SCHOOL OF
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Factors triggering currency and banking crises

An empirical study of Latin America during 1990-2010

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Abstract

This paper examines factors that triggered widespread currency and banking crises in Latin America during 1990-2010 by looking at specific macroeconomic and financial variables. The paper aim to contribute to the vast literature of financial crises by distinguishing itself in three ways. First, the paper implements a dynamic binary choice panel data model with fixed effects. The binary choice model utilizes a maximum likelihood estimator with bias corrections to account for incidental parameter bias. To the best of my knowledge, such an estimation approach has never been implemented for data on financial crises. Second, the paper looks at the simultaneous relationship between explanatory variables and financial crises instead of trying to forecast financial crises which is the more common approach. Third, the paper analyzes the impact on both currency and banking crises instead of looking at determinants of these crises individually or by looking at currency and banking crises as intertwined. The results indicate that a change in exchange rate have a positive effect on the likelihood of currency and banking crises. The results are in line with previous research on currency crises, implying that the model is more suited for analyzing currency crises compared to banking crises.

Keywords: Latin America, Currency crisis, Banking crisis, Binary choice model, Panel data model, Incidental parameter problem.

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1. Introduction

During the late 20th century the world was plagued by particularly severe currency and banking crises. The likes of the 1994 Mexican Peso crisis and its effect on Latin America, the Asian financial crisis in 1997 along with the Russian currency crisis of 1998 caused tremendous economic and social loss. Financial crises usually have these devastating economic and social impacts, often in the form of bankruptcies of financial institutions, substantial corporate losses and a sharp rise in unemployment (Aydin and Cavdar, 2015). Another negative aspect of financial crises is their unpredictability, often catching governments, corporations and households by surprise (Allen and Gale, 2008). Financial crises and their element of surprise suggest that there is a substantial knowledge deficit concerning the causes of financial crises, and the capability of foreseeing and act proactively to avoid them. These adverse effects have led to increased interest from scholars, policymakers, and economists hoping to lessen the economic costs of financial crises (Jordà et al., 2010).

This increasing interest has led to an expanding amount of research on financial crises. The modern literature on currency and banking crises ranges from the three generations of currency crisis models to early warning system models used to forecast financial crises, such as the parametric regression model and the non-parametric signals approach (Berg and Pattillo, 1999). There are also a considerable number of economic models which are specifically developed in order to analyze previously observed crises incidences (such as the previously mentioned crises; the Mexican Peso crisis of 1994, the Asian financial crisis of 1997 and the Russian currency crises of 1998). Some econometric models also try to link banking and currency crisis. All in all, the number of studies of financial crises is vast.

However, the majority of recent crises studies relies on the binary choice model which has proven to be good at modelling financial crises and is a popular method among researchers. Nevertheless, the estimation of such a model is challenging due to its nonlinear specification. When estimating binary choice panel data models with fixed effects, the estimation of such a model is even more difficult as the estimators can be biased due to the incidental parameter problem. Recent advancement in the field of econometrics has led to a couple of different approaches to cope with this problem (Fernández-Val and Weidner

2016). This paper will focus on a simple parametric approach using a dynamic binary choice model with fixed effects to examine the link between financial crisis and selected macroeconomic and financial variables.

Even though financial crises have occurred for centuries and much previous research has sought to understand the phenomena, the early literature did not make use of econometric models to any greater extent (see Minsky 1977; Kindleberger, 1978). Therefore econometric research with regards to financial crises is a fairly new research discipline. As we know, economic research is not without its limitations, and neither does there exist a flawless economic model, nor a model that perfectly forecast financial crises (Hamdaoui, 2016). Adding to the difficulty of analyzing the causes of financial crises is the fact that no financial crisis is the same and there is no consensus regarding which macroeconomic and financial variables to include when modelling financial crises (Ganioğlu, 2013). Nevertheless, there has been an extensive amount of research on the subject which has led to narrowing the list of potential explanatory variables (e.g., Sachs et al., 1996 and Demigüc-Kunt and Detragiache 1998). Previous research also underlines the problem of no generally accepted way of defining a financial crisis (Claessens and Kose, 2013). The definitions vary from general causes such as speculation and mismanagement to definitions of financial crises based on macroeconomic and financial variables fluctuating between previously determined thresholds. Even more so, the results of the analysis might even depend on the chosen definition of a crisis as stated by (Van den Berg et al., 2008). However, one common distinction between the different types financial crises in the literature is Reinhart and Rogoff's (2009) five categories; inflation, currency, banking, debt, and stock market crisis, which will be used in this paper together with the dataset of financial crisis which they have constructed.

The purpose of this paper is to analyze the main causes of currency and banking crises in Latin America during 1990-2010 by looking at specific macroeconomic and financial factors. Latin America is chosen as a sample since it has been stricken by financial crises on a number of occasions throughout the years, making it a well-suited region to study. The paper aims to contribute to the existing literature on financial crises by implementing a dynamic binary choice panel data model with fixed effects. The binary choice model utilizes a maximum likelihood estimator with bias corrections to account for incidental parameter bias as

proposed by Fernández-Val and Weidner (2016). To the best of my knowledge, such an estimation approach has never been implemented for data on financial crises.

The paper will be structured in the following way. Section 2 introduces the economic history of Latin America in regards to financial crises. Section 3 is a literature review of financial crisis research. Section 4 establishes the methodology used by reviewing the data and the econometric method. Section 5 presents the results. Section 6 presents a discussion of the results. Section 7 concludes the essay.

2. Brief economic history of Latin America

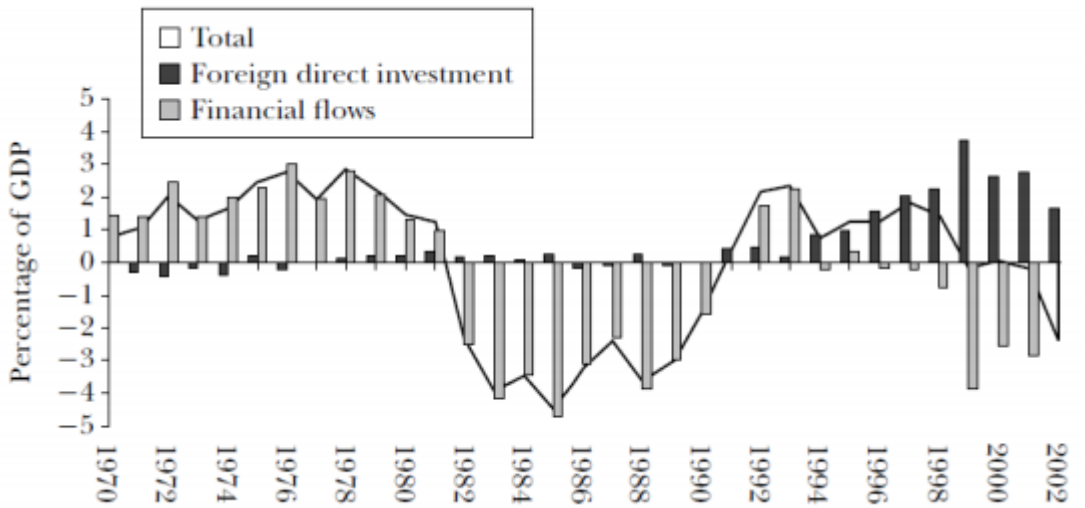
Latin America is no stranger to financial crises. The region has experienced more than 35 years of recurring financial crises. Two major waves of crises struck Latin America during 1970-2010, first a period of predominantly sovereign debt crises and currency crises during 1980-1990 and second a period of primarily currency crises and banking crises during the 1990s (Damill et al. 2013). In order to analyze the determinants of financial crises during 1990-2010, one must take a step back and look at the region's early economic history.

