

Understanding Financial Crises

FRANKLIN ALLEN

and

DOUGLAS GALE

OXFORD
UNIVERSITY PRESS

OXFORD

UNIVERSITY PRESS

Great Clarendon Street, Oxford OX2 6DP

Oxford University Press is a department of the University of Oxford.
It furthers the University's objective of excellence in research, scholarship,
and education by publishing worldwide in

Oxford New York

Auckland Cape Town Dar es Salaam Hong Kong Karachi

Kuala Lumpur Madrid Melbourne Mexico City Nairobi

New Delhi Shanghai Taipei Toronto

With offices in

Argentina Austria Brazil Chile Czech Republic France Greece

Guatemala Hungary Italy Japan Poland Portugal Singapore

South Korea Switzerland Thailand Turkey Ukraine Vietnam

Oxford is a registered trade mark of Oxford University Press
in the UK and in certain other countries

Published in the United States

by Oxford University Press Inc., New York

© Franklin Allen and Douglas Gale, 2007

The moral rights of the authors have been asserted

Database right Oxford University Press (maker)

First published 2007

All rights reserved. No part of this publication may be reproduced,
stored in a retrieval system, or transmitted, in any form or by any means,
without the prior permission in writing of Oxford University Press,
or as expressly permitted by law, or under terms agreed with the appropriate
reprographics rights organization. Enquiries concerning reproduction
outside the scope of the above should be sent to the Rights Department,
Oxford University Press, at the address above

You must not circulate this book in any other binding or cover
and you must impose the same condition on any acquirer

British Library Cataloguing in Publication Data

Data available

Library of Congress Cataloging in Publication Data

Data available

Typeset by Newgen Imaging Systems (P) Ltd., Chennai, India

Printed in Great Britain

on acid-free paper by

Biddles Ltd., King's Lynn, Norfolk

ISBN 978-0-19-925141-4

1 3 5 7 9 10 8 6 4 2

History and institutions

1.1 INTRODUCTION

What happened in Asia in 1997? Countries such as South Korea, Thailand, Indonesia, Singapore, and Hong Kong whose economies had previously been the envy of the world experienced crises. Banks and other financial intermediaries were put under great strain and in many cases collapsed. Stock markets and currencies plunged. Their real economies were severely affected and their GDPs fell significantly. What were the causes of these dramatic events?

To many people these crises were a new phenomenon. There had been crises in other countries such as Mexico and Brazil but these could be attributed to inconsistent government macroeconomic policies. In those cases taxes were too small relative to government expenditures to maintain a fixed exchange rate. This was not the case for the Asian crisis. Other causes were looked for and found. The institutions in these countries were quite different from those in the US. Many had bank-based financial systems. There was little transparency either for banks or corporations. Corporate governance operated in a quite different way. In many cases it did not seem that managers' interests were aligned with those of shareholders. In some countries such as Indonesia corruption was rife. These factors were seen by many as the cause of the crises. However, they had all been present during the time that these countries were so successful.

Others blamed guarantees to banks and firms by governments or implicit promises of "bail-outs" by organizations such as the International Monetary Fund (IMF). Rather than inconsistent macroeconomic policies being the problem, bad microeconomic policies were the problem. Either way it was governments and international organizations that were to blame.

In this book we will argue that it is important not to take too narrow a view of crises. They are nothing new. They have not been restricted to emerging economies even in recent times. The Scandinavian crises of the early 1990's are examples of this. Despite having sophisticated economies and institutions, Norway, Sweden and Finland all had severe crises. These were similar in many ways to what happened in the Asian crisis of 1997. Banks collapsed, asset prices

plunged, currencies came under attack and their value fell. Output was severely affected.

Taking an historical view the period from 1945–1971 was exceptional. There were no banking crises anywhere in the world, apart from one in Brazil in 1962. There were currency crises when exchange rates were pegged at the wrong levels but that was all. Going back to the first half of the twentieth century and before there were many examples of financial crises. The stock market crash of 1929, the banking crises of the early 1930's and the Great Depression were some of the most dramatic episodes. There were many others, particularly in the US in the last half of the nineteenth century when it had no central bank. In Europe crises were much less frequent. The Bank of England had learned to prevent crises and the last one there was the Overend & Gurney crisis of 1866. Other central banks also learned to prevent crises and their incidence was significantly reduced. Prior to that crises were endemic in Europe as well.

Particularly after the experience of the Great Depression in the period prior to 1945–1971, crises were perceived as a market failure. It was widely agreed they must be avoided at all costs. The reform of the Federal Reserve System in the early 1930's and the extensive regulation of the financial system that was put in place in the US were part of this mindset. In other countries financial regulation went even farther. Governments controlled the allocation of funds to different industries through state-owned banks or heavily regulated banks. This extensive regulation was the cause of the virtual disappearance of banking crises from 1945–1971.

However, the elimination of crises came at a cost. Because of the extensive regulation and government intervention the financial system ceased to perform its basic function of allocating investment. There were many inefficiencies as a result. This led to calls for deregulation and the return of market forces to the allocation of investment. As a result crises have returned. Bordo et al. (2000) find that the frequency of crises in the recent period since 1971 is not that different from what it was before 1914.

We start in this chapter with an historical review of crises and the institutions involved. This provides a background for the theories that are subsequently developed.

1.2 HISTORICAL CRISES IN EUROPE AND THE US

Prior to the twentieth century banking panics occurred frequently. Kindleberger (1993, p. 264) in his book recounting the financial history of Western Europe points out that financial crises have occurred at roughly 10 year

intervals over the last 400 years. Panics were generally regarded as a bad thing because they were often associated with significant declines in economic activity. Over time one of the main roles of central banks has become to eliminate panics and ensure financial stability. It has been a long and involved process. The first central bank, the Bank of Sweden, was established over 300 years ago in 1668. The Bank of England was established soon after. It played an especially important role in the development of effective stabilization policies in the eighteenth and nineteenth centuries. The last true panic in the UK was the Overend & Gurney crisis of 1866.

In his influential book *Lombard Street*, Bagehot (1873) laid out his famous principles of how a central bank should lend to banks during a crisis.

- Lend freely at a high rate of interest relative to the pre-crisis period but only to borrowers with good collateral (i.e. any assets normally accepted by the central bank).
- The assets should be valued at between panic and pre-panic prices.
- Institutions without good collateral should be allowed to fail.

Bordo (1986) documents that for the period 1870–1933 there were very few banking panics in the UK, Germany, and France. Kindleberger (1993) points out that many British economists ascribe the absence of crises in the UK to central banking experience gained by the Bank of England and their ability to skillfully manipulate discount rates. However, France also experienced no financial crises from 1882–1924 despite leaving its discount rate constant for many decades. Kindleberger suggests that France was perhaps stabilized by England.

