

Journal of Economic Cooperation & Development

Ahmed S. Abutaleb and Marwa G. Hamad

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Sudden Stops Recessions for Egypt:
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EDITORIAL NOTE

Five papers make up this issue. **The first one, titled Optimal Levels of Reserves and Hedging Sudden Stops Recessions for Egypt: A Stochastic Control Approach** by *Ahmed S. Abutaleb and Marwa G. Hamad*, discusses the issue of optimal international reserves in Egypt during the period 1977-2007. The paper also presents a new approach to manage international reserves. It is proposed that part of the reserves will be held as risky assets. The risky assets are sensitive to the volatility index (VIX) of the Chicago Board Options Exchange (CBOE). The analysis reveals that the actual normalized level of reserves is in excess of the optimal one. Hence, the study recommends reducing the international reserves to the optimal level. This is almost 25% of the current levels of reserves. Moreover, the study proposes the activation of other institutions role in the society to attract long term investments, maintaining a certain limit of coordination among fiscal and monetary policies and consolidating the norms of ethical standards in the financial system.

The second paper, titled **Export Instability, Income Terms of Trade Instability and Growth: Evidence from Pakistan** by *Faiz Bilquees and Tahir Mukhtar*, explores the causal relationship among export instability, income terms of trade instability and economic growth in Pakistan. By using the cointegration analysis and vector error correction model for the period 1960 to 2008, the study demonstrates that there exists a long run equilibrium relationship among export instability, income terms of trade instability, investment and economic growth. The Granger causality test results indicate that in the short run there exists a uni-directional causality running from export instability and income terms of trade instability to economic growth. However, in the long run all the variables of the study cause one another. This finding is suggestive of closer coordination among the monetary, fiscal and trade policies in Pakistan.

The third paper, titled **The Impact of Foreign Trade on the Labor Market: Evidence from Turkish Economy** by *Enes E. Uslu and Ozgur Polat*, analyzes the impact of foreign trade on labor market by using the random coefficient panel data analysis and the quarterly data of 17 sectors in manufacturing industry of Turkey according to 2 digit level of NACE Rev. 1.1 and ISIC Rev.3 classification between 1994 and 2010. Data are seasonally adjusted by TRAMO/SEATS method before data

evaluation, since the data used are quarterly. The results showed that production had positive impact on labor whereas it had negative impact on wages. Furthermore it was shown that imports and exports have a significant and positive impact on labor. Thus the results of the study point out that foreign trade positively affect the economy. Sector specific estimations, which is the one of distinctive aspects of this study, derived from the random coefficient panel data analysis, are also discussed in detailed.

The fourth paper, titled **Efficiency of Zakat Institutions in Malaysia: An Application of Data Envelopment Analysis** by *Norazlina Abd. Wahab and Abdul Rahim Abdul Rahman*, measures the efficiency of zakat institutions in Malaysia during the period of 2003 to 2007. Using a Data Envelopment Analysis (DEA) technique, the results show that zakat institutions have exhibited mean technical efficiency of 80.6%. The results also suggest that pure technical inefficiency dominates the scale inefficiency effects in determining technical efficiency of zakat institutions in Malaysia. Further analysis of Spearman and Pearson correlation coefficients suggests that while higher Muslim population states tend to positively correlated to zakat collection, its correlation with efficiency score does not indicate a strong relationship, implying that it does not promise efficiency of zakat organization.

The last and fifth paper, titled **Pension Reforms: A Case for Pakistan** by *Umaina Arif and Eatzaz Ahmad*, deals with pension system reforms for the Pakistan economy and highlights the current situation and future prospects. The study presents an overview of empirical evidence on pension system reforms, the strengths and weaknesses of the pension system of Pakistan and the institutional development pertaining to pension reforms. Fully funded pension system can help to strengthen the formal channels of retirement savings and can help to get rid of problems prevailing in current pension system. If the decision to reform the pension system is not taken in time then in the near future rising pension expenditure would lead to increase in indirect taxes, reduction in development expenditure and/or increase in government borrowings. Although some efforts to reform the pension system had been made to reduce the government's rising pension bill, yet despite realization of the problem no serious effort had been made to reform the pension system in a fundamental way.

Optimal Levels of Reserves and Hedging Sudden Stops Recessions for Egypt: A Stochastic Control Approach

Ahmed S. Abutaleb¹ and Marwa G. Hamad²

This paper discusses the issue of optimal international reserves in Egypt during the period 1977-2007. We derive, using stochastic control, the optimal level of reserves to maximize the welfare of the society as measured by the utility of the consumption. The paper also presents a new approach to manage international reserves. It is proposed that part of the reserves will be held as risky assets. The risky assets are sensitive to the volatility index (VIX) of the Chicago Board Options Exchange (CBOE). The analysis reveals that the actual normalized level of reserves is in excess of the optimal one. Hence, the study recommends reducing the international reserves to the optimal level. This is almost 25% of the current levels of reserves. We also present a scenario whereby the reserves are reduced by almost half of its existing levels in year 2007. We then invest a small portion, through a sovereign wealth fund, in VIX based options. In case of crisis (sudden stop) the payoff of the options will yield an amount that is almost the same as the kept value of reserves. Following this strategy allows for an opportunity gain in the range of (1-2) % of GDP. Moreover, the study proposes the activation of other institutions role in the society to attract long term investments, maintaining a certain limit of coordination among fiscal and monetary policies and consolidating the norms of ethical standards in the financial system.

“International reserves are both observable and have a market value...”
Gray, Merton and Bodie 2007

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1. Introduction

Recently, along with the dramatic increase in international reserves in emerging market countries, estimated by more than 60 percent since the Asian financial crisis in 1997 as mentioned by Mendoza (2004), debates about the fitting/optimal amount of reserves for an open economy have gained a new life (Jeanne and Rancière 2009). Being characterized by weak access to international capital markets, recurrent credit crunches and financial underdevelopment; emerging countries run persistent current account deficits and are vulnerable to foreign investors' insights about the underlying economic and institutional circumstances. Jeasakul (2005) put forward that, since investment decisions are based upon profitability criteria,³ any alterations in these conditions due to financial crisis or turmoil, foreign creditors can suddenly cause capital inflows to come to an end, leading to what Dornbusch, Goldfajn and Valdes (1995) firstly marked as a "sudden stop", a term that was further developed analytically in Calvo (1998).

1.1 Sudden Stops: Some Stylized Facts

Many Asian countries during the late nineties of the last century were hit by currency crises and sudden stops.⁴ Since then, hoarding international reserves has been the preferential policy of most developing economies (Cheung and Qian 2007; Wijnholds and Sndergaard 2007). Sighted in this light, the sharp augmenting in the amount of reserves held by many emerging markets can be relevant to the rise in the "globalization hazard" that confronts emerging markets as suggested by Calvo (2002). A moderate probability of globalization hazard "sudden stop" can induce emerging markets to self-insure fully by hoarding international reserves, rather than relying on non-reserve options of taking

³ Martin and Morrison (2008) label these speculative flow of funds (or capital) from one country to another as being "Hot Money", because they can move very quickly in and out of market, hence potentially lead to market instability.

⁴ Financial crises are events in which people suspect that some major economic agents can no longer uphold their financial obligations, which trigger panic in financial markets. Generally, the term financial crisis is used to describe currency crises, banking crises and debt crises. In the past, the scope of financial crises tended to be domestic. However, contagion effects became more prevalent in the past decades, as the international community witnessed a series of major financial breakdowns spanning various countries from the debt crises of 1982 to the Russian crisis of 1998 (Jeasakul 2005).

preventative measures. A sudden stop,⁵ in this context, is a distinctive phenomenon of the crisis wracked in emerging countries during the post of the nineties. Lee (2008) put forward that sudden stops in its essence is a situation under which there is a reversal capital inflows to the country, lack of access to external insurance and hence a sharp current account adjustment on recipient countries. Caballero and Panageas (2005) demonstrate that international financial markets cause the sudden stop and not the emerging economies themselves.

On the main features of sudden stops, Mendoza (2008) mentioned three stylized facts that are: (1) Changing direction of international capital flows in a reverse order, (2) reductions in domestic production and absorption, (3) Alterations in asset prices. Besides these three main outstanding macroeconomic regularities, there are three distinct features of sudden stops: The first encompasses that they are placed within business cycles. Calvo, Izquierdo and Rudy (2005) points out that sudden stop describes a situation under which country's capital flows are insignificantly below their mean which is rarely events in each country. Secondly, they indicate business cycle asymmetries. Third, standard growth accounting displays that a large slump in the Solow residual accounts for a Sudden Stops' initial output collapse. Part of this is due to factors that favor the Solow residual as a measure of "true" total factor productivity (TFP), such as changes in imported inputs, capacity utilization, and labor hoarding (Mendoza 2006).

In a nutshell, Asian crises revived the literature on sudden stops. Calvo (1998) in his work portrays the basic procedures and implications of sudden stops and Calvo and Reinhart (1999) document the incidence of the phenomenon. For emerging countries, having much of their growth ahead of them, any sudden stop in capital flows has serious repercussions on the economy and might very well trigger a recession. Caballero and Panageas (2005) pointed out that in a typical sudden stop, external funding declines by 10 percent or more, and the key impact lasts for over six years. The first considerable episode of this type was the Mexican crisis of 1994-1995, followed by the severe Asian crisis in 1997, where the hot money firstly moved out of Thailand and then from

⁵ Jeanne and Rancière (2009) in their empirical study concerning assessing the optimal levels of international reserves for a group of emerging market countries identified a sudden stop at the point where the ratio of capital inflows to GDP falls by more than 5 percent.

the Southeast Asian countries. The Russian and the Brazilian crises in the late 1990s and beginning of the 21st century showed that this was not an exceptional event (Ito, 2006). Even well managed developed economies suffer from sudden stops or crashes. The recent 2008 financial crisis is a proof of this. The situation is even worse for emerging economies such as that of Egypt. Foreign direct investments (FDI) are needed to finance new long term projects especially in emerging markets where capital is hard to find. In the case of crash, at a moment notice these economies are required to face capital outflows. It is not an exaggeration to say that, in the mean time, sudden stops portray the profile of the world Cúrdia (2007).

1.2 International Reserves: Literature Review

International reserves, also popularly known as foreign exchange reserves, are those liquid assets that are nominated in different reserve units (foreign currency, foreign currency bonds and gold) and basically managed by monetary authorities; the central or reserve banks (Kester 2001; Bar-Ilan and Lederman 2006; IMF 1993). The issue of international reserves is not a new topic, but it has gained new eminence for two noticeable reasons: the dramatic surge in the level of such reserves over the last decade and the diversity of management styles. Alongside these developments; there is a rising debate about the extent to which hoarding excessive reserves is necessary. The opponents point out that holding a lot of reserves is costly; it yields a lower return than the interest rate on the country's long-term debt (Jeanne and Ranciere 2006; Aizenman and Marion 2002). Hence, there is no need to hold cash in the bank and pay high interest on outstanding liabilities.

On the other hand the proponents of holding many reserves claim that reserves play a key role in promoting the stability of any emerging configuration due to a sudden stop, counting up the benign impacts of accumulated reserves, even if it is not a panacea. *One rationale* is that reserves allow the country to self-insure against sudden stops,⁶ capital

⁶ Aizenman (2009) spot light on the fact that emerging markets that increased their financial integration during the 1990s-mid 2000s, hoarded international reserves due to precautionary motives, as self insurance against sudden stops, and deleveraging crises as suggested in the earlier research. Crisis-insurance motives could be considered as the main driver behind international reserve accumulation in emerging economies.

flight, mitigate real effective exchange rate effects of terms of trade shocks⁷ and hedge against the risk of balance of payments crises, and therefore avoids being shut out of international capital markets, which came to be apparent as higher after the 1997-98 Southeast Asian crises (Jeanne and Ranciere 2006; Aizenman 2007^{a, b}). Hence fore, having a precautionary stock for unexpected shocks promotes the nations capability to smooth domestic absorption in response to sudden stops, by allowing more persistent current account patterns. A competitive approach to that strand line of thought exhibits that international reserves accumulation is a by product of promoting export competitiveness, which results in better job creation particularly in the work of China as explained by Dooley, Folkerts-Landau and Garber (2004).

A *second view* postulates that reserves serve up as a deterrent against speculative attacks especially under a floating exchange rate regimes and deregulation of the foreign exchange rate markets; being equipped with reserve assets represents a safety valve of the nation against speculative attacks (Sidaoui 2005; Noyer 2007). In this context, accumulated reserves promote the countries ability to absorb any shock and hence its exchange rate vis-à-vis other currencies does not affect. A *third vision* states that countries based on hoarded reserves could manage international transactions imbalances directly and implement monetary as well as foreign exchange policies indirectly (Cheung and Qian 2007; Kester 2001; Noyer 2007; IMF 1993). A *fourth reason* mentioned the non-fundamental factors or psychological aspirations as motives for mounting up reserves. A fifth strand line focuses on the benefits of international reserves as a tool for sterilization intervention policy; where the central banks sells public bonds for international reserves during the capital flows boom to maintain internal stability (1.e. stability in prices) (Aizenman 2007^c; Caballero 2000). Consequently, exchange rates will not be affected and the nation's exports will still be competitive. It is noticeable that accumulating growth to enhance

⁷ The real effective exchange rate represents the weighted average of a country's currency relative to an index or basket of other major currencies adjusted for the effects of inflation. The weights are determined by comparing the relative trade balances, in terms of one country's currency, with each other country within the index. While the terms of trade denotes the relative prices of a country's export to import.

exports goes in consistency with the mercantilist school of trade (Aizenman and Lee 2005; Aizenman^b 2007).

Other sights highlight the importance of reserves for countries to keep up with their peers and stimulate their growth given the positive impact of reserves on the output circumstances (Bar-llman and Lederman 2006; Kriesler and Cruz 2008). In this respect, the proponents of hoarding reserves claim out that reserve accumulation is not an end in itself but a mean to different ends; reserves give the country with large amount of reserves a competitive advantage over its peers. It follows up that assuming two economies with similar economic fundamentals,⁸ in case of a financial crisis in the region, the one with a higher level of international reserves is less likely to be attacked and is more likely to survive the crisis. Hence for, the cost of building up excessive reserves is trivial relative to the economic consequences of a crisis.

1.3 International Reserves; is it the case of more is better or there is an opportunity cost?

Having discussed the importance of international reserves in the period of crisis, the question comes to mind: Is it a case of “more is better” or a case of “trade off”? Throughout this paper, we postulate that the international reserve accumulation process may achieve some relevant economic purposes up to a certain level, above which there will be an increasing opportunity cost. It is rather non-controversial to state that, *ceteris paribus*, international reserves help absorb unexpected exogenous triggered shocks and smooth current and capital account imbalances; in this regard its outstanding to mention that external crisis could be due to the response of international financial markets to national crisis (i.e. there may be national crisis that lead international markets to loose confidence in investing in emerging markets). The crisis experience and the development after it appear to be consistent with the notion of accumulating international reserves to anticipate future speculating. The

⁸ Economic fundamentals refer to socio-economic variables that reflect the overall performance of the economy. For example; interest rates, exchange rates, the government’s budget deficit, the country’s balance of trade account (relating to exports and imports), the level of domestic business confidence, the inflation rate, the state of (and confidence in) the banking and wider financial sector and consumer confidence, health of job market, ability of wages to keep up with prices and value of home prices and stock prices (which have the greatest impact on household wealth).

debatable question, however, is regarding the optimal level of international reserves an economy has to hold?

Regarding the adequacy level of reserves, there are two schools: 1) Motivated by having low opportunities to penetrate international financial markets, Greenspan-Guidotti principle of maintaining reserves equivalent to existing short term obligations (short external debt maturing within one year) in case of quick drop in external financing circumstances (Jeanne and Rancière 2009; Guidotti 2002, IMF 2000; European Central Bank 2006). Such approach seems to be prominently followed by the Egyptian Central Bank since 1991 (Messrs, Opev and Ondiege 2000). An outstanding notice of the evolution of international reserves in Egypt is that it recorded an increasing upward trend that exceeds the short term obligations, see figure 1 in the annex. 2) Caballero and colleagues, on the other hand illustrate that there are other tools, the purchase of future options on the risky assets, which make it possible for emerging economies to penetrate international financial markets at a fraction of the held reserves. The payoff of the risky assets, at the time of sudden stop, would be equivalent to the needed reserves to offset the drop in the needed capital.

On reviewing the international experience in managing reserves, IMF (2008) puts forward that countries with large accumulated fiscal surpluses tend to establish two sovereign wealth funds (SWF). Such funds are mainly financed by foreign exchange revenues on commodity exports and/or transfers of foreign reserves from the central bank. These funds have raised concerns about: (i) Financial stability; (ii) corporate governance as well as enhancing transparency considerations versus commercial objectives; and (iii) finance expected future pension expenditure and sustain general government spending in case of an economic downturn political interference and protectionism or strategic and political objectives of such funds. Blundell-Wignall, Hu and Yermo (2008) defined SWFs as pools of assets owned and managed directly or indirectly by governments to achieve national objectives. SWFs⁹ support developmental plans of the governments through: (i) Diversifying the investment portfolio; (ii) getting a better return on reserves; (iii) financing expected future pension expenditure (v) meeting future needs

⁹ Some of the longer-established SWFs, e.g., those of Kuwait, Abu Dhabi, and Singapore, have existed for decades (table 1 in the annex).

when natural resources run out; (vi) setting price stabilization schemes; (vii) promoting the industrialization process; and (viii) supporting strategic and political objectives and sustain general government spending in case of an economic downturn (Blundell-Wignall, Hu and Yermo 2008 and IMF 2008). It is worthwhile to mention that one of the investment funds retains a conservative strict investment policy and is controlled by a central bank, while the other is subject to more flexible rules under which the government is putting down a strategic asset allocation schema to boost the returns on the annual budget and hence be able to higher spending on priority requirements. We next present an overview of one of the commonly used indices to measure the volatility of the global financial market; the CBOE volatility index (VIX). Caballero and colleagues, and do are we; propose to invest in options that are related to the VIX.

1.4 Option Pricing Approach to International Reserves

Away from the conventional method of hedging against risk that encompasses full dependence on international reserves, this paper handles a new approach that is "option pricing".¹⁰ The option pricing approach provides another tool that allows the government to decrease the amount of reserves to hedge against sudden stops in cash flows when a crisis occurs (Lee 2008). There are two pillars of option pricing approach: (i) To decrease the accumulated reserves to the optimal level; and (ii) to invest in risky assets that are VIX based, such investments which yields a payoff that compensates for the drop in the reserves.

The VIX is the ticker symbol for the Chicago Board Options Exchange (CBOE) Volatility Index, a popular measure of the implied equity market volatility extracted from options on S&P 500 firms (Caballero and Panageas 2005; Keel 2006). It is sometimes called the investor fear index, since investor uncertainty can lead to high market volatility through drops in prices. Options are traded on the VIX, enabling additional hedging and speculation positions on volatility. Closely

¹⁰ The discussion of the equivalence between insurance and a put option was firstly appeared in Merton's (1976) analysis of the cost of providing deposit insurance. He noted that the Federal Deposit Insurance Corporation (FDIC) in the United States, provided guarantees for the loan extended by depositors to banks. Moreover, there was a further belief that the U.S. government offered the ultimate implicit guarantees for the liabilities of the FDIC, and thus those of the banks.

related to the VIX are the VXD, or CBOE Dow Jones Industrial Average Volatility Index, and the VXN, or CBOE NASDAQ 100 Volatility Index. VIX-based investments could yield a significant reduction in the average cost of sudden stops. This result should not be surprising to those following the practices of hedge funds and other leading investors. Except for extremely high frequency events, which unfortunately sudden stops are not, institutional investors seldom immobilize large amounts of “cash” to insure against jumps in volatility and risk-aversion. The use of derivatives and the creation of the VIX in particular, are designed precisely to satisfy hedging needs. Why should central banks, which aside from their monetary policy mandate are the quintessential public risk management institutions, not adopt best-risk-management practices?

