

**Financial Liberalization and Twin Crises:
Banking and Balance of Payments Problems
in Pakistan**

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***Abstract:** Pakistan's recent experience with financial liberalization and various exchange rate regimes provides a good opportunity to study effects of financial liberalization on banking and balance of payments. Financial liberalization has brought the well known problem of twin crisis, where banking and balance of payments problems entwine together. Crises in Pakistan are usually result of weak economic conditions, hence worsening condition of economic variables can serve as an early warning for the forthcoming banking or currency crisis.*

Key Words: Twin Crisis, Emerging Economies, Financial Liberalization, Early Warning System

Introduction

Starting from late 1970s' and early 1980s' financial distress has resulted in multidimensional losses to economies all over the world irrespective of their development level. Literature on this subject has rightfully grown manifold in last few decades. However, even though being a frequent victim of financial distress and crashes Pakistan has remained ignored at large in academic debate and research.

One of the main macroeconomic roles of monetary policy is to keep exchange rate stable through managing domestic inflation and aggregate demand in the economy, while the microeconomic aspect of monetary policy requires sound banking and financial system for pulling the strings and providing appropriate leverage for achieving desired macroeconomic objectives. Unstable exchange rate and weak financial system are harmful to fiscal and monetary outlook of any economy.

Financial system of a country plays a major role in channelizing funds from savers to entrepreneurs, providing payments system in the economy, creating information base on both creditors and debtors and help policy makers in management of demand in the economy. Over time the control of financial system has been passed on to private sector from government in both developed and developing countries.

After World War II, there was a period when public sector became more active and got involved deeply in financial system with stringent monetary policy and credit controls. During late 1970s and early 1980s financial liberalization started to take place in various parts of the world. While during the same period banking problems starting re-emerged with a new phenomenon of twin crisis, in which both currency and banking problems started surfacing simultaneous. Financial liberalization happens to be both a challenge and an opportunity, for stability and growth of banking and balance of payments.

Financial system of Pakistan largely comprises of commercial banks (owning 73 % of total assets of financial system). After its liberalization in 90's banking has emerged as a vibrant and dynamic sector, serving as the primary monetary policy transmission channel, controlling an efficient payments system and developing an information base on creditors and debtors.

Banking system along with many other sectors were under direct national controls during 1974's nationalization policy of the government. Financial reforms process was started during early 1990s, with aims of bringing efficiency to financial system along with banking sector. Privatization of the banks and introduction of prudential regulations with protracted liberalization of the sector took more than a decade. Interest rate liberalization, independence of the central bank (State Bank of Pakistan), establishment of money market, introduction of discount window, floating of exchange rate, and entry of new banks are the major features of the financial reform process that took place in Pakistan.

This study reviews performance of banking and balance of payments in Pakistan over a period from 1964 to 2009, covering periods of pre-nationalization, nationalization and liberalization period. Our study shows that there was no banking crisis while the banking sector was in state control. The indices for banking and balance of payments used in this study show a sharp decline in the number of crises after 2000 not providing support to the hypothesis that financial liberalization leads to financial problems especially twin crises.

The indices used by Kaminsky Reinhart (1998), for Banking and Balance of Payments problems show that in Pakistan, frequency of both types of crisis dropped suddenly after 2000, as there have been only one BoP crisis in 2008, as compared to 11 during Jan 1991-Aug 2000. Similarly, there has been no Banking crisis since Oct 2000, while 3 banking crises were observed before 2000.

The rest of this paper is organized as such; the next section presents a brief literature review and provides definitions of important relevant concepts. Third section presents our methodology and fourth section discuss results. Finally, the last section concludes and provides direction for future research.

Literature Review:

During the last few years economic and financial research has been driven by frequently occurring financial crises. Therefore, it is no surprise that literature on financial crises is growing both horizontally as well as vertically, covering non-crisis period, digging down to find causes of such crises and their effects over times across different sectors of economy.

Kaminsky and Reinhart (1999) in their paper investigate the relationship between the banking & BoP crisis. They studied 20 economies including 5 industrial and 15 developing economies using a dataset from 1970 to 1995. The results were based on 26 banking and 76 currency crises. They found strong relationship between the two crises in economies where financial liberalization has already taken place. Their study concluded that while knowing a banking crises occurrence we can say that a currency crisis will follow. However, due to the effects of currency crisis the peak of banking crisis usually comes after the currency crisis. Furthermore the study held weak economic

conditions responsible for these crises, proposing an early warning system to signal approaching crises.

Eichengreen and Rose (1998), conclude on the basis of data from 100 developing economies that increase in interest rates in the developed world causes reversal of capital flows in the developing economies which increases the probability of banking crisis, irrespective of exchange rate situation and currency regime. They tested three categories of factors; domestic, fiscal and monetary policies, external environment, exchange rate regime, and banking regulation structure, their multivariate analysis confirmed the significance of external environment for banking crisis.

Von Hagen and Tai Kuang Ho (2007) studied 47 economies to develop an index of market pressure. Along with studying economic factors behind the crises they also checked validity of existing definitions of bank crises. They followed events study methodology and applying market pressure index identified banking crises with improved precision.

For currency crises, four different types of models have been introduced over time in response to different crises. Conveniently, these are called first, second, third generations and sudden stop models respectively. Krugman (1979), introduced the first generation models, while proponents of second generation models include Flood and Garber (1984b), and Obstfeld (1986, 1994), Krugman (1998) in response to Asian crisis of 1997 also gave third generation model. The sudden stop models were given by Calvo (1998), Calvo and Reinhart (2000) and Calvo et al. (2002).

Causality Relationship:

The relationship between banking and currency crises is not very clear-cut, some authors believe that banking problems result in currency crashes, while others claim vice versa. Banking problems compel the government to increase liquidity in the money market or bail-out the banking system. In both cases money supply increases which leads to classical model of currency crash, and currency crisis fuels banking sufferings eventually bringing banking crisis. Whatever is the case, it is clear that both the crises are result of deteriorating economy and eroding competitiveness. In studies, different explanations were given for the relationship between banking and currency crises.

Obstfeld (1994), Velasco (1987), Miller (1999), Gonzalez-Herosillo (1996), and Diamond and Dybvig (1983), are of the view that banking problems lead to currency crises. Another way from balance of payments problems to banking failures was advocated by Krugman (1979), Rojas-Suarez and Weisbrod (1995). There are some others who find joint causality between the two, these include; Reinhart and Vegh (1995), McKinnon and Pill (1996, 1998), Chang and Velasco (1999), and Kaminsky and Reinhart (1999). Laeven and Valencia (2008), while compiling database on banking crises maintain the point that banking problems are worsened by the currency crises.

Defining the crises:

Banking Crisis:

Higher leverage ratio sets banks apart from other businesses and firms making their business a semi-public good. Mismatch in liquidity and opaqueness of liabilities and assets of the banks, prone them to abrupt emergence of problems. Banks pose an avenue for funds to pass from savers to investors, this flow of funds keep the banks alive. However, a faltering economy may cause disruptions or outflow of funds from banking channel. Other way round, problems in the banking system hinders efficient allocation of resources and effects the economy in which it operates. Illiquid and opaque

assets are difficult to recall, banks can not honor all their commitments when called back by creditors, for which banks go to money markets for funds. When this causes the whole banking system to come under pressure then it turns to the lender of the last resort, central bank, to extend credit to the banking system.