From 1950 to 1980 the Latin American countries grew at a remarkable pace of approximately 5.5% in GDP annually (Ocampo 2004). Conventional economic policies drove the growth, focusing on domestic, comparative advantages and capital accumulation (Cardoso and Fishlow, 1989). The growth period primarily happened under a heavily regulated capital inflow regime, overseen by the World Bank (WB) and the International Monetary Fund (IMF). However, during the 1960s and 1970s, many Latin American countries deregulated their financial markets, leading to an increased influx of foreign capital. Deregulation in combination with excess liquidity from mainly OPEC countries led to a substantial increase in foreign loans to Latin America. Ramos-Francia et al. (2013) exemplified the heavy inflow of foreign capital by showing that during the period of 1975-1982, Latin America's long-term foreign debt obligations grew from $68 billion (20% of Latin America's GDP) up to $238 billion (35% of Latin America's GDP).

Graph 1 below visualizes the capital inflow and outflow to the Latin American region during 1970-2002. A couple of noticeable events can be observed in the graph. The Mexican

sovereign default in 1982 led to substantial capital. Another defining period occurred around 1990, marking the start of economic recovery after the low growth period during 1980-1990. These two events will be further examined in the sections beneath.

Graph 1.[1] Capital inflows and outflows to Latin America during 1970-2002.



The high influx of foreign capital after the financial deregulation in the 1960s and 1970s resulted in inflated exchange rates, rising current account deficits and growth in external debt raised in foreign currency. Currency mismatch between Latin American countries and its creditors due to high amounts of foreign debt and dollarization further contributed to an unstable economic situation. This paired with higher global interest rates and appreciating exchange rates in relation to the dollar meant difficulties for Latin American countries to service their external debt. The unsustainable situation came to an abrupt end when Mexico defaulted on its sovereign debt in 1982, announcing that it could no longer service its debt obligations. This led to a loss of confidence from international capital markets which in turn resulted in a sharp stop in capital inflow to the region. The sovereign default of Mexico marked the start of the 'lost decade' stretching from 1980-1990, a period of characterized by large capital outflows due to excessive debt repayment and capital flight and stagnating economies, and soaring inflation (Dornbusch 1990). The social cost was tremendous. For example, the unemployment rate increased from 40.5% to 48.3% during the period of 1980-1990, and it would take until 2004 for the unemployment rate to reach the of 1980s levels.

[1] The graph is from Ocampo (2004). He used data from ECLAC and IMF's International financial statistics database.

The financial crisis also exacerbated the widespread inequality already present before the crisis (Ocampo, 2004).

The period of 1990-2010 in Latin America was characterized by both economic recoveries from the 'lost decade' as well as the second wave of financial crises, primarily in the form of currency and banking crises. A second surge of capital inflow to the Latin American region started in 1989 when the Mexican government accepted the Brady Plan[2] to restructure its sovereign debt. The Brady agreement was signed in parallel with the implementation of the Washington Consensus[3]. These policies further increased the inflow of foreign capital. Still, two major problems persisted from the previous financial turmoil in the 1980s, old financial obligations and weak financial regulation (Jácome, 2008). The capital boom set of in 1989 was halted in end of 1994 by the eruption of the Mexican currency crises. The Mexican government's sudden devaluation of the peso led to increased interest rates, capital flight, and soon after a change of currency regime from fixed to floating currency regime, which did not stop the currency to from continued depreciation. Having learnt from the debt crisis from the previous decade the IMF and US Treasury responded quickly by granting the Mexican government a $50 billion bailout package to hinder crisis contagion (Whitt, 1996). The response stifled major contagion and by the end of 1995 investor confidence was back, and capital inflow returned to Latin America. However, two years later the capital influx was once again reduced, this time due to the Asian and Russian financial crises in 1997-1998. The crises rattled international capital markets, creating severe financial and real economic effects that reached Latin American and decreased capital inflows yet again (Calvo and Mendoza, 2000). By the time of 1998, the decrease of capital inflow hit Brazil leading devaluations and eventually a full blown currency crisis in 1999. The Brazilian depreciation spilled over to the already volatile Argentinian economy which in turn led to a sovereign default in 2001 and change of currency regime[4] and substantial currency devaluation in

[2] The Brady plan was a strategy formulated by the US Treasury with the goal of dealing with emerging economies' debt levels. The core of the strategy was to implement reform programs, thus signaling to investors genuine ambitions of structural improvement.

[3] It summarizes the policy recommendations for reform packages for crises stricken countries proposed by the likes of the IMF, WB and the United States Treasury.

[4] For a detailed overview of exchange rate regimes in Latin America, see Frenkel and Rapetti (2011)

2002. The turmoil was not limited to Brazil and Argentina but hit Uruguay in 2002 as well, leading to a severe currency and eventually a banking crisis.

The financial crises that hit the Latin American region during 1990-2010 were not limited to currency crises. From the mid-1990s a high amount of banking crises struck the region. A lot of these banking crises were connected to the frequent currency crises, but they were also affected by large amounts of central bank money injected into the financial system. The excess money supply led to disrupted monetary policy, worsened macroeconomic conditions and caused additional widespread currency and banking crises, undermining economic and financial stability. Countries hit by these crises were among others Colombia, Paraguay, Peru, and Venezuela (Jácome, 2008).

Latin America experienced a less tumultuous period between 2002 and 2007 before the global financial crisis hit in 2008. The implementation of a new macroeconomic policy framework led to two major changes which would help to strengthen the Latin American economies and decrease overall risk (Frenkel and Rapetti, 2010). Firstly, many Latin American countries changed currency regime from pegged exchange rate to a managed floating rate. A pegged exchange rate suffers at the risk of coming under speculative attack, which happened during previous crises periods. A managed floating rate means that the exchange regime inhibits a dampening characteristic towards the impacts of shocks or business cycles, and at the same time leaving the option open for intervention in the foreign exchange market. These three characteristics of the managed floating rate helped to decrease the risk for currency crises in the Latin American region. Secondly, Latin American countries together with other developing nations started to decrease their current account deficits and generated current account surpluses. Where many of the Latin American countries previously received large capital inflows to finance current account deficits, many of these countries started to supply the global financial system with capital and accumulated foreign exchange reserves (Damill et al. 2013). These factors contributed to an economic stabilization of Latin America and the region experienced a prosperous period up until the global financial crisis hit in 2008. The adverse effects of the global financial crisis were not as severe as the previous waves of financial crises hitting Latin America. The accumulation of foreign exchange reserves led to more maneuverability in terms of counter-cyclical policy, dampening the effect of the crisis. However, a rapid decrease in global demand led to a

negative trade shock with economic stagnation and financial distress as a result (Ocampo, 2009).