The US took a different tack. Alexander Hamilton was influenced by British experience with the Bank of England and after the revolution advocated a large federally chartered bank with branches all over the country. This led to the foundation of the First Bank of the United States (1791–1811) and later the Second Bank of the United States (1816–1836). However, there was considerable distrust of the concentration of power these institutions represented. In a report on the Second Bank, John Quincy Adams wrote “Power for good, is power for evil, even in the hands of Omnipotence” (Timberlake 1978, p. 39). The controversy came to a head in the debate on the re-chartering of the Second Bank in 1832. Although the bill was passed by Congress it was vetoed by President Jackson and the veto was not overturned. Since then there has been a strong bias toward decentralization of the banking system and an aversion to powerful institutions of any kind. There was no central bank in the US from 1836 until 1914.

Throughout the nineteenth century the US banking system was highly fragmented and unlike every other industrializing country the US failed to develop nationwide banks with extensive branch networks. Prior to the Civil War, states were free to regulate their own banking systems and there was no national system. Many states adopted a “free banking” system which allowed free entry. There were serious banking panics in 1837 and 1857 and both were followed by depressions and significant economic disruption.

The advent of the Civil War in 1861 and the need to finance it significantly changed the role of the Federal Government in the financial system. The National Bank Acts of 1863 and 1864 set up a national banking system. They granted limited powers to banks. In particular, the 1864 Act was interpreted as confining each to a single location. When the question of whether banks could hold equity arose, the Supreme Court ruled that since the 1864 Act had not specifically granted this right they could not.

The creation of the National Banking system did not prevent the problem of panics and the associated economic disruption and depressions. There were panics in 1873, 1884, 1893 and 1907. Table 1.1, which is from Gorton (1988), shows the banking crises that occurred repeatedly in the US during the National Banking Era from 1863–1914. The first column shows the business cycles identified by the National Bureau of Economic Research (NBER). The first date is the peak of the cycle and the second is the trough. The second column shows the date on which panics occurred. In a banking panic people worry

Table 1.1. National Banking Era panics.

NBER cycle Peak–Trough	Panic date	%Δ(Currency/ deposit)*	%Δ Pig iron†
Oct. 1873–Mar. 1879	Sep. 1873	14.53	–51.0
Mar. 1882–May 1885	Jun. 1884	8.80	–14.0
Mar. 1887–Apr. 1888	No Panic	3.00	–9.0
Jul. 1890–May 1891	Nov. 1890	9.00	–34.0
Jan. 1893–Jun. 1894	May 1893	16.00	–29.0
Dec. 1895–Jun. 1897	Oct. 1896	14.30	–4.0
Jun. 1899–Dec. 1900	No Panic	2.78	–6.7
Sep. 1902–Aug. 1904	No Panic	–4.13	–8.7
May 1907–Jun. 1908	Oct. 1907	11.45	–46.5
Jan. 1910–Jan. 1912	No Panic	–2.64	–21.7
Jan. 1913–Dec. 1914	Aug. 1914	10.39	–47.1

*Percentage change of ratio at panic date to previous year’s average.

†Measured from peak to trough.

(Adapted from Table 1, Gorton 1988, p. 233)

about the soundness of the banks they have deposited their funds in. As a result they withdraw their money and hold it in the form of currency. The third column shows the percentage change in the ratio of currency to deposits. It is a measure of the severity of a banking panic. The higher the change in the currency/deposit ratio, the more serious is the crisis. It can be seen that the panics of 1873, 1893, 1896, and 1907 were particularly severe. The final column shows how much the production of pig iron changed from the peak of the cycle to the trough. GDP figures for this period have not been reliably compiled. Economic historians often use production of pig iron as a proxy for GDP. The final column is therefore meant to indicate how serious the recessions were. It can be seen that the troughs occurring after the panics of 1873, 1890, 1893, 1907, and 1914 were particularly severe.

After the crisis of 1907, a European banker summed up European frustration with the inefficiencies of the U.S. banking system by declaring the US was “a great financial nuisance” (Studenski and Krooss 1963, p. 254). The severity of the recession following the 1907 banking panic led to a debate on whether or not a central bank should be established in the US. The National Monetary Commission investigated this issue and finally in 1914 the Federal Reserve System was established.

The initial organization of the Federal Reserve System differed from that of a traditional central bank like the Bank of England. It had a regional structure and decision making power was decentralized. During the years after its creation it did not develop the ability to prevent banking panics. In 1933 there was another major banking panic which led to the closing of banks for an extended period just after President Roosevelt took office. The problems faced by the banking system led to the Glass–Steagall Act of 1933, which introduced deposit insurance and required the separation of commercial and investment banking operations. The Banking Act of 1935 extended the powers of the Federal Reserve System and changed the way it operated. These reforms finally eliminated the occurrence of banking panics almost seventy years after this had happened in the UK.

1.3 CRISES AND STOCK MARKET CRASHES

So far we have focused on banking crises. Often banking crises and stock market crashes are closely intertwined. For example, Wilson et al. (1990) consider four major banking panics accompanied by stock market crashes in the US during the National Banking Era. These are the crises of September 1873, June 1884, July 1893, and October 1907.

Why was there a link between banking panics and stock market crashes? As mentioned above banks were not able to hold equity so it might be thought that movements in the stock market would be independent of banks' policies. In fact this was not the case. To see why, it is necessary to have some understanding of the link between banks and the stock market during this period.

Banks must hold liquid reserves in case customers wish to withdraw cash from their accounts. All banks hold some reserves in the form of currency. In addition a large proportion of reserves were held in the form of interbank balances. In practice, most banks had deposits in New York City banks. The reason banks held interbank deposits rather than cash was that they paid interest. The New York City banks could pay attractive rates of interest because they lent a large proportion of these funds in the call loan market at the stock exchange in New York. The loans were used to buy stocks on margin (i.e. the stocks were bought with borrowed money). They were referred to as call loans because they were payable on demand. The borrowers could either obtain funds to repay their call loans by taking out other loans or if necessary they could sell the securities the original call loans were used to purchase. These call loans constituted a large part of New York banks' assets. For example, Sprague (1910, p. 83) reports that on September 12, 1873, 31 percent of New York banks' loans were call loans.

Agriculture was much more important during the National Banking Era than it is today. During the Spring planting and Autumn harvesting banks in farming areas required cash. Because of the random nature of these demands for cash it was difficult for the New York City banks to plan with certainty what their liquidity needs would be. When liquidity needs were high the New York City banks would demand repayment of their call loans. The borrowers might be forced to sell the securities they had purchased on margin. A wave of selling could cause prices to fall if those participating in the market on the buy side had limited amounts of cash. In other words there could be a crash in prices.

Wilson, Sylla, and Jones investigate stock returns and their volatility during the panic and crash periods of 1873, 1884, 1893, and 1907. Table 1.2 shows the 25 lowest and 25 highest stock monthly price changes between 1866 and 1913. Four of the eight lowest returns occurring during this period were during panic months. Apart from May 1880, which is not associated with a banking panic, all the others from the nine lowest returns are around panics. Notice also from the highest stock returns that there is some tendency for stocks to rally two or three months after a crisis. December 1873

Table 1.2. The 25 lowest and 25 highest stock price changes 1866–1913 (from Table 1 of Wilson et al. 1990).

