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The Use of DSGE Models in the Policymaking Process

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Introduction

Recent years have witnessed a remarkable evolution in formulating and communicating monetary policy in many central banks. A key development observed in this process is that an increasing number of central banks tends to portray a wider use of advanced econometric tools, calibrations and simulations in their Inflation Reports and Monetary Policy Reports. Also, the fiscal authorities in certain countries have, too, shown keen interest in presenting their economic outlook and policy strategies in a much technical way. Meanwhile, recent research on monetary and fiscal policy has increasingly employed modern dynamic

macroeconomic models, while universities have introduced (or are in the process of introducing) modules which dwell greatly on the building blocks of modern dynamic macroeconomic literature. In this context, an important role has been played by dynamic stochastic general equilibrium (DSGE) models. Yet, as highlighted by many, the main features of DSGE models and their appeal for policymaking seem to be little well-known to the public, in general. The objective of this article is to introduce the basic structure of DSGE models in order to broaden the understanding on their key features as well as to motivate such models for use of policymaking.

What is a DSGE Model?

DSGE models build on both real business cycle theory as well as the New Keynesian framework.¹ A basic DSGE model (open or closed economy) has three interrelated components representing demand side, supply side, and monetary policy. These three components are modelled by three equations which are explicitly derived from microfoundations, which describe the behavior of key economic agents in the economy, generally, households, firms, government and central bank.

¹ Real business cycle (RBC) models build on the assumption of flexible prices, and use real shocks (other than monetary shocks) to describe business cycle fluctuations (see Kydland and Prescott (1982)). The New-Keynesian models build on a similar structure to RBC models, but introduce nominal rigidities (sticky prices/sticky wages), instead of flexible prices (see Galí (2008) and Woodford (2003)).

- More precisely, households are modelled as maximizing lifetime utility subject to the budget constraint. In doing so, households optimally decide how much to consume, work, save, and invest. Also, in many models, households can set wages, as they offer differentiated types of labour (monopolistic suppliers).
- Firms' objective function can be modelled as maximizing profits in a monopolistically competitive environment by hiring labour, renting capital, and setting prices optimally. The ability of households and firms to reset prices is limited by various forms of rigidities in setting wages and nominal prices.
- Fiscal policy in early models was restricted to a Ricardian setting, while the latest models introduced non-Ricardian features as well, thus providing a sound environment to understand the different effects of alternative policies.

Particularly, such models would facilitate the analysis of the effects of the fiscal policy in the context of state of the economy (expansion or recession), type of spending (goods/employment/infrastructure), and the monetary and exchange rate regime.

- Monetary policy is usually implemented through an interest rate rule (such as Taylor rule), in that, nominal interest rate responds to deviations of inflation and output from the target levels. Often, some degree of interest rate smoothing and persistence in consumer habit formation are assumed. Further, there exist some rigidities in the real sector, particularly in capital accumulation, due to adjustment costs to investment, capital in the production function, and variable capital utilization.
- Finally, the other features of the model, which lead to the 'DSGE' tag, are as follows: (a) the dynamic feature introduces interaction between the components of the model through the role of expectations, which form the main channel through which policy affects the economy. This implies that the expected future course of monetary policy by the market participants determines the future path of output and inflation; (b) the stochastic feature introduces uncertainty in the evolution of the economy through random exogenous events that generate economic fluctuations by way of supply side shocks (productivity and labour supply); demand side shocks (preference, government spending, and investment specific shocks); cost-push shocks or mark-up shocks (price mark-up, wage mark-up, risk premium); and monetary shocks (interest rate or on other target variables); and (c) the general equilibrium feature satisfies the condition that economic agents in the model interact in markets that clear every period.

Basic Structure of DSGE Models

The three basic components of DSGE models are described below.

Demand Side

The demand side reflects the negative relationship between the real interest rate and desired spending. In the basic model, the negative relationship between the interest rate and demand emerges from the consumption decision of households. Likewise, the demand side is represented by a linear approximation of the optimal consumption condition of a representative household:

$$x_t = E_t x_{t+1} - \gamma(i_t - E_t \pi_{t+1}) + \varepsilon_t \quad (1)$$

where x_t is output gap, i_t is nominal interest rate, and π_t is inflation rate. All variables are percentage deviations around the steady-state values (Walsh, 2003). The error term ε_t reflects demand shocks of the type that was described above, and γ is a parameter and E_t is expectations operator.

The demand side equation is similar to a traditional IS equation, as it describes the relationship between the aggregate real activity and the *ex-ante* real interest rate. However, the above equation deviates from the traditional IS relationship, as it is dynamic and forward looking due to current and future expected variables, hence, sometimes referred to as an *expectational* or *forward looking IS curve*. Further, it establishes a link between current output and the entire future expected path of real interest rates, thereby implying that the current economic conditions are directly affected by the expectations of future monetary policy actions (Sbordone *et al.*, 2010).

Supply Side

The supply side reflects the positive relationship between the real activity and inflation. The supply side equation is derived from the firms' price setting behavior as a function of the level of their demand. It builds on the fact that in economic good times, aggregate demand is higher, and firms pay higher wages resulting in an increase in the general price level:

$$\pi_t = \beta E_t \pi_{t+1} + \kappa x_t + u_t \quad (2)$$

where κ entails a combination of structural parameters and is an increasing function of the firms which are able to adjust prices each period, and u_t is a cost-push shock or mark-up shock, and β is a parameter. The above equation often referred to as the *New Keynesian Phillips curve* which implies a forward looking inflation process and a measure of output gap (or the real marginal cost) as the driving variable of the inflation process. Further, a forward iteration of the supply side equation shows that inflation today really depends on the entire future expected path output gaps (or the real marginal costs) and cost-push shocks or mark-up shocks.

Monetary Policy

The short-term nominal interest rate is set by the monetary policy. The DSGE models assume that the central banks raise the policy rate when inflation and/or output are above some baseline or target levels:

$$i_t = \rho i_{t-1} + (1 - \rho)[r^* + \pi^T + \alpha_x(y_t - y^*) + \alpha_\pi(\pi_t - \pi^T)] + v_t \quad (3)$$

where i_t is nominal interest rate, r^* is baseline (or equilibrium) real interest rate, π^T is target level of inflation, $(y_t - y^*)$ is deviation of real output from the baseline level. The monetary policy shocks v_t capture deviation of the nominal interest rate from the value suggested by the above monetary policy rule. The interpretation of this equation is that, if inflation and output rise above their baseline levels, the nominal interest rate is raised over time above its own baseline ($r^* + \pi^T$), by amounts determined by the parameters α_x and α_π and at a speed that depends on the parameter ρ . Thus, the parameter ρ implies the degree of smoothing of the nominal interest rate, which implies the desire of the central bank to avoid large changes in the interest rate. These types of monetary policy rules are famously known as Taylor Rules (Taylor, 1993).

Policy Applications with DSGE Models

Among the central banks, there is a growing demand for the use of DSGE models as a powerful tool and a sound framework for policy discussion. Table 1 lists out a cross-section of central banks and other institutions which employ DSGE models in the policymaking process. As it is well recognized, the general design of the DSGE models is to capture the business cycle dynamics of an economy, particularly they are useful in identifying sources of economic fluctuations (analyzing historical decomposition of shocks), forecasting and predicting the effects of policy changes, examining structural reforms, studying non-observable variables, such as the potential GDP, natural unemployment rate, natural interest rate, etc., and performing counterfactual experiments.

- *Identifying sources of economic fluctuations*

Identifying sources of economic fluctuations can build from historical decomposition of shocks which obtains underlying shocks in order to analyze the alternative policies from a historical perspective. For a given set of time series with observable variables used to estimate (or calibrate a model) it is possible to obtain time series for the underlying shocks coherent with the model and the observable variables. The types of shocks can be accommodated for in DSGE models are of various types: supply side shocks, demand side shocks, cost-push shocks or mark-up shocks; and monetary shocks. A historical

decomposition of shocks is helpful to address the issues such as: what has been the contribution of different shocks in explaining the evolution of observable variables (GDP growth, inflation, wages etc.); and how the economy would have evolved if macroeconomic policies had followed an alternative path.

- *Forecasting with DSGE models*

The DSGE models are able to produce unconditional and conditional forecasts. A typical forecasting exercise of central banks involves the following steps: estimate the shocks hitting the economy; given the estimated shock decomposition, generate an unconditional forecast; and carry out a scenario analysis and risk assessment – how would the baseline forecast change if some shock hits the economy during the forecasting horizon. A key advantage of forecasting with DSGE models is that the forecasts can be interpreted because – it is a function of the economic shocks and it is based on an economic model which can be interpreted using economic theory. However, some practical challenges which may be encountered by any forecasting model are applicable to DSGE models as well, eg, the available GDP data are observed with a delay and are revised after the initial publishing. Also, as some economic data which becomes available on a monthly basis, such latest information needs to be incorporated into DSGE models, which are generally estimated using quarterly data.

- *Structural reforms analysis*

The DSGE models are not generally subject to the ‘Lucas Critique’, because of the microfoundations of the model and the separability of deep structural parameters (which do not vary with policy, eg, parameters for preferences, technology etc.) from expectational parameters which are regime dependent. Thus, DSGE models provide a solid framework for policy applications of structural reforms such as determining the optimal monetary policy in the context of changing target variables such as inflation, price level, output gap, exchange rate etc.; determining the optimal fiscal policy in the context of changes in public spending, mix of consumption tax, capital tax, and labour tax etc.; formation of optimal currency unions, labour market reforms, changes in degree of openness and trade liberalization etc.

