

ANALYSING THE ROLE OF FINANCIAL DERIVATES IN THE INTERNATIONAL EMERGING MARKETS FINANCIAL CRISES IN TERMS OF THE EXISTING CRISIS LITERATURE: A CONTRIBUTION TO THE THIRD GENERATION MODELS*

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ABSTRACT

The Role of Financial Derivative Instruments in International Financial Crises can be tackled as Direct Crisis Effects and Indirect Crisis Effects. The paper aims to analyse these roles of derivatives in the financial crises in terms of crisis literature, such as first, second and third generation models of crisis. It mainly aims to connect and test such role of derivatives with the third generation models, which the paper tackles as the most appropriate one for the new generation crises in terms of derivatives. In this regard, the paper maintains that these potential roles present neither “wrong government monetary policies” of the first generation nor “speculation attack under policy tradeoffs of governments” of the second generation. Rather they point to the financial market failures, illiquidity, high leverage, contagion channel, balance sheet distortions of firms and fuelling the speculative risky capital inflows, which all refers to the issues used by the third generation models. In this respect, if the role of financial derivatives in emerging markets financial crises is tested within the framework of a third generation model by a panel data analysis then the major findings indicate that financial derivatives have exposed emerging markets to remarkable risks and financial instabilities in the 1990s and they had role in such crises both directly and indirectly.

Keywords: *International Financial Crises, Financial Derivatives, Crisis Models, Panel Data Analysis.*

JEL classification: F39, G01, G15.

* The work was produced from the PhD thesis conducted at The University of Sheffield, the Department of Economics, the UK. I would like to thank Dr. Jonathan Perraton and Prof. Karl Taylor from the Department of Economics of the University of Sheffield for their valuable feedbacks.

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YDÜ Sosyal Bilimler Dergisi, C. VI, No. 2, (Ekim 2013)

ÖZET**ULUSLARARASI YÜKSELEN PİYASA FİNANSAL KRİZLERİNDE FİNANSAL TÜREVLERİN ROLÜNÜN MEVCUT KRİZ LİTERATÜRÜ BAKIMINDAN ANALİZİ: ÜÇÜNCÜ NESİL MODELLERE BİR KATKI**

Finansal Türev Araçların Uluslararası Finansal Krizlerdeki Rolü Doğrudan Kriz Etkileri ve Dolaylı Kriz Etkileri olarak ele alınabilir. Makale türevlerin finansal krizlerdeki bu rollerini birinci, ikinci ve üçüncü nesil kriz modelleri gibi kriz literatürü açısından analiz etmeyi amaçlamaktadır. Makale esas olarak türevlerin söz konusu rolünü, yeni nesil krizler için türevler açısından en uygun olanı olarak değerlendirdiği üçüncü nesil modellerle birleştirmeyi ve test etmeyi amaçlamaktadır. Bu bağlamda, makale bu potansiyel rollerin ne birinci neslin “hükümetin yanlış para politikaları”nı ne de ikinci neslin “hükümetlerin politika ikilemleri altındaki spekülasyon atakları”nı temsil ettiğini savunmaktadır. Daha çok onlar, üçüncü nesil modellerce kullanılan sorunlar olan finansal piyasa başarısızlıkları, likidite sıkışıklığı, yüksek kaldıraç, yayılma kanalı, firmaların bilançolarının bozulması ve spekülatif riskli sermaye akımlarının teşviğine işaret etmektedir. Bu bağlamda, şayet finansal türev araçların yükselen piyasa finansal krizlerindeki rolü üçüncü nesil bir model çerçevesinde panel data analiziyle test edilirse o zaman ana bulgular göstermektedir ki finansal türevler yükselen piyasa ülkelerini 1990’larda kayda değer risklere ve finansal istikrarsızlıklara maruz bırakmıştır ve söz konusu krizlerde hem doğrudan hem de dolaylı rol oynamıştır.

Anahtar Kelimeler: Uluslararası Finansal Krizler, Finansal Türevler, Kriz Modelleri, Panel Data Analizi.

JEL sınıflandırması: F39, G01, G15.

1. Introduction

The Role of Financial Derivative Instruments¹ in International Financial Crises can be tackled as Direct Crisis Effects and Indirect Crisis Effects. These

¹ 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 (Derivatives Study Centre/Derivative 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.

potential roles present neither “wrong government monetary policies” of the first generation models nor “speculation attack under policy tradeoffs of governments” of the second generation models. Rather they point to the financial market failures, illiquidity, high leveraged positions, contagion channel for crisis, balance sheet distortions of firms and fuelling the speculative risky capital inflows, which all refers to the issues used by the third generation models.

The paper aims to analyse the role of derivatives in the international financial crises in terms of crisis literature, such as first, second and third generation models of crisis, in order to determine how far these models fit the role of derivatives and in what aspects they cannot explain what happened in the crisis economies in terms of derivatives. It tries to connect and test such role of derivatives with the third generation models, which the paper tackles as the most possible appropriate crisis theory for the new generation crises in terms of derivatives. In this regard, if derivative instruments are not included in the big picture of the crises of developing economies or if they are not made clear, even the existing third generation models will remain incomplete since they hidden behind the most of the factors that the third generation models cover, such as the dramatic increase of capital inflows and their quick outflows, financial fragility with illiquidity issue and contagion issue. In this respect, a kind of third generation crisis model involving both “fundamental and self-fulfilling non-fundamental variables” is built and a proxy for the presence of financial derivatives is added to this model in order to test the role of financial derivatives in emerging markets financial crises through a third generation model by a panel data analysis. It is found out that derivatives had some significant role in emerging market crises of the 1990s both directly and indirectly, proved by the realization of the expected signs of the relevant coefficients and being statistically significant of them.