Our definition of banking crisis is based on weighted average of the ratio of funds borrowed by banks from State Bank of Pakistan to total deposits of the banking system and the real interest rates. The index can count the flow of funds from the central bank or rise in real interest rate in money market due to evaporation of credit in money market. Money market real interest rates represent the funds availability in the banking system.

$$IMP = \frac{\Delta\gamma}{\sigma\Delta\gamma} + \frac{\Delta r}{\sigma\Delta r}$$

Where,

$$\gamma = \frac{\beta}{D}$$

Where, β represents the borrowing of the banking system from State Bank of Pakistan, D is total deposits of the banks, σ is their standard deviation, Δ shows change in the variable.

It is important to note that information on assets rather than deposits can certainly be more useful but due to limitations of data availability and accuracy we are forced to rely on deposits.

In this paper, we use macroeconomic variables approach to identify and predict future banking sector problems. Other approaches used in the literature are bottom up approach, which starts from balance sheets of individual banks and goes to aggregate level. This approach is based on consolidated balance sheets of banking systems from a panel of countries¹. Events occurrence method used in various studies depends on the information on historical events like bank runs, government actions e.g. bailout packages, nationalization, bank holidays, government guarantee to depositors etc. The weakness of this method is that it identifies the crises only when it has already happened. Moreover it fails to identify the events in which government successfully contained the crises and it also requires the crises to substantially develop before being considered as an event of crisis.

Balance of Payments:

Exchange rate provides an anchor to the economy; central bank and governments both try to keep this important anchor stable. However, domestic or external economic conditions can sometimes make it difficult for the managers to sustain pressure on national currency. In order to ease such pressure, foreign exchange reserves are usually used to intervene in the market, which reduces the available cushion, and pressure develops further resulting in a speculative attack, eventually causing a shift of exchange rate regime. Pakistan has faced this phenomena number of times, and adopted the same strategy. We have used weighted average of foreign exchange reserve loss and change in real bilateral exchange rate as our index for identification of balance of payments problems.

¹ Detail on these three methods can be consulted in “Bank Soundness and Macroeconomic Policy”, by Carl-Johan Lindgren, Gillian Garcia, and Matthew I. Saal, IMF, 1996.

This index was initially developed by Eichengreen (1996b), which also included interest rates. We haven't included interest rates because in our country foreign inflows and outflows are less responsive to local interest rates as real interest rates are negative for large periods of time.

$$BoP = \frac{\Delta e}{e} - \frac{\sigma e}{\sigma R} \cdot \frac{\Delta R}{R}$$

Where,

Δ is symbol for change in the variable, e is real bilateral exchange rate, R represents foreign exchange reserves and σ stands for standard deviation of the respective variable.

Financial Liberalization:

Kaminsky and Schmukler (2003), define financial liberalization as liberalization of interest rates, market based allocation of credit and introduction of foreign currency deposits. Moreover, they also focus on the reserve requirements for the banks. For equity market they focus on investments by foreigners in domestic stock markets, regulations on repatriation of profits and capital of foreign based firms.

On the other hand, Kaminsky and Reinhart (1999), consider positive real interest rates as the only benchmark for financial liberalization. Some other studies also differ on the definition of financial liberalization, but generally most studies include the measures highlighted by Kaminsky and Schmukler (2003).

Twin Crises:

In literature, different models attempt to explain the relationship of banking and balance of payments crises, but the problem of causality remains there to be investigated. However, there is general agreement that currency and banking crises can occur together due to weakening economic conditions. If either banking or BoP crisis takes place within twelve months window of the other, then it is known as a twin crisis. In literature twenty four months' window has been used as well, but due to high frequency of crises in our case we stick with a twelve month window.

Data Summary Statistics:

The monthly data used in the analysis from February 1964, to June 2008,

	BNK	BOP	CRIR	CRPS_IPIN	DRBER	EXM1	EXP_PK	FXRS	IMP_PK	IPIN	M2_FXRS	MMM2	STPR	TBDS
Mean	0.00	0.01	-0.06	0.23	-0.15	0.00	0.20	0.30	0.20	0.05	0.12	0.02	0.11	0.16
Median	-0.01	0.00	0.81	-0.10	0.01	0.00	0.14	0.05	0.16	0.05	0.01	0.02	0.07	0.17
Maximum	12.10	0.49	11.91	12.13	4.49	0.05	2.54	13.69	3.28	0.25	4.53	0.25	1.29	0.43
Minimum	-6.38	-0.26	-24.44	-0.82	-10.92	-0.03	-0.56	-0.85	-0.53	-0.12	-0.92	-0.13	-1.00	-0.09
Std. Dev.	1.44	0.04	5.05	1.17	1.55	0.01	0.35	1.04	0.35	0.06	0.76	0.06	0.29	0.08
Skewness	1.14	2.83	-1.62	5.43	-3.62	0.75	2.33	5.92	3.25	0.37	2.44	0.45	0.73	0.06
Kurtosis	13.23	37.78	7.96	46.47	23.62	4.32	13.26	63.06	22.18	3.17	12.26	3.70	6.04	3.61
Jarque-Bera Probability	2,438.10	27,576.19	781.66	23,082.45	10,603.32	29.73	2,817.58	83,213.46	9,111.88	6.59	926.83	11.14	250.68	8.28
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.02
Sum	1.24	3.65	-29.83	64.31	-80.84	0.11	104.04	160.95	104.26	14.27	24.91	4.10	56.25	84.89
Sum Sq. Dev.	1,102.87	1.00	13,582.18	377.36	1,272.46	0.03	64.42	572.97	66.00	1.11	116.54	0.73	45.63	3.07
Observations	533.00	533.00	533.00	276.00	533.00	178.00	533.00	533.00	533.00	276.00	203.00	204.00	527.00	522.00

Quantiles		BNK	BOP	CRIR	CRPS_IPIN	DRBER	EXM1	EXP_PK	FXRS	IMP_PK	IPIN	M2_FXRS	MMM2	STPR	TBDS
Percentiles	90	1.62	0.04	5.09	1.18	0.78	0.02	0.54	1.22	0.46	0.14	0.93	0.09	0.42	0.26
	95	2.21	0.06	6.52	1.85	1.64	0.02	0.73	1.66	0.64	0.16	1.46	0.13	0.70	0.30
	99	3.74	0.13	8.50	5.02	2.73	0.04	1.67	3.20	1.80	0.22	2.99	0.17	1.05	0.35
	80	0.86	0.03	3.44	0.61	0.27	0.01	0.36	0.75	0.34	0.10	0.41	0.06	0.28	0.22
Quartiles	Q1	-0.74	-0.01	-2.16	-0.29	-0.14	-0.01	0.01	-0.22	0.03	0.01	-0.39	-0.02	-0.05	0.12
	Q2	-0.01	0.00	0.81	-0.10	0.01	0.00	0.14	0.05	0.16	0.05	0.01	0.02	0.07	0.17
	Q3	0.66	0.02	2.84	0.33	0.17	0.01	0.31	0.51	0.29	0.09	0.29	0.05	0.23	0.20

This table presents summary statistics of the variables and indices to highlight data distribution and variation.