The two waves of financial crises that hit Latin America in 1980-1990 and 1990-2010 can be summarized by a classical cyclical boom-bust pattern proposed by Hyman Minsky (1977) in combination with insufficient domestic financial systems. Deregulation of already weak financial systems, increase in capital flow, overvalued exchange rates were all factors that contributed to the high frequency of crises.

3. Literature review

The literature on currency and banking crisis is vast. Early research on banking crisis was conducted by Kindleberger (1973) and Minsky (1975) who claimed that banking crises are an inherent part of the business cycle through the tendencies of irrational behavior and shortsighted behavior of market participants. Others argue that it is the underlying structure of the balance sheet of banks that is to blame for banking distress (Diamond and Dybvig, 1983).

Early research on financial crises resulted in what is known as the three generations of currency crises models. The first-generation model was proposed by Krugman (1979) and enhanced by Flood and Garber (1984) and sought to understand the currency crisis concerning macroeconomic factors, poor policies and structural imbalances using macroeconomic modelling. These studies reasoned that worsening of macroeconomic conditions was a sign of a looming financial crisis. The studies focused on macroeconomic conditions such as sharp increases in domestic interest rates, substantial current account deficits, severe rise in exchange rates, decreasing amount of international reserves, unsustainable budget deficits and high inflation rates. The first generation models contributed greatly to our understanding of certain macroeconomic variables and their impact on financial crises. The examples used in the first generation models were speculative currency attacks on a fixed exchange regime.

The second-generation model was developed by Obstfeld (1986) and sought to update the first generation model by looking at the discrepancy between policy targets and economic

agents and their expectations. Obstfeld argued that uncertainty regarding a government's willingness to defend its pegged exchange rate leads to a scenario of multiple equilibria in which self-fulfilling prophecies might occur. Obstfeld underlined his point by exemplifying by pointing to speculative currency attacks on a fixed exchange regime, but this time the attack was motivated by the belief that other investors would initiate the attack, leading to an uncoordinated joint speculative attack on the currency regime.

The third-generation model of currency crisis developed when the two previous models failed to explain the Asian financial crisis in 1997. Kaminsky and Reinhart (1999) had a look at the dual crisis phenomena of currency and banking crisis which they coined 'twin crises.' Further research on twin crises was conducted by Rossi (1999) and Glick and Hutchinson (2000). Their work was corroborated by further research which underlined that currency and banking crises were the result of mutual causes stemming from the banking and the financial sector (Radalet and Sachs 1998; Krugman 1999; Mishkin, 1999, 2000). Complementing prior research were models that tried to capture the contagion effect often prevalent during financial crises. One such study concluded that contemporaneous crises hit separate countries revealing similar imbalances and instabilities, stating that different countries were often prone to the same external shocks (Aziz, 2000). Another study that confirmed these findings was conducted by Mendis (2002) who showed that banking crises hitting developing economies are often due to external shocks.

The early modelling of banking crises as well as the first and second generation of currency crises were mainly historical iterations of the anatomy of the crisis, usually backed up by boom-bust theories or a narrative of speculation or mismanagement or arguments underlined by macroeconomic modelling. The same theoretical approaches are still implemented today, but breakthroughs in the field of econometrics led to new ways of modelling financial crises (Hamdaoui 2016). The econometric methods started to gain popularity in the mid-1990s and became a part of the third generation currency crisis modelling as well as banking crisis modelling.

Although there have been a variety of models proposed to identify the driving factors of financial crises, the binary choice model is the most frequently used. The method is well proven in regards to empirically observed crises periods and in determining the likelihood of

these crises appearing. The binary choice panel data model is a nonlinear model that utilizes panel data to estimate the effects of explanatory variables on the likelihood for a financial crisis happening. The dependent variable is binary, taking the form of 0 if the crisis does not happen or 1 if the crisis happens (Berti et al., 2012). The model can be used either for finding the contemporaneous relationship between variables that trigger a financial crisis, or the model can be used to predict financial crisis or the associated factors contributing to it. This paper utilizes a dynamic binary choice model focusing on the contemporaneous relationship between factors triggering a financial crisis, even though most previous studies have focused on the predicting financial crisis.

The most frequently used method for predicting financial crises is the so called early warning system. This method can be divided into two different approaches, the parametric regression model and the non-parametric signal model (Aydin and Cavar, 2015). The non-parametric signal approach analyzes the pre-crisis period in order to identify indicators signaling the crisis. Univariate models are usually implemented for signal models. A signal is sent when a variable exceeds or are beneath a certain predetermined threshold value, warning that a crisis could occur. In order for the signal approach to work, it is imperative for the researcher to choose a threshold value which makes it easy to distinguish from the true and the false signals of the model. The model assumes that certain macroeconomic and financial variables fluctuate within an interval, but it is essential that these boundaries be correctly specified as true and false warning signals (Kaukko, 2014). Kaminsky, Lizondo, and Reinhart (1998) were the first to propose an early warning system by utilizing evidence on historical currency crises. Additional work in accordance to this method was done by among others Ottels et al. (2005) as well as Borio and Lowe (2002).

There have been wide arrays of studies implementing the binary choice model concerning currency and banking crises. Eichengreen et al. (1996) were among the first who pioneered the binary choice approach with respect to financial crisis. They used a probit model to analyze the appearance of currency crises in 20 industrialized economies. Their research indicated that speculative attacks on countries with fixed exchange rate have significant effects on the appearance of currency crisis. Sachs et al (1996) compared different macroeconomic variables in order to understand which countries were more vulnerable to contagion in the aftermath of the Mexican Currency crisis in 1994. Their research decreased

the list of suitable macroeconomic variables useful for predicting financial crisis using regression models. They found that change in exchange rate, lending booms, strength of banking system as well as level of international reserves have a significant impact on the likelihood of currency and financial crisis. Additional suitable macroeconomic variables were e.g. amount of broad money, current account, investment and saving, government consumption and capital inflows. Demirguc-Kunt and Detragiache (1998) determined that low economic output, high real interest rates, and high inflation have a significant impact on the probability of a banking crisis. Hardy and Pazarbasioglu (1998) were also among the pioneers to analyze the link between banking crisis and macroeconomic and financial variables using a binary choice model. Their work helped to limit the variables of interest, namely to; decreased growth in gross domestic product, sharply increasing-decreasing rates of inflation, increased volumes of credit, decrease in the real exchange rate together with negative trade shock. Rossi (1999) found a significant connection between the occurrence of banking crisis and sluggish economic growth and rapid credit expansion from domestic banks.

Furthermore Rossi found that changes in terms of trade, GDP growth, and banking instability to have significant impact on currency crisis. Kaminsky and Reinhart (1999) found that dual currency and banking crises are more severe when they occur together compared to when they occur individually and that banking crises tend to precede currency crisis. Both types of crises seem to be set off by an external shock, in the Latin American case due to rapid financial liberalization and large capital inflow. This led to a classic boom-bust cycle and they argued for strong regulation and supervision to counter the risks of rapid financial liberalization. They only considered macroeconomic variables and not financial variables and they did not have a look at regional patterns and they did not consider contagion. Chang and Velasco (2001) looked at financial crises in emerging economies, the relationship between currency and banking crises. They concluded that banking runs turn into currency runs when the country is operating under a fixed exchange rate regime and the domestic central bank acts as a lender of last resort.