1.5 The Objective of the Study

Caballero and Panageas (2004) derived and estimated a quantitative model to assess the (uncontingent) reserves management strategy typically followed by central banks. They concluded that this strategy is clearly inferior to one in which portfolios include assets that are correlated with sudden stops. In their model, they showed that holding contracts on the S&P100 implied volatility index provide emerging economies with a tool to well manage their reserves and make profit. In this study we adopt the methodology presented in Caballero and Panageas (2005) and apply it, after modifications, to the Egyptian economy. This paper, quantitatively, examines the optimal amount of reserves to be held by the Egyptian government so as to maximize the utility of domestic absorption (total expenditures on household consumption, plus government consumption plus investments), and calculates the corresponding optimal level of absorption. In this study we also estimate the optimal investments in risky assets. The payoff at the time of sudden stops will be enough to offset the reduction in the reserves. Thus the central bank will have enough reserves to smooth the drop in foreign capital flows. By developing optimal hedging strategies, Egypt could reduce its international reserve.¹¹

¹¹ The paper does not pretend to know the objective function of certain central banks. Therefore, the notions of “adequacy” versus “excessive” presented in this paper are purely assessments of whether or not reserve accumulation exceeds the conservative estimates of reserves needed for self-insurance purposes.

This paper is organized as follows. In section II, we give a conceptual overview of the sudden stops and explain the basic features of the international reserves, upon which the quantitative model is based. In Section III, we show the optimal level of reserves that should be held by Egypt. The proposed model is used to analyze and forecast how the country could hedge against sudden stops. In Section IV, we present results, summary, and policy implications. There are three appendices that contain different elements of the mathematical techniques and the stochastic optimal control approach.

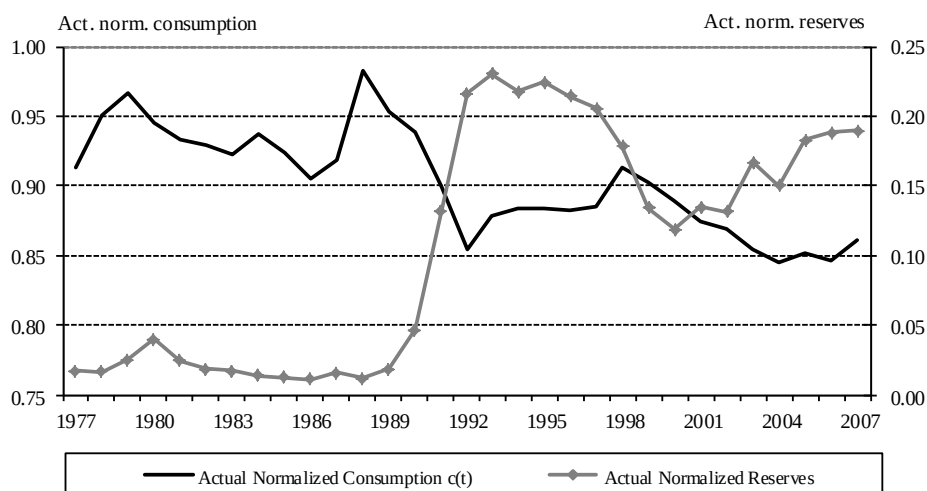
2. Sudden stops and the Mathematical Model

In this section, the current status of consumption and reserves for Egypt are put forward. We then present a dynamic equation for the demand for reserves that incorporates monetary disequilibrium considerations is derived following closely the approach presented in (Caballero and Panageas 2005, 2003) and using the method of optimal stochastic control to obtain our results. It is worthy to mention that this paper focuses on the crises that are triggered externally. Under the stringent assumption of time-invariance of the variables under study and the cost function, optimal levels of reserves and consumption are derived. The main bulk of the stochastic optimal control procedure stems from the work of Abutaleb and Papaioannou (2009).

2.1 Egypt Current Status

Figure 1 displays the fact that there is a negative relation ship between actual consumption and actual reserves. It is obvious that during the period (1977-1989) Egypt accumulated modest level of reserves as a percentage of GDP in relation to high level of consumption as a percentage of GDP. Years 1979 and 1980 were exception years where at the former the normalized reserves represent 0.02 and 0.97 for the consumption, but when reserves increase by 0.02 percentage points in year 1980, consumption decreases to 0.95 as a percent of GDP. Starting from year 1989 accumulated normalized reserves witnessed a dramatic increase at the expense of normalized consumption that fell behind; that situation which persisted till year 1992. Thereafter, normalized levels of both reserves and consumption were to some extent stable at higher and lower levels respectively till year 1997, after which normalized reserves started to get smaller for the favor of normalized current consumption till year 1999.

Figure.1 The Actual Normalized Consumption and the Actual Normalized Reserves



Source: Based on the authors calculations and data from WD1.

A remarkable feature of the profile of Egypt's normalized reserves as well as consumption is that throughout years 1999 and 2000 they moved together downwards, but normalized consumption are still at a higher level than normalized reserves. Over the period of (2001-2003) normalized levels of reserves and consumption seemed to move in divergence to each other, where the normalized level of reserves increased while that of consumption diminishes. Beginning from year 2004 till the end of the period of the study, international reserves increased gradually in contrast to normalized levels of consumption that looked like a zigzag pattern in its movement downward.

A sudden stop is defined as a drop in domestic absorption from the previous years. A sudden stop occurred at the 1981 (at the assassination of President Sadat) and continued for five years, the recovery occurred at 1986 till 1991; a sudden stop happened in 1991 and lasted till 1993. Another sudden stop occurred in 1998 till the year 2004. In 1991, a jump in the reserves as a percentage of GDP occurred and it seems that accumulating high level of reserves was policy of the central bank at that time.

2.2 The Utility Function

We study a representative agent economy with a responsible government that seeks to maximize the expected present value of the utility from consumption $C(t)$:

$$E \left\{ \int_{t_0}^{\infty} U(C(s)) e^{-r(s-t_0)} ds \right\} \quad (2.1)$$

where r is the riskless interest rate and the discount factor, and t_0 is the initial time. The utility function $U(C(t))$ has many shapes, and in this analysis we shall use the popular constant relative risk aversion (CRRA) shape given as:

$$U(C) = \frac{C^{1-\gamma}}{1-\gamma} \quad (2.2)$$

2.3 Emerging Market Economies and World Capital Markets:

Let $Y(t)$ represent the country's income in the pre-development phase, and assume that it follows the Geometric Brownian motion model. The stochastic differential equation (SDE) of $Y(t)$ is given as:

$$dY(t) = \mu_Y Y(t) dt + \sigma_Y Y(t) dB(t) \quad (2.3)$$

where $B(t)$ is the Brownian motion or the Wiener process.

A country in its developing stage would like to borrow against its post development income. The potential financiers are: (1) World capital markets WCM, and (2) Specialists. Unlike the specialist, WCM have limited understanding of emerging markets hence they do not accept contracts that are related to the emerging economies. The country can also accumulate international assets $X(t)$. Both assets and liabilities pay a return of r per unit of time.

2.4 Specialists and Sudden Stops

Specialists are investors who are familiar with the emerging markets at large and are willing to invest in many areas where the WCM refrain

from investing in it. In practice they have equity investments, FDI, the riskiest tranches of GDP-indexed bonds, or toxic-waste more generally. Thus, during non-sudden stop times “NSS” or normal times, the maximum flow of resources received is “ $\bar{f}Y(t)$ ”:

$$\max f^{NSS}(t) = \bar{f} \quad (2.4)$$

During sudden stops, the maximum flow of resources received from the specialists is “ $\underline{f}Y(t)$ ” with:

$$\underline{f} < \bar{f} \quad (2.5)$$

Thus

$$f^{SS}(t) = \underline{f} \quad (2.6)$$

Define $A(t)$ as the sum of income and contingent flows from specialists:

$$A(t) = (\theta^{NSS} 1\{NSS\} + \theta^{SS} 1\{SS\})Y(t) \quad (2.7)$$

$$\text{where } \theta^{NSS}(t) \leq (1 + \bar{f}) \quad (2.8)$$

$$\theta^{SS}(t) \leq (1 + \underline{f}) \quad (2.9)$$

$$1\{NSS\} = \begin{cases} 1 & \text{Country in normal times} \\ 0 & \text{elsewhere} \end{cases} \quad (2.10)$$

$$1\{SS\} = \begin{cases} 1 & \text{Country in sudden stop times} \\ 0 & \text{elsewhere} \end{cases} \quad (2.11)$$

Note that $\theta^{SS} < \theta^{NSS}$

The net assets accumulation or reserves $X(t)$ is now described by:

$$dX(t) = [rX(t) - C(t) + A(t)]dt \quad (2.12)$$

The change in reserves is due to: (1) Interest on reserves at $r\%$, (2) The difference between the “GDP + net foreign accumulation” and the consumption “ $A(t) - C(t)$ ”. The consumption, $C(t)$, is defined as: the gross national expenditure or the domestic absorption, that is the sum of

household final consumption expenditure, general government final consumption expenditure and gross capital formation.

2.5 The Calculation of the Optimal Level of Reserves

We shall study the case where the economy is normal i.e. no sudden stops (NSS) and find the optimal levels of reserves and the corresponding optimal levels of consumption.

Define

$$V(X(t_0), Y(t_0)) = \max_{C(s)} E \left\{ \int_{t_0}^{\tau^{SS}} e^{-r(s-t_0)} U(C(s)) ds + \phi(X(\tau^{SS}), Y(\tau^{SS})) \right\}$$

= value function in the normal state (2.13)

$$\phi(X(\tau^{SS}), Y(\tau^{SS})) = \text{Utility of the desired value of the Reserves at the onset of SS} \quad (2.14)$$

τ^{SS} = time to sudden stop which is random

$$U(C) = \frac{C^{1-\gamma}}{1-\gamma} \quad (2.15)$$

Transition from normal times to sudden stops occurs with a constant hazard rate λ at the random time τ^{SS} . The constraints and the system dynamics are:

$$dY(t) = \mu_Y Y(t) dt + \sigma_Y Y(t) dB(t) \quad (2.3)$$

$$A(t) = \theta^{NSS} Y(t) \quad (2.11)$$

θ^{NSS} for developing countries is around 1.2 (Caballero and Panageas 2005)

$$dX(t) = [rX(t) - C(t) + A(t)] dt$$

$$X(t) \geq 0 \quad (2.12)$$

In vector format, equations (2.3), (2.11) and (2.12) are written compactly as:

$$\begin{bmatrix} dX(t) \\ dY(t) \end{bmatrix} = \left\{ \begin{bmatrix} r & \theta^{NSS} \\ 0 & \mu_Y \end{bmatrix} \begin{bmatrix} X(t) \\ Y(t) \end{bmatrix} + \begin{bmatrix} -C(t) \\ 0 \end{bmatrix} \right\} dt + \begin{bmatrix} 0 \\ \sigma_Y Y(t) \end{bmatrix} dB(t) \quad (2.17)$$

The country is faced with the decision of how much to consume $C(t)$ in order to maximize the utility function and at the same time ending with a desired level of reserves $X(\tau^{SS})$ with a utility function $\phi(X(\tau^{SS}), Y(\tau^{SS}))$. The final value of reserves is defined by the decision maker. Reserves, $X(t)$, play the role of providing the country with resources during sudden stops. Accumulating reserves, however, is costly and deprives the economy from precious resources that could be used for development. The optimization problem is to find the optimal reserves and consumption paths and at the same time satisfying the level of the desired reserves at the end time τ^{SS} .

The Equations of Caballero and Panageas (2005)

Assuming that time-invariance of the objective function, the optimal normalized consumption $c(x)$ as function of the normalized $x(t)$ reserves was derived as (see Appendix A):

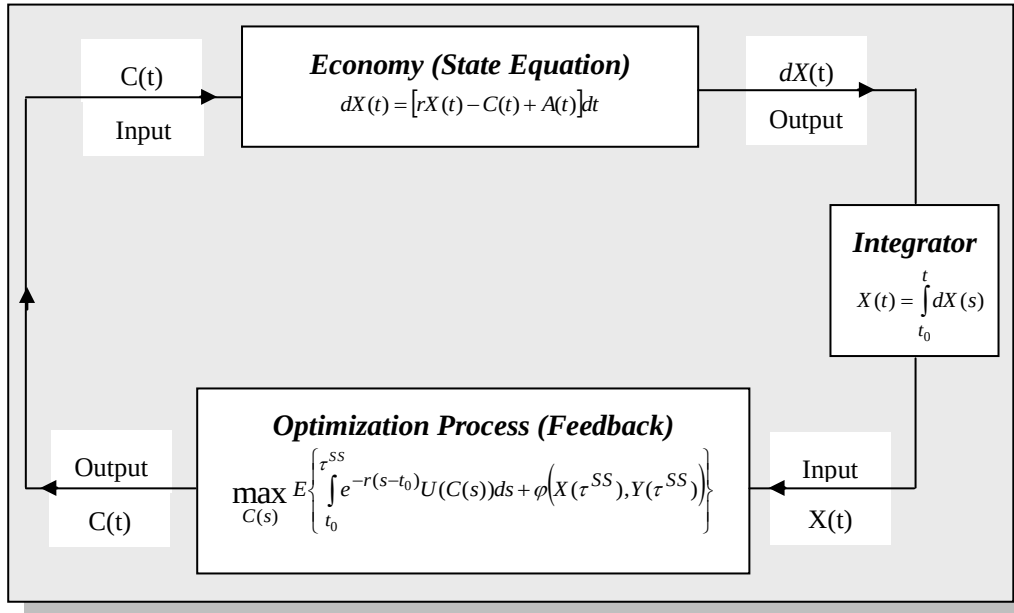
$$c(x) = K \frac{x^{\frac{2}{\sigma_Y \gamma}}}{1 - x^{\frac{2}{\sigma_Y \gamma}}} \quad (A.8)$$

where K is a constant to be determined from the boundary conditions. Notice that we see a positive correlation between the optimal normalized levels of consumption and the optimal normalized levels of reserves. Equation (A.8) is what is called the feedback equation.

Figure 2 maps out the relationship between consumption as well as international reserve levels. It highlights that, according to the economy SDE (equation 2. 12), there is a negative relationship between international reserves and consumption. Without doubt, there is a trade off; the more the money is allocated for reserves, the less is the expenditure on consumption and the vice versa. Considering that our goal is to maximize the expected value of the utility function, the resultant optimization equation (equation A. 8) reveals that there is a

positive relation between the levels of reserves and the consumption (the feedback). Thus, a decrease/increase in reserves will be mirrored in drop/rise in consumption. This way we have two mechanisms acting on the economy; the first generates negative correlation between reserves and consumption and the second generated positive correlation between consumption and reserves. Thus, we have what is called a negative feedback mechanism and the economy is stable.

Figure.2 System Dynamics and Feedback Mechanism



3. Optimal Levels of Reserves In Case of Adding Risky Assets to the Portfolio

In this section, a quantitative framework is developed to bring forward the insurance motive of holding international reserves. The insurance value of reserves is quantified as the market price of an equivalent option that provides the same insurance coverage as the reserves. This quantitative framework is applied to calculating the cost of an international insurance arrangement (e.g., VIX) and to analyzing one leg of an optimal reserve-holding decision. It brings forward the approach of option pricing as a device that enhances Egypt capability to access international markets. Conceptually speaking, this approach goes in parallel with the insurance aspect of international reserves. Moreover, it

steps further where the reserves are being recycled and hence widen the scope of available money to fund public expenditures on priorities in the future.

In this section we present the optimal levels of reserves, the corresponding optimal levels of consumption, and the optimal values of the optimal investments in risky assets. The derivations are shown, in detail, in Appendix B. We shall present the significant potential gains from improving current SS management practices by adding contingent instruments that are largely independent of the country's actions and sensitive to international events. One of the commonly used contingent instruments is based on the change in the volatility index VIX.

3.1 Portfolio Decision:

The international reserves of Egypt were in the order of 30% of GDP in 2007. We need to gradually reduce this amount to a fixed level on the span of few years. Purchasing risky assets that are VIX based is the key to that policy, such risky assets enjoy high values of payoff when SS occurs. At the same time, the payoff should be enough to ensure the coverage of several months of imports once an SS occurs. The basic idea is that starting with high value of reserves $X(t_0)$ we need to reduce this quantity gradually to a final fixed value X_C . At the time of SS there is a payoff obtained from an external fund X_F . The summation of X_C and X_F should be around 10 months of imports (the Greenspan doctrine). In this section we calculate the optimal reserves to be held by the central bank and the optimal values invested in risky assets, and at the same time, the utility of the consumption is maximized. The central bank reserves are gradually reduced to some fixed final value X_C in the case of a sudden stop. This policy will reduce the needed cashed reserves from the current high levels to the value X_C . The reduction in the reserves will free needed cash to be infused in the economy. This will act as a stimulus to the GDP growth. We first explain the mechanism of getting into SS.

Getting into SS

There is a Poisson process with intensity λ that puts the economy in a sudden stop zone at stochastic time τ^{SS} 1.e.

$$\text{Prob}\{\text{SS occurs in the interval } dt\} = \lambda dt$$

$$\text{Prob}\{\text{SS does not occur in the interval } dt\} = 1 - \lambda dt$$

where λ is the mean time of occurrences per unit time. Let $N(t)$ define the independent Poisson process with the following properties:

$$\text{Probability}\{dN(t) = 1\} = \lambda dt$$

$$\text{Probability}\{dN(t) = 0\} = (1 - \lambda)dt$$

$$\text{Thus, } E\{dN(t)\} = \lambda dt$$

Assume that there is a financial asset with payoff $F(t)$ that has the potential to exhibit a jump, $F(t)J$, in its value when the system enters the “SS zone” at the random time τ^{SS} . J is a nonnegative random variable that could have the probability density function of the lognormal distribution or others (Law and Kelton 1991).

The risky asset's payoff process is defined as:

$$dF(t) = r_F F(t)dt + F(t)JdN(t) \quad (3.1)$$

The asset has a return $\frac{dF(t)}{F(t)}$.