- *Estimating non-observable variables*

With regard to obtaining estimates of non-observable

variables, some filtering technique such as the Kalman filter, can directly estimate them if they are defined within the model (eg, capital, optimal prices and wages); alternatively, if the non-observable variables are functions of the state variables, they can also be constructed. Overall, the DSGE models are able to offer a structured way to perform counterfactual analysis to inform about the role of policy in the past and into the future, and to understand how the changes in the economy modify the transmission mechanism of shocks. A caveat follows as the policy analysis will tend to be model-specific, hence, some robustness checks are needed.

Bringing DSGE Models to the Data

Bringing DSGE models to the data may encounter difficulties due to several factors. They mainly include: existence of a larger number of parameters to be estimated, modeling the role of expectations, existence of unobservable state variables, estimating the model dynamics which are nonlinear functions of its parameters, and need for imposing cross-equation restrictions. In bringing DSGE models to the data two approaches are widely used, namely, calibration and econometric estimation. In real business cycle models, parameter values are assigned using stylized facts of the economy (based on cyclical and long-run properties of the data) and information from other studies are also used for calibration. Once the model is calibrated, it is simulated (by log-linearization) and compared to the data. As such, by construction, the model explains the long-run properties of the data. However, with the improvement of computational power and the development of new econometric methods, the popularity has shifted from calibration to estimation. Particularly, the use of Bayesian econometrics has come in handy to estimate macroeconomic models. The key advantage of Bayesian estimation is that the posterior inference is not dependent on the model being the correct data generating process. However, the method of Bayesian estimates too has some weaknesses, particularly, when the results are distorted by the priors if the likelihood function imposes inadequate information. Also, as reported by some, the replication of Bayesian results may not always straightforward (Tovar, 2008).

Communicating DSGE Results

Communicating DSGE results is a delicate job at every level, whether it is from the policymakers to the general public or from the DSGE modelers to the policymakers. As it is generally the case that the central banks want the market to understand that they will deliver the mandate of price stability without

creating surprises in the market. When central banks operate likewise, the market uses that information to build expectations. The usual form of central bank communication to the market is by way of monetary policy reports and inflation reports. In these reports, central banks generally carry out three types of exercises: (a) discussion of landmark events or important news since the last report, with quantified effects showing the impact of shocks and counterfactual analysis; (b) forecasts of the main variables (GDP, inflation, interest rate etc.); and (c) analysis of risk scenarios to assess the impact of certain relevant contingencies and how should the monetary policy respond to such shocks. In terms of communicating these results, policymakers are often confronted with the issue of how much information to be revealed and what level of technical details can they entail, e.g., while some central banks publish the forecasted path of the interest rates, others do not do so, because of the concerns that the market participants may perceive that the central bank is committed to implement such specific path for the policy rates.

Further, DSGE modelers find that communicating the results to the policymakers is, too, not an easy task. Because the models are in bigger scale with a larger number of parameters, communication can easily get complicated in determining the drivers of the results. Also, the DSGE modelers face the challenge of convincing the policymakers that the model has a good fit to the data and the story emerges from the model is a robust one.² Further, the flexibility of the DSGE models is sometimes limited, thus, leaving less room for policymakers' preferences and elements of different views. Also, as it is generally understood, DSGE models are simple approximations of how the economy functions and there are other sources of information that the model may not fully take into account; and there may be transmission mechanisms that the model may not fully capture. Hence, the DSGE modelers may have to complement the DSGE results, particularly, the forecast results, with a combination of various models, other sources of information and expert judgment.

Conclusion

There is a growing demand for the use of DSGE models as a powerful tool and a sound framework for policy discussion. In particular, DSGE models are useful in identifying sources of economic fluctuations in the context of a historical decomposition of shocks, forecasting and predicting the effects of policy changes, examining structural reforms, studying non-

2. See Smets and Wouters (2003, 2007) for a detailed discussion on the success of DSGE models in fitting the macroeconomic data.

observable variables. With the improvement of computational power and the development of new econometric methods, the popularity of DSGE models reached its new heights resulting in a remarkable evolution in formulating and communicating monetary policy in many central banks across the world. That said, DSGE models are still confronted with various challenges

in terms of modelling, estimating, ensuring goodness of fit, and interpreting and communicating results to a wider audience. Nevertheless, the coherent framework that is brought into the policy discussion by DSGE models with sufficiently articulated description of the economy will ensure that its use in the policymaking process would be indispensable.

Table 1: DSGE Models in selected Central Banks and the IMF

Central Bank/Institution	DSGE Model	
Bank of Canada	ToTEM II	Terms-of-Trade Economic Model-ToTEM II (Enhanced version of the ToTEM used previously)
Bank of England	COMPASS	-Central Organising Model for Projection Analysis & Scenario Simulation
	MAPS	-Model Analysis & Projection System
	EASE	-Economic Analysis & Simulation Environment (The previous model 'BEQM' has been replaced by the above models)
Sveriges Riksbank (Sweden)	RAMSES	Riksbank Aggregate Macromodel for Studies of the Economy of Sweden
European Central Bank	NAWM	New Area-Wide Model of the euro area
Federal Reserve (United States)	SIGMA	A multi-country open economy DSGE model
Central Bank of Chile	MAS	Model for Analysis and Simulations
Central Reserve Bank of Peru	MEGA-D	Aggregate General Equilibrium Model with dollarization.
Norges Bank (Norway)	NEMO	Norwegian Economy Model
International Monetary Fund (IMF)	GIMF	-Global Integrated Monetary and Fiscal Model
	GEM	-Global Economy Model
	FSGM	-Flexible System of Global Models
	GPM	-Global Projection Model

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International standards for financial market infrastructures

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Introduction

There are a number of international initiatives under way to maintain financial stability by strengthening financial market infrastructures. The Committee on Payment and Settlement Systems (CPSS) of Bank for International Settlements (BIS) on behalf of the central banks of Group of Ten (G - 10) countries set out core principles initially in 2001. At the first step, ten (10) principles were published on core principles for systemically important payment systems. Subsequently, the new global standards / principles for financial market infrastructures (FMIs), including systemically important payment systems, securities settlement systems, central securities depositories, central counterparties and trade repositories were developed by together with the Basel Committee on Banking Supervision (BCBS), Committee on the Global Financial System (CGFS), International Organization of Securities Commissions (IOSCO), Financial Stability Board (FSB), and CPSS. Accordingly, new 24 international standards for FMIs were published by CPSS on 16 April 2012.

In general, these new standards are expressed as broad principles in recognition of FMIs differing organizations, functions and designs, and the range of ways potentially available in relation to some issues to achieve a particular result.

An FMI can be defined as “a multilateral system among participating institutions, including the operator of the system, used for the purposes of clearing, settling, or recording payments, securities, derivatives, or other

financial transactions.” The principles for FMIs are designed to ensure that FMIs supporting global financial markets are robust and well placed to withstand financial shocks. Accordingly, FMIs serve and play a key role in the smooth functioning of the economy and can enhance the stability of markets and promote wider financial stability in global level. The significance of that role is highlighted by the new global regulatory requirement that mandates central clearing of standardized OTC (over-the-counter) derivative trades. The overall objective is to ensure that principles for FMIs promote stability and efficiency in the financial system. The principles also set out responsibilities for central banks, market regulators and other relevant authorities in their supervision of FMIs, including arrangements for cooperation between the relevant authorities. Members of CPSS and IOSCO are expected to adopt and apply the principles within their regulatory frameworks, at least for FMIs that are considered to be systemically important.

Forms of FMIs

The new principles strengthen five (5) key types of FMIs, as follows including existing international standards for payment systems that are systemically important.

- Payment System (PS) – A payment system is a set of instruments, procedures, and rules for the transfer of funds between or among participants; the system includes

the participants and the entity operating the arrangement. Accordingly, payment systems enable the lending and repayment of money, allow businesses to receive payments for goods and services, and facilitate the payment of salaries and benefits to the general public. A payment system is generally categorized as either a retail-value payment system (RVPS) or a large-value payment system (LVPS). RVPS is a funds transfer system that typically handles a large volume of relatively low-value payments in such forms as cheques, credit transfers, direct debits, and credit card and debit card transactions etc. Many RVPSs are operated either by the private sector or the public sector, using a multilateral deferred net settlement (DNS) or a real – time gross settlement (RTGS) mechanism. LVPS is a funds transfer system that typically handles large-value and high-priority payments. Many LVPSs are operated by central banks, using RTGS system or equivalent mechanism.

- Securities Settlement System (SSS) – An entity that enables securities to be transferred and settled by book entry according to a set of predetermined multilateral rules. Such systems allow transfers of securities either free of payment or against payment. When transfer is against payment, many systems provide delivery versus payment (DvP), where delivery of the security occurs if and only if payment occurs. An SSS may be organized to provide additional securities clearing and settlement functions such as the confirmation of trade and settlement instructions. Under the new principles, Central Securities Depository (CSD) and Central Counterparty (CCP) are treated as separate types of FMIs, however, in many countries, CSDs also operate an SSS.
- Central Securities Depository – An entity that provides securities accounts, central safekeeping services, and asset services, which may include the administration of corporate actions and redemptions, and plays an important role in helping to ensure the integrity of securities. A CSD can hold securities either in physical form or in dematerialized form. Dematerialized securities exist only in the form of electronic records. The legal impact of dematerialization differs in relation to bearer and registered securities respectively.
- Central Counterparty – A central counterparty intervenes itself between counterparties to contracts traded in one or more financial markets, becoming the buyer to every seller and the seller to every buyer and thereby ensuring the performance of open contracts. A CCP becomes counterparty to trades with market participants. The original

contract between the buyer and seller is extinguished and replaced by two new contracts, one between the CCP and the buyer, and the other between the CCP and the seller.

