A TIME-SERIES CROSS SECTION ANALYSIS OF THE ROLE OF FINANCIAL DERIVATIVES IN THE EMERGING MARKET FINANCIAL CRISES OF THE 1990S

Ayça SARIALİOĞLU HAYALİ(*)

Abstract: The 1990s witnessed several remarkable international financial crises around the world, especially in emerging market countries and can be called "the international financial crises and instability era" in the history of political economy. In the financial crisis literature, the potential reasons of these crises have been extensively studied. However, the role of financial derivative instruments as one of the possible key factors in international financial crises of the emerging markets in the 1990s has not been covered fully and not undertaken empirically, especially, by a time-series cross section analysis. This paper aims to investigate the role and significance of financial derivatives in the financial crises of the emerging market countries in the 1990s, notably the South East Asian Crisis of 1997 and the Brazilian Crisis of 1999, through a time-series cross section approach. The major findings indicate that financial derivatives, designed to hedge financial risks, have exposed emerging market economies to remarkable risks and financial instabilities in the 1990s and they had role in such crises both directly and indirectly.

***Key Words*:** international financial crises, financial derivative instruments, time-series cross section analysis

FİNANSAL TÜREVLERİN 1990'LARIN YÜKSELEN PİYASA FİNANSAL KRİZLERİNDEKİ ROLÜNÜN BİR ZAMAN SERİSİ YATAY KESİT ANALİZİ

Özet: 1990'lar dünya genelinde, özellikle yükselen piyasa ekonomilerinde pek çok kayda değer uluslararası finansal krize şahit olmuştur ve bu dönem, politik ekonomi tarihinde "uluslararası finansal krizler ve istikrarsızlık dönemi" olarak adlandırılabilir. Finansal kriz literatüründe, bu krizlerin olası nedenleri geniş ölçüde çalışılmıştır. Fakat olası bir anahtar rol olarak finansal türev araçların 1990'lardaki yükselen piyasaların uluslararası finansal krizlerindeki rolü tam olarak kavranmamış ve ampirik olarak incelenmemiştir, özellikle, bir zaman serisi yatay kesit analizi yöntemiyle. Bu makale, finansal türevlerin 1990'lardaki yükselen piyasa ülkelerinin finansal krizlerindeki, özellikle 1997 Güneydoğu Asya Krizi ve 1999 Brezilya Krizi'ndeki rolünü ve önemini zaman serisi yatay kesit analizi yöntemiyle araştırmayı amaçlamaktadır. Ana bulgular göstermektedir ki finansal riskleri sabitlemek için tasarlanmış finansal türevler, 1990'larda yükselen piyasa ekonomilerini ciddi risklere ve finansal istikrarsızlıklara maruz bırakmış ve bu krizlerde hem doğrudan hem dolaylı rol oynamıştır.

Anahtar Sözcükler: uluslararası finansal krizler, finansal türev araçlar, zaman serisi yatay kesit analizi

---

(*) Yrd. Doç. Dr. Karadeniz Teknik Üniversitesi, İİBF İktisat Bölümü

I would like to thank Dr. Jonathan Perraton and Prof. Karl Taylor from The Department of Economics of the University of Sheffield, my previous affiliation and also the affiliation at which the work was conducted first, for their valuable feedbacks.

I. Introduction

The restructuring of the world economy following the collapse of the Bretton Woods fixed exchange rate system in 1973, led to the emergence of a new world monetary order, which Steinherr (2000) describes as "a more diverse, complex and less rigid system" (Steinherr 2000). This process was enhanced by the policies of liberalisation and deregulation of financial markets in the 1980s and gained momentum in the 1990s, under the process broadly termed "globalisation". This is due to significant developments in the information and communication technologies and in the political arena through having entered a new bipolar world order after the collapse of the Soviet Union.

Although by virtue of financial liberalisation, the volume, speed and prevalence of capital flows has risen sharply; this largely unrestricted movement of capital has also made the emerging market countries unstable and crisis prone by spreading crises to fragile economies. In this regard, in the 1990s, many parts of the developing countries, which underwent almost complete and rapid liberalization in order to open up their financial markets to both greater capital flows and a wider array of capital vehicles, have witnessed the new form of capital flows. However, this new form of capital flows is criticised in terms of being volatile and possibly short lived character, such as stocks and bonds and parallel transactions, the so-called "shadow transactions" such as "financial derivative instruments" **(Derivative Instruments are the contracts, whose value or price depends on, or is derived from, that of another asset such as a commodity, security, interest rate, index, an event or foreign exchange rate. The term "derivative" is used to stress the fact that the prices or values of these contracts are "derived from" the price of an underlying item such as a commodity, security or the value of interest rate, foreign exchange rate, index or an event (Derivatives Study Centre/Derivatives Glossary). There are four main types of derivative instruments: Forwards, Futures, Options and Swaps. Beside these traditional types, there are some special purposed derivative instruments called "Hybrid Instruments" which are determined by combining these traditional instruments with each other or with the other traditional securities and debt instruments. Financial derivative instruments, which constitute the main concern of this paper and will be called "derivatives" in what follows are the subject of financial contracts whose value do not directly depend on the contracts themselves, rather depend on the new values of financial assets, which the mentioned contracts are linked. Such new values of financial assets, which can be exchange rates, stock exchanges and interest rates, emerge according to the developments in the market conditions of financial assets)** (Dodd 2002a). In this regard, Tickell (2000) puts the concerns about financial derivatives as they have "potential to undermine global finance" (Tickell 2000). In other words, this openness has meant not only openness to growth of output, welfare and international trade, but also referred, ironically, to the negative effects of these international transactions, of which the most important one is the international financial crises experienced severely across the world in the 1990s.

Although the possible determinants of the crises in the 1990s have been extensively studied, the role of financial derivative instruments as one of the

possible key factors in international financial crises and financial instability has not been covered fully and not undertaken empirically. The main aim of this paper is to analyze the role of financial derivative instruments in the emerging markets international financial crises since 1990, notably the South East Asian Crisis of 1997 and the Brazilian Crisis of 1999 in an analytical manner through a time-series cross section (TSCS) approach. In this regard, TSCS analysis, which is especially recommended for the applied works in politics, comparative politics and international relations (IR), has more advantages over panel data analysis, in the case of the data when its time dimension (T) is bigger than individual dimension (N), namely, in the case of T>N. Although even in such cases, panel data analysis was not hesitated to be used in the applied literature and text books on panel data econometrics, TSCS also could be strongly advised in the applied literature (See Beck 2001; Beck and Katz 1995).

The paper argues that derivatives, designed to hedge currency risks and thus to prevent financial instability after the collapse of the Bretton Woods System, in practice exposed developing economies to significantly greater risks and financial instabilities in the 1990s. Moreover, they played a much greater role than previously estimated in these crises. It handles the topic in three parts. After the introduction, in the first part, the role of financial derivatives in financial instability and crises is tackled in terms of direct and indirect crisis effects. And in the last part, which is the empirical part of the paper, the hypotheses of the paper are tested. Within this framework, first, data set is handled including the dependent and independent variables used in the research. Second, the methodology of TSCS analysis is tackled. Third, testing the direct crisis effect and the indirect crisis effect of derivatives are handled.

II. The Role of Financial Derivative Instruments in International Financial Crises

Viewed at the macroeconomic level, financial derivative instruments can act as a destabilizing factor creating vulnerability to crisis, and also, after the crisis began, the collapsing process was accelerated and deepened by the usage of some specific types of derivatives (Dodd 2000). In this regard, it can be said that in especially weakly regulated, undercapitalized financial systems and imbalanced derivative markets, derivatives are highly open to be used for economically harmful purposes such as evading prudential regulations by leading to huge risky positions represented by high leverages, manipulating accounting rules and credit ratings, avoiding from taxation and capital requirements.

Moreover, during the crisis, the derivatives affect the dynamics of the crisis by speculation against local currency, "which is accepted as one way bet" under pegged exchange rate regimes, leading to massive capital outflows and the collapse of the currency. Lien and Zhang (2008) put it as follows: "The

misuse of financial derivatives lays the foundation for financial crisis, and financial derivatives can accelerate capital outflow during a crisis. As a consequence, the volatility of international capital flow increases, which exacerbates the crisis by rendering the dynamics of crisis more unpredictable" (Lien and Zhang 2008). In this respect, Savona *et al.* (2000) argue that although at the microeconomic level there are advantages of derivatives for market agents, at macro level, it should be paid attention to "the great potential systemic instability that derivatives could generate" (Savona *et al*. 2000). On the other hand, it can be said that even in microeconomic level, there have been potential challenges for market agents, which Naor (2006) puts as follows:

> "A complementary effect to the scarcity in regulation, germane to this paper, was the lack of clear accounting standards governing reporting on derivatives. A possible outcome of these effects is the fact that financial derivatives were the subject matter of several financial fiascos in the '90s, such as Gibson Greetings, Procter & Gamble, Orange County, as well as the infamous Enron case" (Naor 2006).

It can be said that this list can be enlarged by adding the last cases of Wall Street investment banks such as Bear Sterns, Lehman Brothers, Merrill Lynch, Goldman Sachs and Morgan Stanley, in addition to the American International Group Inc, the largest insurance company in the world (Marcos and Cintra 2009), after the last global financial crisis, which points out that even regulated financial systems can remain vulnerable to crises by virtue of the sophisticated Over the Counter (OTC) derivatives, such as Credit Default Swaps (CDSs).

The Role of Financial Derivative Instruments in International Financial Crises can be handled and redefined as follows: 1-Direct Crisis Effects and 2-Indirect Crisis Effects of the Financial Derivative Instruments in International Financial Crises.

A. The Direct Crisis Effects

Within the framework of the direct crisis effect of derivatives, the presence of derivatives in the unregulated derivatives markets of developing world of the 1990s is tackled as a destabilizing factor of the financial sector and the economy as a whole, which creates vulnerability to crisis, namely, affects the dynamics of a crisis, whether in the floating or fixed exchange rate systems. As a next step, during the crisis, in the fixed exchange rate system case, whether a hard, soft or crawling peg, the presence of derivatives is handled as a special set of challenges for a government which tries to maintain the fixed exchange rate (Dodd 2002b). In this case, the derivative products are handled as they affect the dynamics of the exchange rate during the crisis and once the crisis begins they contribute to the volatility of the exchange rate. In this regard, it can be said that developing economies are highly open to economically harmful

usages of derivatives due to they do not have enough regulations to monitor these risks and prevent such activities. They mostly do not have appropriate legal framework or power to implement such framework and have political corruption or market failures such as moral hazard problems or asymmetric information. In these situations, the derivatives obtain a significant potential in making the developing countries vulnerable to financial crises more rapidly and destructively. The direct crisis effect of derivatives can be handled as first *vulnerability to crisis effect* and second *crisis-driven capital outflow effect*.