Methodology

In order to study causes of different crisis, we first need to establish a definition of crisis and then an established method to identify and date them. Furthermore, we can analyze the behavior of certain economic variables, suspected to be affecting these crises, in a specific period around crisis months.

While defining, identifying and locating the crisis points we follow technique used by Kaminsky and Reinhart (1999). The two indices used provide us with consistent results in line with historical evidence for Pakistan in terms of time periods that were considered to be problematic for banking and balance of payments.

Banking problems are very difficult to identify as the banking problems can emerge from either side of the bank's balance sheet. But liquidity problems can bring even the big banks to ground overnight as compared to slow pace of asset deteriorations. Bank runs are not common phenomena today, major banking problems now a days result from gradual deterioration in the assets of the banking sector. Higher frequency data of the health of bank assets is not available, which proves to be a great obstacle in making a good analysis from assets side. Bank crisis in any way results in default of the bank over its commitment to honor depositors' claims, for which bank have to either use its reserves or reverse the investments. As banks take funds from depositors and lend them to investors

with a little proportion keeping in reserves. (A bank can never repay all the deposits, which limits banks ability to honor depositors' claims without reversing the investments it has already extended). Both short term and long term loans cannot be retrieved easily, as the entrepreneurs want rollover of the finance or their business doesn't allow extraction of capital. This again puts a limit on the ability of the banks to repay the amounts it borrowed from its depositors. Whatever is the case, reserves are the first to evaporate. On the basis of this proposition we have used weighted average index of borrowed reserves and interest rate to identify the banking crises (also used by Kaminsky and Reinhart 1999). The nature of banking business entails the threat of bank runs; customer's strong confidence usually keeps the bank in business. The factors which impact the banking business the most come from all the sectors of economy from external, real, fiscal and finance. This study investigates the behavior of certain economic indicators around the crisis period important for developing an early warning system. During a twelve month window² if a variable crosses the threshold set for it, we consider it as a signal, while a signal out of the window is dubbed as noise. Hence, the signal to noise ratio reveals ability of a given variable to foretell the crisis.

Currency or balance of payments problems happen when there is a large devaluation of national currency, normally it entails exchange rate regime shift or huge intervention by the central banks which requires sufficient amount of foreign exchange reserves to fight back speculations getting air from the devaluation. In the case of developing economies, which have limited or low reserves, defending currency against speculative attacks in most of the cases leads to depletion of reserves and further devaluation of the national currency, eventually bringing a regime shift. The weighted average index of foreign exchange reserves and real exchange rate serves as a good indicator of crisis with a threshold level, this index was initially developed by Eichengreen (1996b) but with some modifications was applied by Kaminsky and Reinhart (1999).

We have used these above mentioned indices for the identification of crises; on the basis of these results we calculate probabilities for banking and currency crisis independent of each other, and then probabilities for each crisis dependent on the other. The individual independent probabilities for either of the crises are lower, compared to the dependent probabilities of the crisis. It means when there is a banking or currency crisis, the chances for the other crisis happening increases significantly.

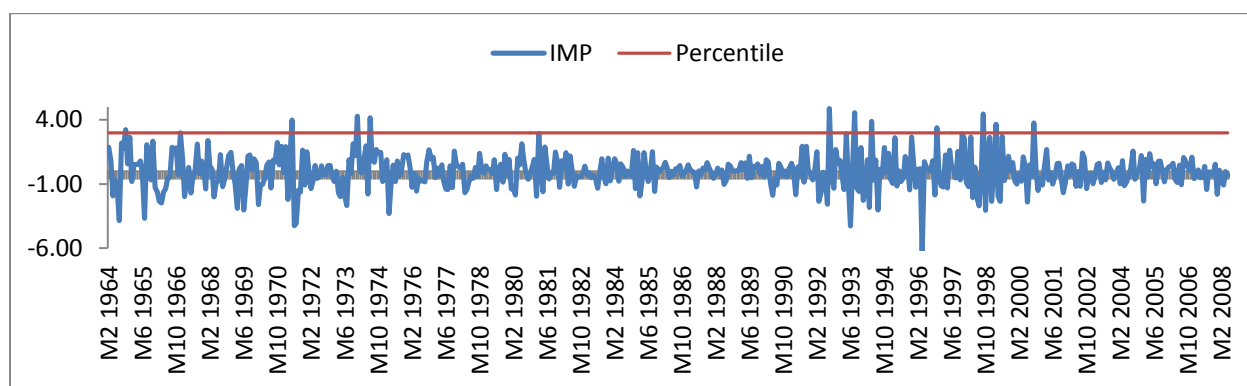
The results found also substantiate that twin crisis happen only in presence of financial liberalization, as there was no such incident during the whole period of nationalization. However, the pre-nationalization period included twin crises, the most crisis ridden period happened to be the post-nationalization or the reforms period. The results also assert that the way liberalization takes place matter, as sudden removal of limitations can result in financial distress. The way Pakistan liberalized its financial system underscores importance of slow paced deregulation for long term stability of the system. During 1990s', banking sector was grappling with chronic issues of non-performing loans, overstaffing, lack of management skills and others. Economic problems and sanctions on the country along-with frequent policy changes brought about the numerous currency and banking problems in a span of about ten years. However, during the 2000s' banking started maturing and strengthening which can be attributed to economic growth and stability. During this period no crisis happened until the twin crisis of Sep 2008.

² Reuven Glick (1999), too followed twelve months window. Other authors have used windows of different length but due to the frequency and duration between the two crises we have selected twelve month window, which performs better for signal to noise ratio as compared to twenty four month window and three or six month windows.

Results

Banking Crisis

The following graph covers three distinctive regimes of banking sector in Pakistan, namely pre-nationalization, nationalization and the post nationalization. The pre-nationalization period shows a turmoil ridden phase, during this period Pakistan's financial sector even though in private domain was still lacking major components like money market, autonomous central bank and other features like discount window and bond market. Credit rationing and interest rate controls limited freedom of financial system. The period from 1974 to 1992 shows a period of tranquility, during this episode the banking sector was in public control and this can be the reason for smooth sailing of the banking sector. The most interesting phase of banking history starts after 1992, privatization and liberalization of banking sector, deregulation of financial sector all started here.³This period has two very different episodes, first spans from 1992 up to 2000, and the second from 2000 to date. In the first period we can see a very unstable condition of banking industry. While, after 2000 there is very smooth and stable behavior as indicated by the index without any turmoil during the nine years period.



These periods of turbulence, tranquility, turbulence and again tranquility present a thought provoking phenomena, which needs to be studied in detail to get some useful information on behavior of the banking sector in Pakistan.

Post nationalization period remains our prime focus, as we can clearly see two different behaviors of the banking sector. During the 1990s' banking sector faced a lot of crises, while 2000s' remained calmer period in the history of banking in Pakistan. The possible explanation of this phenomenon is that 1990s' was period of reforms and restructuring and the banking was grappling with changing circumstances and accommodating structural changes. The years after 2000, banking emerged as a vibrant and resilient sector to external shocks. State Bank of Pakistan, central bank of the country being regulator of the banking industry learned and acted pro-actively to embolden and strengthen the banking industry. In the face of various challenges it used all possible levers to ensure the success of banking in the country. In the era of economic effluence it emphasized capital base, capital adequacy ratios, and cap on the number of players. The coherent policies helped banks consolidate their balance sheets, and diversify their risks portfolio without losing the market shares.