- Trade Repository (TR) – An entity that maintains a centralized electronic record of transaction data. The function of a TR, where permitted by applicable law, may also be performed by a payment system, CSD, or CCP in addition to its core functions. A TR may also provide or support subsidiary services such as the management of trade life-cycle events and downstream trade-processing services based on the records it maintains. TRs have emerged as a new type of FMI and have recently grown in importance, particularly in the OTC derivatives markets. An important function is to provide information that supports risk reduction, operational efficiency, and cost savings for both individual entities and the market as a whole.

Organization and general applicability of the principles

The new principles are categorized into nine (9) broad categories that incorporate the major elements critical to the safe and efficient design and operation of FMIs. The principles are broadly designed to apply to all systemically important payment systems (SIPS), SSSs, CSDs, CCPs, and TRs. FMIs that are determined by national authorities to be systemically important are expected to meet these principles. In Sri Lanka, there are two SIPSs which are namely RTGS System and cheque imaging and truncation (CIT) System.

These principles are designed to apply to domestic, cross-border, and multicurrency FMIs. All FMIs are encouraged to meet these principles. Most principles are applicable to all types of FMIs. However, a few principles are only relevant to specific types of FMIs. The following table shows general applicability of principles to different types of FMIs. For example, TRs do not face credit or liquidity risks, because the principles on credit and liquidity risks are not applicable to them. In general, the principles are applicable to FMIs operated by central banks, as well as those operated by the private sector. Central banks should apply the same standards as are applicable to similar private-sector systems. However, in certain cases, central banks also have separate public policy objectives and responsibilities for monetary and liquidity policies that may take superiority.

Implementation and usage of principles

FMIs that are subject to these principles should apply them on an ongoing basis in the operation of their business. This includes when reviewing their performance, assessing or

proposing new services, or proposing changes to risk controls. FMIs should communicate the outcome of their findings as part of their regular dialogue with relevant authorities. FMIs should also conduct more formal periodic self-assessments of compliance with the principles, where this is consistent with national practice. The relevant authorities, consistent with their respective responsibilities for regulation, supervision, and oversight of an FMI, are expected to perform their own assessments of the FMI. To the fullest extent permissible under national statutory regimes, relevant authorities should seek to incorporate these principles into their respective activities. If an FMI is not in compliance with these principles, actions should be taken to promote compliance. The FMI's self-assessment, or

the summary of the authorities' assessments, should be publicly disclosed, where consistent with national law and practice. Central banks, market regulators, and other relevant authorities for FMIs should accept and be guided by the responsibilities, consistent with relevant national law. While each individual FMI is fundamentally responsible for complying with these principles, effective regulation, supervision, and oversight are necessary to ensure compliance and induce change. Authorities should cooperate with each other both domestically and internationally to minimize their potential duplication of effort and reduce the burden on the FMI and the relevant authorities. These responsibilities are consistent with international best practices. Other CPSS and IOSCO guidance to authorities on

Organization and General applicability of the principles to different types of FMIs

Principle	PSs	CSD & SSSs	CCPs	TRs
(i) General organization				
1. Legal basis	✓	✓	✓	✓
2. Governance	✓	✓	✓	✓
3. Framework for the comprehensive management of risks	✓	✓	✓	✓
(ii) Credit and liquidity risk management				
4. Credit risk	✓	✓	✓	NA
5. Collateral	✓	✓	✓	NA
6. Margin	NA	NA	✓	NA
7. Liquidity risk	✓	✓	✓	NA
(iii) Settlement				
8. Settlement finality	✓	✓	✓	NA
9. Money settlement	✓	✓	✓	NA
10. Physical deliveries	NA	✓	✓	NA
(iv) CSDs and exchange-of-value				
11. CSDs	NA	✓	NA	NA
12. Exchange-of-value settlement systems	✓	✓	✓	NA
(v) Default management				
13. Participants-default rules and regulations	✓	✓	✓	NA
14. Segregation and portability	NA	NA	✓	NA
(vi) General business and operational risk management				
15. General business risk	✓	✓	✓	✓
16. Custody and investment risk	✓	✓	✓	NA
17. Operational risk	✓	✓	✓	✓
(vii) Access				
18. Access and participation requirements	✓	✓	✓	✓
19. Tiered participation arrangements	✓	✓	✓	✓
20. FMI links	✓	✓	✓	✓
(viii) Efficiency				
21. Efficiency and effectiveness	✓	✓	✓	✓
22. Communication procedures and standards	✓	✓	✓	✓
(ix) Transparency				
23. Disclosure of rules, key procedures and market data	✓	✓	✓	✓
24. Disclosure of market data by TRs	NA	NA	NA	✓

the regulation, supervision, and oversight of FMIs also may be relevant. International financial institutions, such as the International Monetary Fund, and the World Bank, may also use these principles in promoting the stability of the financial sector when carrying out assessment programmes for FMIs and related arrangements and in providing technical assistance to particular countries.

Business continuity and FMIs

Business continuity is defined as a state of uninterrupted business operations. Therefore, FMIs need to ensure the continuity of business activities under any circumstances. Business continuity also refers to all of the organizational, technical and staffing measures employed in order to ensure the continuation of core business activities in the immediate aftermath of an operational crisis and, gradually, of all business activities. Business continuity preparation is crucial among all financial market participants; due to the existence of common infrastructure and the high degree of interdependencies between them. However, achieving financial stability in a country depends among others on the smooth functioning of FMIs. As financial markets are highly interconnected across national borders, incidents occurring in one market infrastructure might have a domino effect and

easily spread into other systems. Therefore, the development of effective business continuity is essential to the containment of the operational risk for FMIs. Operational risk consists in the risk of their disruption as a result of deficiencies in information systems or internal control systems, operational weaknesses, human error or external events. In order to ensure the continuity of business activities, the FMIs should ensure a high degree of security and operational reliability and also should have contingency arrangements for the timely completion of daily business activities. In addition to the establishment of standards, the central banks and regulatory bodies should organize business continuity exercises. It is foreseen that FMIs and other market participants will participate in these exercises. Therefore, Central Bank of Sri Lanka (CBSL) is required to ensure the smooth execution of cross-border and domestic payments, as well as the settlement of securities transactions, accordingly preserving the uninterrupted implementation of the monetary policy and smooth functioning of the payment and settlement systems, in order to ensure financial system stability in the country. In this context, CBSL has to adopt and apply following principles for FMIs that are considered to be systemically important, in the conduct of payment systems oversight.

Principles for financial market infrastructures

Principle	Description
Principle 1: Legal basis	An FMI should have a well-founded, clear, transparent, and enforceable legal basis for each aspect of its activities in all relevant jurisdictions.
Principle 2: Governance	An FMI should have governance arrangements that are clear and transparent, promote the safety and efficiency of the FMI, and support the stability of the broader financial system, other relevant public interest considerations, and the objectives of relevant stakeholders.
Principle 3: Framework for the comprehensive management of risks	An FMI should have a sound risk-management framework for comprehensively managing legal, credit, liquidity, operational, and other risks.
Principle 4: Credit risk	An FMI should effectively measure, monitor, and manage its credit risk from participants and from its payment, clearing, and settlement processes. An FMI should maintain sufficient financial resources to cover its credit exposure to each participant fully with a high degree of confidence. A CCP should also maintain additional financial resources to cover a wide range of potential stress scenarios that should include, but not be limited to, the default of the participant (s) and its (their) affiliates that would potentially cause the largest aggregate credit exposure (s) in extreme but plausible market conditions.
Principle 5: Collateral	An FMI that requires collateral to manage its or its participants' credit risk should accept collateral with low credit, liquidity, and market risk. An FMI should also set and enforce appropriately conservative haircuts and concentration limits.
Principle 6: Margin	CCP should cover its credit exposures to its participants for all products through an effective margin system that is risk-based and regularly reviewed.
Principle 7: Liquidity risk	An FMI should effectively measure, monitor, and manage its liquidity risk. An FMI should maintain sufficient liquid resources to effect same-day and, where appropriate, intraday settlement of payment obligations with a high degree of confidence under an wide range of potential stress scenarios that should include, but not be limited to, the default of participant (s) and its (their) affiliates that would generate the largest aggregate liquidity need in extreme but plausible market conditions.
Principle 8: Settlement finality	An FMI should provide clear and certain final settlement, at a minimum, by the end of the value date. Where necessary or preferable, an FMI should provide final settlement intraday or in real time.