Vulnerability to Crisis Effect

In the unregulated and imbalanced derivatives markets of developing world of the 1990s, the presence of derivatives is tackled as a destabilizing factor. This creates vulnerability to crisis, whether in a floating or fixed exchange rate system mainly for two reasons which are as follows: The first one is the fact that derivatives were open to be used economically harmful purposes in the unregulated derivatives markets of developing world of the 1990s in which deregulation and liberalization of the markets were highly recommended and supported. In this regard, "the abuses of derivatives" and "the negative consequences of the misuse of derivatives" of Dodd (2003) can be tackled within this framework. The abuses of derivatives which can be listed as credit or default risk, manipulation and moral hazard, evading prudential regulation and information distortion (Dodd 2003) create vulnerability to crises, by threatening the financial market integrity and efficiency.

Garber (1998) argues that derivatives can be used to evade prudential market regulations such as "reserve requirements, limits on lending to individuals, firms or sectors, liquidity requirements against the domestic or foreign exchange liabilities, net foreign currency exposure limits, capital requirements etc." aiming at maintaining financial stability through preventing capital inflows away from risky or inefficient projects (Garber 1998). In this regard, derivatives are criticised in terms of destroying the efficient allocation of funds by masking the actual risk in an investment (Kregel 1998). Partnoy (1998) tells real *inside stories* about how financial derivatives could be used for information distortion, reducing transparency and evading prudential regulation and how they could be involved in moral hazard and fraud situations in selling such sophisticated derivatives to clients, who sometimes even did not know what they bought in real and how the products that they bought were risky (Partnoy 1998).

Derivatives can also be used to avoid tax liabilities and capital requirements by managing reported earnings through moving income from one period to another, by showing today's profits in the future, through using accounting tricks. Within the framework of "information distortion", Dodd (2002b) argues that derivatives "reduce transparency by being off-balance

sheets", thus, cause distorting the meaning of balance sheets of firms as "the basis for measuring the risk profile of firms" (Dodd 2002b). So, Dodd (2002b) maintains that the balance of payments accounts of those countries do not show the real country risks since by being off-balance sheets, derivatives distort the meaning of balance sheets as the basis for measuring the risk profile of firms, central banks and national accounts, thus "reducing transparency" **(For a detailed discussion of the Effects of Derivatives on Interpretation of Balance of Payments Accounting see Garber (1998))**. In other words, there became a gap between the total risk exposure and that reflected by balance sheets (Dodd 2002b).

Within the framework of the negative consequences of the misuse of derivatives, "leverage, illiquidity and channel for contagion" can be handled as the factors creating vulnerability to crisis, thus making the presence of derivatives a possible cause of the emerging market crises. Dodd (2003) points out that the negative consequences of misuses of derivatives are experienced even in the case where derivatives are being used primarily for hedging or risk management purposes in the presence of poorly structured and improperly regulated derivatives markets. He notes that "even though individual firms and investors successfully hedge by shifting risk from those who can least beat it and towards those who are more willing and able to do so, the entire financial sector now includes new and greater risks from the presence of this trading activity and the resulting outstanding derivatives contracts" (Dodd 2003).

Derivatives are very open to be used for highly leveraged positions, which can be defined as "taking a large position with small amounts of money" by creating huge risks since "the potential gain as well as the potential loss is very large" (Rothig 2004). One of its negative consequences is pointed out by Dodd (2003) as "encouraging greater amounts of currency speculation and empowering those who might mount a speculative attack on a country's currency regime" (Dodd 2003). Hence, the short-term character of derivatives together with this high leverage opportunity make derivatives powerful speculation and manipulation tools **(Due to the huge opportunities that financial derivatives allow to speculators, speculation is mostly seen with manipulation, such as making *corners* and *squeezes*. *Corners* point out the fact that speculators with superior information gradually sell the stocks, which they had obtained a large number of them before with the aim of making a temporary monopoly, in order to keep the prices high. *Squeezes* point out the fact that those speculators with superior information, who know that not all stocks can be obtained on favourable terms at the futures delivery date, threaten the short sides of the contract to take delivery especially when they have problems to deliver. Thereby *squeezing*/ forcing them to deliver goods which are not on favourable terms. In this regard, this kind of manipulation is done profitably when the speculator takes a long futures position after he buys the underlying item in the spot market in order to increase the prices as long as his futures position is larger than his spot position, which is called "punching the settlement price". It is noted that "a large player can always profitably corner and squeeze the market" (Rothig 2004))**, which are mostly seen together due to huge opportunities that derivatives allow to speculators. Illiquidity which is defined as "the lack of liquidity and the lack of active market trading" by Dodd (2003)

is also a relevant case for derivatives markets, especially for the OTC markets (Dodd 2003). Rothig (2004) maintains that margin requirements and daily marking to market character of futures, which can lead herding behaviour as a massive sale from the derivatives portfolio in one emerging country due to the crisis in another one, generate a liquidity problem as "one side of the market shrinks while the other side booms" by creating imbalanced markets in even exchange traded derivatives. This liquidity problem can stem from grouping all emerging markets together although they are too different from each other through herding behaviour or entering short positions in one country in order to fulfil the commitments of the margin requirements in the crisis country. This can also be experienced in markets where there is consistently one direction as the currency weakens leading all participants taking short positions (Rothig 2004).

In this regard, derivative transactions in huge amounts also point out the potential "Systemic Risk" due to the possibility of a rapid expansion of counterparty credit risk during the economic downturn. It is noted that these credit risks might then transform to actual delinquent counterparty debts and obligations during an economic crisis. Although, Darby (1994) argues that systemic risk is diminished by virtue of derivative instruments through their ability of cancelling or shifting the risk to the ones that most able to manage and bear it (Darby 1994), the Bank of International Settlements (BIS)'s Promisel Report handles the derivatives markets as leading to greater systemic risk **(In this regard, McClintock (1996) summarizes the points which the report stressed as follows: First, since some derivative markets constitute an oligopoly as involving just a few market makers, a default in obligations of one of them would create more repercussion effects. Second, increased competition between financial intermediaries, which constitute the counterparts of hedge funds, make them tackle greater risks when they maintain large lines of credits to these speculative institutions, leading to the increase of potential sources of failure. Third, due to derivatives lack of transparency by being off-balance sheet items, they lead market participants not to evaluate the potential risks of the counterparts properly by heightening the systemic risk, which is hidden behind derivatives. Fourth, by financial and technological innovations such as through dynamic hedging and other strategies, market shocks are rapidly and easily transmitted. Lastly, by derivatives trading, domestic and international financial markets are integrated extensively. This increases systemic risk since derivatives, by their nature, have the potential to require additional liquidity even at the worst time, such as when liquidity is tightened in markets, by causing the increase of price volatility (McClintock 1996)).**

In this regard, Dodd (2003) points out that "the systemic risk in international level" refers to the contagion **("The tendency of a firm crisis in one country to adversely affect the financial markets in other economies" is called "Contagion" (Dodd 2000))** issue for which derivatives turn into channels because of the following: First, many derivatives involve cross-border counterparts. So that such counterparts will be adversely influenced by the losses of market value and credit rating in the crisis country, due to international nature of markets as herding behaviour or just the fact that they involve cross border counterparts.

Second, in crisis economies to meet collaterals selling securities in other markets is common (Dodd 2003). Beattie (2000) gives the example from the Brazilian case as follows: "Since the Brazilian economy was in a state of recovery at the time of the Russian default, the collapse of the exchange rate peg is likely not a consequence of the Brazilian economy, but rather a consequence of liquidity pressures resulting from the Russian default. Investors who were caught by surprise by the Russian default sold Brazilian bonds to meet margin calls" (Beattie 2000).

Crisis-driven Capital Outflow Effect

The derivatives affect the dynamics of the crisis by also promoting speculation against the local currency at the beginning of the crisis of developing country, which has mainly imbalanced derivative markets, especially during crisis. Dodd (2000) analyses such speculation "as one way bet" leading to massive capital outflows and the collapse of the currency peg under fixed exchange rate system, whether a hard peg or a soft peg, in the imbalanced derivative markets of developing countries. Similarly Garber (1998) maintains that derivatives can have a "crisis-driven capital outflow" effect under the imbalanced derivatives markets of developing countries especially during a crisis. Derivatives can have a direct crisis effect on economies by creating instability in the fixed exchange rate system and leading to the system to collapse at the beginning of the crisis of developing country, under imbalanced derivative markets, especially during crisis.

Derivatives are open to be used as a speculative or hedging instrument against the success of government's policy by speculators, attackers or hedge fund operators. Dodd (2002a) asks the right question that "…how and why would they use (derivatives) since there is no market volatility to hedge?" Because of the fact that in a fixed exchange rate system, a risk regarding the exchange rate is "a failure of the fixed exchange rate system that results either a devaluation of the pegged exchange rate or a complete collapse of the regime" speculators using a forward, swap, futures or option to take a profitable position on the possible fall in the currency's value is accepted as "practically a one way bet" as self-fulfilling the expectations of devaluation. This *one way bet* character of hedging and speculation in fixed exchange rate systems make all the short positions in derivatives *a one way bet* as *speculative against the peg* (Dodd 2002a). Rothig (2004) puts it as "The one way bet together with the ability to leverage reinforces self-fulfilling speculation, leads to capital outflows and consequently makes it very difficult for the government to defend the peg".

