

Taiwan's Looming Banking Crisis

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Abstract

In light of the recent decline in the health of Taiwan's banking sector, this study applies the threshold indicators approach of Kaminsky and Reinhart (1999) to evaluate the likelihood of a banking crisis in Taiwan. 70% of Kaminsky and Reinhart's indicators signal a banking crisis, even using only a 1 year window for indication. This percentage is close to that of Korea in late 1996, just before the Asian Crisis of 1997 hit, and is actually higher than that of Japan around the same time period, just before Japan's banking crisis erupted in the Fall of 1997.

It is unlikely that an economy such as Taiwan, with a flexible exchange rate regime and substantial foreign reserves, would face a balance of payments crisis of the type that hit Asia in 1997. However, an institutional analysis of the nature and causes of the weakness in Taiwan's banking sector suggests that the economy seems very vulnerable to an internal banking crisis.

The analytic and empirical results of this study indicate that Taiwan will soon be facing a banking crisis similar in type and scale to that faced in Japan in 1997-1998.

Journal of Economic Literature Classification Codes: F31

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1 Introduction

Is Taiwan headed for a banking crisis? The economy weathered the Asian financial crisis of 1997 remarkably well. While many other Asian economies slipped into recession in 1998, Taipei, China

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maintained a moderate growth rate of 4.83%¹. Taiwan's liberalization of cross border capital flows is considered to have been more cautious and gradual than that of other Asian countries². The current account balance remained positive and the central bank maintained ample foreign reserves. Although the new Taiwan dollar has lost some strength since 1999, the currency faced nothing like the devaluations experienced in crisis hit Asian countries.

However, while the economy of Taipei, China remains well insulated from the type of *external* shocks that caused the Asian crisis of 1997, the economy is currently facing an *internal* crisis in its banking system. The non-performing loan ratio of Taiwanese banks have reached an all time high and measures of bank performance such as return on equity and return on assets have been declining steadily since 1997.

The domestic nature of the problems faced by Taiwan's banking sector has led to comparisons with Japan. This study examines the banking problems in Taipei, China, drawing relevant comparisons with Japan's banking crisis of 1997. Section 2 examines the health of the Taiwanese banking sector. Section 3 analyzes the major causes of the banking sector problems and section 4 reviews the similarities between the experiences of Taiwan and Japan. Section 5 uses a threshold indicators approach to evaluate the likelihood of a banking crisis in Taiwan, providing comparisons with Japan and Korea prior to the 1997 crisis. Section 6 concludes.

2 Early Warning Signs of a Banking Crisis?

Why are there fears of a banking crisis in Taipei, China? The return on assets (ROA) and return on equity (ROE) of Taiwan's major banks have been declining since 1997 (see figure 1). In addition, the non-performing loan ratio of Taiwan's major banks has been steadily increasing over the past decade and is now at an all-time high³. The most current figure of 7.79% reported in figure 1 is underestimated since new non-performing loan definitions, following current global standards, will be implemented at the close of this fiscal year. Current estimates of the non-performing loan ratio under the new definition are 11.53%.

The non-performing loan problem, although serious for all banks in Taipei, China, is much more pronounced at smaller financial institutions such as the credit cooperatives and credit departments of farmers' and fishermen's associations⁴ (see figure 2). Even before the non-performing loan problem had grown to such proportions, there were a string of arranged mergers between troubled

¹(Ding and Yeh 2001). In the 5 years prior to the 1997 crisis, Taipei, China had average growth rate of 6.3% (ADB 1998).

²For example, see (Thurbon 2001) for an analysis of Taiwan's external financial liberalization as compared with South Korea.

³Krugman (1998) shows that the nonperforming loan rates of banks are a major determinant of financial crises in Asia.

⁴Yu (2000) shows that bank size is one of the main determinants of capital ratios of Taiwanese banks and that small and medium sized banks may be undercapitalized.

	Taipei, China		
	ROA	ROE	NPL/ Loans
1993	0.97%	8.76%	1.14%
1994	1.16%	9.31%	1.82%
1995	0.93%	7.81%	2.85%
1996	0.99%	9.15%	3.68%
1997	1.09%	10.21%	3.70%
1998	0.75%	5.69%	4.36%
1999	0.59%	4.55%	4.88%
2000	0.38%	2.28%	5.34%
2001			7.79%

Figure 1: Taipei, China: Performance of Major Banks 1991-2001

credit cooperatives and healthier banks in the late 1990s⁵. When the problems in the banking sector began to surface after 1997, there were also runs on several financial institutions⁶. These were also resolved, in many cases, via arranged mergers with healthier institutions.

	1993	1994	1995	1996	1997	1998	1999	2000	2001
Domestic Banks	1.17%	1.85%	2.92%	3.68%	3.70%	4.36%	4.88%	5.34%	8.26%
Foreign Banks	0.38%	0.45%	0.82%	0.97%	1.00%	1.60%	3.20%	3.22%	3.59%
Credit Cooperatives	1.17%	2.15%	3.14%	6.11%	6.44%	7.58%	10.44%	12.44%	11.89%
Credit Department of Farmers' Association	1.70%	2.87%	5.24%	8.46%	10.83%	13.18%	16.10%	17.97%	19.44%
Credit Department of Fishermen's Association	2.90%	2.55%	5.02%	6.21%	9.21%	11.32%	12.99%	14.11%	15.19%

Figure 2: Taipei, China: Non-Performing Loans of Financial Institutions 1993-2001

As the banking sector problems grew, the government finally allocated a special Financial Reconstruction Fund to deal with troubled institutions and this was first activated in August of last year when 36 institutions, mostly agricultural cooperatives, were placed under state management.

⁵In just two years between 1997-1998, there were 15 arranged mergers for troubled credit cooperatives (Lee 2001).

⁶At least 10 reported bank runs since November 1998 (Lee 2001).

Although some public funds were used in this process, eventually the troubled financial institutions were again pushed off on to healthier banks. In October of the same year, this fund took over the management of Chung Shing Bank, a mid-sized bank. The government has still failed to come to an agreement with bidders in order to sell off the bank to a merger partner. In January of this year, the reconstruction fund took over the Medium Business Bank of Kaosiung, another mid-sized bank.

3 Causes of the Banking Sector Problems

This section discusses two principle causes of the banking sector problems in Taiwan: macroeconomic conditions, in particular the extremely volatile movement in asset markets, and financial liberalization of both capital markets and the banking sector.

3.1 Macroeconomic Conditions

Asset prices skyrocketed in Taipei, China in the late 1980s⁷. Housing prices more than quadrupled between 1987 and 1990⁸ (see figure 3). During the same period, the Taiwan Stock Exchange (TAIEX) soared from 637 points in July 1985 to 12,054 points in January 1990. After peaking in January 1990, the TAIEX began to fall, and hit as low as 2,705 in September 1990. Since this initial fall, the market has been extremely volatile, rising and crashing again in 1997 and again 2000 (see figure 4).