In what follows we condition on those times τ^{SS} where the country enters into “SS zone”. The addition of a risky asset with the above properties modifies the analysis given in Section 2. The evolution of the reserves now becomes:

$$dX(t) = [r(X(t) - \xi(t)F(t)) - C(t) + \theta^{NSS}Y(t)]dt + \xi(t)dF(t) \quad (3.2)$$

Where $\xi(t)$ is the amount (or more precisely the number of units) invested in the risky asset $F(t)$. Substitute the expression for the risky asset " $dF(t) = r_F F(t)dt + F(t)JdN(t)$ " in the reserves equation we get:

$$dX(t) = [r(X(t) - \xi(t)F(t)) - C(t) + \theta^{NSS}Y(t)]dt + \xi(t)\{r_F F(t)dt + F(t)JdN(t)\}$$

Rearrange we get:

$$dX(t) = [rX(t) - C(t) + \theta^{NSS}Y(t) + (r - r_F)\xi(t)F(t)]dt + \xi(t)F(t)JdN(t) \quad (3.3a)$$

In a vector form, the new SDE describing the economy will be:

$$\begin{bmatrix} dX(t) \\ dY(t) \\ dF(t) \end{bmatrix} = \begin{bmatrix} r & \theta^{NSS} & (r - r_F)\xi(t) \\ 0 & \mu_Y & 0 \\ 0 & 0 & r_F \end{bmatrix} \begin{bmatrix} X(t) \\ Y(t) \\ F(t) \end{bmatrix} + \begin{bmatrix} -C(t) \\ 0 \\ 0 \end{bmatrix} dt + \begin{bmatrix} 0 \\ \sigma_Y Y(t) \\ 0 \end{bmatrix} dB(t) + \begin{bmatrix} \xi(t)F(t)J \\ 0 \\ F(t)J \end{bmatrix} dN(t) \quad (3.4)$$

The objective function is now defined as:

$$V(X(t_0), Y(t_0), F(t_0)) = \max_{C(s), \xi(s)} E \left\{ \int_{t_0}^{\tau^{SS}} e^{-r(s-t_0)} U(C(s)) ds + \phi_1(X(\tau^{SS})) + \phi_2(\xi(\tau^{SS})F(\tau^{SS})) \right\} \quad (3.5)$$

$$\begin{aligned} \text{Where } \phi_1(X(\tau^{SS})) &= [X(\tau^{SS}) - (X_C + X_F)]^2 \\ \phi_2(\xi(\tau^{SS})F(\tau^{SS})) &= [\xi(\tau^{SS})F(\tau^{SS}) - X_F]^2 \end{aligned}$$

X_C is the desired value of the risk free assets or cash for the reserves

And X_F is the desired payoff from the risky asset

The objective is to find the control variables $C(s)$, $\xi(s)$ that will maximize the expected value of the utility function and at the same time make the expected values of the reserves, from risk-free assets at the terminal time, as close as possible to X_C and the expected value of the payoff of the risky assets, at the terminal time, as close as possible to X_F . As it stands, this is not an easy problem to solve. An analytic solution is almost impossible and one has to go to numerical solutions or use some approximations to make the problem analytically tractable.

3.2 Normalized Variables and the Optimal Solution

As we prove in Appendix C, the normalized reserves

$$x(t) = \frac{X(t)}{\theta^{NSS}Y(t)} \text{ have the SDE:}$$

$$dx(t) = \left[(r - \mu_Y + \sigma_Y^2)x(t) + 1 + (r - r_F)\bar{\xi}(t) - c(t) \right] dt - \sigma_Y x(t) dB(t) + \bar{\xi}(t) E_J \{J\} dN(t) \quad (C.7)$$

where $c(t) = \frac{C(t)}{\theta^{NSS}Y(t)}$ is the normalized consumption, and

$\bar{\xi}(t) = \frac{\xi(t)F(t)}{\theta^{NSS}Y(t)}$ is the normalized payoff due to investments in risky

assets. As shown in Appendix B, the approximate optimal values for the normalized consumption, $c(s)$, and the normalized value of risky assets are given by:

$$c(s) \approx \left(\alpha K_g \right)^{\left(\frac{-1}{\gamma} \right)} \exp \left[\left(\frac{-1}{\gamma} \right) (r(s-t) + \lambda s + \alpha x(s)) \right] \quad (B.26)$$

$$\bar{\xi}(s) = \frac{\xi(s)F(s)}{\theta^{NSS}Y(s)} \approx \frac{1}{\alpha E_J \{J\}} \left\{ \ln \left[\frac{(r_F - r)}{\alpha E_J \{J\} \lambda K_g} \right] - [\lambda s + \alpha x(s)] \right\} \quad (B.27)$$

The above are approximate formulae. They give us the approximate structure or shape of the optimal functions. Thus, in general, one can assume that:

$$c(t) = K_c \exp \left[\left(\frac{-1}{\gamma} \right) (\lambda_c t + \alpha_c x(t)) \right] \quad (3.6)$$

and

$$\bar{\xi}(t) = \frac{\xi(t)F(t)}{\theta^{NSS}Y(t)} = K_{\xi 1} \{ K_{\xi 2} - [\lambda_c t + \alpha_c x(t)] \} \quad (3.7)$$

where K_c , λ_c , α_c , $K_{\xi 1}$ and $K_{\xi 2}$ are unknown constants to be

determined by maximizing the utility function $U(c) = \frac{c^{1-\gamma}}{1-\gamma}$, when γ is large i.e. $\gamma \gg 1$.

Comments

As we saw in section II, it is interesting to notice that there is a negative feedback mechanism that stabilizes the economy at optimal levels of reserves and consumption. Specifically, the normalized reserves $x(t)$ will decrease as the normalized consumption $c(t)$ increases (see equation (C.7)). Because there is another relation, stemming from the optimization or feedback (eqn. (3.6)), the consumption will decrease as the reserves decrease (K_c is positive and α_c is negative). When this happens, the reserves will increase (eqn. (C.7)), and consequently the consumption will increase (eqn. (3.6)). Thus, we reach a dynamic equilibrium and the system (economy) is stable.

3.3 The Time of Sudden Stop τ^{SS}

For an accurate analysis, the sudden stop time τ^{SS} is a random quantity. According to the analysis of SS in the past years, it was found that an SS occurs almost every 4-6 years (Caballero and Panageas 2005). It is costly if the SS occurs and we are not prepared by buying risky assets. Thus, in this report we adopt the conservative policy of assuming that $\tau^{SS} = 4$ years, and the government of Egypt must purchase the risky assets before the four years from the last SS. Thus, we shall present the scenario when the $\tau^{SS} = 4$ years.

4. Results for the Egyptian Economy

This section is devoted to present the results of the study concerning the optimal level of reserves, consumption and the optimal value of investing in risky assets. The basic assumption of our analysis is that actual reserves are reduced to 10 percent of the GDP at the onset of SS. We shall first explain how to calibrate the model. Then, we display the optimal level of normalized consumption and the normalized reserves versus their actual levels. Next, under the assumption that there is a sudden stop during the next four years, we present the future values of reserves, risky assets investments, and the corresponding normalized consumption. Finally, we estimate the opportunity gain resulting from infusing the freed reserves, after excluding a small portion for investing in VIX based risky assets, in the economy to stimulate it.

4.1 Model Calibrations

The obtained approximate formulae of the normalized optimal reserves, the normalized optimal consumption, and the normalized optimal values of the risky assets will serve as a starting point to model the different variables. It has been observed that the Egyptian economy has two different periods. The first from 1977-1990, and the second period is 1991-2007. Thus, we use the same formulae but with different constants in each period.

Thus, we have for the first period, we have the equations:

$$c(t) = K_{-c_1} \exp \left[\left(\frac{-1}{\gamma} \right) (\lambda_{c1} t + \alpha_{c1} x(t)) \right] \quad (4.1)$$

where K_{-c_1} , λ_{c1} and α_{c1} are unknown constants to be determined by maximizing the utility function $U(c) = \frac{c^{1-\gamma}}{1-\gamma}$, and γ was set to the value $9 > 1$.

in the second period we have a similar equation:

$$c(t) = K_{-c_2} \exp \left[\left(\frac{-1}{\gamma} \right) (\lambda_{c2} t + \alpha_{c2} x(t)) \right] \quad (4.2)$$

where K_{-c_2} , λ_{c2} and α_{c2} are unknown constants to be determined by

maximizing the utility function $U(c) = \frac{c^{1-\gamma}}{1-\gamma}$.

for the future values of $c(s)$, we have:

$$c(t) = K_{-c_F} \exp \left[\left(\frac{-1}{\gamma} \right) (\lambda_F t + \alpha_F x(t)) \right] \quad (4.3)$$

where K_{-c_F} , λ_F and α_F are unknown constants to be determined by

maximizing the utility function $U(c) = \frac{c^{1-\gamma}}{1-\gamma}$.

For each time period, the starting values for the reserves were different. To find the optimal reserves and the optimal consumption, we used the true values of reserves as initial conditions. Thus, for the first period we used $x(1977)$ as initial conditions, for the second period we used $x(1991)$ as initial conditions, and for the future period we used $x(2008)$ as initial conditions. The future values of the investments in the risky assets,

$\bar{\xi}(t) = \frac{\xi(t)F(t)}{\theta^{NSS}Y(t)}$, were calibrated in the same way. We used the derived

approximate formula as a guideline. Thus,

$$\bar{\xi}(t) = \frac{\xi(t)F(t)}{\theta^{NSS}Y(t)} = K_{\xi 1} \{K_{\xi 2} - [\lambda_F t + \alpha_F x(t)]\} \quad (4.4)$$

where $K_{\xi 1}$, $K_{\xi 2}$, λ_F , and α_F are constants to be estimated by maximizing the utility function.

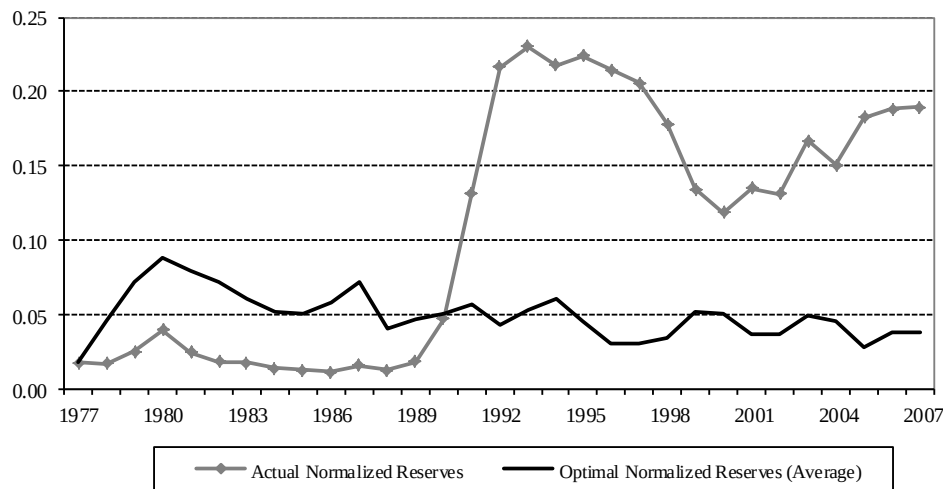
In all the periods, we used the same reserves SDE that was derived before:

$$dx(t) = \left[(r - \mu_Y + \sigma_Y^2)x(t) + 1 + (r - r_F)\bar{\xi}(t) - c(t) \right] dt - \sigma_Y x(t) dB(t) + \bar{\xi}(t) E_J \{J\} dN(t) \quad C.7$$

During simulation, however, $dN(t)$ was set to zero except at the time of occurrence of the sudden stop. The SS was simulated to occur in the year 2012. It was also assumed that $E_J(J) = 10$ i.e. the average value of the random amplitude of the jump process is 10. Other values could also be used. In what to follow we present the average of ten simulation runs.

4.2 Actual Normalized versus Optimal Normalized Levels of Reserves and Consumption

Figure.3 The Actual Normalized Reserves and the Optimal Normalized Reserves



Source: Based on the authors calculations and data from WD1.

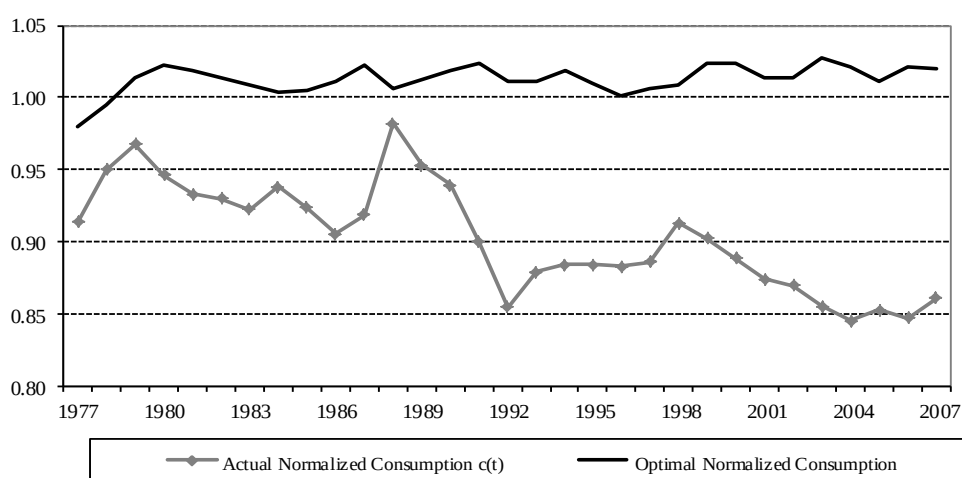
Examining the evolution of actual and optimal level of reserves in the Egyptian economy during the period 1977-2007, it is clear from figure 3 that there is a gap among both levels. Starting from 1977 till year 1989, the optimal level of reserves exceeds the actual ones. After that, the picture is reversed; where the actual reserves were much higher than the optimal values. For efficient management of international reserves, we recommend for the government of Egypt to decrease its accumulated reserves to the optimal level. The average optimal normalized reserves value is around 5% which is consistent with the observed values of reserves in developing countries. As a matter of fact; actual reserves have to down to almost a quarter of its existing rates in year 2007 as portrayed. The decision of diminishing the accumulated level of reserves encompasses two issues:

a- Is there an alternative policy that compensates the central bank for the drop in reserves and hence allows it to self-hedge against sudden stops in capital flows? If yes, what is this; and

b- Is there an opportunity gain from reducing the actual normalized level of reserves to the optimal level?

The answer is yes for both questions as will be tackled in more details in the following two sub-sections respectively.

Figure.4 The Actual Normalized Consumption and the Optimal Normalized Consumption



Source: Based on the authors calculations and data from WD1.

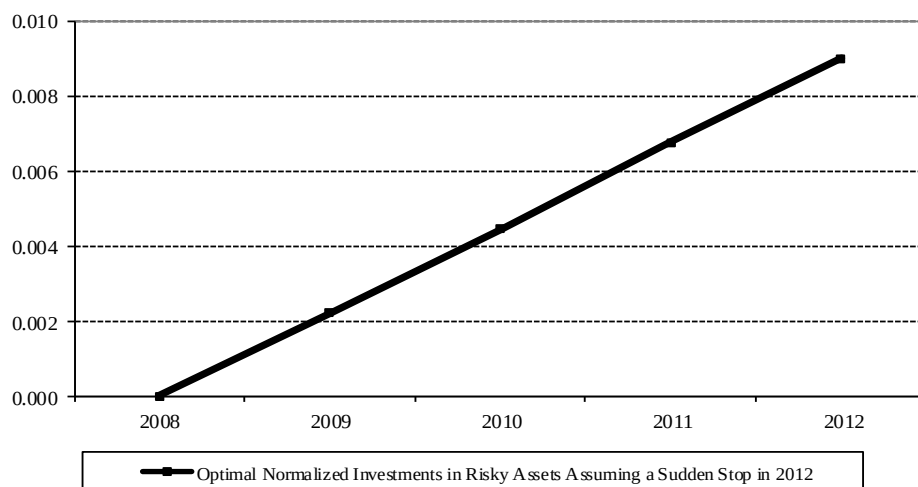
Figure 4 shows that, on the average, if we have followed the optimal path in managing the international reserves, the GDP would have been from 10 to 15 percent higher than the actual values. That is managing international reserves away from the optimal criteria; the actual normalized consumption is below its optimal levels all over the period of the study. This is under the assumption that the current account is the same during the whole period of the study. It follows that the Egyptian economy incurs an opportunity cost represented in enjoying low levels of welfare by its individuals, due to pooling large amounts of reserves.

4.3 Investing in VIX Based Risky Assets that are Contingent to Option Pricing Approach

Investing in risky assets through VIX based options is the complementary policy of reducing the actual level of reserves to the optimal one. Purchasing of risky assets that are VIX based allows Egypt

to compensate for the drop in international reserves and obtain the needed funds when the sudden stop occurs. Making use of the approach of investing in risky assets that are VIX based, figure 5 gives an idea about the optimal normalized investments in risky assets such that utility of consumption will be maximized. Supposing that there is a sudden stop in year 2012, figure 5 indicates the optimal level of investments in risky assets needed to yield an equivalent amount to that dropped in the reserves to hedge against risks. It is worth to mention that the optimization criteria in our case is to find the optimal investments such that the welfare of the society will be maximized. In other applications as in portfolio management, the optimization criteria is to find the optimal investments such that return on investments will be maximized like in capital asset pricing model (CAPM) and arbitrage pricing model (APA) (Standard and Poor's 2008).

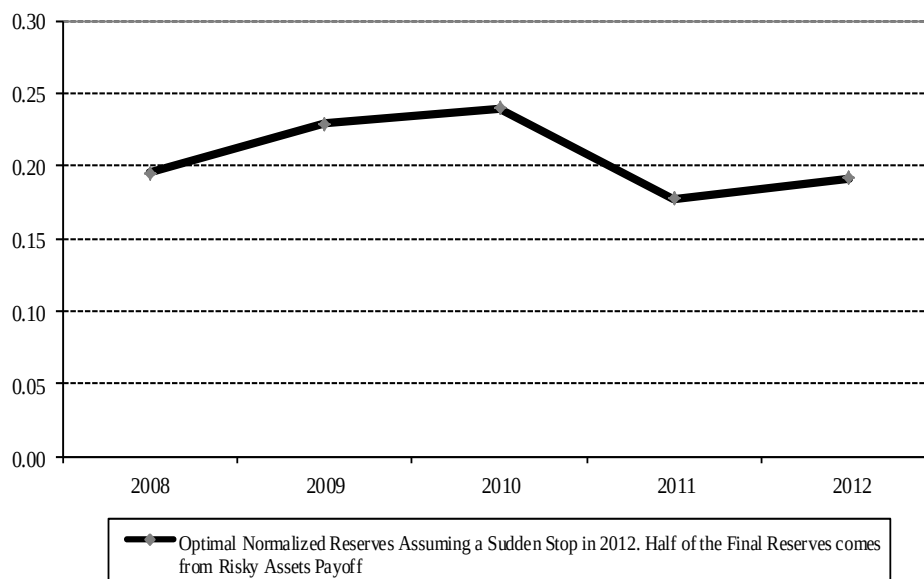
Figure.5 The Optimal Normalized Investments in Risky Assets
Assuming that a Sudden Stop will Occur in Year 2012



Source: Based on the authors calculations and data from WD1.

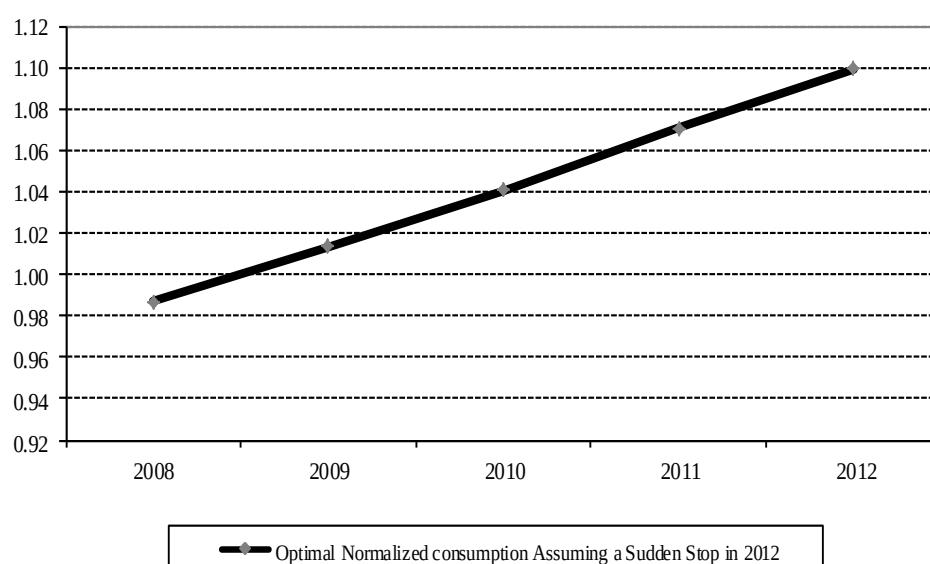
Figure 6 marks out the optimal normalized reserves that could have been accumulated in 2010. It is worthy to mention that half of the final reserves comes from VIX based risky assets payoff, taking in to consideration the exclusion of 50 percent of it for being invested in VIX based risky assets.