Kumar et al. (2003) found a link between currency crises and lagged financial and macroeconomic variables. The most important variables were declining foreign reserves, economic growth as well as contagion. Laeven and Valencia (2012) studies underlined the

same results of Kaminsky and Reinhart, finding evidence that currency and banking crisis tend to arise simultaneously. Ganioğlu (2013) looked at different macroeconomic variables in developed and developing countries in order to analyze which these variables affected the possibility of a banking crisis. She found that current account, as well as credit and monetary expansion, were heavily linked to banking crisis. Comelli (2013) utilized both types of early warning system approaches in order to find which models best forecasted currency crisis in emerging market nations. He found that the regression based method outperformed the signal based non-parametric method. The regression based parametric method found a significant negative relationship between the probability of a currency crisis and decrease in the growth rate of GDP, current account balance, external reserves growth and foreign exchange reserve-to-short term external debt. Yurdakul (2014) looked at the simultaneous relationship between macroeconomic and financial variables and the financial crisis in Turkey between 1998 and 2001. She used a logit model and found that growth rate, high interest rate, inflation, stock index, non-performing loans, foreign exchange rate and unemployment rate all had significant effects for the probability of a financial crisis occurring.

As for studies with a specific focus on Latin America, Jácome (2008) made significant contributions to the understanding financial of crisis in Latin America during the mid-1990s and forwards. He found that the large amounts of central bank money injected into the financial system led to disrupted monetary policy, worsened macroeconomic conditions and caused currency and banking crises and thus undermining financial stability.

4. Data, variables and methodology

4.1 Data and variables

The data on explanatory variables is a panel dataset that contains annual observations for every country included from 1990 to 2010. The sample includes macroeconomic and financial variables for the Latin American countries; Argentina, Brazil, Colombia, Mexico, Paraguay, Peru, Uruguay and Venezuela. The specified period was chosen mainly in order to capture the most intensive period of currency and banking crisis (Garcia-Herrero, 2016).

Sovereign debt crises were the most prevalent and frequently occurring types of financial crisis during the 1980s in Latin America (Damill et al. 2013). Another reason for not choosing the period of 1980-2010 is because of data limitations, data on key variables such as interest rates are missing. This is confirmed by previous studies which omit this variable when studying the financial crisis episodes in Latin America during this period.

The countries included are chosen by economy size and crises frequency. Some Latin American countries were excluded from the sample for various reasons. Chile was excluded due to the crisis variables taking the value of zero for all the years, leading to problems in estimation while Bolivia and Ecuador were excluded due to lack of data on interest rates. Smaller countries such as Costa Rica, Cuba, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Nicaragua and Panama were excluded due to the size of their economies and less severe impact of currency and banking crisis. The empirical data on independent variables was collected from various IMF databases and the WB's World Development Indicators Database. The IMF databases used were International Financial Statistics Database (IFS) and the Financial Development Index Database (FD).

Table 1 displays 8 independent macroeconomic and financial variables selected believed to have an impact on the likelihood of a currency or banking crisis appearing. The explanatory variables are; one year lag of currency and banking crisis, growth in real GDP, inflation, real interest rate, current account to GDP, domestic credit supplied to private sector, growth in exchange rate, broad money to GDP, total reserves to GDP and financial development index.

Table 1. [5]Definitions of variables used in the study

Variable	Abbrevation	Definition
Dependent variable		
Currency and banking crisis	crisis	Currency and banking crisis
Explanatory variables		
Lagged currency crisis	crisis(-1)	Currency and banking crisis lagged on the previous year
Growth in real GDP	gdpg	Annual percentage growth of real GDP in local currency
Inflation	inf	Inflation in terms of GDP
Real interest rate	int	Real interest rate percentage
Current account to GDP	ca	Current account balance as a percentage of GDP in current USD
Credit to private sector	credit	Domestic credit to private sector by banks as a percentage of GDP in current USD
Growth in exchange rate	gex	Period average of growth in exchange rates in domestic currency per USD
Broad money to GDP	broad	Broad money as a percentage of GDP in current USD
Total reserves to GDP	reserves	Total reserves miuns gold in current USD in relation to GDP in current GDP
Financial developent index	fd	Measures how advanced a county's financial system

One year lag of the crisis is included since I believed that a crisis from the previous year will affect the likelihood of a crisis appearing during the year studied. All explanatory variables except for the lagged crisis variable are described in terms of percentage in order to avoid problems with non-stationarity (Verbeek, 2012). *Growth in real GDP* is included in order to proxy for the general health of the economy and how responsive the economy will be in the occurrence of financial crises (Hardy and Pazarbasioglu 1998; Rossi, 1999). *Inflation* is a good crisis indicator since a sharp increase of inflation might precede a banking crisis (Demirguc-Kunt and Detragiache 1998; Hardy and Pazarbasioglu 1998). *Real interest rate* might be a sign of an impending financial crisis (Demirguc-Kunt and Detragiache 1998). *Current account*

[5] Missing data for real interest rate was recalculated using the following formula: $real\ interest\ rate\ = nominal\ interest\ rate - inflation\ rate$

Real interest rate was calculated using short term money market rate minus annual change of GDP deflator. This action was performed for Argentine, Brazil, Mexico and Paraguay.

to GDP tells us about the fragility of the economy and has been found to be a precursor to financial crisis (Sachs et al., 1996; Ganioğlu 2013; Comelli 2013). *Domestic credit supplied to private sector* has been studied numerous time and an increase in credit have preceded financial crisis on a number of times Hardy and Pazarbasioglu 1998; Rossi 1999; Ganioğlu 2013). *Broad money to GDP* is a proxy for loose monetary policy which in itself can be a precursor to currency and banking crisis (Sachs et al. 1996; Ganioğlu 2013). *Total reserves to GDP* proxies for a decline in foreign reserves, which has been found to be significant for financial crisis (Kumar et al. 2003; Comelli 2013). *Financial development index* accounts for how well developed the financial system is in the respective countries. A well-developed financial system is ambiguous when it comes to a crisis. A highly developed and deepened financial system can act as a cushion against volatility in production, growth in investment and consumption. A well-developed financial system can also help to mitigate the effects of shocks to the economy. However, studies suggest that there exists a threshold where the effects of financial development and deepening decreases and even become negative (Dabla-Norris and Srivisal, 2013; Arcand et al. 2012).

Table 2 visualizes the descriptive statistics of the panel data. The astonishing values for inflation and real interest rate are worth to notice; they reflect the extreme situation in the Latin American region during the studied years.