After the introduction part, the role of derivatives in the international financial crises, is tackled in two sections: First, the “direct crisis effects” as “vulnerability to crisis” and “crisis-driven capital outflow”; second, the “indirect crisis effects” as “accelerating the crisis” and “increasing the lending boom”. In the third part, the analysis of the role of derivatives in the international financial crises is done in terms of the existing crisis literature in order to connect such role of derivatives with the third generation models, which constitutes the most possible appropriate one for the new generation crises. Before this a brief description of the third generation models is tackled as a subsection. In the last part before the conclusion, which constitutes the empirical part of the paper, the hypotheses of the

paper are tested through a panel data analysis by building the relevant models within the framework of the third generation models of crisis.

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

The presence of derivatives, themselves, can be a very effective destabilizing factor of the economy under fully liberalized, poorly structured and improperly regulated derivatives markets as seen in the emerging markets of the 1990s. 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. 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, p. 166). 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: “...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, p. 286).

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, p. 14), 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 reclassified as follows: 1-Direct Crisis Effects and 2-Indirect Crisis Effects.

2.1. The Direct Crisis Effects

The direct crisis effect of derivatives can be tackled as “vulnerability to crisis effect” and “crisis-driven capital outflow effect” as follows.

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, p. 8) 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, p. 17). In this regard, derivatives are criticized in terms of destroying the efficient allocation of funds by masking the actual risk in an investment (Kregel, 1998, p. 679). 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, pp. 463-464). 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 (CBs) and national accounts, thus “reducing transparency.”² In other words, there became a gap between the total risk exposure and that reflected by balance sheets (Dodd, 2002b, pp. 463-464).

² For a detailed discussion of the Effects of Derivatives on Interpretation of Balance of Payments Accounting see Garber (1998).

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 (Dodd, 2003, pp. 8-9).

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, p. 4). 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, p. 16). Hence, the short-term character of derivatives together with this high leverage opportunity make derivatives powerful speculation and manipulation³ tools, 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, p. 18). 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, p. 17), the Bank of International Settlements (BIS)’s Promisel Report handles the derivatives markets as leading to greater systemic risk.⁴

³ 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 (Rothig, 2004, p. 4).

⁴ See McClintock (1996) for a useful summary of the report stressing the systemic risk of derivatives.

In this regard, Dodd (2003) points out that “the systemic risk in international level” refers to the contagion⁵ 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, p. 20).

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. In this regard, 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.

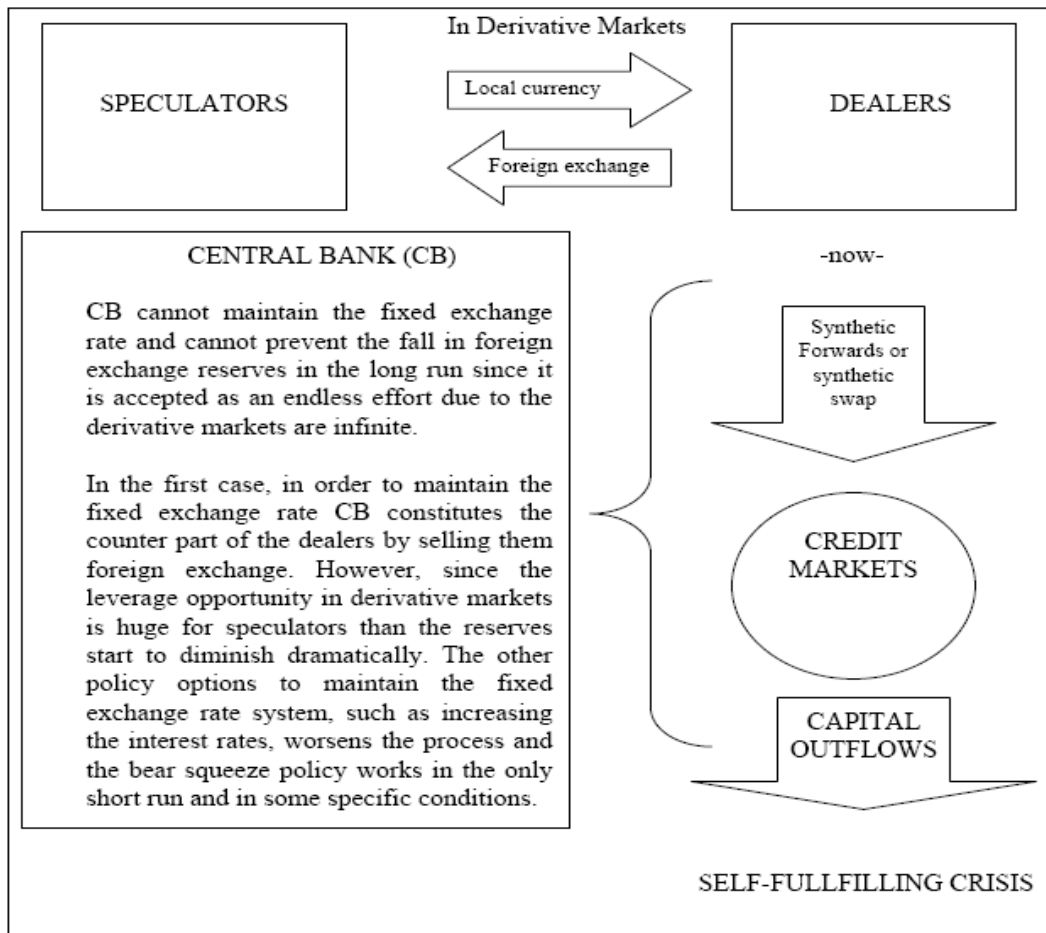
Derivatives are open to be used as a speculative or hedging instrument against the success of government’s policy by speculators, attackers or hedge fund operators. Dodd (2002a) asks the right question that “...how and why would they use (derivatives) since there is no market volatility to hedge?” Because 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, p. 15). Rothig (2004) puts it as

⁵ “The tendency of a firm crisis in one country to adversely affect the financial markets in other economies” is called “Contagion” (Dodd, 2000, p. 21).

“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” (Rothig, 2004, p. 6).