Figure.6 The Optimal Normalized Reserves Assuming a Sudden Stop Occurs in Year 2012 (Half of the Reserves was Constrained to Come from the Payoff, at 2012, on the Investments in the Risky Assets)



Source: Based on the authors calculations and data from WD1.

In consistent with the previous analysis, figure 7 predicts the optimal normalized consumption during the period 2008 till 2012 where the SS is expected to occur. Managing international reserves according to the optimal levels and applying the approach of option pricing, figure 7 sketches out that the normalized consumption will reach its optimal in year 2012 where the SS occurs.

Figure7. Optimal Normalized Consumption Assuming a Sudden Stop Occurs in Year 2012

Source: Based on the authors calculations and data from WD1.

4.4 Estimating the Opportunity Gain from Reducing Actual International Reserves

Under the assumption that there is a negative relationship between reserves and consumption; the Egyptian economy is assumed to gain a slight favorable increase in its GDP growth as a result of cutting down its actual reserves to the optimal level. It follows that reducing the normal level of international reserves to the optimal one is not the end of the story, since this released money could be injected in the economy to stimulate its growth. This subsection examines and quantifies the contribution of the released reserves to the GDP growth of the economy. Arguing that actual level of reserves should decrease to its optimal levels (to almost a quarter of its existing levels in 2007), we quantify the impact of infusing such released money (estimated to be 24.08 billion \$) into the Egyptian economy according to a number of scenarios:

4.4a- (Scenario 1): Estimating the opportunity gain from infusing the total amount of the released reserves in the Economy

Table 1. Estimating the opportunity gain resulting from infusing all the released reserves in the Economy

Year	Y_i	M_0	ΔY_i	Y_{total}	$\% \Delta Y_{total}$	ΔGDP_{DGR} (% points)
2007	132.95	4.01				
2008	139.09	4.01	4.01	143.11		
2009	145.53	4.01	8.21	153.74	7.43	2.80
2010	152.26	4.01	12.60	164.86	7.24	2.61
2011	159.30	4.01	17.20	176.50	7.06	2.43
2012	166.67	4.01	22.23	188.90	7.02	2.40

Source: Based on authors calculations

Notes

Y_i : Initial GDP in billions US\$, GDP growth rate is assumed to be constant and it is equal to 0.046 at all years.

M_0 : Yearly equal share of released international reserves in billions US\$.

ΔY_i : Change in the initial GDP as a result of injecting all the released reserves in the economy.

Y_{total} : Total GDP is the sum of initial GDP (Y_i), and change in it (ΔY_i); taking into consideration the effect of infusing all released reserves in the economy.

$\% \Delta Y_{total}$: Percentage growth rate of total GDP (Y_{total}).

ΔGDP_{GR} (percentage points): Measures the difference between the initial GDP growth rate which is equal to a fixed rate that is 4.62% and that GDP growth rate resulting from the injection of the total released reserves into the economy (ΔY_{total}).

Table 1 shows that a gradual infusion of the total released reserves in to the economy will contribute to GDP growth rate by a range from 7.02 to

7.43%. It follows that the new growth rate of GDP exceeds the old level by a range from 2.40 to 2.80 percentage points.

4.4b- (Scenario 2): Estimating the opportunity gain from investing one billion \$ in VIX based risky assets and infusing the other in the Economy

Table 2. Estimating the opportunity gain resulting from investing one billion\$ in VIX based risky assets and infuse the rest in the economy

Year	Y_i	M_0	ΔY_i	Y_{total}	$\% \Delta Y_{total}$	ΔGDP_{DGR} (% points)
2007	132.95	132.95	3.85			
2008	139.09	139.09	3.85	3.85		
2009	145.53	145.53	3.85	7.87	7.32	7.32
2010	152.26	152.26	3.85	12.08	7.13	7.13
2011	159.30	159.30	3.85	16.49	6.97	6.97
2012	166.67	166.67	3.85	21.31	6.93	6.93

Source: Based on authors calculations

Notes

Y_i : Initial GDP in billions US\$, GDP growth rate is assumed to be constant and it is equal to 0.046 at all years.

M_0 : Yearly equal share of released international reserves in billions US\$.

ΔY_i : Change in the initial GDP as a result of injecting 23.08 billions\$ of the released reserves in the economy.

Y_{total} : Total GDP is the sum of initial GDP (Y_i), and change in it (ΔY_i); taking into consideration the effect of infusing 23.08 billions\$ of the released reserves in the economy.

$\% \Delta Y_{total}$: Percentage growth rate of total GDP (Y_{total}).

ΔGDP_{GR} (*percentage points*): Measures the difference between the initial GDP growth rate which is equal to a fixed rate that is 4.62% and

that GDP growth rate resulting from injecting 23.08 billions\$ of the released reserves in the economy (ΔY_{total}).

Table 3, by the same token, shows the impact of gradually infusion of 23.08 billions US\$ of the total released reserves in the economy. The GDP growth rate is assumed to increase by a range from 7.02 to 7.43%. Such increase yields an increase estimated to be in the range of 6.93 to 7.32 percentage points above its old levels.

4.4c- (Scenario 3): Estimating the opportunity gain from infusing half of the total of the released reserves in the Economy, and invest the other half in risky assets that are VIX based

Table 3. Estimating the opportunity gain resulting from infusing half of the total released reserves in the Economy, and investing the other half in risky assets that are VIX based

Year	Y_i	M_0	ΔY_i	Y_{total}	$\% \Delta Y_{total}$	ΔGDP_{DGR} ((% points))
2007	132.95	2.01				
2008	139.09	2.01	2.01	141.10		
2009	145.53	2.01	4.11	149.63	6.05	1.42
2010	152.26	2.01	6.30	158.56	5.97	1.34
2011	159.30	2.01	8.60	167.90	5.89	1.27
2012	166.67	2.01	11.12	177.78	5.89	1.26

Source: Based on authors calculations

Notes

Y_i : Initial GDP in billions US\$, GDP growth rate is assumed to be constant and it is equal to 0.046 at all years.

M_0 : Yearly equal share of released international reserves in billions US\$.

ΔY_i : Change in the initial GDP as a result of injecting half of the released reserves in the economy.

Y_{total} : Total GDP is the sum of initial GDP (Y_i), and change in it (ΔY_i); taking into consideration the effect of infusing half of the released reserves in the economy.

$\% \Delta Y_{total}$: Percentage growth rate of total GDP (Y_{total}).

ΔGDP_{GR} (**percentage points**): Measures the difference between the initial GDP growth rate which is equal to a fixed rate that is 4.62% and that GDP growth rate resulting from injecting half of the released reserves in the economy (ΔY_{total}).

Table 3 illustrates that investing half of the released in VIX based risky assets and gradually infuse the other half in the economy will stimulate the growth rate of the economy by a range from 5.89 to 6.05%. Such increase in GDP is assumed to be above its old levels by a range from 1.26 to 1.42%. We adopt such scenario in demonstrating the approach of VIX based risky assets; see figures 6 and 7.

5. Conclusion and Discussion

In response to the rebirth of the old debate concerning the appropriate level of reserves for an emerging open economy, this paper derives a simple formula for the optimal level of international reserves in Egypt. Surveying the literature marked out the various benevolent benefits of accumulating reserves especially in case of unanticipated sudden stops of capital flows. The question comes to mind is: Does holding up reserves is a case of “more is better” or there is a “trade off”? Unlike to the prevalent approach concerning the optimal management of international reserves in emerging countries that are based upon Greenspan-Guidotti-IMF principle, this paper adopts a new approach that encompasses the purchase of option contracts on VIX based risky assets. VIX-based investments could yield a significant reduction in the average cost of sudden stops. Options are traded on the VIX, enabling additional hedging and speculation positions on volatility. Throughout this paper, we postulate that the process of building up international reserves is necessary but not sufficient condition to ensure improvement in the standards of living of the society and maximizing its welfare. The main idea is how far/close the actual normalized level of reserves to the optimal normalized one is. The closer there are; the more is the utility of consumption of the society. But as long as there is a deviation among

the optimal and actual normalized levels; whether it is above or below it, there is an opportunity cost that the society incurred. Enjoying excessive levels of reserves, we recommend for Egypt the following:

- i) To scale down its pooled actual reserves to the optimal level; (subsection 4.2).
- ii) To invest in VIX based risky assets which in turn compensates it for the reduction in reserves. Such investment yields a payoff sufficient to overcome disruptions resulting from sudden stops in capital flows. Consequently, it could smooth its consumption and investment expenditures (absorption); (subsection 4.3).

On the ground of those recommendations, the following policy implications could be derived:

5.1 Improving the welfare of the society

Under the assumption that there is a negative relationship between the total amount of reserves and the welfare level of individuals in the society, reducing actual level of reserves will improve the welfare of the society. Since the released reserves could be used for stimulating the economy; (see section 4.4).

5.2 Establishing investment funds or corporations outside the central bank to manage the released reserves

Following the VIX based options approach encompasses the establishment of an investment fund/corporation to manage the released reserves outside the central bank. On reviewing the international practices of establishing such investment funds/corporations, we found the following remarkable features (IMF 2008):

a- SWFs are operated outside the central bank: Despite the prominent experience of the public sector investment managers (such as reserve managers) in fixed income markets, most SWFs employ external expertise. The main driving force behind that is the limited capacity of the national public sector reserve managers for investment in other asset categories (IMF 2008). In this context; SWFs are operated outside the central bank, based on surveying international practices.

b- SWFs invest in a broad variety of assets; motivated by individual objectives: For countries with reserves pools in surplus of immediate central bank short term liquidity needs like the case of Egypt, creating a separate SWF can allow some released money to be managed with higher returns to compensate part of the cost of maintaining large liquidity stocks. While other SWFs are provoked by income purposes, and may invest across all major asset classes. Hence, the procedures of such funds have to be monitored to ensure that they are consistent directly or indirectly with the government's developmental plan.

c- There is no need to establish a unique investment fund: An outstanding feature of investment fund/corporations is that some countries like Kuwait, Singapore and Russia have two investment funds. Taking in to concern the political, economic and social considerations in the Egyptian context, this paper states that SWFs should be subject to the control of regulatory institutions that should be streamlined and consolidated. The question now is to what extent the Egyptian financial system could invest in risky assets? Despite significant efforts to upgrade the financial system, there is lack in technically proficient human resources. In this regard we recommend for Egypt to begin externally outsource a renowned international investment corporation that undertakes the management of freed reserves, till it acquires highly effective national human resources base.

5.3 Establishing of an Early Warning and Monitoring System at the International Level

Adopting the view of reducing international reserves to almost half and invest the remaining part in risky assets is no doubtfully a risky decision for a conservative country like Egypt. Building an early warning and monitoring system EWAMS to detect crisis at the international level becomes vital to avoid the crisis.¹² An early warning system can be defined as a system of data collection to monitor the probability of crisis onset (USAID 2007). EWAMS is useful in alarming the crisis in its initial phase and hence the necessary precautions and remedies could be taken. However, early warning of crisis is no guarantee of the prevention

¹² The focus on crisis at the international crisis does not mean that those at the intra-national level are insignificant. Rather, there is a critical need for having an integrated warning system that could predict crisis of all levels (internal, external, military, environmental, food...).

of crisis, since capacity and willingness to respond is essentially (Lundin 2004; USAID 2007; Campbell and Meier 2007). It follows that early warning and monitoring system will only function if the whole chain of response is in place (1.e. there must be an effective response to early warning signs).

5.4 Coordination between monetary and fiscal policies

The degree of coordination among various institutions in the society is an issue of a paramount interest from different categories in the society. The central bank being the only formal institution responsible for implementing the monetary policy does not work in isolation from other institutions in the society. Instead its decisions affect the policies of other institutions and vice versa. In this respect, to avoid the problems that may be resulting from making the decision of reducing international reserves. Other institutions in the society should do its best; each according to its responsibility. For example, the ministry of investments and its followed associations should do their best in maintaining the same level of investments especially in case of crises, which could be motivated by giving incentives. In a word, the formulation of consistent and rigorous based economic policies is a sort of an art where each decision has its resonance in other policies.

5.5 Culture, Ethics and Finance in the Financial System

Assessing an ethical culture among organizations is a key ingredient to business life in the organization (Argandoña 1998). Correcting unethical behavior once occurred is vital for healthy financial system. So, transparency, monitoring and accountability (1.e. the existence of corporate governance with its three pillars) should be in place. On the other hand, government policies, rather than stifling innovation and trading, should enjoy a reasonable level of transparency which in turn reduce the costs of the financial system (American Chamber of Commerce in Egypt, 2004). Furthermore, the degree of derivatives markets' upgrading needs to be considered. It follows that there are prerequisites that must be available in the workplace of the financial system to be well managed.

5.6 Future Work

This paper postulates that investing in risky assets, that are VIX based, is a beneficial tool that allows the government to efficiently manage its international reserves. More work is needed to identify which risky assets and how much to be invested. This might be the subject of another study.

APPENDICES

Appendix A: Optimal Consumption

In this appendix we derive the consumption $C(t)$ that will optimize the expected value of the utility function subject to the system dynamics constraints. Instead of working with the reserves $X(t)$, we shall, for mathematical purposes, use the normalized reserves, $x(t)$, and the normalized consumption, $c(t)$, defined as:

$$x(t) = \frac{X(t)}{(\theta^{NSS}Y(t))} \quad (A.1a)$$

$$c(t) = \frac{C(t)}{(\theta^{NSS}Y(t))} \quad (A.1b)$$

The GDP, $Y(t)$, and the reserves, $X(t)$, evolve according to the SDE's:

$$dY(t) = \mu_Y Y(t)dt + \sigma_Y Y(t)dB(t), \quad 0 < \mu_Y < r \quad (2.3)$$

$$dX(t) = [rX(t) - C(t) + \theta^{NSS}Y(t)]dt \quad (2.12)$$

$X(t) \geq 0$ An SDE for $x(t)$:

We shall derive an SDE for $x(t)$, for non sudden stop, using Ito's lemma:

$$dx = \frac{\partial x}{\partial t}dt + \frac{\partial x}{\partial X}dX + \frac{\partial x}{\partial Y}dY + \frac{1}{2} \frac{\partial^2 x}{\partial X^2}(dX)^2 + \frac{\partial^2 x}{\partial X \partial Y}dXdY + \frac{1}{2} \frac{\partial^2 x}{\partial Y^2}(dY)^2 \quad (A.2)$$

$$\begin{aligned} \text{Since } x(t) &= \frac{X(t)}{(\theta^{NSS}Y(t))} & \text{Then } \frac{\partial x}{\partial t} &= 0 & \frac{\partial x}{\partial X} &= \frac{1}{\theta^{NSS}Y} \\ \frac{\partial x}{\partial Y} &= \frac{-\theta^{NSS}X}{(\theta^{NSS}Y)^2} = \frac{-X}{\theta^{NSS}Y^2} & \frac{\partial^2 x}{\partial X^2} &= 0 & \frac{\partial^2 x}{\partial X \partial Y} &= \frac{-1}{\theta^{NSS}Y^2} \\ \frac{\partial^2 x}{\partial Y^2} &= \frac{2X}{\theta^{NSS}Y^3} & (dY)^2 &= \sigma_Y^2 Y^2 dt & (dX)^2 &= 0 & dXdY &= 0 \end{aligned}$$

Substituting for the partial derivatives in equation (A.2) we get:

$$dx = \frac{1}{\theta^{NSS}Y}dX - \frac{X}{\theta^{NSS}Y^2}dY - \frac{1}{\theta^{NSS}Y^2}dXdY + \frac{X}{\theta^{NSS}Y^3}(dY)^2$$

Substituting for the complete derivatives we get:

$$dx = \frac{1}{\theta^{NSS}Y} [rX(t) - C(t) + \theta^{NSS}Y(t)]dt - \frac{X}{\theta^{NSS}Y^2} [\mu_Y Y(t)dt + \sigma_Y Y(t)dB(t)] + \frac{X}{\theta^{NSS}Y^3} \sigma_Y^2 Y^2 dt$$

Which is reduced to:

$$dx = \frac{X}{\theta^{NSS}Y(t)} \left[r - \frac{C(t)}{X(t)} + \frac{\theta^{NSS}Y(t)}{X(t)} \right] dt - \frac{X(t)}{\theta^{NSS}Y(t)} [\mu_Y dt + \sigma_Y dB(t)] + \frac{X(t)}{\theta^{NSS}Y(t)} \sigma_Y^2 dt$$

Rearrange we get:

$$\begin{aligned} dx &= x(t) \left[r - \frac{C(t)}{X(t)} + \frac{\theta^{NSS}Y(t)}{X(t)} \right] dt - x(t) [\mu_Y dt + \sigma_Y dB(t)] + x(t) \sigma_Y^2 dt \\ &= x(t) \left[\left(r - \mu_Y + \sigma_Y^2 \right) - \frac{C(t)}{X(t)} + \frac{\theta^{NSS}Y(t)}{X(t)} \right] dt - x(t) \sigma_Y dB(t) \\ &= x(t) \left[\left(r - \mu_Y + \sigma_Y^2 \right) - \frac{c(t)}{x(t)} + \frac{1}{x(t)} \right] dt - x(t) \sigma_Y dB(t) \end{aligned} \quad (A.3)$$

Equation (A.3) is the desired SDE that describes the evolution of the normalized reserves $x(t)$.

Exact Solution for the Normalized variables:

We shall now derive an exact ODE for the control, $c(x)$, this is because all the components are explicitly independent of time and the diffusion is independent of the control (Abutaleb and Papaioannou 2009; Mangel 1985). The SDE describing the normalized reserves is given as:

$$dx(t) = x(t) \left[\left(r - \mu_Y + \sigma_Y^2 \right) - \frac{c(t)}{x(t)} + \frac{1}{x(t)} \right] dt - x(t) \sigma_Y dB(t) \quad (A.3)$$

The normalized utility function is given as:

$$U(c(x)) = \frac{c^{1-\gamma}}{1-\gamma} \quad (A.4)$$

The objective function is given as:

$$V(x(t)) = \max_{c(s)} E \left\{ \int_{t_0}^{\tau^{SS}} U(c(s)) ds + \varphi_1(x(\tau^{SS})) \right\} \quad (A.5)$$

Where all the variables involved are the normalized variables and where we have eliminated, for simplifications, the discount factor $e^{-r(s-t_0)}$.

