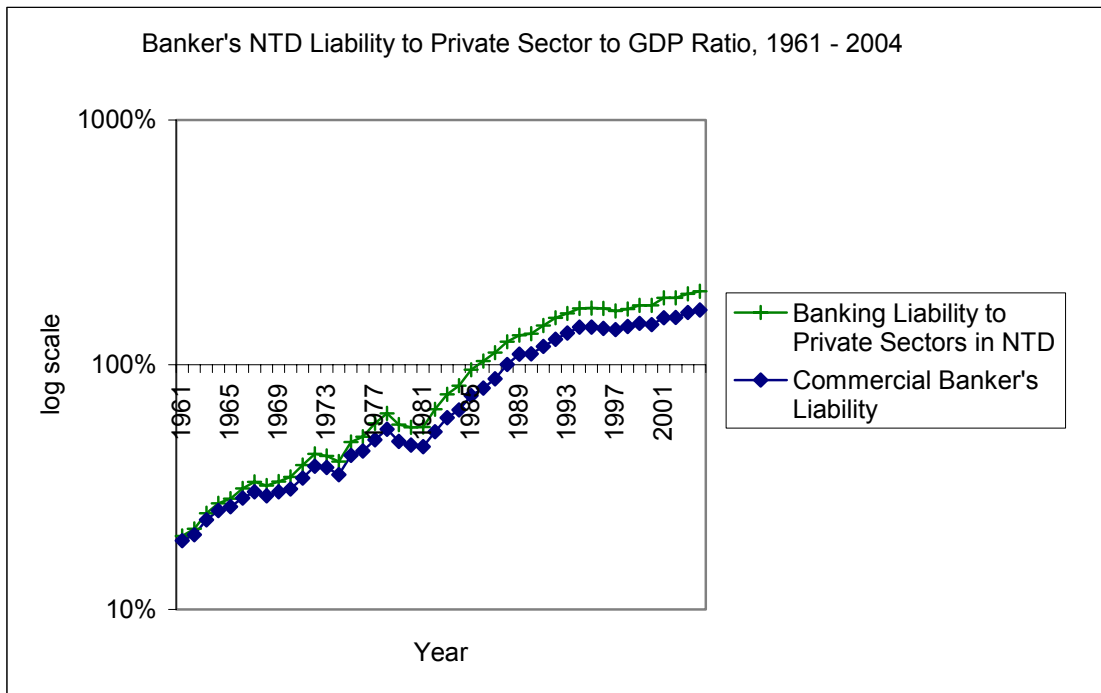


Figure 4: LLY for Taiwan

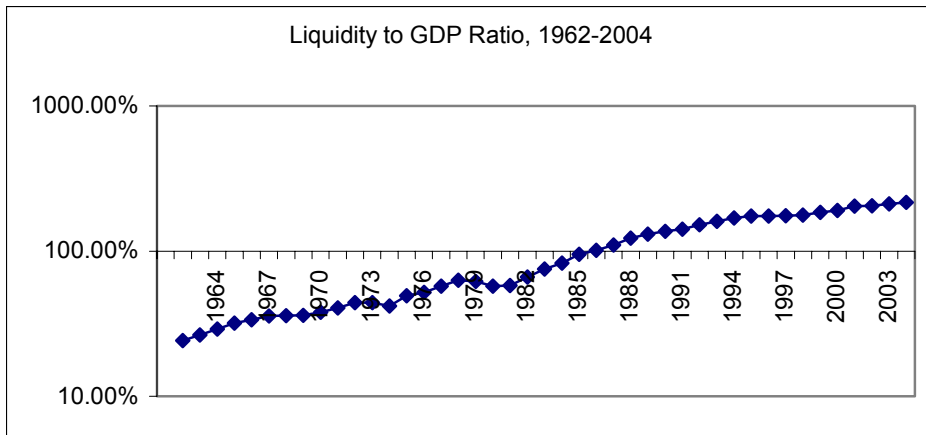


Figure 5: DEPTH for Taiwan

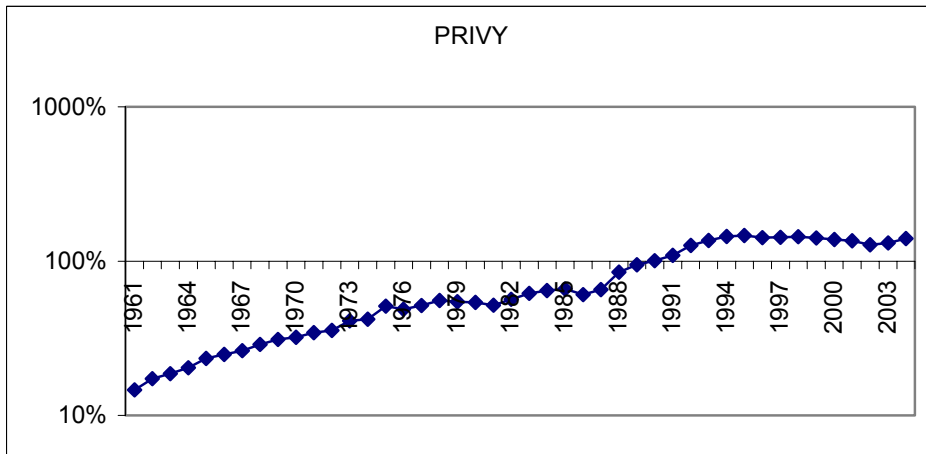


Figure 6: PRIVY for Taiwan

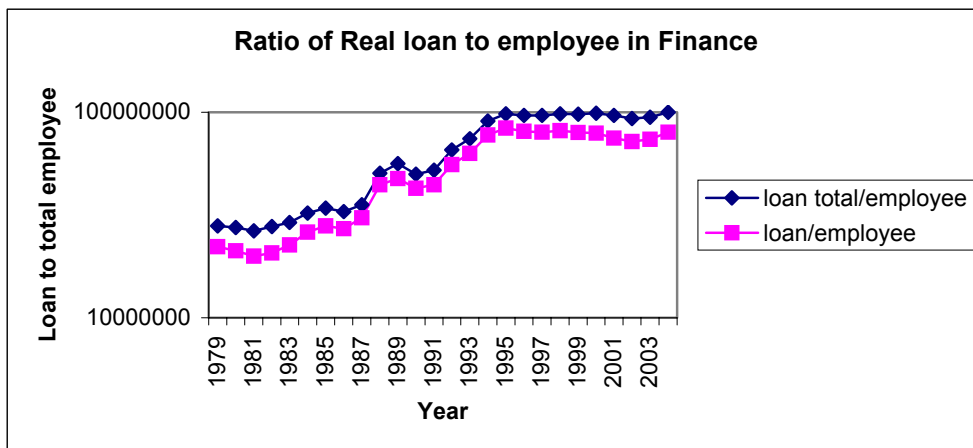


Figure 7: Real loan to employee ratio
(Source: Emp: DGBAS, Loan: CBC)