³ A brief history of banking sector reforms and independence of State Bank of Pakistan during 1990's is given in appendix, while for detail various publications of SBP can be consulted.

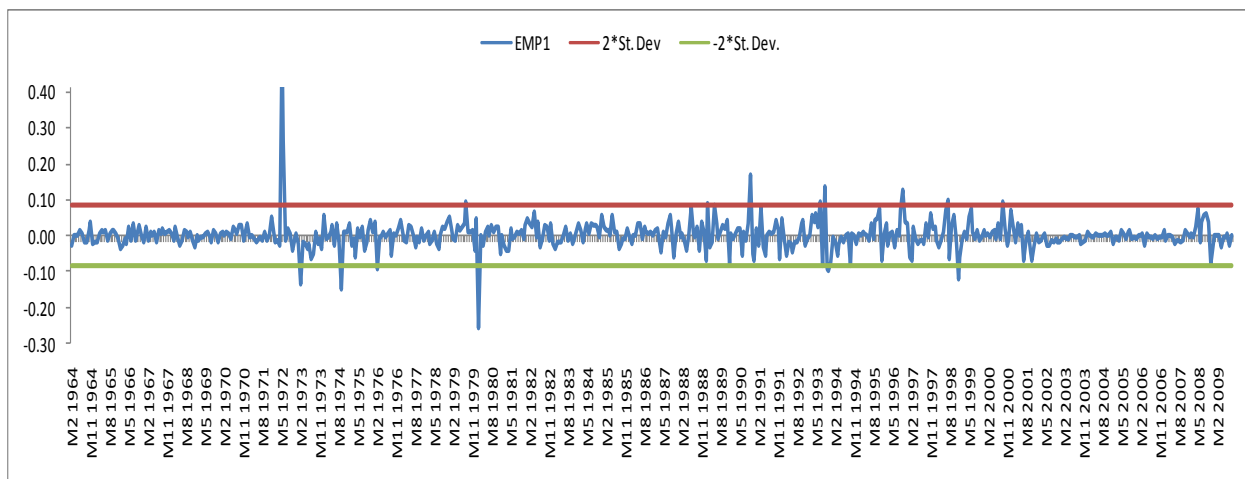
The economic upswing brought windfall profits, and rush of foreign inflows into the industry. With the change in economic scenario within and outside the country during 2008, SBP acted promptly in relaxing the capital requirements, easing the race for aggressive profit earnings, increasing the share of SBP financing for export refinance and other such schemes, making the existing liquidity available in the system, slashing the reserve requirements and lending to commercial banks through discount window. These steps of SBP worked both in protecting the banking sector particularly and stimulating the economy in general.

As far as the early warning system for financial crises is concerned, the behavior of economic variables like foreign exchange reserves, growth of reserve money to foreign exchange ratio, equity prices, growth in money multiplier, and growth in domestic credit to output ratio can give some indication of the forthcoming problems in the financial sector. Unfortunately, the inter linkages between banking and external sector of the economy are neither straightforward nor very strong, but there is no doubt that external sector's performance impacts the banking system through change in financial position of banks' customers.

Financial liberalization triggers competition among banks for higher market shares and profits, making them vulnerable to involvement in more risky sectors, a moral hazard on the part of banks. This behavior of banks needs to be reigned in through proper regulations and rules of the game.

Balance of Payments Crisis

The index of exchange market pressure emphasizes the view that Pakistan's Balance of Payments problems are chronic. There was no problem until the 1970s', but once it started BoP problems have recurred frequently till the year 2000, after which there was a relatively calm period to be disturbed again during 2008.



The above graph shows and highlights the balance of payments problems, if we look at the historic events when either regime change or other shock to balance of payments affected the exchange rate of Pakistan, the index becomes more useful. For example, Pakistan delinked its currency from Pound Sterling and pegged it with the USA dollar in 1971. The outlier in the graph shows clearly, a 56.7 % devaluation of PKR in May 1972 in gold terms. On 11th of May, 1972, Unified Official rate of PKR 11.00 per US \$ was introduced, a 4.5 % currency fluctuation range was provided and complex system of Export Bonus Voucher was abolished.

Similar history holds for the other shocks given by the index. Further details of Pakistani Rupee regimes and history are given in the appendix.

Empirical evidences show that economic pressure lead to currency problems and eventually regime shifts.

Are twin crises results of financial liberalization?

Banking all over the world saw a very healthy period after 1930s, till the late 1970s', when financial liberalization and loose monetary policies were being adopted in most of the countries in the world. Currency problems have become the norm of all modern economies, even though developed countries have also faced the currency meltdowns, but developing economies remains its main victim. But after the start of financial liberalization, banking and currency crises have more often then not became entwined and caused much greater losses in output, as is figured out by Hutchison and Noy (Aug 2005).

Pakistan being no exception to all this, experienced the same pattern in its short history of just above 60 years. During these years Pakistan has experienced with different policies and objectives, which affected its financial sector and balance of payments in many ways.

Unconditional Probabilities of Crises:			
	No. of Months	No. of Crises	Probabilities
Banking			
M2 1964-M7 1974	125	6	0.05
M8 1974-M8 1992	217	0	-
M10 1992-M10 2000	98	7	0.07
M11 2000-M6 2009	104	0	-
Overall	544	13	0.02
Balance of Payments			
M1 1964-M4 1972	100	0	-
M4 1972-M2 1976	46	5	0.11
M3 1976-M6 1979	40	0	-
M7 1979-M9 2000	255	15	0.06
M10 2000-M4 2008	91	0	-
M5 2008-M6 2009	14	4	0.29
Overall	546	24	0.04

Conditional Probabilities of Crises:			
	No. of Bank Crises	No. of BoP Crisis during Bank Crisis Window	Probability of BoP on Bank
Twin			
M2 1964-M7 1974	6	5	0.83
M8 1974-M8 1992	0	-	-
M10 1992-M10 2000	7	6	0.86
M11 2000-M6 2009	0	-	-
Overall	13	11	0.85

Conditional Probabilities of Crises:			
	No. of BoP Crises	No. of Bank Crisis during BoP Crisis Window	Probability of Bank on BoP
Twin			
M2 1964-M7 1974	3	2	0.67
M8 1974-M8 1992	10	0	-
M10 1992-M10 2000	7	7	1.00
M11 2000-M6 2009	4	0	-
Overall	24	9	0.38

The above given table gives a good account of the performance of banking and balance of payments under various policy regimes. The table further supports the hypothesis that financial liberalization

brings along the problem of twin crisis. The experience of Pakistan offers a unique avenue which remains unexplored in literature so far that although financial liberalization can lead to twin crises, but it can also help improving and stabilizing the financial system. Moreover, sudden changes and shocks (like abrupt policy changes) can have negative impact on growth and health of the financial system as witnessed in 2008 crisis.

Probabilities of crises show that balance of payments crises probability is higher than the probability of banking crises during all the three periods of pre-nationalization, nationalization and post-nationalization.