The decline in equity and real estate prices greatly affected the banking sector. As the housing market boomed in the 1980s, bank loans to individuals drew double digit loan growth rates (figure 5). In March 1980 20% of total bank lending was to individuals⁹. By March 1990, the share of lending going to individuals had more than doubled¹⁰ (figure 6). As a result, loans to individuals make up a large share - 44% - of the non-performing loans held by banks¹¹ (figure 7).

⁷Yin (2001) provides a description of how financial regulation and macroeconomic policies contributed to the asset bubble in Taipei, China.

⁸Real estate prices in Taipei, China have not collapsed as yet, partially due to government intervention in the market. However, the effectiveness of these so-called "hot air" policies is declining and real estate prices in certain areas have seen significant drops. For example, the real estate prices in south and central Taipei, China are now 50-60% of their peak (Yin (2001)).

⁹Lending to individuals is not entirely housing loans. The category includes real estate, movable properties, business investments and current operations. However, most loan to individuals (64.45%) are made to finance real estate. (Data from CEIC)

¹⁰Overall, including loans to individuals and various industrial sectors, 36.2% of loans are made to finance real estate deals. Since real estate loans to individuals make up 25.4% ($39.42\% \times 64.45\%$), the remaining 10.79% ($36.2\% - 25.4\%$) are lending to private or government enterprises in order to finance real estate.

¹¹Other sectors that stand out relative to the share they hold in the overall loan portfolio are construction, commerce and the finance, insurance and real estate sector. Thus, within loans to private enterprises, the composition of non-performing loans by sector is similar to that of Japanese banks.

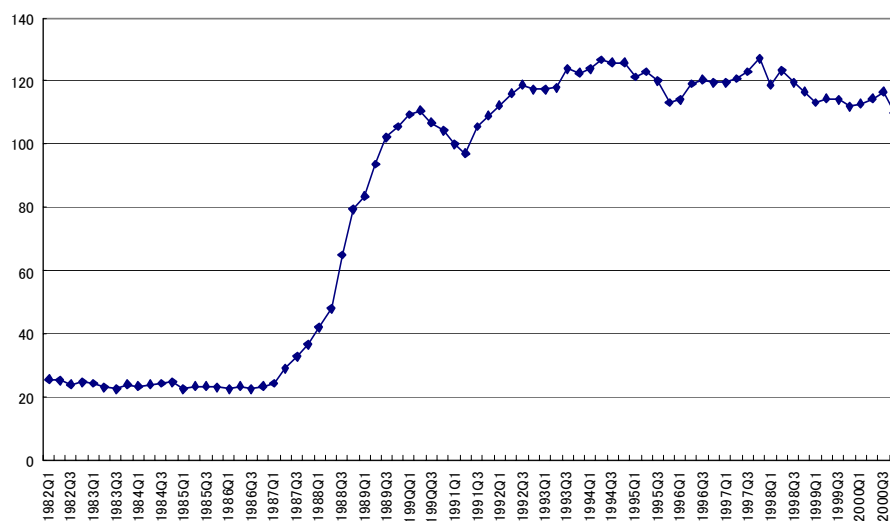


Figure 3: Taipei, China: Housing Price Index 1982-2000

Even loans other than housing loans are often backed by real estate collateral. Collateral based lending has historically been used by banks in Taiwan as insurance against incomplete monitoring. Thus, the decline in land prices significantly eroded the value of the collateral backing these loans.

The collapse in the equity markets also hurt the banking sector. Although banks in Taiwan are prohibited from holding more than 5% of the outstanding shares of any one company¹², banks currently hold about 10% of their total assets as non-government securities (see figure 8). Even though the total amount of stock banks and insurance companies may hold in public companies is limited, the fall in the stock market hurt the banks directly by reducing the value of equities held in the banks' trading, or short-term investment account.

The fall in equity prices also hurt the banks' capital stock. Although equities held in the long-term account are not valued at market value, banks are allowed to count up to 45% of the unrealized gains on these stocks, the difference between the book value and market value, as Tier II capital. Thus, the fall in equity prices reduced the banks' capital to asset ratios, contributing to a "capital crunch" which reduced aggregate lending.

There is one additional way in which the equity markets affect the health of the banking sector. In Taiwan, so called "leveraged stock purchases" are common, meaning that companies use bank loans to speculate in stocks. Thus the level of the equity market is directly related to the asset quality of the banking sector even for loans that are not going directly to finance property deals.

¹²How well this law is enforced is debatable, since the family ownership structure makes it difficult to track how much of a given company one family really controls.