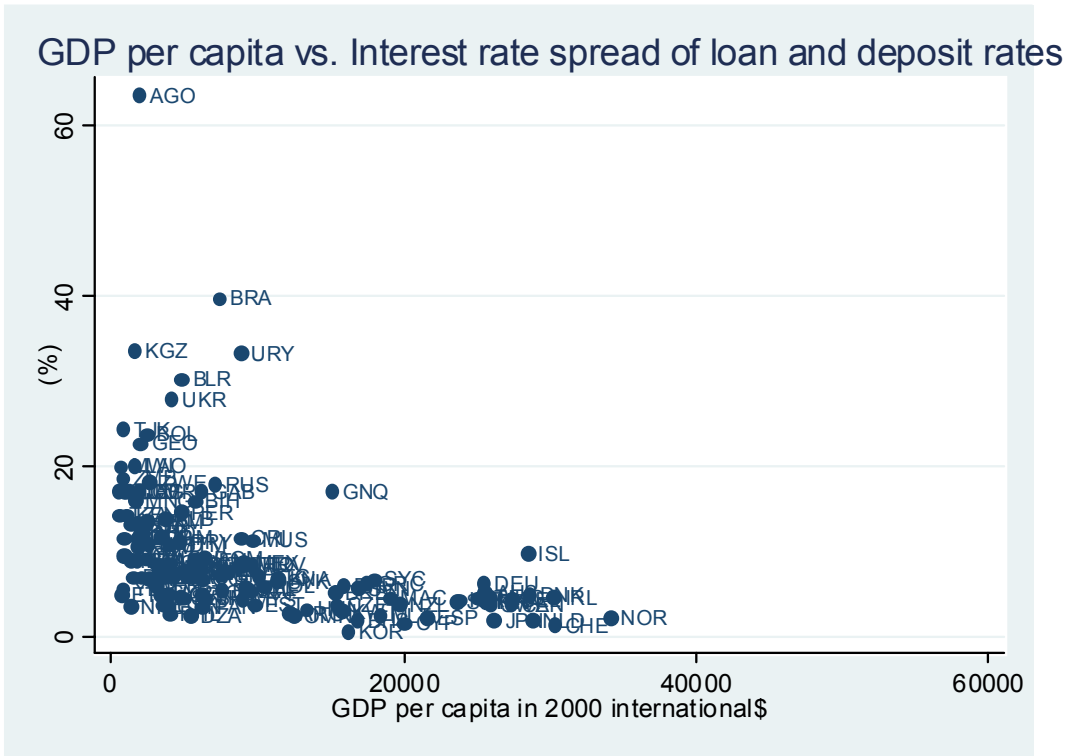


Figure 8: GDP per capita vs. SPREAD (Source: World Development Indicator)