First of all we calculated the unconditional probabilities of the both crises, which show that unconditional probability of the banking crises before nationalization was very low (5%), with no crisis during the whole period of the nationalization. The probability of bank crisis under nationalization regime is zero, unconditional probability of the banking crisis remains low (7%) despite a minor increase after liberalization. Overall unconditional probability of the banking crisis remains 2 % only.

Unconditional probability of the balance of payments crisis before start of nationalization is zero, with the rise in number of balance of payments crises during nationalization, the unconditional probability of the crisis reaches 11 %, and after liberalization of the financial sector it comes down to only 6%. Overall unconditional probability of the balance of payments crisis is only 4 %.

Interestingly, probabilities change drastically with the introduction of conditionality; the conditional probabilities for both the crises are very high as compared to the unconditional probabilities of the incidents. However, probability of the balance of payments crisis once the banking crisis has already happened is very high (85%) as compared to the probability (38%) of banking crisis happening with balance of payments crisis already taken place. Conditional probabilities for the nationalization regime remain zero. The major point to be noticed is that conditional probabilities have increased substantially during the post nationalization period.

Looking closely at conditional probabilities of banking and balance of payments crises, it can be noted that banking crisis can be the leading event for twin crisis, as the conditional probability of balance of payments crisis on banking is higher (85 %) as compared to the conditional probability of banking crisis on balance of payments crisis (38 %).

It leads us to the conclusion that financial liberalization eventually brings the problem of twin crisis, but as mentioned earlier this problem can be tackled through prudent policy, regulation and monitoring of the performance of the banks.

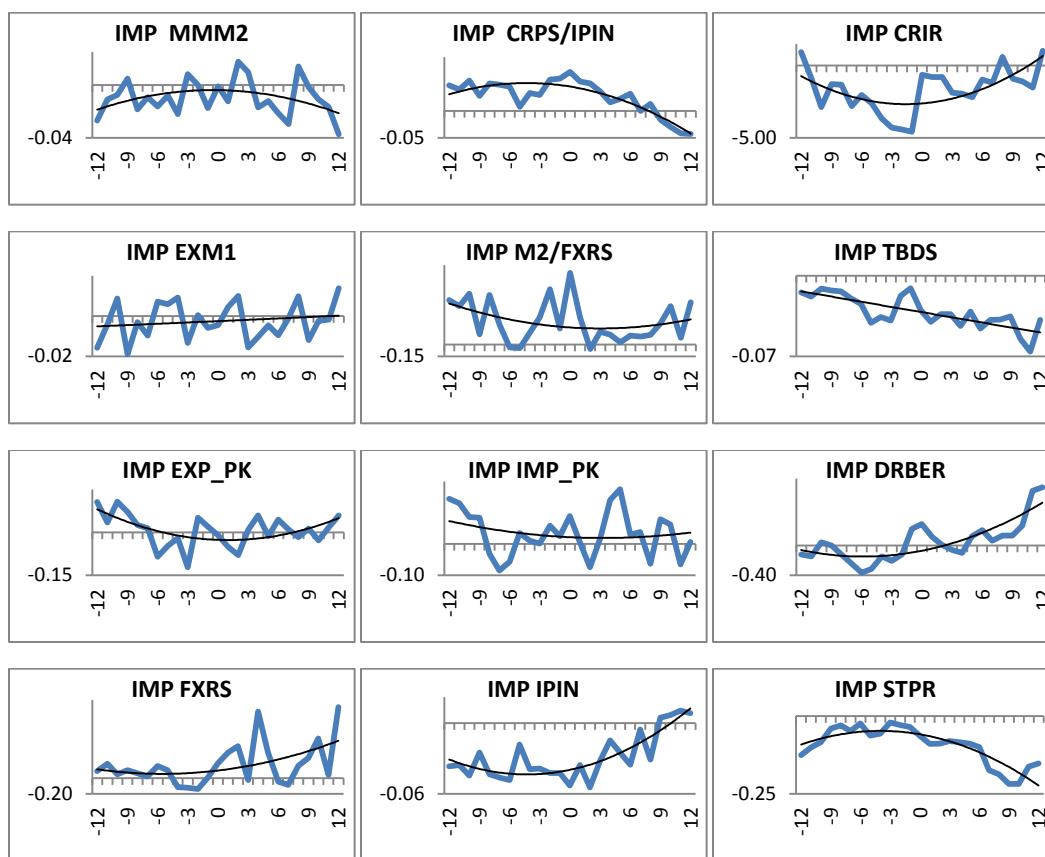
	No. of Crises per Year	No. of Years per Crisis	No. of Months Per Crisis
Banking			
M2 1964-M7 1974	0.58	1.74	20.83
M8 1974-M8 1992	-		
M10 1992-M10 2000	0.86	1.17	14.00
M11 2000-M6 2009	-		
Overall	0.29	3.49	41.85
Balance of Payments			
M1 1964-M4 1972	-		
M4 1972-M2 1976	1.30	0.77	9.20
M3 1976-M6 1979	-		
M7 1979-M9 2000	0.71	1.42	17.00
M10 2000-M4 2008	-		
M5 2008-M6 2009	3.43	0.29	3.50
Overall	0.53	1.90	22.75

The table given above explains how the time span for boom and bust cycle changed in response to different policy stances. Pre-nationalization period was featured with longer business cycles for the banking sector; it took about 21 months for completion of one business cycle. During period of liberalization time period for boom and bust reduces substantially, about 14 months, which means increase in the chances of crisis.

In case of balance of payments problems, during 1972 to 1976, it was less than a year, about 9 months, during 1976 to 1979, there is some improvement in balance of payments and it takes about 17 months for completion of one business cycle. The last regime can be called an outlier, because it is only one crisis point spanning more than a quarter, which makes the cycle shorter.

Overall we can see that banking has larger boom bust cycle period as compared to currency boom and bust cycle. Intuitively, financial liberalization renders greater vulnerability for the banking and financial system, because the brutal market forces and competition test the system.

Banking Crises;