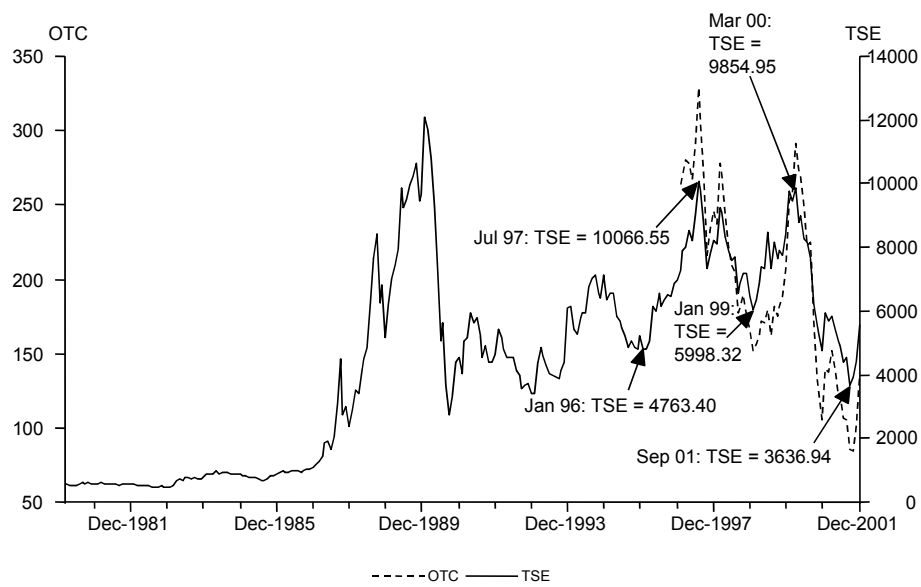


Figure 4: Taipei, China: Taiwan Stock Exchange 1980-2000

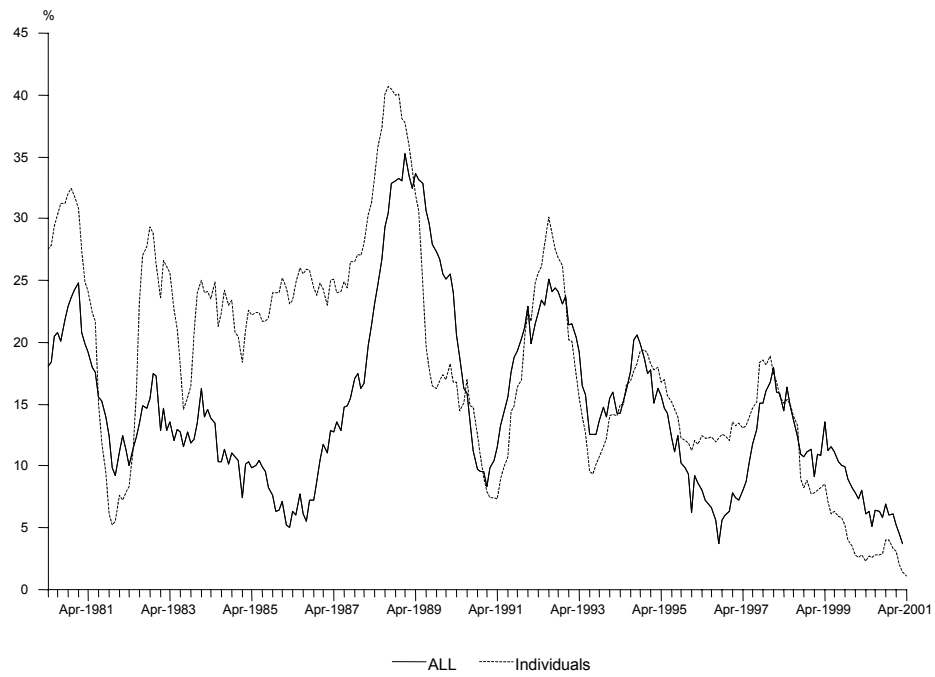


Figure 5: Taipei, China: Growth Rate of Loans Outstanding 1980-2001

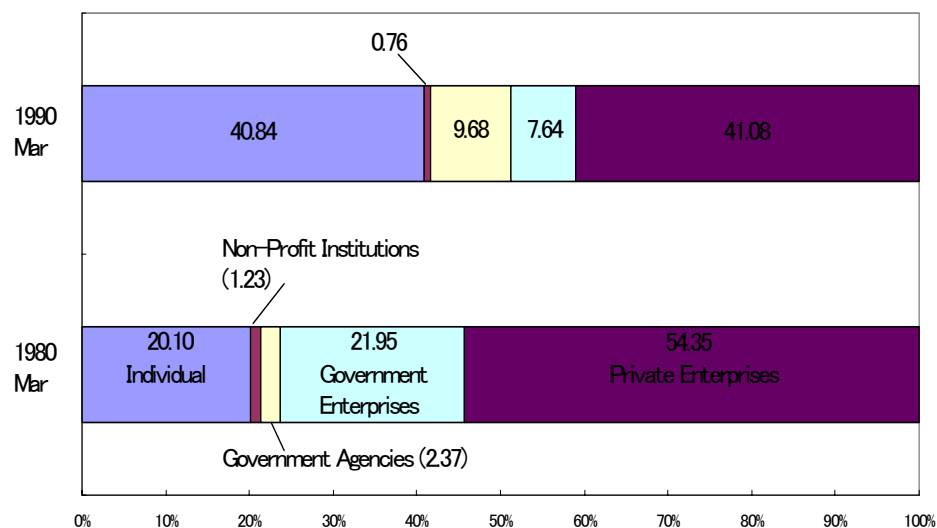


Figure 6: Taipei, China: Outstanding Loans-Share by Sector 1980&1990

Industry	END OF	2001
Private Enterprises		55.40%
Agricultural,Forestry,Fishing & Animal Husbandry		0.45%
Mining & Quarrying		0.11%
Manufacturing		20.52%
Electricity, Gas & Water Supply		0.04%
Construction		7.23%
Commerce Sector		14.08%
Transport, Storage & Communication		0.59%
Finance , Insurance & Real Estate		9.49%
Business & Individual Services		0.00%
Others		2.89%
Government Enterprises		0.10%
Government Agencies		0.00%
Non-Profit Institutions		0.07%
Individuals		43.48%
Financial Institutions		0.41%
Others		0.54%
Total		100.00%

Figure 7: Taipei, China: Composition of NPL by Sector 2001

(Units: % of total assets or liabilities)	Assets		Liabilities		
	Loans	Securities (Govt. Securities)	Deposits	Certificate of Deposit	Bank Debentures Issued
Domestic Banks	63.2	12.03 (2.11)	64.44	1.4	10.75
Medium Business Banks	68.31	8.03 (2.04)	72.53	0.56	1.5
Credit Cooperative Association	52.61	3.14 (0.68)	95.33		
Credit Dept of FFA	48.15	1.06 (0.02)	87.29		
Foreign Banks	39.64	7.99 (0.45)	43.32	2.31	

Figure 8: Taipei, China: Composition of Balance Sheet by Bank Type (Sept. 2000)

3.2 Financial Liberalization

In addition to being hit with the shock of macroeconomic events such as the asset bubble in equity and land prices, banks in Taiwan were forced to adjust to a rapidly changing environment as a result of financial liberalization in the 1990s. Financial liberalization started in the late 1980s with a revision of the securities transaction law in 1988 permitting new entrants into the brokerage business. The number of brokerage houses and trading accounts expanded and since that time the number of companies listed on the TSE has increased from 163 to almost 600. In addition, in July 1994 an over the counter market was rebuilt and the over-the-counter (OTC) stock exchange established. The number of companies listed on the OTC has more than doubled in just 4 years (figure 9). Corporate bond financing also grew in importance in the mid-1990s. The number of outstanding corporate bond issues took off (figure 10) and by 1997, corporate bonds constituted 32% of long-term debts, up from 5% in 1991 (Ding and Yeh 2001).

As a result of this liberalization, through the 1990s private enterprises in Taipei, China reduced their reliance on indirect financing from banks. Figure 11 shows the ratio of short term borrowing to total liabilities for about 350 Taiwanese manufacturing firms between 1980-2000. These manufacturing firms have reduced their reliance on indirect financing continuously since 1990.

Perhaps even more significant for the banking sector was the deregulation of the industry itself in 1992. A revision to the Banking Law in 1989 privatized the banking sector and in June of 1991 15 new banks were permitted to begin operations, almost doubling the number of banks in operation in Taiwan¹³.

¹³Prior to 1991, there were only 20 banks in operation in Taipei, China. See Yu (1999) for more details on the liberalization of Taiwan's banking system.

