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# **Trade First and Trade Fast: A Duration Analysis of Recovery from Currency Crisis**

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## **Abstract**

Over the last three decades, durations of recovery of output from contractionary currency crises have shown much variation both within and across countries. Using a dataset comprising of both developing and industrial countries, this paper examines the importance of economic fundamentals, international trade and liberalized capital account in determining the speed of recovery from such crises. We found that poor macroeconomic fundamentals and capital account liberalization have no significant effect on duration of recovery. However, all trade related variables were found to be significant. Our results indicate the preeminence of export led recovery.

JEL Classification: F30; F41; C41

Keywords: Currency Crisis; Output Recovery; Duration Analysis

## **1. Introduction**

The 1990s was a decade of financial turmoil. The collapse of the European Exchange Rate Mechanism, the devaluation of the Mexican Peso and the severe financial crisis in East Asia that brought to a halt the ‘miracle’ of the ‘Asian Tigers’ have spurred much debate in academic and policy circles. The debates range over a variety of issues: from importance of economic fundamentals and arbitrary adverse changes in market expectations to the effect of expected future fundamentals on investors’ confidence; from the choice of exchange rate regime to the importance of prudent banking regulations, dangers of short term capital inflows and the desirability of capital account liberalization.

While much attention has been paid to the causes, consequences and predictability of currency crisis, the literature on recovery from crisis remains far less abundant.

Several studies have examined the severity of currency crisis. Bordo, Eichengreen, Klingebiel and Martinez-Peria (2000), Park and Lee (2001), Gupta, Sahay and Mishra (2003) and many others have studied output behavior, the magnitude of deviation of output in the post-crisis years from some pre-crisis trend, following currency crisis. However, duration of recovery, the time it takes for the crisis hit countries to return to normalcy, and its determinants have not been examined so far. Bordo, Eichengreen, Klingebiel and Martinez-Peria (2000) is the only paper which delves into the duration of recovery, albeit tangentially. They have compared the recovery time from contractionary crises during the Gold Standard era with the post-Bretton Woods period. However, their study fell well short of recognizing the wide variations in such durations both within and across countries and analyzing their determinants. So, although severities of currency crises have been studied over and over again, durations of recovery from such crises remain mostly neglected. This paper aims to fill in this void. To the best of our knowledge, this is the first study on duration of recovery from contractionary crisis.

Over the last three decades, the recoveries from currency crises have shown much variation. Mexico's quick turnaround following the 1994 devaluation of the peso has surprised both academicians and policy makers. High demand for Mexican exports emanating from strong growth performance in the United States has been attributed to be behind Mexico's V-shaped recovery.

The financial crises in the South East Asian countries in 1997-98 along with recessions in Japan and other Asian countries were thought to be the beginning of a

severe and prolonged global recession. None of the *pundits* predicted the quick recoveries which followed. By 1999, the real GDPs in Korea, Singapore and Philippines exceeded their pre-crisis levels. In Malaysia, the recovery started in 1999 and by 2000, Malaysian GDP exceeded the 1997 level by more than seven percent. However, Thailand and Indonesia were less fortunate. It took them more than five years to return to their pre-crisis peak level of GDP.

After the collapse of the European Exchange Rate Mechanism (ERM), all the affected member countries recovered within two years of the crisis. Sweden though not a member of the ERM, chose to fix its currency to the Deutsche Mark. The unification of Germany followed by the growth of DM in 1990 and contractionary monetary policy in subsequent years slowed down German growth. This had an adverse effect on the Swedish economy. It took Sweden five years to recover from the crisis that followed.

How can we explain these country specific variations? Sweden had a relatively large fiscal deficit compared to the member countries of the ERM. In contrast, all the countries that recovered quickly from the Asian financial crises either had low fiscal deficits or surpluses. But so did Indonesia and Thailand. However, prior to the crisis, Thailand was running a large and persistent current account deficit. Moreover, around the time of the Asian crisis, the export performances of the countries which recovered faster and those that didn't were very different. The export growth in Thailand and Indonesia slowed down a year before the crisis. In the post-crisis years, the export growth increased but at a much slower rate than that of Korea. Lee and Rhee (2002) argued that like Mexico, Korea's quick turn around was an export led recovery.

Moving from specifics to general, how important are the trade factors in determining the pace of recovery? Do countries with poor pre-crisis economic fundamentals and weak banking systems recover slowly? Volatility of short term capital flows has been associated with severe financial crises and output contraction. Capital account liberalization encourages such short-term flows. Does that imply that countries with liberalized capital accounts recover slowly?

This paper attempts to address these questions. We found that industrial countries recover faster than their developing counterparts. Poor macroeconomic fundamentals like high fiscal deficits and current account deficits have no significant effect on the duration of recovery. Similarly, a liberalized capital account neither impedes nor facilitates the pace of recovery. However, we found most of the trade related variables to be highly significant. Faster recoveries are associated with variables that facilitate exports.

The rest of the paper has been organized as follows. Section 2 contains a theoretical discussion of the factors that might be potentially important in determining the pace of recovery. Section 3 contains a brief discussion of the data and empirical identifications of crisis and recovery. In section 4, we discuss our econometric methodology. This is followed by an analysis of the results in Sections 5 and 6. Section 7 concludes.

## **2. Determinants of Post-Crisis Recovery**

Faced with pressure on its exchange market, a country has three possible options. It can release its stock of foreign exchange reserves to stabilize its currency. Alternatively, it can raise the interest rate or can just let the currency depreciate. While

the first option is the least costly in terms of output loss, it is available to the very few who have sufficient reserves to cover their entire liquid liabilities. Otherwise, the country has to choose between an interest rate hike and depreciation to close its external gap. While an interest rate increase is likely to be contractionary, in a Mundell-Flemming world, depreciation would increase exports and suppress imports, thereby, leading to an economic expansion. However, three decades of experience from episodes of exchange market pressures suggest that the actual adjustment process from such events is far more complicated. Along with the nature and magnitude of initial shocks, the initial conditions prevailing in the economy before the onslaught of the crisis, macroeconomic and structural adjustment policies taken to cope with the situation and the overall global economic environment play a crucial role in determining the severity of such events and the pace of subsequent recovery.

In the canonical first generation currency crisis models, countries with poor macroeconomic fundamentals become more vulnerable to crisis. Specifically, fixed exchange rate regimes with low or limited reserves and persistent money financed fiscal deficits would eventually be subject to speculative attacks due to the inherent non-sustainability of the system. Second generation crisis models endogenise government's policy decisions as to whether to defend a peg in terms of its relative cost. In such models, adverse expectations like future deterioration in macroeconomic fundamentals, can lead to speculative attacks and crises can be self-fulfilling. More recently, third generation models prompted by the South East Asian crisis associate the collapse of the exchange rate with the more general problem in the financial system. Both second generation and third generation models are characterized by multiple equilibria which

imply that financial weakness and poor fundamentals are neither necessary nor sufficient conditions for currency crisis. But they do make countries more vulnerable to speculative attacks. While the link between poor fundamentals and speculative attacks are well researched and beyond the scope of this paper, an interesting question would be whether such weaknesses contribute to slower recoveries.

For countries facing a currency crisis, the conventional strategy is to pursue tight monetary and fiscal policies. That would reduce the demand for imports and increase the demand for domestic assets. A tight monetary policy also helps keep prices under control, thereby, preventing inflation from eroding the benefits to export competitiveness achieved through devaluation. The combination of lower imports, higher exports and increased volume of capital inflows attracted by higher interest rates will lead to subsequent output recovery. However, poor fundamentals and financial weaknesses can make this post-crisis adjustment process painful and prolonged.

Countries with large current account deficits financed mostly by short-term foreign capital are more likely to face severe contraction in output following a crisis. The foreign capital might turn around at the slightest sign of distress. A reversal in capital flow can be met by reducing the demand for tradables. Because of the proportionality in consumption between tradable and non-tradable, cutting down the demand for tradables will result in a proportional decrease in the demand for non-tradables. The falling prices of non-tradable along with tighter international credit and the consequent rise in domestic interest rates will result in widespread bankruptcies in the non-tradable sector. To the extent that the non-tradable sector is linked to the tradable sector through inter-industry

credit, bankruptcies might quickly spread to other sectors of the economy resulting in significant output destruction.

Under these circumstances if the country attempts to stabilize its currency by releasing reserves, selling dollars against domestic currency, it would decrease the domestic money supply. This would result in a sharp increase in interest rates, internal deflation and a collapse of prices of financial assets. For example, during the South East Asian crisis, due to the operation of the Hong Kong Currency Board in which domestic currency was 100 percent backed by foreign exchange reserves, the interest rate rose from 7 percent to 300 percent. As pointed out by Calvo (1998), a tight monetary policy during periods of capital flight will further exacerbate the credit crunch in the economy and will push otherwise solvent firms towards insolvency. Alternatively, if the Central Bank attempts to cushion the credit crunch through an expansionary monetary policy, the resulting increase in high-powered money will lead to further depreciation of the currency. The depreciation might seriously jeopardize the solvency of the non-tradable sector if they have undertaken significant dollar denominated debt.

The health of the banking system also plays a crucial role in determining the speed of the post crisis recovery. The greater the share of bad loans made by the banks to the private sector, the more vulnerable the banking system would be to an interest rate hike to prevent a speculative attack or currency depreciation. In the South East Asian countries prior to the 1997 crisis, sustained economic growth, huge foreign capital inflow along with a policy of fixed exchange rate to reduce the volatility of domestic currency vis-à-vis the US dollar resulted in rapid expansion of domestic credit. Large foreign exchange reserves further enhanced the credibility of the fixed exchange rate. The



stability of the exchange rate reduced the risk premium on dollar denominated debt and encouraged domestic banks to borrow heavily and at very short maturities from international banks and lend it to domestic businesses. Exposure of domestic banks to dollar denominated debt added to the vulnerability of the banking system. In the case of bank distress, the Central Bank will not be able to support troubled banks through creation of domestic currency. It has to use its foreign exchange reserves to act as a lender of last resort. Under this situation, irrespective of the monetary policy stance, a speculative attack on the currency will lead to output destruction and bank failures.<sup>1</sup>

A high fiscal deficit is typically seen as very disruptive. It increases a country's vulnerability to currency crisis. However, prior to the 1977 crisis in Chile, fiscal balance was in surplus. So was the case in Mexico before the Tequila crisis. The worst hit countries in the South East Asian crisis were also running either low deficits or surpluses. Burnside, Eichenbaum and Rebelo (1998) argued that large prospective deficits associated with implicit bailout guarantees to troubled financial institutions led to the collapse of the Asian currencies. With implicit bailout guarantees, the fiscal costs associated with currency crisis might be significant. This would require an appropriate adjustment in the fiscal balance. The higher the pre-crisis deficits, the higher would be the post-crisis fiscal tightening necessary to accommodate the additional costs. The worse would be the crisis induced recessions.