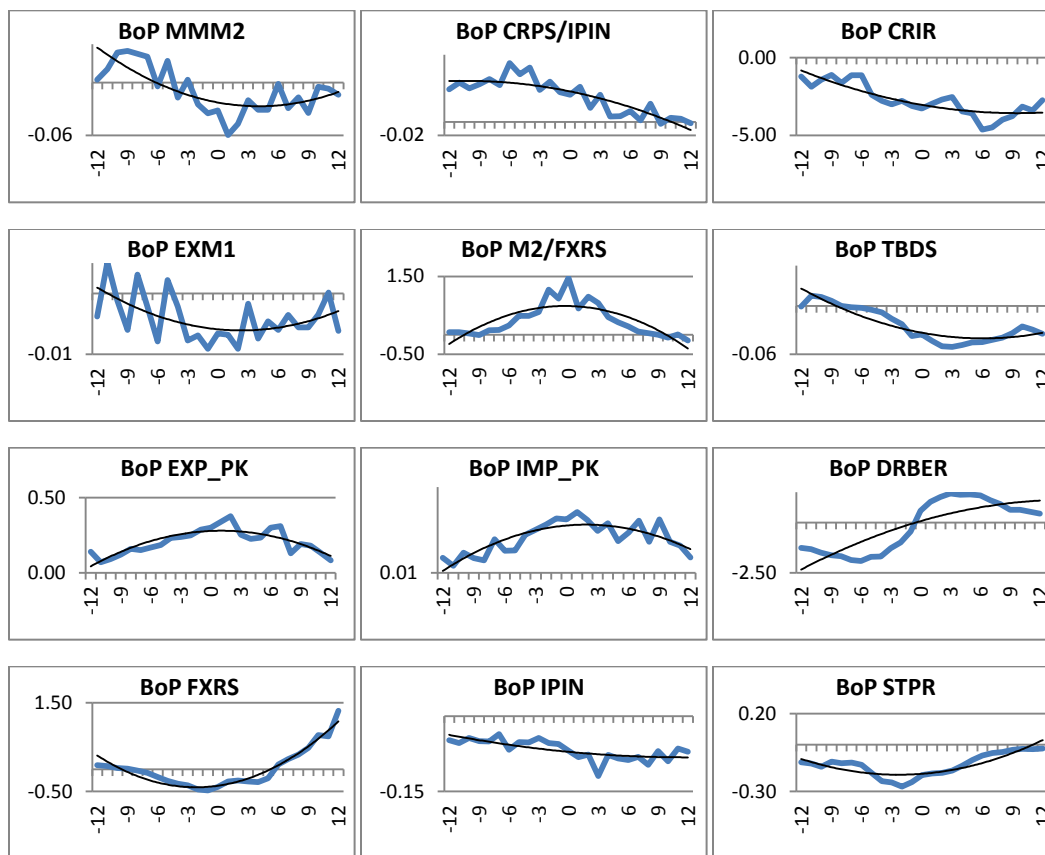
Figure; The horizontal axis represents twelve month window around the crisis point zero, the vertical axis shows the difference from the mean of tranquil period. The linear trend line is added to each graph to indicate general behavior. The solid line shows difference of average of crisis points from tranquil period average.

The behavior of different economic variables around the time of crises is shown by the above graphs, which represent different sectors of the economy. The time window is taken as twelve month before and after the crisis point. In other words twenty five months period including the crises point is observed. The line represents the average value of the variable during the months of crises. Added trend lines show clearly the way variable behaved around the crisis period.

Money demand multiplier shows clear signs of a bubble burst phenomena, the meager change imply limited banking activity in the economy. Before the crisis, banking activity increases and reaches the peak before the crisis point gradually coming down afterwards. Credit to private sector being the result of increased banking activity also follows somewhat similar pattern up and down. Real interest rates visit negative regions frequently in our country, showing that during the increased banking activity and higher credit to private sector regimes, the real interest rates are lowest which fuels the boom in lending and ends in crisis. Excess money balances show a vague behavior and no information worth deduction can be extracted from it. Crisis follows the degrading money base, with lower proportion of foreign assets. Because of the ineffective interest rates, deposits in our banks continue their plunge during the whole twenty five month period about the crisis. In the

external sector we witness the worsening of both exports and imports growth which only picks up after the crisis has passed. Foreign exchange reserves depletion leads the crisis and improvement only comes once the crisis passes over. Real sector growth shown by industrial production index falls before the crisis. Similarly, equity market too takes a dip before the crisis sets in.

BoP Crises:



Figure; The horizontal axis represents twelve month window around the crisis point zero, the vertical axis shows the difference from the mean of tranquil period. The linear trend line is added to each graph to indicate general behavior. The solid line shows difference of average of crisis points from tranquil period average.

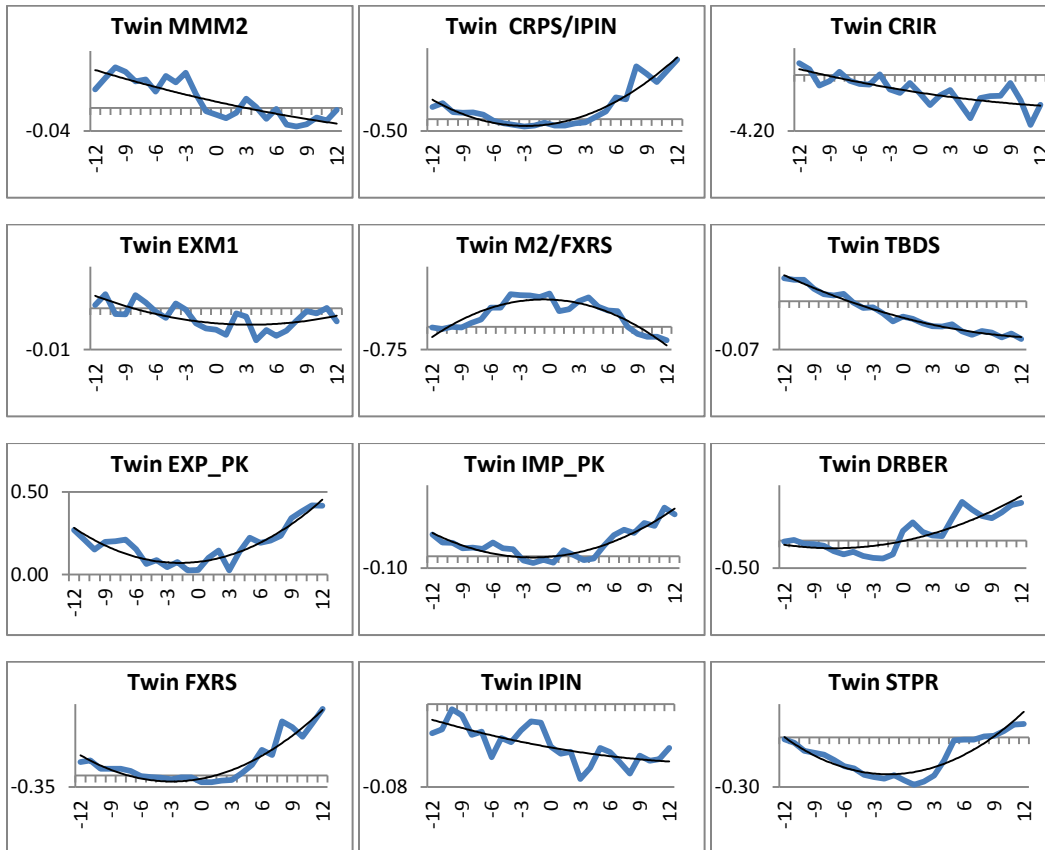
The behavior of economic variables around the time of balance of payments crises is given in the above figure.

The growth of variables, twelve months before and after the crisis point, is compared to the growth of the variable during the crises period. Deterioration can be observed in the economic variables before the crises, and strengthening trend after the crises point. The horizontal axis represents the time period starting from twelve months before the crises point and ending after the twelve months passed crises. The solid line showing the variables is the difference of average of the values of the variable at the time. Zero point refers to the crises month.

Money multiplier growth falls during the crisis from a higher level before the crisis, due to pressure on shrinking external reserves and high inflation rates the government tries to defend the currency,

which leads to tighter monetary policies and reduction in credit to private sector, real interest rates continue their declining trend due to higher inflation. Excess money balances shrink and the ratio of foreign exchange reserves to money balances decreases. However, due to slowing economic activity deposit base of the banking system erodes. Growth in both imports and exports along with depleting foreign exchange reserves makes the real exchange rate to shoot up in terms of Rs. Per US \$. The decline in industrial output and fall in equity market remain behind the balance of payments crisis. Real bilateral exchange rate in term of Rs. Per US \$, depreciated about 7.29 % month to month on average. However, due to higher standard deviation, 14.76% depreciation in exchange rates restrict us from generalizing that 7.29% depreciation leads to crisis.