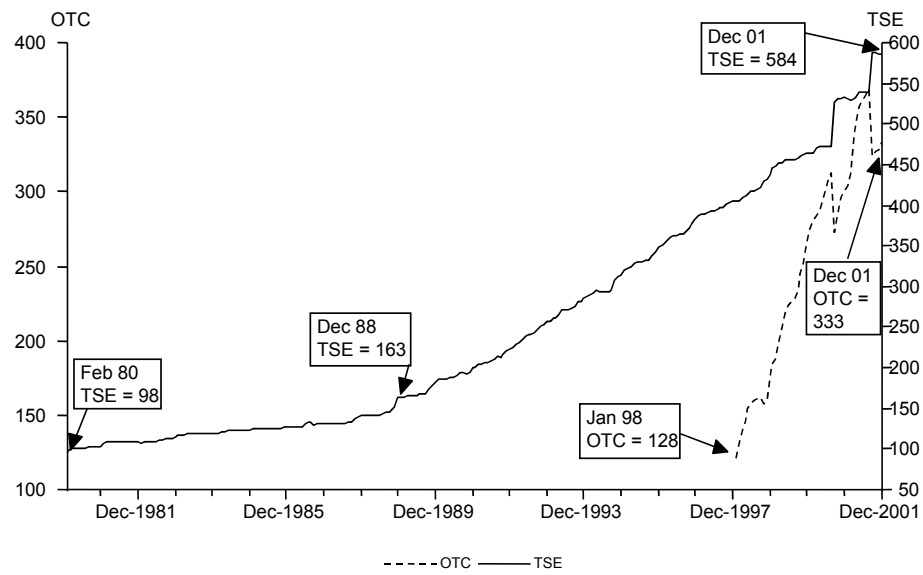


Figure 9: Taipei, China: Number of Companies Listed on the TSE and OTC 1980-2001

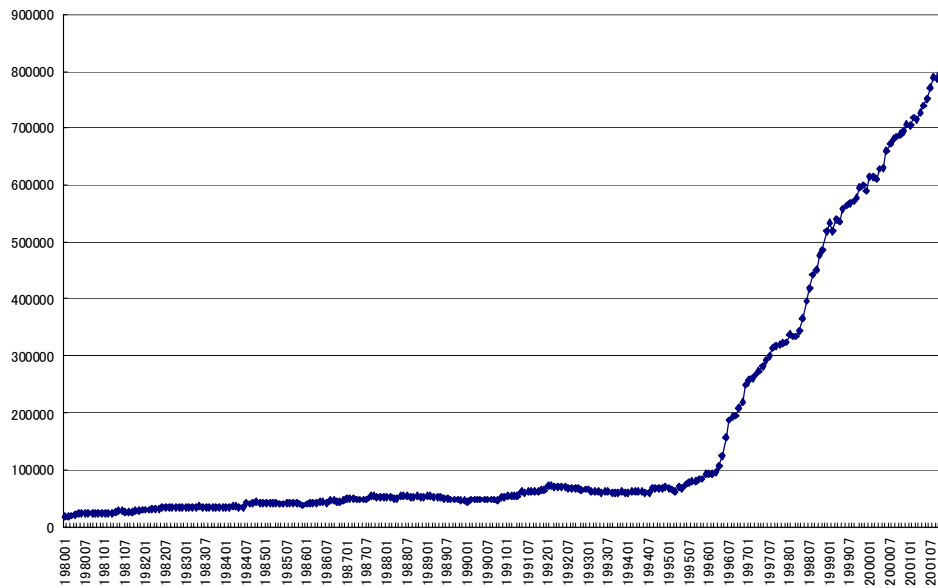


Figure 10: Taipei, China: Outstanding Corporate Bond Issues 1980-2001

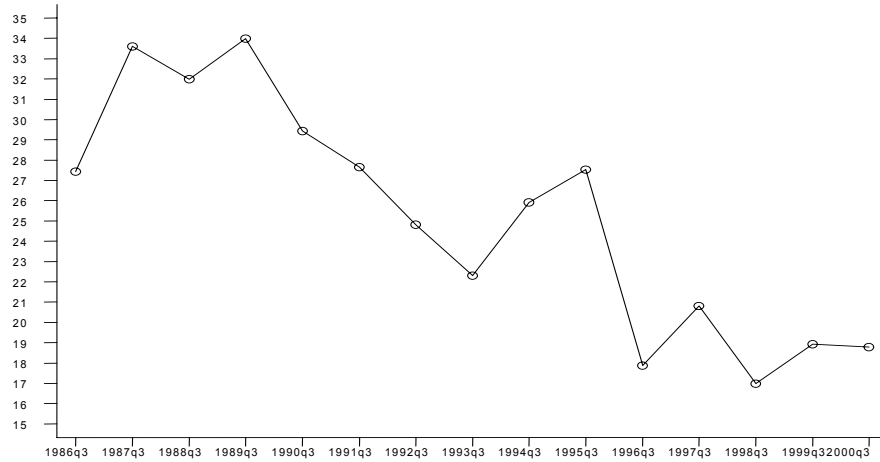


Figure 11: Taipei, China: Borrowing /Total Liabilities Manufacturing Firms 1980-2000

Financial institutions in Taiwan include commercial banks¹⁴, medium business banks¹⁵ and cooperative financial institutions¹⁶. Following Lee (2001), commercial banks can be further categorized as old banks, new commercial banks, industrial banks and converted banks (see appendix A for a detailed list of banks in each category). Almost all of the old banks are government banks¹⁷. Although the government has reduced its shareholdings in these banks and now owns less than a majority share in most of the old banks, government holdings are still quite large and the banks are

¹⁴Commercial banks dominate the financial sector, accounting for more than 80% of all loans made in fiscal year 2000.

¹⁵Taipei, China's medium business banks were established in 1978-1979 from mutual loan and savings companies with the purpose of extending medium and long term credit to small and medium scale enterprises (SMEs). Loans to SMEs must comprise at least 70% of the total loans made by these banks. These banks are privately owned, but they are restricted to a particular region, so competition between them is limited. The number of medium business banks has remained constant, but their role in the financial system is declining. In fiscal year 2000, about 5.58% of total loans were made by medium business banks.

¹⁶These include credit cooperatives and the credit departments of farmers' and fishermen's association (Lee (2001)). Combined, these institutions comprise about 10% of total assets in the banking sector.

¹⁷Many of these banks originally had very specific purposes. For example, the Central Trust of China (100% government owned) is responsible for cooperating with the government in its purchasing, trade, banking, trust, insurance, storage, freight and other needs. Taiwan Cooperative Bank (60% state owned) is designated to supervise the operations of credit cooperatives and along with the Farmers Bank of China (60% owned by the Ministry of Finance), specializes in agricultural financing. In addition to these central government owned banks, there are two municipal government owned banks - the Bank of Kaohsiung and Taipei Bank, as well as six provincial government controlled banks - the Bank of Taiwan, Chang Hwa Commercial Bank, First Commercial Bank, Hua Nan Commercial Bank, the Land Bank of Taiwan and the International Commercial Bank of China. (Shea (1995)).

largely viewed as government controlled. The new commercial banks are those banks that were allowed to begin operation in the 1990s. These new banks are privately owned and are in most cases affiliated with a particular family conglomerate.

Although the old government banks continue to dominate the banking sector, accounting for more than 60% of total bank assets, the new commercial banks quickly established a sizable market share. By 1993, just 2 years after having been established, the new commercial banks accounted for 22% of total banks assets (figure 12). That share has grown slightly, and currently the new banks account for a quarter of total bank assets.