Year	Month	Lowest return	Rank	Year	Month	Highest return
1907	10	-10.8514%	1	1879	10	10.8824%
1907	3	-9.7987	2	1901	6	9.9678
1893	7	-9.4340	3	1873	12	9.5385
1893	5	-8.8993	4	1901	4	8.4437
1873	10	-8.6721	5	1891	9	8.0605
1884	5	-8.5575	6	1900	11	7.8512
1880	5	-7.9137	7	1899	1	7.6923
1873	9	-7.7500	8	1906	8	7.4074
1907	8	-7.4809	9	1877	8	6.9869
1890	11	-7.3350	10	1898	5	6.8120
1877	6	-7.1730	11	1893	9	6.6869
1877	4	-7.0588	12	1897	8	6.6852
1899	12	-6.7308	13	1896	11	6.6667
1901	7	-6.7251	14	1908	11	6.6066
1896	7	-6.6092	15	1884	8	6.4067
1869	9	-6.4913	16	1885	11	6.3131
1884	6	-6.4171	17	1898	12	6.3084
1876	9	-6.0127	18	1877	9	6.1224
1877	2	-5.9441	19	1881	1	5.9574
1907	11	-5.8052	20	1904	10	5.9423
1895	12	-5.6911	21	1900	12	5.9387
1903	6	-5.5556	22	1885	10	5.8824
1896	8	-5.5385	23	1895	5	5.6980
1911	9	-5.4201	24	1882	7	5.6893
1877	3	-5.2045	25	1885	8	5.5710

is the third highest return, September 1993 is the eleventh highest, and August 1884 is the fifteenth highest. It is not just stocks where this effect is found. Bonds and commercial paper show similar patterns of returns. Returns are low during the panic and then rebound in the months after the panic.

Table 1.3 shows the top 50 months of volatility for stocks between 1866 and 1913. These volatilities are calculated by including the annualized standard deviation of returns using the current month and nine of the previous 11 months with the two discarded being the ones with the highest and lowest returns. The greatest volatility seems to occur in the year following the panic with peak stock price volatility coming 2–7 months after the panic.

Table 1.3. The top 50 months of volatility for stocks 1866–1913 (from Table 5 of Wilson et al. 1990).

Rank	Stocks		
	Year	Mo.	Stocks
1	1908	5	16.2433
2	1908	6	15.6801
3	1908	7	15.6239
4	1908	4	15.4590
5	1908	2	15.0509
6	1908	1	15.0179
7	1901	7	15.0078
8	1878	1	14.2182
9	1877	10	14.1960
10	1877	12	14.1921
11	1877	11	14.1841
12	1873	12	14.1461
13	1908	3	13.9722
14	1901	8	13.7695
15	1901	10	13.7645
16	1877	8	13.7459
17	1877	9	13.7238
18	1907	12	13.5497
19	1893	9	13.5273
20	1908	9	13.0782
21	1908	8	13.0658
22	1901	9	13.0519
23	1878	2	13.0206
24	1896	11	12.8153
25	1894	4	12.5641
26	1901	5	12.4214
27	1894	3	12.3836
28	1901	11	12.3543
29	1891	9	12.2079
30	1884	8	12.1837
31	1898	5	12.0430
32	1901	12	12.0014
33	1901	6	11.9526
34	1902	1	11.8947
35	1878	3	11.8415
36	1893	12	11.8154
37	1874	8	11.8127
38	1902	2	11.8042
39	1880	5	11.7880
40	1898	6	11.7863

Table 1.3. (Continued)

Rank	Stocks		
	Year	Mo.	Stocks
41	1874	7	11.7802
42	1874	6	11.7571
43	1874	5	11.7442
44	1874	4	11.7132
45	1893	11	11.7040
46	1874	3	11.5068
47	1894	2	11.5040
48	1874	2	11.4914
49	1901	4	11.4480
50	1902	3	11.4422

1.4 CURRENCY AND TWIN CRISES

Many of the crises in the nineteenth and early twentieth century were international in scope. For example, the crisis of 1873 had an extensive impact in Austria and Germany as well as in the US and in a number of emerging countries such as Argentina. In fact the 1873 crisis ended a wave of lending that occurred in the 1850's and 1860's to finance railroads in Latin America (Bordo and Eichengreen 1999). These international dimensions led to a flow of funds between countries and this in turn could cause a currency crisis. When banking crises and currency crises occur together there is said to be a twin crisis.

Prior to the First World War countries had a strong commitment to the gold standard. If a country suffered an outflow of funds it might leave the gold standard but it was generally expected to resume after some time had passed. This lessened the effect of currency crises as investors believed the value of the currency would eventually be restored. Between the wars, commitment to the gold standard was weakened. As a result banking and currency crises frequently occurred together. These twin crises are typically associated with more severe recessions than banking or currency crises occurring on their own.

After the Second World War the Bretton Woods system of fixed exchange rates was established. Strong banking regulations and controls were put in place that effectively eliminated banking crises. Currency crises continued to occur. Due to the extensive use of capital controls their nature changed. During this period they were typically the result of macroeconomic and financial policies that were inconsistent with the prevailing exchange rate. After the collapse of the Bretton Woods system in the early 1970's banking crises and twin crises reemerged as capital controls were relaxed and capital markets became global.

1.5 CRISES IN DIFFERENT ERAS

Bordo et al. (2000, 2001) have addressed the question of how recent crises such as the European Monetary System crisis of 1992–1993, the Mexican crisis of 1994–1995, the Asian crisis of 1997–1998, the Brazilian crisis of 1998, the Russian crisis of 1998, and the Argentinian crisis of 2001 compare with earlier crises. They identify four periods.

1. Gold Standard Era 1880–1913
2. The Interwar Years 1919–1939
3. Bretton Woods Period 1945–1971
4. Recent Period 1973–1997

As we shall see there are a number of similarities between the periods but also some important differences. They consider 21 countries for the first three periods and then for the recent period give data for the original 21 as well as an expanded group of 56.

The first issue is how to define a crisis. They define a banking crisis as financial distress that is severe enough to result in the erosion of most or all of the capital in the banking system. A currency crisis is defined as a forced change in parity, abandonment of a pegged exchange rate or an international rescue. The second issue is how to measure the duration of a crisis. To do this they compute the trend rate of GDP growth for five years before. The duration of the crisis is the amount of time before GDP growth returns to its trend rate. Finally, the depth of the crisis is measured by summing the output loss relative to trend for the duration of the crisis.

Figure 1.1 shows the frequency of crises in the four periods. Comparing the data with the original 21 countries it can be seen that the interwar years are the worst. This is perhaps not surprising given that this was when the Great Depression occurred. Banking crises were particularly prevalent during this period relative to the other periods.

It can be seen that the Bretton Woods period is very different from the other periods. As mentioned above, after the Great Depression policymakers in most countries were so determined not to allow such an event to happen again that they imposed severe regulations or brought the banks under state control to prevent them from taking much risk. As a result banking crises were almost completely eliminated. There was one twin crisis in Brazil in 1962 but apart from that there were no other banking crises during the entire period. There were frequent currency crises but as we have seen these were mostly situations where macroeconomic policies were inconsistent with the level of the fixed exchange rates set in the Bretton Woods system.