Trade factors also play an important role in post-crisis recovery. A high growth in the dollar value of exports in the post-crisis years could lead to faster output growth. High

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<sup>1</sup> A contractionary monetary policy and high interest rates will result in corporate and banking bankruptcies. On the other hand, an attempt to bail out troubled financial institutions will lead to speculative attack and subsequent currency depreciation increasing the foreign currency liability of the domestic financial and non-financial institutions.

export growth and the subsequent improvement in current account could in turn help restore foreign investors' confidence in the domestic currency and stabilize the exchange market.

Export growth depends on both supply and demand side factors. A severe credit crunch might limit the ability of the firms in the tradable sector to produce and export. Demand considerations are also equally important. If the inflation rate is lower than the rate of depreciation, a devaluation of the currency reduces the dollar price of the country's exports leading to an increase in the volume of exports. For example, following the Asian crisis, the volume of exports in the crisis countries increased, while the dollar value of exports fell from between 5 percent and 20 percent relative to the pre-crisis level. The recession in their regional trading partner countries, namely Japan and other East Asian countries led to a lower demand for exports and consequent sharp fall in export prices. On the other hand, following the collapse of the Peso in December 1994, the dollar value of Mexican exports increased rapidly and by 1996, it exceeded the pre-crisis level by 20 percent. During the Mexican crisis, Mexico's major trading partner in the region, the United States, was on the expansionary phase of its business cycle. The higher demand for Mexican exports from US contributed to Mexico's sharp export growth in the post-crisis years. So, high output growth in trading partner countries are likely to be associated with a faster export growth rate and quicker recoveries. Moreover, a diversification of the export base makes overall exports much less sensitive to terms of trade shocks. Accordingly, diversified exporters are expected to recover faster.

### **3. Empirical Identifications of Crisis and Reversal**

Our data set comprises 80 countries, 60 developing and 20 developed. The data ranges from 1975 to 1999. For the countries which entered the European Monetary Union in 1999, the data ends in 1998. The countries included in the study have been selected mostly on the basis of data availability. The appendix contains a detailed description of the data and the sources.

#### **3.1 Currency Crisis**

There are two basic approaches to the identification of currency crisis. In the studies of Frankel and Rose (1996), Esquivel and Felipe (1998) and Milesi-Ferretti and Razin (1998), a currency crisis has been defined as a sharp break in the path of the exchange rate such as abandonment of a currency peg and forced devaluations or a major acceleration of the rate of depreciation for more flexible regimes. For example, Frankel and Rose (1996) defined a currency crash as a nominal depreciation of the exchange rate of at least 25 percent, which is also at least 10 percent higher than the depreciation in the previous year. The later condition has been added to avoid capturing the large exchange rate fluctuations associated with high inflation episodes.

However, this definition captures only successful attacks on the currency and would exclude instances of crises where the currency was successfully defended by the Central Bank. Eichengreen, Rose and Wyplosz (1996), inspired by the monetary model of Girton and Roper (1977), constructed a crisis index based on a measure of exchange rate pressure. The basic idea is that, an episode of exchange rate pressure is characterized by an excess demand for foreign exchange at the prevailing exchange rate. The monetary

authorities can meet the excess demand by devaluing the currency, by running down their international reserves, by raising the interest rates, or by using a combination of all three. Eichengreen et. al. (1996), therefore, used a weighted average of exchange rate changes, reserve changes and interest changes to construct their exchange market pressure index (EMPI). The variables were measured relative to a reference country, Germany. The weights were chosen so as to equalize the sample volatilities of each of the three components, thereby preventing any one of them from dominating the index.

$$EMPI_{j,t} = \frac{1}{\sigma_e} \frac{\Delta e_{j,t}}{e_{j,t}} - \frac{1}{\sigma_r} \left( \frac{\Delta rm_{j,t}}{rm_{j,t}} - \frac{\Delta rm_{G,t}}{rm_{G,t}} \right) + \frac{1}{\sigma_i} (\Delta(i_{j,t} - i_{G,t}))$$

where  $e_{j,t}$  denotes the price of a DM in country j's currency at time t;  $rm_{j,t}$  is the ratio of gross foreign reserve to M1 for country j at period t;  $i_{j,t}$  denotes the nominal interest rate for country j at period t; subscript G denotes the reference country Germany;  $\sigma_e$  denotes the standard deviation of the rate of change of nominal exchange rate;  $\sigma_r$  is the standard deviation of the rate of change of the ratio of foreign reserves to money relative to the reference country;  $\sigma_i$  denotes the standard deviation of the nominal interest rate differential. Eichengreen et. al. defined a crisis if the index exceeds its historic mean by more than 1.5 standard deviation. Thus,

$$\begin{aligned} Crisis_{j,t} &= 1 \text{ if } EMPI_{j,t} > 1.5\sigma_{EMPI} + \mu_{EMPI} \\ &= 0 \text{ otherwise} \end{aligned}$$

However, a problem with the above methodology is the choice of appropriate weights. Nitithanprapas and Willett (2002) showed that the use of reciprocal of variances of each series as weights would result in an understatement of unsuccessful speculative attacks under fixed exchange rate regimes. The pressure would be manifested in high fluctuations in reserves during the pre-crisis period. As a result, reserve changes would have a high variance and a low weight in the crisis index. By the same logic, the depreciation following a successful attack under a fixed exchange rate would be over weighted.

Another genuine problem with this index is the availability and the quality of interest rate and M1 data for the developing countries. For most of these countries, the data is not available on a monthly or quarterly basis. So, Kaminsky and Reinhart (1999) modified the Eichengreen et al formulation to include only exchange rate and international reserves changes in their Index of Currency Market Turbulence (I).

$$I = \frac{\Delta_e}{e} - \frac{\sigma_e}{\sigma_r} \cdot \frac{\Delta_r}{r}$$

where  $r$  denotes the reserves and  $\sigma_r$  is the standard deviation of the rate of change of reserves.

It is important to point out that exclusion of interest rate changes remains a potentially serious drawback of this index. The speculative attack on Hong Kong in October 1997 didn't affect the international reserves much. Since it was unsuccessful, neither did it affect the exchange rate. However, there was a substantial increase in

interest rates and fall in stock prices. Incidences of pressures like this would be ignored by the index.

In our analysis, we have adopted Kaminsky and Reinhart's formulation to identify episodes of exchange market pressure in our sample of 80 countries. We have used monthly exchange rate and reserve data from International Financial Statistics. Since high devaluations are common occurrences during periods of hyper-inflation, the sample has been split into periods of high and low inflation and separate indices have been constructed for each sub-sample. A hyperinflation episode has been defined as a situation where the average inflation rate in the preceding six months exceeds 150 percent. A crisis month has been identified as the month for which the index exceeds the mean by two- standard deviation. Kaminsky and Reinhart (1999) used mean plus three standard deviations as the critical value of their crisis index. However, there is no theoretical rationale for preferring the use of say two instead of three standard deviations or vice versa. The value of the index and hence, the critical value depend on the range of the sample. Kaminsky and Reinhart (1999) used data from 1970 to 1995, whereas, our sample ranges from 1975-1999. Since many of the Asian countries faced severe crises in 1997, that would increase the historic mean and standard deviation of the index. As a result, some of the not so severe crisis episodes in the previous years might be ignored. For example, the crises years of 1978, 1981 and 1984 in Thailand (as identified by Kaminsky and Reinhart) would be ignored in our sample if we use three standard deviations as critical value. So, we decided to use two standard deviations instead of three.

### 3.2 Contractionary Currency Crisis

Since we are interested in recovery patterns following crises, the relevant crises episodes are the ones, which are contractionary. Contractionary crises are associated with declining output. Bordo et al (2000) defined a crisis as contractionary if the GDP growth in the year of the crisis is lower than the average GDP growth in the preceding five years. Their definition is a variant of the IMF (1998) methodology that used a three-year pre-crisis average. Gupta et al (2003) also used a three-year pre crises average similar to IMF and compared it to the average GDP growth of the two post-crises years. They argued that three-year pre-crisis average would smooth out large fluctuations in any particular year, whereas the two-year post-crisis average would correct for the measurement problem if crisis occurred late in the year. While their argument for using two years post-crisis average is very valid, Bordo et al found that using three years pre-crisis average ‘yields unstable and unreliable results’. However, a five-year post crisis average is as ad hoc as three. For example, in the late ‘70s and early ‘80s, the Mexican economy grew very rapidly. When Mexico was hit by crisis in 1983, both the three-year and five-year pre-crisis average growth rate was very high. Using either of the above mentioned metrics of contraction would imply that Mexico never recovered from that crisis. Similar problem arises for Saudi Arabia and many other countries.

In this paper, we have used a very different definition of contraction. A crisis is contractionary if it causes a recession rather than being caused by a recession. Since causality is difficult to decipher, for simplicity, we have assumed that such crisis hits the economy at its business cycle peak or a year after the peak. The duration of recovery has been defined as the time it takes for the economy to go back to its business cycle peak

level of GDP. So to identify contractionary crisis, we need to come up with a measure of business cycle turning points. We have defined business cycle turning points based on existing business cycle dating algorithms. Once we have identified the peaks and the troughs, a recession is defined as the time interval between a business cycle peak and the following trough.