	1993	1994	1995	1996	1997	1998	1999	2000
New	22.92%	26.33%	23.80%	21.56%	23.88%	25.04%	24.07%	24.52%
Old	65.58%	63.90%	69.40%	72.69%	65.72%	63.95%	64.25%	64.04%
Converted	0.00%	0.00%	0.00%	0.00%	1.09%	1.90%	2.59%	2.65%
Industrial	0.51%	0.50%	0.37%	0.33%	3.45%	3.68%	3.92%	3.84%
SME	10.99%	9.27%	6.42%	5.42%	5.85%	5.43%	5.17%	4.96%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Figure 12: Taipei, China: Share of Total Asset of Domestic Banks by Type 1993-2001

By most measures of performance, the new banks at first out-performed the old government banks. The average return on assets of the new banks quickly out-performed the old banks and non-performing loan ratios were lower in the first several years for the new banks. However, when conditions in the banking sector began to decline in 1997, the performance of the new banks suffered more. Non-performing loan ratios for the new banks now exceed those of the old banks and ROA ratios have already turned negative. (figures 13 and 14)

	1993	1994	1995	1996	1997	1998	1999	2000
New	0.84	0.91	0.67	0.73	0.91	0.27	0.27	-0.12 (0.18)*
Old	0.81	0.69	0.49	0.57	0.69	0.67	0.44	0.38
Converted					0.97	0.66	0.35	-0.52
Industrial	5.09	10.34	11.50	12.04	6.37	4.64	3.84	3.40
SME	0.44	0.57	0.53	0.53	0.58	0.33	-0.21	0.03

Figure 13: Taipei, China: Return on Assets of Domestic Banks by Type 1993-2001

Taiwan's financial sector now suffers from the problem of "overbanking" and a lack of exit from the sector. One problem may be that when the banking sector was allowed to expand in Taipei,

	1993	1994	1995	1996	1997	1998	1999	2000
N e w	1.96	2.27	2.74	3.63	3.74	3.98	5.15	6.68 (5.47)*
Old	2.26	2.58	3.75	4.94	4.82	4.80	5.15	5.17
Co n v e r t e d					2.47	2.43	3.59	6.44
I n d u s t r i a l	0.60	0.67	2.12	3.46	1.82	1.51	1.90	1.55
S M E					9.37	10.46	7.60	8.91

Figure 14: Taipei, China: Non-Performing Loans of Domestic Banks by Type 1993-2001

China, supervisory resources were not increased (Yin 2001). Thus, both the frequency and quality of bank supervision suffered.

4 Similarities to the Japanese Experience

The experience of Taiwan thus far closely resembles the early stages of Japan's banking crisis, which really came to the forefront in the Fall of 1997. The ROE and ROA of Japanese banks began to decline in 1990 and are now in the negative (Hoshi and Kashyap 1999). Although non-performing loan levels in Japan never reached the level that they are now in Taiwan, that is only because of the massive amount of write-offs banks have been forced to realize in the 1990s. As in Taiwan, the weakness in Japan's banking sector was first evident in the smaller financial institutions such as credit cooperatives, which even now have much higher non-performing loan ratios than the major banks. As in Taiwan, the problems in the smaller financial institutions were handled by the "convoy" system: arranged mergers with healthier banks.

The causes of the banking sector problems in Taiwan are also similar to those in Japan. Japan's "bubble economy" of the 1980s and its subsequent collapse in the early 1990s, are well known. As in Taiwan, bank performance in Japan was closely tied to the performance of the equity and real estate market. And as in Taiwan, Japanese banks were also forced to adjust to very different business environment due to financial liberalization. Liberalization of capital markets gave the banks traditional clients - large manufacturing firms - easy access to direct financing, reducing their reliance on bank loans. Japanese banks turned increasingly to new clients - small and medium sized firms, particularly those in the construction, real estate or non-bank finance industries. Although the banking sector itself was not liberalized in Japan as it was in Taiwan in the 1990s, there is little doubt that due to capital market liberalization Japan faced "overbanking".

In 1997, the weakness in Japan's financial sector erupted into a full-blown banking crisis: among other smaller failures, 1997-1998 witnessed the collapse of one of the top 4 securities houses and 3 of the top 20 banks, all of which had previously been considered "too big to fail". The next section examines empirically whether this is the route for which Taiwan is headed.

5 Statistical Indicators of a Banking Crisis

This section uses the threshold indicators approach of Kaminsky and Reinhart (1999) to identify the likelihood of a banking crisis in Taiwan.

In their original study, Kaminsky and Reinhart (1999) examine 26 banking crises and 76 currency crises that occurred in 20 countries between 1970 and 1995. Four Asian crises of 1997 - Indonesia, Malaysia, Philippines and Thailand - were also examined out of sample. The authors "examine the behavior of macroeconomic indicators that have been stressed in the theoretical literature...and shed light on the extent to which the crises were predictable".

This paper looks at three countries not included in the Kaminsky and Reinhart (1999) study: Korea, Japan and Taiwan. Since all three countries have flexible exchange rate regimes, they are not appropriate case studies for examining the behavior of macroeconomic indicators around the time of currency crises¹⁸, but the theoretical considerations guiding the selection of variables are still relevant for examining the characteristics of banking crises. Kaminsky and Reinhart (1999) note that banking crises are often preceded by slowing economic activity, often following a boom, and financial liberalization. Based upon the analytical analysis above, it is clear that this observation holds for the case of Japan and Taiwan.

The methodology of the Kaminsky and Reinhart (1999) study is followed as closely as possible. Following the original study, a banking crisis is identified as "the closure, merging, takeover, or large-scale government assistance of an important financial institution that marks the start of a string of similar outcomes for other financial institutions". Following this criteria, Japan's banking crisis can be dated as beginning in November 1997 when Hokkaido Takushoku Bank, one of the top 20 banks, failed.

15 monthly macroeconomic indicators are examined¹⁹: the M2 multiplier, the ratio of domestic credit to nominal GDP, the real interest rate on deposits, the ratio of lending to deposit interest rates, excess real M1 balances, real commercial-bank deposits, the ratio of M2 to foreign exchange reserves (both converted to U.S. dollars), the percent deviation of the real exchange rate from trend, the value of exports and imports, the terms of trade, foreign exchange reserves, the domestic-foreign real interest rate differential on deposits, industrial production and an index of equity prices. (See Kaminsky and Reinhart (1999) data appendix for details on how each data series was constructed.) With the exception of the deviation of the real exchange rate from trend, excess real M1 balances and the lending deposit interest rate ratio, which are in levels, 12 month percent changes in the data are examined. Appendix B provides a plot of each indicator for each of the three countries

¹⁸In the 1999 study, the authors chose countries that were "small open economies, with a fixed exchange rate, crawling peg, or band through portions of the sample".

¹⁹The original study also included the overall budget deficit as a percent of GDP in order to indicate the fiscal state of the economy. This data is unavailable for Japan since 1993. For Taiwan, this series is only available since 1994. As Kaminsky and Reinhart (1999) point out themselves, other data that might be desired such as non-performing loans, real estate prices or the number of corporate bankruptcies are actually not very useful for predicting crises since they are only available at low frequencies and "made less informative by banks' desire to hide their problems as long as possible".

for the entire sample period of 1970-2001.

For each of the 15 indicators, a "threshold value" which minimizes the noise to signal ratio was selected. Any indicator that crosses the threshold value within the 12 months before or after the beginning of the banking crisis was labeled a signal. For Taiwan, which has not yet experienced a major bank failure, the 12 month period preceeding the last available data point was examined. With the exception of the fiscal sector indicator, which is not included in this study due to data availability, all the indicators accurately called the majority of the banking crises examined in Kaminsky and Reinhart's study²⁰. Those indicators that were available for Malaysia, Philippines and Thailand, also correctly called the banking crises that hit with the Asian crisis of 1997 out of sample.