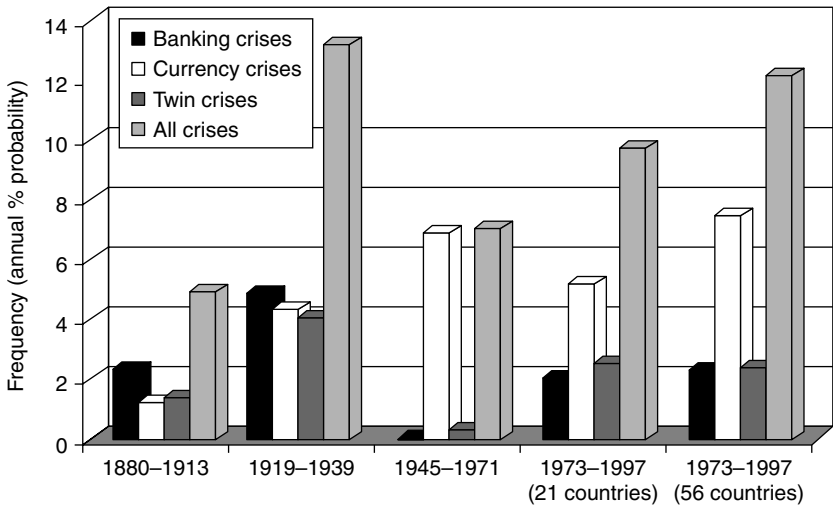


Figure 1.1. Crisis frequency, 1880–1997 (from Figure 1 of Bordo et al. 2001).

Interestingly the most benign period was the Gold Standard era from 1880 to 1913. Here banking crises did occur but were fairly limited and currency and twin crises were limited compared to subsequent periods. Since the global financial system was fairly open at this time, the implication is that globalization does not inevitably lead to crises.

The recent period is not as bad as the interwar period but is nevertheless fairly bad. Banking and twin crises are more frequent than in every period except the interwar years and currency crises are much more frequent. This is especially true if the sample of 56 countries is used as the basis of comparison rather than the 21 countries used in the other periods. The countries that are added to create the larger sample are mostly emerging countries. This suggests that emerging countries are more prone to crises and particularly to currency crises.

Figure 1.2 confirms this. It breaks the sample into industrial countries and emerging markets. In recent years emerging countries have been particularly prone to currency crises and twin crises. The other interesting observation from Figure 1.2 is that during the interwar period it was the industrial countries that were particularly hard hit by crises. They were actually more prone to currency and twin crises than the emerging countries.

Table 1.4 shows the average duration and depth of crises broken out by type of crisis and for the different periods and samples. Perhaps the most striking feature of Table 1.4 is the short duration and mild effect of crises during the

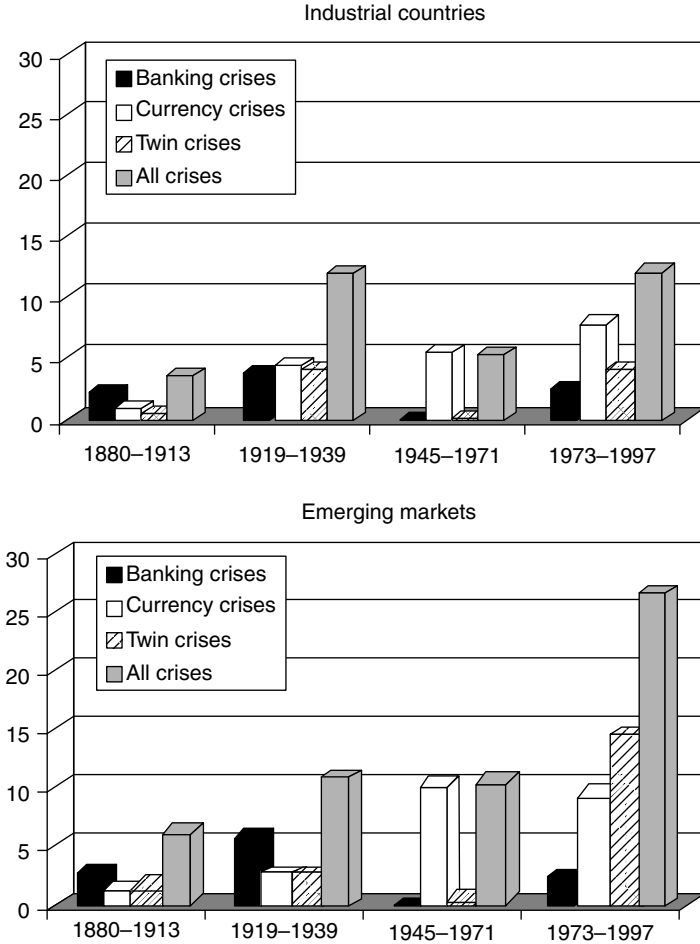


Figure 1.2. Frequency of crises – distribution by market (from Figure 2 of Bordo et al. (2000)).

Bretton Woods period. The second distinctive feature is that twin crises are much worse than other crises in terms of the output lost. As might be expected during the interwar period the effect of crises was much more severe than in the other periods. Although they did not last longer the cumulative loss in output is higher than in the other periods. During the Gold Standard Era the duration and cumulative loss were not remarkable compared to the other periods. In recent years twin crises have lasted for a particularly long time and the lost output is significant.

Table 1.4. Duration and depth of crises (from Table 1 of Bordo et al. 2001).

All countries	1880–1913	1919–1939	1945–1971	1973–1997	1973–1997
				21 nations	56 nations
	Average duration of crises in years				
Currency crises	2.6	1.9	1.8	1.9	2.1
Banking crises	2.3	2.4	^a	3.1	2.6
Twin crises	2.2	2.7	1.0	3.7	3.8
All crises	2.4	2.4	1.8	2.6	2.5
	Average crisis depth (cumulative GDP loss in %)				
Currency crises	8.3	14.2	5.2	3.8	5.9
Banking crises	8.4	10.5	^a	7.0	6.2
Twin crises	14.5	15.8	1.7	15.7	18.6
All crises	9.8	13.4	5.2	7.8	8.3

Notes: ^aindicates no crises.

Source: Authors' calculations.

Finally, Figure 1.3 shows the effect of crises on recessions. It can be seen that recessions with crises have a much higher loss of GDP than recessions without crises. This was particularly true in the interwar period. Also the average recovery time is somewhat higher in recessions with crises rather than recessions without crises.

In summary, the analysis of Bordo et al. (2000, 2001) leads to a number of conclusions. Banking crises, currency crises, and twin crises have occurred under a variety of different monetary and regulatory regimes. Over the last 120 years crises have been followed by economic downturns lasting on average from 2 to 3 years and costing 5 to 10 percent of GDP. Twin crises are associated with particularly large output losses. Recessions with crises were more severe than recessions without them.

The Bretton Woods period from 1945 to 1971 was quite special. Countries either regulated bank balance sheets to prevent them from taking very much risk or owned them directly to achieve the same aim. These measures were successful in that there were no banking crises during this time and only one twin crisis.

The interwar period was also special. Banking crises and currency crises were widespread. Moreover the output losses from these were severe particularly when they occurred together and there was a twin crisis.