Burns and Mitchell (1946) defined the business cycle as a pattern in the aggregate economic activity. So, measuring business cycles require a proxy for the aggregate economic activity. The most commonly used one is real GDP, which we have used in our analysis. The business cycle researchers have taken two main approaches in defining cyclical fluctuations – classical cycles are based on fluctuations in the level of aggregate economic activity, while deviation cycles (also known as growth cycles) are based on fluctuations around some trend. The most well known classical cycle algorithm is the Bry-Boschan (1971) procedure. It performs different degrees of smoothing on the data to locate the neighborhood of the business cycle turning points, which are then finalized using the unsmoothed series. Harding (1997) and Harding and Pagan (2002) introduced the concepts of expansion terminating sequence and contraction terminating sequence and set the exit probabilities to identify the business cycle turning points. However, because of the annual nature of our data (for the majority of countries in our sample, the real GDP figures are available only at annual frequency), we cannot use either of the above procedures. Instead we have used the simple calculus rule to identify the business cycle peaks and troughs. We have defined a peak if a year of positive growth is followed by a year of negative growth and a trough if a year of negative growth is followed by a year of positive growth. Thus year  $t$  has a peak if  $\Delta y_t > 0$  and  $\Delta y_{t+1} < 0$ ; and year  $t$  has a



trough if  $\Delta y_t < 0$  and  $\Delta y_{t+1} > 0$ . Accordingly, the minimum duration of a cycle is two years.

For comparison purpose, we have also identified deviation cycle dates based on band-pass (BP) filter [Baxter and King, 1999]. A BP filter defines business cycles as components of the time series with frequencies between two and eight years in duration. It's a linear filter which only retains the business cycle frequencies while removing all other components with higher and lower frequencies. In Table 1, we compare our classical cycle and deviation cycle dates with the NBER dates between 1965 and 1999 using annual data for real US GDP. As evident from Table 1, the Band Pass filter generates more cycles than the simple calculus rule. Interestingly, the calculus rule collects the business cycle chronologies on a consistent basis.

Using our methodology, we have identified 324 currency crises out of which 64 are contractionary. Table 2 presents the distribution of the contractionary crises and a summary of durations of recovery from these crises. Out of a total of 64 of such crises, 45 are in emerging economies and 19 are in industrial countries. Considering that there are only 20 industrial countries in our sample, contractionary currency crises are not just developing country phenomena. They are equally frequent in the industrial countries as well. Among the emerging economies, Asian and the Latin-American countries account for the majority of the contractionary crises. 31 of the contractionary crises episodes occurred in these countries. Low income countries, on the other hand, are relatively less prone to such events. In the 23 low income countries in our sample, we found only 9 episodes of contractionary crises.

Table 1 Comparison of Business Cycle Dates with NBER Dates: US, 1965-1999

<b>NBER Dates</b>		<b>Classical Cycle</b>		<b>BP Filter</b>	
<i>Peak</i>	<i>Trough</i>	<i>Peak</i>	<i>Trough</i>	<i>Peak</i>	<i>Trough</i>
				1966	1967
Dec. 1969	Nov. 1970			1969	1970
Nov. 1973	Mar. 1975	1973	1975	1973	1975
Jan. 1980	July. 1980	1979	1980	1979	1980
July 1981	Nov. 1982	1981	1982	1981	1982
				1984	1987
July 1990	Mar. 1991	1990	1991	1989	1991
				1994	1996

In calculating the recovery time, we have included the year during which real GDP returns to the pre-crisis peak. So, by definition, the minimum recovery time is 2 years. For our full sample, the average duration of recovery is 3.56 years. The recovery time is substantially lower for the industrial countries, 2.84 years as compared to 3.87 years for the developing countries. The median and the third quartile of recovery time are also lower for the industrial countries. The Table shows that in Asia and Latin America, contractionary currency crises are not only more frequent but also more prolonged. The average duration of recovery is 4.52 years and the median duration is 4 years which is higher than the median for the developing countries. The contractions are relatively short lived in the low income countries. Their average duration of recovery is only 2.66 years

Table 2 Distributions of Contractionary Crises and Durations of Recovery

<b>Countries</b>	<b>Number of Contractionary Crisis</b>	<b>Mean Duration (years)</b>	<b> ----- Survival time ----- </b>		
			<b>25%</b>	<b>50%</b>	<b>75%</b>
All Countries	64	3.5625	2	3	4
Developing	45	3.8666	2	3	5
Industrial	19	2.8421	2	2	3
Asia & Latin-America	31	4.5161	2	4	9
Low Income	9	2.6667	2	3	.

In Table 3, we have presented the distribution of duration time of recovery. Since our data ends in 1999, if a country does not recover by then, that spell will be right censored. In the Table, a plus sign indicates a censored spell. 44 percent of the contractionary crises have a recovery time of 2 years. 33 percent of the crises have recovery times between 2+ and 4 years. And only 19 percent have recovery times of more than 5 years. So, the majority of the crises episodes have short durations of recovery and a prolonged recovery is not a very common phenomenon.

Table 3 Distribution of Duration Time

<b>Spell Length</b>	<b>No. of Spells</b>	<b>Percentage of Total</b>
1+	3	4.69
2	28	43.75
2+	2	3.13
3	12	18.75
3+	2	3.13
4	5	7.81
5	2	3.13
6	2	3.13
7	1	1.56
8+	1	1.56
9	2	3.13
10	1	1.56
12	2	3.13
14	1	1.56
<b>Total</b>	<b>64</b>	<b>100.00</b>

#### **4. Econometric Methodology**

We have used survival analysis to study the determinants of duration of recovery from contractionary crisis. Our event of interest is the transition from recession to recovery. A failure occurs when a country recovers, i.e. when the country's GDP exceeds its pre-crisis peak level. Naturally, a country is at the risk of failure only when it is hit by a contractionary crisis. So, our analysis of duration of recovery is basically an analysis of

time to failure. Since we have measured duration in years, there is substantial grouping in our data. Our event of interest occurs in continuous time. Since our data is interval censored, exact survival times are unknown. We only know that they fall within some interval of time. So, discrete time specifications have been used to take into account interval censoring and high prevalence of tied survival times.

Let  $T$  be a non-negative discrete random variable representing the duration of recovery.  $T$  takes on values  $t_i, i = 1, 2, \dots, m$ . The duration of spells are arranged in order of magnitude such that  $t_1 < t_2 < \dots < t_m$ . The cumulative distribution function of  $T, F(t)$  measures the probability that the spell will end before time  $t$ . It is also called the failure function. Survival function,  $S(t)$ , gives the survival probability at time  $t$ . It is defined as the probability of not experiencing recovery, i.e. the probability of surviving through time  $t$ :

$$\begin{aligned} S(t) &= \Pr(T > t) \\ &= 1 - F(t) \end{aligned}$$

The hazard probability  $h_j$  is defined as the probability of failure (recovery) at  $t_j$  conditional on survival to that date.

$$h_j = \Pr(T = t_j | T \geq t_j)$$

So, the survival probability at time period  $t_j$  can be expressed in terms of hazard by

$$\begin{aligned} S(t_j) &= \Pr(T > t_j) \\ &= \Pr(T \neq t_j | T \geq t_j) \cdot \Pr(T \neq t_j - 1 | T \geq t_j - 1) \cdot \dots \cdot \Pr(T \neq 2 | T \geq 2) \cdot \Pr(T \neq 1 | T \geq 1) \end{aligned}$$

$$\text{or, } S(t_j) = \prod_{k=1}^{t_j} (1 - h_k)$$

For our right censored data, if  $r_j$  denotes the number of spells in the risk set (i.e. the number of spells which have not ended in a recovery) at  $t_j$  and  $n_j$  denotes the number of spells that ends at  $t_j$ , the hazard rate can be estimated as :

$$\hat{h}_j = \frac{n_j}{r_j}$$

Accordingly,

$$\hat{S}(t) = \prod_{t_j \leq t} \left(1 - \frac{n_j}{r_j}\right)$$

This is the Kaplan-Meier non-parametric estimate of the survival function. The subscript  $t_j$  runs over all the distinct times at which exits are observed. This non-parametric methodology has been used to compare survival function across groups, i.e. which group takes longer to recover.

For parametric estimates, we have used discrete time proportional hazard specifications. Under the assumption of proportional hazard, the underlying continuous time hazard function  $\theta(t, X)$  can be written as:

$$\theta(t, X) = \theta_0(t)e^{\beta X} = \theta_0(t)\lambda$$

Where  $X$  is a vector of covariates describing country specific characteristics and  $\theta_0(t)$  is the baseline hazard function that is common to all countries and accordingly depends on  $t$  but not on  $X$ .

The survivor function at time  $a_j$  is given by

$$\begin{aligned} S(a_j, X) &= \exp\left[-\lambda \int_0^{a_j} \theta_0(u) du\right] \\ &= \exp[-H_j \lambda] \end{aligned}$$

Where  $H_j = \int_0^{a_j} \theta_0(u) du$  is the integrated baseline hazard evaluated at  $a_j$ .

The discrete time hazard function is:

$$h(a_j, X) = h_j(X) = \frac{S(a_{j-1}, X) - S(a_j, X)}{S(a_{j-1}, X)}$$

$$= 1 - \exp[\lambda(H_{j-1} - H_j)]$$

$$\therefore -\log(1 - h_j) = \lambda(H_j - H_{j-1})$$

$$\text{or } \log[-\log(1 - h_j)] = \beta'X + \log(H_j - H_{j-1})$$

This is a complementary log-log (cloglog) specification.

The hazard function can be rewritten as:

$$h_j = 1 - \exp[-\exp(\beta'X + \gamma_j)]$$

Where  $\gamma_j = \log(H_j - H_{j-1})$ . So,  $\gamma_j$  measures the differences in value of the integrated hazard function. It shows the pattern of duration dependence in interval hazard. In our paper, we have used four alternative types of specification of duration dependence in interval hazard. The full model under each specification would be:

- *Weibull:*  $c \log \log[h(j, X)] = q \log(j) + \beta'X$  (1)

Where  $q$  is a parameter to be estimated along with  $\beta$  s. If  $q > 0$ , the hazard is monotonically increasing; if  $q < 0$ , hazard is monotonically decreasing and if  $q = 0$ , hazard is constant.