Although here especially fixed exchange rate is considered, it can be either in the case of fixed exchange rate system to maintain the fixed exchange rate or floating exchange rate system to stabilize the economy following a speculative attack or at the financial disruption. The mechanism of the direct crisis effect of derivatives can be shown in several versions⁶ of which one of them is as below:

Figure 1: The Crisis-Driven Capital Outflow Effect



⁶ See Sarialioglu-Hayali (2010) for a detailed analysis of the other mechanisms of the direct crisis effect of derivatives.

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 of 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 swaps⁷ 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 CB, 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, p. 15).

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 CBs to maintain the fixed exchange rate system such as selling

⁷ See Neftci (2002) for a detailed analysis of synthetic assets.

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 CBs 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 CBs to maintain the fixed exchange rate since the direct intervention of CBs 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 (2002a) puts this as “While the spot market is large, the potential size of the forward and swap market is infinite” (Dodd, 2002a, p. 16). As a second tool to defend the exchange rate, the CB can raise the local interest rates. However, this would increase the interest rate differential, leading to forward discount much more and creating more capital outflows by signalling devaluation.⁸ Especially this is a relevant case under the dynamic hedging techniques, which Granville (1999) puts as the ones that “replace human judgment 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 CB increasing interest rates in a currency attack situation, thus making such defence useless (Granville, 1999, p. 722). All these point out the inefficiency of the regular tools of CBs.

2.2. 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, p. 21). The indirect crisis effect of derivatives can also be handled in terms of “Increasing the Lending Boom” through fuelling capital inflows to developing world.

⁸ 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, p. 468).

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. 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, p. 18), causing a shortage of liquidity, which is defined as “the ability to match obligations with the ability to pay” (Kelly, 1995, p. 230). 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 and 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.

3. Analyzing the Role of Derivatives in the International Financial Crises In Terms of Existing Crisis Literature: A Contribution to the Third Generation Models

3.1. The Third Generation Models

When the first and second generation models were seen to be inadequate to explain the emerging markets crises in the 1990s, such as the Mexican crisis and the South East Asian crisis, the third generation models, which can be handled as a package of a number of models,⁹ were developed (Copeland, 2005, p. 462).

Although there are some common points with the other two models, first and second generation models, the significance of the third generation models is the fact that they put the real side effects of the crisis. Moreover, they stress the creator role of the capital movements in international financial crises among the other problems stemming from the financial sectors including the banking. They also highlight the contagion issue. Chang and Velasco (1999) put some real side effects of crisis as “Crises have real effects, in contrast with first- and second-generation models. Costly liquidation (or, more generally, projects that are left unfinished or not undertaken because of lack of funding) can cause illiquid banks to suffer real losses and become de facto insolvent” (Chang and Velasco, 1999, p. 28).

Like the first generation models, they handle the weak economic fundamentals behind the crises. However, in contrast to the first generation models they mostly focus on the microeconomic fundamentals of the crises rather than on the macroeconomic ones. Like the second generation models, they tackle the speculative attacks and self-fulfilling crisis and are typically multiple equilibria models. In this regard, Hamann *et al.* (2003), an International Monetary Fund (IMF) publication, put this fact as follows: “These models acknowledged that second generation models captured some aspects of the Asian crisis (notably the existence of multiple equilibria) but noted that other factors were also at play—namely,

⁹ Although there is no eventual consensus on the third generation models the following classification is thought to be better to handle the third generation models, which is mostly tackled as a package in this paper, rather than as alternative theories to each other: The Third Generation Models of Crisis Stemming from the Problems in the Financial Sector such as Overly Rapid Financial Liberalisation, Moral Hazard and Adverse Selection, The Liquidity Issue/Financial Fragility; The Third Generation Models of Crisis Stemming from the Problems in the Balance Sheets of Corporations and The Third Generation Models of Crisis Stemming from the Contagion Issue such as Herding Behaviour: The Irrational Contagion of Crisis and The Trade and Financial Linkages between Countries: The Rational Contagion of Crisis.

corporate and financial weaknesses” (Hamann *et al.*, 2003, p. 14). However, in contrast to the second generation models, they do not explain the speculative attacks under governments’ policy trade-off situation. So, it is argued that although output gains can accompany the second generation models of crisis, due to the policy choice of government, under policy dilemma, the third generation models of crisis are experienced mostly with output losses. This is due to the existing problems in the balance sheets of corporations in which liabilities are mostly in foreign exchange and assets are in local currencies leading to distortions of the balance sheets in such crises. Hence this causes to the fall of their investment and output at the macro level.

Furman and Stiglitz (1998) maintain that second generation models stress the “transitory benefits of devaluation”. If the banks and corporations have foreign exchange exposure and especially if the banks have weak positions, pointing out the fragility of the whole system, such transitory benefits cannot be a policy choice for the government. They maintain that third generation models cannot include a policy dilemma of governments, even reducing the government’s debt cost. This is because devaluation would mean highly increased costs in foreign exchange exposure both in terms of government and corporations, which would collapse the whole system by reducing the credits and aggregate demand (Furman and Stiglitz, 1998, pp. 31-33).

Hemming *et al.* (2003), an IMF publication, argue that although the third generation models can be in various forms, they tend to underline the balance sheet problems. Moreover, they include both “self-fulfilling nonfundamentals-and fundamentals-driven crises” (Hemming *et al.*, 2003, p. 32).