The mechanism of the direct crisis effect of derivatives can be shown in several versions **(See Sarialioglu-Hayali (2010) for a detailed analysis of the other mechanisms of the direct crisis effect of derivatives)** of which one of them is as below:

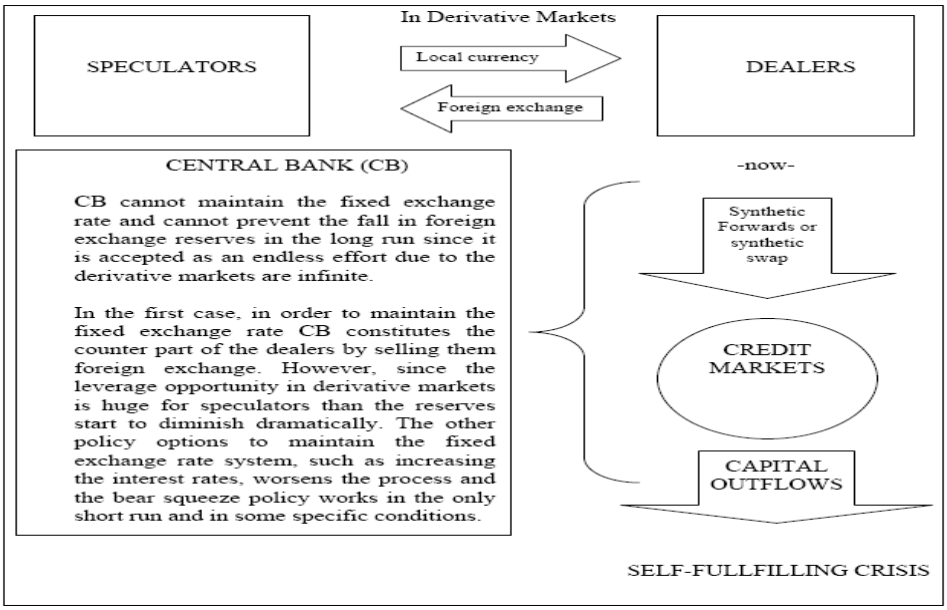

Figure 1: *The Crisis-Driven Capital Outflow Effect*

The following explanations describe the process shown in Figure 1:

1-Speculators take large positions against pegged exchange rate as short in local currency in derivatives market either forward, swap, futures or put option. In Figure 1, it is a forward contract telling that at the maturity in the future, speculator will buy foreign currency in the exchange of local currency at a forward discount rate. This forward discount can stem from the Interest Rate Parity (IRP) conditions, namely the interest rate differential between the interest rates of home country, here, developing country, and of foreign country, which indicates an expectation of forward discount in terms developing country currency. If the Risk Premium issue of developing countries is added to this then the forward discount becomes more than expected. 2-This position creates a liability for dealers in terms of foreign exchange in the future. Since almost everybody in the weak currency derivatives market is short in local currency, pointing out imbalanced derivatives markets issue, they had to create synthetic forwards or swaps **(See Neftci (2002) for a detailed analysis of synthetic assets)** to offset this exposure. 3-Within the framework of synthetic short positions in the credit market, the dealers borrow in the local currency now (time t_0) and create local currency liability for the future (time t_1). For this they use local credit markets as shown in Figure1. 4-They buy foreign exchange with the local currency at the spot market, namely, from the Central Bank, at the fixed exchange rate systems. 5-They invest this amount of foreign exchange in foreign exchange assets for the maturity of initial forward. 6-This process

creates massive capital outflows now (time t_0). In a short time, after this speculative attack to the pegged exchange rate by using derivatives, forward rates start to constitute a signal for devaluation then everybody starts to be in short for local currency. At last, the exchange rate system collapses as creating self-fulfilling expectations and thus, self-fulfilling crisis (Dodd 2002a). Dodd (2002a) puts this as follows: (in order) "to complete the market for instance derivative dealers will have to engage in the action of creating synthetic short positions in order to lay-off their long-side risks. The result is capital outflows and as the short interest rate grows in the derivative markets capital outflows increase". This *one-way bet* can be called self-fulfilling expectations creating crisis. 7-Since there is huge leverage opportunity sustained by derivatives to speculators, ordinary tools of central banks to maintain the fixed exchange rate system such as selling foreign currency to markets or increasing the interest rates do not work in the long-run. Because, the leverage opportunity of derivatives sustains speculators to take positions against the local currency in huge amounts causes the reserves to diminish dramatically. In this process, as a policy option increasing the interest rate by central banks does not work also, rather it contributes to the sales of the weak currency, if forward discount issue is reconsidered. All these will create challenges for central banks to maintain the fixed exchange rate since the direct intervention of central banks works in the Foreign Exchange (FX) spot market; however, it does not work in the present derivative markets because of the fact that there is "potentially no end to the effort" since the derivative markets are accepted as more problematic compared to the spot markets. Dodd (2002) puts this as "While the spot market is large, the potential size of the forward and swap market is infinite". As a second tool to defend the exchange rate, the Central Bank can raise the local interest rates. However, as mentioned before, this would increase the interest rate differential, leading to forward discount much more and creating more capital outflows by signalling devaluation **(The fact that increasing the interest rate can worsen the situation, already suffered from the relatively high interest rate, which is noted as the forward and swap rates will indicate a greater rate of depreciation if a market risk premium is also added to the interest rate differential, which is already high (Dodd 2000)).** Especially this is a relevant case under the dynamic hedging techniques, which Granville (1999) puts as the ones that "replace human judgement with computerized decision-taking analogous to stop-loss orders on the stock exchange" pointing to their widespread use and rapid implementation through ordering immediate sales of the weak currency during a defence of Central Bank increasing interest rates in a currency attack situation, thus making such defence useless. All these point out the inefficiency of the regular tools of Central Banks.

B. The Indirect Crisis Effects

The Indirect Crisis Effects of Derivative Instruments in International Financial Crisis can be handled as *Accelerating the Crisis* effect by quickening and deepening the crisis. In this regard, especially some types of derivatives such as Total Return Swaps (TRS) and Put-able (P.) Debts have also a role as crises accelerators, pointing out the quick capital outflows, which Dodd (2000) ironically calls "microwave money" when compared to the description of "hot money" (Dodd 2000). The indirect crisis effect of derivatives can also be handled in terms of *Increasing the Lending Boom* through fuelling capital inflows to developing world.

The Accelerating Crisis effect of derivative instruments can be handled as the quickening and deepening the crisis after the crisis began and as long as continue. These kinds of crisis accelerator effects can be experienced more frequently if there is the usage of some specific types of derivatives, such as TRS, Structured Notes and P. Debts *etc*., since all these derivatives require some margin or collateral requirements, pointing out the capital outflows in the wake of the crises in which capital or liquidity is most required. Moreover, since futures have margin requirements and daily marking to market character besides dynamic hedging techniques, they also have potential crisis accelerator effects like options in which unlimited loss situations of option writers have also potential crisis-accelerating effects.

Within the framework of quickening the process it can be said that the derivative transactions of financial institutions of developing countries generally require strict collateral or margin requirements such as hard currencies or securities because of the default risk of these relatively weak economies. Dodd (2003) argues that at the beginning of devaluation or much more broad financial crises causing a sharp fall in the price of the underlying collateral such firms are immediately required to add hard currency assets to their collateral in proportion to the loss in the present value of their derivatives position. This causes rapid outflows of foreign currency reserves as local currency and other assets were exchanged into dollars in order to meet the collateral requirements (Dodd 2003), causing a shortage of liquidity, which is defined as "the ability to match obligations with the ability to pay" (Kelly 1995). Within the framework of deepening the impact of the crisis, in the case of the high leverage that derivatives provide the process of effort to meet collateral requirements will accelerate the size of the losses to the whole financial system. It thereby deepens the impact of the crisis by creating international financial instability.

In the unregulated derivatives markets of developing world of the 1990s, the presence of derivatives is also tackled as an indirect crisis effect due to derivatives promoting capital inflows to developing world in huge amounts. Because of those facts that first, derivatives can be a very useful risk shifting tool and second, they can easily be used to avoid prudential regulations, such as capital or tax requirements, capital flows which were increased, mostly the

short-term volatile ones, went to developing world for high returns. In this regard, such capital inflows in huge amounts, which went to developing world in the 1990s, financed risky projects of the private sector or private consumption through banking sector, leading to *lending boom*, created balance sheet disruptions in the financial sectors, namely, open positions in terms of foreign exchange, and also revaluated the local currency having led to the CAD. Moreover, derivatives contributed to the capital in and out flows, which are in short-run speculative character leading to volatility in the exchange rate. All these contributed to crisis of emerging markets in an indirect way.

III. The Empirical Analysis

In order to test the null hypotheses, which will be described in the following parts, a TSCS data covering six emerging countries **(The sample countries are chosen according to data availability on derivatives and they are defined as emerging market countries in the emerging market database of International Financial Corporation (IFC) and also in the IMF during those years),** Brazil, Malaysia, South Korea, South Africa, Hungary and Singapore, for the era of 1996q1-2003q4 is used through a TSCS analysis to investigate the potential role of the derivatives in such crises. The data sources are International Monetary Fund (IMF) International Financial Statistics (IFS) 2007, BIS and the National Agencies of the related countries. The variables are chosen among the ones which were used and found statistically significant in the applied literature of crisis theories.

A. Variables

Table 1 indicates the symbols, definitions, units and scales of all variables used in the research.

Table 1: *Explanations of Dependent and Independent Variables*

Expected Sign	**Symbols**	**Definitions**	**Units and Scale**
+	CI	CRISIS INDEX	Index
+	CPS	CLAIMS ON PRIVATE SECTOR (NON-PERFORMING LOANS)	National Currency Millions
-	CA	CURRENT ACCOUNT	US Dollars Millions
+	CR	CREDIT TO PIVATE SECTOR (LENDING BOOM)	National Currency Millions
+	CD	CONTAGION DUMMY	CD=1 OR CD=0
+	TD	TOTAL OUTSTANDING AMOUNTS OF THE EXCHANGE TRADED DERIVATIVES	US Dollars Millions

	GDP	GROSS DOMESTIC PRODUCT	National Currency Millions
	FR	FOREIGN RESERVES MINUS GOLD	US Dollars Millions
+	CPSGDP	THE RATIO OF THE NON-PERFORMING LOANS TO GDP	Ratio
-	CAGDP	THE RATIO OF THE CURRENT ACCOUNT TO GDP	Ratio
+	CRGDP	THE RATIO OF THE DOMESTIC CREDITS ON PRIVATE SECTOR TO GDP	Ratio
+	CD	THE CONTAGION DUMMY	CD=1 OR CD=0
+	TDFR	THE RATIO OF THE TOTAL OUTSTANDING AMOUNTS OF THE EXCHANGE TRADED DERIVATIVES TO FOREIGN EXCHANGE RESERVES	Ratio

Sources: IMF IFS (2007), BIS and the National Agencies.