- *Quadratic:*  $c \log \log[h(j, X)] = z_1 j + z_2 j^2 + \beta'X$  (2)

- *Cubic:*  $c \log \log[h(j, X)] = w_1 j + w_2 j^2 + w_3 j^3 + \beta'X$  (3)

- *Piecewise constant:* This is a semi-parametric estimation. The hazard is assumed to be constant within each interval but varies across intervals. So, the model specification would be

$$c \log \log[h(j, X)] = \alpha_1 D_1 + \alpha_2 D_2 + \dots + \alpha_k D_k + \beta' X \quad (4)$$

Where  $D_i$  s are dummy variables for each interval at which failures are observed.

In our data, a recovery spell for a country  $i$  is observed from year  $k = 1$  through to the end of the  $j^{\text{th}}$  year at which point the spell is either complete ( $c_i = 1$ ) or right censored ( $c_i = 0$ ).

The likelihood of a censored spell is

$$\begin{aligned} L_i &= \Pr(T_i > j) \\ &= S_i(j) \\ &= \prod_{k=1}^j (1 - h_{ik}) \end{aligned}$$

The likelihood of a completed spell is

$$\begin{aligned} L_i &= \Pr(T_i = j) \\ &= h_{ij} S_i(j - 1) \\ &= \frac{h_{ij}}{1 - h_{ij}} \prod_{k=1}^j (1 - h_{ik}) \end{aligned}$$

So, the likelihood for the whole sample is

$$\begin{aligned} L &= \prod_{i=1}^n \left[ \frac{h_{ij}}{1 - h_{ij}} \prod_{k=1}^j (1 - h_{ik}) \right]^{c_i} \left[ \prod_{k=1}^j (1 - h_{ik}) \right]^{1 - c_i} \\ &= \prod_{i=1}^n \left[ \left( \frac{h_{ij}}{1 - h_{ij}} \right)^{c_i} \prod_{k=1}^j (1 - h_{ik}) \right] \\ \therefore \log L &= \sum_{i=1}^n c_i \log \left( \frac{h_{ij}}{1 - h_{ij}} \right) + \sum_{i=1}^n \sum_{k=1}^j \log(1 - h_{ik}) \end{aligned}$$

We have defined a new binary indicator variable  $y_{ik}$  such that  $y_{ik} = 1$  if country  $i$ 's spell ends in year  $k$  and  $y_{ik} = 0$  otherwise.

For a completed spell  $c_i = 1$  which implies  $y_{ik} = 1$  for  $k = T_i$ ,  $y_{ik} = 0$  otherwise.

For a right censored spell  $c_i = 0$  which implies  $y_{ik} = 0$  for all  $k$ .

$$\therefore \log L = \sum_{i=1}^n \sum_{k=1}^j y_{ik} \log\left(\frac{h_{ij}}{1-h_{ij}}\right) + \sum_{i=1}^n \sum_{k=1}^j \log(1-h_{ik})$$

or  $\log L = \sum_{i=1}^n \sum_{k=1}^j [y_{ik} \log h_{ik} + (1-y_{ik}) \log(1-h_{ik})]$

This is the standard likelihood function for a binary regression model in which  $y_{ik}$  is the dependent variable. So, using  $y_{ik}$  as the dependent variable specifications (1) to (4) have been estimated using the cloglog package in STATA.

## 5. Fundamentals, External Environment and Duration of Recovery

Table 4 presents the Kaplan-Meier estimates of the survival function and the hazard function for the whole sample. The survival probabilities along with 95 percent confidence interval have been plotted in Figure 1. The survival probability decreases with time. Figure 2 shows the hazard function for the recovery from contractionary crises. Hazard rate is the probability that a country which is undergoing recovery will recover at time  $t$ . In the second year of recovery, the hazard rate is around 0.46. So, the probability that a country will recover by the second year is quite high. However, if a country does not recover by the second year, the chances of recovery in the subsequent three years gradually decrease. For example, the hazard rate in the fifth year is only 0.16. After eight years, the hazard rate increases again. And by the fourteenth year, all the countries in our sample have recovered. So the hazard rate is 1.

Next we plotted the survival functions for the developing and the industrial countries (Figure 3). The survival probabilities for the developing countries are substantially higher than their industrial counterparts. The probability that a developing country will take more than two years to recover from a contractionary crisis is 0.62. The



corresponding figure for the industrial countries is only 0.37. Similarly, the probabilities of survival beyond three years for the developing and the industrial countries are 0.41 and 0.16 respectively. Both the log-rank test and the Wilcoxon test for equality of survivor functions reject the null hypothesis of equality at 5 percent level. So, our data indicates that developing countries take significantly longer time to recover from crises than industrial countries.

Parametric estimates of our model are presented in Tables 5 to 8. The estimated coefficients have a proportional hazard interpretation. In other words, each coefficient summarizes the proportional change in hazard due to a change in the corresponding covariate. So, a positive regression coefficient implies that an increase in the corresponding covariate causes an increase in hazard. Hence, a positive coefficient is associated with faster recoveries. Similarly, a negative coefficient is associated with slower recoveries. In Table 5, we present the estimates with Weibull baseline hazard. Weibull baseline hazard is monotonic. It is either increasing or decreasing or constant. To allow for non-monotonic baseline hazard, same specifications have been estimated using baseline hazards which are quadratic and cubic polynomial of time. The results are presented in Tables 6 and 7 respectively. Finally, in Table 8 we have presented our estimates without assuming any functional form for the baseline hazard. This is discrete time equivalent of Cox's semi-parametric model. Interestingly, the estimated coefficients are qualitatively similar across specifications of baseline hazard. This shows the robustness of our results.

Our choice of covariates is mostly based on the discussion on determinants of post-crisis recovery. The model has been estimated first with a dummy for the industrial

countries. Subsequently, variables representing geographic and political factors, external economic environment and macroeconomic fundamentals are included. The dummy for the industrial countries, *dtype*, has a positive coefficient which is significant in all specifications at 1 percent level. This supports our findings from Kaplan-Meier estimation that the industrial countries recover faster from contractionary crisis than their developing counterpart. The coefficient of the dummy for the landlocked countries (*land*) is negative though not always significant. So, the landlocked countries take longer to recover. Radelet and Sachs (1998) showed that high transport cost associated with lack of coastal access can jeopardize the export competitiveness of the landlocked countries and wipe out their export profitability<sup>2</sup>. As a result, these countries are unlikely to experience an export led recovery.

We also included an indicator for civil rights in our specification. The civil liberties index, published by Freedom House, is a composite index of freedom of expression and belief, organizational rights, rule of law and individual rights. The index ranges from 1 to 7 with higher values associated with fewer liberties. The estimated coefficient is positive and significant at the 5 percent level in all specifications of baseline hazard except the non-parametric one. So our empirical results indicate that more free societies are also the ones which are slower to recover from contractionary crises. In the literature on political regimes and economic growth, the main argument against democracy is that it promotes excessive current consumption and reduces investment, thereby, hinders economic growth (Huntington and Dominguez, 1975). Haggard (1990)

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<sup>2</sup> Radelet and Sachs (1998) compared the shipping costs of six landlocked African countries to that of their coastal neighbors. They found that for similar export shipment to Northern Europe, the landlocked countries pay between 25 percent and 228 percent more in shipping costs compared to their coastal neighbors.

argues that authoritarian regimes are relatively insulated from distributionist and particularistic pressures and are more able to extract resources and impose the short-term costs necessary for efficient economic adjustment. The same line of argument would suggest that authoritarian regimes would be able to make the sacrifices required for quicker recovery.

We took the two-year pre-crisis average of current account balance relative to GDP ( $lcagdp2$ ) and fiscal balance relative to GDP ( $lcfgdp2$ ). Both the coefficients have the expected signs. They are positive though not significant. Since fiscal and current account deficits in our data are negative values, our results indicate that higher pre-crisis current account deficits and fiscal deficits would lead to slower recoveries.

To account for possible banking sector vulnerabilities, we used two pre-crisis years average domestic credit as percentage of GDP ( $ldcgdp2$ ). According to Tornell (1999), a lending boom is a good indicator of banking sector weakness. The greater the loans provided by the banking sector during a short period of time, the larger would be the share of bad loans in the subsequent period. According to Tornell, this is likely to be the case because banks' capacity to evaluate projects and availability of projects with high expected returns are limited. Since weak banking system is likely to make the crisis induced recession worse, we expect higher values of  $ldcgdp2$  to be associated with slower recoveries. Our estimated coefficient of the domestic credit variable has the expected sign. However, it is not significant.

A large stock of international reserves in years before the crisis does not necessarily imply solid fundamentals. They do make countries less vulnerable to speculative attacks. However, high output growth, huge foreign capital inflow and a

policy of fixed exchange rates to reduce exchange rate volatility can lead to significant reserve accumulation and consequent expansion of domestic credit. To the extent rapid credit expansion weakens the banking system, as the Asian experience suggests, high international reserves can very well be associated with severe crisis. So, high reserves may or may not be associated with faster recoveries. However, the percentage change in international reserves in the crisis year is a better indicator of vulnerability. It represents the magnitude of the initial shock. A higher loss of reserves can also lead to a significant increase in domestic interest rates and subsequent slowdown in investment. So we included percentage change in international reserves in crisis year (pintlres) instead of pre-crisis stock of reserves in our regressions. The estimated coefficient is positive and significant at the 5 percent level in all specifications. As we expected, a higher loss of reserves in the crisis year leads to a longer duration of recovery.

To verify the importance of export led recovery, we included variables related to export growth. The variable *gdptradeprts* is the GDP growth rate of the trading partners weighted by their respective trade share. In addition, we included a terms of trade growth variable (*ttg*) and dummies indicating the type of exporters. Our results indicate that higher GDP growths in trading partner countries are associated with quicker recoveries. The respective coefficient is positive and significant at the 1 percent level in every specification. The coefficient of terms of trade growth is negative and significant at the 5 percent level. An improvement in the terms of trade (an increase in terms of trade growth) reduces the hazard and, hence, increases the duration of recovery. Since the terms of trade is the price of a country's exports relative to its imports, a positive growth in terms of trade implies a higher relative price of exports. If the higher prices of exports

are associated with higher demands, an improvement in terms of trade should lead to faster output growth and quicker recovery. However, higher prices of exports may also lead to a worsening of the balance of payments if price increase results in proportionately greater fall in demand for exports.