3.2. Analyzing the Role of Derivatives in the International Financial Crises In Terms of Existing Crisis Literature: A Contribution to the Third Generation Models

It can be said that the presence of derivatives in the developing countries, which underwent nearly complete and rapid financial liberalization without implementing efficient and necessary regulations, and which had remarkably imbalanced derivative markets, especially during a crisis, present neither wrong government monetary policies nor speculation attack under policy tradeoffs of governments. Rather, they present potential crisis determinants because they were highly open to be used for economically harmful purposes, such as information distortion, manipulation, reducing transparency. All pointing to the financial market

failures, and also creating illiquidity, high leveraged positions and contagion channel for crisis, making balance sheet distortions of firms and fuelling the speculative risky capital inflows. And also, the presence of some types of derivatives such as TRS, P. Debts, and Synthetic Forwards had a contributing role to affecting the dynamics of crisis. Besides, the presence of such derivatives acted as a crisis accelerator, pointing out the quick capital outflows, which are called ironically “microwave money” (Dodd, 2000, p. 11). All these created vulnerability to crisis in such conditions of poorly structured and improperly regulated imbalanced derivatives markets in emerging market countries. In this regard, it can also be said that all these point out the complex structure of the financial crises in the 1990s, requiring more than one theory or requiring more explanations than “the governments’ wrong policies or speculators’ harmful behaviours” to explain it. Since the first and second generation models of crisis were not accepted sufficient enough to explain the financial crises in the developing countries in the 1990s and these financial crises have been tackled within the framework of the third generation models of crisis, it seems it is better to evaluate these financial crises and the role of derivatives in these financial crises in terms of the third generation models. This is due to they much more focus on micro economic fundamentals, besides macroeconomic ones, behind crises combining alternative theories such as financial market failures, highly volatile capital flows and contagion problems (Copeland, 2005, p. 462). In other words, they can be handled as a package of theories.

When the role of derivatives is taken as direct crisis effect of vulnerability to crisis, it seems that derivatives, unfortunately, can present financial market failures creating vulnerability to crisis, whether in fixed or floating exchange rate systems of emerging markets. In this regard, the presence of derivatives which can be easily used for economically harmful purposes, such as default, moral hazard, manipulation, information distortion, evading prudential regulations and reducing transparency, in the emerging market economies can build the vulnerabilities to crisis. All these point out the financial market failures which are already tackled by the third generation models. These failures are criticised in terms of creating “boom-bust cycle” turning into crisis. It is argued that under poorly structured derivatives market, the presence of derivatives can be handled as an indicator of financial market failures since they can be used for moral hazard, manipulation, insider trading and also asymmetric information. Moreover, 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. The presence of some specific types of derivatives, such

TRS, P. debts and structured notes, are also tackled as the factors affecting the dynamics of crisis because of their nature. Thus, all these are pointing out the financial market failures, balance sheet effect and contagion effect which constitute the important factors of the third generation models. So, it can be said that rather than the macroeconomic fundamentals, which the first generation models mainly focus on, the “microeconomic fundamentals”, which third generation models tackle, can be easily destroyed by the derivatives by contributing to the fragility of the financial sector. This is due to derivatives are open to be used in highly leveraged positions. The “microeconomic fundamentals” here refer to the situation of the financial sector/banking sector, represented by the balance sheets and their open positions.

The third generation models can also handle the volatility and destructive role of capital flows in creating the emerging market crises of the 1990s. In this regard, derivatives in the unregulated derivatives market of emerging countries are blamed for fuelling huge amounts of capital flows, more than needed, to such countries, thus creating “lending booms”, and distortions in balance sheets and fragilities in the banking sectors, which are already tackled by the third generation models. Moreover, the rapid capital in and out flows for emerging countries leading to the significant volatilities of capital flows are also handled in terms of derivative transactions which are very open to be used by this purpose. In this regard, it is noted that high usage of derivatives contributed to this process significantly, due to the capital transactions allowed to move more sudden and more violent (Kelly, 1995, pp. 218-219). Unfortunately, these highly volatile capital movements, sustained by the usage of derivatives, made especially the emerging markets unstable and prone to crisis.

When the role of derivatives is taken as direct crisis effect, driven by capital outflows, it seems that derivatives, unfortunately, can be a very useful vehicle of speculative attacks. Kelly (1995) puts this issue as follows: “...It was the growth of financial derivatives which made aggressive speculation against currencies cheaper and faster than had previously been possible, exacerbating the short-term bias of financial markets and undermining international policy coordination...” (Kelly, 1995, pp. 214-215) in which she points to the role of derivatives in the European Exchange Rate Mechanism (ERM) crisis in 1992. In this regard, within the framework of speculative attack the role of derivatives can be handled both in terms of second generation and third generation models. However, it should be pointed out that since these models try to explain different types of crises, the mechanism of derivatives participating in the speculative attack differs also.