Table 2. Descriptive statistics

Variable	Observation	Mean	Std. Dev.	Min.	Max.
Year	168	-	-	1990	2010
Currency and banking crisis	168	0,4167	0,4945	0,0000	1,0000
Growth in real GDP	168	3,4669	4,9195	-10,8945	30,0695
Inflation	168	118,7698	595,0206	-1,8366	6261,2400
Real interest rate	168	57819,8100	747849,1000	-61,6232	9693345,0000
Current account to GDP	168	-0,3265	4,4818	-8,6744	17,6044
Credit to private sector	168	24,5400	14,3502	6,8843	133,0759
Growth in exchange rate	168	1,0573	6,0174	-0,1678	69,4698
Broad money to GDP	168	32,9596	12,7979	10,5568	93,6589
Total reserves to GDP	168	0,1107	0,0547	0,0119	0,2891
Financial developent index	168	0,2580	0,1186	0,0663	0,6154

The data on the binary dependent variable is an extensive dataset constructed and coded by Reinhart and Rogoff (2011), covering 70 countries spanning over the years of 1800-2010. The set is extensive and frequently used in financial crisis literature. To my knowledge it is one of the most comprehensive datasets on historical financial crisis to this date. The cross sectional and time series sample covers the same countries and period as previously stated. The crisis variable is coded with a 1 if the crisis occurs in the specific year or a 0 if the crisis does not occur in the dataset. Reinhart and Rogoff (2011) divide financial crises into five different types; inflation, currency, banking, debt and stock market crises. This paper will study the currency crisis and the banking crisis variable. If any of the crises take place in an observed year they are coded with a 1. The same is true if both crises happen in the same year. By examining both currency and banking I hope to be able to analyze the immediate effect between the crisis and the explanatory variables contributing to the occurrence of the crisis.

Reinhart and Rogoff (2009) define currency crash as “an annual depreciation versus the US dollar (or the relevant anchor currency – historically the UK pound, the French franc, or the German DM and the present Euro) of 15 percent or more”.

They divide banking crisis into types; Type 1: systemic or severe banking crisis and Type 2: financial distress or milder banking crisis. Reinhart and Rogoff define banking crisis of type 1 “bank runs that lead to the closure, merging, or takeover by public sector of one or more financial institutions.” Banking crisis of type 2 is taking place “if there are no runs, the closure, merging, takeover, or large-scale government assistance of an important financial institution (or group of institutions), that marks the start of a string of similar outcomes for other financial institutions.”

4.2 Methodology

The purpose of this paper is to determine which factors contribute to currency and banking crises by looking at specific macroeconomic and financial factors. This is done by using a dynamic binary choice panel data model with fixed effects. The parameter coefficients are estimated by a logit model and it examines the contemporaneous relationship between financial crisis, in the form of currency and banking crisis, and frequently used macroeconomic and financial variables. This is done in order to assess the impact of these explanatory variables on the probability of the crisis occurring.

The binary choice model has been extensively used in previous research on financial crises (Yurdakul, 2014). The main reason for its popularity is because the binary choice model is non-linear and performs better than a standard linear regression model in the context of financial crisis research. A usage of ordinary least square method tends to result in bias and inconsistency in the estimators (Horrace and Oaxaca, 2006). Econometric theory rule out a linear relationship between financial crises and macroeconomic and financial variables, which is another argument for choosing the binary choice model in favor of a simple ordinary least squares method (Bussiere and Fratzscher, 2006). Another reason for using the binary choice model is due to its ability to facilitate a multivariate regression in order to

discern the relationship between multiple explanatory variables and the occurrence of a financial crisis (Alessi et al., 2014).

Although the binary choice model is widely used in financial crisis literature does not mean that the model is without flaws. Fernández-Val and Weidner (2016) recognized that fixed effects estimation of the coefficients for the explanatory variables in nonlinear panel data models, such as the binary choice model, run the risk of being highly biased. This is due to the incidental parameter problem which in the end might affect inference. In order resolve this issue they introduced a new way of estimating the fixed effects parameters through a jackknife and analytical bias correction[6]. The bias correction model will be applied to the baseline binary choice model.

The logit model is the specific binary choice model selected. The reason for choosing the logit model instead of the probit model is mainly due to previous research praxis. Even though both models are frequently used, the logit model seems to be marginally preferred to the probit model. The logit model might be favored in earlier research because of distributional reasons. The logit model distribution has fatter tails, making it more suitable to use the logit model to monitor rare events such as financial crises. The underlying distribution is also simpler. However, it is very typical for the logit and probit model to display similar output in the form of empirics on estimators, standard errors and probabilities Verbeek (2012).

The logit model specification for the binary choice model is the following;

$$\Pr(CRISIS_{it} = 1|X_{it}) = F(\alpha + X_{it}\beta)\epsilon[0,1]$$

In the expression above i denotes country and t denotes time. The binary dependent variable as stated earlier is currency and banking crisis, 1 denotes the crisis happening and 0 is the case of no crisis. X_{it} refers to the matrix of explanatory macroeconomic and financial variables. F represents the underlying function $F(z)$ consisting of the intercept α, matrix X_{it}

[6] For detailed explanation of the analytical and jackknife bias correction, see Fernández-Val, I. and Weidner, M. (2016) *Individual and Time Effects in Nonlinear Panel Data Models* with Large *N*, *T*". Journal of Econometrics, vol. 192, May 2016, p. 291-312

and the unknown β parameter for the explanatory variables. The parameter estimates are calculated using the maximum likelihood approach (Deutsch 2010).

$$F(z) = \frac{e^z}{1 + e^z} = L(z)$$

The expression above is the underlying standard logistic distribution function. The popularity of the model is due to its characteristics; the function will always range between values 0 to 1. This is always the case which makes the model ideal for estimating probabilities.

Model 1.

Model 1 is the baseline regression function named Z_{it} which will be used to analyze the simultaneous relationship between the chosen independent variables and the likelihood of financial crisis.

$$Z_{it} = \beta_0 + \beta_1 CRISIS(-1) + \beta_2 GDPG + \beta_3 INF + \beta_4 INT + \beta_5 CA + \beta_6 CREDIT + \beta_7 GEX + \beta_8 BROAD + \beta_9 RESERVES + \beta_{10} FD + \varepsilon_{it}$$

However, since I believe that unobserved heterogeneity across the cross-sections exits in the panel data, I introduce cross-country specific sectional dummies. By introducing these country specific fixed effects the model can account for unobserved heterogeneity, which otherwise risks causing inference problems (Arellano, 2003).

Model 2.

$$Z_{it} = \alpha_i + \beta_1 CRISIS(-1) + \beta_2 GDPG + \beta_3 INF + \beta_4 INT + \beta_5 CA + \beta_6 CREDIT + \beta_7 GEX + \beta_8 BROAD + \beta_9 RESERVES + \beta_{10} FD + \varepsilon_{it}$$

By accounting for country specific fixed effects, α_i, Model 2 is thought to have a better estimate of the simultaneous relationship of the macroeconomic and financial variables and the occurrence of a financial crisis. Hence the second model seems to be better suited for modelling financial crisis.

Nevertheless, two additional problems remain. The first problem is related to the characteristics of the dataset used. Since I am using a panel dataset it is important to acknowledge the time specific effects which capture the underlying cross-sectional dependence. The second problem is the so called incidental parameter problem (Verbeek, 2012). Fixed effects estimators for nonlinear panel data models might end up biased due to

this problem. As I continue to introduce new cross sectional and time dummies to consider unobserved heterogeneity and cross-sectional dependence, the estimators become biased. The problem is present in panel data models with fixed effects, as an increasing number of observations lead to an increasing number of parameters causing the incidental parameter problem. This in turn might cause an inference problem. Model 3 accounts for both of these problems (Lancaster, 2000).