The coefficients of the dummies for manufacturing exporters (xman) and service exporters (xserv) are negative and not significant. However, the dummy for the diversified exporters (xdiverse) is positive and mostly significant. Diversified exporters are less prone to fluctuations in international prices. Hence, they recover faster.

## **6. Capital Account Liberalization and Recovery**

Large volumes of capital inflows in emerging economies of Asia and Latin America in 90s and their subsequent turnaround following financial turmoil in these economies have led to renewed interest on the desirability of capital account liberalization. Unrestricted international capital flows improve allocative efficiency through risk diversification and can play a pivotal role in promoting financial development and economic growth. However, as the Asian experience suggests, in the absence of prudential regulation and supervision of financial system, short term cross border inter-bank loans can be very disruptive due to the volatile nature of such flows. Portfolio bond and equity investments can also be equally volatile. An economy with liberalized capital account and excessive dependence on such short-term capital can be extremely vulnerable because a sudden reversal in capital flows can lead to a severe financial crisis (Calvo, 1998). Calvo argues that with tighter international credit, a lowering of interest rates is necessary to cushion the domestic credit crunch. However, if

a country has a large stock of foreign currency denominated debt, the Central Bank will be forced to maintain high interest rates. Because under perfect capital mobility, a lowering of interest rates would lead to further depreciation of currency and increasing debt burden. Krugman (1998) suggested that capital control could help by breaking this link between interest rate and exchange rate.

We used the Kaplan-Meier method to separately estimate the survival functions for the countries that have liberalized their capital account and countries that haven't. If capital account liberalization has any effect on duration of recovery, we would expect the survival functions of these two groups to differ significantly. The plots of the survival functions are shown in Figure 4. The test statistics indicate that we cannot reject the null hypothesis of equality of survival functions.

However, with limited data, a major problem with the non-parametric approach is that we cannot control for all the country specific characteristics that might affect the duration of recovery. To control for those characteristics, we re-estimated our model including an additional dummy for capital account liberalization. The results are presented in Tables 9 to 12. The coefficient of the liberalization dummy is negative and mostly insignificant. So, we can safely conclude that capital account liberalization does not help a country to recover faster from currency crisis. Edwards (2001) in his study on capital account liberalization and economic growth found that such liberalization has a positive growth effect only in high income countries.<sup>3</sup> To investigate whether a similar result holds for the duration of recovery, we included an interactive term of per capita GDP and the liberalization dummy. The results have not been reported for space

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<sup>3</sup> Areta, Eichengreen et al found no evidence that capital account liberalization has different growth effects in high and low income countries.

consideration. Like Edwards, we found that the coefficient of the liberalization dummy is negative but the coefficient of the interactive term is positive. So, capital account liberalization in countries with high level of per capita GDP might be associated with quicker recoveries. However, none of the coefficients are significantly different from zero.

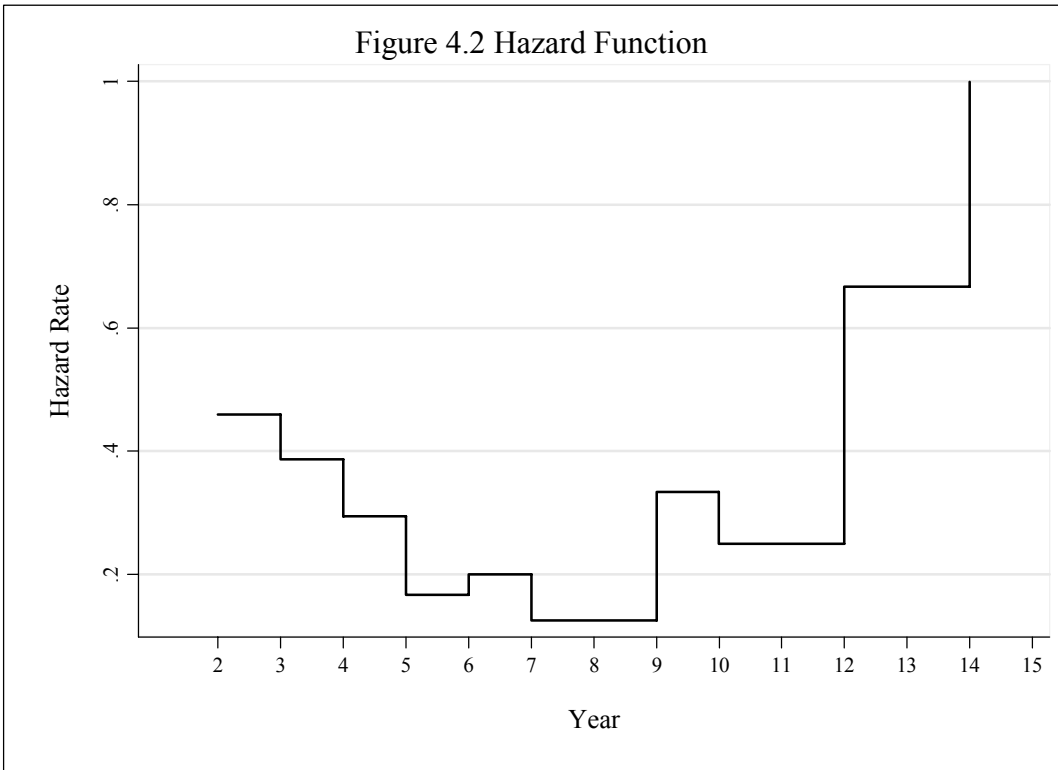
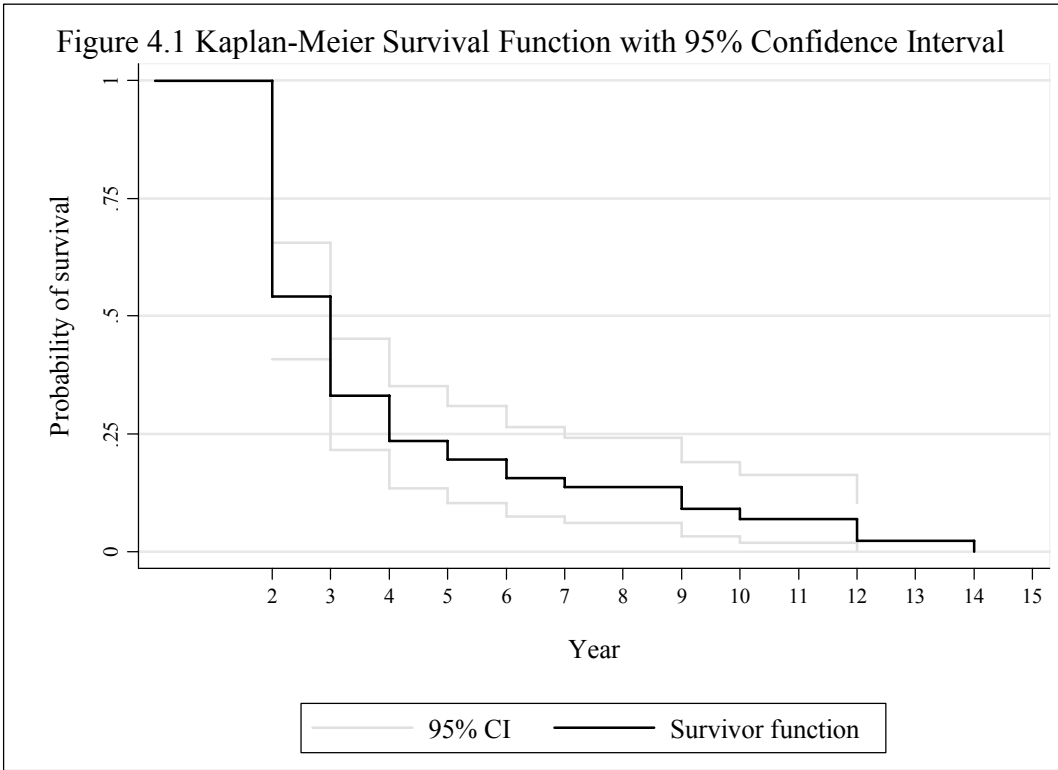
## **7. Conclusion**

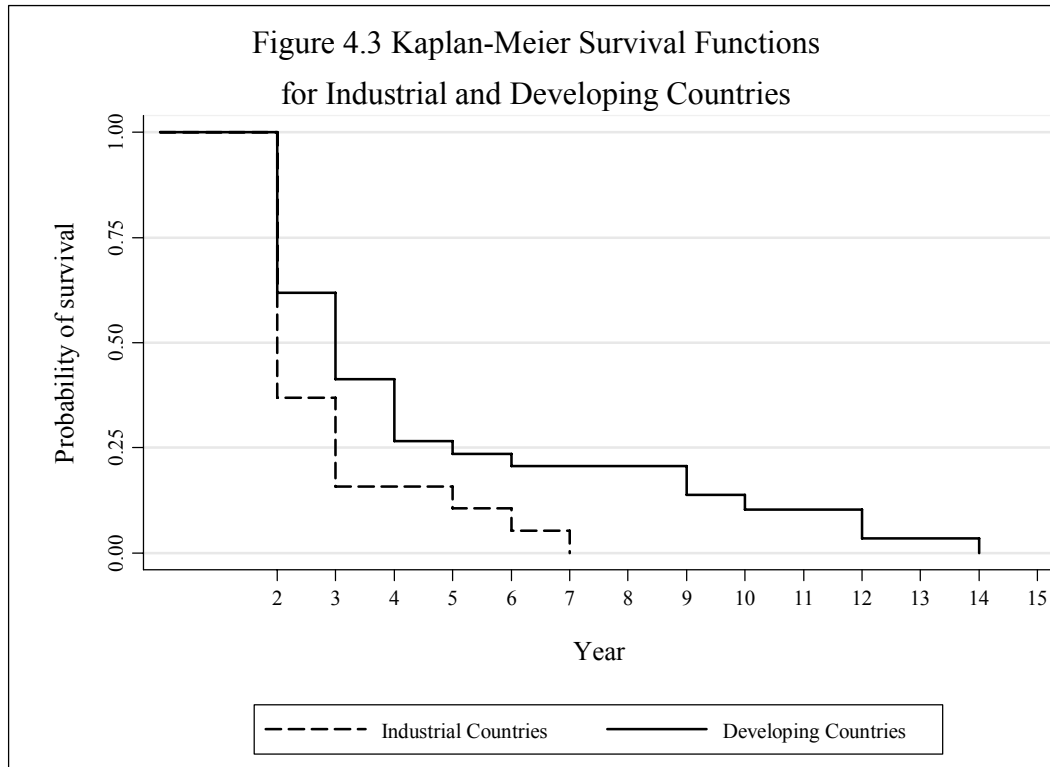
Over the last three decades currency crises have been quite frequent. But the majority of these crises were not contractionary. And most of the episodes of contraction were rather short lived – the affected countries recovered within two years from the crisis induced recessions. While contractionary crises were common to both the developing and the industrial countries alike, it was the Asian and the Latin American countries which were subject to more frequent and severe contractions. These countries accounted for two-third of the contractionary crises in our sample and they took on an average 4.5 years to recover. In contrast, the average recovery time for the other developing countries and the industrial countries were 2.4 years and 2.8 years respectively.