Principle 9: Money settlements	An FMI should conduct its money settlements in central bank money where practical and available. If central bank money is not used, an FMI should minimize and strictly control the credit and liquidity risk arising from the use of commercial bank money.
Principle 10: Physical deliveries	An FMI should clearly state its obligations with respect to the delivery of physical instruments or commodities and should identify, monitor, and manage the risks associated with such physical deliveries.
Principle 11: Central securities depositories	A CSD should have appropriate rules and procedures to help ensure the integrity of securities issues and minimize and manage the risks associated with the safekeeping and transfer of securities. A CSD should maintain securities in an immobilized or dematerialized form for their transfer by book entry.
Principle 12: Exchange-of-value settlement systems	If an FMI settles transactions that involve the settlement of two linked obligations (for example, securities or foreign exchange transactions), it should eliminate principal risk by conditioning the final settlement of one obligation upon the final settlement of the other.
Principle 13: Participant-default rules and procedures	An FMI should have effective and clearly defined rules and procedures to manage a participant default that ensure that the FMI can take timely action to contain losses and liquidity pressures, and continue to meet its obligations.
Principle 14: Segregation and portability	A CCP should have rules and procedures that enable the segregation and portability of positions and collateral belonging to customers of a participant.
Principle 15: General business risk	An FMI should identify, monitor, and manage its general business risk and hold sufficiently liquid net assets funded by equity to cover potential general business losses so that it can continue providing services as a going concern. This amount should at all times be sufficient to ensure an orderly wind-down or reorganization of the FMI's critical operations and services over an appropriate time period.
Principle 16: Custody and investment risk	An FMI should safeguard its assets and minimize the risk of loss or delay in access to those assets, including assets posted by its participants. An FMI's investments should be in instruments with minimal credit, market, and liquidity risks.
Principle 17: Operational risk	An FMI should identify all plausible sources of operational risk, both internal and external, and minimize their impact through the deployment of appropriate systems, controls, and procedures. Systems should ensure a high degree of security and operational reliability, and have adequate, scalable capacity. Business continuity plans should aim for timely recovery of operations and fulfillment of the FMI's obligations, including in the event of a wide-scale disruption.
Principle 18: Access and participation requirements	An FMI should have objective, risk-based, and publicly disclosed criteria for participation, which permit fair and open access.
Principle 19: Tiered participation arrangements	An FMI should, to the extent practicable, identify, understand, and manage the risks to it arising from tiered participation arrangements.
Principle 20: FMI links	An FMI that establishes a link with one or more FMIs should identify, monitor, and manage link-related risks.
Principle 21: Efficiency and effectiveness	An FMI should be efficient and effective in meeting the requirements of its participants and the markets it serves.
Principle 22: Communications procedures and standards	An FMI should use or accommodate the relevant internationally accepted communication procedures and standards in order to facilitate efficient recording, payment, clearing, and settlement across systems.
Principle 23: Disclosure of rules and key procedures	An FMI should have clear and comprehensive rules and procedures and should provide sufficient information to enable participants to have an accurate understanding of the risks they incur by participating in the FMI. All relevant rules and key procedures should be publicly disclosed.
Principle 24: Disclosure of market data by TR	A TR should provide timely and accurate data to relevant authorities and the public in line with their respective needs.

Source: CPSS and IOSCO – Report on Principles for financial market infrastructures – April 2012

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Textiles and Garment Industry in Sri Lanka: Developments Challenges and Way Forward

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The textiles and garment sector is the single largest industry in Sri Lanka. It had been recognized as a thrust area for growth in early 1980s due to the sector's potential to boost productivity, employment and investment. It has been identified as the largest export industry in Sri Lanka. In 2013, total value of export earnings from textiles and garment was US dollars 4,508 million accounting for more than 40 per cent of total export earnings. The contribution of the textiles and garment industry to the Gross Domestic Product (GDP) was around 3 per cent in 2013. This industry provides over 300,000 direct employment and 600,000 indirect employment opportunities and is the largest single employer in the manufacturing industry. Further, it provides a substantial number of employment opportunities to the women labour force in Sri Lanka.

Given the importance of the textiles and garment industry to the economy, this paper discusses the developments and challenges of the Sri Lanka's garment industry by focusing the on trends in exports of textiles and garments.

History of the Textiles and Garment Industry

The textiles and garment export industry in Sri Lanka became popular in 1950's when the government took steps to promote the textiles manufacturing industry as an import substitution industry. Since then several factors contributed to the significant growth in this industry. These include open economic policies, Multi-Fibre Arrangement (MFA), establishing Board of Investment (BOI), 200 Garment Factory Programme (GFP)

and The Generalised System of Preferences (GSP+) scheme etc. The second phase of garment manufacturing boom started after 1977 along with the export led open economic policies. Sri Lanka's garment exports were largely supported by the MFA since 1978. The MFA, by providing a ready market, has restricted Sri Lanka's exports but has protected it from competitors (Dheerasinghe, 2003). Sri Lanka was able to increase the exports of apparel products due to the specialization of skills it acquired during the MFA period, which acted as an incubation phase for the industry. In 1992, BOI came into operation and the BOI offered several incentives to attract garment producers to move to the rural areas of Sri Lanka under the 200 GFP. A textile quota board was established in the same year to streamline the allocation of export quotas for the garment industry, including those coming under the 200 GFP (Kelegama, 2003).

The GSP+ scheme is another factor that contributed to the growth of textiles and garment industry. Sri Lanka successfully negotiated with the European Union (EU) and obtained duty free and quota free access for exports of over 7,200 products to the 27 member countries of the EU from July 2005 to August 2010, under the GSP+ scheme. Sri Lanka was the first country to receive tariff preferences under the GSP+ scheme from the EU, which was introduced to support countries with special development needs and meet the objective criteria for sustainable development and good governance. Sri Lanka was able to increase the exports of apparel products by 13.1 per cent on average between 2005 and 2009, compared to 6.2 per cent

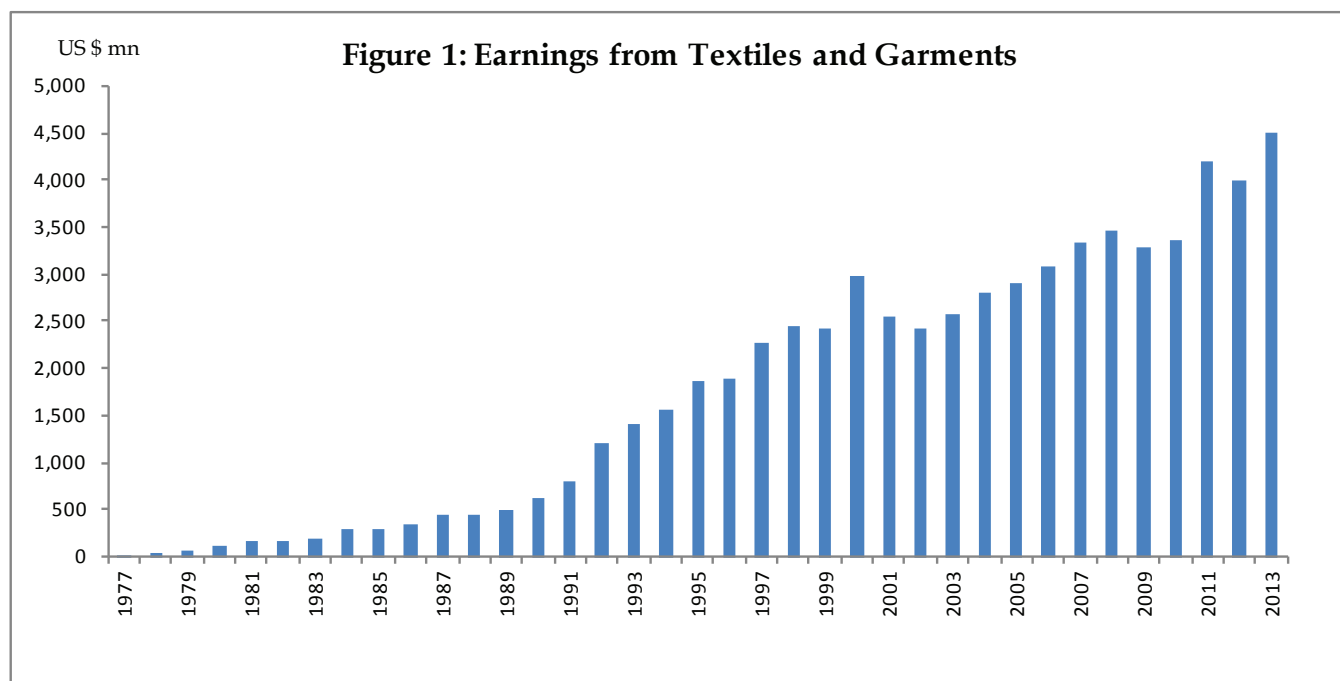
increase recorded during the period of 2000-2004. Sri Lanka's exports to the EU have increased at an annual average rate of 8.5 per cent during the 2005-2009. This export growth can be partly attributed by price competitiveness through lower tariff received by Sri Lanka under the GSP+ scheme. EU withdrew the concessions with effect from 15 August 2010, resulting in exporters accessing the EU market under the general GSP scheme, which is nevertheless below the Most Favoured Nation (MFN) rates.

Current Developments in the Textiles and Garment Industry in Sri Lanka

Sri Lanka's exports remained resilient despite the withdrawal of the GSP+ scheme in 2010. Sri Lankan exporters were able to record higher than projected earnings from key export industries. Earnings from textiles and garment exports amounted to US dollars 3,356 million in 2010, reflecting a 2.9 per cent growth during the year, and accounted for nearly 39 per cent of total export proceeds. In view of the impending withdrawal of the GSP+ benefits, many manufacturers improved the quality of their products and enhanced productivity enabling them to face the new competition. They achieved higher levels of value addition by capitalizing more on designing products, focusing

and 201, respectively. Total earnings from textiles and garment exports increased by 24.9 per cent to US dollars 4,191 million in 2011, surpassing the US dollars 4 billion target set by the apparel industry.

Meanwhile, in 2012 earnings from textiles and garment recorded a decline of 4.8 per cent, year-on-year, due to the dampened global demand amidst the slowing down of global economic activity, specially in the Euro area. Earnings from exports of garments to the European Union, which accounted for about 50 per cent of total garment exports over the past several years declined by 9.2 per cent in 2012. However, textiles and garment exports rebounded from May 2013 and recorded a 13 per cent increase in 2013. During the first seven months of 2014, exports earnings from textiles and garments increased by 19.1 per cent and garment exports to the USA increased by 14.8 per cent while exports to EU increased by 23.4 per cent in value terms during this period. Amongst the members of the EU, United Kingdom was the largest market for Sri Lanka's garments exports, accounting for around 20.2 per cent of the total garment exports in the first seven months of 2014, followed by Italy and Germany, which accounted for around 11.0 per cent and 4.0 per cent, respectively.



Source: Central Bank of Sri Lanka

on branded products and catering to the high end market. As a result, Sri Lanka's garments exports to EU, which constituted approximately 51 per cent of total apparel exports, amounted to US dollars 1,616 million and US dollars 2,022 million in 2010

Garment exports to EU which represented 32 per cent in 2003 increased its share to 46 per cent in 2013. Sri Lanka's garment exports to the EU and the USA for the period 2000 - 2013 is shown in Figure 2.

