AN ECONOMETRIC ANALYSIS OF THE MEXICAN PESO CRISIS OF 1994-1995

1994-1995 MEKSİKA PEZO KRİZİ'NİN EKONOMETRİK BİR ANALİZİ

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ABSTRACT: This article aims at identifying the factors behind the Mexican Peso Crisis of 1994-1995 through building a probit model incorporating 20 monthly macroeconomic, political, and financial sector variables from 1970:1 – 1995:1. As a result of the probit regressions, strong evidence emerges that the significant variables are political instability, foreign exchange reserves, domestic credit/GDP, lending and deposit rate spread, national savings, and foreign direct investment/GDP. Evidence further indicates that the signs of the variables are mostly in line with our expectations, with the exception of inflation, bank reserves/bank assets, export growth, and lending and deposit rate spread.

Key words: Mexican Peso crisis, financial crises, probit model.

ÖZET: *Bu makale 1994-1995 Meksika Pezo Krizi'nin ardındaki faktörleri aylık 20 makroekonomik, siyasi ve finans sektörü değişkenleriyle oluşturulan bir probit modeli kullanarak tespit etmeyi amaçlamaktadır. Probit regresyonunun neticesinde anlamlı değişkenler olarak siyasi istikrarsızlık, döviz rezervleri, yerel kredi/GSMH, borç ve mevduat oranı arasındaki fark, ulusal tasarruflar ve doğrudan yabancı yatırım/GSMH değerleri alınmıştır. Bulgular, değişkenlerin, enflasyon, banka rezervleri/banka aktifleri, ihracat büyüme oranı ve borç ve mevduat oranı arasındaki fark haricinde beklenildiği şekilde ortaya çıktığını göstermektedir.*

Anahtar kelimeler: *Meksika Pezo krizi, finansal krizler, probit modeli.*

1. Introduction

Mexico experienced recurring financial crises in 1976, 1982, 1986 and, 1994-1995 with devastating economic and social consequences. The most recent crisis that emerged in December 1994 was the worst with the peso losing 40% of its value. Prior to the crisis, Mexico had a crawling peg exchange rate system. The peso-US dollar exchange rate was kept within a narrow target band, but the upper limit of the band was raised slightly every day by a predetermined amount, allowing for a gradual nominal depreciation of the peso. However, in reality the peso was appreciating leading to a current account deficit. The band floor was fixed at 3.051 Mexican pesos per US dollar. The band ceiling had been allowed to increase 0.004 pesos a day and any increase of the peso – US dollar exchange rate beyond this threshold in one day would force the Mexican central bank to intervene and defend the parity. In December 1994, the Mexican government decided to devalue the peso by 15 percent, to about four pesos per dollar and within a few days the peso plummeted, sinking the country into a financial crisis which led to a 9.2% fall in real GNP per capita, loss of 2 million jobs, and 21% fall in the average manufacturing wages as well as to a stock market crash. The crisis, however, was handled relatively quickly due to the prompt response of the United States and the IMF in providing a

$50 billion line of credit. Mexico, in return, put up its oil revenues as collateral. After a tough recession in 1995, Mexico began to recover strongly from the crisis. The rescue package restored investor confidence and stopped the massive capital outflows.

The theoretical literature on financial crises is categorized into three mainstream models, namely first-generation models, second-generation models, and third-generation models. In the "first-generation" models (Krugman 1979; Flood and Garber 1984), a government with persistent money-financed budget deficits is assumed to use a limited stock of reserves to peg its exchange rate and the attempts of investors to anticipate the inevitable collapse generates a speculative attack on the currency when reserves fall to some critical level. In the "second-generation" models (Obstfeld 1994, 1996, Ozkan and Sutherland 1995, Radelet and Sachs 1998) policy is less mechanical: a government chooses whether or not to defend a pegged exchange rate by making a tradeoff between short-run macroeconomic flexibility and longer-term credibility. The crisis then arises from the fact that defending the parity is more expensive as it requires higher interest rates. Should the market believe that defense will ultimately fail, a speculative attack on a currency develops either as a result of a predicted future deterioration in macro fundamentals, or purely through self-fulfilling prediction. The need for the third generation models became apparent in 1990s with Mexican Tequila crisis of 1994 and the East Asian crisis of 1997. A number of new approaches have emerged to explain how these crises evolved and how they spread from country to country. Third-generation models (Dooley 1997, Krugman 1998, Radelet and Sachs 1998) are categorized into three different groups such as herd-behavior, contagion, and moral hazard. There have been numerous empirical studies such as Frankel and Rose (1996), Sachs *et al.* (1996), Kaminsky *et al.* (1998), Berg and Pattillo (1999) Komulainen and Lukkarila (2003), and Feridun (2004a, 2004b. 2004c, 2005a in the literature on financial crises. It is beyond the scope of the present study to review the existing literature in detail. Interested readers may refer to Feridun 2005b for a detailed review of the literature.