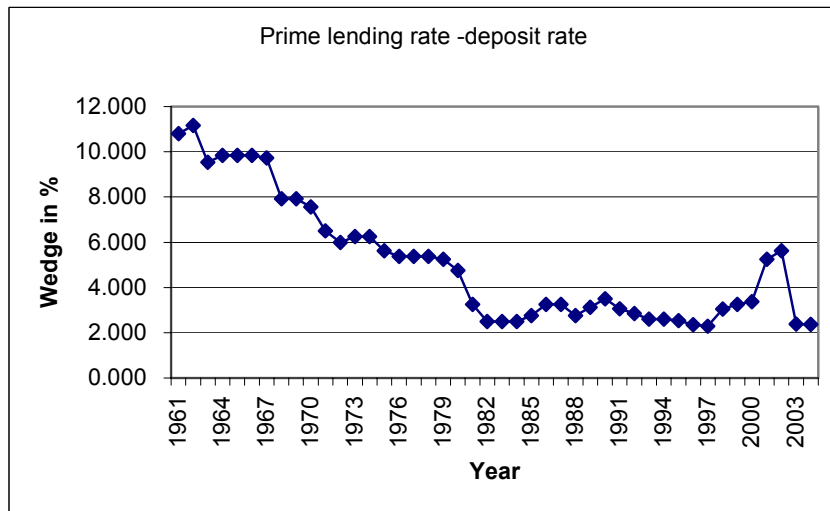


Figure 9: SPREAD

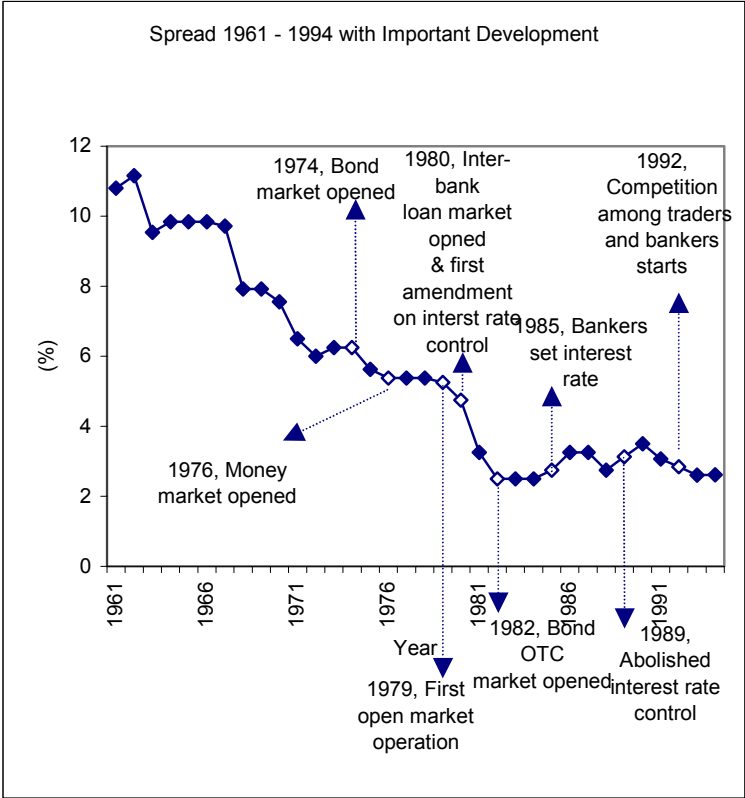


Figure 10: SPREAD and Financial Development