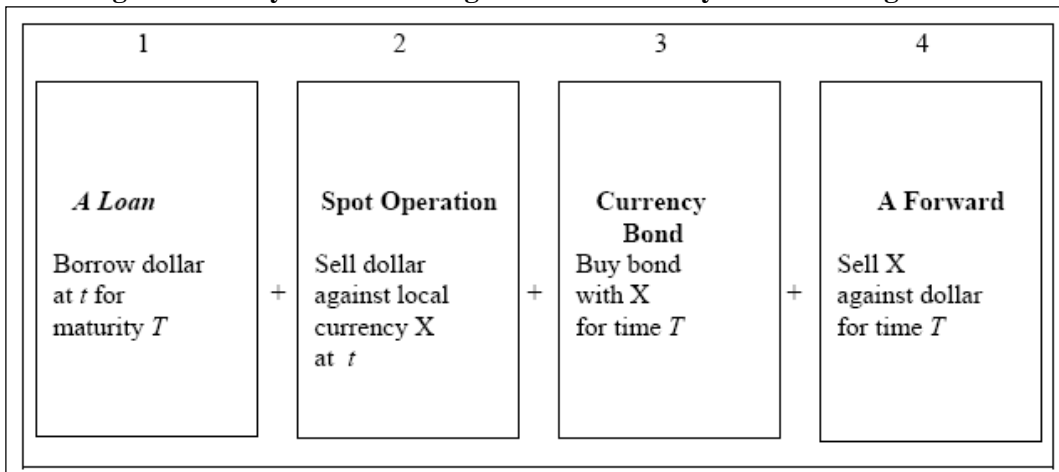
It can be said that within the framework of second generation models focusing on mainly the developed country crises such as the ERM crisis (or European Community (EC) currency crisis) in 1992, which handle the speculation attacks during the policy dilemma conditions of governments, even under sound financial markets, derivatives play a pure speculation attack vehicles used by hedge funds. McClintock (1996) puts this as follows: “During the EC currency crisis, hedge funds shorted or sold pounds sterling using currency options in the expectation that this speculation would force the British government to devalue the pound below its lower bound in the Exchange Rate Mechanism. Once the pound indeed devalued (both because of the speculative pressure and the difficulties associated with creating monetary union), hedge funds engaged in profit-taking by purchasing sterling to close out their currency positions” (McClintock, 1996, p. 22). Moreover, in this kind of crises, the hedge funds of which power are relatively small among institutional investors gained huge power through acting as market leaders by virtue of taking highly leveraged positions sustained by derivatives. Kelly (1995) puts this as follows: “...Part of this increased volatility can be attributed to ‘hedge funds’, a particularly aggressive type of speculative investment vehicle that uses sophisticated hedging and leverage techniques to play in the financial markets” (Kelly, 1995, pp. 219-220). However, in the crises of the developing countries in the 1990s, although speculative attacks played a role by using derivatives, not just hedge funds, but also local banks as well as pension and/or insurance funds, played a role by using economically harmful purposes of derivatives, such as information distortions, evading prudential regulations. In this regard, in such crises, local dealers have already participated in the process as counterparts (See figure 1), who wanted to benefit from huge arbitrage opportunities and mainly had to offset their exposures via synthetic contracts in the imbalanced derivatives markets of developing countries. So, it can be said that just looking at hedge funds by ignoring local counterparts in the imbalanced derivative markets of developing countries or handling the crisis only in terms of the second generation models seems insufficient to explain the role of derivatives in the international financial crises of the developing countries. Garber and Lall (1996) put this issue as follows: “Although the general macroeconomic principles of speculative attacks are still relevant, the existing literature has limitations in analyzing financial market developments during the attack and its aftermath. To gain an understanding of the source of the volatility associated with a foreign exchange crisis, we must turn to the details of the underlying capital markets and particularly of the derivatives markets” (Garber and Lall, 1996, p. 211).

As acknowledged in this research, hedge funds were not the only or primarily concern in the emerging market crises, in which local players and also the other institutional investors, which wanted to benefit from the speculative gains through derivatives and capital inflows, had also significant roles. In this regard, these capital inflows were accelerated by derivatives, leading to bad bank loans issue and fragility in the banking system. And the derivatives, themselves, which are highly open to unproductive usages in unregulated derivatives markets, were the other significant cases. In this respect, our research concludes that the second generation models view handling, specifically, the speculative attacks of hedge funds is not the case; rather, the role of derivatives in emerging market crisis should be handled without ignoring the weak fundamentals of the emerging market economies. However, these weak fundamentals are mostly financial ones, rather than fiscal ones, pointing to the third generation models instead of first generation ones. This is also consistent with the ways, which derivatives positions created the vulnerabilities to crisis, as follows: Accelerating the capital inflows more than needed and transforming them to bad bank loans, creating high fragilities in the banking system, namely, market failures, by virtue of their ability to avoid prudential regulations and moreover, constituting a very useful channel for contagion. All these issues are handled within the framework of the third generation models.

The usage of derivatives in such speculation attacks do not need anything else other than hedge funds, and, maybe, the other institutional investors following such hedge funds, taking aggressive speculative attacks against currency and governments' policy trade-off situation. So, the mechanism of the usage of derivatives in triggering the crisis seems somewhat different from the one in emerging market financial crises of the 1990s. In such crises, local dealers have already participated in the process as counterparts due to they wanted to benefit from huge arbitrage opportunities. However, they mainly had to offset their exposures via synthetic contracts in the imbalanced markets of developing countries, under weak currency, weak financial fundamentals and contagion issues, by leading to massive capital outflows at the end. In this regard, it can be said that for this, there should be speculators starting the speculative attack and also local banks as counterparts, which actually want to benefit from the arbitrage opportunities that are sustained by the high interest rate- low exchange rate (appreciated currency) situation. Moreover, they had to take synthetic assets in the imbalanced markets of the emerging/developing countries, under highly liberalized financial markets and the contagion factor as a triggering effect of the speculative attack.

It can be said that the direct role of derivatives in the crises of the emerging markets is a significant factor to highlight the speculative attack mechanism, since they constitute a very useful vehicle of both speculation attacks and also rapid capital in and out movements. In this regard, it can be argued that the presence of derivatives, themselves, can be a very effective destabilizing factor of the economy under fully liberalized, poorly structured and improperly regulated imbalanced derivatives markets. This is due to they can create instability in the fixed exchange rate system during the crisis and lead the system to collapse since the speculative attack can be done easily by them and be converted into “a one-way bet” under fixed exchange rate regime. All this refers to the third generation models dealing with the conditions of over valuation of the local currency leading to huge arbitrage opportunities. These end with huge losses once the speculative attack starts, pointing out the financial excess and financial collapse process, which are created by massive capital in and out flows sustained significantly by virtue of derivatives, under rapid and complete financial liberalization. All this refers to profitable carry trade operations in which massive capital in and outflows are maintained easily, making the boom-bust cycle of exchange rates. The following Figure 2 handles the issue.

Figure 2: Carry Trade Causing the Boom-Bust Cycle of Exchange Rate



As seen on Figure 2, in the first place, trader borrows dollar from abroad in relatively low interest rates and then, second, he converts the funds into local currency of an emerging market in the spot markets. This has a potential impact to create overvaluation of local currency. At the third stage, he buys a local-currency-

denominated money market instrument, such as a bond of the emerging market, for the equivalent amount or as another type, lends on local currency short-term inter-bank market. All these create virtual welfare effect on private sector and consumers through banking credit, creating the “boom” of the cycle. At the same time, he takes a position as selling local currency in forward markets at the amount of principal and interest (IMF, 1998, p. 44). This increases pressure on financial markets of emerging markets, which already have problems, going to “bust” of the cycle.