The following part summarises the dependent and independent variables, including their possible relationships with financial crisis, their hypotheses with the expected signs of their coefficients.

1. The Dependent Variable CI (Crisis Index): It is a calculated index, which can also be called "Financial Pressure Index" or "Crisis Pressure Index" or "Exchange Market Pressure Index" of which expected coefficient sign is positive, pointing out that if it increases then the possibility of crisis, namely, crisis pressure, increases. Following the works in applied literature, it is calculated as follows **(This is mostly based on the one developed by Edison (2000), which was originally based on the model developed by Girton and Roper (1977))**:

$CI = \%\Delta S - \alpha_1 \%\Delta R$

%ΔS: Quarterly percentage change of the exchange rate, defined in the domestic currency per unit of the US Dollar

%ΔR: Quarterly percentage change of the foreign exchange reserves

$\alpha_1 = \sigma s / \sigma r$

σs: The fixed standard deviation of the percentage change of the exchange rate

σr: The fixed standard deviation of the percentage change of the foreign exchange reserves

In the paper the Crisis Index is calculated as the weighted average of percent changes in the bilateral nominal exchange rate and the percent change in

foreign reserves, with weights such that the two components of the index have equal sample volatility. Since, the changes in the exchange rate have positive sign and the changes in the reserves have negative signs, both depreciations in the exchange rate and declines in reserves increase the crisis pressure. In this regard, it can be said that the increase in crisis index refers to the increase in the weighted difference between the percentage depreciation of the exchange rate and percentage decreasing of the foreign exchange reserves. The weighting here is achieved by multiplying the change in reserves by the ratio of α_1, although it has been done arbitrarily in previous applied works. In this regard, the definition of crisis, which is used as the basis of Crisis Index calculated here, is as "an episode in which an attack on the currency leads to a sharp depreciation of the currency, a large decline in international reserves, or a combination of both these effects" (Edison 2000).

By this definition both successful attacks leading to the sharp depreciation of the currency and also unsuccessful attacks not just leading to the depreciation of the currency, but also leading to a large decline in foreign reserves to prevent such sharp depreciation are covered. In this regard, a sharp currency depreciation, which is a result of a successful attack, has been widely used as a crisis proxy in the empirical literature. However, since it is limited to just successful attacks it has been criticised by the works telling that unsuccessful attacks should be also considered for crisis. As one of them, Vlaar (2000) notes "…from an investor's point of view, including unsuccessful speculative attacks might be useful as unsuccessful attacks also indicate vulnerability" (Vlaar 2000). So, in order to cover unsuccessful attacks, besides successful ones, the flow out of foreign reserves was also included in the index. In this respect, to prevent sharp depreciation governments use policies such as selling foreign exchanges as direct intervention in the foreign exchange market at the cost of the loss of foreign reserves and also increasing interest rates. In the empirical studies on the crises of the emerging markets (see *e.g.* Corsetti *et al.* 1999; Kruger *et al.* 1998; Akiba and Jia 2007), interest rates have not been used in crisis indexes due to interest rate data of emerging market countries not always being available and/or reliable and comparable. Moreover, as Corsetti *et al.* (1999) maintain there can be another important fact for excluding the interest rates in the relevant crisis index, which they put as "...increase in interest rates in the presence of speculative pressures is highly correlated with non-sterilized foreign exchange intervention leading to a fall in reserves" (Corsetti *et al.* 1999). This definition of crisis index also includes both fixed exchange rate regimes and floating exchange rate regimes. It is noted that "Even currencies that are allowed to float freely might be subject to a disruptive depreciation due to a speculative attack. Moreover, a small official devaluation in a tranquil period does not have to be disruptive as it probably brings the real exchange rate more in line with fundamentals" (Vlaar 2000).

2. Independent/Explanatory Variables CPSGDP (The ratio of the Non-performing loans for the last 16 quarters (four years) to GDP): This is a proxy variable for bank's non-performing loans, which are calculated as claims on the private sector of the deposit money banks for the last 16 quarters. It is pointed out that where the liquidity is increased by foreign capital inflows, this excessive liquidity is spread into the private sector by banks through bank credits. In this regard, in such conditions when the loans increase, the banks act in a relaxed manner, hence, the criteria of the banks for examining loan applications get relatively loose leading to "bad bank loans" and as a result, non-performing ones (Akiba and Jia 2007). The high ratio of this proxy to GDP is handled as one of the possible determinants/causes of the financial crisis following Corsetti *et al.* (1999). So, the expected sign of this variable is positive pointing out the positive relationship with the Crisis Pressure Index.

CAGDP (The ratio of the Current Account to GDP): Since the CAD, which points out the current account having a negative sign, possibly increases the pressure of currency depreciation, it is a common determinant used in empirical studies. The opposite case is the Current Account Surplus, which points out the current account having a positive sign. In this respect, the ratio of the CA to GDP is used here as one of the possible determinants/causes of the financial crisis. It is expected that this variable (CAGDP) has a negative relationship with the Crisis Pressure Index.

CRGDP (The ratio of the Domestic Credits on Private Sector to GDP): This variable is evaluated as a "lending boom" variable, pointing out that the current banking system does not have a sound/healthy structure, which is also evaluated as a proxy of financial fragility leading to negative expectations and investor trust issues related to the banks and the whole system ending with the self-fulfilling crisis, namely, a weak banking system increases the probability of a speculative attack (Kruger *et al*. 1998). In this regard, this indicator, which can also be used as a positive indicator of financial liberalisation, points to the potential relationship between a weak banking system and the currency crisis. The expected sign of this variable is positive pointing out its positive relationship with the Crisis Pressure Index.

CD (The Contagion Dummy): Following Eichengreen *et al.* (1996), it is calculated as a dummy variable taking a value of 1 if there is also a crisis elsewhere in the world at the same point in time and in the pre-crisis period, which points out that there is a contagion or spread of another crisis, and taking a value of 0, which points out that there is not any contagion of another crisis. It is expected that the incidence of crises elsewhere in the world at the same point in time and in the pre-crisis period affects the probability of another crisis. The contagion of a crisis to another crisis can stem from the rational causes, such as the trade and investment linkages of the countries and irrational causes, such as the herding behaviour coming from psychological matters. So, it is expected that this variable will have a positive relationship with the Crisis Pressure Index.

TDFR (The ratio of the Total Notional Amounts Outstanding of the Exchange Traded Derivatives to Foreign Exchange Reserves):

TDFR is used as a proxy variable for the presence of derivatives, pointing out the ratio of the Total Notional Amounts Outstanding of the Exchange Traded Derivatives **(Total Outstanding Amounts of Derivatives, which can be regarded as open interest data of derivatives, were used as a proxy for derivatives in the ratio of TDFR. Although daily open interest data is mainly proxied as hedging due to it is accepted that speculators are mainly day traders, this kind of distinction cannot be done for quarterly data. In fact, due to there are different types of speculators other than day traders such as position traders and scalpers that have positions more than one day this distinction is problematic even for daily data for especially open interest data. In this regard, although this kind of distinction can be done for daily data, which even has some limitations, it is useless for quarterly derivatives data. Moreover, quarterly open interest data cannot be used as a proxy for just hedging since this kind of proxy for hedging, both daily and quarterly, is problematic and there are also reports pointing out that outstanding amounts/open interest data can both indicate hedging and speculation. For this see Chatrath *et al.* (1996). Although we do not have such an open interest data, which is divided into subgroups as speculative and hedging, the existing BIS data is well enough to be used as a proxy for derivatives),** which is calculated by the BIS, to Foreign Exchange Reserves, in which only exchange traded derivatives data is used due to the lack of OTC derivatives data. A high value of this ratio is one of the possible determinants/causes of the emerging market financial crisis. This is due to under fully liberalized, poorly structured and improperly regulated derivatives markets, derivatives can be highly open to be used for economically harmful purposes. These purposes can be as follows: Manipulation, huge risky positions represented by high leverages, information distortions, reducing transparency, evading prudential regulations *etc*., which all creates the vulnerability to crisis. Moreover, all misuses of derivatives, such as creating illiquidity, contagion channel for crisis and making balance sheet distortions of firms, creates financial fragility leading to financial sector vulnerability and crises by threatening financial market integrity and efficiency. All this causes negative expectations and investor trust issues related to the whole system, by increasing the pressure to sell weak currency. Evading prudential regulations by virtue of derivative instruments in such conditions also causes huge capital inflows to the developing world pointing out a boom-bust cycle process. Moreover, the presence of derivatives in the fixed exchange rate system case, during the crisis, will also act as a special set of challenges for a government, which tries to maintain the fixed exchange rate. This issue points out the ultimate collapse of the exchange rate system. This is due to the leverage in a speculative attack using derivatives is huge. So, the central bank will lose international reserves in order to prevent the speculative attack or will increase interest rates, which would result in a worsening situation as giving more signals for selling weak currency by affecting the forward rates. Additionally, since the dependent variable, the crisis pressure index, covers both fixed and floating exchange rate systems, the presence of derivatives in the floating exchange rate system case,

during the crisis, will also act as a special set of challenges for a government. This is due to in this case the government tries to keep the stability of foreign exchange markets. It points out the significant deprecations of the exchange rate in the floating system since the leverage in a speculative attack using derivatives is huge, which will be also covered by the Crisis Index Pressure Index. The presence of some specific types of derivatives during the crisis also will increase the pressure to sell weak currency due to the needs of additional collaterals. So, following Garber and Lall 1996; Garber 1998, 2000; the works of Dodd 2000, 2002a, 2002b, 2003 and Rothig 2004, the expected sign of this variable is positive.

B. Methodology for TSCS Analysis

In order to test the null hypotheses, which will be described in the following parts, TSCS data covering South Korea, Malaysia, Brazil, South Africa, Singapore and Hungary, for the era of 1996q1-2003q4 is used through a TSCS analysis to investigate the potential role of the derivatives in the financial crises or crisis pressures in such emerging market countries during the 1990s. By TSCS analysis, the inference will be made to the observed units.

TSCS analysis is like the panel data analysis which has a double subscript on its variables indicated in the following form. However, in this case the time dimension of the data is bigger than its individual dimension.