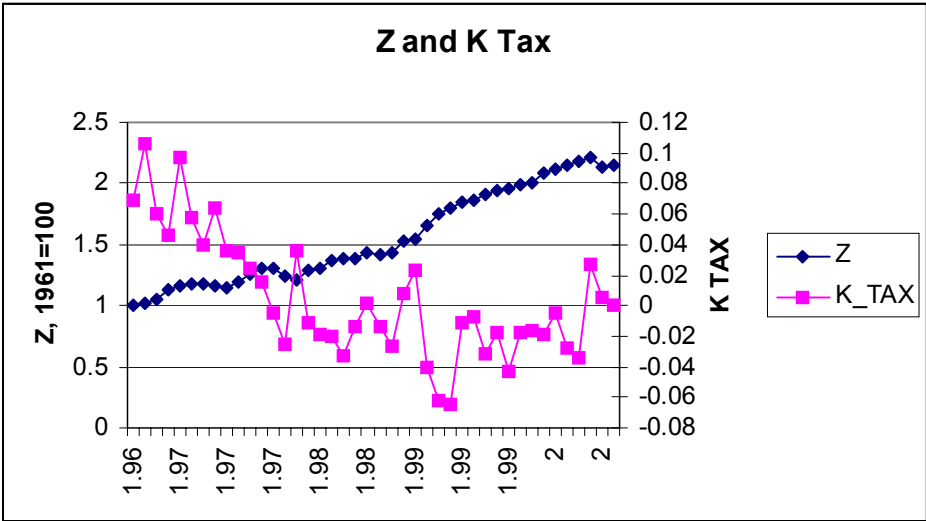


Figure 11: Z and K Tax

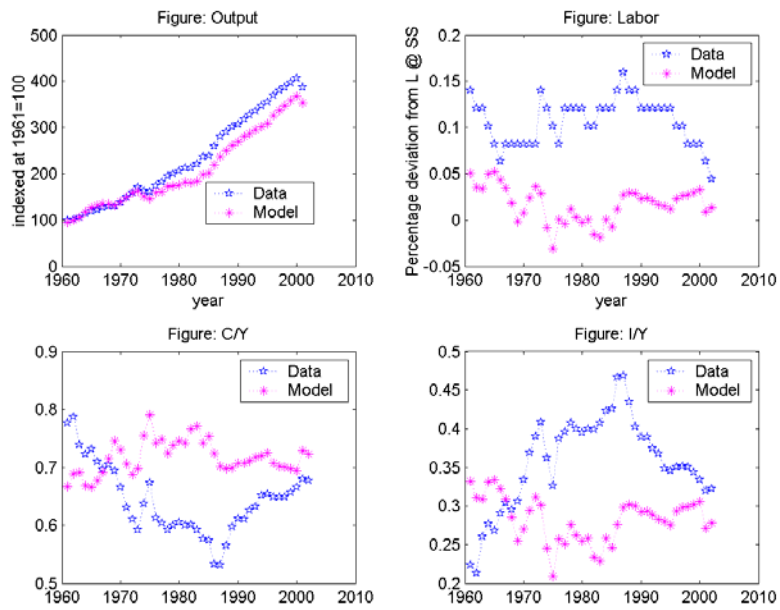


Figure 12: Simulation with Z

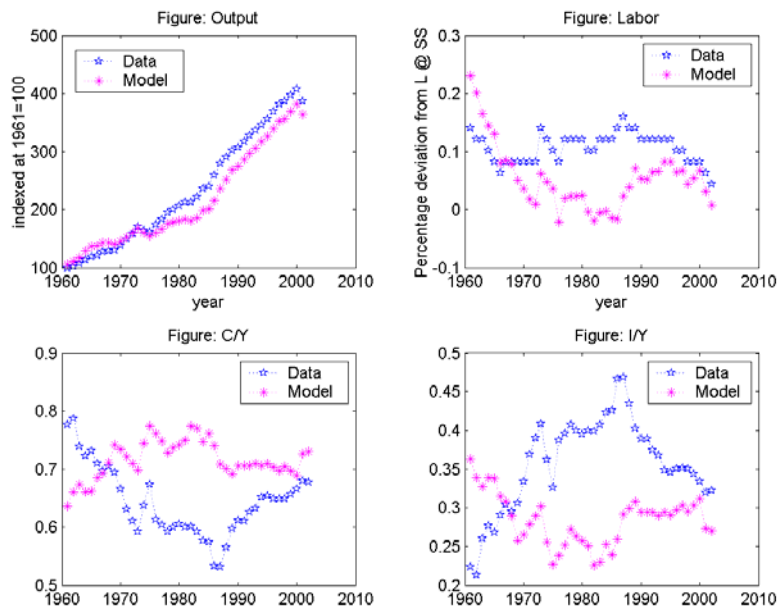