When the role of derivatives is taken as indirect crisis effect as accelerating the crisis, it seems that derivatives, unfortunately, can also be very useful in creating post-crisis panic attitudes. Since the presence of some specific types of derivatives act also as a crisis accelerator in the developing countries, namely, they quicken and deepen the crisis process after the crisis begins by leading to illiquidity, systemic risk and contagion of crisis as a result of high leverage positions, which is especially seen in the OTC derivatives, all this refers to the third generation model. Because the third generation models, which try to fill the gaps of the other models which cannot explain the reasons of the new generation crises, mainly focus on the high leverage issue, illiquidity issue and contagion problem whether rational or irrational.

4. The Empirical Analysis

In order to test the null hypotheses, which will be described in the following parts, panel data covering six emerging countries,¹⁰ Brazil, Malaysia, South Korea, South Africa, Hungary and Singapore, for the era of 1996q1-2003q4 is used through a panel data analysis¹¹ to investigate the potential role of the derivatives in the global financial crises of the emerging market countries in the 1990s. In this regard, as a methodology, a panel data analysis is put as follows: “A panel data regression differs from a regular time-series or cross-section regression in that it has a double subscript on its variables” (Baltagi, 2003, p. 11) which can be indicated in the following form:

$$Y_{it} = a + X'_{it}B + u_{it} \quad i = 1, \dots, N; t = 1, \dots, T$$

Where i denotes households, individuals, firms, countries *etc.* and t denotes time in which periodical observation of a variable set is done. So that, while the i

¹⁰ 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.

¹¹ Panel data analysis is briefly handled here, because its details can be easily found in even beginner level econometrics books (See Wooldridge, 2006) or panel data books (See Baltagi, 2003 and Gujarati, 2003).

subscript refers the cross-sectional dimension, the t subscript refers the time-series dimension. In the equation above, a is a scalar, X_{it} is the it th observation on K explanatory variables and B is $K \times 1$, which indicates a column vector of which column number is 1 and line number is K , and u_{it} is error term or error component model in which $u_{it} = \mu_i + v_{it}$ where μ_i denotes the unobservable individual specific effect which is time invariant and not included in the regression and v_{it} refers the remainder disturbance. The latter varies with individual and time and can be handled as the usual disturbance in the regression (Baltagi, 2003, p. 11).

The benefits of the panel data analysis over time-series or cross-section is summarized as follows: 1- Panel data suggest that individuals, firms and countries are heterogeneous, pointing out the controlling for individual heterogeneity, when compared to the time-series and cross section, which have the risk of obtaining biased results due to not controlling this heterogeneity. 2- Panel data give more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency compared to the others, especially time-series in which multicollinearity is common. 3- Panel data are better able to study the dynamics of adjustments compared to others especially cross-section, due to it works with the repeated cross-section observations. 4- Panel data are better able to identify and measure effects that are simply not detectable in pure cross-section or pure time-series data. 5- Panel data sustain the researcher to build and test more complicated behavioural models compared to pure cross-section or pure time-series data (Baltagi, 2003, pp. 5-7 and Gujarati, 2003, p. 638).

Since in our research, our sample emerging countries are chosen according to data availability on derivatives we handled these countries in the relatively long-time dimension both in order to catch the 1990s and also to increase the data set at least in terms of time dimension. Hence, by this it is also tried to overcome the limitation of panel data, such as short time-series dimension, which typical panels have and criticised in terms of “asymptotic arguments rely crucially on the number of individuals tending to infinity” (Baltagi, 2003, p. 9). In this regard, since in the applied literature panel data analysis are used both for data sets of $N > T$ and $T > N$, for the research, which has a data set of $T > N$, due to data availability, panel data analysis is found appropriate to use.

4.1. The Variables

Table 1 indicates the symbols, definitions, units and scales of dependent and independent 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 PRIVATE 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: International Monetary Fund International Financial Statistics (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.

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” 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:

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

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

% Δ R: Quarterly percentage change of the foreign exchange reserves

$$\alpha_1 = \sigma_s / \sigma_r$$

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

σ_r : 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, p. 2).

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, p. 1). 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 for example Corsetti *et al.*, 1999; Kruger *et al.*, 2000; 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, p. 8).

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, p. 64). 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 other case is the Current Account Surplus, which points out the current account having a positive sign. In this regard, 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.*, 2000, p. 263). In this regard, this indicator, which can also be used as a positive indicator of financial liberalisation/development in the literature,¹² 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, 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 and so forth, which all creates the

¹² See for instance, Arestis, Demetriades and Luintel (2001) for the usage of Domestic Credits as a proxy of Financial Development.

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. So, following Garber and Lall (1996), Garber (1998, 2000), the works of Dodd (2000, 2002a, b, 2003) and Rothig (2004), the expected sign of this variable is positive.

4.2. Testing the Direct Crisis Effect

4.2.1. The 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. Within the framework of panel data analysis, the potential role of the derivative instruments in the financial crises of emerging market countries in the 1990s is investigated. Thus, the presence of derivatives in 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.

4.2.2. The Null Hypothesis and Assumptions

The null hypothesis is as follows:

H₀: There was not any role of derivatives in the global financial crises of the emerging market countries in the 1990s. The null of interest is $H_0: B_5=0$ which is indicated in the specification part under 4.2.3. We interpret evidence of the null as being inconsistent with the role of derivatives in the global financial crises of the emerging market countries in the 1990s.

H₁: There was a role of derivatives in the global financial crises of the emerging market countries in the 1990s ($H_1: B_5 \neq 0$).

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” (Mathieson *et al.*, 2004, p. 69).