$Y_{it}= X_{it}B+ e_{it}$ $\quad i= 1,….., N; t=1,….,T$

Here i denotes especially countries, states and t denotes time in which periodical observation of a variable set is done. So that, while X_{it} is a K vector of exogenous variables, the i subscript refers the cross-sectional dimension, the t subscript refers the time-series dimension. e_{it} is error term or error component model in which Ω is assumed to be the NT×NT covariance matrix of the errors with typical element $E(e_{i,t}e_{i,j})$ (Beck 2001).

The notation of TSCS looks like the notation of panel data, namely, there does not seem any significant difference between TSCS data and panel data in terms of their notations. However, it is argued that there are differences between panel data and TSCS data both in terms of theoretically and practically although the text books on panel data econometrics do not distinguish them. Following Freedman and Peters (1984), Beck (2001) puts the differences between them by first redefining them as follows: "Panel data are repeated cross-section data, but the units are sampled (usually they are survey respondents obtained in some random sampling scheme), and they are typically observed only a few times. TSCS units are fixed; there is no sampling scheme for the units, and any "resampling" experiments must keep the units fixed and only resample complete units" (Beck 2001). In this regard, he explains that in panel data the people observed are not important referring to the fact that all inferences of interest concern the underlying population that was sampled,

rather than being conditional on the observed sample. On the other hand, opposite to panel data, within the TSCS data all inferences of interest are conditional on the observed units (Beck 2001). So that in TSCS data, since the units, here, countries are fixed, they are not "interested in extending inference to a larger, hypothetical, population of similar countries" (Beck 2001). In this respect, it is argued that fixed effect is appropriate for TSCS data although there is a debate in the panel data literature about how to model the effects, and in particular, whether it is as fixed or random effect. Following Hsaio (1986), in the work it is argued that "fixed effects are appropriate if one wants to make inferences to the observed units, whereas the random effects model (which assumes that the effects are drawn from some distribution) is appropriate if one thinks of the observed units as a sample from a larger population and if one wants to make inferences about the larger population" (Beck 2001). From this point, Beck (2001) concludes that since the units, here, countries are fixed in TSCS data and it is not interested in extending inference to a larger, hypothetical, population of similar countries, fixed effect is appropriate (Beck 2001). On the other hand, if T is large, then the distinction between fixed and random effects becomes unimportant **(Fixed effects and random effects differ by** $\frac{\sigma_\varepsilon 2}{\sigma_\varepsilon^2 + T\sigma_\alpha^2}$ **As T gets large; this term goes to zero, so that the random-effects and fixed-effects estimators become identical (Beck 2001)).** Although he acknowledges that this distinction is not made in the econometrics text books on panel data, he builds his TSCS approach on this distinction.

Within the framework of theoretical differences, Beck (2001) argues that the T dimension includes all asymptotics for TSCS data, the number of units is fixed and even an asymptotic argument must be based on the N observed units, opposite to the panel data, which mostly uses "general estimating equation" that are justified by asymptotics in N. He claims that the general estimating equation, which can be very useful for panel data, is not necessary to be very useful for TSCS data. Within the framework of practical differences he explains that T should be large enough that averages over the T time periods for each unit make sense opposite to the panel data, which are constructed to deal with small Ts. He also adds that although there is no number limit for minimum T for TSCS methods to work, TSCS methods used for, say, T<10, can be problematic. Moreover, although a large N is generally no problem, it is not required for TSCS methods (Beck 2001).

In the work of Beck (2001), the methods are handled as "old-fashioned methods" in which the term "old-fashioned" is used "because this perspective views violations of the Gauss-Markov assumptions **(The Gauss-Markov assumption is that each of the $e_{i,t}$ is independent and identically distributed (Beck 2001). It is as follows:**

$$E(\epsilon_{i,t}\epsilon_{j,s}) = \begin{cases} \sigma^2 \text{ if } i = j \text{ and } s = t \\ 0 \quad \text{otherwise.} \end{cases}$$

) as an estimation nuisance rather than

something to be modelled" and "modern methods", which is put as follows: "…at least in time series, is to regard these 'violations' as interesting features to be modelled and not swept under the rug" (Beck 2001). Since several of the Gauss-Markov assumptions are often suspect for TSCS data, it is argued that among old-fashioned methods neither Feasible Generalized Least Squares (FGLS), which treat these violations as a nuisance and correct for them, nor Ordinary Least Squares (OLS), which assume that there are no violations, are optimal for TSCS data, rather TSCS analysis is proposed as a method using OLS with Panel Corrected Standard Error (PCSE). In the work of Beck and Katz (1995), the logic behind using the TSCS analysis with PCSE rather than the other methods is noted as follows: Although Generalized Least Squares (GLS) has optimal properties for TSCS data, it assumes that the error process is known, opposite to the reality. On the other hand, instead of GLS, FGLS can be used by researchers since "it is 'feasible' because it uses an estimate of the error process, avoiding the GLS assumption that the error process is known". However, although in many applications it does not cause any problem since the error process has few enough parameters in those applications that they can be well estimated, it can be problematic in the case for TSCS models, in which the error process has a large number of parameters (Beck and Katz 1995).

In this regard, TSCS analysis is based on an OLS method with panel corrected standard errors since it is thought that the assumptions on standard errors are not realistic as GLS method done and also they cannot be estimated as FGLS method done. It is noted that the errors can have "(a) panel heteroskedasticity, i.e. each country may have its own error variance; (b) contemporaneous correlation of the errors, i.e. the error for one country may be correlated with the errors for other countries in the same year; or (c) serially correlated errors, i.e. the errors for a given country are correlated with previous errors for that country" (Beck 2001). In this respect, it is expected that the errors from TSCS models would often have such conditions, namely, violate the Gauss-Markov assumptions (Beck 2001), since panel heteroskedasticity, one type of interunit heterogeneity, would be expected in the case that nations vary so that the error variance varies from nation to nation, or one or two units do not fit the basic specification well.

So, if the errors for TSCS models are not spherical errors, which most analysts do not accept as assumption, then OLS is taken as not optimal because of the fact that there is no guarantee that the OLS standard errors will be correct, which refers to "accurate estimates of the variability of parameter estimates" (Beck and Katz 1995). It is noted that correct standard errors maintain the correct computation of confidence intervals and statistical tests. Incorrect standard errors will lead to be either too confident or insufficiently confident about whether the findings might merely be statistical artefacts. So to solve these problems some structure on the assumed error process is put in order to create TSCS analysis by improving on OLS for TSCS data as follows: It is

assumed that for any given unit, the error variance is constant, so that the only source of heteroscedasticity is differing error variances across units. Second, it is assumed that all spatial correlation both is contemporary and does not vary with time. In this regard, the temporal dependence exhibited by the errors is also assumed to be time-invariant and may also be invariant across units. All these assumptions are called "panel error assumptions" since all based on the panel nature of the data (Beck and Katz 1995).

C. Testing the Direct Crisis Effect

1. The First Model: When the role of derivatives is taken as direct crisis effect of vulnerability to crisis, derivatives can present financial market failures and destabilizing effects on economy by creating vulnerability to crisis, whether in fixed or floating exchange rate systems of emerging markets. In this regard, the presence of derivatives in the emerging market economies, which can be used for economically harmful purposes, such as default, fraud activities, moral hazard, manipulation, information distortion and evading prudential regulation, reducing transparency, highly leveraged and short-term purposes can build the vulnerabilities to crisis.

Since within the TSCS data analysis all inferences of interest are conditional on the observed units, the findings will be about the six emerging countries which were handled. The potential role of the derivative instruments in the financial crises of the emerging market countries which were handled is investigated. Thus, the presence of derivatives in the underlying emerging markets of the 1990s is handled as a destabilizing factor of the financial sector and the economy as a whole, which creates vulnerability to crisis, namely, affects the dynamics of a crisis, whether in the floating or fixed exchange rate systems.

The Assumptions: The null hypothesis of the TSCS analysis is as follows: H_0: There was not any role of derivatives in the global financial crises of some emerging market countries, which were handled in this work, during the 1990s. The null of interest is H_0: $B_5=0$ which is indicated in the specification below. We interpret evidence of the null as being inconsistent with the role of derivatives in the global financial crises of some emerging market countries, which were handled in this work, during the 1990s.

H_1: There was a role of derivatives in the global financial crises of some emerging market countries, which were handled in this work, during the 1990s (H_1:$B_5\neq0$).

The assumptions are as follows: 1-There were poorly structured and improperly regulated derivatives markets in the emerging market economies, including the ones handled in the applied part of the paper, during the 1990s. So, derivatives were open to be used for economically harmful purposes such as evading prudential regulations by leading to huge risky positions represented by

high leverages, manipulating accounting rules and credit ratings, avoiding from taxation and capital requirements.

2-All misuses of derivatives, such as creating illiquidity, high leveraged positions and contagion channel for crisis, making balance sheet distortions of firms, create financial fragility leading to vulnerability to crises by threatening to financial market integrity and efficiency. As Mathieson *et al.* (2004) put it: "…the problem of misuse of derivatives is perceived to be more acute in emerging market countries where prudential regulation, credit information infrastructure, and risk management practices are not fully developed".

The Specification

Through TSCS analysis TDFR is handled as a potential crisis determinant/explanatory variable, among some other significant determinants, used in the applied works, such as CPSGDP, CAGDP, CRGDP and CD. The first model specification is as follows:

$$CI_{it}=C+B_1CPSGDP_{it}+B_2CAGDP_{it}+B_3CRGDP_{it}+B_4CD_{it}+B_5TDFR_{it}+U_{it}$$

$i=1,2,3,4,5,6$

$t=1,2,3,\ldots 32$ (1996q1-2003q4)

This equation comes from the first model of *direct crisis effect* pointing to the potential role of financial derivatives in increasing crisis pressure among some other variables, which reflect both fundamentals and non-fundamentals in increasing crisis pressure. In this regard, such variables are selected due to some of them represent macroeconomic fundamentals, such as CAGDP, and some of them represent microeconomic fundamentals, such as CPSGDP and CRGDP. Moreover, while these variables all represent fundamentals, there is also another variable, CD, which represents non-fundamentals in increasing crisis pressure.