The optimal normalized consumption $c(t)$ satisfies the ordinary differential equation (ODE)¹³:

$$\frac{dc}{dx} \left[\frac{dF^u/dc}{db/dc} \frac{d^2b}{dc^2} - \frac{d^2F^u}{dc^2} \right] = \frac{2}{\sigma(x)} \left[\frac{b dF^u/dc}{db/dc} - F^u \right] + \frac{d^2F^u}{dc dx} - \frac{dF^u/dc}{db/dc} \frac{d^2b}{dc dx} \quad (A.6)$$

where $u(x)=c(x)$

$$F^u(x) = \frac{c^{1-\gamma}}{1-\gamma} \quad b(x, c) = x \left[\left(r - \mu_Y + \sigma_Y^2 \right) - \frac{c}{x} + \frac{1}{x} \right] \quad \sigma(x) = -x\sigma_Y$$

We need the following derivatives:

$$\begin{aligned} \frac{dF^u(x)}{dc} &= c^{-\gamma} & \frac{d^2F^u(x)}{dc^2} &= -\gamma c^{-\gamma-1} & \frac{d^2F^u(x)}{dc dx} &= 0 \\ \frac{db(x, c)}{dc} &= -1 & \frac{d^2b(x, c)}{dc^2} &= 0 & \frac{d^2b(x, c)}{dc dx} &= 0 \end{aligned}$$

Substituting the different elements in equation (A.6) we get:

$$\frac{dc}{dx} [\gamma c^{-\gamma-1}] = -\frac{2}{x\sigma_Y} \left[-x \left[\left(r - \mu_Y + \sigma_Y^2 \right) - \frac{c}{x} + \frac{1}{x} \right] c^{-\gamma} - \frac{c^{1-\gamma}}{1-\gamma} \right]$$

Dividing both sides by $c^{-\gamma}$ and rearrange we get:

$$\begin{aligned} \frac{dc}{dx} &= \frac{2c}{x\sigma_Y\gamma} \left[x \left[\left(r - \mu_Y + \sigma_Y^2 \right) - \frac{c}{x} + \frac{1}{x} \right] + \frac{c}{1-\gamma} \right] \\ &= \frac{2c}{\sigma_Y\gamma} \left[\left(r - \mu_Y + \sigma_Y^2 \right) - \frac{c}{x} + \frac{1}{x} \right] + \frac{2c^2}{x\sigma_Y\gamma(1-\gamma)} \\ &= \frac{2c}{\sigma_Y\gamma} \left[\left(r - \mu_Y + \sigma_Y^2 \right) - \frac{c}{x} + \frac{1}{x} + \frac{c}{x(1-\gamma)} \right] \\ &= \frac{2c}{\sigma_Y\gamma} \left[\left(r - \mu_Y + \sigma_Y^2 \right) + \frac{-c(1-\gamma) + (1-\gamma) + c}{x(1-\gamma)} \right] \\ &= \frac{2c}{\sigma_Y\gamma} \left[\left(r - \mu_Y + \sigma_Y^2 \right) + \frac{-\gamma c + (1-\gamma)}{x(1-\gamma)} \right] \end{aligned}$$

¹³ Abutaleb and Papaioannou (2009).

$$= \frac{2c}{\sigma_Y \gamma} \left[\left(r - \mu_Y + \sigma_Y^2 \right) + \frac{\gamma c + (\gamma - 1)}{x(\gamma - 1)} \right] \quad (\text{A.7})$$

This is the desired ODE for the optimal normalized consumption $c(x)$.
Some approximations:

We know that c is in the order of 1, while x is in the order 0.2, and assuming that $\gamma \gg 1$, then

$$\frac{dc}{dx} \approx \frac{2c}{\sigma_Y \gamma} \left(\frac{c+1}{x} \right)$$

Separating variables we get:

$$\frac{dc}{c(c+1)} \approx \frac{2}{\sigma_Y \gamma} \left(\frac{dx}{x} \right)$$

which has the solution:

$$\int \frac{dc}{c(c+1)} = \ln c - \ln(c+1) + \ln K = \ln \frac{Kc}{c+1} \approx \frac{2}{\sigma_Y \gamma} \ln x$$

where K is the constant of integration, and is determined from the boundary conditions.

$$\text{i.e. } \frac{Kc}{c+1} \approx x^{\frac{2}{\sigma_Y \gamma}} \quad \text{Thus } c = \frac{x^{\frac{2}{\sigma_Y \gamma}}}{K - x^{\frac{2}{\sigma_Y \gamma}}},$$

$$\text{A better formula is } c = K \frac{x^{\frac{2}{\sigma_Y \gamma}}}{1 - x^{\frac{2}{\sigma_Y \gamma}}} \quad (\text{A.8})$$

Substitute in the normalized reserves equation we get:

$$dx(t) = x(t) \left[\left(r - \mu_Y + \sigma_Y^2 \right) - \frac{Kx(t)^{\frac{2}{\sigma_Y \gamma}}}{x(t) \left(1 - x(t)^{\frac{2}{\sigma_Y \gamma}} \right)} + \frac{1}{x(t)} \right] dt - x(t) \sigma_Y dB(t) \quad (\text{A.9})$$

Appendix B: Optimal Consumptions and Optimal Values Invested in Risky Assets to Maximize the Utility Function

The risky asset's payoff process, $F(t)$, is defined as:

$$dF(t) = r_F F(t)dt + F(t)JdN(t) \quad (B.1)$$

Where r_F is the interest rate and will be assumed to be the same as r (the risk free interest rate), $N(t)$ is a Poisson process, J is a random variable that has lognormal distribution. The probability density function of J , $f(J)$, is given as:

$$f(J) = \frac{1}{J\sqrt{2\pi\sigma_J^2}} \exp \frac{-(\ln J - \mu_J)^2}{2\sigma_J^2}$$

$$\text{With } E\{J\} = \exp\left(\mu_J + \frac{\sigma_J^2}{2}\right)$$

$$E\{J^2 - E\{J\}^2\} = \exp(2\mu_J + \sigma_J^2) [\exp \sigma_J^2 - 1]$$

The peak of J is located at $\exp(\mu_J - \sigma_J^2)$.

The evolution of reserves, $X(t)$, becomes:

$$dX(t) = [r(X(t) - \xi(t)F(t)) - C(t) + A(t)]dt + \xi(t)dF(t) \quad (B.2)$$

where $C(t)$ is the consumption, $A(t) = \theta^{NSS}Y(t)$, $\theta^{NSS} \approx 1.2$, $Y(t)$ is the GDP, $\xi(t)$ is the amount (or more precisely the number of units) invested in the risky assets with payoff $F(t)$. Substitute the expression for the payoff of the risky assets in the reserves equation we get:

$$dX(t) = [r(X(t) - \xi(t)F(t)) - C(t) + A(t) + r\xi(t)F(t)]dt + \xi(t)F(t)JdN(t)$$

This equation is reduced to:

$$dX(t) = [rX(t) - C(t) + A(t)]dt + \xi(t)F(t)JdN(t) \quad (B.3)$$

Working with normalized variables we get:

$$dx(t) = \left[(r - \mu_Y + \sigma_Y^2)x(t) + 1 + (r - r_F)\bar{\xi}(t) - c(t) \right] dt - \sigma_Y x(t) dB(t) + \bar{\xi}(t) E_J \{J\} dN(t) \quad (C.7)$$

The optimization problem now involves a portfolio decision. This decision is straightforward in the SS region since investing in the risky assets with payoff $F(t)$ only means adding risk to the country's reserve holdings, without reward in terms of hedging value. Thus, the country picks $\xi(t) = 0$ in the SS region. The portfolio decision is interesting only in the non-sudden-stop (NSS) regions where the country is preparing itself for a potential sudden stop and we have $\xi(t) > 0$.

Notice that the quantity $F(t)$ does not appear separately. It appears in the variable $\bar{\xi}(t)$. And since $\bar{\xi}(t)$ is actually a control variable that we need to estimate in order to maximize the utility function, we do not need the SDE for $F(t)$ to be involved in the analysis.

We now solve the optimization problem in the following steps:

(1) The system dynamics becomes:

$$dx(t) = \left[(r - \mu_Y + \sigma_Y^2)x(t) + 1 + (r - r_F)\bar{\xi}(t) - c(t) \right] dt - \sigma_Y x(t) dB(t) + \bar{\xi}(t) E_J \{J\} dN(t) \quad (C.7)$$

The control variables are now $u_1(t) = c(t) = \frac{C(t)}{\theta^{NSS} Y(t)}$ and

$u_2(t) = \bar{\xi}(t) = \frac{\xi(t)F(t)}{\theta^{NSS} Y(t)}$. The objective function in terms of the language

of stochastic control is given as:

$$J^u(t_0, x_0) = E \left(\int_{t_0}^{t_1} F^u(s, x) ds + \phi[x(t_1)] / x(t_0) = x_0 \right) \quad (B.4)$$

where $F^u(s, x) = e^{-r(s-t_0)} U(c(s))$,

$$U(C) = \frac{C^{1-\gamma}}{1-\gamma}, \quad t_1 = \tau^{SS}, \quad \phi[x(t_1)] = \text{terminal value conditions} \quad (B.5)$$

$$\text{Define } \Psi(t, x) = \sup_u J^u(t, x) \quad (B.6)$$

In a compact form, the system dynamics are given as:

$$dx(t) = b(x, \underline{u})dt + \sigma(x)dW(t) + h(\underline{u})dN(t) \quad (\text{B.7})$$

Where $b(x, \underline{u}) = \left[(r - \mu_Y + \sigma_Y^2)x(t) + 1 + (r - r_F)\bar{\xi}(t) - c(t) \right]$

$\sigma(x) = -\sigma_Y x(t)$, which is independent of the controls.

$$h(\underline{u}) = \bar{\xi}(t)E_J \{J\}$$

(2)The HJB equation becomes:

$$0 = \frac{\partial \Psi(s, x)}{\partial s} + \sup_{\underline{u}} \left\{ F^u(s, x) + b(x, \underline{u}) \frac{\partial \Psi(s, x)}{\partial x} + \frac{1}{2} \sigma^2(x) \frac{\partial^2 \Psi(s, x)}{\partial x^2} + \lambda [\Psi(s, x + h(\underline{u})) - \Psi(s, x)] \right\}$$

(B.8)

The shift term " $[\Psi(s, x + h(\underline{u})) - \Psi(s, x)]$ ", due to the Poisson process, will cause many mathematical difficulties. Thus, we shall try to approximate this term.

In what to follow one will be able to find an approximate analytic solution if we further assume that:

$$\Psi(s, x) = g(s)e^{\alpha x} \quad (\text{B.9})$$

Which yields

$$\frac{\partial \Psi(s, x)}{\partial s} = \frac{\partial g(s)}{\partial s} e^{\alpha x} \quad \frac{\partial \Psi(s, x)}{\partial x} = \alpha g(s) e^{\alpha x} \quad \frac{\partial^2 \Psi(s, x)}{\partial x^2} = \alpha^2 g(s) e^{\alpha x}$$

$$\begin{aligned} \text{Then } \Psi(s, x + h(\underline{u})) &= g(s)e^{\alpha(x+h(\underline{u}))} = g(s)e^{\alpha(x+\bar{\xi}(s)E_J \{J\})} \\ &= \Psi(s, x)e^{\alpha(\bar{\xi}(s)E_J \{J\})} \end{aligned} \quad (\text{B.10})$$

$$\bar{\xi} = \frac{\xi F}{(\theta^{NSSY})}$$

where

Substitute we get:

$$\begin{aligned} \lambda [\Psi(s, x + h(\underline{u})) - \Psi(s, x)] &= \lambda \Psi(s, x) \left[e^{\alpha(\bar{\xi}(s)E_J \{J\})} - 1 \right] \\ &= \lambda g(s) e^{\alpha x} \left[e^{\alpha(\bar{\xi}(s)E_J \{J\})} - 1 \right] \end{aligned} \quad (\text{B.11})$$

We need to find the different elements of the HJB equation (B.8). We have:

$$\sigma^2(x) \frac{\partial^2 \Psi(s, x)}{\partial x^2} = \sigma_Y^2 x^2(s) \alpha^2 g(s) e^{\alpha x} \quad (\text{B.12})$$

$$b(x, \underline{u}) \frac{\partial \Psi(s, x)}{\partial x} = \left[(r - \mu_Y + \sigma_Y^2) x(s) + 1 + (r - r_F) \bar{\xi}(s) - c(s) \right] \frac{\partial g(s)}{\partial s} e^{\alpha x} \quad (\text{B.13})$$

We need to find the optimal controls and the solution of the HJB equation.

(3) Substitute the above derivatives in the different elements of the HJB equation and find the optimal controls:

$$\sup_{\underline{u}} \left\{ F^u(s, x) + b(x, \underline{u}) \frac{\partial \Psi(s, x)}{\partial x} + \frac{1}{2} \sigma^2(x) \frac{\partial^2 \Psi(s, x)}{\partial x^2} + \lambda [\Psi(s, x + h(\underline{u})) - \Psi(s, x)] \right\} =$$

$$+ \frac{1}{2} \sigma^2(x) \frac{\partial^2 \Psi(s, x)}{\partial x^2} + \sup_{\underline{u}} \left\{ F^u(s, x) + b(x, \underline{u}) \frac{\partial \Psi(s, x)}{\partial x} + \lambda [\Psi(s, x + h(\underline{u})) - \Psi(s, x)] \right\}$$

(B.14) And

$$\sup_{\underline{u}} \left\{ F^u(s, x) + b(x, \underline{u}) \frac{\partial \Psi(s, x)}{\partial x} + \lambda [\Psi(s, x + h(\underline{u})) - \Psi(s, x)] \right\}$$

$$= \sup_{\underline{u}} \left\{ e^{-r(s-t_0)} \frac{c^{1-\gamma}}{1-\gamma} + \left[(r - \mu_Y + \sigma_Y^2) x + 1 + (r - r_F) \bar{\xi} - c \right] \frac{\partial \Psi(s, x)}{\partial x} + \lambda \Psi(s, x) \left[e^{\alpha(\bar{\xi}_{E_T}\{J\})} - 1 \right] \right\}$$

(B.15)

Maximizing with respect to $c(s)$ we get:

$$e^{-r(s-t_0)} c(s)^{-\gamma} - \frac{\partial \Psi(s, x)}{\partial x} = 0$$

$$\text{1.e. } c(s) = \left[e^{r(s-t_0)} \frac{\partial \Psi(s, x)}{\partial x} \right]^{\left(\frac{-1}{\gamma} \right)} \quad (\text{B.16})$$

This is an expression for the optimal value of the consumption that maximizes the utility function.

Maximizing with respect to $\bar{\xi}$ we get:

$$(r - r_F) + \alpha E_J \{J\} \lambda \Psi(s, x) e^{\alpha(\bar{\xi} E_J \{J\})} = 0$$

Rearrange we get:

$$\begin{aligned} \lambda \Psi(s, x) e^{\alpha(\bar{\xi} E_J \{J\})} &= \frac{-(r - r_F) e}{\alpha E_J \{J\}} \\ \text{1.e. } \bar{\xi}(s) &= \frac{1}{\alpha E_J \{J\}} \ln \left[\frac{-(r - r_F)}{\alpha E_J \{J\} \lambda \Psi(s, x)} \right] \end{aligned} \quad (\text{B.17})$$

Substitute the derived optimal values in the supremum function we get:

$$\begin{aligned} \sup_{\underline{u}} & \left\{ e^{-r(s-t_0)} \frac{c^{1-\gamma}}{1-\gamma} + \left[(r - \mu_Y + \sigma_Y^2)x + 1 + (r - r_F)\bar{\xi} - c \right] \frac{\partial \Psi(s, x)}{\partial x} + \lambda \Psi(s, x) \left[e^{\alpha(\bar{\xi} E_J \{J\})} - 1 \right] \right\} \\ &= e^{-r(s-t_0)} \frac{\left(e^{r(s-t)} \frac{\partial \Psi(s, x)}{\partial x} \right)^{\frac{\gamma-1}{\gamma}}}{1-\gamma} + \left[(r - \mu_Y + \sigma_Y^2)x + 1 \right] \frac{\partial \Psi(s, x)}{\partial x} \\ &+ (r - r_F)\bar{\xi} \frac{\partial \Psi(s, x)}{\partial x} - \left(e^{r(s-t)} \frac{\partial \Psi(s, x)}{\partial x} \right)^{\left(\frac{-1}{\gamma} \right)} \frac{\partial \Psi(s, x)}{\partial x} + \frac{-(r - r_F)e}{\alpha E_J \{J\}} - \lambda \Psi(s, x) \end{aligned} \quad (\text{B.18})$$

For large values of γ , and for small values of $(r - r_F)$, we get the approximation:

$$\begin{aligned} \sup_{\underline{u}} & \left\{ e^{-r(s-t_0)} \frac{c^{1-\gamma}}{1-\gamma} + \left[(r - \mu_Y + \sigma_Y^2)x + 1 + (r - r_F)\bar{\xi} - c \right] \frac{\partial \Psi(s, x)}{\partial x} + \lambda \Psi(s, x) \left[e^{\alpha(\bar{\xi} E_J \{J\})} - 1 \right] \right\} \\ &\approx \frac{1}{1-\gamma} \frac{\partial \Psi(s, x)}{\partial x} + \left[(r - \mu_Y + \sigma_Y^2)x + 1 \right] \frac{\partial \Psi(s, x)}{\partial x} - e^{\frac{-r}{\gamma}(s-t_0)} \frac{\partial \Psi(s, x)}{\partial x} - \lambda \Psi(s, x) \end{aligned} \quad (\text{B.19})$$

(4) Solve the HJB equation to find $\Psi(s, x)$.

Substitute the different derived elements in the HJB equation we get:

$$\begin{aligned}
 0 &= \frac{\partial \Psi(s, x)}{\partial s} + \sup_{\underline{u}} \left\{ F^u(s, x) + b(x, \underline{u}) \frac{\partial \Psi(s, x)}{\partial x} + \frac{1}{2} \sigma^2(x) \frac{\partial^2 \Psi(s, x)}{\partial x^2} + \lambda [\Psi(s, x + h(\underline{u})) - \Psi(s, x)] \right\} \\
 &\approx \frac{\partial \Psi(s, x)}{\partial s} + \frac{1}{1-\gamma} \frac{\partial \Psi(s, x)}{\partial x} + \left[(r - \mu_Y + \sigma_Y^2)x + 1 \right] \frac{\partial \Psi(s, x)}{\partial x} - e^{\frac{-r}{\gamma}(s-t_0)} \frac{\partial \Psi(s, x)}{\partial x} - \lambda \Psi(s, x) \\
 &\quad + \frac{1}{2} \sigma_Y^2 x^2(s) \frac{\partial^2 \Psi(s, x)}{\partial x^2}
 \end{aligned}
 \tag{B.20}$$

which is reduced to:

$$0 \approx \frac{\partial \Psi(s, x)}{\partial s} + \left[\frac{1}{1-\gamma} + (r - \mu_Y + \sigma_Y^2)x + 1 - e^{\frac{-r}{\gamma}(s-t_0)} \right] \frac{\partial \Psi(s, x)}{\partial x} - \lambda \Psi(s, x) + \frac{1}{2} \sigma_Y^2 x^2(s) \frac{\partial^2 \Psi(s, x)}{\partial x^2}
 \tag{B.21}$$

$$\text{Substitute } \frac{\partial \Psi(s, x)}{\partial s} = \frac{\partial g(s)}{\partial s} e^{\alpha x}, \quad \frac{\partial \Psi(s, x)}{\partial x} = \alpha g(s) e^{\alpha x},$$

$$\frac{\partial^2 \Psi(s, x)}{\partial x^2} = \alpha^2 g(s) e^{\alpha x}, \text{ in the HJB equation we get:}$$

$$\begin{aligned}
 0 &\approx \frac{\partial g(s)}{\partial s} e^{\alpha x} + \left[\frac{1}{1-\gamma} + (r - \mu_Y + \sigma_Y^2)x + 1 - e^{\frac{-r}{\gamma}(s-t_0)} \right] (\alpha g(s) e^{\alpha x}) - \lambda g(s) e^{\alpha x} \\
 &\quad + \frac{1}{2} \sigma_Y^2 x^2(s) (\alpha^2 g(s) e^{\alpha x})
 \end{aligned}$$

Dividing by $e^{\alpha x}$, we get:

$$0 \approx \frac{\partial g(s)}{\partial s} + \left[\frac{1}{1-\gamma} + (r - \mu_Y + \sigma_Y^2)x + 1 - e^{\frac{-r}{\gamma}(s-t_0)} \right] (\alpha g(s)) - \lambda g(s) + \frac{1}{2} \sigma_Y^2 x^2(s) (\alpha^2 g(s))$$

(B.22) Noting that $x(s)$ is around 0.1, σ_Y^2 is in the order of 10^{-2} , we get:

$$0 \approx \frac{\partial g(s)}{\partial s} - \lambda g(s)
 \tag{B.23}$$

Which yields:

$$g(s) = K_g \exp \lambda s \quad (\text{B.24})$$

where K_g is a constant of integration and is determined from the boundary values.