The most recent period does indeed appear more crisis prone than any other period except for the interwar years. In particular, it seems more crisis prone than the Gold Standard Era, which was the last time that capital markets were as globalized as they are now.

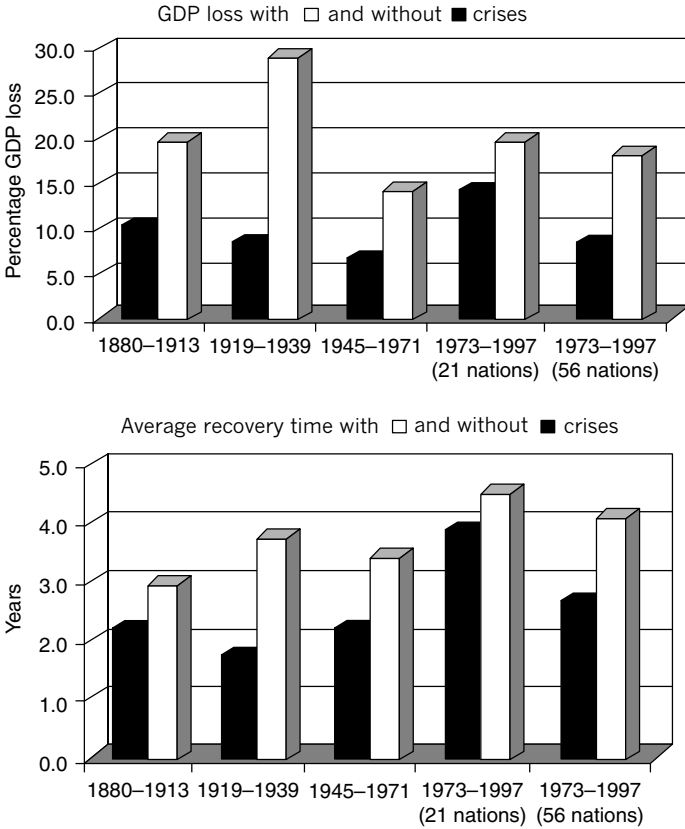


Figure 1.3. Recessions with and without crises (from Figure 2 of Bordo et al. 2001).

1.6 SOME RECENT CRISES

Now that we have seen a comparison of recent crises with crises in other eras, it is perhaps helpful to consider some of the more recent ones in greater detail. We start with those that occurred in Scandinavia in the early 1990's.

1.6.1 The Scandinavian crises

Norway, Finland and Sweden experienced a classic boom–bust cycle that led to twin crises (see Heiskanen 1993 and Englund and Vihriälä 2006). In Norway lending increased by 40 percent in 1985 and 1986. Asset prices soared while investment and consumption also increased significantly. The collapse in oil

prices helped burst the bubble and caused the most severe banking crisis and recession since the war. In Finland an expansionary budget in 1987 resulted in massive credit expansion. Housing prices rose by a total of 68 percent in 1987 and 1988. In 1989 the central bank increased interest rates and imposed reserve requirements to moderate credit expansion. In 1990 and 1991 the economic situation was exacerbated by a fall in trade with the Soviet Union. Asset prices collapsed, banks had to be supported by the government and GDP shrank by 7 percent. In Sweden a steady credit expansion through the late 1980's led to a property boom. In the fall of 1990 credit was tightened and interest rates rose. In 1991 a number of banks had severe difficulties because of lending based on inflated asset values. The government had to intervene and a severe recession followed.

1.6.2 Japan

In the 1980's the Japanese real estate and stock markets were affected by a bubble. Financial liberalization throughout the 1980's and the desire to support the United States dollar in the latter part of the decade led to an expansion in credit. During most of the 1980's asset prices rose steadily, eventually reaching very high levels. For example, the Nikkei 225 index was around 10,000 in 1985. On December 19, 1989 it reached a peak of 38,916. A new Governor of the Bank of Japan, less concerned with supporting the US dollar and more concerned with fighting inflation, tightened monetary policy and this led to a sharp increase in interest rates in early 1990 (see Frankel 1993; Tschoegl 1993). The bubble burst. The Nikkei 225 fell sharply during the first part of the year and by October 1, 1990 it had sunk to 20,222. Real estate prices followed a similar pattern. The next few years were marked by defaults and retrenchment in the financial system. Three big banks and one of the largest four securities firms failed. The real economy was adversely affected by the aftermath of the bubble and growth rates during the 1990's and 2000's have mostly been slightly positive or negative, in contrast to most of the post-war period when they were much higher. Using the average growth rate of GDP of 4 percent from 1976–1991, the difference between trend GDP and actual GDP from 1992–1998 is around ¥340 trillion or about 68 percent of GDP (Mikitani and Posen 2000, p. 32).

1.6.3 The Asian crisis

From the early 1950's until the eve of the crisis in 1997 the “Dragons” (Hong Kong, Singapore, South Korea, and Taiwan) and the “Tigers” (Indonesia, Malaysia, the Philippines, and Thailand) were held up as models of successful

economic development. Their economies grew at high rates for many years. After sustained pressure, the Thai central bank stopped defending the baht on July 2, 1997 and it fell 14 percent in the onshore market and 19 percent in the offshore market (Fourçans and Franck 2003, Chapter 10). This marked the start of the Asian financial crisis.

The next currencies to come under pressure were the Philippine peso and the Malaysian ringitt. The Philippine central bank tried to defend the peso by raising interest rates but it nevertheless lost \$1.5 billion of foreign reserves. On July 11 it let the peso float and it promptly fell 11.5 percent. The Malaysian central bank also defended the ringitt until July 11 before letting it float. The Indonesian central bank defended the rupee until August 14.

The Dragons were also affected. At the beginning of August, Singapore decided not to defend its currency and by the end of September it had fallen 8 percent. Taiwan also decided to let their currency depreciate and were not much affected. Hong Kong's exchange rate, which was pegged to the dollar came under attack. However, it was able to maintain the peg. Initially the South Korean won appreciated against the other South East Asian currencies. However, in November it lost 25 percent of its value. By the end of December 1997 which marked the end of the crisis the dollar had appreciated by 52, 52, 78, 107, and 151 percent against the Malaysian, Philippine, Thai, South Korean, and Indonesian currencies, respectively.

Although the turbulence in the currency markets was over by the end of 1997, the real effects of the crisis continued to be felt throughout the region. Many financial institutions, and industrial and commercial firms went bankrupt and output fell sharply. Overall, the crisis was extremely painful for the economies involved.

1.6.4 The Russian crisis and long term capital management (LTCM)

In 1994 John Meriwether who had previously worked for Salomon Brothers and had been a very successful bond trader founded LTCM. In addition to Meriwether, the other partners included two Nobel-prize winning economists, Myron Scholes and Robert Merton, and a former vice-chairman of the Federal Reserve Board, David Mullins. The fund had no problem raising \$1.3 billion initially (see http://www.erisk.com/Learning/CaseStudies/ref_case_ltcm.asp and Lowenstein 2000).