Model 3.

$$Z_{it} = \alpha_i + \beta_1 CRISIS(-1) + \beta_2 GDPG + \beta_3 INF + \beta_4 INT + \beta_5 CA + \beta_6 CREDIT + \beta_7 GEX + \beta_8 BROAD + \beta_9 RESERVES + \beta_{10} FD + \tau_t + \varepsilon_{it}$$

By introducing both cross sectional dummies and time specific dummies Model 3 does a better job of accounting for the problem with unobserved heterogeneity and cross-sectional dependence. The time specific dummies are represented by τ_t. The model accounts for the incidental parameter problem by using a combination of analytical and jackknife bias correction proposed by Fernández-Val and Weidner (2016). This solves the problem with biased estimators thus avoiding making erroneous inference.[7]

[7] The bias correction operation itself is performed by using a command in STATA called logitfe. For detailed description on underlying calculations, see Cruz-Gonzalez et al. (2017).

5. Results

Table 3 displays the binary choice estimation results for the three different models.

Table 3. Estimation results

	Model 1		Model 2		Model 3	
Variable	**All variables**	**Only sign.**	**All variables**	**Only sign.**	**All variables**	**Only sign.**
crisis(-1)	0,6903	0,8771*	0,6284	0,6351	0,5595	0,4562
	(0,5198)	(0,4722)	(0,5631)	(0,5300)	(0,9684)	(0,7189)
gdpg	0,0550		0,0569		0,0626	
	(0,0509)		(0,0533)		(0,0801)	
inf	0,0227		0,0584		0,0060	
	(0,0288)		(0,0426)		(0,0859)	
int	0,0031		0,0116		-0,0070	
	(0,0207)		(0,0333)		(0,0508)	
ca	-0,0839		0,0273		0,0974	
	(0,0705)		(0,0846)		(0,1351)	
credit	0,0410		0,0906		0,0176	
	(0,0436)		(0,0583)		(0,0955)	
gex	12,5823***	10,9044***	15,2695***	14,3476***	18,1355*	16,1748***
	(3,5239)	(2,5834)	(4,0848)	(3,5648)	(9,5981)	(6,1375)
broad	-0,0391		0,003		0,0494	
	(0,0436)		(0,0518)		(0,0909)	
reserves	-11,0562*	-15,3988***	-32,0194***	-28,4811***	-16,3813	
	(5,9872)	(5,1958)	(10,9061)	(8,3666)	(16,8471)	
fd	2,3716		5,4661		14,7161	
	(3,0335)		(7,4793)		(15,2094)	
cons	-1,9008	-0,3657				
	(1,3521)	(0,5950)				
Individual FE	No	No	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	Yes	Yes
Observations	160	160	160	160	128	128
Pseudo R^2	0,4500	0,4210	-	-	0,5877	0,5096
Log-likelihood	-59,2295	-62,3485	-53,89	-57,5807	-36,5808	-43,5068

Be advised: ***,**,* represents a statistical significance at the 1%,5% and 10% level

I run three types of logit models in order to determine which explanatory variables have a significant contemporaneous effect on the dependent crisis variable. Three models are included in the results table. Each one of these models are split into two sub-models, one with all the variables included and one with only significant variables included. The one exception to the second sub-model is that the lagged crisis variable is always included. The reason for this is that we want to make sure that every version of the logit model is dynamic.

Model 1 is the baseline regression with neither country nor time specific fixed effects included. When all the variables are included in the first sub-model, the coefficients show that growth in exchange rate and total reserves to GDP are statistically significant on the 1 % level and 10% level respectively. The coefficients for growth in exchange rate is positive while the coefficient for total reserves to GDP is negative. The second sub-model of Model 1 only includes significant variables, and the results differ slightly in comparison to with the previous sub-model. The previously insignificant lagged crisis variable is significant at the 10% level and has a positive sign, signifying that a crisis in the previous year has will increase the likelihood of the observed year. The coefficient of growth in exchange rate is still positive at the 1% significance level while total reserves to GDP is still negative but is now significant at the 1% level as well. The coefficients and standard errors for growth in exchange rate have decreased in comparison to when I include all the variables in the first sub-model for Model 1. The same thing is true for total reserves to GDP.

Model 2 includes cross country fixed effects. When all variables are included in the first-model, the coefficients show that growth in exchange rate and total reserves to GDP are both statistically significant at the 1% level. The coefficient for growth in exchange rate is still positive while the coefficient for total reserves to GDP is still negative as well. The second sub-model of Model 2 only include significant variables, the only exception is the lagged crisis variable which is still insignificant but still included due to previously specified reason. The coefficients of growth in exchange rate and total reserves to GDP are still significant at the 1% level, growth in exchange rate showing a positive sign while total reserves to GDP displays a negative sign. The coefficients and standard errors for growth in exchange rate have decreased when comparing them to the first sub-model with all variables included for

Model 2. However, this is not the case for the total reserves to GDP variable. The coefficient has instead increased which means that the negative variable coefficient contributes less to the likelihood of a crisis than when comparing with the first sub-model which includes all the independent variables in Model 2. The standard errors have however decreased when comparing them to the second sub-model with all variables included for Model 2.

Model 3 contains both cross country fixed effects and time specific time effects as well as the bias correction method. When all the variables are included in the first sub-model the coefficients show that growth in exchange rate is the only significant variable. It is statistically significant at the 10% level. The coefficient for growth in exchange rate is still positive, as it has been from Model 1, 2 and 3. The second sub-model of Model 3 only include significant variables, the only exception being the lagged crisis variable which is still insignificant but still included, making sure that the model is dynamic. The coefficient of growth in exchange rate is still positive but now significant at the 1% level. The coefficients and standard errors for growth in exchange rate have decreased when comparing them to the first sub-model with all variables included for Model 3. One notable difference between the models is that while the variable total reserves to GDP is significant for both Model 1 and Model 2, it is insignificant for both sub-models of Model 3.

I ran robustness checks using a shorter dataset for currency and banking crises as well as a dataset including solely banking crises. The models proved to be robust. For detailed results, see appendix.

6. Discussion

The empirical results from the section above will be interpreted and discussed in order to evaluate which factors triggered the financial crises in Latin America during 1990-2010. The paper implements three models to analyze the effect of macroeconomic and financial variables on currency and banking crises in the region. The first model is a dynamic binary choice panel data model without fixed effects. The second model dynamic binary choice panel data model with individual specific fixed effects but without time specific fixed effects. The third model is a dynamic binary choice panel data model with both individual fixed

effects and time specific fixed effects which is estimated using maximum likelihood method with analytical and jackknife bias corrections suggested by Fernandéz-Val and Weidner (2016) which accounts for the incidental parameter problem. The variables growth in exchange rate is significant in all three models while the variable total reserves to GDP is significant in the first and the second model.

The positive sign for the growth in exchange rate coefficient suggests that an increased (decreased) growth in exchange rate contributes to an increase (decrease) in the probability of currency and banking crises happening. Macroeconomic theory states that the demand for an appreciating currency increases, but if there is a shock that changes investors' sentiments the effect might be the opposite leading to decreasing demand and a depreciating currency. The empirical observations during the studied crisis period largely confirm the economic theory recognizing a boom-bust pattern in the capital inflow and outflow to Latin America, mostly from 1990 to 2000, with subsequent appreciations and depreciations resulting in currency crashes. The significance of the exchange rate variable highlights the relationship between growth in exchange rate and the financial crises.