Table 15 summarizes the results of applying this threshold indicators approach to the case of Korea, Japan and Taiwan. Korea, which was hit by both a banking crisis and a balance of payments crisis in 1997, has the highest percentage of signals from the 15 indicators: 86.67%. However, the percentage of signals are also quite high for Japan and even for Taiwan, for which only a 12 month window is used. For Japan, 60% of the indicators signaled a crisis in the 12 month period before or after the banking crisis erupted in November 1997. This is consistent with the findings of Kaminsky and Reinhart (1999) who found that more than half of the banking crises in their sample were signalled by between 60-79% of their indicators²¹. For Taiwan, although only a 12 month window was used, an even higher percentage, 66.67%, of the indicators are signalling a banking crisis.

The first 7 indicators, the financial sector indicators, provide the most signals of a banking crisis in Japan and Taiwan. The first two indicators, the M2 multiplier, which is signalling for Taiwan, and the credit to GDP ratio, which is signalling for Japan, were selected to indicate the "rapid growth (boom-bust) in credit and monetary aggregates". Consistent with the analysis of Kaminsky and Reinhart (1999), in Japan the central bank appears to have been "pumping money" as the banking crisis unfolded. The real interest rate indicator is high in Taiwan, perhaps indicating increased risk in the banking sector. The lending to deposit ratio is signalling for both Japan and Taiwan, indicating both financial deregulation and a deterioration in credit risk. Excess M1 balances are high in both countries, perhaps due to excess liquidity that is being created in order to ease conditions for the troubled banks. Deposit growth also falls below the threshold value in both countries as depositors lose faith in the banking sector as the crisis unfolds.

The next 6 indicators are external sector indicators. Note that foreign exchange reserves fall below the threshold value in both countries and that exports have begun to underperform in Taiwan. In Japan, it is imports that signal: consistent with the observations of Kaminsky and Reinhart (1999), we see the tail end of an import boom, but then observe declining imports prior to the crisis, perhaps as a symptom of the slowdown in economic activity. Finally, consistent with

²⁰See Kaminsky and Reinhart (1999) page 490 for data on the percentage of banking crises accurately called by each indicator.

²¹See Kaminsky and Reinhart (1999) page 491 for data on the percent of banking crises called for various degrees of signals.

the observation on real interest rates above, the interest rate differential indicator is above the threshold value for Taiwan, again, perhaps indicating increased risk.

The final 2 indicators capture the empirically observed fact that "recessions and the burst of asset price bubbles precede financial crises". Consistent with the analysis above, these indicators signal strongly for both Japan and Taiwan. In both economies, we see high growth rates in industrial production up to a point, but then eventual contraction as the banking crisis unfolds. Similarly, in both economies stock prices boom up to a point, but then collapse as the economy moves into recession. Real estate prices were not included in the Kaminsky and Reinhart (1999) study and are not suitable for inclusion here since they are not reported monthly and are not available as a time series going back to 1970. However, Kaminsky and Reinhart (1999) did note in their study that other asset markets, such as real estate, also show a tendency to "burst" before banking crises, and we can note from the analysis above that this certainly holds for the case of Japan and Taiwan.

Figure 15: Early Warning Signals: 2 Year Window

Indicator	Korea 1996	Japan 1996	Taiwan 2002
M2/M0	1	0	1
Credit/GDP	0	1	0
Real Deposit Rate	1	0	1
Lending-Deposit Rate Ratio	1	1	1
Excess M1 Balances	1	1	1
M2/Foreign Exchange Reserves	1	0	0
Real Deposits	1	1	1
Exports	1	0	1
Terms of Trade	1	1	0
Real Exchange Rate	1	0	0
Imports	0	1	0
Foreign Exchange Reserves	1	1	1
Interest Rate Differential: Domestic vs	1	0	1
Industrial Production Index	1	1	1
Stock Price	1	1	1
Signaling	86.67%	60.00%	66.67%

6 Conclusions

The answer to the question posed in the introduction of this paper, "Is Taiwan headed for a banking crisis?", appears to be in the affirmative. The nature of this crisis will be very different than the infamous Asian crisis of 1997. Both the symptoms and causes of Taiwan's looming banking crisis are much more similar to that which hit the Japanese banking sector in the Fall of 1997.

This paper has provided both analytic and empirical evidence to support this hypothesis. First consider the current state of the financial sector and recent events. Since the mid-1990s, Taiwan's banking sector has experienced declining performance and deteriorating asset quality, much as Japan's banking sector began to experience in the early 1990s. The problems are much worse in the smaller financial institutions in Taiwan, and there have been several banks runs and forced mergers of credit cooperatives with healthier banks. This again is reminiscent of Japan in the early 1990s. Although Taiwan has yet to experience a major bank failure, the problems in the banking sector have already claimed two medium sized banks. The causes of the banking sector problems - the asset bubble in equity and real estate prices combined with financial liberalization - also echo the experience of Japan in the late 1980s and early 1990s.

Using the threshold indicators approach of Kaminsky and Reinhart (1999) to quantify these observed similarities, an empirical analysis of Taiwan's macroeconomy reveals that almost 70% of the indicators examined signal the imminent occurrence of a banking crisis. This percentage is close to that of Korea in late 1996, just before the Asian Crisis of 1997 hit, and is actually higher than that of Japan around the same time period, just before Japan's banking crisis erupted in the Fall of 1997.

Based on both the analytic and empirical evidence provided here, we may conclude that Taiwan may well soon be facing a banking crisis similar in type and scale to that faced in Japan in 1997-1998.

Appendix

A List of Financial Institutions in Taipei, China²²

1. Old Banks (15)

Bank of Taiwan²³ (Provincial Government)
Export-Import Bank (Government)
Farmers Bank of Taiwan (Government)
Hua Nan Commercial Bank Ltd. (Provincial Government)
International Commercial Bank of China (Provincial Government)
Land Bank of Taiwan (Provincial Government)
Taiwan Co-operative Bank²⁴ (Government)
Bank of Kaosiung (Municipal Government)
Central Trust of China (Government)
Chang Hwa Commercial Bank Ltd. (Provincial Government)
Overseas Chinese Bank (Overseas Chinese and Government)
Shanghai Commercial and Savings Bank Ltd. (Rong Family)
Taipei Bank (Municipal Government)
First Commercial Bank²⁵ (Provincial Government)
United World Chinese Commercial Bank (Various Government Banks)

2. New Commercial Banks (21)

Asia Pacific Bank (Diversified)
Bank Sinopac (RUNTEX Group²⁶)
Bao-Dao Commercial Bank (Jih Sun Group²⁷)
Chinfon Commercial Bank (Sanyang Group²⁸)

²²Classifications as well as notes on ownership from Lee (2001).

²³Proposed merger between Bank of Taiwan, Land Bank of Taiwan and Central Trust of China.