The USA is the single biggest market which accounted for more than 40 per cent of Sri Lanka's garment exports. In 2013, Sri Lanka's garment exports to the USA increased by 21 per cent to US dollars 1,830 million.

Key Challenges of the Textiles and Garment Industry

While the industry recorded a remarkable growth, it faces a series of challenges.

1. Lack of diversification of export destinations

Sri Lanka's textiles and garment exports are concentrated in a few export markets. USA accounted for 42.9 per cent of the total garment exports while EU accounted 45.9 per cent in 2013. Canada, accounted for 1.8 per cent of the total garment exports. The balance 9.4 per cent comprises more than ninety countries, including Australia, Japan and Switzerland. Performance of the export of garments to major markets in 2013 is depicted in figure 3.

2. Lack of product diversification

Sri Lanka's textiles and garment industry is mainly restricted to the export of finished clothing products (garments). Garments exports accounted for about 95 per cent of total textiles and garments exports in 2013. Textiles, other than made up articles and yarn emerged as export items in early 1990's and increased their shares to 3 per cent each in recent times. Sri Lanka expanded its product coverage from four items (shirts, blouses, trousers and jackets) in 1977 to a broader base of more than 50 items in 2013, but yet it is highly concentrated

on a limited categories. The textiles and garment industry in Sri Lanka has failed to create significant backward and forward linkages with the rest of the economy. Because of the lack of fabric and accessory production base, the degree of vertical integration in the industry is also minimal compared to other competitive producer countries.

3. Heavy dependence on the imported materials

Since the country does not have an extensive and efficient industrial base of producing textiles material and clothing accessories, the industry depends heavily on the import of materials. Of the total material imports of US dollars 2,046 million in 2013, nearly 94 per cent was imports of fabric and yarn. Major source countries for these products were China (33.7 per cent), India (18.9 per cent), Hong Kong (11.2 per cent), Taiwan (9.1 per cent) and Italy (5.7 per cent). The other major material import was staple fibre which accounted for about 1.3 per cent of total textile material imports in 2013.

4. Sri Lanka's garment industry has centred around a few large scale producers

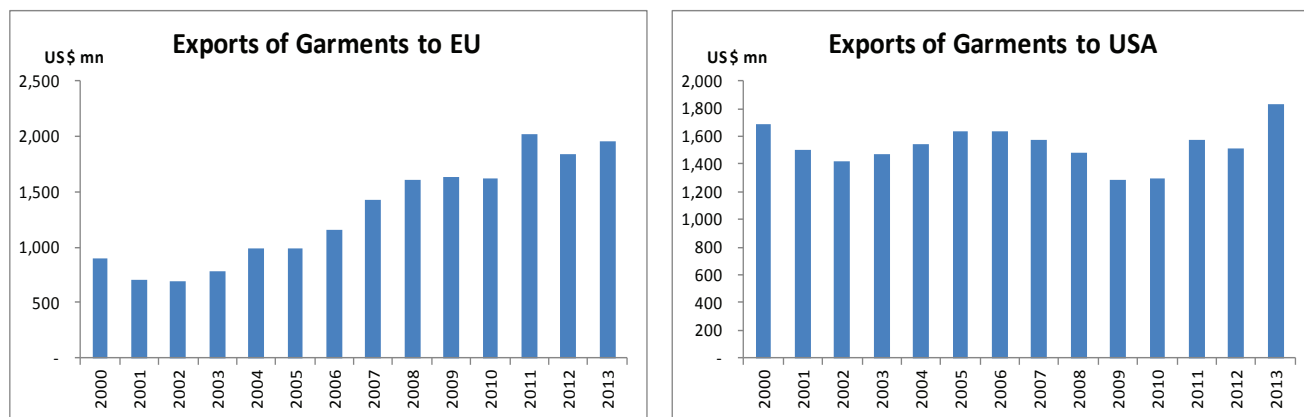
As reflected in records of Sri Lanka Customs, 820 manufacturers exported garment products in 2010 and among them 20 companies accounted for 51 per cent, amounting to US dollars 1,915 million. Further, the top ten exporters accounted for more than 45 per cent of total garments exports. This indicates the heavy concentration of the garment industry. With regard to geographical

Table 1: Garment and Other Exports to the EU, USA and Other Countries (2003-2014)

Year	Exports (US dollars million)							
	EU		USA		Other Countries		TOTAL	
	Garment	Other	Garment	Other	Garment	Other	Garment	Other
2003	778	762	1,471	307	151	1,333	2,400	2,733
2004	986	885	1,539	330	129	1,798	2,654	3,103
2005	994	967	1,633	355	121	1,917	2,748	3,599
2006	1,154	1,167	1,633	373	130	1,872	2,917	3,966
2007	1,425	1,450	1,570	400	149	2,487	3,145	4,495
2008	1,604	1,430	1,485	384	194	3,013	3,284	4,827
2009	1,630	1,098	1,285	291	204	2,577	3,120	3,965
2010	1,616	1,259	1,296	406	267	3,782	3,178	5,447
2011	2,022	1,554	1,575	570	389	4,449	3,986	6,573
2012	1,836	1,392	1,512	614	437	3,983	3,784	5,989
2013	1,959	1,314	1,830	665	476	4,151	4,265	6,129
2013 Jan-July	1,020	724	956	347	252	2,216	2,228	3,287
2014 Jan-July	1,259	781	1,098	410	328	2,517	2,686	3,708

Sources: Sri Lanka Customs, CBSL

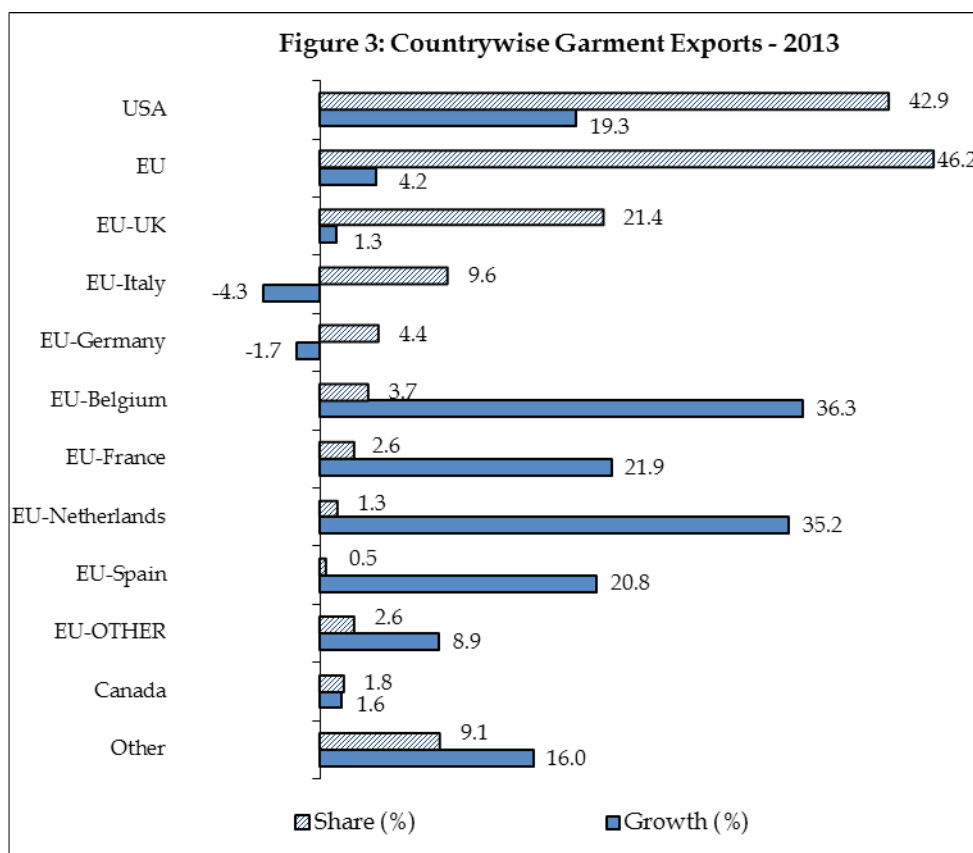
Figure 2: Exports of Garments to EU and the USA



distribution, the large scale establishments in textiles and garment industry are concentrated in the Colombo and Gampaha districts while the small and medium scale establishments are distributed across the country.

- Sri Lankan competitor countries such as China, India, Vietnam, Bangladesh have become a key challenge in the textiles and garment industry. The rapid growth of China's textiles and garment exports has led to major changes in the world textiles and garment market. China remains as the world's largest producer of cotton, cashmere, flax and silk, as well as the biggest manufacturer and exporter of textiles in the world. According to data published by China

Customs, textiles and garment exports recorded at US dollars 283.9 billion in 2013, which registered a growth of 11.4 per cent year-on-year. In 2013, India's textiles exports amounted to US dollars 40 billion, overtaking Germany and Italy to emerge as the world's second largest textile exporter. Further, India's textile sector contributes to about 14 per cent of industrial production, 4 per cent of the gross domestic product (GDP), and 17 per cent of the country's export earnings. India's textiles industry is the second largest employment provider after agricultural sector and currently employs more than 35 million people. India has made inroads into the markets of its key competitors which include Asian countries such as Sri Lanka, China,



Bangladesh, Vietnam and Cambodia. Vietnam's earnings from textiles and garments increased by 17 per cent in 2013, exceeding the US dollars 20 billion mark for the first time. The textiles and garment sector turned out to be the largest foreign exchange earner for Vietnam, accounting for 15 per cent of the country's GDP and 18 per cent of its total exports, according to the Vietnam National Textile and Garment Group (VINATEX). Earnings from textiles exports in Bangladesh amounted to US dollars 28 billion in 2013 and the low cost of labour is one of the key factors for Bangladesh's success, with an average wage per hour of garment factory workers is only 31 cents of a US dollar compared to per hour wage of US dollars 1.66 in China, 56 cents in Pakistan, 51 cents in India, 44 cents in Indonesia and 36 cents in Vietnam.