Thus, the optimal objective function is approximately given as:

$$\Psi(s, x) = g(s)e^{\alpha x} = K_g e^{\lambda s} e^{\alpha x} \quad (\text{B.25})$$

Substitute in the expressions of the controllers we get the approximate values:

$$\begin{aligned} c(s) &= \frac{C(s)}{\theta^{NSS} Y(s)} \approx \left[e^{r(s-t_0)} \alpha K_g e^{\lambda s} e^{\alpha x(s)} \right]^{\left(\frac{-1}{\gamma}\right)} \\ &\approx (\alpha K_g)^{\left(\frac{-1}{\gamma}\right)} \exp \left[\left(\frac{-1}{\gamma} \right) (r(s-t_0) + \lambda s + \alpha x(s)) \right] \end{aligned} \quad (\text{B.26})$$

Thus, for real value of " $(\alpha K_g)^{\left(\frac{-1}{\gamma}\right)}$ ", $(\alpha K_g) > 0$.

$$\begin{aligned} \bar{\xi}(s) &= \frac{\xi(s)F(s)}{\theta^{NSS} Y(s)} \approx \frac{1}{\alpha E_J \{J\}} \ln \left[\frac{-(r - r_F)}{\alpha E_J \{J\} \lambda K_g e^{\lambda s} e^{\alpha x}} \right] \\ &\approx \frac{1}{\alpha E_J \{J\}} \left\{ \ln \left[\frac{(r_F - r)}{\alpha E_J \{J\} \lambda K_g} \right] - \ln e^{(\lambda s + \alpha x(s))} \right\} \\ &\approx \frac{1}{\alpha E_J \{J\}} \left\{ \ln \left[\frac{(r_F - r)}{\alpha E_J \{J\} \lambda K_g} \right] - [\lambda s + \alpha x(s)] \right\} \end{aligned} \quad (\text{B.27})$$

Appendix C: Ito lemma for Jump diffusion process¹⁴

Assume the SDE governing the system is given as:

$$d\underline{X}(t) = \underline{f}(\underline{X}(t), t)dt + g(\underline{X}(t), t)d\underline{B}(t) + h(\underline{X}(t), \underline{q}, t)d\underline{P}(\underline{X}(t), t) \quad (C.1)$$

Where $\underline{q}$ is the vector of the random amplitudes of the Poisson vector process $\underline{P}(\underline{X}(t), t)$. Assume that we have a continuous function $\Pi(\underline{X}(t), t)$ and we need to find its SDE. Using Ito lemma for diffusion jump process we get the general expression:

$$\begin{aligned} d\Pi(\underline{X}(t), t) = & \frac{\partial \Pi}{\partial t} dt + \sum_i \frac{\partial \Pi}{\partial X_i} \left(f_i dt + \sum_k g_{i,k} dB_k \right) + \frac{1}{2} \sum_i \sum_j \sum_k \sum_l \frac{\partial^2 \Pi}{\partial X_i \partial X_j} g_{i,k} g_{j,l} dB_k dB_l \\ & + \sum_j E_{q_j} \{ \Pi(\underline{X}(t) + \underline{h}_j, t) - \Pi(\underline{X}(t), t) \} dP_j \end{aligned} \quad (C.2)$$

where $\underline{h}_j$ is the j th column of the matrix $h(\underline{X}(t), \underline{q}, t)$.

We apply this lemma to the system under study where now:

$$\underline{X}(t) = \begin{bmatrix} X(t) \\ Y(t) \\ F(t) \end{bmatrix}, \quad \Pi(\underline{X}(t), t) = \frac{X(t)}{\theta^{NSS} Y(t)} = x(t) \quad (C.3)$$

The SDE describing the evolution of the economy is given as:

$$\begin{bmatrix} dX(t) \\ dY(t) \\ dF(t) \end{bmatrix} = \left\{ \begin{bmatrix} r & \theta^{NSS} & (r - r_F)\xi(t) \\ 0 & \mu_Y & 0 \\ 0 & 0 & r_F \end{bmatrix} \begin{bmatrix} X(t) \\ Y(t) \\ F(t) \end{bmatrix} + \begin{bmatrix} -C(t) \\ 0 \\ 0 \end{bmatrix} \right\} dt + \begin{bmatrix} 0 \\ \sigma_Y Y(t) \\ 0 \end{bmatrix} dB(t) + \begin{bmatrix} \xi(t)F(t)J \\ 0 \\ F(t)J \end{bmatrix} dN(t) \quad (3.4)$$

¹⁴ Hanson (2007).

Thus,

$$d\Pi(\underline{X}(t), t) = \frac{\partial \Pi}{\partial t} dt + \sum_i \frac{\partial \Pi}{\partial X_i} (f_i dt + g_i dB) + \frac{1}{2} \sum_i \sum_j \frac{\partial^2 \Pi}{\partial X_i \partial X_j} g_i g_j dt + E_J \{ \Pi(\underline{X}(t) + \underline{h}, t) - \Pi(\underline{X}(t), t) \} dN \quad (C.4)$$

where

$$\begin{aligned} f_1 &= rX(t) + \theta^{NSS} Y(t) + (r - r_F) \xi(t) F(t) - C(t) = rX_1(t) + \theta^{NSS} X_2(t) + (r - r_F) \xi(t) X_3(t) - C(t) \\ f_2 &= \mu_Y Y(t) = \mu_Y X_2(t), \quad f_3 = r_F F(t) = r_F X_3(t), \quad g_1 = 0, \\ g_2 &= \sigma_Y Y(t) = \sigma_Y X_2(t), \quad g_3 = 0, \quad h_1 = \xi(t) F(t) J = \xi(t) X_3(t) J, \quad h_2 = 0, \\ h_3 &= F(t) J = X_3(t) J. \end{aligned}$$

We substitute these values to get the different elements of the transformed system SDE.

$$\begin{aligned} \Pi(\underline{X}(t) + \underline{h}, t) - \Pi(\underline{X}(t), t) &= \frac{X(t) + \xi(t) F(t) J}{\theta^{NSS} Y(t)} - \frac{X(t)}{\theta^{NSS} Y(t)} \\ &= \frac{\xi(t) F(t) J}{\theta^{NSS} Y(t)} = \bar{\xi}(t) J \end{aligned} \quad (C.5)$$

$$\text{Thus, } E_J \{ \Pi(\underline{X}(t) + \underline{h}, t) - \Pi(\underline{X}(t), t) \} = \bar{\xi}(t) E_J \{ J \} \quad (C.6)$$

$$\begin{aligned} \frac{\partial \Pi}{\partial t} &= 0, \quad \frac{\partial \Pi}{\partial X_1} = \frac{1}{\theta^{NSS} Y(t)}, \quad \frac{\partial^2 \Pi}{\partial X_1^2} = 0, \quad \frac{\partial^2 \Pi}{\partial X_1 \partial X_2} = \frac{-1}{\theta^{NSS} Y^2(t)}, \\ \frac{\partial^2 \Pi}{\partial X_1 \partial X_3} &= 0, \quad \frac{\partial \Pi}{\partial X_2} = \frac{-X(t)}{\theta^{NSS} Y^2(t)}, \quad \frac{\partial^2 \Pi}{\partial X_2^2} = \frac{2X(t)}{\theta^{NSS} Y^3(t)}, \quad \frac{\partial^2 \Pi}{\partial X_2 \partial X_3} = 0 \\ \frac{\partial \Pi}{\partial X_3} &= 0 \end{aligned}$$

Substituting in the general form of the system SDE we get:

$$\begin{aligned} d\Pi(\underline{X}(t), t) &= \frac{1}{\theta^{NSS} Y(t)} [rX(t) + \theta^{NSS} Y(t) + (r - r_F) \xi(t) F(t) - C(t)] dt + \frac{-X(t)}{\theta^{NSS} Y^2(t)} \mu_Y Y(t) dt \\ &+ \frac{-X(t)}{\theta^{NSS} Y^2(t)} \sigma_Y Y(t) dB(t) + \frac{X(t)}{\theta^{NSS} Y^3(t)} \sigma_Y^2 Y^2(t) dt + \bar{\xi}(t) E_J \{ J \} dN(t) \end{aligned}$$

Collecting terms and rearranging we get:

$$dx(t) = \left[(r - \mu_Y + \sigma_Y^2)x(t) + 1 + (r - r_F)\bar{\xi}(t) - c(t) \right] dt - \sigma_Y x(t) dB(t) + \bar{\xi}(t) E_J \{J\} dN(t) \quad (\text{C.7})$$

Which is an SDE in the normalized reserves with two controllers, $c(t)$ and $\bar{\xi}(t)$.

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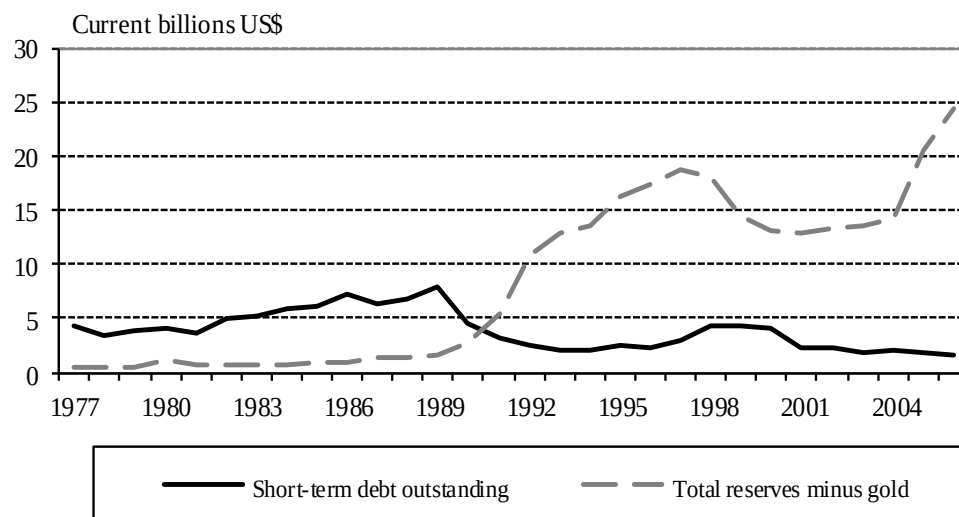
ANNEX

Table 1. Market Estimates of Assets Under Management for SWFs
Based on Latest Available Information (As of February 2008)

<i>Name of Fund</i>	
1. Oil and Gas Exporting Countries	
UAE	Abu Dhabi Investment Authority, (1976 ¹)
Norway	Government Pension Fund-Global
Saudi Arabia ¹ /	No designated name
Kuwait 1/	Reserve Fund for the Future Generations
	Government Reserve Fund
Russia 1/	Reserve Fund
	National Welfare Fund
Libya	Libyan Investment Authority
Qatar	State Reserve Fund/Stabilization fund
Algeria	Reserve Fund/Revenue Regulation Fund
USA (Alaska)	Alaska Permanent Reserve Fund
Brunei	Brunei Investment Authority, (1983 ²)
Kazakhstan	National Fund
Malaysia	Khazanah National BHD
Canada	Alberta Heritage Savings Trust Fund
Nigeria	Excess Crude Account
Iran	Foreign Exchange Reserve Fund, (1976 ³)
Azerbaijan	State Oil Fund
Oman	State General Reserve Fund
Timor-Leste	Petroleum Fund of Timor-Leste
Venezuela	FIEM
Trinidad & Tobago	Revenue Stabilization Fund
Singapore 1/	Government Investment Corp.
	Temasek
China	State Foreign Exchange Investment Co.
Hong Kong	Investment Portfolio (HKMA)
Korea	Korea Investment Corp.
Taiwan, Province of China	National Stabilization Fund
Australia	Australian Future Fund
Chile	FEES and Pension Reserve Fund
Botswana 1/	Pula Fund
	Kiribati Revenue Equalization Fund
Total	

Source: IMF. 2008. Chile: Selected Issues Paper. IMF Country Report No. 08/239, July, Washington D.C.

^{1,2,3} As cited in Blundell-Wignall, Hu, and Yermo (2008).

Figure 1. Total Reserves minus Gold and Short-term Debt Outstanding.

Source: WDI-Database 2008.

Export Instability, Income Terms of Trade Instability and Growth: Evidence from Pakistan

Faiz Bilquees and Tahir Mukhtar¹

The study explores the causal relationship among export instability, income terms of trade instability and economic growth in Pakistan. By using the cointegration analysis and vector error correction model for the period 1960 to 2008, the study demonstrates that there exists a long run equilibrium relationship among export instability, income terms of trade instability, investment and economic growth. The Granger causality test results indicate that in the short run there exists a uni-directional causality running from export instability and income terms of trade instability to economic growth. However, in the long run all the variables of the study cause one another. This finding is suggestive of closer coordination among the monetary, fiscal and trade policies in Pakistan.

1. Introduction

Historically, industrial development resulting in the export of manufactured goods has proven to be the major determinants of rapid economic growth. Exports are a reliable source of foreign exchange earnings, essential to the financing of economic development without invoking future indebtedness. Exports not only ease the pressure on the balance of payments but also create employment opportunities and can increase intra-industry trade. While exports help the country to integrate in the world economy and reduce the impact of external shocks on the domestic economy, fluctuations in export revenues lead to macroeconomic instability. Hence, the stable flow of exports and the

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resulting stable income flows provide the basis for a stable growth for any economy.

An income term of trade instability arises due to the instability in prices of exports and imports. If terms of trade worsen, then the country needs to export more to buy the same amount of imports. The instability of income terms of trade affects the economy by reducing real income, which in turn lowers savings and investment, thus causing overall economic instability. Fluctuations in the terms of trade affect the availability of funds for capital formation, and hence growth. Additionally it could also lead to sudden changes in a country's trade and current account balances and create problems in financing the national debt.

Considerable in-depth research on the relationship among the variables like real GDP, real investment, export instability, income terms of trade instability and the terms of trade instability within and across the countries of almost all the regions has been undertaken. Effects of export instability on economic growth have been extensively analyzed by Brempong (1991), Fosu (1992), Love (1992), Ghirmaya et. al.,(1999), Sinha (1999), Afrentiou and Apostolos (2000) and Kaushik et. al., (2008). Except for Kaushik et. al.,(2008), these studies analyze the effects of export instability on economic growth for specific country groupings such as African, South Asian, East Asian and Pacific countries, and the developing countries in general. The results invariably show a negative relationship between export instability and economic growth. Ghirmaya et. al.,(1999) find that export and income terms of trade instability have long run relationships with output. For most countries in their sample, instability in the income terms of trade is negatively related to output while the results for export instability are mixed. With respect to causality it seems that export instability and income terms of trade instability play a causal role in the development process via a variety of avenues. Kaushik et. al.,(2008) examine the relationship among export instability, economic growth and gross fixed capital formation for India. The results show that export instability affects economic growth and causes economic instability. Similar findings are reported by Sinha (1999) for Asian countries including India and Pakistan. While results for India are mixed there exists a

positive but insignificant relationship between export instability and economic growth for Pakistan.

The effects of terms of trade instability on economic growth have also been analyzed by a number of studies [see, for example, Ostry and Reinhart (1992), Wincoop (1992), Mendoza (1997), Blattman et.al.,(2003) and Paulino (2007)] for groups of developed and developing countries. The first two studies show that instability of terms of trade affects economic growth indirectly. In the first case terms of trade shocks generate substantial fluctuations in the real exchange rates which in turn change consumption expenditures and also affect the saving behavior. In the second study uncertainty of terms of trade leads to a significant withdrawal of labor from the tradable sectors and this affects the output growth negatively. The other two studies show that adverse terms of trade directly affect economic growth leading to an overall macroeconomic instability. Paulino (2007) analyzes the effects of terms of trade shocks on the current account of small Caribbean and Pacific island economies. The results indicate adverse effects on the current account balance as well as the overall output growth. The single country study of Malaysia by Wong (2004), uses two measures of terms of trade—commodity and income terms of trade. Both measures are found to be negatively related to economic growth.

Considering the implications of the adverse impact of terms of trade instability on economic growth with respect to consumption expenditures, saving behavior, unemployment in the tradable sector and growth, it is quite surprising that in case of Pakistan hardly any relevant literature is found. One study by Tariq and Qazi (1995) analyzes the causes of export instability in Pakistan over the period 1969 to 1991. They attribute it to the concentration of exports on a few commodities, fluctuations in export quantities and limited number of export markets. The objective of this study is to investigate the causal relationship among export instability, income terms of trade instability and economic growth of Pakistan over the period 1960 to 2008. The study uses the multivariate Johansen cointegration and vector error correction model (VECM) techniques.

The rest of the study is organized as follows: section 2 describes the methodology adopted by the study, including discussion on the

theoretical model and nature of data; results of the study are presented in section 3; and finally, section 4 concludes the study with some policy implications.

2. Methodology

2.1. Theoretical Model

The theoretical model is mainly based on Ghirmaya et. al., (1999). There are three possible channels through which export instability can affect economic growth; through its effect on output, the level of investment, and the level of imports. Export instability can directly affect economic growth by creating distortions, thus creating losses in output, and can directly affect output by affecting the level of investment, and hence capital accumulation, as well as by affecting the flow of imports into the domestic economy (by creating import instability). Hence, four economic variables are involved in these relationships, namely economic growth (Y), investment (INV), export instability (XI) and import instability (MI). Thus, the baseline estimating model can be stated as follows:

$$Z = (Y, INV, XI, MI) \quad (1)$$

The size of export revenue a country accumulates does not in itself reflect its capacity to finance imports. This is because, how much can be imported depends not only on the level of foreign exchange availability but also on the level of import prices. An improved measure of the capacity to import is better reflected by the income terms of trade (ITT), which is derived by multiplying the real export value by the terms of trade. A rise in ITT indicates that a country can obtain a larger volume of imports from the sale of its exports. By the same token, income terms of trade instability ($ITTI$) is a better measure of import instability linked with export instability. Therefore, to investigate the relationship between export instability, income terms of trade instability, investment and economic growth, equation (1) is modified as:

$$Z = (Y, INV, XI, ITTI) \quad (2)$$

where Y, INV, XI are the same as in (1) but $ITTI$ represents the instability of the income terms of trade. Gross domestic product (GDP) is used to measure economic growth and gross fixed capital accumulation is used as a proxy for investment. Both GDP and investment are measured in real units using implicit GDP deflator with base 2000. Both these variables are also modeled in natural logarithms. The export variable is measured by real export earnings, which are obtained by adjusting the nominal export values by an export price index. The income terms of trade is calculated using the ratio of export price index to import price index and multiplying by real export earnings. Data for all the time series have been collected from the *International Financial Statistics* (IFS), *World Development Indicators* (WDIs) and the World Bank. The study uses annual time series data for the period from 1960 to 2008 for Pakistan.