²⁴Proposed merger between Taiwan Co-operative Bank and Chinfon Bank.

²⁵Proposed merger between First Commercial Bank, Pan Asia and Dah-An Bank.

²⁶Yin Family. Closely related to KMT.

²⁷Chen Family.

²⁸Huang Family.

Chinatrust Commercial Bank (Chinatrust Group²⁹)
 Grand Commercial Bank (President's Group³⁰)
 Pan Asia Bank (KMT and Nice Industry)
 Taishin International Bank (Shin Kong Group³¹)
 Union Bank of Taiwan (Union's Group - Sanchung Group³²)
 The Chinese Bank (Rebar's Group³³)
 Chung Shing Bank (Hua Eng Group³⁴)
 Cosmos Bank (Prince Group³⁵)
 Da Chong Bank (Sanyang, Industry, Formosa Plastic, Chan Family)
 Dah An Commercial Bank (Walsin Lihwa Corporation, Yi-Mei Food³⁶)
 E. Sun Commercial Bank (Cathay's Insurance³⁷)
 En Tie Commercial Bank (En-Tie Group, Sanchung Group³⁸)
 Far Eastern International Bank (Far Eastern Group³⁹)
 Fubon Commercial Bank (Tsai Family)
 Hsinchu International Bank (Wu Family)
 International Bank of Taipei (Loc Family, Shin Kong Group, YFY Group, Lien Family⁴⁰)
 Taichung Business Bank (Everfortune Group, Tsai Family⁴¹)

3. Industrial Banks (3)

Chiao Tung Bank (Government)
 China Development Industrial Bank⁴² (KMT influential)
 Industrial Bank of Taiwan⁴³ (Loc Family and various hi-tech firms)

²⁹Koo Family.

³⁰Kao and Ho Families.

³¹Wu Family.

³²Lin Family.

³³Wang Family.

³⁴Wang Family. Under government supervision.

³⁵Hsu Family.

³⁶Jiaw and Kao Families.

³⁷President Huang.

³⁸Lin Group.

³⁹Hsu Family. DBS interested in take-over.

⁴⁰Lien Family is influential.

⁴¹Tsai Family is influential.

⁴²From China Development Corporation.

⁴³Newly established.

4. **Converted Banks**

Cathay United Bank⁴⁴ (Cathay Group, Tsai Family)

Bank of Panshin⁴⁵ (Diversified)

COTA Commercial Bank⁴⁶ (Diversified)

Hwatai Bank⁴⁷ (Diversified)

Kao Shin Commercial Bank⁴⁸ (Diversified)

Lucky Bank⁴⁹ (Diversified)

Makoto Bank⁵⁰ (Diversified, Chairman Lin)

Sunny Bank⁵¹ (Diversified, Chairman Chen)

United Credit Commercial Bank⁵² (Diversified)

5. **SME Banks (5)**

Taiwan Business Bank (Government)

Tainan Business Bank (Chen Family)

Kaohsiung Business Bank (KMT)

Enterprise Bank of Hualien (Sino-Japan International Group⁵³)

Taitung Business Bank (Full Long Group⁵⁴)

⁴⁴Converted from Tawan First Investment and Trust Companies.

⁴⁵From Panchiao Credit Cooperative.

⁴⁶From Taichung Third Credit Cooperative.

⁴⁷From Taipei Second Credit Cooperative.

⁴⁸From Kaosiung First Credit Cooperative.

⁴⁹From Taichung Seventh Credit Cooperative.

⁵⁰From Taipei Third Credit Cooperative.

⁵¹From Yang Ming Shan Credit Cooperative.

⁵²Formed July 1, 2000 by Taichung Sixth Credit Cooperative and Pingdong First Credit Cooperative.

⁵³Lin Family.

⁵⁴Yew Family.