This article aims at identifying the variables that account for the Mexican financial crisis based on a probit model set up using 20 indicators. This article is structured as follows: Section 1 presents the data and methodology. Section 2 points out the findings of the research. The last section points out the conclusions that emerge from the study.

2. Data and Methodology

The probit model is built based on monthly observations spanning the period between 1970:1 and 1995:1. Most data are gathered from DataStream. The data for government debt figures come from several sources, including IFS, the World Bank's WDI and IMF country reports. The tested 20 indicators are selected on the basis of currency crisis theories and previous empirical literature, and are transformed into log returns to achieve mean reverting properties and to make statistical testing procedures valid. In addition to the traditional macroeconomic variables, we include several indicators describing the vulnerability of domestic banks. These indicators include the growth of bank deposits, the ratio of the lending rate to the deposit rate, and the ratio of bank reserves to assets. We also employ variables that indicate vulnerability to a sudden stop of capital inflows. These

variables are public debt, M2/ foreign exchange reserves, and private sector liabilities. We also include an index that proxies the political instability. To study foreign influences on crises, we include the US interest rate. Since we study all these variables simultaneously, we hope to distinguish those indicators that reflect actual causes of the recent crises in Mexico. Table 1 shows the explanatory variables.

Table 1. Explanatory Variables

Indicator & Expected Sign		Explanation
Inflation	+	Inflation is associated with high nominal interest rates and may proxy macroeconomic mismanagement that adversely affects the economy and the banking system (Demirguc-Kunt and Detragiache 1997).
Real Exchange Rate	-	Currency overvaluation may lead to deteriorations in the current account and have historically been associated with currency crises (Berg *et al*. 1999).
Export Growth	-	Weak exports may lead to deteriorations in the current account and have often been associated with currency crises (Dowling and Zhuang, 2000).
Import Growth	+	Excessive import growth could lead to worsening in the current account and have been related with currency crises (Berg and Patillo 1999)
M1	+	Growth of M1 indicates excess liquidity, which may invoke speculative attacks on the currency thus leading to a currency crisis (Eichengreen *et al*. 1995).
Domestic Credit/GDP	+	High levels of domestic credit indicate the fragility of a banking system (Kaminsky and Reinhart, 1998).
Stock Prices	-	Recessions and a burst in asset price bubbles often precede currency crises (Kaminsky and Reinhart, 1999).
Public Debt/GDP	+	Higher indebtedness is expected to raise vulnerability to a reversal in capital inflows, and hence to raise the probability of a crisis (Lanoie and Lemarbre, 1996).
Foreign direct investment/GDP	+	Shows net inflows in the reporting economy. East Asian countries had been dependent on net capital inflows over the decade preceding the crisis
US Interest rates	+	International interest rate increases are often associated with capital outflows (Edison, 2003)
Bank Reserves/Bank Assets	-	Shows the liquidity of the banking system. Adverse macroeconomic shocks are less likely to lead to crises in countries where the banking system is liquid (Demirguc-Kunt and Detragiache, 1997).
Lending Rate-Deposit Rate	+	An increase of this indicator reflects a deterioration in credit risk as banks are unwilling to lend or decline in loan equity (Kaminsky *et al*. 1998)

Real interest rate	+	Used as a proxy of financial liberalization. Liberalization process itself tends to lead to high real rates. High real interest rates have been increased to repel a speculative attack (Kaminsky *et al.* 1998).
Foreign exchange reserves	-	Most currency collapses are preceded by a period of increased efforts to defend the exchange rate, which are market by declining foreign exchange reserves (Kaminsky *et al.* 1998).
Current Account/GDP	-	An increase in the current account is associated with large capital inflows which indicate a diminished probability to devalue and thus to lower the probability of a crisis (Berg and Patillo 1999).
M2/Foreign Exchange reserves	+	Indicates to what extent the liabilities of the banking system are backed by foreign reserves. It also captures the ability of the central bank to meet sudden domestic foreign exchange demands (Berg and Patillo 1999).
Fiscal Balance/GDP	+	Higher fiscal deficits are expected to raise the probability of crisis since they increase the vulnerability to shocks and investor's confidence (Demirguc-Kunt and Detragiache, 1997).
Political Instability	+	Frequent change in the political regime may reduce the willingness of the international financial community to provide financing for a current account deficit. Moreover, political instability may lead to larger budget and current account deficits.
GDP per capita	-	Deterioration of the domestic economic activity is expected to increase the likelihood of crises (Lanoie and Lemarbre 1996).
National Saving Growth	-	High national savings may be expected to lower the probability of debt rescheduling (Lanoie and Lemarbre 1996).