4.2.3. The Specification of the Model

In the research, through a panel data regression 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. This is also consistent with testing the third generation models of crisis. Hemming *et al.* (2003), an IMF publication, argue that although the third generation models can be in various forms, they include both “self-fulfilling nonfundamentals- and fundamentals-driven crises” (Hemming *et al.*, 2003, p. 32). So, a third generation model would be tested by both including the fundamentals such as non-performing loans and non-fundamentals such as contagion issue represented by variables in the model specification.

According to this, the model specification is as follows:

$$CI_{it} = C + B_1 CPSGDP_{it} + B_2 CAGDP_{it} + B_3 CRGDP_{it} + B_4 CD_{it} + B_5 TDFR_{it} + U_{it}$$

$i=1,2,3,4,5,6$
 $t=1,2,3,\dots,32$ (1996q1-2003q4)

For panel data analysis, both random effect and fixed effect models are calculated and the Hausman test is used for consideration. According to the Hausman test, the random effect model was found to be statistically significant. Before the analysis, the unit root test for the panel data by using Fisher test, which is common for unbalanced panel data, were done according to Phillips- Perron (PP)

tests. The obtained test results of the PP tests, which are fixed lag based, for Intercept with Trend Model, which is handled as the most important one for consideration, are presented in the appendix-2. The panel unit root test results indicate that all the variables are stationary on their levels.

4.3. Testing the Indirect Crisis Effect

4.3.1. The 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, which were handled before, 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, p. 21). So, the presence of Some Specific Types of Derivatives in the crises economies of the 1990s is handled as a crises accelerator.

4.3.2. The Null Hypothesis and 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 including the crisis quarters and after some time, in which capital or liquidity is most required.

The null hypothesis of the model is as follows:

H₀: Some Specific Types of Derivatives in the crises economies of the 1990s did not accelerate the global financial crises of the emerging market countries. The null of interest is $H_0: B_6=0$ which is indicated in the specification part under 4.3.3

H₁: Some Specific Types of Derivatives in the crises economies of the 1990s accelerated the global financial crises of the emerging market countries ($H_1: B_6 \neq 0$).

4.3.3. The Specification of the Model

$$CI_{it}=C+B_1CPSGDP_{it}+B_2CAGDP_{it}+B_3CRGDP_{it}+B_4CD_{it}+B_5TDFR_{it}+B_6TDFR_{it}.D+U_{it}$$

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

$$t=1,2,3,\dots,32$$

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.

In this regard, 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 below, in order to measure effectively its potential accelerating role in crises. According to this, 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,¹³ 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 2 indicates the crisis and non-crisis countries in the sample, which are determined according to this method, as follows:

¹³ 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, p. 11).

Table 2: 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

The estimation of the Random Effects Models, which were decided according to the Hausman test statistics, were estimated by Generalized Least Squares (GLS) regressions since it is noted that a simple Ordinary Least Squares (OLS) does not take the error structure into account. The details including the relevant diagnostic tests are in the appendixes.¹⁴

¹⁴ Here a static panel data analysis is done due to the especially data limitations. However, the time series-cross section (TSCS) versions of the models were also computed. The results did not change significantly.

4.4. The Interpretation and Evaluation of the Results

Table 3: The Results Table

Models Variables (sign)	Testing The Direct Crisis Effect: By Panel data	Testing The Indirect Crisis Effect: By Panel data
CPSGDP(+)	-1.57	-1.17
SE	1.405	1.398
P value	0.26	0.41
CAGDP(-)	-23.62	-18.45
SE	14.09	14.085
P value	0.09***	0.19
CRGDP(+)	0.75	0.52
SE	0.788	0.784
P value	0.34	0.50
CD (+)	18.21	18.38
SE	3.873	3.826
P value	0.00*	0.00*
TDFR(+)	0.94	0.83
SE	0.361	0.36
P value	0.01*	0.02**
AD(TDFR.D)(+)		2.61
SE		1.103
P value		0.02**
C(constant)	-3.25	-3.15
SE	2.384	2.354
P value	0.17	0.18
Adopted Model	Random Effect	Random effect
Hausman test		
HO:RE vs. FE	1.31	1.85
P value	0.9334	0.9326

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

When it is looked at the findings of the direct crisis effect model, as crisis determinants, 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. Secondly, the sign condition of CRGDP is satisfied, but it is statistically insignificant at the 10 per cent level. Thirdly, 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 in terms of direct crisis effect, it can be said that the estimated coefficient has the expected sign as positive at 1 per cent significance. So, we can reject the null hypothesis since $B_5 > 0$ at the 1 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. According to these results, it can be said that based on the third generation models to explain the currency crisis, the increase in total derivatives, contagion dummy and CAD were possible causes of the currency crises.

Looking at the findings of the indirect crisis effect model, as crisis determinants the sign conditions (plus) for CD, TDFR and AD are satisfied and they are statistically significant at the 1 per cent, 5 per cent and 5 per cent levels, respectively. Secondly, the sign condition of CRGDP and CAGDP are satisfied, but they are statistically insignificant at the 10 per cent level. Thirdly, 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 in terms of indirect crisis effect, it can be said that the estimated coefficient has the expected sign as positive at 5 per cent significance. Since $B_5 > 0$ the null hypothesis can be rejected at 5 per cent significance. 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 2.61 unit (B_5) more, on average. This is significant at the 5 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 2.61 unit (B_5), on average.

5. Conclusion

Since the first and second generation models of crisis were not accepted as sufficient to explain the financial crises in the developing countries in the 1990s, which were much more complex, requiring more explanations than the governments' wrong policies or speculators' harmful behaviours in a government's trade-off situation, these crises have been tackled within the framework of the third generation models.