B Data Series

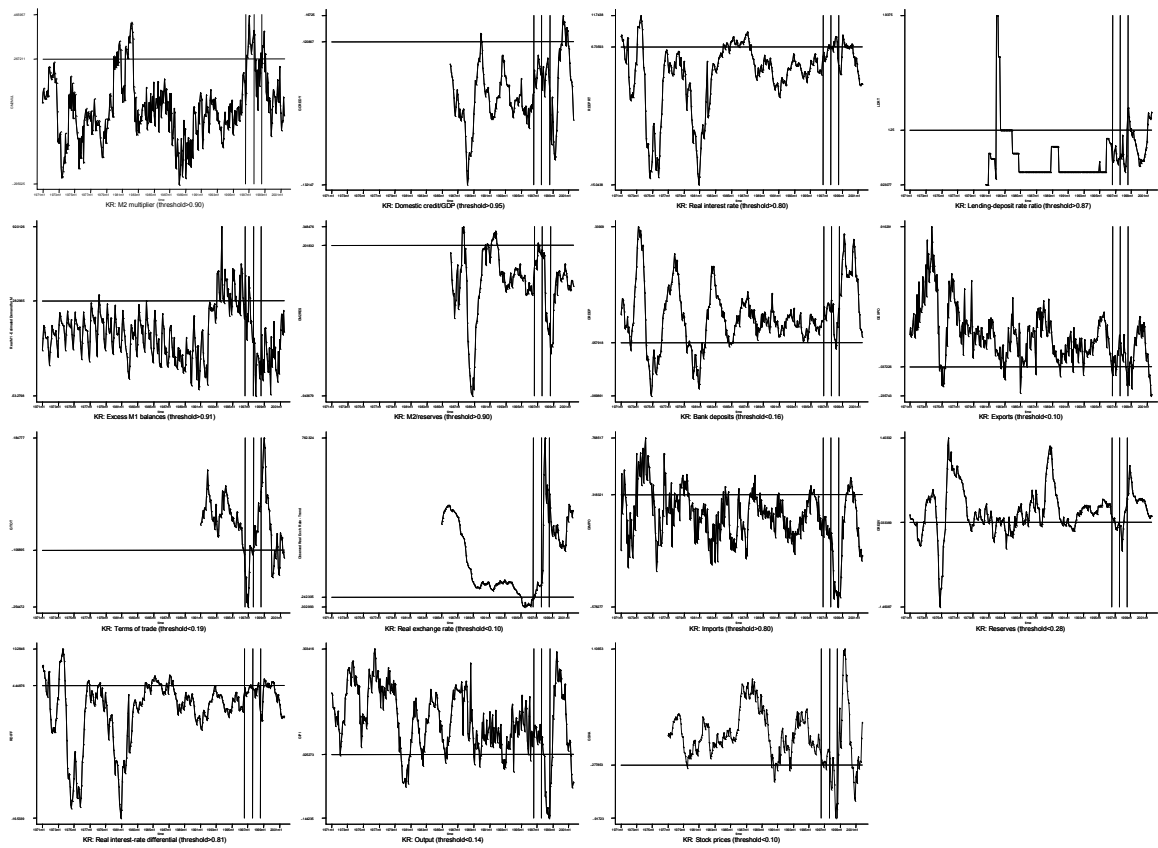


Figure 16: Data for Korea

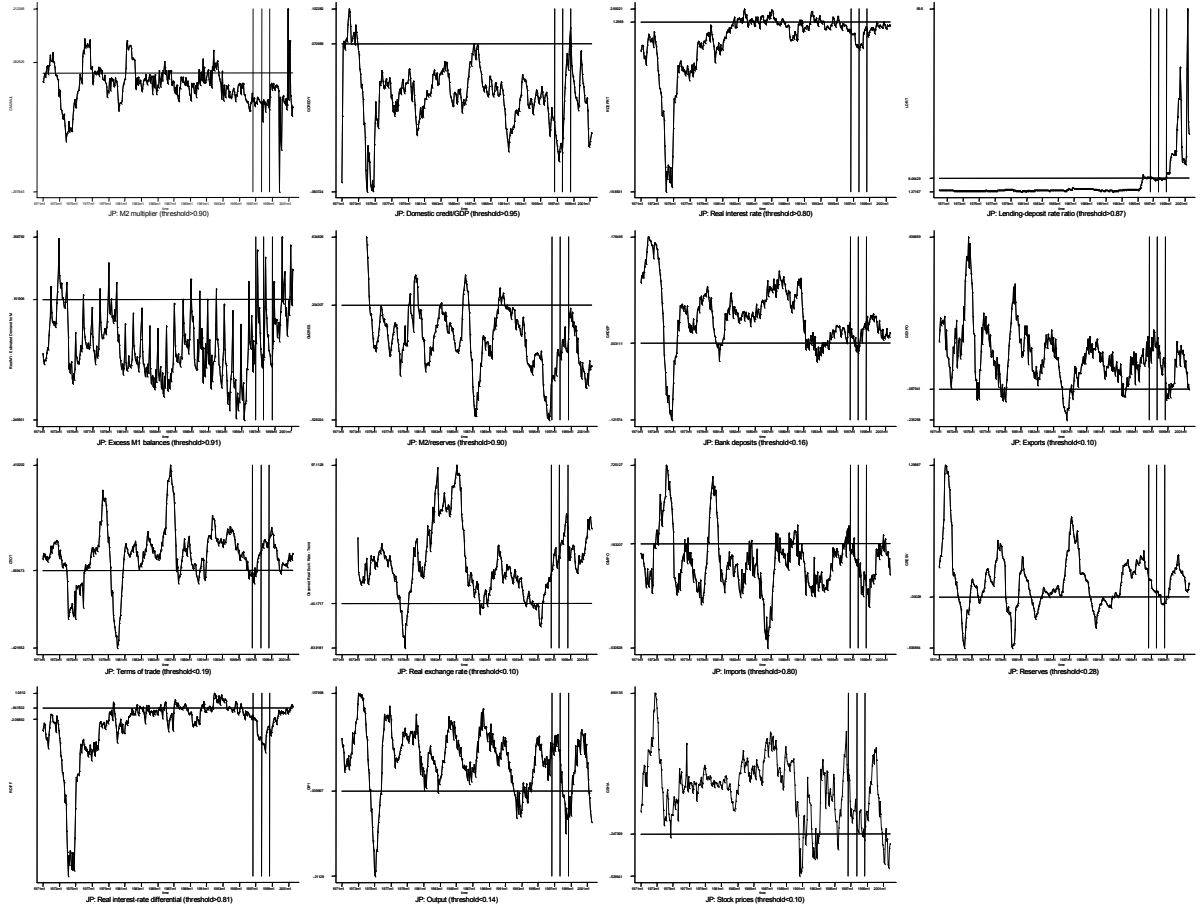


Figure 17: Data for Japan

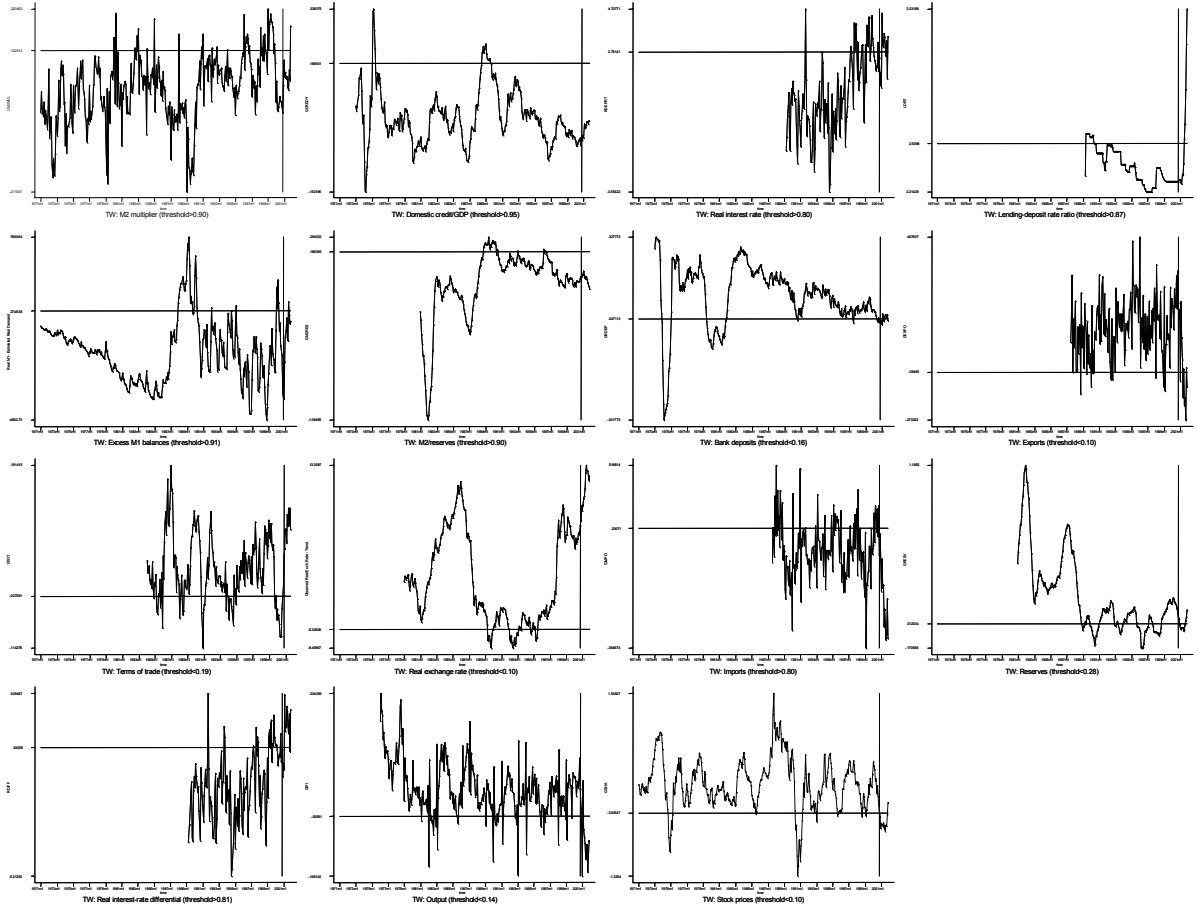


Figure 18: Data for Taiwan

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