Given the aforementioned indicators, the model estimates the probability for financial crises. The estimated model takes the form:

$$Prob \,(y_{it} = 1 \mid x_t , \beta_t) = F(x_t , \beta_t) \tag{1}$$

where x_t corresponds to our set of indicators and β_t is a vector of unknown parameters. The observed variable y_{it} receives a value of 0 or 1 depending on whether a crisis has occurred or not. With a probit model, the right-hand side of the model is constrained between 0 and 1, and is compared to the observed value y_{it}. The probit model assumes that the probability distribution function (y_{it} conditional on x_{it}) corresponds to normal distribution. Since in currency crisis situations a successful attack leads to sharp currency depreciation and substantial reserve losses, both the signal approach and limited dependent models traditionally define a currency crisis as a discrete event. One common technique is to construct an index of exchange market pressure as a weighted average of exchange rate changes and reserves changes (as well as interest rates in some cases). The crisis is said to occur when the index exceeds a particular threshold level. At this point, we calculate an exchange market pressure index (EMP) for each country. The index includes exchange rate depreciation and loss of reserves, which are weighted to influence equally. The exchange market pressure index takes the form:

$$EMP = \Delta e - (\sigma_e/\sigma_r)*\Delta r \qquad (2)$$

where Δe denotes the change in exchange rate and Δr in international reserves, σ_e and σ_r denote the standard deviation of exchange rate alteration and reserves, respectively. We determine the values of the EMP index more than two standard deviations above the mean as a crisis. Since macroeconomic variables often worsen prior to the actual crash, we define not only the crisis month but also the preceding eleven months as a crisis. In other words, we use a one-year window for our variables.

3. Empirical Results

As Table 2 indicates, the signs of the variables are mostly in line with our expectations, with the exception of inflation, bank reserves / bank assets ratio, export growth, and lending and deposit rate spread. The significant variables are political instability, foreign exchange reserves, domestic credit / GDP, lending and deposit rate spread, national savings, and foreign direct investment / GDP. Table 3 summarizes the results of the study.

Table 2. Probit Model

Variable	Coefficient	Z-statistic	Variable	Coefficient	Z-statistic
Inflation	-21.14572	0.726587	US interest rates	1.579576	0.789433
Real exchange rate	-14.052321	0.626598	FDI / GDP	-22.54734	1.675097*
Export growth	16.24368	0.327680	National savings	-11.65876	-1.724881*
Import growth	23.25560	0.658798	Real interest rate	3.557567	-0.49468
M1	-33.78773	0.868798	Public debt / GDP	12.86547	0.789999
Domestic credit / GDP	-23.78677	2.854786***	Current account/GDP	-22.65778	0.732654
Stock prices	-13.65477	0.766577	GDP per capita	-14.66766	-0.595546
Political Instability	12.687879	2.76577***	Fiscal balance / GDP	11.76528	0.6568767
Lending and deposit rate spread	-22.768987	2.885467***	M2 / foreign exchange reserves	-23.65572	0.3698789
Bank reserves / bank assets	1.786868	0.755436	Foreign exchange reserves	-26.87680	1.674280*

* Significant at the 10% level
** Significant at the 5% level,
*** Significant at the 1% level.

Table 3. Regression Results

Variable	Expected Sign	Found Sign	Significance	Variable	Expected Sign	Found Sign	Significance
Inflation	+	-		US interest rates	+	+	
Real Exchange Rate	-	-		FDI / GDP	+	-	*
Export Growth	-	+		National savings	-	-	*
Import Growth	+	+		Real interest rate	+	+	
M1	+	-		Public debt / GDP	+	+	
Domestic Credit/GDP	+	-	***	Current account/GDP	-	-	
Stock Prices	-	-		GDP per capita	-	-	
Political Instability	+	+	***	Fiscal balance / GDP	+	+	
Lending and deposit rate spread	+	-	***	M2 / foreign exchange reserves	+	-	
Bank reserves / bank assets	+	+		Foreign exchange reserves	-	-	*

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

4. Conclusions

This study analyzes the causes of the Mexican peso crisis using data from 1970:1 to 1995:1. It estimates a probit model using 20 macroeconomic, political, and financial sector indicators. The Results indicate that the significant variables are political instability, foreign exchange reserves, domestic credit/GDP, lending and deposit rate spread, national savings, and foreign direct investment/GDP. Evidence further indicates that the signs of the variables are mostly in line with our expectations, with the exception of inflation, bank reserves / bank assets, export growth, and lending and deposit rate spread. Based on this analysis, we can conclude that the Mexican Peso Crisis of 1994-95 was the result of a mix of microeconomic and macroeconomic factors.

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