The following Table 2 indicates the results of the TSCS applications of the first model. Within TSCS analyses, three different versions of TSCS such as with no-autocorrelation, with AR(1) and with panel-spesific AR(1), are used as seen on the three columns of the table 2. According to this table, the first column of the table shows the variables with expected signs. Under each variable, there are PCSEs and p values in order to indicate whether the variable is statistically significant or not, which is shown by single star (*) if the variable is significant at 1% level, two stars (**) if the variable is significant at 5% level, three stars (***) if the variable is significant at 10% level. The last line of the first column indicates the adopted models, which are Linear Regression Model with correlated panels corrected standard errors for TSCS with no-autocorrelation and Prais-Winsten Regression Models with correlated panels corrected standard errors for the last TSCS analyses with AR(1) and with panel-specific AR(1), respectively **(All these descriptions of Table 2 are also valid for the other results tables of the paper).**

Table 2: *The Results Table*

Models / **Variables (sign)**	***Testing The Direct Crisis Effect: By TSCS, OLS with PCSE No-autocorrelation*** **THE FIRST MODEL**	***Testing The Direct Crisis Effect: By TSCS, OLS with PCSE AR(1)*** **THE FIRST MODEL**	***Testing The Direct crisis Effect: By TSCS, OLS with PCSE Panel-specific AR(1)*** **THE FIRST MODEL**
CPSGDP(+)	**-1.57**	**-1.66**	**-2.02**
PCSE	1.393	1.79	1.881
P value	0.26	0.35	0.28
CAGDP(-)	**-23.62**	**-23.01**	**-29.83**
PCSE	13.329	15.377	14.954
P value	0.08***	0.13	0.05**
CRGDP(+)	**0.75**	**0.73**	**1.07**
PCSE	0.714	0.848	0.891
P value	0.30	0.39	0.23
CD (+)	**18.21**	**19.17**	**17.28**
PCSE	4.721	5.447	5.373
P value	0.00*	0.00*	0.00*
TDFR(+)	**0.94**	**0.93**	**1.03**
PCSE	4.721	0.48	0.457
P value	0.02**	0.05**	0.02**
C(constant)	**-3.25**	**-3.18**	**-3.80**
PCSE	2.484	2.954	3.153
P value	0.19	0.28	0.23
Adopted Model	Linear regression, correlated panels corrected standard errors (PCSEs)	Prais-Winsten regression, correlated panels corrected standard errors (PCSEs)	Prais-Winsten regression, correlated panels corrected standard errors (PCSEs)

***significant at 1% level, **significant at 5% level, ***significant at 10% level**

The Interpretation, Evaluation and Comparison of the Results: As crisis determinants, first, the sign conditions (plus) for CD and (negative) for CAGDP are satisfied, and they are statistically significant at the 1 per cent and the 10 per cent levels, respectively. Second, the sign condition of CRGDP is satisfied, but it is statistically insignificant at the 10 per cent level. Third, CPSGDP is not only statistically insignificant at the 10 per cent level, but also inverse to the expected sign condition. When it is focused on the derivatives findings, it can be again said that the estimated coefficient has the expected sign as positive, at the 5 per cent significance. So, the null hypothesis can be rejected since B5>0 at the 5 per cent significance level. The interpretation can be as follows: If the total derivatives ratio to foreign reserves increases by one unit

then the crisis pressure (crisis index) rises by 0.94, on average, holding the other independent variables constant.

When the findings in the third and fourth columns of Table 2, which were determined by dynamic TSCS analysis as AR(1) and panel specific AR(1), are analysed it is seen that both the coefficients and PCSEs differ from each other and from the other columns. Within the framework of the first dynamic model with AR(1) the interpretation can be as follows: As crisis determinants, the sign conditions (plus) for CD, (plus) for CRGDP and (negative) for CAGDP are satisfied, but among them, only CD is statistically significant, which is at the 1 per cent level. However, both CRGDP and CAGDP are statistically insignificant at the 10 per cent levels. CPSGDP is not only statistically insignificant at the 10 per cent level, but also inverse to the expected sign condition. When it is focused on the derivatives findings, it can be again said that the estimated coefficient has the expected sign as positive, but now at the 5 per cent significance level. So, the null hypothesis can be rejected since B5>0 at the 5 per cent significance level. The interpretation can be as follows: If the total derivatives ratio to foreign reserves increases by one unit then the crisis pressure (crisis index) rises by 0.93, on average, holding the other independent variables constant.

Within the framework of the second dynamic model with panel specific AR(1) the interpretation can be as follows: As crisis determinants, first, the sign conditions (plus) for CD and (negative) for CAGDP are satisfied, and they are statistically significant at the 1 per cent and the 5 per cent levels, respectively. Second, the sign condition of CRGDP is satisfied, but it is statistically insignificant at the 10 per cent level. Third, CPSGDP is not only statistically insignificant at the 10 per cent level, but also inverse to the expected sign condition. When it is focused on the derivatives findings, it can be again said that the estimated coefficient has the expected sign as positive, but now at the 5 per cent significance level. So, the null hypothesis can be rejected since B5>0 at the 5 per cent significance level. The interpretation can be as follows: If the total derivatives ratio to foreign reserves increases by one unit then the crisis pressure (crisis index) rises by 1.03, on average, holding the other independent variables constant.

2. The Second Model: When the role of derivatives is taken as direct crisis effect of *crisis-driven capital outflow effect*, during a crisis derivatives can present a special set of challenges for governments, which especially use fixed exchange rate systems, whether a hard, soft or crawling peg, in which they try to maintain the fixed exchange rate. In this regard, all this process puts the central bank on the spot exposure. This can be either in the case of a fixed exchange rate system in order to maintain the fixed exchange rate or floating exchange rate system in order to stabilize the economy following a speculative attack or at the financial disruption. In any case, derivatives markets in such cases expose central banks in challenging positions in terms of their foreign

exchange reserves. The policy options to maintain the fixed exchange rate system work in temporary base since it is recognized that under such defences of central banks reserve losses could put developing countries "in play" for international speculators pointing out the inevitable "one way bet" process in the long-run. So, during the crisis, the derivatives affect the dynamics of the crisis by speculation against local currency, "which is accepted as one way bet" under pegged exchange rate regimes, leading to massive capital outflows and the collapse of currency. Hence, in this case, the derivative products are handled as they affect the dynamics of the exchange rate during the crisis and once crisis begin they contribute to the volatility of the exchange rate.

The Assumptions The assumptions are as follows: In the 1990s, derivatives were mostly used with the aim of speculation as "one way bet" as "speculative against the peg" rather than hedging in crises economies pointing out self-fulfilling crises. Because "one way bet" character of hedging and speculation in fixed exchange rate systems make all the short positions in derivatives "a one way bet" as "speculative against the peg". Especially, at the beginning of crisis, the derivative markets are assumed imbalanced. In this regard, all commitments at the beginning of crisis are assumed in short position as "one way bet" as "speculative against peg".

Since in the 1990s there were fixed or pegged exchange rate systems under a nearly complete financial liberalization. Freeing capital movements in the developing countries that experienced financial crises, including the ones handled in this work, and taking a position in derivatives market, whether in speculative or hedging purposes under such conditions, pointed out a "one way bet".

Since the developing countries, who were capital importers, were taking long positions on their own securities, which were not hedging due to the fact that it does not reduce risk, rather it is taking additional risk. In this regard, it is also stressed that the aims of speculators who bet on the currency, and foreign investors, who hedge their investment, do not create any difference in terms of tackling these kinds of short positions on local currency by international banking system in those conditions (Garber 1998). Moreover, hedging under such conditions also point out a "destabilising hedging" process. In this regard, hedging the currency risk by short hedge positions at the outbreak of the currency crisis, when currency and asset prices begin to fall, leads to further pressure on prices.

The null hypothesis of TSCS analysis is as follows: H_0: There was not any crisis-driven capital outflow role of derivatives in the global financial crises of the emerging market countries, which were handled in this work, during the 1990s. The null of interest is H_0: $B_6=0$ which is indicated in the specification below.

H_1: There was a crisis-driven capital outflow role/differential effect of derivatives in the global financial crises of the emerging market countries, which were handled in this work, during the 1990s (H_1:$B_6 \neq 0$).

The Specification: To measure the direct/differential effect of derivatives in the crisis, as the crisis-driven capital outflows effect of derivatives, a dummy for the crisis quarter in the presence of derivatives is put, which points out realized/successful one way bet process of derivatives and/or destabilising hedging activities. In this regard, crisis quarters, which can be defined as a situation of CI when it is over a threshold, the sum of the arithmetic mean of CI with its 2.5 standard deviation, which is widely used as a threshold value in the similar works **(This is mainly based on the one used by Edison (2000). The other values used in the applied works such as Eichengreen, Rose and Wyplosz 1996; Eichengreen, Rose and Wyplosz 1995; Kaminsky, Lizondo and Reinhart 1997, are 1.5, 2 and 3, respectively. They were also used for sensitivity analysis, here, in this research. However, among them 2.5 gave most reliable and most consistent results with the content of news articles, and the treatment found in empirical studies. Edison (2000) puts this issue as follows: "Although the choice of 2.5 as a threshold value is somewhat arbitrary, the cataloging of crises obtained by this method tends to follow closely the chronology of currency market disruptions described in the literature" (Edison 2000))**, and crisis countries, which are calculated according to these crisis country thresholds are as follows: A quarter is handled as a crisis quarter if in that quarter CI was more than 2.5 standard deviation above the mean and a country is called a crisis country if it had such crisis quarter in the past. The following Table 3 indicates the crisis and non-crisis countries in the sample, which are determined according to this method, as follows:

Table 3: *Crisis and Non-crisis Countries in the Sample*

Crisis/Non-Crisis Country Threshold	
Crisis	
BRAZIL	CRISIS COUNTRY
MALAYSIA	CRISIS COUNTRY
S. KOREA	CRISIS COUNTRY
Non-Crisis	
SINGAPORE	NON-CRISIS COUNTRY
HUNGARY	NON-CRISIS COUNTRY
SOUTH AFRICA	NON-CRISIS COUNTRY

Notes: Crisis if $CI>2.5\sigma_{ci}+\mu_{ci}$ (σ_{ci}: The Standard Deviation of the CI; μ_{ci}: The Arithmetic Mean of the CI)

Source: Author's calculations

$$CI_{it}=C+B_1CPSGDP_{it}+B_2CAGDP_{it}+B_3CRGDP_{it}+B_4CD_{it}+B_5TDFR_{it}+B_6(TDFR_{it}*d)+U_{it}$$

d=1 if t= crisis quarters

d=0 otherwise

i=1,2,3,4,5,6

t=1,2,3,…32 (1996q1-2003q4)

The following Table 4 indicates the results of the second model.