Twin Crisis:



Figure; . The horizontal axis represents twelve month window around the crisis point zero, the vertical axis shows the difference from the mean of tranquil period. The linear trend line is added to each graph to indicate general behavior. The solid line shows difference of average of crisis points from tranquil period average.

In case of twin crisis, there are clear signs of economic deterioration, where money multiplier was high before the crisis and when the boom explodes the value of money multiplier falls sharply. In case of private sector credit to industrial production ratio, a whimsical picture comes up, where the ratio is higher but it rises to even higher levels after the crisis, however in the previous two cases we saw a decline in the ratio after the crisis. This particular behavior on the part of this ratio implies that due to fall in industrial production the decrease in denominator exceeds the fall in nominator, which

can also be observed in the graph of industrial production. That is why the curve reverts upward after touching the lower levels. This also implies that the output losses from the both crises combined are higher than in the cases of either banking or balance of payments crisis individually (Hutchison & Noy, 2005). Due to low real interest rates the credit boom is induced by the low real interest rates, the trend continues even after the crisis. The fall in real interest rates after the crisis is due to the increased inflation in the country in the wake of credit boom. Increase in the nominal interest rates after the crisis become ineffective in the presence of high inflation rate. Before the crisis the excess money balances are higher and tend to decrease while approaching the crisis and remain low after the crisis. Money demand to foreign reserves ratio shows an increase towards the crisis point but this picture becomes clearer if we look at the graph of foreign exchange reserves which shows a decline before the crisis and climbs up after the crisis. This means that the rise in the ratio of M2 to foreign reserves before the crisis is due to the fall in foreign exchange reserves and increase in M2. The total bank deposits show a falling trend which continue after the crisis. Import and export show the similar behavior around the crisis point, the bowl shaped trend line represents worsening in trade before the crisis and gain in activity after the crisis. Value of PKR deteriorates after the crisis. Foreign exchange reserves and industrial production add to the list of weak economic variables before the crisis. Stock market shows significant fall in the prices before the crisis.

Noise to Signal Ratio:

Banking		MMM2	CRPS/IPIN	CRIR	EXM1	M2/FXRS	TBDS	EXP_PK	IMP_PK	DRBER	FXRS	IPIN	STPR	
M2 1963-M11 1965	Signal	N/A	N.A	0	N/A	N/A	N/A	1	0	0	0	N/A	0	0.17
	Noise	N/A	N.A	0	N/A	N/A	0	0	0	0	0	N/A	0	-
M1 1966-M1 1968	Signal	N/A	N.A	0	N/A	N/A	0	0	1	0	0	N/A	0	0.14
	Noise	N/A	N.A	0	N/A	N/A	0	1	0	0	0	N/A	0	0.14
M6 1970-M6 1972	Signal	N/A	N.A	0	N/A	N/A	0	0	1	1	1	N/A	1	0.57
	Noise	N/A	N.A	0	N/A	N/A	0	0	1	1	0	N/A	0	0.29
M1 1973-M7 1975	Signal	N/A	N.A	1	N/A	N/A	1	1	1	0	0	N/A	0	0.57
	Noise	N/A	0	1	N/A	N/A	0	0	1	1	1	1	0	0.56
M9 1991-M51995	Signal	1	1	1	1	1	0	0	0	1	1	1	1	0.75
	Noise	1	0	0	1	0	0	0	0	1	0	0	1	0.33
M12 1995-M10 2001	Signal	1	1	0	1	1	1	0	0	1	1	1	1	0.75
	Noise													-
Total	Signal	2	2	2	2	2	2	2	3	3	3	2	3	
	Noise	1	0	1	1	0	0	1	2	3	1	1	1	

Balance of Payments		MMM2	CRPS/IPIN	CRIR	EXM1	M2/FXRS	TBDS	EXP_PK	IMP_PK	DRBER	FXRS	IPIN	STPR	
M51971-M21977	Signal	N/A	N.A	1	N/A	N/A	1	1	1	0	0	N/A	1	0.71
	Noise	N/A	N.A	0	N/A	N/A	1	1	1	0	1	N/A	0	0.57
M7 1978-M7 1981	Signal	N/A	N.A	1	N/A	N/A	0	1	1	0	1	N/A	0	0.57
	Noise	N/A	0	0	N/A	N/A	0	1	0	0	1	N/A	0	0.25
M6 1987-M3 1992	Signal	0	0	1	N/A	0	1	1	1	0	1	N/A	0	0.56
	Noise	1	1	1	0	1	0	1	0	1	1	0	0	0.58
M11 1994-M9 2001	Signal	1	1	0	1	1	1	1	0	1	1	1	1	0.83
	Noise	0	1	1	1	1	0	1	1	1	0	0	1	0.67
M5 2007-M10 2009	Signal	0	0	1	1	1	1	1	1	1	1	1	0	0.75
	Noise													-
Total	Signal	1	1	4	2	2	4	5	4	2	4	2	2	
	Noise	1	2	2	1	2	1	4	2	2	3	0	1	

Twin		MMM2	CRPS/IPIN	CRIR	EXM1	M2/FXRS	TBDS	EXP_PK	IMP_PK	DRBER	FXRS	IPIN	STPR	
M6 1970-M7 1976	Signal	0	0	20	0	0	0	0	16	0	0	0	4	
	Noise	0	0	0	0	0	0	0	2	0	0	0	0	
M9 1991-M10 2001	Signal	10	6	0	3	12	0	0	0	4	0	0	0	
	Noise	0	1	1	3	0	0	0	0	10	0	0	0	
Total	Signal	10	6	20	3	12	0	0	16	4	0	0	4	
	Noise	0	1	1	3	0	0	0	2	10	0	0	0	

As conditional probability of either crisis is higher than its own probability of happening, the above table shows the noise to signal ratio of twelve economic variables for banking and balance of payments crisis. These variables are considered to be the leading factors for banking and balance of payments problems. In our case, these variables give no cutting edge information about the looming crisis. However, in-depth analysis shows that some of these factors like M2/FXRS, and CRPS/IPIN provide good signals, while the others don't provide good signals. One of the reasons behind the poor performance of the variables can be the frequency of crises. The frequent recurring crises overlap the windows of each other therefore the signals of crises turn to noise. Higher frequency of crises in Pakistan limits our window span to twelve months, which results in higher noise to signal ratio. So if we follow the studies like Kaminsky, Reinhart (1999), with twenty four months before and after the crisis, the ratio will fall sharply.

Conclusion

After financial liberalization in Pakistan, probability of twin crises has increased, which never happened during the period of nationalization. The occurrence of either banking or balance of payments crises increases the probability of the other's happening. Even though both crises happen at the same time but which precedes the other is not clear. Sometimes it is the banking crisis leading the currency problems, and at other times it is vice versa. The economic conditions around the crisis period generally show instability and deterioration.