Way Forward

Since garments industry has become a hi-tech industry worldwide, Sri Lanka needs to concentrate on moving into higher value added products in order to be competitive in the international markets. For this purpose, Sri Lanka needs to produce specialized, high quality up-market garments which are less sensitive to price fluctuations. To achieve the quality standard to meet the up-market products it is necessary to invest in advanced technology. Most small scale factories are unable to invest in hi-tech machinery due to the large capital cost.

Since Sri Lanka lacks preferential treatment from the traditional markets, efforts to sustain its market share through improved quality need to continue. Sri Lanka's Free Trade Agreements

(FTAs) would help its textiles and garment manufacturers to enter and compete more easily in the global market place. Those agreements eliminate or reduce high tariff, improve intellectual property regulations, open government procurement opportunities, ease investment rules, and much more. In general, the agreements would help level the international playing field and encourage foreign governments to adopt open and transparent rulemaking procedures, as well as non-discriminatory laws and regulations. Sri Lanka is mostly utilising India- Sri Lanka Free Trade Agreement. During 2013, conditions of the agreement were further liberalised and placed the total eight million pieces under the garment export quota with no duty and no conditions. Further, the industry needs to focus more on exploring new markets and making efforts to strengthen the raw material base for the industry and to reduce lead time. As China is emerging as a country with a large affluent middle income economy class, the proposed China - Sri Lanka FTA will bring more benefits to Sri Lankan textiles and garment industry enabling easier access to the Chinese market with its branded products.

With limited access to development finance and the high cost of upfront capital formation, SMEs are constrained in investing in technology and advanced machineries. Therefore, it is vital to design a financial assistance scheme for SMEs to provide an incentive to invest in technology.

Factories located in the Western Province are facing difficulties in recruiting labour due to emerging competition from other sectors. Further, it is needed to release metropolitan properties for high value commercial activities going beyond traditional manufacturing activities, under the city development plans.



Therefore, a concerted effort needs to be made to encourage new factories to set up in areas where labour can be found easily and infrastructure is available. Industry should explore the opportunities to invest in the Northern and Eastern zones with the developments of infrastructure facilities.

Quality improvement is a priority area, which Sri Lanka can maximise opportunities in the developed markets. Sri Lanka can focus on developing brand names to build an image as the best garment manufacturer in Asia. The Government could promote the country as one that maintains high quality standards and engages in ethical business practices. In addition to the development of infrastructure across the country, the Government could also work on improving the investment and business climate of the country which would facilitate productivity.

Conclusion

The textiles and garment sector, the single largest industry in Sri Lanka plays a key role in the economy, generating a substantial direct and indirect employment opportunities. The Sri Lankan textiles and garment industry is growing but is facing several challenges. Lack of diversification of export destinations and product diversifications are key among the challenges. Sri Lanka needs to concentrate on moving into higher value added products in order to be competitive in the international markets.

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Foreign Exchange Derivatives

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1. Introduction

It is observed that International trade and cross-country financial flows play a major role in the current global economic context. In order to facilitate such trade and financial transactions, carried out around the globe in hundreds of national currencies, there needs to be a vibrant and sustainable market. In addition to the emergence of the modern foreign exchange market, the past few decades witnessed a rapid growth in these markets. Foreign Exchange Market (FX market) is a financial market where participants are able to buy, sell, exchange and speculate on currencies. Participants generally include financial institutions such as central banks, commercial banks, investment management firms, intermediary entities such as foreign exchange brokers, commercial entities, governments, retail customers and investors as well as currency speculators. This is a highly decentralized market and most of the transactions are carried out as over the counter transactions.

FX market is considered the largest and the most liquid financial market in the world. According to the Triennial Central Bank Survey on foreign exchange turnover in April 2013, which is published by the Bank of International Settlement (BIS), trading in FX markets averaged to \$5.3 trillion per day (April 2013). This is up from \$4.0 trillion in April 2010. Further the survey has found that Foreign Exchange Swaps were the most actively traded instruments in April 2013, at \$2.2 trillion per day, followed by spot trading at \$2.0 trillion per day. According to the same report, United States Dollar (USD) remains as the prominent currency in the FX market, being on one side of 87% of all foreign exchange trades followed by Euro which recorded 33%. The report further states the sales desks in

the United Kingdom, the United States, Singapore and Japan dominate the FX market having 71% global market share in April 2013.

Having above numbers in mind and given nature of the international trade and the volatility of the FX market, it could be understood that the participants naturally face a significant risk in dealing with different currencies. Let's take a simple example of a person who wants to import a luxury car from the United States of America to Sri Lanka. Suppose he places an order in January 2012 and opens a Letter of Credit to import the car which has a price tag of 100,000 USD. At the time of placing the order the exchange rate is 113.9000 USDLKR and he expects to spend 11,390,000 in Sri Lankan rupees (without tax). However, due to the delay in manufacturing, the car will arrive in Colombo only in December 2012 and by that time exchange rate has changed to 128.7469 USDLKR. Now, once he goes to the bank to make the payment, the cost of the same car would be 12,874,690 in Sri Lankan rupees. Even though there is no change in the price tag of the car he has to pay additional 1,484,690 LKR due to the depreciation of the Sri Lankan rupee. This simple example gives us a glimpse of the risks associated with the highly volatile FX market. Therefore, having a proper risk mitigation mechanism is vital for a person/corporation or any other institution to manage their risk arising from exchange rate volatility.

Engaging in any economic activity like farming, retail selling, manufacturing etc. is certainly linked with taking of risks. All the activities carry various risk components which could be defined as an unexpected outcome. Managing such risks is one of the

most important tasks in an ever changing volatile economic environment. Traditional way of risk mitigation was linked with the concept of insurance. However, insurance may not be suitable for managing each and every type of risk specially given the complex economic environment an economic agent would face in modern markets. Therefore, along with the development of the financial market, new methods have emerged to use for managing the risks. One such new method is the use of derivatives. Derivatives are the most common and widely used risk mitigation tools in place within the modern economic structure. Use of derivatives has become more prominent during the last few decades. From simple Forward Contract to highly sophisticated structured products like credit linked notes have been introduced to the financial market as tools for hedging of risks. In spite of the risks associated with derivative products themselves such as credit default risks and some negative remarks derivatives have taken from the recent global financial crisis, still the use of derivatives are considered to be one of the preferred ways of mitigating risks in business. Derivatives could be used to mitigate many types of risks arising in the economic environment such as interest rate risk, foreign exchange risk or even a risk faced by the farmers due the changing weather.

First two paragraphs of this article have given an introduction to the FX market. Due to the importance of the FX market there are various types of derivative products developed to cater to the FX market for managing foreign exchange exposure. In proceeding sections we will discuss the various types of derivative products available in the financial market to use as risk management tools in managing the foreign exchange exposure faced by an economic agent. Though there

are number of derivative products to cater to different types of economic agents, here, we will discuss only the basic structures of Foreign Exchange Derivatives which are listed as follows:

- i. Swaps
- ii. Forward Contracts
- iii. Futures Contract
- iv. Options

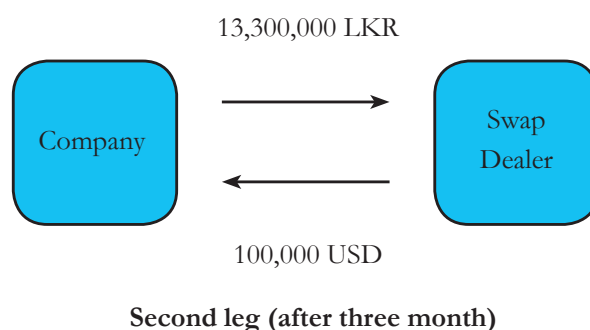
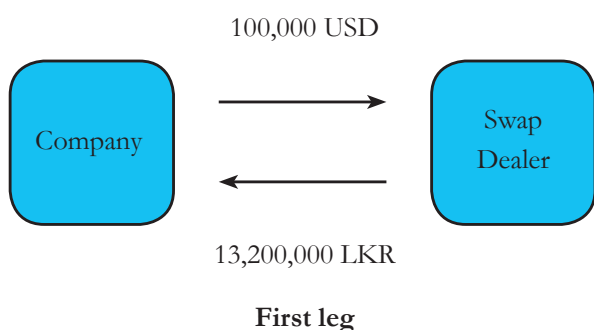
2. Swaps

A Swap could be described as an over the counter derivative contract in which two parties agree to exchange a sum of money against another sum of money, arising from exchange of two currencies, in periodic intervals. Generally, two parties agree to exchange a principal and/or interest in one currency to a principal and/or interest in another currency for an agreed period at an agreed exchange rate. Since this is an over the counter transaction, both parties face the credit default risk.

2.1 Foreign Exchange Swap

Foreign Exchange Swap is a simultaneous purchase and sale of identical amount of one currency for another with two different value dates. Mostly, this contains a spot transaction and a forward transaction. Essentially, this is a simple model of a Currency Swap where only the principal is exchanged at the start and the maturity. This would allow companies to use certain currency without foreign exchange exposure as the exchange rate and the receipt currencies are fixed for both transactions.