The fund's main strategy was to make convergence trades. These involved finding securities whose returns were highly correlated but whose prices were

slightly different. The fund would then short (i.e. borrow) the one with the high price and use the proceeds to go long in the one with the low price. The convergence trades that were taken included the sovereign bonds of European countries that were moving towards European Monetary Union, and on-the-run and off-the-run US government bonds. Since the price differences were small the strategy involved a large amount of borrowing. For example, at the beginning of 1998 the firm had equity of about \$5 billion and had borrowed over \$125 billion.

In the first two years the fund was extremely successful and earned returns for its investors of around 40 percent. However, 1997 was not as successful with a return of 27 percent which was about the same as the return on equities that year. By this time LTCM had about \$7 billion under management. Meriwether decided to return about \$2.7 billion to investors as they were not able to earn high returns with so much money under management.

On August 17, 1998 Russia devalued the rouble and declared a moratorium on about 281 billion roubles (\$13.5 billion) of government debt. Despite the small scale of the default, this triggered a global crisis with extreme volatility in many financial markets. Many of the convergence trades that LTCM had made started to lose money as the flight to quality caused prices to move in unexpected directions. By September 22, 1998 the value of LTCM's capital had fallen to \$600 million. Goldman Sachs, AIG, and Warren Buffet offered to pay \$250 million to buy out the partners and to inject \$4 billion into the business so that it would not be forced to sell out its positions. Eventually the Federal Reserve Bank of New York coordinated a rescue whereby the banks that had lent significant amounts to LTCM would pay \$3.5 billion for 90 percent of the equity of the fund and take over the management of the portfolio. The reason the Fed did this was to avoid the possibility of a meltdown in global asset markets and the systemic crisis that would follow.

1.6.5 The Argentina crisis of 2001–2002

During the 1970's and 1980's Argentina's economy did poorly. It had a number of inflationary episodes and crises. In 1991 it introduced a currency board that pegged the Argentinian peso at a one-to-one exchange rate with the dollar. This ushered in a period of low inflation and economic growth. Despite these favorable developments, a number of weaknesses developed during this period including an increase in public sector debt and a low share of exports in output and a high concentration of these in a limited number of sectors (see IMF 2003).

In the last half of 1998 a number of events including the crisis in Brazil and the resulting devaluation and the Russian crisis triggered a sharp downturn in Argentina's economy. The public debt the government had accumulated limited the amount of fiscal stimulation that the government could undertake. Also the currency board meant that monetary policy could not be used to stimulate the economy. The recession continued to deepen. At the end of 2001, it began to become clearer that Argentina's situation was not sustainable. The government tried to take a number of measures to improve the situation such as modifying the way that the currency board operated. Exporters were subject to an exchange rate that was subsidized and importers paid a tax. The effect of these kinds of measures was to lower confidence rather than raise it. Despite an agreement with the IMF in September 2001 to inject funds of \$5 billion immediately and the prospect of another \$3 billion subsequently the situation continued to worsen. There were a number of attempts to restructure the public debt but again this did not restore confidence.

During November 28–30 there was a run on private sector deposits. The government then suspended convertibility in the sense that it imposed a number of controls including a weekly limit of 250 pesos on the amount that could be withdrawn from banks. In December 2001, the economy collapsed. Industrial production fell 18 percent year-on-year. Imports fell by 50 percent and construction fell 36 percent. In January 2002 the fifth president in three weeks introduced a new currency system. This involved multiple exchange rates depending on the type of transaction. In February this was abolished and the peso was allowed to float and it soon fell to 1.8 pesos to the dollar.

Overall the crisis was devastating. Real GDP fell by about 11 percent in 2002 and inflation in April 2002 went to 10 percent a month. The government defaulted on its debt. Although the economy started to recover in 2003 and has done well since then, it will be some time before it retains its pre-crisis activity.

1.7 THE COSTS OF CRISES

There is a large literature on the costs of crises and their resolution (see, e.g. Bordo et al. 2001; Hoggarth et al. 2002; Roubini and Setser 2004; Boyd et al. 2005; and Honohan and Laeven 2005). Much of the debate has been concerned with how exactly to measure costs. A large part of the early literature focused on the fiscal costs. This is the amount that it costs the government to recapitalize banks and reimburse insured depositors. However, these are mostly transfers

rather than true costs. The subsequent literature has focused more on the lost output relative to a benchmark such as trend growth rate.

There are two important aspects of the costs of crises. The first is the high average cost and the second is the large variation in the amount of costs. Boyd et al. (2005) estimate the average discounted present value of losses in a number of different ways. Depending on the method used the mean loss is between 63 percent and 302 percent of real per capita GDP in the year before the crisis starts. The distribution of losses is very large. In Canada, France, Germany, and the US, which experienced mild nonsystemic crises, there was not any significant slowdown in growth and costs were insignificant. However, at the other extreme the slowdown and discounted loss in output were extremely high. In Hong Kong the discounted PV of losses was 1,041 percent of real output the year before the crisis.

It is the large average costs and the very high tail costs of crises that makes policymakers so averse to crises. This is why in most cases they go to such great lengths to avoid them. However, it is not clear that this is optimal. There are significant costs associated with regulations to avoid crises and in many cases crises are not very costly. An important theme of this book is that the costs of avoiding crises must be traded off against the costs of allowing crises.

1.8 THEORIES OF CRISES

The contrast between the majority view concerning the cause of crises in the 1930's and the view of many today is striking. In the 1930's the market was the problem and government intervention through regulation or direct ownership of banks was the solution. Today many argue that inconsistent government macroeconomic policies or moral hazard in the financial system caused by government guarantees is at the root of recent crises. Here the view is that government is the cause of crises and not the solution. Market forces are the solution.

In this book we aim to provide some perspective on this debate by developing a theoretical approach to analyze financial crises. In each chapter we will develop the basic ideas and then provide a brief account of the theoretical and empirical literature on the topic.

We start in Chapter 2 with some background material. In particular, we review the basics of time, uncertainty, and liquidity. For many readers who are quite familiar with this material it will be better to proceed straight to Chapter 3. For those who are not, or who need a refresher on models of resource allocation over time and with uncertainty, Chapter 2 will provide

an introduction. The first part of the chapter develops basic ideas related to consumption and saving, and production, such as dated commodities and forward markets. The second part considers uncertainty and introduces states of nature, contingent commodities, complete markets, and Arrow securities. Attitudes toward risk, and the roles of insurance and risk pooling are also introduced. The final part of the chapter considers how liquidity and liquidity preference can be modeled.

Chapter 3 considers intermediation. In order to understand how banking crises arise it is first necessary to develop a theory of banking or more generally of intermediation. The approach adopted is to model intermediaries as providing liquidity insurance to consumers. Using this foundation two approaches to crises can be developed. Both views of crises have a long history. One view, well expounded by Kindleberger (1978), is that they occur spontaneously as a panic. The modern version was developed by Bryant (1980) and Diamond and Dybvig (1983). The analysis is based on the existence of multiple equilibria. In at least one equilibrium there is a panic while in another there is not.