Another striking behavior shown by the banking sector of Pakistan is that after surviving the hot waters of 1990s', it has become significantly more stable and resilient to external shocks. Recent global financial meltdown and consequent economic recession didn't impact the performance of banking sector in Pakistan. Overall the behavior of economic variables shows a boom and bust cycle around the crises, banking, balance of payments and twin. However, twin crisis have only occurred in Pakistan after financial liberalization. Protracted process of financial liberalization with proper prudential regulations and close vigilance has ensured banking sector stability in the long run. The early warning system although with its limitations can provide a good signal of approaching problems. Either of the banking or balance of payments crisis can happen first but their combined impact on economy is much more severe as compared to any of the two happening individually.

Further research and study can be undertaken to build a model for early warning system, which can provide more accurate and clear indication of the crisis and give explicit weights to each economic variable's contribution in bringing the crisis. Moreover we can explore the dynamics of our banking system for the potential contagion shocks and vulnerability due to assets deterioration.

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Appendix

Variables:

Abbreviation Used	Name	Definition	Level Used
BNK	Index of Banking Crisis		
BOP	Index of Balance of Payments Crisis		
CRIR	Real Interest Rate		
CRPS_IPIN	Ratio of Private Sector Credit to Industrial Production Index		
DRBER	Real Bilateral Exchange Rate		
EXM1	Excess Money Balances		
EXP_PK	Exports in PKR		
FXRS	Foreign Exchange Reserves		
IMP_PK	Imports in PKR		
IPIN	Industrial Production Index		
M2_FXRS	Ratio of M2 to Foreign Reserves		
MMM2	Money Multiplier M2		
STPR	Stock Prices		
TBDS	Total Bank Deposits		

History of Pakistan's Exchange Rate

Date	Changes to the exchange rate regime	Rupee per U.S. Dollar
1-Jul-55	The Pakistan Puree, divided into 100 Paisa, was devalued from an Official Rate of PRs3.31 to PRs4.76 per U.S. Dollar (WCY 1984, p. 585)	4.760
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1-Jul-55	The Pakistan Puree, divided into 100 Paisa, was devalued from an Official Rate of PRs3.31 to PRs4.76 per U.S. Dollar (WCY 1984, p. 585)	4.760
22-Jul-70	A fluctuating Tourist Rate was introduced based upon a 45% Export Bonus Voucher plus its salable premium, thus effecting a partial devaluation. (WCY 1984, p. 585)	
15-Aug-71	Following the de facto devaluation of the U.S. Dollar, the Rupee, through its link to the Pound Sterling, began to appreciate against the U.S. Dollar. (WCY 1984, p. 585)	
17-Sep-71	Pakistan cut her currency's ties to the Pound and pegged the Rupee to the U.S. Dollar at the previous Official Rate of PRs4.76 per Greenback, thus de facto devaluing the Rupee. (WCY 1984, p. 585)	
18-Dec-71	In the wake of the de jure devaluation of the U.S. Dollar, the Rupee's Official Rate against the U.S. unit was left unchanged, thus devaluing Karachi's currency 7.89% in terms of gold. (WCY 1984, p. 585)	
11-May-72	The Rupee was devalued 56.7% in terms of gold to a new, unified Official Rate of PRs11.00 per U.S. Dollar. A 4.5% fluctuation range for the currency was also introduced. At the same time, the entire Export Bonus Voucher scheme with its complex of accessory rates was abolished. (WCY 1984, p. 585)	11.000
23-Jun-72	With the debacle of the British Pound, the Sterling Area, of which Pakistan was a member, was dismantled. (WCY 1984, p. 585)	
Feb-73	In the wake of the U.S. Dollar devaluation, Karachi realigned the Rupee's Official Rate to PRs9.90 per U.S. Dollar, effective February 14th, based on the unchanged gold content of the Pakistan currency. (WCY 1984, p. 585)	9.900
31-Dec-74		9.900
8-Jan-82	The Rupee was devalued when the currency was unhitched from its link to the U.S. Dollar and the fixed Official Rate abolished. A controlled, floating Effective Rate for the Rupee, initially at PRs10.10 per U.S. Dollar, was established in relation to a trade-weighted basket of currencies. (WCY 1984, p. 585)	10.100
31-Dec-82		12.840
31-Dec-83		13.500
31-Dec-84		15.360
1-Jan-85	Foreigners and Pakistanis can purchase Foreign Exchange Bearer Certificates (FEBC) with foreign exchange only. Denominated in Pakistan Rupees, they can be taken in and out of the country, converted into Rupees or foreign exchange at the Effective Rate, or traded on the stock exchange at a premium of 7.25% at the end of 1986. (WCY 1986-1987, p. 497)	
31-Dec-85		15.980
31-Dec-86		17.250
31-Dec-87		17.450
31-Dec-88		18.650
31-Dec-89		21.420
31-Dec-90		21.900
Jan-91	Foreign exchange controls were removed, making the Rupee all but completely convertible. (WCY 1990-1993, p. 501)	
22-Apr-91	Dollar Bearer Certificates (DBC) were introduced. Asset holders (resident or nonresident) could now purchase a one-year maturity instrument similar to the FEBC but denominated in U.S. Dollars with no questions asked as to source of funds. The return on the DBC is 1/4 of 1% over LIBOR. The can be encashed in Pakistan Rupees or in foreign currency at the Effective Rate. (WCY 1990-1993, p. 501)	
31-Dec-91		24.720
1-May-92	The rate of return on FEBCs was raised to 15 percent a year from 14.5 percent. (IMF 1993, p.389)	
31-Dec-92		25.760
31-Dec-93		30.150
31-Dec-94		30.880
31-Dec-94		30.880
31-Dec-95		34.280
5-Feb-98	Banks were allowed to quote their own exchange rates for currencies other than the dollar. (IMF 1998, p.686)	
24-Mar-98	Banks were allowed to quote their own exchange rates for the dollar within the SBP buying/selling band. The spread between the SBP buying/selling rates was also increased to 1% from 0.5%. (IMF 1998, p.686)	
22-Jul-98	A multiple exchange rate system was introduced comprising an official, an interbank, and a composite exchange rate. Banks were allowed to quote their own exchange rates for currencies other than the dollar. (IMF 1999, p.664)	
16-Oct-98	Petroleum and wheat exports became subject to the official exchange rate. (IMF 1999, p.664)	
21-Dec-98	The exchange rate arrangement of Pakistan was reclassified from "other conventional fixed peg arrangement" to the category "managed floating with no preannounced path for the exchange rate". The exchange rate is determined in the interbank foreign exchange market as a weighted average of a free interbank rate and the official exchange rate. (IMF 1999, p.664)	
18-Mar-99	The weight of the FIBR(floating interbank rate) and the official exchange rate in the composite exchange rate was changed to 95% and 5%, respectively. (IMF 2000, p.680)	
19-May-99	The multiple exchange system was unified. (IMF 2000, p.680) The rupp was floated only to be informally controlled by the State Bank of Pakistan within a narrow range of 52.10-52.30 rupees to the U.S. dollar. (CR2000, p.3)	
30-Jun-99	The exchange rate of the rupee has been de facto pegged to the dollar. Thus, the exchange rate arrangement has been reclassified to the category conventional fixed pegged arrangement from the category managed floating with no preannounced path for the exchange rate. (IMF 2000, p.680)	
20-Jul-00	The State Bank of Pakistan removed the band of rupees 52.10-52.30 to the dollar. (CR2000, p.3)	