The negative sign for the total reserves to GDP coefficient implies that an increase (decrease) in total reserved with respect to GDP decreases (increases) the probability of a crisis happening. Central banks hold foreign reserves for a number of reasons. Some of the reasons for accumulating foreign reserves are to; preserving the value of the exchange rate, providing the market with liquidity, combating inflation, providing foreign investors with confidence and meeting external obligations. A low level of foreign reserves might thus be a signal of weak economic fundamentals or fragilities (Bastourre et al. 2009). Speculative attacks, debt obligations and countermeasures for capital flights contributed to the decreased foreign exchange reserves in Latin America during the 1990s to 2010s. (Luna, 2015). This led to an increased likelihood for financial crises. The significance of the reserve variable underlines this relationship.

This study focus on the occurrence of both currency and banking individually. Most previous research has either focused on one type of financial crises, currency crises or banking crises (e.g., Sachs et al. 1996; Kumar et al. 2003; Comelli 2013). Others studied the simultaneous occurrence of currency and banking crises, twin crisis (e.g., Kaminsky and Reinhart, 1999;

Rossi 1999, Hutchinson and Glick 2000). Even though this study differs from these two types of approaches the results show similarities with previous findings.

Sachs et al. (1996) found that changes in exchange rate have a significant impact on the likelihood of currency crises through exchange rate pressure. Their results underline mine, a positive relationship between change in exchange rate and the likelihood of financial crisis. Yurdakul (2014) studied the simultaneous effect of, among other variables, change in exchange rate and currency crisis in Turkey and found a positive relationship, also in line with the results obtained in this study. Hardy and Pazarbasioglu (1998) found a significant relationship between changes in exchange rate and banking crises but for a 50 country-sample. The relationship was negative though, differing from the positive relationship of this study. However, Hardy and Pazarbasioglu (1998) acknowledge that the variable captures the appreciation and then sudden depreciation of the real exchange rate. The reason for the negative sign in their study is because they conclude that banking distress increases with a sharp decline in exchange rates.

Total reserves to GDP had a significant impact on the likelihood of a crisis in Model 1 and Model 2, but not regarding Model 3. Kumar et al. (2003) studied currency crises and found a significant negative effect of declining foreign reserves. The findings of Kumar et al. were further solidified by the findings of Comelli (2013) who found that the stock of foreign exchange (albeit to short term debt, which was not the measurement used in this study) has a negative relationship with a currency crisis. The result of both previous studies is in line with my findings.

The dynamic binary choice panel data model with fixed effects and bias correction (Model 3) has one significant variable, growth in exchange rate. Even though it seems tempting to continue the analysis of Model 1 and Model 2 due to the significance of two variables instead of one, this would be ill-advised. Model 1 and Model 2 reflect the dynamics of the crises badly, mainly because of unobserved heterogeneity and cross-sectional dependence leading previously stated erroneous inference. Even though Model 3 is lacking one previously statistically significant variable, it makes up for this due to correct specification and its bias correction for the incidental parameter problem. It does not matter how good the results of an econometric model are if the model in itself is wrongly specified and no

inference can be deducted. The fact that one variable is still significant should not be downplayed, it means that Model 3 still does a decent job of explaining what factor can be associated with currency and banking crises.

However, growth in exchange rate is the only significant variable in the final model and this raises some questions. At first glance, there might be some confusion regarding the difference between the dependent variable currency crisis (one of the dependent variables, the other being banking crisis) and the explanatory variable growth in exchange rate. One could argue that a sharp and severe decrease in the growth in exchange rate might, in fact, be a currency crisis if the currency depreciates to a certain threshold. However, the dependent variable will either take the value of 1 or 0, while the value for the explanatory variable growth in exchange varies across time in my sample. Also, the model codes both currency and banking crisis 1 or 0, underlining that a banking crisis might as well be affected by the explanatory variable growth in exchange rate. A sharp depreciation of exchange rate might de facto be a currency crisis (if the currency loses a substantial amount of its value) but a sharp depreciation of exchange rate can certainly not be a banking crisis de facto. However, a currency crisis or a sharp depreciation in currency might lead to a banking crisis eventually.

A second look at the result table above raises some additional interesting questions. In general, the model seems to be better suited for modelling currency crises compared to banking crises. This can be understood from the perspective of economic theory and empirical observations from the crisis periods in Latin America. Another reason to why Model 3 seems to be better suited to modelling currency crises might be because the explanatory macroeconomic and financial variables included are better at explaining the occurrence of currency crises than banking crises. There is some merit to this idea since previous literature that focuses on currency and banking crises individually include different explanatory variables in their models. In general, currency crises seems to include more general macroeconomic and financial variables while banking crises focus on some macroeconomic variables but more specifically financial variables. There seems to be a drift towards using an extended amount of credit variables and bank specific variables (such various credit ratios and non-performing loans) when modelling banking crises. However, these variables are generally excluded when modelling other crises than banking crises. This

could be considered a weakness for my model, but the purpose of the thesis is to implement the bias correction to a standard binary model and not to develop an economic model that reflected the events in Latin America with extreme accuracy.

Despite the fact that Model 3 seems to be better suited for modelling banking crises, there are still some studies that show that growth in exchange rate has a significant impact on banking crises (Hardy and Pazarbasioglu 1998). A case could also be made for analyzing the twin crises and the connection between them. The motivation is a bit different for this approach compared to the individual crisis approach which aims to pinpoint explanatory variables and their effect on a specific type of crisis. The aim for the twin crisis approach is still to identify explanatory variables for both type of crises but they also examine their interconnectedness, analyzing which of the crises run the risk of setting the other one off. For example, Hutchinson and Glick (2002) discovered that a banking crisis may be a precursor to currency crises but that the reversed relationship was not true.

This study is by no means without its flaws and limitations. First of all, the results could have been more accurate given a higher amount of observations, either by using annual data spanning over a longer period or by using monthly observations. Second, it would have been interesting to look at the period from 1980 to 2018. An extension of the period could have analyzed key events such as both waves of financial crises, the global financial crises and the current economic situation in the Latin American region. The benefit of including a larger sample of observations when it comes to studying financial crises is the fact that financial crises are rare events. However, I chose to study 1990-2010 due to two reasons. Currency and banking crisis were especially frequent during this period in Latin America. Data limitations for the period 1980-1990 also contributed to the choice of 1990-2010. Third, this study analyzes financial crises using a contemporaneous relationship model. However, the early warning system (EWS) is the most frequently used method to analyze the likelihood of financial crises. This in itself does not necessarily mean that the paper is weaker; it is more common to use a predictive model in order to combat financial crises proactively.

Fourth, a single focus on one type of crisis, currency for example, could have provided a better understanding of which factors are associated with a currency crisis specifically. By focusing on two types of crises it might be difficult to see which variable is associated with

which kind of crisis. An alternative to this could have been to run different regressions for five types of crises (e.g., Reinhart´s and Rogoff's (2011) definition; currency, inflation, banking, debt and stock market crises).