Over the years, researchers have used various methods to measure instability. However, the present study follows Basu and McLeod (1991), Tariq and Qazi (1995) and Ghirmaya et.al., (1999) to measure instability. Thus, the instability variable is obtained from the following regression:

$$\log(X_t) = \alpha_0 + \alpha_1 t + u_t \quad (3)$$

where X_t is the variable for which the instability is to be estimated, t is the time trend and u_t is the error term. Equation (3) is estimated by the least squares method and the instability measure is then obtained as squared deviations from the estimated exponential time trend. The instability values for export revenue, and the income terms of trade for Pakistan are derived using this technique.

2.2. Cointegration Test

Since macroeconomic time-series data are usually non-stationary (Nelson and Plosser, 1982) leading to high possibility of spurious regression, we test for stationarity of time series at the outset of cointegration analysis. For this purpose, an augmented Dickey-Fuller (ADF) test is commonly used. However, the ADF unit root test is known to lose power dramatically against stationary alternatives with a low

order moving average (MA) process: a characterization that fits well to a number of macroeconomic time series. Consequently, along the lines of ADF test, a more powerful variant is the Dicky-Fuller Generalized Least Square (DF-GLS) de-trending test proposed by Elliott, Rothenberg and Stock (ERS, 1996). This test is similar to an Augmented Dickey-Fuller test, but has the best overall performance in terms of small-sample size and power, dominating the ordinary Dickey-Fuller test. Therefore, to check the stationarity of variables, the study has used the DF-GLS test.

The econometric framework used for analysis in the study is the Johansen (1988) and Johansen and Juselius (1990) Maximum-Likelihood cointegration technique, which tests both the existence and the number of cointegration vectors. This multivariate cointegration test can be expressed as:

$$Z_t = K_1 Z_{t-1} + K_2 Z_{t-2} + \dots + K_{k-1} Z_{t-k} + \mu + v_t \quad (4)$$

Where

$Z_t = (Y_t, INV_t, XI_t, ITTI_t)$ i.e., a 4 x 1 vector of variables that are integrated of order one [i.e. $I(1)$]

μ = a vector of constant and

v_t = a vector of normally and independently, distributed error term.

Equation (4) can be reformulated in a vector error correction model (VECM) as follows:

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + \dots + \Gamma_{k-1} \Delta Z_{t-k+1} + \Pi Z_{t-1} + u_t \quad (5)$$

where $\Gamma_i = (I - A_1 - A_2 - \dots - A_k)$ ($i = 1, 2, 3, \dots, k-1$) and $\Pi = -(I - A_1 - A_2 - A_3 - \dots - A_k)$. The Π matrix contains information regarding the long run relationships. Π can be factored into $\alpha\beta'$ where α will include the speed of adjustment to the equilibrium coefficients while the β will be the long run matrix of coefficients. To determine the number of cointegrating vectors, Johansen developed two likelihood ratio tests: trace test (λ_{trace}) and maximum eigenvalue test (λ_{max}). If there is any divergence of results between these two tests, it is advisable to rely on the evidence based on the λ_{max} test because it is more reliable in small samples [see Dutta and Ahmed (1997) and Odhiambo (2005)].

3. Results and Discussion

The first step in cointegration analysis is to test the unit roots in each variable for which we apply the DF-GLS stationarity tests on variables Y , INV , XI and $ITTI$ for Pakistan. The estimated results of the DF-GLS tests are reported in Table 1. The DF-GLS test is applied both for the level as well as for the first-difference of the relevant variables. The results show that unit root test for all the variables fail to reject the null hypothesis of non-stationarity at level i.e., all the variables are non-stationary at level. However, the null hypothesis of non-stationarity is rejected at the first-difference meaning that all variables are first-difference stationary. This implies that all the series are integrated of order one $I(1)$.

Table 1. DF-GLS Unit Root Tests

Variable	Level	1 st difference	1%	5%	10%	Order of integration
Y	-1.21	-5.83	-3.77	-3.19	-2.89	I(1)
INV	-2.31	-4.31	-3.77	-3.19	-2.89	I(1)
XI	-2.54	-6.98	-3.77	-3.19	-2.89	I(1)
ITTI	-2.58	-8.69	-3.77	-3.19	-2.89	I(1)

In order to determine appropriate lag length to be used in the cointegration test we use two lag length selection criteria, namely the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (SBC). Table A1 in Appendix presents results for selecting lag length for Pakistan. The results show that the optimal lag length is 4 as measured by AIC but is only 1 as measured by SBC. In this case we have to make a choice of the optimal lag length. We have selected optimal lag length of 1 as given by SBC for two reasons: firstly, SBC is more accurate than AIC; secondly, when we use the lag length 4 for our cointegration analysis in case of Pakistan, then we find no cointegrating vector under both trace and maximum eigenvalue statistics while at lag length 1 we get one cointegrating vector under both these statistics.

After determining the optimal lag length the next step is to perform the co-integration test. The Long run relationship among all the variables i.e. Y, INV, XI, and

Table 2. Cointegration Test Based on Johansen's Maximum Likelihood Method

Null Hypothesis	Alternative Hypothesis			Critical values	
λ_{trace} rank tests		Eigen values	λ_{trace} rank value	95%	P-values ^{oo}
$H_0: r=0$	$H_1: r=1$	0.555953	79.35298***	63.87610	0.0015
$H_0: r=1$	$H_1: r=2$	0.399891	41.19723	42.91525	0.0735
$H_0: r=2$	$H_1: r=3$	0.231334	17.19693	25.87211	0.4004
$H_0: r=3$	$H_1: r=4$	0.097687	4.831320	12.51798	0.6207
λ_{max} rank tests			λ_{max} rank value		
$H_0: r=0$	$H_1: r=0$	0.555953	38.15575***	32.11832	0.0081
$H_0: r \leq 1$	$H_1: r \geq 1$	0.399891	24.00030	25.82321	0.0854
$H_0: r \leq 2$	$H_1: r \geq 2$	0.231334	12.36561	19.38704	0.3819
$H_0: r \leq 3$	$H_1: r \geq 3$	0.097687	4.831320	12.51798	0.6207
Normalized Cointegrating Vector (t-values in the parenthesis)					
$Y_t = 1.851 + 0.843INV_t - 2.325 XI_t - 1.356ITTI_t$ (1.822)* (13.819)*** (-2.571)** (-1.991)**					

Notes:

- ^{oo} MacKinnon_Haug_Michelis (1999) p_values
- Both the tests (i.e., Trace and Max-eigenvalue) indicate 1 cointegrating equation at 1% percent significance level.
- *** , ** and* indicate significance at 1 percent ,5 percent and 10 percent levels respectively.

ITTI has been investigated using the Johansen technique. Its ability to capture the properties of the time series, to produce estimates of all possible cointegrating vectors, and to provide test statistics for the number of cointegrating vectors are among other reasons for choosing this technique. From the results reported below in Table 2 it is observed that both trace statistic (λ_{trace}) and maximal eigenvalue (λ_{max}) statistics indicate at least one cointegrating vector among all the variables (Y, INV, XI, and ITTI). Hence we can reject the null hypothesis of no cointegrating vector in favor of one cointegrating vector in both test statistics at 1 percent level of significance. However, we cannot reject the null hypothesis of at most one cointegrating vector against the alternative hypothesis of two cointegrating vectors under both the trace and maximum eigenvalue test statistics.

The cointegrating equation given at the bottom of Table 2 is normalized on economic growth just to get meanings from the coefficients. The coefficient of INV is significant at 1 percent level and it carries the expected positive sign. Thus we may say that 1 percent increase in INV brings 0.84 percent increase in Y in Pakistan. Increase in investment will lead to increase the production process which will cause growth in the economy. XI is significantly and negatively related with Y such that a one unit increase in XI brings about a 2.32 percent decrease in Y of Pakistan. This result of the study supports the findings of Fosu (1992), Dawe (1996), and Kaushik et. al., (2008). Study by Fosu (1992) shows that the export instability has a significant negative effect on the GDP of the country and creates uncertainty about future income. The results of the study conducted by Dawe (1996) indicate that the export instability is harmful for economic growth. Export instability creates income instability, reducing the returns on investment that creates instability in production process and adversely affects the growth. Finally, Kaushik et.al., (2008) also show that the export instability adversely affects the economic growth and causes macroeconomic instability in the country. However, this result contradicts the finding of Sinha (1999) who reports a positive association between exports instability and economic growth in Pakistan. Finally, the negative sign of the coefficient of ITTI also indicates the expected inverse relationship between ITTI and Y. As ITTI is significantly affecting Y, so a one unit increase in ITTI produces

1.356 percent decrease in the Y in Pakistan. This implies lower savings, reduced investment, and further decline in exports.

3.2. Causality Tests

Engle and Granger (1987) demonstrated that once a number of variables (say, x_t and y_t) are found to be cointegrated, there always exists a corresponding error-correction representation which implies that changes in the dependent variable are a function of the level of disequilibrium in the cointegrating relationship (captured by the error-correction term) as well as changes in other explanatory variable(s). This direction of the Granger (or temporal) causality can be detected through the vector error-correction model derived from the long run cointegrating vectors. In addition to indicating the direction of causality amongst variables, the VECM approach allows us to distinguish between “short run” and “long run” Granger causality. When the variables are cointegrated, then in the short term, deviations from this long run equilibrium will feed back on the changes in the dependent variable in order to force the movement towards the long run equilibrium. If the dependent variable is driven directly by this long run equilibrium error, then it is responding to this feedback. If not, it is responding only to short-term shocks to the stochastic environment. The Wald χ^2 tests of the “differenced” explanatory variables gives an indication of the “short-term” causal effects, whereas the “long run” causal relationship is implied through the significance or other wise of the t test(s) of the lagged error-correction term(s) that contains the long term information, since it is derived from the long run cointegrating relationship(s). The coefficient of the lagged error-correction term, however, is a short term adjustment coefficient and represents the proportion by which the long run disequilibrium (or imbalance) in the dependent variable is being corrected in each short period (Masih and Masih, 1997).

Table 3.Short Run Causality Patterns

	$\Delta RGDP$	ΔRI	ΔXI	$\Delta ITTI$
Dep. Variable		χ^2 (Sig. Levels)		
$\Delta RGDP$	-	0.024**	0.069*	0.093*
ΔRI	0.044**	-	0.099*	0.097*
ΔXI	0.995	0.768	-	0.061*
$\Delta ITTI$	0.861	0.679	0.029**	-

Note: ** and * indicate significance at 5 percent and 10 percent levels respectively.

The results for the short run causal relationship among the variables i.e., (Y, INV, XI, and ITTI) for Pakistan are reported in Table 3. Apparently there exists a bi-directional causality between Y and INV. This finding is consistent with the findings of Chimobi (2010) who has found a strong evidence of bi-directional causality between economic growth and investment. We find that XI and ITTI both Granger cause Y but Y does not cause XI and ITTI. This implies that unidirectional causality runs from XI and ITTI to Y and the opposite does not happen. This finding supports the contention that export instability and income terms of trade instability induce short run macroeconomic instability. For real investment as dependent variable both export instability and income terms of trade instability Granger cause INV at 10 percent but opposite does not happen. It means unidirectional causality runs from XI and ITTI to INV. Export revenue instability results in income instability, which makes estimation of expected returns on investment difficult, generating risks and uncertainty for entrepreneurs. In addition, government revenue is often directly linked to export revenue, implying that instability in the latter will lead to instability in the former and thus reduced investment by governments in infrastructure (Ghirmaya et.al.,1999). However it is important to note that many governments, particularly in the developing countries tend to provide maximum infrastructure facilities to attract domestic and foreign investors. It is particularly well documented in case of Pakistan (see Ahmed and Amjad,1984). Finally, export instability and income terms of trade instability both Granger cause each other. Therefore, a bi-directional causality exists between XI and ITTI.

To examine the stability of long run equilibrium relationship and long run causality patterns among the variables of the study we look at the sign and significance of error correction term (ECT) in the estimated vector error correction model (VECM). The results are reported in Table 4. The coefficient of the ECT of economic growth variable carries the expected negative sign and it is statistically significant at 1 percent. It shows that RI, XI, and ITTI Granger cause economic growth in the long run in Pakistan. Furthermore, it also indicates that the long run equilibrium relationship in case of economic growth variable is stable and whenever there is any disturbance in the system in the long run, in every short run period, i.e. in a year almost 27 percent correction to disequilibrium will take place.

Table 4. Long Run Causality Patterns

	DL (RGDP)	DL (RI)	D (XI)	D (ITTI)
Constant	0.0396 (4.487)	0.030 (0.831)	0.001 (0.015)	-0.002 (-0.308)
ECT (-1)	-0.277*** (-3.712)	-0.161*** (-2.773)	0.118* (1.813)	0.238*** (3.977)
R ²	0.829	0.853	0.253	0.404
Adjusted R ²	0.791	0.835	0.228	0.361
S.E of Regression	0.023	0.096	0.023	0.018
F-Stat	11.111	10.201	2.736	5.563
Diagnostic Tests χ^2 (<i>p</i> values are in the parenthesis)				
Serial Correlation (Breusch–Godfrey serial LM)	1.146(0.483)	0.884(0.529)	0.993(0.322)	1.292(0.246)
Heteroscedasticity (White Heteroskedasticity Test)	0.04(0.982)	0.675(0.662)	0.977(0.491)	1.247(0.297)
Normality (Jorjue-Bera)	0.661(0.544)	0.387(0.715)	0.682(0.471)	1.338(0.226)
AR.Cond. Heteroscedasticity (ARCH LM Test)	0.057(0.828)	1.211(0.346)	0.075(0.904)	1.427(0.235)

Note: t-values given in parenthesis with, ***, **, *, indicate significance at 1 percent, 5 percent and 10 percent level s respectively.

The coefficient of the ECT of investment also carries the correct (negative) sign and it is statistically significant at 5 percent level. It implies that Y, XI and ITTI are all causing investment in the long run. Moreover, it also corresponds to the stability of the system and nearly 16 percent correction occurs to disequilibrium in the system every year to restore the equilibrium position. The coefficients of the error correction terms (ECTs) of export instability and income terms of trade instability variables have positive sign and are statistically significant at 10 percent and 1 percent level respectively. It implies that these two variables not only Granger cause each other but they are also caused by economic growth and investment variables. However, the positive sign with the coefficients of the ECTs of the two variables indicates that their long run systems are unstable. Thus, it is evident from the long run causal analysis that all the four variables Granger cause one another. This implies a closer coordination among the monetary, fiscal and trade policies in Pakistan. Finally, the study uses some diagnostic tests which involve χ^2 tests for the hypothesis that there is no serial correlation; that the residual follow the normal distribution; that there is no heteroscedasticity; and lastly that there is no autoregressive conditional heteroscedasticity. Table 4 also contains the results for all these tests. In all equations the diagnostics suggest that the residuals are Gaussian as the Johansen method presupposes.

IV. Conclusion and Policy Implications

The purpose of the study is to examine the causality patterns among export instability, income terms of trade instability and economic growth in Pakistan. For this purpose the Johansen cointegration technique and vector error correction model are applied. We have used annual data for the variables real GDP, real investment, export instability and income terms of trade instability over the period 1960 to 2008.

The results of the study show that there exists a long run relationship among economic growth, real investment, export instability and income terms of trade instability in Pakistan. In order to determine the direction of causality in the short run and the long run among the variables of the study, we have applied vector error correction model framework. The results indicate that in the short run both the economic growth and real

investment Granger causes each other while a uni-directional causality runs from exports instability and income terms of trade instability to economic growth and real investment. For export instability and income terms of trade instability a bi-directional causality exists between the two time series. However, in the long run all the variables being considered cause one another as reflected by significant Granger causality test results.

Several policy recommendations can be drawn from this study. Firstly, as export instability has negatively affected economic growth in Pakistan, there is a need to reduce reliance on the exports of a few primary commodities, and rather exports should be diversified by increasing the share of non-traditional exports. Secondly, there is a need to increase savings as a precautionary motive. As export instability creates income instability which affects investment, domestic savings will sustain the levels of the investment which will stabilize the growth path. Thirdly, the findings of the study suggest that both economic growth and investment are highly correlated. Thus on one hand, increase in investment will lead to production of more goods which will cause growth in the economy and on the other hand, economic growth will guarantee increase in investment and promote exports.

Indeed it is quite ironic to see that these implications reflect the history of export development in Pakistan. In the first decade of its existence (1947-58) Pakistan was faced with serious instability of export earnings since it could only export raw jute and raw cotton (Andrus and Mohammed, 1966). Pakistan adopted the import substituting industrialization (ISI) strategy and through massive inflow of aid and subsidized loans coupled with concerted efforts to attract investors through heavy subsidies and tax holidays eventually moved to the export of manufactured goods in the mid sixties (see Naqvi, 1970). Pakistan was acknowledged to have reached the "Take-off" stage, ready to produce heavy machinery and capital goods for export [see, for example, Lewis (1970), Haq (1973) and Papanek (1967)]. However, the whole structure of industrial growth and export promotion was stalled with the virtual stoppage of external inflows due to the 1965 Indo-Pakistan war. Due to easy access to foreign capital inflows successive governments completely ignored the domestic resource mobilization; rather the available inflows were used to provide duty free raw materials

and extended tax holidays to producers of exports goods. They were also entitled to retain certain proportion of the foreign exchange earnings for their own use. These policies resulted in increasing income inequalities among the rich and the poor with serious consequences (see Griffin and Khan, 1972 and Ahmed and Amjad, 1984). The process of industrialization was completely thrown out of gear with the nationalization of the large scale manufacturing sector by the new government in 1971-2. Since then all efforts to revive the industrial sector to the levels reached earlier have failed mainly due to the domestic resource constraint, lack of confidence of the private investor (both domestic and foreign) in the piece meal policies of the successive governments, and the deteriorating economic and political situation. Over time Pakistan is once again faced with the situation that prevailed in the first decade of its existence – lack of domestic resources and heavy reliance on the export of two primary commodities- raw cotton and rice with some manufactured goods.

This situation corresponds to the classification of the less developed countries (LDCs) by the Latin American Structuralist School of thought in the fifties. The LDCs are characterized by agriculture sector constraints due to division of land assets, low tax ratios and the foreign exchange constraint due to heavy reliance on the agriculture sector exports. This calls for due consideration of the implications of this study.

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Appendix

Table A1. Lag Length Criteria

Lag	AIC	SBC
0	-10.60986	-10.44927
1	-18.79393	-17.99097*
2	-18.63551	-17.19018
3	-18.88683	-16.79914
4	-19.06407*	-16.33401

*Indicates lag order selected by the criterion

AIC: Akaike Information Criterion

SBC: Schwarz Bayesian Criterion

The Impact of Foreign Trade on the Labor Market: Evidence from Turkish Economy

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This paper analyzes the impact of foreign trade on labor market by using the random coefficient panel data analysis and the quarterly data of 17 sectors in manufacturing industry of Turkey according to 2 digit level of NACE Rev. 1.1 and ISIC Rev.3 classification between 1994 and 2010. Data are seasonally adjusted by TRAMO/SEATS method before data evaluation, since the data used are quarterly. The results showed that production had positive impact on labor whereas it had negative impact on wages. Furthermore it was shown that imports and exports have a significant and positive impact on labor. Thus the results of the study point out that foreign trade positively affect the economy. Sector specific estimations, which is the one of distinctive aspects of this study, derived from the random coefficient panel data analysis, are also discussed in detailed.