Table 4: *The Results Table*

Models / **Variables (sign)**	***Testing The Direct Crisis Effect: By TSCS, OLS with PCSE No-autocorrelation*** **THE SECOND MODEL**	***Testing The Direct Crisis Effect: By TSCS, OLS with PCSE AR(1)*** **THE SECOND MODEL**	***Testing The Direct Crisis Effect: By TSCS, OLS with PCSE Panel-specific AR(1)*** ***THE SECOND MODEL***
CPSGDP(+)	**-1.09**	**-1.18**	**-1.09**
PCSE	1.188	1.505	1.478
P value	0.357	0.432	0.460
CAGDP(-)	**-17.54**	**-18.60**	**-20.14**
PCSE	11.87	13.564	13.129
P value	0.140	0.170	0.125
CRGDP(+)	**0.49**	**0.54**	**0.67**
PCSE	0.644	0.765	0.771
P value	0.447	0.477	0.385
CD (+)	**18.39**	**19.43**	**18.49**
PCSE	4.262	4.676	4.713
P value	0.000*	0.000*	0.000*
TDFR(+)	**0.83**	**0.90**	**0.93**
PCSE	0.355	0.418	0.392
P value	0.019**	0.031**	0.017**
TDFR.d (+)	**14.64**	**15.76**	**14.81**
PCSE	2.859	2.822	2.865
P value	0.000*	0.000*****	0.000*
C(constant)	**-3.222**	**-3.54**	**-4.24**
PCSE	2.291	2.726	2.736
P value	0.16	0.194	0.121
Adopted model	Linear regression, correlated panels corrected standard errors (PCSEs)	Prais-Winsten regression, correlated panels corrected standard errors (PCSEs)	Prais-Winsten regression, correlated panels corrected standard errors (PCSEs)

***significant at 1% level, **significant at 5% level**

The Interpretation, Evaluation and Comparison of the Results: As crisis determinants, first, the sign conditions (plus) for CD, TDFR and TDFRd are satisfied and they are statistically significant at the 1 per cent, 5 per cent and 1 per cent levels, respectively. Second, the sign condition of CRGDP and CAGDP are satisfied, but they are statistically insignificant at the 10 per cent level. Third, CPSGDP is not only statistically insignificant at the 10 per cent level, but also inverse to the expected sign condition. If it is focused on the

crisis quarters of the crisis countries then the results can be interpreted as follows: One unit increase in TDFR in crisis quarters increases the crisis pressure (crisis index) 14.64 unit (B6) more, on average, so the differential effect (B5+B6) is totally 15.47 (0.83+14.64), holding the other independent variables constant.

When the findings in the third and fourth columns of the results table, which were determined by dynamic TSCS analysis as AR(1) and panel specific AR(1), are analysed, it is seen that both the coefficients and PCSEs differ from each other and from the other columns. Within the framework of the first dynamic model with AR(1) the interpretation can be as follows: As crisis determinants, first, the sign conditions (plus) for CD, TDFR and TDFRd are satisfied and they are statistically significant at the 1 per cent, 5 per cent and 1 per cent levels, respectively. Second, the sign condition of CRGDP and CAGDP are satisfied, but they are statistically insignificant at the 10 per cent level. Third, CPSGDP is not only statistically insignificant at the 10 per cent level, but also inverse to the expected sign condition.

If it is focused on the crisis quarters of the crisis countries then the results can be interpreted as follows: One unit increase in TDFR in crisis quarters increases the crisis pressure (crisis index) 15.76 unit (B6) more, on average, so the differential effect (B5+B6) is totally 16.66 (0.90+15.76), holding the other independent variables constant. Within the framework of the second dynamic model with panel specific AR(1) the interpretation can be as follows. As crisis determinants, first, the sign conditions (plus) for CD, TDFR and TDFRd are satisfied and they are statistically significant at the 1 per cent, 5 per cent and 1 per cent levels, respectively. Second, the sign condition of CRGDP and CAGDP are satisfied, but they are statistically insignificant at the 10 per cent level. Third, CPSGDP is not only statistically insignificant at the 10 per cent level, but also inverse to the expected sign condition. If we focus on the crisis quarters of the crisis countries then we can interpret the results as follows: One unit increase in TDFR in crisis quarters, namely, at the beginning of the crisis, increases the crisis pressure (crisis index) 14.81 unit (B6) more, on average, so the differential effect (B5+B6) is totally 15.74 (0.93+14.81), holding the other independent variables constant.

D. Testing the Indirect Crisis Effect

1. The Third Model: The indirect crisis effects of derivative instruments in international financial crises can be handled as *Accelerating the Crisis* by quickening and deepening the crisis. In this regard, some types of derivatives such as futures, TRS and P. Debts have a role as crises accelerators, pointing out the quick capital outflows, which are called ironically "microwave money" when compared to the description of "hot money" (Dodd 2000). So, the presence of Some Specific Types of Derivatives in the crises economies of the 1990s is handled as a crises accelerator.

The Assumptions: In the 1990s, some specific derivatives were mostly used in the crises economies including the ones handled in this work. They quickened and deepened the crisis process.

Because TRS, Structured Notes, P. Debts, Swaps (Synthetic and/or normal), Synthetic Forwards, Futures among derivatives, require some margin or collateral requirements. All these point out capital outflows during the whole period of crisis **(Following Hattori (2002) crisis periods of each country were chosen by evaluating the content of news articles, and the treatment found in empirical studies. However, as a contribution, these crisis periods were started by the crisis quarters of which threshold method calculated previously, in order to measure effectively its potential accelerating role in crises)** including the crisis quarters and after some time, in which capital or liquidity is most required.

The null hypothesis of TSCS analysis is as follows: H_0: Some Specific Types of Derivatives in the crises economies of the 1990s did not accelerate the global financial crises of some emerging market countries, which were handled in this work. The null of interest is H_0: $B_5=0$ which is indicated in the specification below.

H_1: Some Specific Types of Derivatives in the crises economies of the 1990s accelerated the global financial crises of some emerging market countries, which were handled in this work (H_1:$B_5\neq0$).

The Specification

$$CI_{it}= C+B_1CPSGDP_{it}+ B_2CAGDP_{it}+B_3CRGDP_{it}+B_4TDFR_{it}+B_5TDFR_{it}.D+U_{it}$$

$i= 1,2,3,4,5,6$

$t=1,2,3,\ldots32$

D=1 if derivative is some specific type (TRS or Structured Notes or P. Debts or Swaps or Forwards or Futures or Options) during crisis periods of crisis countries

D=0 if derivative is not some specific type (TRS or Structured Notes or P. Debts or Swaps or Forwards or Futures or Options) during crisis periods of crisis countries

The following Table 5 indicates the results of the third model. Within TSCS analyses, three different versions of TSCS such as with no-autocorrelation, with AR(1) and with panel-spesific AR(1), are used as seen on three columns of the table. According to this table, the first column of the table

shows the variables with expected signs. Under each variable, there are PCSEs for TSCS analyses and p values in order to indicate whether the variable is statistically significant or not, which is shown by single star (*) if the variable is significant at 1% level, two stars (**) if the variable is significant at 5% level, three stars (***) if the variable is significant at 10% level. The last line of the first column indicates the adopted models, which are Linear Regression Model with correlated panels corrected standard errors for TSCS with no-autocorrelation and Prais-Winsten Regression Models with correlated panels corrected standard errors for the last TSCS analyses with AR(1) and with panel-spesific AR(1), respectively.

Table 5: *The Results Table*

Models / **Variables (sign)**	***Testing The Indirect Crisis Effect: By TSCS, OLS with PCSE No-autocorrelation*** **THE THIRD MODEL**	***Testing The Indirect Crisis Effect: By TSCS, OLS with PCSE AR(1)*** **THE THIRD MODEL**	***Testing The Indirect Crisis Effect: By TSCS, OLS with PCSE Panel-specific AR(1)*** **THE THIRD MODEL**
CPSGDP(+)	**-1.17**	**-1.14**	**-1.34**
PCSE	1.350	1.722	1.801
P value	0.39	0.51	0.46
CAGDP(-)	**-18.45**	**-16.94**	**-22.44**
PCSE	12.942	14.859	14.71
P value	0.15	0.25	0.13
CRGDP(+)	**0.52**	**0.48**	**0.77**
PCSE	0.698	0.826	0.866
P value	0.45	0.57	0.37
CD (+)	**18.38**	**19.37**	**17.83**
PCSE	4.661	5.313	5.304
P value	0.00*	0.00*	0.00*
TDFR(+)	**0.83**	**0.81**	**0.91**
PCSE	0.397	0.466	0.447
P value	0.04**	0.08***	0.04**
AD(TDFR.D)(+)	**2.61**	**3.50**	**2.27**
PCSE	1.683	2.021	1.573
P value	0.12	0.08***	0.15
C(constant)	**-3.15**	**-3.19**	**-3.94**
PCSE	2.452	2.906	3.107
P value	0.20	0.27	0.21
Adopted Model Hausman test HO:RE vs. FE P value	Linear regression, correlated panels corrected standard errors (PCSEs)	Prais-Winsten regression, correlated panels corrected standard errors (PCSEs)	Prais-Winsten regression, correlated panels corrected standard errors (PCSEs)

*significant at 1% level, **significant at 5% level, *** significant at 10% level

The Interpretation, Evaluation and Comparison of the Results

As crisis determinants, first, the sign conditions (plus) for CD and TDFR are satisfied and they are statistically significant at the 1 per cent and 5 per cent levels, respectively. Second, the sign condition of CRGDP, CAGDP and AD are satisfied, but they are statistically insignificant at the 10 per cent level. Third, CPSGDP is not only statistically insignificant at the 10 per cent level, but also inverse to the expected sign condition. When it is focused on the derivatives findings related to its accelerating effect it can be said that the estimated coefficient has the expected sign as positive, but it was insignificant at the 10 per cent significance. So, the null hypothesis can be accepted, opposite to the first and second models of the paper, in which the null hypothesis was rejected.