The objective of this paper was to look into the determinants of duration of recovery. Stabilization and structural adjustment policies implemented by the government following crisis play a very important role in post-crisis recovery. However, due to the endogenous nature of these variables and practical impossibility to find appropriate instruments, we had to confine our analysis mostly to pre-crisis fundamentals and external variables which are exogenous to the recovery process.

A high current account deficit, a severe fiscal imbalance and a high rate of domestic credit creation are considered to be indicative of increasing vulnerability to currency crisis. But we found no effect of these variables on the duration of recovery. Though our results suggest a positive relationship, higher deficits or credit creation leading to longer duration, the estimated coefficients are not significantly different from zero. Similarly, capital account liberalization does not appear to have any significant effect on the pace of recovery. Higher loss of reserves in the crisis year is associated with longer duration of recovery. Relatively autocratic regimes tend to recover faster. We found most of the trade related variables to be highly significant. Higher output growth in the trading partner countries, a diversification of the export base and relatively lower prices of exports help a country to recover faster. Landlocked countries, on the other hand, tend to recover slowly due to their lack of export competitiveness. To summarize, our results indicate the importance of export led recovery.







**Log-rank test for equality of survivor functions**

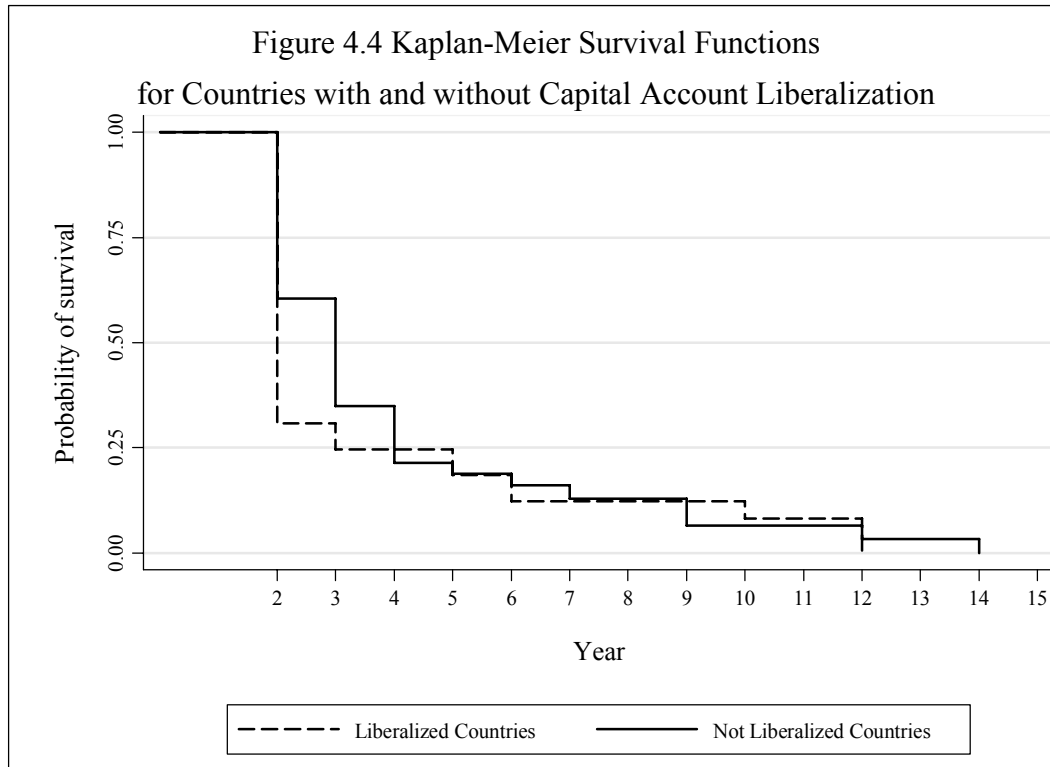
<i>dtype</i>	<i>Events observed</i>	<i>Events expected</i>
0	37	42.66
1	19	13.34
<i>Total</i>	56	56.00

$chi2(1) = 5.42$   
 $Pr>chi2 = 0.0199$

**Wilcoxon (Breslow) test for equality of survivor functions**

<i>dtype</i>	<i>Events observed</i>	<i>Events expected</i>	<i>Sum of ranks</i>
0	37	42.66	-244
1	19	13.34	244
<i>Total</i>	56	56.00	0

$chi2(1) = 4.31$   
 $Pr>chi2 = 0.0379$



**Log-rank test for equality of survivor functions**

	/ Events	Events
<i>dcapitallib</i>	/ observed	expected
0	42	43.20
1	14	12.80
<i>Total</i>	56	56.00

*chi2*(1) = 0.24  
*Pr*>*chi2* = 0.6272

**Wilcoxon (Breslow) test for equality of survivor functions**

	/ Events	Events	Sum of
<i>dcapitallib</i>	/ observed	expected	ranks
0	42	43.20	-139
1	14	12.80	139
<i>Total</i>	56	56.00	0

*chi2*(1) = 1.77  
*Pr*>*chi2* = 0.1835

Table 4 Survival and Hazard Functions

<b>Time</b>	<b>Survivor Function</b>	<b>[95% Conf. Int.]</b>		<b>Hazard Function</b>
1	1.0000			
2	0.5410	0.4086	0.6559	0.4590
3	0.3316	0.2158	0.4517	0.3871
4	0.2340	0.1334	0.3510	0.2941
5	0.1950	0.1031	0.3086	0.1667
6	0.1560	0.0746	0.2646	0.2000
7	0.1365	0.0612	0.2419	0.1250
8	0.1365	0.0612	0.2419	0.0000
9	0.0910	0.0314	0.1901	0.3333
10	0.0683	0.0190	0.1624	0.2500
12	0.0228	0.0019	0.1021	0.6667
14	0.0000			1.0000

Table 5 Duration of Recovery : Complementary Log-Log Specification with Weibull Baseline Hazard

	(1)	(2)	(3)	(4)	(5)
dtype	0.8266*** (0.3006)	1.7412*** (0.4505)	2.0948*** (0.4950)	2.3755*** (0.6156)	3.1858*** (0.6915)
cl		0.3194*** (0.1139)	0.2884** (0.1241)	0.3096** (0.1317)	0.3868*** (0.1488)
land		-0.5092 (0.4144)	-0.8666* (0.5218)	-0.7626 (0.5429)	-0.7046 (0.5716)
gdptradeprts			0.4085*** (0.1259)	0.3865*** (0.1364)	0.3869*** (0.1344)
ttg			-0.0408** (0.0169)	-0.0407** (0.0180)	-0.0454** (0.0187)
pcintlres				0.0075*** (0.0025)	0.0071*** (0.0026)
lcagdp2				0.0021 (0.0214)	0.0177 (0.0232)
lccgdp2				0.0291 (0.0320)	0.0496 (0.0420)
ldcgdp2				-0.0050 (0.0056)	-0.0054 (0.0068)
xman					-0.8670 (0.8297)
xserv					-0.6644 (0.6755)
xdiverse					0.8128* (0.4694)
lnt	0.4963*** (0.1806)	0.7522*** (0.2078)	0.6631*** (0.2426)	0.8777*** (0.2678)	1.3137*** (0.3298)
Constant	-1.9942*** (0.2861)	-3.4039*** (0.6243)	-4.1627*** (0.7059)	-4.0926*** (0.7701)	-5.0297*** (0.8985)
Observations	228	228	206	201	201
Chi-Square	11.72	21.14	37.26	43.62	55.46
Prob > Chi2	0.00	0.00	0.00	0.00	0.00
Log-likelihood	-121.24	-116.53	-93.21	-87.50	-81.59

Standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Table 6 Duration of Recovery: Complementary Log-Log Specification with Quadratic Baseline Hazard

	(1)	(2)	(3)	(4)	(5)
dtype	0.7263** (0.2987)	1.5085*** (0.4475)	2.0889*** (0.5184)	2.3666*** (0.6262)	3.0454*** (0.6981)
cl		0.2714** (0.1140)	0.2873** (0.1288)	0.3245** (0.1381)	0.4090** (0.1592)
land		-0.4651 (0.4132)	-0.7975 (0.5247)	-0.7632 (0.5450)	-0.7088 (0.5676)
gdptradeprts			0.4678*** (0.1286)	0.4617*** (0.1405)	0.4700*** (0.1390)
ttg			-0.0416** (0.0166)	-0.0438** (0.0178)	-0.0471*** (0.0182)
pcintlres				0.0068*** (0.0025)	0.0062** (0.0025)
lcagdp2				0.0053 (0.0211)	0.0189 (0.0225)
lccgdp2				0.0336 (0.0313)	0.0511 (0.0402)
ldcgdp2				-0.0038 (0.0055)	-0.0057 (0.0069)
xman					-0.4580 (0.8130)
xserv					-0.5473 (0.6826)
xdiverse					0.8656* (0.4868)
t	0.2352 (0.1647)	0.3062* (0.1660)	0.0941 (0.1730)	0.1634 (0.1842)	0.3338 (0.2080)
t2	-0.0148 (0.0147)	-0.0159 (0.0145)	0.0035 (0.0140)	0.0021 (0.0147)	-0.0049 (0.0162)
Constant	-1.9919*** (0.3753)	-3.1938*** (0.6572)	-4.0042*** (0.7508)	-4.0489*** (0.8098)	-5.0138*** (0.9532)
Observations	228	228	206	201	201
Chi-Square	7.49	14.44	34.05	39.58	49.25
Prob > Chi2	0.06	0.01	0.00	0.00	0.00
Log-likelihood	-123.36	-119.88	-94.81	-89.53	-84.69

Standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Table 7 Duration of Recovery: Complementary Log-Log Specification with Cubic Baseline Hazard

	(1)	(2)	(3)	(4)	(5)
dtype	0.6695** (0.2935)	1.4045*** (0.4501)	1.7614*** (0.5106)	2.2083*** (0.6268)	2.9376*** (0.6916)
cl		0.2547** (0.1157)	0.2291* (0.1262)	0.2694** (0.1354)	0.3263** (0.1537)
land		-0.3410 (0.4180)	-0.5274 (0.5176)	-0.3551 (0.5471)	-0.2353 (0.5860)
gdptradeprts			0.3899*** (0.1298)	0.3868*** (0.1397)	0.3577** (0.1416)
ttg			-0.0426** (0.0181)	-0.0390** (0.0188)	-0.0437** (0.0199)
pcintlres				0.0062** (0.0025)	0.0058** (0.0026)
lcagdp2				0.0106 (0.0229)	0.0232 (0.0247)
lcgdp2				0.0238 (0.0336)	0.0542 (0.0417)
ldcgdp2				-0.0080 (0.0059)	-0.0084 (0.0070)
xman					-0.8564 (0.8653)
xserv					-0.4119 (0.6931)
xdiverse					0.7894 (0.4937)
t	2.1753*** (0.4882)	2.2016*** (0.4907)	1.7147*** (0.5432)	1.8738*** (0.5786)	2.1475*** (0.6262)
t2	-0.4113*** (0.0961)	-0.4039*** (0.0966)	-0.3216*** (0.1045)	-0.3381*** (0.1099)	-0.3584*** (0.1146)
t3	0.0209*** (0.0050)	0.0204*** (0.0050)	0.0167*** (0.0053)	0.0173*** (0.0056)	0.0178*** (0.0058)
Constant	-4.2110*** (0.6908)	-5.3041*** (0.8811)	-5.4714*** (0.9284)	-5.4347*** (0.9911)	-6.4304*** (1.1234)
Observations	228	228	206	201	201
Chi-Square	30.99	36.64	45.88	51.11	60.82
Prob > Chi2	0.00	0.00	0.00	0.00	0.00
Log-likelihood	-111.61	-108.78	-88.90	-83.76	-78.90

Standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Table 8 Duration of Recovery: Complementary Log-Log Specification with Non-Parametric Baseline Hazard

	(1)	(2)	(3)	(4)	(5)
dtype	0.6774** (0.2981)	1.3489*** (0.4568)	1.6994*** (0.5258)	2.0329*** (0.6551)	2.6270*** (0.7440)
cl		0.2262* (0.1162)	0.1658 (0.1272)	0.2073 (0.1360)	0.2272 (0.1477)
land		-0.3888 (0.4191)	-0.6064 (0.5395)	-0.5195 (0.5688)	-0.3579 (0.6395)
gdptradeprts			0.4856*** (0.1353)	0.4742*** (0.1437)	0.4709*** (0.1491)
ttg			-0.0501** (0.0199)	-0.0442** (0.0207)	-0.0518** (0.0224)
pcintlres				0.0048** (0.0024)	0.0043* (0.0025)
lcagdp2				0.0092 (0.0215)	0.0164 (0.0223)
lcgdp2				0.0208 (0.0344)	0.0416 (0.0388)
ldcgdp2				-0.0057 (0.0062)	-0.0050 (0.0072)
xman					-0.8132 (0.8996)
xserv					-0.2576 (0.7286)
xdiverse					0.5768 (0.4902)
d2	3.8302*** (1.0185)	3.8194*** (1.0188)	3.3705*** (1.0295)	3.3365*** (1.0318)	3.4190*** (1.0410)
d3	3.6585*** (1.0423)	3.7065*** (1.0432)	3.2366*** (1.0538)	3.2955*** (1.0677)	3.4006*** (1.0849)
d4	3.3018*** (1.0962)	3.4016*** (1.0979)	2.7150** (1.1060)	2.8944*** (1.1202)	3.2407*** (1.1462)
d5	2.6431** (1.2257)	2.8001** (1.2287)	2.1593* (1.2357)	2.2813* (1.2436)	2.7045** (1.2736)
d6	2.8960** (1.2268)	3.1258** (1.2327)	2.3624* (1.2397)	2.5495** (1.2508)	3.0370** (1.2865)
d7	2.4699* (1.4186)	2.7536* (1.4255)	1.5639 (1.5056)	1.8341 (1.5115)	2.1739 (1.5606)
d9	3.6396*** (1.2333)	4.1269*** (1.2624)	3.8943*** (1.2600)	4.1258*** (1.2805)	4.5291*** (1.3066)
d10	3.2964** (1.4216)	3.7022** (1.4384)	3.4668** (1.4398)	3.7595*** (1.4551)	4.1732*** (1.4955)
d12	4.6363*** (1.2516)	5.0555*** (1.2753)	5.2274*** (1.3104)	5.4211*** (1.3272)	6.0210*** (1.4204)
Constant	-4.5423*** (1.0070)	-5.4302*** (1.1256)	-5.8768*** (1.1489)	-5.6486*** (1.1823)	-6.1162*** (1.2465)
Observations	228	228	206	201	201
Chi-Square	59.46	64.17	71.86	74.13	79.75
Prob > Chi2	0.00	0.00	0.00	0.00	0.00
Log-likelihood	-97.37	-95.02	-75.91	-72.25	-69.44

Standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%



Table 9 Capital Account Liberalization and Recovery: Complementary Log-Log Specification with Weibull Baseline Hazard

	(1)	(2)	(3)	(4)	(5)
dcaplib	-0.1153 (0.3148)	-0.5296 (0.3446)	-0.7627* (0.4025)	-0.8360* (0.4326)	-0.9109** (0.4545)
dtype		1.9693*** (0.4703)	2.4872*** (0.5478)	2.7969*** (0.6531)	3.5042*** (0.7159)
cl		0.3175*** (0.1129)	0.2938** (0.1229)	0.3121** (0.1295)	0.4072*** (0.1490)
land		-0.5046 (0.4179)	-0.8475 (0.5272)	-0.7512 (0.5624)	-0.6529 (0.5923)
gdptradeprts			0.4026*** (0.1282)	0.3797*** (0.1401)	0.3861*** (0.1359)
ttg			-0.0458** (0.0179)	-0.0464** (0.0193)	-0.0514** (0.0200)
pcintlres				0.0073*** (0.0026)	0.0063** (0.0027)
lcagdp2				0.0007 (0.0215)	0.0181 (0.0229)
lccgdp2				0.0422 (0.0314)	0.0622 (0.0417)
ldcgdp2				-0.0056 (0.0056)	-0.0088 (0.0072)
xman					-0.3714 (0.8506)
xserv					-0.8094 (0.6777)
xdiverse					0.9755** (0.4818)
lnt	0.3782** (0.1712)	0.8231*** (0.2126)	0.8153*** (0.2560)	1.0527*** (0.2849)	1.5044*** (0.3458)
Constant	-1.6161*** (0.2352)	-3.3994*** (0.6180)	-4.2788*** (0.7195)	-4.1449*** (0.7674)	-5.0761*** (0.8999)
Observations	228	228	206	201	201
Chi-Square	4.86	23.64	41.09	47.66	59.79
Prob > Chi2	0.09	0.00	0.00	0.00	0.00
Log-likelihood	-124.67	-115.28	-91.29	-85.49	-79.42

Standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Table 10 Capital Account Liberalization and Recovery: Complementary Log-Log Specification with Quadratic Baseline Hazard

	(1)	(2)	(3)	(4)	(5)
dcaplib	-0.0622 (0.3157)	-0.4690 (0.3436)	-0.6385 (0.4014)	-0.7065* (0.4272)	-0.8378* (0.4523)
dtype		1.7192*** (0.4671)	2.3897*** (0.5565)	2.6969*** (0.6530)	3.3593*** (0.7224)
cl		0.2739** (0.1134)	0.2924** (0.1277)	0.3291** (0.1360)	0.4348*** (0.1597)
land		-0.4706 (0.4157)	-0.7702 (0.5274)	-0.7514 (0.5599)	-0.6827 (0.5834)
gdptradeprts			0.4570*** (0.1301)	0.4515*** (0.1434)	0.4625*** (0.1400)
ttg			-0.0455*** (0.0174)	-0.0484** (0.0189)	-0.0525*** (0.0194)
pcintlres				0.0066** (0.0026)	0.0056** (0.0026)
lcagdp2				0.0043 (0.0212)	0.0194 (0.0225)
lccgdp2				0.0422 (0.0306)	0.0613 (0.0402)
ldcgdp2				-0.0041 (0.0055)	-0.0085 (0.0071)
xman					-0.0495 (0.8331)
xserv					-0.7211 (0.6874)
xdiverse					1.0001** (0.4964)
t	0.2046 (0.1654)	0.3389** (0.1666)	0.1773 (0.1788)	0.2548 (0.1917)	0.4433** (0.2154)
t2	-0.0146 (0.0149)	-0.0172 (0.0144)	-0.0012 (0.0141)	-0.0030 (0.0148)	-0.0105 (0.0162)
Constant	-1.6715*** (0.3446)	-3.2281*** (0.6522)	-4.1502*** (0.7635)	-4.1713*** (0.8101)	-5.1694*** (0.9600)
Observations	228	228	206	201	201
Chi-Square	2.00	16.39	36.71	42.50	52.91
Prob > Chi2	0.57	0.01	0.00	0.00	0.00
Log-likelihood	-126.10	-118.91	-93.48	-88.07	-82.86

Standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Table 11 Capital Account Liberalization and Recovery: Complementary Log-Log Specification with Cubic Baseline Hazard

	(1)	(2)	(3)	(4)	(5)
dcaplib	0.1694 (0.3171)	-0.3393 (0.3809)	-0.5718 (0.4321)	-0.5939 (0.4634)	-0.5940 (0.4846)
dtype		1.5888*** (0.4908)	2.0815*** (0.5657)	2.4905*** (0.6618)	3.1469*** (0.7162)
cl		0.2542** (0.1155)	0.2316* (0.1257)	0.2710** (0.1347)	0.3436** (0.1550)
land		-0.3574 (0.4202)	-0.5442 (0.5232)	-0.3989 (0.5598)	-0.2527 (0.5984)
gdptradeprts			0.3802*** (0.1310)	0.3768*** (0.1420)	0.3594** (0.1420)
ttg			-0.0456** (0.0190)	-0.0427** (0.0199)	-0.0475** (0.0209)
pcintlres				0.0060** (0.0025)	0.0054** (0.0027)
lcagdp2				0.0105 (0.0230)	0.0241 (0.0246)
lcgdp2				0.0337 (0.0332)	0.0631 (0.0418)
ldcgdp2				-0.0076 (0.0058)	-0.0098 (0.0072)
xman					-0.5184 (0.8918)
xserv					-0.5074 (0.6963)
xdiverse					0.8986* (0.5032)
t	2.1782*** (0.4863)	2.1981*** (0.4940)	1.7566*** (0.5518)	1.8745*** (0.5802)	2.0813*** (0.6255)
t2	-0.4187*** (0.0959)	-0.3981*** (0.0972)	-0.3183*** (0.1055)	-0.3264*** (0.1099)	-0.3348*** (0.1156)
t3	0.0213*** (0.0050)	0.0200*** (0.0051)	0.0162*** (0.0054)	0.0165*** (0.0056)	0.0164*** (0.0058)
Constant	-4.0033*** (0.6839)	-5.3052*** (0.8820)	-5.5779*** (0.9450)	-5.4727*** (0.9880)	-6.4127*** (1.1181)
Observations	228	228	206	201	201
Chi-Square	26.41	37.45	47.69	52.81	62.37
Prob > Chi2	0.00	0.00	0.00	0.00	0.00
Log-likelihood	-113.90	-108.38	-87.99	-82.91	-78.13

Standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Table 12 Capital Account Liberalization and Recovery: Complementary Log-Log Specification with Non-Parametric Baseline Hazard

	(1)	(2)	(3)	(4)	(5)
dcaplib	0.1805 (0.3224)	-0.2845 (0.3759)	-0.5655 (0.4545)	-0.5711 (0.4801)	-0.5850 (0.5067)
dtype		1.4963*** (0.4927)	2.0245*** (0.5921)	2.3271*** (0.7095)	2.8090*** (0.7533)
cl		0.2278** (0.1159)	0.1745 (0.1272)	0.2139 (0.1359)	0.2435 (0.1495)
land		-0.3820 (0.4199)	-0.5963 (0.5430)	-0.5288 (0.5765)	-0.3224 (0.6471)
gdptradeprts			0.4737*** (0.1371)	0.4684*** (0.1470)	0.4690*** (0.1490)
ttg			-0.0543*** (0.0207)	-0.0490** (0.0218)	-0.0561** (0.0233)
pcintlres				0.0047* (0.0024)	0.0039 (0.0025)
lcagdp2				0.0086 (0.0214)	0.0161 (0.0220)
lccgdp2				0.0283 (0.0341)	0.0495 (0.0390)
ldcgdp2				-0.0055 (0.0063)	-0.0059 (0.0073)
xman					-0.5116 (0.9051)
xserv					-0.2941 (0.7316)
xdiverse					0.6767 (0.5017)
d2	3.8524*** (1.0187)	3.8076*** (1.0188)	3.3861*** (1.0295)	3.3546*** (1.0323)	3.4271*** (1.0388)
d3	3.6228*** (1.0419)	3.7183*** (1.0441)	3.3034*** (1.0581)	3.3350*** (1.0712)	3.4112*** (1.0869)
d4	3.2639*** (1.0963)	3.4429*** (1.1000)	2.8879*** (1.1156)	3.0472*** (1.1276)	3.3635*** (1.1521)
d5	2.6099** (1.2256)	2.8493** (1.2307)	2.3268* (1.2433)	2.4312* (1.2510)	2.8279** (1.2786)
d6	2.8197** (1.2257)	3.1569** (1.2337)	2.4404** (1.2430)	2.6473** (1.2573)	3.1344** (1.2918)
d7	2.2829 (1.4156)	2.8172** (1.4281)	1.8459 (1.5023)	2.1103 (1.5093)	2.4910 (1.5642)
d9	3.3919*** (1.2283)	4.2186*** (1.2695)	4.0264*** (1.2692)	4.2586*** (1.2902)	4.7065*** (1.3223)
d10	2.9954** (1.4246)	3.8621*** (1.4518)	3.9490*** (1.4904)	4.2300*** (1.5053)	4.6522*** (1.5516)
d12	4.4298*** (1.2490)	5.0889*** (1.2752)	5.4392*** (1.3240)	5.6629*** (1.3467)	6.2897*** (1.4445)
Observations	228	228	206	201	201
Chi-Square	54.92	64.75	73.45	75.59	81.09
Prob > Chi2	0.00	0.00	0.00	0.00	0.00
Log-likelihood	-99.64	-94.72	-75.11	-71.52	-68.77

Standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

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## Appendix 1 – List of Countries

Algeria	Argentina	Australia	Austria
Bangladesh	Barbados	Belgium	Benin
Bolivia	Botswana	Brazil	Burkina Faso
Burundi	Cameroon	Canada	Central African Republic
Chile	China	Colombia	Costa Rica
Cote d'Ivoire	Denmark	Dominican Republic	Ecuador
Egypt, Arab Rep.	El Salvador	Finland	France
Gabon	Germany	Ghana	Greece
Guatemala	Haiti	Honduras	Iceland
India	Indonesia	Ireland	Israel
Italy	Jamaica	Japan	Kenya
Korea, Rep	Malaysia	Mexico	Morocco
Netherlands	New Zealand	Nicaragua	Niger
Nigeria	Norway	Oman	Pakistan
Papua New Guinea	Paraguay	Peru	Philippines
Portugal	Saudi Arabia	Senegal	Singapore
South Africa	Spain	Sri Lanka	Swaziland
Sweden	Switzerland	Thailand	Togo
Trinidad and Tobago	Tunisia	Turkey	United Kingdom
Uruguay	Venezuela, RB	Zambia	Zimbabwe



## Appendix 2 – Contractionary Currency Crises

### *List of Contractionary Crises:*

Algeria	1990
Argentina	1975, 1981
Austria	1977
Burundi	1998
Belgium	1980, 1992
Bolivia	1979
Brazil	1982, 1987, 1989
Barbados	1975
Chile	1982
Colombia	1998
Costa Rica	1981
Germany	1992
Denmark	1980, 1992
Ecuador	1982, 1986
Finland	1991
France	1992
Greece	1992
Haiti	1991
Indonesia	1997
Ireland	1982

*List of Contractionary Crises (Contd.)*

Iceland	1982
Italy	1992
Jamaica	1978
Korea	1997
Morocco	1991
Mexico	1982, 1994
Malaysia	1997
Nigeria	1986
Netherlands	1980
Oman	1986
Peru	1987
Philippines	1983, 1990, 1997
Papua New Guinea	1983, 1994, 1997
Portugal	1982
Saudi Arabia	1986
Singapore	1997
Spain	1980, 1992
Sweden	1991
Swaziland	1975, 1986
Switzerland	1981, 1991
Thailand	1997
Trinidad and Tobago	1985

*List of Contractionary Crises (Contd.)*

Tunisia	1981
Turkey	1978
Uruguay	1982
Venezuela	1995
South Africa	1975, 1984
Zimbabwe	1991, 1998

## Appendix 3 – Data Appendix

### *Description of Variables and Data Sources*

Real GDP: IFS line 99b deflated using consumer prices (IFS line 64)

gdpgrowth: Growth rate of GDP (constant 1995 dollars) from World Development Indicators (2003).

Nominal Exchange Rate: National currency per US dollar. IFS line rf. For Brazil, Barbados, Egypt and El Salvador, IFS line ae has been used either due to data discrepancy or unavailability. For Australia, Ireland, New Zealand, Papua New Guinea, Swaziland, United Kingdom and Zimbabwe, inverse of IFS line rh has been used.

Reserves: IFS line 1L.d

Consumer Price Index: IFS line 64

gdptradepts – GDP growth rate of the trading partners weighted by their respective trade shares. World Development Indicators (WDI) for GDP growth rate data and IMF Direction of Trade Statistics (DOTS) for trade share data.

pcintlres – Percent change in international reserves (IFS line 1L.d)

lcagdp2 – Current Account Balance (percent of GDP), 2-year backward average, from Ghosh *et al* (2003)

lccgdp2 – Central Government Budget Balance (percent of GDP), 2-year backward average, from Ghosh *et al* (2003)

ldcgdp2 – Domestic Credit (percent of GDP), 2-year backward average, from World Development Indicators (WDI)

ttg – Terms of Trade Growth from Ghosh *et al* (2003)

cl – Index of civil liberties, from Freedom in the World, Freedom House, New York

land – Dummy for the landlocked countries, from Global Development Network Growth Database

dtype – Dummy for the industrial countries, from IFS

xman – Dummy for the manufacturing exporters, from Global Development Network Growth Database

xserv – Dummy for the services exporters, from Global Development Network Growth Database

xdiverse – Dummy for the diversified exporters, from Global Development Network Growth Database

dcaplib – Dummy for capital account liberalization, from IMF *Annual Report of Exchange Arrangement and Exchange Restrictions* various issues