Third generation models much more focus on micro economic fundamentals, besides macroeconomic ones. In this regard, they include micro and macro economic variables as fundamentals and, for instance, contagion issue as

non-fundamentals. Thus they try to combine alternative theories such as financial market failures, highly volatile capital flows and contagion problems. More importantly, they potentially include or point to the economically harmful usages of derivatives. In this regard, if derivative instruments are not included in the big picture of crisis developing economies or if they were not made clear, even the third generation models of crisis will remain incomplete since they are hidden behind the most of the factors that the third generation models cover. Examples are the dramatic increase of capital inflows and their quick outflows, moral hazard issue, financial fragility with illiquidity issue and contagion issue. In this respect, if the role of financial derivatives in emerging markets financial crises is tested within the framework of a third generation model then it can be said that it is found out that derivatives had some significant role in emerging market crises of the 1990s both directly and indirectly, proved by the realization of the expected signs of the relevant coefficients and being statistically significant of them. However, at least in terms of the empirical results when we compare their role with the contagion issue, if it can be accepted that they are comparable, it can be said that they had a significant but not a “key role” in emerging market crises compared with the other issues.

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 to 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, b, 2003) works. So, it can be concluded that whether derivatives played a key role (by considering OTC or contagion issue) or not, the findings of the empirical analysis point out that they had an increasing role in the emerging market crisis pressures/crises. If the OTC data could be reached and/or the existing exchange traded data covered more emerging markets data then the empirical results would point to the “key role” of the financial derivatives in the emerging market crises in the 1990s. However, 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.

It can be said that sudden movements of the short-term capital in a rapid and nearly complete financial liberalisation of the developing economies in the 1990s are blamed for “violent fluctuations in foreign exchange rates that caused domestic financial turmoil that then led to further fluctuations in exchange rates and spread

to other economies” (Tomita, 2000, p. 2). The latter points out the theories of both capital movements and contagion problems explained by the third generation models and maintained especially by virtue of huge opportunities that derivatives sustain, such as high leverage and short-term character. In this regard, Tickell (2000) puts the concerns about derivatives as they have “potential to undermine global finance” (Tickell, 2000, p. 87). However, the attitude of ignoring or underestimating the potential role of financial derivatives in crises brought the ones who had such tendencies to the point at which the recent global financial crisis emerged as a “surprising fact” for them, but not for the rest. So, for the policy implication the starting point should be the changing of such approach arguing the totally innocence of derivatives in crises at the first beginning. And then the regulatory basis should come in action.

Within the framework of the regulatory basis of the financial derivatives, the policies about the financial regulation should be tackled in terms of a “win-win” solution since there can be two extremely different points of view about them. While Savona *et al.* (2000) put them as “the greatest financial innovation of the late twentieth century”, Buffet (2002) can describe them as “financial weapons of mass destruction”. So it can be said that there should be a “fine tune” between them in terms of policy options. This can be done by the policies that both encouraging the use of derivatives for risk management purposes while discouraging their use in unproductive or harmful purposes. However, it does not mean that all the use of derivatives for the risk management purposes such as hedging is harmless for macro economy. There is the issue of “the destabilising hedging activities” caused by dynamic hedging techniques, which should not be ignored. Moreover, all policies should be harmonised between developed and developing countries and also between developed countries in order to prevent “regulatory arbitrage-geographical arbitrage”. The rules should be harmonised and coordinated not just between countries and also among the institutions within the country requiring “the consolidation of the country’s different regulatory agencies”. Last but not least, within the country, the regulatory or supervisory authorities should get “increased powers” in order to supervise “banks, insurance companies and investment funds (including the hedge funds)” besides the “financial holdings” and all global shadow banking system institutions.

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APPENDIXES**Appendix-1: Descriptive Statistics of the Data**

	CI	CPSGDP	CAGDP	CRGDP	TDFR
Mean	0.4065423	0.9677652	0.0276435	2.745521	3.014903
Std. Dev.	11.65212	0.8054924	0.0873447	1.920299	2.631469
Min.	-39.93469	-0.0460488	-0.1050273	0.5765026	0.0003229
Max.	66.79475	3.551265	0.271192	6.971009	11.85414
Obs.	192	192	192	192	188

Appendix-2: The Results Table for the Fisher Test of the Panel Unit Root Using the PP Test

Variables	Fixed Lag Length	PP Test Statistics	
		Intercept With Trend (Constant, Linear Trend)	Intercept With Trend (Constant, Linear Trend)
Level		Lag 4	Lag 1
CI	4/1	86.0910 ^a	85.3172 ^a
CAGDP	4/1	37.3950 ^a	37.0411 ^a
CPSGDP	4/1	31.1971 ^a	31.7206 ^a
CRGDP	4/1	74.3711 ^a	69.5929 ^a
TDFR	4/1	27.2589 ^a	28.3862 ^a

Notes: The superscript a denotes significance at the 1% critical level. The lag orders are computed according to the fixed lag lengths. According to PP tests, the series marked with (a) do not exhibit a unit root at the 1% significance level.

Appendix-3: The Results Table

Models		<i>Testing The Direct Crisis Effect: Model-I</i>	<i>Testing The Indirect Crisis Effect: Model-II</i>
Variables (sign)			
CPSGDP(+)	Coefficient	-1.57	-1.17
	Standard Error	1.405	1.398
	P value	0.26	0.41
CAGDP(-)	Coefficient	-23.62	-18.45
	Standard Error	14.09	14.085
	P value	0.09***	0.19
CRGDP(+)	Coefficient	0.75	0.52
	Standard Error	0.788	0.784
	P value	0.34	0.50
CD (+)	Coefficient	18.21	18.38
	Standard Error	3.873	3.826
	P value	0.00*	0.00*
TDFR(+)	Coefficient	0.94	0.83
	Standard Error	0.361	0.36
	P value	0.01*	0.02**
AD(TDFR.D)(+)	Coefficient		2.61
	Standard Error		1.103
	P value		0.02***
C(constant)	Coefficient	-3.25	-3.15
	Standard Error	2.384	2.354
	P value	0.17	0.18
Adopted Model		Random Effect	Random effect
Hausman test			
HO:RE vs. FE		1.31	1.85
P value		0.9334	0.9326
R ²		0.16	0.18
N (Observation number)		188	188
Wald (Group) X ²		33.77*	40.22*

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