Example: suppose a company in Sri Lanka receives 100,000 USD today and will have a payment liability with same value,

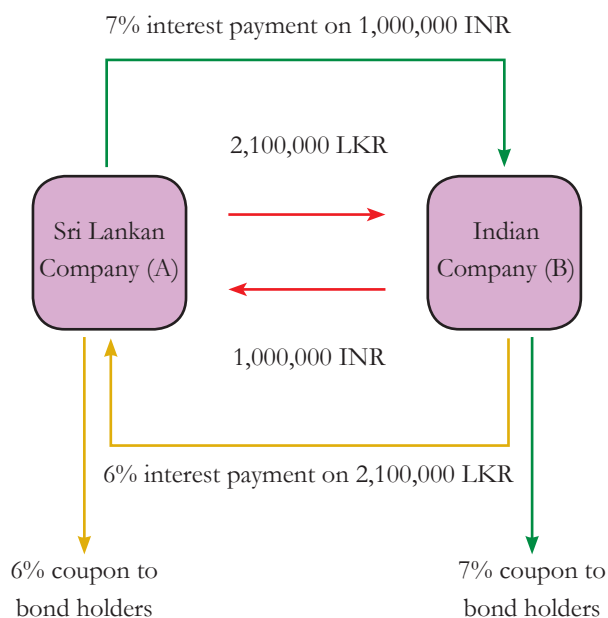


for an import, in three months' time. A company could decide to keep the 100,000 USD as it is once received and hold for another three months to make the payment for import, thereby mitigating the foreign exchange risk that could be faced by the company. However, this would result in the company earning lesser interest rate for USD as well as the company being unable to use such funds for operational aspects of the business. In the circumstances, the company could use a Foreign Exchange Swap to convert the United States Dollar proceeds to Sri Lankan Rupees today and re-convert them on three months' time while keeping the foreign exchange risk away.

In this example, Foreign Exchange Swap works as follows: at the first leg of the Swap, the company will sell the 100,000 USD to a Swap Dealer and obtain 13,200,000 LKR (assuming the Spot rate is 132 USDLKR) and as the second leg of the Swap, Swap Dealer agrees to give back the 100,000 USD to the company and in turn company will return the 13,300,000 LKR in three months' time (i. e. three months' Swap rate is 133 USDLKR after adjusting swap points). This would effectively fix the exchange rate for the company and thereby eliminate the foreign exchange risk. The Swap rate may differ from the Spot rate depending on the interest rates of respective currencies.

2.2 Currency Swap

Currency Swaps are used to gain the competitive advantage in doing business in local markets. Suppose a company in Sri Lanka expects to invest in India and expects to borrow from Indian financial market. But, as the company is new to the Indian market, the interest rate that would be offered to the company in Indian financial market would be comparatively higher where the company may borrow in local financial market at much cheaper and prime rates. In this circumstance the company could use a Currency Swap with another party to raise Indian rupee capital while keeping the borrowing cost low (i. e. borrowing in local currency). Suppose there is another company in India who is expecting to do business in Sri Lanka and looking to raise Sri Lankan rupee capital. Like Sri Lankan company could raise cheaper funds in Sri Lanka, the Indian company would also be able to raise cheaper funds in India. As we can understand, now there are two companies who will be able to raise cheaper funds in respective local markets but both of them need funds not in local currency but in foreign currency. Here, there is an opportunity for a Currency Swap where both parties would be better off.



Suppose, the interest rate that would be faced by the Sri Lankan company in India is 11% and Indian company face in Sri Lanka is 10%. However, Sri Lankan company can raise funds in local market at 6% by issuing a local bond and conversely Indian company could raise Indian rupees at 7%. In this context, they could borrow from their respective local markets and exchange the proceeds in terms of a Currency Swap.

First, Sri Lankan Company (Company A) will raise 2,100,000 LKR from a 5 year bond issued with a 6% rate in Sri Lanka and the Indian company (Company B) will raise 1,000,000 INR from a 5 year bond issued with a 6% rate in India. Then, they will exchange the proceeds (Assuming the agreed Swap exchange rate is 2.1 USDLKR). Once the principal has been exchanged, Company A will pay the annual coupon of Indian rupee bond to the Company B (i. e. 7%) and which will be used by Company B to pay to the bond holders in India. Conversely, Company B will pay the annual coupon of Sri Lankan rupee bond to the Company A (i. e. 7%) and which will be used by Company A to pay to the bond holders in Sri Lanka. This process will continue up to the maturity of the bonds (i. e. 5 years) and thereafter, at the maturity, two companies will exchange back the principal (i. e. Company A paying 100,000 INR to the Company B and Company B paying 2,100,000 LKR to the Company A). Accordingly, we can observe that two companies effectively borrowing at the lower interest rates in respective foreign currencies and this process lock the exchange rate at the beginning of the contract and thereby eliminating

the possible exchange rate risks. However, it is important to note that the rates pay by the companies may differ from the bond rates as there are some cost components which have been excluded for the simplicity.

3. Forward Contracts for Foreign Exchange

Foreign Exchange Forward Contract is an agreement between two parties to exchange specific amount of currency at a specified exchange rate on a specific date in a future. The specified exchange rate is called the 'Forward Rate'. If the Forward Rate exceeds the spot rate, it is said to contain a premium and if the Forward Rate is less than the spot rate, it is said to contain a discount. Forward Contracts typically do not require a payment of upfront fee by either party.

While the Forward Contracts are tailor-made and over the counter derivatives, they are widely used to hedge the currency or exchange rate risk. Generally, in financial jargon, buyer of the Forward Contract is said to be in a long position while the seller is said to be in a short position.

Example: Suppose there is an importer who is going to import certain goods valued at 100,000 USD on Letter of Credit terms. At the time of placing the import order, both parties (local importer and the foreign exporter) have agreed that the payment will be due after three (03) months' time. Accordingly, the importer now has a payment to be made in a future date. In the normal circumstance he would go to a bank after three months and would buy the USD 100,000 by selling Sri Lankan Rupees to the bank at the prevailing exchange rate at that time. However, this would expose him to the exchange rate risk. If the exchange rate has depreciated by that time from today's rate of 130 USDLKR to 140 USDLKR, then for the payment of same USD 100,000 amount of the import bill he will need more Sri Lankan rupees (i. e. 1,000,000 LKR more - $(140-130)*100,000$). Thus, due to the volatility of market foreign exchange rate he could face a financial uncertainty. Therefore, in order to mitigate this risk arising from possible future depreciation of Sri Lanka rupees, importer has opportunity to enter in to a Forward Contract.

Now, at the time of the import order, importer would go to a bank and enter into a Forward Contract with the bank. Accordingly, bank will sell a Forward Contract to the importer (taking a short position on USD) agreeing to sell USD 100,000 on a date after three months times and at an exchange rate

of 132 USDLKR. Thus, the rate 132 USDLKR is considered as the Forward Rate and importer will be assured that he will get the required 100,000 USD at the Forward Rate after three months' time irrespective of market price of the USD of that trading day (i. e. spot rate). This will protect the importer from losses that could arise from depreciation of the currency. It is also important to note that there are a number of factors that affect the deciding of Forward rate; mainly the interest rates of the currency pair and other factors such as expectation of direction of movement of a particular currency pair, market liquidity etc.

Non Deliverable Forward Contract (NDF): Forward Contracts could be entered as 'NDF'. An NDF also has the same features of a typical Forward Contract except the fact that there will not be any exchange of currencies at maturity. Instead there will be a net settlement. If we re-take the above example in the context of an NDF and the spot rate after three months' time is 140 USDLKR, then the bank will pay to the importer an amount of $(140 - 132) * 100,000$ in Sri Lankan rupees as a net settlement. Effectively, this would result in the same outcome like a general Forward Contract as the importer in turn can go to the market and purchase required 100,000 USD at 140 USDLKR (i. e. market spot rate). Since the importer has already been paid the difference between Forward rate and the Spot rate, effective exchange rate applied to the importer will be 132 USDLKR.

Even though Forward Contracts are used to mitigate the exchange rate risk, Forward Contract themselves carry risks, particularly the credit default risk. Since this is essentially an agreement between two parties it is possible that one party could default by not honoring the settlement.

4. Futures Contract for Foreign Exchange

This is fundamentally the same as Forward Contract though there are operational differences as these are 'Exchange' traded derivatives. Accordingly, these are publicly traded in exchanges such as international monetary market of Chicago Mercantile Exchange, London International Financial Futures Exchange etc. Currency Future Contract could be identified as a standard agreement which enables buyer/seller to buy/sell specific amount of a particular currency at specific date at pre-determined exchange rate. Since this is a standard contract, unlike the Forward Contract, Future Contracts have standard features such that the amount of single contract and the settlement date will be fixed by the exchange. Settlement date

is typically the third Wednesdays in March, June, September, and December in Chicago Mercantile Exchange and could be different from exchange to exchange. Currency Futures may be purchased by a person/corporation to hedge the currency payables and sold to hedge the currency receivables. Further, unlike Forward Contracts these are traded through brokers who are members of the particular exchange.

Generally the price of a Future Contract differs from spot rate when the interest rate of two currencies differs. Currency which has lower interest rate will sell at a forward premium in terms of the higher interest currency and currency which has higher interest rate will sell at a forward discount in terms of the lower interest currency. This is to prevent the risk free arbitrage activities.

Since Futures Contracts are traded through an exchange, unlike the Forward Contracts, there is no default risk. Exchange will guarantee the payments at the settlement date. However, this would result in increasing risk faced by the exchange in the case of default by a buyer/seller. Therefore, Exchange requires a margin deposit from a person/corporation who buys or sells a Future Contract.