7. Conclusion

This paper sought to analyze the main factors triggering currency and banking crises in Latin America during the 1990-2010 by looking at specific macroeconomic and financial factors. The paper aimed to contribute to the existing literature on financial crises by implementing a dynamic binary choice panel data model with fixed effects and bias corrections to account for incidental parameter bias as proposed by Fernández-Val and Weidner (2016). I gave a brief overview of the Latin American economic history and the waves of financial crises that hit the region between the years of 1970-2010. The historical background was followed by a review of previous literature on financial crises, with methodology spanning from historical exposé and macroeconomic models to modern econometric approaches. The dynamic binary choice panel data model with fixed effects indicated that growth in exchange rate has a significant positive impact on the likelihood of currency and banking crises, which is in line with the majority of previous research. The econometric method showed a significant result for a variable traditionally connected to currency crises, and a possible explanation to this are the macroeconomic and financial variables included. The discussion also reflects upon the limitations of the study. For instance, a larger sample with more observation would likely provide more precise results. For future research it would be interesting to conduct a similar study using dynamic binary choice panel data model with fixed effects and bias corrections and implementing an early warning system. This would hopefully allow for more precise forecasting methods for financial crises.

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9. Appendix

Table 4. Estimation results robustness check. Currency and banking crisis, 1990-2006.

	Model 1		Model 2		Model 3	
Variable	**All variables**	**Only sign.**	**All variables**	**Only sign.**	**All variables**	**Only sign.**
crisis(-1)	0,7883	0,9103*	0,7603	0,7197	0,7872	0,4589
	(0,5512)	(0,5021)	(0,6108)	(0,5736)	(1,0225)	(0,7173)
gdpg	0,0442		0,0508		0,0661	
	(0,0537)		(0,0572)		(0,0809)	
inf	0,0042		0,0398		0,0493	
	(0,0315)		(0,0465)		(0,0988)	
int	-0,0012		0,0024		0,0014	
	(0,0222)		(0,0341)		(0,0493)	
ca	-0,0913		0,0246		0,0910	
	(0,07554)		(0,0895)		(0,1393)	
credit	0,0410		0,0916		0,0502	
	(0,0448)		(0,0616)		(0,1023)	
gex	14,9201***	11,6607***	17,3293***	17,5866***	15,9712*	16,5705**
	(4,2314)	(2,9554)	(4,8674)	(4,5914)	(9,6216)	(7,1506)
broad	-0,0612		0,0058		0,0505	
	(0,0523)		(0,0664)		(0,1061)	
reserves	-9,0163	-13,61109**	-34,7207**	-30,9303***	-26,6846	
	(6,6004)	(5,6946)	(13,9659)	(10,7340)	(21,3564)	
fd	2,5851		1,5783		15,4915	
	(3,3853)		(10,8316)		(19,9915)	
cons	-1,4097	-0,5696				
	(1,6136)	(0,6397)				
Individual FE	No	No	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	Yes	Yes
Observations	128	128	128	128	112	112
Pseudo R^2	0,3987	0,4315	-	-	0,5530	0,4940
Log-likelihood	-53.2689	-50,3559	-48,0484	-45,7495	-34,5055	-39,0531

Be advised: ***,**,* represents a statistical significance at the 1%,5% and 10% level

Table 5. Estimation results robustness check. Banking crisis, 1990-2010.

	Model 1		Model 2		Model 3	
Variable	**All variables**	**Only sign.**	**All variables**	**Only sign.**	**All variables**	**Only sign.**
crisis(-1)	3,1270***	3,2092***	3,6892	3,8346***	0,3439	1,7093**
	(0,6600)	0,6321	(0,8525)	(0,8322)	(2,3932)	(0,8510)
gdpg	-0,1574*	-0,1895***	-0,1770	-0,1840***	0,0681	
	(0,0706)	(0,0663)	0,0777	(0,0685)	(0,1447)	
inf	-0,0050		-0,0021		-0,0269	
	(0,0116)		(0,0127)		(0,0571)	
int	0,0148	0,0094**	0,0146	0,0127***	0,0041	
	(0,0091)	(0,0045)	(0,0089)	(0,0048)	(0,0266)	
ca	0,1551		0,2189	0,2004**	0,1269	
	(0,0887)		(0,1107)	(0,1009)	(0,2580)	
credit	0,1327	0,1190***	0,2916	0,3005***	-0,0847	
	(0,0517)	-0,0428	(0,0869)	(0,0814)	(0,2786)	
gex	-1,4838	-1,2623**	-1,9881	-1,9738***	3,5919	
	(0,9321)	(0,6312)	(1,0853)	(0,6577)	(5,1729)	
broad	-0,1805**	-0,1727***	-0,1319		-0,2156	
	(0,0728)	(0,0636)	(0,0886)		(0,2115)	
reserves	-8,01445		-7,1021		35,2959	
	(8,9772)		-12,2707		(37,4236)	
fd	2,395483		-3,1309		-13,6746	
	(3,3582)		(8,5107)		(25,1846)	
cons	0,477	0,2943				
	(1,8220)	(1,2657)				
Individual FE	No	No	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	Yes	Yes
Observations	160	160	160	160	88	88
Pseudo R^2	0,4402	0,4124	-	-	0,6483	0,3718
Log-likelihood	-41,5323	-43,5967	-35,3795	-35,6976	-19,3605	-34,5775

Be advised: ***,**,* represents a statistical significance at the 1%,5% and 10% level

Table 6. Estimation results robustness check. Banking crisis, 1990-2006.

	Model 1		Model 2		Model 3	
Variable	**All variables**	**Only sign.**	**All variables**	**Only sign.**	**All variables**	**Only sign.**
crisis(-1)	2,8850***	2,9881***	3,5394***	3,6269***	0,3439	1,7093**
	(0,6547)	(0,6297)	0,8731	(0,8409)	(2,3932)	(0,8510)
gdpg	-0,1616**	-0,1845***	-0,1864**	-0,2117***	0,0681	
	(0,0716)	(0,0671)	(0,0816)	(0,0781)	(0,1447)	
inf	-0,0027	0,0091*	-0,0054		-0,0269	
	(0,0118)	(0,0045)	(0,0128)		(0,0571)	
int	0,0127		0,0173**	0,0156***	0,0041	
	(0,0091)		(0,0079)	(0,0046)	(0,0266)	
ca	0,1511		0,2302**	0,2202**	0,1269	
	(0,0863)		(0,1051)	(0,0991)	(0,2580)	
credit	0,1234**	0,1048**	0,3103***	0,2903***	-0,0847	
	(0,0505)	(0,0422)	(0,0917)	(0,0804)	(0,2786)	
gex	-1,4831	-1,2083*	-2,0392*	-2,5246***	3,5919	
	(0,9293)	(0,6223)	(1,1059)	(0,6974)	(5,1729)	
broad	-0,1616**	-0,1517**	-0,0591		-0,2156	
	(0,0689)	(0,0626)	(0,0863)		(0,2115)	
reserves	-6,2598		-3,3893		35,2959	
	(9,4473)		(16,2229)		(37,4236)	
fd	3,6865		0,2596		-13,6746	
	(3,5823)		(9,6271)		(25,1846)	
cons	-0,1133	0,1977				
	(1,8505)	('1,2327)				
Individual FE	No	No	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	Yes	Yes
Observations	160	160	160	160	128	128
Pseudo R^2	0,4500	0,4210	-	-	0,5877	0,5096
Log-likelihood	-59,2295	-62,3485	-53,8900	-57,5807	-36,5808	-43,5068

Be advised: ***,**,* represents a statistical significance at the 1%,5% and 10% level