When the findings in the third and fourth columns of the results table which were determined by dynamic TSCS analysis as AR(1) and panel specific AR(1) are analysed, it is seen that both the coefficients and PCSEs differ from each other and from the other columns. Within the framework of the first dynamic model with AR(1) the interpretation can be as follows: As crisis determinants, first, the sign conditions (plus) for CD, TDFR and AD are satisfied and they are statistically significant at the 1 per cent, 10 per cent and 10 per cent levels, respectively. Second, the sign condition of CRGDP and CAGDP are satisfied, but they are statistically insignificant at the 10 per cent level. Third, CPSGDP is not only statistically insignificant at the 10 per cent level, but also inverse to the expected sign condition. Since B5>0 the null hypothesis can be rejected at the 10 per cent significance level. The interpretation of the results can be as follows: In the crisis countries, if there are some specific types of derivatives during the crisis periods- crisis quarters and after some time- one unit increase in TDFR increases the crisis pressure (crisis index) by 3.50 unit (B5) more, on average. This is significant at the 10 per cent level. In other words, in the crisis countries, if there are some specific types of derivatives during the crisis periods, one unit increase in TDFR accelerates the crisis pressure (crisis index) by 3.50 units (B5), on average.

Within the framework of the second dynamic model with panel specific AR(1) the interpretation can be as the same with the TSCS analysis with no-autocorrelation, seen on the second column, as follows: As crisis determinants, first, the sign conditions (plus) for CD and TDFR are satisfied and they are statistically significant at the 1 per cent and 5 per cent levels, respectively. Second, the sign conditions of CRGDP, CAGDP and AD are satisfied, but they are statistically insignificant at the 10 per cent level. Third, CPSGDP is not only statistically insignificant at the 10 per cent level, but also inverse to the expected sign condition. These findings are the same with the findings of TSCS analysis with no-autocorrelation. So, especially for the accelerating dummy, which was tested in this third model, the interpretation is the same with the one made for TSCS analysis with no-autocorrelation as follows. When it is focused

on the derivatives findings related to its accelerating effect it can be said that the estimated coefficient has the expected sign as positive, but it was insignificant at the 10 per cent significance level. So, the null hypothesis can be accepted opposite to the TSCS analysis with panel specific AR(1), in which the null hypothesis was rejected.

IV. A Brief Summary and Concluding Remarks

In the first model through TSCS analysis, it is tried to find out the potential direct crisis effect of derivatives in the crisis pressures of the six emerging market countries. It can be said that at the end of this application part of the first model of the direct crisis effect, it is found out that they had some significant role in increasing the crisis pressure of such countries. As proved by the realization of the expected sign of the coefficient and also being statistically significant of the coefficient. In the second model, it is tried to find out the role of derivatives as their crisis-driven capital outflow effects in crisis quarters obtained by the specific thresholds; these were also found statistically significant. However, the third model which handles the indirect effect of derivatives in such emerging market countries was not found statistically significant except for the dynamic model of AR(1). This can stem from the lack of the relevant data on OTC derivatives in such data.

At the end of the application part of the first and second models of the direct crisis effect it is found out that derivatives had some significant role in crises of such emerging market countries, proved by the realization of the expected signs of the coefficients and being statistically significant of the coefficients. However, it can be said that at least in terms of the empirical results they had not *a key role* in emerging market crises compared with the other issues, if it can be accepted that they are comparable. On the other hand, it can also be said that the empirical analysis does not give the whole picture since the data of OTC derivatives could not be included in the existing data due to lack of the relevant data and also some other significant and key variables, at least, in terms of empirical results, such as the contagion issue, already covers the derivatives contagion channel, maintained by mainly the Dodd's (2000, 2002a, 2002b, 2003) works.

Under these limitations, it can be concluded that whether derivatives played *a key role or not*, all these findings point out that they had an *increasing role* in the emerging market crisis pressures/crises of the 1990s for these sampled emerging market countries. Under these circumstances even these results are so significant due to neo-liberal perspective have tendencies to ignore these facts. They are at a point in which they hardly accept even the results of *some significant role* of derivatives in emerging market crises. Due to this attitude, which ignores or underestimates the potential role of financial derivatives in crises, they were caught by the recent global financial crisis, which emerged as *a surprising fact* for them, but not for the rest.

References

Akiba H and Jia Y (2007) Reassessment of Currency Index by Fundamentals. *Annals of Economics and Finance* 1: 57–85.

Beattie J (2000) Contagion in Latin America: An Analysis of Credit Derivatives. *Duke University and Goldman Sachs.*

Beck N (2001) Time-Series–Cross-Section Data: What Have We Learned In The Past Few Years? *Annual Review of Political Science* 4: 271–293.

Beck N and Katz J N (1995) What To Do (And Not To Do) With Time-Series Cross-Section Data. *The American Political Science Review* 89(3): 634-647.

Chatrath A, Ramchander S and Song F (1996) The Role of Futures Trading Activity in Exchange Rate Volatility. *The Journal of Futures Markets* 16(5): 561-584.

Corsetti G, Pesenti P and Roubini N (1999) Fundamental Determinants of the Asian Crisis: The Role of Financial Fragility and External Imbalances. *NBER Tenth Annual East Asia Seminar*.

Darby MR (1994) Over-The-Counter Derivatives and Systemic Risk To The Global Financial System. *NBER Working Paper* No. 4801.

Derivatives Study Centre. Derivatives Glossary. http://www.financialpolicy.org/dscglossary.htm. Accessed 15 April 2008.

Dodd R (2000) The Role of Derivatives in the East Asian Financial Crisis. *CEPA- Centre for Economic Policy Analysis- Working Paper Series III,* International Capital Markets and the Future of Economic Policy, Working Paper No. 20.

Dodd R (2002a) Derivatives, the Shape of International Capital Flows and the Virtues of Prudential Regulation. *United Nations University WIDER Discussion Paper* No. 2002/93.

Dodd R (2002b) The Role of Derivatives in the East Asian Financial Crisis. In: Eatwell J. and Taylor L. (eds), *International Capital Markets- Systems in Transition.* Oxford University Press, Oxford, pp. 447-474.

Dodd R (2003) Consequences of Liberalising Derivatives Markets. *Financial Policy Forum Derivatives Study Centre.*

Edison HJ (2000) Do Indicators of Financial Crises Work? An Evaluation Of An Early Warning System. *Board of Governors of the Federal Reserve System,* International Finance Discussion Papers, No. 675.

Eichengreen B, Rose A K and Wyplosz C (1995) Exchange Market Mayhem: The Antecedents and Aftermath of Speculative Attacks. *Economic Policy* 21: 251–312.

Eichengreen B, Rose A K and Wyplosz C (1996) Contagious Currency Crises. *Centre for Economic Policy Research (London),* Discussion Paper, No. 1453.

Freedman D, and Peters S (1984) Bootstrapping a Regression Equation: Some Empirical Results. *Journal of the American Statistical Association* 79: 97-106.

Garber P M (1998) Derivatives in International Capital Flow. *NBER Working Paper Series* No: 6623.

Garber P M (2000) What You See Versus What You Get: Derivatives in International Capital Flows. In: Adams C, Litan R E and Pomerleano (eds), Managing Financial and Corporate Distress: Lessons From Asia. Brooking Books Press, pp. 361-384.

Garber P M and Lall S (1996) Derivative Products in Exchange Rate Crises. In: Glick R. (ed), Managing Capital Flows and Exchange Rates: Lessons from the Pacific Basin. Cambridge University Press, Cambridge, pp. 206-231.

Granville B (1999) Bingo or Fiasco? The Global Financial Situation Is Not Guaranteed. *International Affairs* 75(4): 713-728.

Hattori M (2002) On Determinants of the Depth of Currency Crisis: Fundamentals, Contagion, and Financial Liberalization. *Bank of Japan International Department Working Paper Series*, 02-E-2.

Hsaio C (1986) *Analysis of Panel Data*. Cambridge University Press, New York.

Kaminsky G, Lizondo S and Reinhart CM (1997) Leading Indicators of Currency Crises. *The World Bank Policy Research*, Working Paper, No. 1852.

Kelly R (1995) Derivatives- A Growing Threat to the International Financial System. In: Michie J and Smith J G (eds), *Managing the Global Economy*. Oxford University Press, Oxford, pp. 213-231.

Kregel JA (1998) Derivatives and Global Capital Flows: Applications to Asia. *Cambridge Journal of Economics* 22(6): 677-692.

Kruger M, Osakwe P and Page J (1998) Fundamentals, Contagion and Currency Crisis: An Empirical Analysis. *Bank of Canada*, Working Paper, No: 98/10.

Lien D and Zhang M (2008) A Survey of Emerging Derivatives Markets. *Emerging Markets Finance & Trade* 44(2): 39–69.

Marcos M F and Cintra AM (2009) The Financial Crisis and the Global Shadow Banking System. *Revue de la Régulation* 5: 1-19.

Mathieson DJ, Roldos JE, Ramaswamy R and Ilyina A (2004) *Emerging Local Securities and Derivatives Markets*. World Economic and Financial Surveys. IMF, Washington, D.C.

McClintock B (1996) International Financial Instability and the Financial Derivatives Market. *Journal of Economic Issues* XXX(1): 13-33.

Naor N (2006) Reporting On Financial Derivatives—A Law And Economics Perspective. *European Journal of Law Economics* 21: 285–314.

Neftci SN (2002) Synthetic Assets, Risk Management and Imperfections. In: Eatwell J and Taylor L (eds), *International Capital Markets- Systems in Transition.* Oxford University Press, Oxford, pp. 433-446.

Partnoy F (1998) *F.I.A.S.C.O.: The Inside Story of a Wall Street Trader*. Penguin Books, New York.

Rothig A (2004) Currency Futures and Currency Crises. *Darmstadt Discussion Papers in Economics* No: 136.

Sarialioglu-Hayali A (2010) The Global Financial Crises of the 1990s under the Shadow of Financial Derivatives- La Crisis Financiera Global de los Noventa Bajo la Sombra de los Derivados Financieros (In Spanish). *Ola Financiera* 6: 108-146.

Savona P, Maccario A and Oldani C (2000) On Monetary Analysis of Derivatives. *Open Economies Review* 11:S1: 149–175.

Steinherr A (2000) *Derivatives: The Wild Beast of Finance: A Path to Effective Globalisation?* John Wiley &Sons Ltd., Chichester.

Tickell A (2000) Dangerous Derivatives: Controlling and Creating Risks in International Money. *Geoforum* 31: 87-99.

Vlaar PJG (2000) Currency Crisis Models for Emerging Markets. *Econometric Research and Special Studies Department*, De Nederlandsche Bank, No. 45.