The business cycle theory also has a long history (see, e.g. Mitchell 1941). The basic idea is that when the economy goes into a recession or depression the returns on bank assets will be low. Given their fixed liabilities in the form of deposits or bonds they may be unable to remain solvent. This may precipitate a run on banks. Gorton (1988) showed empirically that in the US in the late nineteenth and early twentieth centuries, a leading economic indicator based on the liabilities of failed businesses could accurately predict the occurrence of banking crises. The second part of Chapter 3 develops this approach to crises.

One of the most important causes of crises is a dramatic collapse in asset prices. One explanation for this drop in prices, which is the basis for the business cycle view of crises examined in Chapter 3, is that expected future cash flows fall. Another possibility is that prices are low because of a shortage of liquidity. Chapter 4 investigates the operation of asset markets where asset price volatility is driven by liquidity shocks. The model is similar to that in Chapter 3, except there are no intermediaries. In addition there is a fixed cost to participating in markets and this can lead to limited market participation. When liquidity is plentiful, asset prices are driven by expected future payoffs in the usual way. However, when there is a scarcity of liquidity there is “cash-in-the-market pricing.” In this case, an asset’s price is simply the ratio of the amount sold to the amount of cash or liquidity that buyers have. Ex post buyers would like to have more liquidity when there is cash-in-the-market pricing. Ex ante they balance the opportunity cost of holding liquidity when liquidity is plentiful against the profits to be made when liquidity is scarce. This theory of

asset price determination is consistent with significant asset price volatility. It is shown that there can be multiple Pareto-ranked equilibria. In one equilibrium, there is limited participation and asset prices are volatile. In another, which is Pareto-preferred, there is complete participation and asset prices are not very volatile.

Although in some crises the initial trigger is a large shock, in others it appears the trigger is a small event. For example, in the Russian crisis of 1998 discussed above, the moratorium on debt payments that triggered the crisis involved a tiny proportion of the world's assets. Nevertheless it had a huge impact on the world's financial markets. There was subsequently a period of extreme turbulence in financial markets. Understanding how this type of financial fragility can arise is the topic of Chapter 5. Rather than just focusing on banks as in Chapter 3, or on markets as in Chapter 4, here the interaction of banks and markets is considered. The markets are institutional markets in the sense that they are for banks and intermediaries to share risks and liquidity. Individuals cannot directly access these markets but instead invest their funds in banks that have access to the markets. As in Chapter 4, the key to understanding the form of equilibrium is the incentives for providing liquidity to the market. In order for banks to be willing to hold liquidity, the opportunity cost of doing this in states where the liquidity is not used must be balanced by the profits to be made when liquidity is scarce and there is cash-in-the-market pricing. It is possible to show that if such events are rare then very large changes in prices can be triggered by small changes in liquidity demand. These price changes can cause bankruptcy and disruption. There is financial fragility.

While in Chapters 3–5 the focus is on understanding the *positive* aspects of how various types of crisis can arise, in Chapter 6 we develop a general framework for understanding the *normative* aspects of crises. The model is a benchmark for investigating the welfare properties of financial systems. Similarly to Chapter 5, there are both intermediaries and markets. However, whereas in Chapter 5 markets were incomplete in the sense that hedging opportunities were limited, here we assume financial markets are complete. In particular, it is possible for intermediaries to hedge all aggregate risks in the financial markets. Under these ideal circumstances it can be shown that Adam Smith's invisible hand works. The allocation of resources is efficient in the following sense. If the contracts between intermediaries and consumers are complete in that they can also be conditioned on aggregate risks, then the allocation is (incentive) efficient.

Many contracts observed in practice between intermediaries and consumers such as debt and deposit contracts are incomplete. Provided financial markets are complete, then even if contracts between intermediaries and consumers are incomplete, it can be shown the allocation is constrained efficient. In other

words, a planner subject to the same constraints in terms of incomplete contracts with consumers could not do better. What is more it is shown that the equilibrium with incomplete contracts often involves there being financial crises. For example, if a bank uses a deposit contract then there can be a banking crisis. This demonstrates that crises are not everywhere and always bad. In some cases they can increase effective contingencies and improve the allocation of resources. Of course, we are not saying that crises are always good, only that in some cases they can be, in particular when financial markets are complete and contracts between intermediaries and consumers are incomplete. If financial markets are incomplete then crises can indeed be bad. For example, as mentioned the financial fragility considered in Chapter 5 occurs because markets are incomplete. Thus the contribution of Chapter 6 is to identify when there are market failures that potentially lead to a loss of welfare.

Having identified when there is a market failure, the natural question that follows is whether there exist policies that can correct the undesirable effects of such failures. This is the topic of Chapter 7. Two types of regulation are considered. The first is the regulation of bank capital and the second is the regulation of bank liquidity. Simple examples with constant relative risk aversion consumers are analyzed when financial markets are incomplete. It is shown that the effect of bank and liquidity regulation depend critically on the degree of relative risk aversion. When relative risk aversion is sufficiently low (below 2) increasing levels of bank capital above what banks would voluntarily hold can make everybody better off. For bank liquidity regulation, requiring banks to hold more liquidity than they would choose to is welfare improving if relative risk aversion is above 1. The informational requirements for these kinds of intervention are high. Thus it may be difficult to improve welfare through these kinds of regulation as a practical matter.

The analysis in Chapters 6 and 7 stresses the ability of investors to share different risks. Risk sharing to the extent it is possible occurs because of explicit contingencies in contracts or effective contingencies that can occur if there is default. Liquidity is associated with supplies of the consumption good. There has been no role for money or variations in the price level. Chapter 8 considers the effect of allowing for money and the denomination of debt and other contracts in nominal terms. It is shown that if the central bank can vary the price level then this provides another way for risk to be shared. This is true for risks shared within a country. It is also true for risks shared between countries. By varying the exchange rate appropriately a central bank can ensure risk is shared optimally with the rest of the world. However, such international risk sharing creates a moral hazard because of the possibility that a country will borrow a lot in domestic currency and then expropriate the lenders by inflating away the value of the currency.

The final two chapters in the book consider two forms of crisis that appear to be particularly important but which were not considered earlier. In many instances financial crises occur after a bubble in asset prices collapses. How these bubbles form and collapse and their effect on the financial system is the subject of Chapter 9. The most important recent example of this phenomenon is Japan which was discussed above. In the mid 1980's the Nikkei stock index was around 10,000. By the end of the decade it had risen to around 40,000. A new governor of the Bank of Japan who was concerned that a loose monetary policy had kindled prospects of inflation decided to increase interest rates substantially. This pricked the bubble and caused stock prices to fall. Within a few months they had fallen by half. Real estate prices continued to rise for over a year however they then also started to fall. Fifteen years later both asset prices and real estate are significantly lower with stocks and real estate at around a quarter of their peak value. The fall in asset prices has led to a fall in growth and a banking crisis. Japan is by no means the only example of this phenomenon. It can be argued the Asian crisis falls into this category. In the US the Roaring 1920's and the Great Depression of the 1930's are another example.