Figure 13: Simulation with ZL

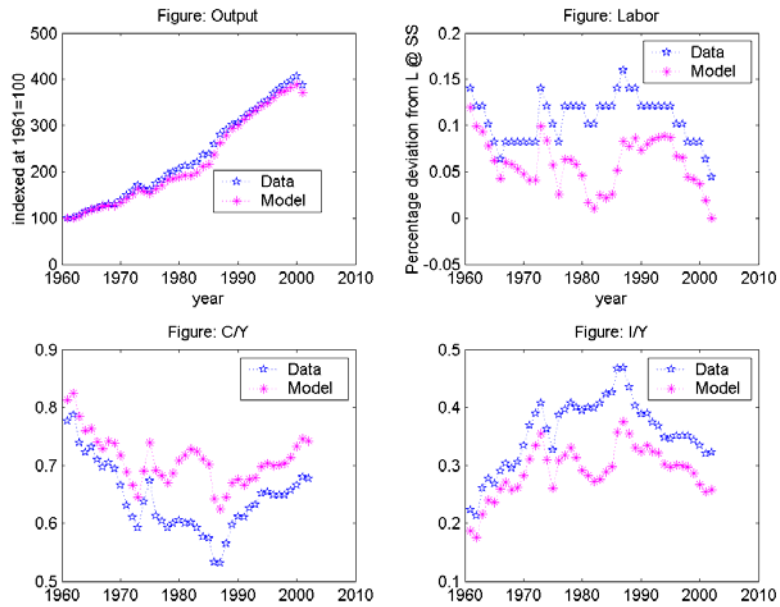


Figure 14: Simulation with ZKL

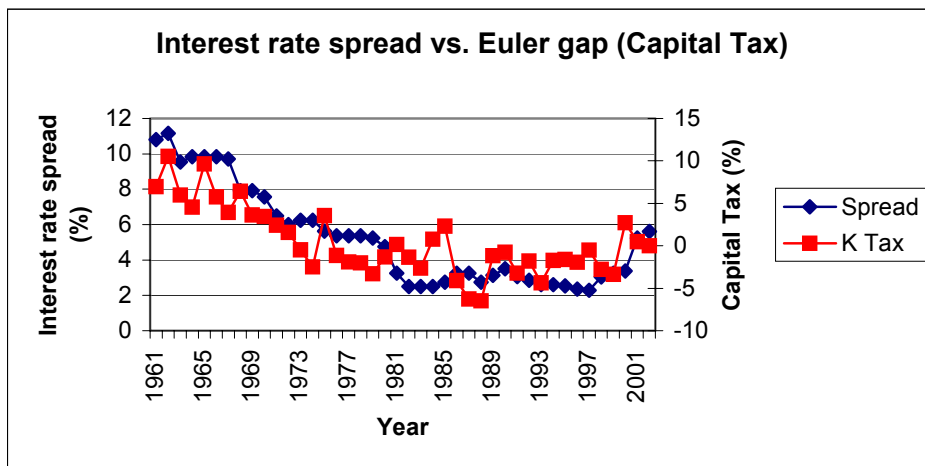


Figure 15: SPREAD vs. K TAX