Accordingly, a buyer or seller of Future Contract needs to open a margin account before trading. However, it is not necessary deposit the total contract value as a margin. The initial deposit as a margin will be a lower percentage of total amount. Initial margin requirement will depend on the volatility of particular currency pair and could be in the range of 5% to 15% of total contract value. Future Contract is marked to market on daily basis. Therefore, once the initial margin is deposited buyer/seller will have to maintain the margin throughout the period and depending on the volatility he may have to top up the

margin account. i. e. if the holder is losing he has to deposit money to margin account to keep the balance. This method will protect the exchange from possible default by a buyer/seller. At the maturity settlement is executed by net basis through already marked to market margin accounts.

Example: Consider the above mentioned same example in Forward Contracts. Since the importer wants to hedge the USD payable in future he can buy future contracts to match the amount he has to pay. Assume the standard contract size of a future contract is 10,000 USD and price of the 3 month Future Contract is at 132 USDLKR and the maturity date has been set after three months' time. In order to hedge the USD payable the importer needs buy ten (10) Future contracts. At the time of initiation of the future contracts he does not have to pay the total amount; instead he will only deposit proportionate amount to the margin account which will be around 5%- 15% of the contract value and decided by the exchange. Thereafter, based on the changes of market value of the future contracts importer will either have a gain or loss which will be posted to the margin account on a daily basis. At the maturity, exchange rate has depreciated to 140 USDLKR. Now the importer has to pay 14,000,000/- LKR to buy 100,000 USD from the market. However, profit from the Futures Contract would be 800,000/- LKR $((140-130)*10,000*10)$. Hence, the effective cost of importer would be 132 USDLKR $((14,000,000-800,000) / 100,000)$.

Buyers of the Futures contract have ability to close out their positions by selling similar Futures Contracts, if they have the impression that the exchange rate is moving unfavorably to them. Conversely, Sellers of the Futures contract have the ability to close out their positions by buying similar Futures Contracts.

4.2 Forward Contract vs. Future Contract

	Forward Contract	Future Contract
Contract size	Customized	Standardized
Delivery date	Customized	Standardized
Deposit	Not necessarily	Margin Deposit
Clearing Operation	Handled by individual banks/brokers	Handled by exchange
Market Place	Over the Counter	Exchange traded
Maturity	Any Maturity	Fixed maturities
Liquidation	Mostly settled by actual delivery	Mostly settled by offset
Transaction cost	Bank's bid/ask rate	Negotiated brokerage fees

5. Foreign Exchange Options

An Option can be described as a derivative contract which gives the option to the buyer (or holder) the right, but not the obligation, to buy or sell a given amount of foreign exchange at a fixed price per unit on a specific expiration or for a specified time period (until the maturity date). As the holder has a choice on exercising the derivative this is considered as a contingent claim and typically requires an upfront payment to the seller (or writer).

Options could be either an Over the Counter, tailor made instrument or an 'exchange' traded standardized instrument. Similar to the Forward derivatives Over the Counter Options are subject to the credit default risk where exchange traded Options do not carry the credit risk as the exchange guarantee the payments. During the past decade there was observed an increase trend of using the Options to hedge the foreign exchange risks arising from business activities as well as for speculative purposes.

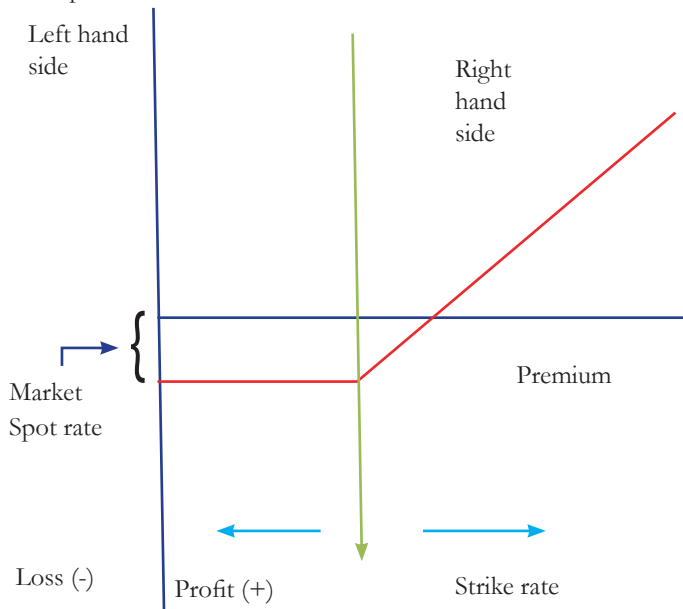
There are two basic types of options namely Call Option where the holder has the right to buy foreign currency and Put Option where the holder has the right to sell foreign currency.

There are three different types of prices associated with an Option. The Exercise of Strike Price is the exchange rate at which the foreign currency could be purchased (call)/sold (put). The premium is the Option price or cost of the Option. The underlying or actual spot exchange rate is the one prevailed in the market. If the strike price is same as spot price of the underlying currency it is identified as an 'At the Money' (ATM). If the Option is profitable (excluding the premium) it is said to be 'In the Money' (ITM). If the Option is not profitable (excluding the premium) it is said to be 'Out of the Money' (OTM).

There is another classification on Options depending on the exercise day. An American Option gives the right to the holder to exercise the Option at any time between date of writing and the expiration or maturity date. A European Option could be exercised only at the expiration or maturity date. European currency options will be suitable for a person /corporation who has future currency flows and who wants pay a lower premium.

Call Options: Call Options gives the buyers the right to purchase foreign currency in a future date. Persons/ Corporations who has open positions in foreign currencies could use a call option

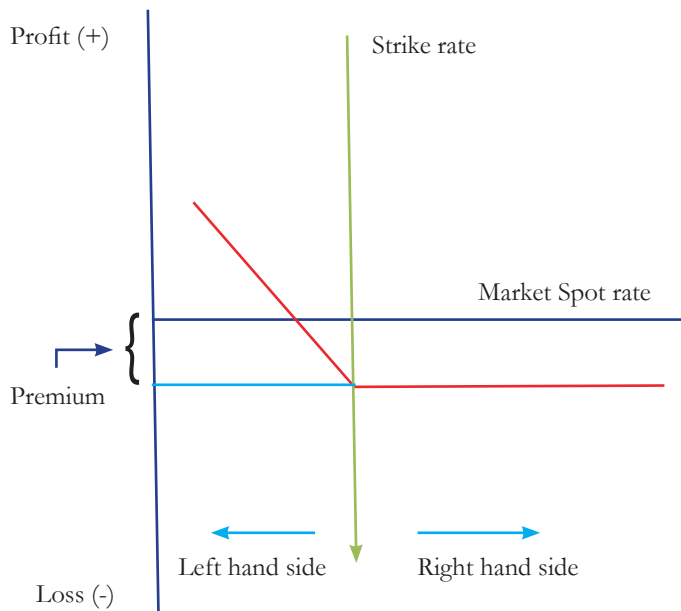
to hedge the foreign currency exposure such as future payables or potential costs. Premium of a call Option will be high if the difference between spot and strike rates is high (Spot – Strike), time to expiration is high and volatility of the particular currency in the market is higher. Payoff matrix to the buyer of Call option is as follows.



If the Strike price of the option is higher than the market Spot price (left hand side of the graph) then the buyer (holder) of the call option will not exercise his right and instead he will buy the required foreign exchange in open market and has to bear the upfront premium as a loss. If the Strike price is lower than the market Spot price (right hand side of the graph) then the buyer will exercise his right and buy the foreign exchange from the option seller at Strike rate. This will be profitable when the gain from the lower Strike price cover the upfront premium.

Put Options: Put Options give the buyers the right to sell foreign currency in a future date. Persons/ Corporations who has open positions in foreign currencies could use a put option to hedge the foreign currency exposure in terms of receivables such as exporter who expect to receive a payment in a future date. Premium of a put Option will be high if the difference between strike and spot rates is high (strike – spot), time to expiration is higher and volatility of the particular currency in the market is high. Payoff matrix to the buyer of Put option is as follows.

If the Strike price of the option is lower than the market Spot price (right hand side of the graph) then the buyer (holder) of the Put option will not exercise his right and instead he will sell



the required foreign exchange in open market and has to bear the upfront premium as a loss. If the Strike price is higher than the market Spot price (left hand side of the graph) then the buyer will exercise his right and buy the foreign exchange from the option seller at Strike rate. This will be profitable when the gain from the higher Strike price cover the upfront premium.

Example for using of an Option (Call): Consider the same example given in the Forward Contract again. In that particular scenario spot rate is 130 USDLKR. Since the importer has foreign currency payable in three months' time and expect the LKR to be depreciated. Since he wants to hedge the risk arising from possible depreciation he could buy a Call option. Suppose the Strike rate of the Call Option is 132 USDLKR. After three months, Spot rate moves to the 140 USDLKR and the

importer will exercise the Call Option and accordingly he will be able to buy USD at Strike rate of 132 USDLKR. Like the Forward and Future Contracts price face by the importer have been protected by the Call Option from the depreciation of the local currency. However, notable difference is in the case of the Call Option the importer has to pay an upfront premium. Therefore, profitability from the Call Option will depend on the amount of the premium. Essentially, the premium needs to be lower than the LKR 800,000 in this case to earn a profit (gain from the price difference is equal to the $(140 - 132) * 100,000 = 800,000$)

6. Conclusion

Foreign exchange market plays a vital role in the global economy by facilitating international trade as well as cross country financial flows and considered to be the largest and most liquid financial market in the world. However, due to the volatile nature of the exchange rates of currencies, economic agents who engage in foreign exchange transactions always face a foreign exchange risk. Development of modern sophisticated financial markets have paved the way to the emergence of various derivative products as hedging tools for the management of such risks. This article discussed the basic structures of derivative products available for management of foreign exchange risks. However, it is important to note that based on these basic structures there are numerous complex products available in the financial market to use as hedging tools. Those complex derivatives may be developed based on these basic products or even designed with combinations of other types of derivatives such as interest rate derivatives.