The Asian crisis illustrated another important phenomenon, contagion. The episode started in Thailand and spread to many other countries in the region including South Korea, Malaysia, Indonesia, Hong Kong, the Philippines and Singapore. Interestingly it did not affect Taiwan nearly as much. Other regions, particularly South America, were also affected. Understanding the contagious nature of many crises has become an important topic in the literature. There are a number of theories of contagion. One is based on trade and real links, another is based on interbank markets, another on financial markets and one on payments systems. Contagion through interbank markets is the subject matter of Chapter 10.

1.9 CONCLUDING REMARKS

The word crisis is used in many different ways. This naturally raises the question of when a situation is a crisis and when it is not. It is perhaps helpful to consider the definition of crises. According to the dictionary (dictionary.com) a crisis is:

1. (a) the turning point for better or worse in an acute disease or fever
- (b) a paroxysmal attack of pain, distress, or disordered function
- (c) an emotionally significant event or radical change of status in a person's life

2. the decisive moment (as in a literary plot)
3. (a) an unstable or crucial time or state of affairs in which a decisive change is impending; especially : one with the distinct possibility of a highly undesirable outcome
 - (b) a situation that has reached a critical phase.

This gives a range of the senses in which the word is used in general. With regard to financial crises it is also used in a wide range of situations. Banking crises usually refer to situations where many banks simultaneously come under pressure and may be forced to default. Currency crises occur when there are large volumes of trade in the foreign exchange market which can lead to a devaluation or revaluation. Similarly it is used in many other situations where big changes, usually bad, appear possible. This is the sense in which we are using the word in this book.

Historically, the study of financial crises was an important field in economics. The elimination of banking crises in the post-war period significantly reduced interest in crises and it became an area for economic historians. Now that crises have reemerged much work remains to be done using modern theoretical tools to understand the many aspects of crises. This book is designed to give a brief introduction to some of the theories that have been used to try and understand these complex events.

There is a significant empirical literature on financial crises. Much of this work is concerned with documenting regularities in the data. Since the theory is at a relatively early stage there is relatively little work trying to distinguish between different theories of crises. In the chapters below the historical and empirical work is discussed as a background to the theory. Much work remains to be done in this area too.

There is a tendency in much of the literature on crises to argue that the particular theory being presented is "THE" theory of crises. As even the brief discussion in this chapter indicates crises are complex phenomena in practice. One of the main themes of this book is that there is no one theory of crises that can explain all aspects of the phenomena of interest. In general, the theories of crises that we will focus on are not mutually exclusive. Actual crises may contain elements of some combination of these theories.

REFERENCES

- Bagehot, W. (1873). *Lombard Street: A Description of the Money Market*, London: H. S. King.
- Bordo, M. (1986). "Financial Crises, Banking Crises, Stock Market Crashes and the Money Supply: Some International Evidence, 1870-1933," in F. Capie and G. Wood

- (eds.), *Financial Crises and the World Banking System*. New York: St. Martin's Press, 1986, 190–248.
- Bordo, M. and B. Eichengreen (1999). "Is Our Current International Economic Environment Unusually Crisis Prone?" Working paper, Rutgers University.
- Bordo, M., B. Eichengreen, D. Klingebiel and M. Martinez-Peria (2000). "Is the Crisis Problem Growing More Severe?" Working paper, University of California, Berkeley. Updated version of previous paper. <http://emlab.berkeley.edu/users/eichengr/research.html> – this link also allows you to download the figures: scroll down the page until you reach the link to the paper and figures – see also <http://www.haas.berkeley.edu/arose/BEKSc.pdf>
- Bordo, M., B. Eichengreen, D. Klingebiel and M. Martinez-Peria (2001). "Is the Crisis Problem Growing More Severe?" *Economic Policy*, April 2001, 53–82 + Web Appendix.
- Boyd, J., S. Kwak, and B. Smith (2005). "The Real Output Losses Associated with Modern Banking Crises," *Journal of Money, Credit, and Banking* 37, 977–999.
- Bryant, J. (1980). "A Model of Reserves, Bank Runs, and Deposit Insurance," *Journal of Banking and Finance* 4, 335–344.
- Diamond, D. and P. Dybvig (1983). "Bank Runs, Deposit Insurance, and Liquidity," *Journal of Political Economy* 91, 401–419.
- Englund, P. and V. Vihriälä (2006). "Financial Crises in Developed Economies: The Cases of Finland and Sweden," Chapter 3 in Lars Jonung (ed.), *Crises, Macroeconomic Performance and Economic Policies in Finland and Sweden in the 1990s: A Comparative Approach*, forthcoming.
- Fourçans, A. and R. Franck (2003). *Currency Crises: A Theoretical and Empirical Perspective*, Northampton, MA: Edward Elgar.
- Frankel, J. (1993). "The Japanese Financial System and the Cost of Capital," in S. Takagi (ed.), *Japanese Capital Markets: New Developments in Regulations and Institutions*, Oxford: Blackwell, 21–77.
- Gorton, G. (1988). "Banking Panics and Business Cycles," *Oxford Economic Papers* 40, 751–781.
- Heiskanen, R. (1993). "The Banking Crisis in the Nordic Countries," *Kansallis Economic Review* 2, 13–19.
- Hoggarth, G., R. Reis, and V. Saporta (2002). "Costs of Banking System Instability: Some Empirical Evidence," *Journal of Banking and Finance* 26, 825–855.
- Honohan, P. and L. Laeven (2005). *Systemic Financial Crises: Containment and Resolution*, Cambridge, UK: Cambridge University Press.
- IMF (2003). "Lessons from the Crisis in Argentina," Washington, DC: IMF, <http://www.imf.org/external/np/pdr/lessons/100803.pdf>.
- Kindleberger, C. (1978). *Manias, Panics, and Crashes: A History of Financial Crises*, New York: Basic Books.
- Kindleberger, C. (1993). *A Financial History of Western Europe* (second edition), New York: Oxford University Press.
- Lowenstein, R. (2000). *When Genius Failed: The Rise and Fall of Long-Term Capital Management*, New York: Random House.

- Mikitani, R. and A. Posen (2000). *Japan's Financial Crisis and its Parallels to U.S. Experience*, Washington, DC: Institute for International Economics, Special Report 13.
- Mitchell, W. (1941). *Business Cycles and Their Causes*, Berkeley: University of California Press.
- Roubini, N. and B. Setser (2004). *Bailouts or Bail-Ins? Responding to Financial Crises in Emerging Economies*, Washington, DC: Institute for International Economics.
- Sprague, O. (1910). *A History of Crises Under the National Banking System*, National Monetary Commission, Washington DC: U.S. Government Printing Office.
- Studenski, P. and H. Krooss (1963). *Financial History of the United States* (second edition), New York: McGraw Hill.
- Timberlake, R. (1978). *The Origins of Central Banking in the United States*, Cambridge MA: Harvard University Press.
- Tschoegl, A. (1993). "Modeling the Behaviour of Japanese Stock Indices," in S. Takagi (ed.), *Japanese Capital Markets: New Developments in Regulations and Institutions*, Oxford: Blackwell, 371–400.
- Wilson, J., R. Sylla and C. Jones (1990). "Financial Market Panics and Volatility in the Long Run, 1830–1988," in E. White (ed.), *Crashes and Panics*, Illinois: Dow-Jones Irwin, 85–125.