Introduction

Importance of trade in the world economy has been increasing during the past decades, which can be seen at the figures of the world trade. The ratio of world exports of goods and services to GDP increased from 13.5% to 32% per cent between 1970 and 2005 (Jansen and Lee, 2007)

The impact of trade on labor market gained importance in the literature due to the structural changes in production brought by the increase in trade. The classical international trade theory based on Heckscher-Ohlin approach suggests that goods with different factor endowment intensity will be subject to trade due to the fact that countries have different factor

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endowment and technology capacity. Relatively labor abundant countries in factor endowment specialize, and thus, export labor intensive goods and import capital intensive goods from relatively capital abundant countries in factor endowment. Thus, employment in industries manufacturing labor-intensive goods will increase in countries exporting labor-intensive goods and employment in industries manufacturing capital-intensive goods will decrease in result of importing capital-intensive goods, and vice versa. Since developing countries have labor-intensive production structure and developed countries have capital-intensive production structure, these theories explain the impact of trade between developed and developing countries on employment structure in these countries.

Most of the studies analyzing impact of trade on employment focused on manufacturing industries of various countries, because of lack availability of data in other sectors for empirical researches (Jansen and Lee, 2007). In most countries, surveys applied to manufacturing sector by national statistical offices are more detailed and has more frequency by comparison with other sectors.

Milner and Wright (1998) investigated labor market effects of trade liberalization in Mauritius. The short and long run responses of employment and wages were examined by conducting a specific factor trade model for importable and exportable sectors for a period covering both the pre- and post-liberalization regimes. Empirical tests showed that trade liberalization had sector specific impacts on employment. The results showed that employment and wages were increased in the long run, but wages were pressured downward in the very short run. Decrease in output caused reduction in employment and wages in the importable sector.

Erlat (2000) used an accounting-identity based approach which decomposed employment change into impact of trade, domestic consumption and productivity change. The results of this decomposition method indicated that trade had a more significant role to play in employment change in the post-1980 period in Turkey, but export-based employment were not dominant in employment changes

Polat and Uslu (2010) found that exports and imports had positive and significant impact on employment in the short run, but not in the long-run, between 1988 and 2007 by conducting Autoregressive Distributed Lag approach with quarterly data of manufacturing industry. In another study, Polat and Uslu (2011) used a dynamic panel data model with an annual panel of data of 95 manufacturing industries in Turkey between 1992 and 2001. They found that export penetration and real exports of current year had positive impact on employment after one year, while import penetration had a negative impact on employment after two years. Polat et al. (2011) estimated employment impact of foreign trade using with panel data analysis with annual data of 22 manufacturing industries of Turkish economy according to two digit level of NACE Rev. 1.1 classification for the period of 2003-2008. Results of this study showed that while production has positive and wages have negative and significant impact on employment, foreign trade has no significant impact on employment for the period of analyzed. An extensive literature review about the relationship between trade and employment can be found in studies of Lee (2005) and Hoekman and Winters (2005).

This paper analyzes the impact of foreign trade on labor market by using the random coefficient panel data analysis and the quarterly data of 17 manufacturing industries in Turkey according to 2 digit level of NACE Rev. 1.1 and ISIC Rev.3 classification between 1994 and 2010. Data used in this study are more current with longer and much more frequency when compared with previous studies. Besides, the random coefficient panel data analysis used in this study enables to obtain sector specific estimations for trade variables. In the following section, data and the model used in this study are briefly summarized. Econometric approach is introduced in the third section. In the fourth section, results of the analysis are presented and sector specific estimations, which is the one of distinctive aspects of this study, derived from the random coefficient panel data analysis, are also discussed in detail. In the fifth section, the results of the study are evaluated.

Data and Model

In order to analyze the long-term and provide more degree of freedom, index numbers of manufacturing industry for employment, wage, production, import and export series are considered in this study and

obtained from TURKSTAT database, which is the one of distinguished aspect of this study. Indices of different periods and classifications of every variable are unified by authors to get a single series of every variable. Dataset of variables are based on two-digit ISIC Rev. 3 and NACE Rev. 1.1 classification and cover 17 sectors in manufacturing industry of Turkey for the quarterly period of 1994:4-2010:1. Since the data are quarterly, all series are seasonally and calendar adjusted by TRAMO/SEATS³ with automatic model identification.

The impact of trade on employment was investigated by using the model derived from Cobb-Douglas production function following Milner and Wright (1998) and Greenaway et al. (1999). Base equation with the random coefficients model specification of sectors estimated in this study can be written as follows:

$$\ln L_{i,t} = \alpha + \sum_{k=1}^p \gamma_{k,i} \ln L_{i,t-k} + \sum_{k=0}^q \beta_{k,i} \ln W_{i,t-k} + \sum_{k=0}^r \theta_{k,i} \ln Q_{i,t-k} + \delta_{1,i} D(1999)_{i,t} + \delta_{2,i} D(2001)_{i,t} + \delta_{3,i} D(2008)_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $\ln L_{i,t}$ is the logarithm of employment index in i 'th sector and t 'th time period; $\ln W_{i,t}$, is the logarithm of wage index in i 'th sector and t 'th time period; $\ln Q_{i,t}$, is the logarithm of production index in i 'th sector and t 'th time period; $D(1999)$, $D(2001)$, $D(2008)$ are dummy variables that represent depressions in Turkish economy; p , q and r are the number of lags; γ , β , θ , δ are cross-sectional (sector) specific coefficients.

Impact of trade on labor market can be analyzed by extending this model with import index (M) and export index (X) variables as below:

$$\ln L_{i,t} = \alpha + \sum_{k=1}^p \gamma_{k,i} \ln L_{i,t-k} + \sum_{k=0}^q \beta_{k,i} \ln W_{i,t-k} + \sum_{k=0}^r \theta_{k,i} \ln Q_{i,t-k} + \sum_{k=0}^s \phi_{k,i} \ln M_{i,t-k} + \sum_{k=0}^m \varphi_{k,i} \ln X_{i,t-k} + \delta_{1,i} D(1999)_{i,t} + \delta_{2,i} D(2001)_{i,t} + \delta_{3,i} D(2008)_{i,t} + \varepsilon_{i,t} \quad (2)$$

³ See Gómez and Maravall (1997) for TRAMO/SEATS

Econometric Approach

In order to estimate model (1) and (2), Swamy (1970) proposed following estimation procedure:

$$Y_i = \beta_i X_i + u_i \quad (3)$$

where; there are T observations on each of the N individual units. $i = 1, \dots, n$, and β_i is the coefficient vector ($k \times 1$) for i 'th cross-sectional unit. Here;

$$\beta_i = \beta + v_i \quad E(v_i) = 0 \quad E(v_i v_i') = \Sigma$$

are assumed. Given that

$$Y_i = \beta_i X_i + u_i = X_i(\beta + v_i) + u_i = \beta X_i + (X_i v_i + u_i) = \beta X_i + \omega_i \quad (4)$$

where $E(\omega_i) = 0$ and

$$E(\omega_i \omega_i') = E\{(X_i v_i + u_i)(X_i v_i + u_i)'\} = E(u_i u_i') + X_i E(v_i v_i') X_i' = \sigma_i^2 I + X_i \Sigma X_i' = \Pi_i \quad (5)$$

Then the GLS estimator of $\hat{\beta}$ is

$$\hat{\beta} = \left(\sum_i X_i' \Pi_i^{-1} X_i \right)^{-1} \sum_i X_i' \Pi_i^{-1} Y_i = \sum_{i=1}^n W_i b_i \quad (6)$$

where

$$W_i = \left\{ \sum_{i=1}^n (\Sigma + V_i)^{-1} \right\}^{-1} (\Sigma + V_i)^{-1} \quad (7)$$

Feasible best linear predictor of β_i is given by

$$\hat{\beta}_i = \hat{\beta} + \hat{\Sigma} X_i' (X_i \hat{\Sigma} X_i' + \hat{\sigma}_i^2 I)^{-1} (Y_i - X_i \hat{\beta}) \quad (8)$$

where b_i : OLS panel-specific estimator; $\hat{\sigma}_i^2 = \frac{\hat{u}_i^2 \hat{u}_i}{n_i - k}$;

$$\hat{V}_i = \hat{\sigma}_i^2 (X_i' X_i)^{-1}; \bar{b} = \frac{1}{n} \sum_{i=1}^n b_i; \hat{\Sigma} = \frac{1}{n-1} \left(\sum_{i=1}^n b_i b_i' - n \bar{b} \bar{b}' \right) - \frac{1}{n} \sum_{i=1}^n \hat{V}_i$$

To test the parameter constancy ($H_0 : \beta_1 = \beta_2 = \dots = \beta_n$), following test statistics are considered (Stata, 2009).

$$\chi^2_{k(n-1)} = \sum_{i=1}^n (b_i - \bar{\beta}^*) \hat{V}_i^{-1} (b_i - \bar{\beta}^*)$$

$$\text{where } \bar{\beta}^* = \left(\sum_{i=1}^n \hat{V}_i^{-1} \right)^{-1} \sum_{i=1}^n \hat{V}_i^{-1} b_i \quad (9)$$

Results

Base model and extended model are estimated using random coefficient approach proposed by Swamy (1970) and presented in Table 1. Standard error are “robust” to panel-specific autocorrelation and heteroskedasticity (Wu, 1986), since jackknife corrected standard error estimates are used. The baseline and augmented specification report significant Wald test which means independent variables are statistically valid in explaining the employment.

Table 1: Results of the Estimations

Model Number	1		2	
Dependent Variable	$\ln L$		$\ln L$	
Variables	Coefficient	Std. Error ¹	Coefficient	Std. Error ¹
Constant	0.6626 ^a	0.132	0.9868 ^a	0.136
$\ln L_{t-1}$	0.8780 ^a	0.064	0.683 ^a	0.055
$\ln L_{t-2}$	-0.0596	0.056	0.0111	0.054
$\ln L_{t-3}$	-0.0885 ^c	0.045	-0.0353	0.045
$\ln L_{t-4}$	0.0802 ^c	0.046	0.0452	0.045
$\ln Q$	0.0219 ^b	0.009	-0.0007	0.010
$\ln Q_{t-1}$	0.0003	0.006	-0.0008	0.008
$\ln Q_{t-2}$	-0.0003	0.007	0.0033	0.007
$\ln Q_{t-3}$	0.0178	0.011	0.0265 ^b	0.010
$\ln Q_{t-4}$	-0.0042	0.006	-0.0110	0.007
$\ln W$	0.0139	0.035	0.0169	0.029
$\ln W_{t-1}$	-0.0020	0.043	0.0268	0.036
$\ln W_{t-2}$	0.0103	0.026	0.0183	0.023
$\ln W_{t-3}$	-0.0337 ^c	0.019	-0.0142	0.032
$\ln W_{t-4}$	0.0219	0.032	-0.0632 ^b	0.029
$\ln X$			0.0332 ^c	0.016
$\ln X_{t-1}$			-0.0064	0.015
$\ln X_{t-2}$			0.0038	0.011
$\ln X_{t-3}$			-0.0008	0.013
$\ln X_{t-4}$			0.0196	0.013
$\ln M$			0.0356 ^a	0.009
$\ln M_{t-1}$			0.0026	0.009
$\ln M_{t-2}$			-0.0040	0.007
$\ln M_{t-3}$			-0.0143	0.010
$\ln M_{t-4}$			0.0019	0.010
$D(1999)$	-0.0372 ^a	0.008	-0.0240 ^a	0.008
$D(2001)$	-0.0239 ^a	0.008	-0.0348 ^a	0.009
$D(2008)$	-0.0159 ^b	0.007	-0.0265 ^a	0.006
Test of parameter constancy	$\chi^2_{288}=750.03$ (0.000)		$\chi^2_{448}=1023.46$ (0.000)	
Wald test of model	$\chi^2_{17}=1982.60$ (0.000)		$\chi^2_{27}=2474.70$ (0.000)	

Notes: a, b and c respectively indicate significance at 1%, 5%, 10% levels. In parenthesis are probability ratios

¹Standard errors are jackknifed small sample ratios for 17 clusters

The test of parameter constancy are rejected which suggest that slope coefficients are heterogeneous across industries. The number of lag is determined empirically. Here, in order to capture one year time period, 4 lags are considered for all variables.

The results of base specification are reported in the first column of Table 1. The coefficient of the first lagged employment variable is positive and significant at 1% level. This indicates that increase in employment has a significant impact on employment for the next quarter. Industrial production index has a positive and significant impact on employment in the same quarter. The industrial wage index has a negative and statistically significant impact on employment index after three quarter. The dummy variables that represent depressions where in 1999, 2001 and 2008 in Turkish economy are found negative which is in accordance with expectations and statistically significant at least at 5% level.

The results of the augmented model presented by equation (2) are given in the second column of Table 1. The coefficient of the first lagged employment variable is positive and significant at 1% level. The third lag of production variable had a positive impact and the fourth lag of wage variable had a negative impact on employment which is statistically significant at the 5% level. Both the import and export quantity index had a positive impact on employment and are found statistically significant respectively at 1% and 10% level. The depression dummies had negative impact with statistical significance similar to coefficients of the base specification.

The sector-specific results of estimations are presented in Table 2. Descriptions of sectors are reported in Appendix 1. Classification of these sectors according to their global technological intensity is presented in Appendix 2. The coefficients of the first lagged employment variables are positive and significant at 1% level in all sectors. In general, impact of wages on employment is positive high technology sectors, but negative in low technology sectors.

Table 2: Coefficients Estimations of Sectors in Manufacturing Industry

Variables	15	16	17	19	20	21	23	24	25	26	27	28	29	31	32	34	36
$\ln L_{t-1}$	0.484 ^a	0.591 ^a	0.802 ^a	0.493 ^a	0.485 ^a	0.622 ^a	0.363 ^a	0.512 ^a	0.882 ^a	0.664 ^a	0.728 ^a	0.856 ^a	0.524 ^a	0.880 ^a	0.877 ^a	0.811 ^a	0.735 ^a
$\ln L_{t-2}$	0.100	0.371 ^a	0.199 ^c	0.024	-0.004	0.103	0.050	0.153	-0.333 ^a	-0.023	0.054	-0.163	0.113	-0.145	-0.026	-0.187	-0.086
$\ln L_{t-3}$	0.194 ^b	-0.011	-0.240 ^a	0.027	-0.020	-0.169 ^c	0.147 ^c	-0.085	0.187 ^b	-0.065	0.037	-0.058	-0.161 ^c	-0.007	0.127	-0.061	-0.015
$\ln L_{t-4}$	-0.043	-0.072	0.002	0.068	0.099	0.210 ^a	0.457 ^a	0.198 ^b	-0.112	0.099	-0.060	-0.030	0.107	-0.069	-0.128	0.134 ^c	0.039
$\ln W$	0.057	0.006	0.047	0.222 ^a	0.110	-0.043	-0.045	0.014	-0.024	0.028	-0.120 ^c	0.092	-0.005	0.051	0.127 ^c	-0.137 ^c	-0.057
$\ln W_{t-1}$	-0.139 ^b	0.093	0.016	-0.177 ^b	-0.043	0.104	0.048	0.021	0.148 ^b	-0.106	0.175 ^b	-0.056	0.017	-0.030	-0.027	0.219 ^a	0.166 ^b
$\ln W_{t-2}$	0.046	-0.050	0.010	0.022	-0.048	0.032	-0.009	0.011	0.012	0.072	-0.049	0.091 ^c	-0.058	0.060	0.120 ^b	0.040	0.013
$\ln W_{t-3}$	0.236 ^a	0.067	0.087	-0.172 ^c	-0.033	-0.078 ^c	-0.086 ^c	0.009	-0.067	0.200 ^b	0.018	0.024	-0.022	-0.072	-0.074	-0.178 ^b	-0.047
$\ln W_{t-4}$	-0.193 ^a	-0.096	-0.159 ^a	0.067	-0.049	-0.004 ^b	0.100 ^b	-0.053	-0.072	-0.268 ^a	-0.037	-0.157 ^a	0.058	-0.065	-0.147 ^a	0.032	-0.080
$\ln Q$	-0.025	-0.011	0.010	0.015	-0.076 ^c	0.042	-0.125 ^a	-0.015	0.017	-0.020	0.033 ^c	-0.008	-0.019	-0.006	0.070 ^b	0.014	0.039
$\ln Q_{t-1}$	0.002	0.009	0.033 ^c	-0.020	0.116 ^c	-0.018	0.028	0.025	-0.011	0.006	-0.012	0.007	-0.005	-0.003	-0.040	-0.030	-0.057
$\ln Q_{t-2}$	-0.046 ^b	0.039	-0.003	0.004	-0.014	-0.003	0.069	-0.003	-0.022	0.030	0.000	0.007	-0.005	-0.016	0.013	-0.025	-0.006
$\ln Q_{t-3}$	0.058 ^a	0.002	0.013	0.033	-0.032	0.013	0.075 ^a	-0.006	0.044 ^b	0.035 ^c	0.010	0.046 ^b	0.033	0.044 ^b	0.082 ^a	0.020	0.002
$\ln Q_{t-4}$	-0.025	0.023	0.011	-0.055 ^c	-0.037	0.007	-0.020	-0.028	0.000	-0.021	0.010	-0.005	-0.035	0.043	-0.031	-0.014	0.002
$\ln X$	0.007	-0.027	0.138 ^a	0.105 ^a	0.039	0.013	-0.002	-0.014	0.000	-0.051	-0.024	0.061 ^b	0.071 ^b	0.077 ^b	0.069 ^b	0.034	0.022
$\ln X_{t-1}$	-0.086 ^a	0.009	-0.068 ^b	-0.026	0.020	0.052 ^c	0.001	0.052	-0.030	0.077 ^b	-0.014	-0.016	-0.051	-0.022	-0.034	0.011	0.019
$\ln X_{t-2}$	0.020	-0.010	0.059 ^b	-0.015	-0.002	-0.038	-0.004	-0.040	0.036	-0.050 ^c	0.009	0.003	0.013	0.025	0.041 ^b	0.013	-0.011
$\ln X_{t-3}$	0.102 ^a	-0.024	-0.040	0.064 ^b	0.026	-0.037	-0.006	-0.026	0.025	-0.057 ^c	0.024	-0.014	0.050	-0.010	-0.032	-0.009	-0.017
$\ln X_{t-4}$	-0.007	-0.013	0.009	-0.041	0.027	0.007	0.026	0.044	0.017	0.154 ^a	0.019	0.040	-0.011	0.011	-0.025	0.029	0.049 ^c
$\ln M$	0.045	0.012	0.049 ^a	-0.022	0.058	0.018	-0.016	0.038	0.071 ^b	0.131 ^a	0.027	0.048	-0.005	0.015	0.074	0.036	0.032
$\ln M_{t-1}$	0.003	-0.021	-0.054 ^b	-0.022	0.050	-0.039	0.029	0.005	0.021	-0.030	0.035	-0.015	0.114 ^b	0.037	-0.008	0.045	-0.029
$\ln M_{t-2}$	0.014	0.004	-0.018	-0.039	-0.046	0.050	-0.017	0.026	-0.024	-0.007	-0.026	-0.009	-0.057	-0.033	-0.047	0.028	0.048 ^c
$\ln M_{t-3}$	-0.023	-0.025	-0.013	-0.027	-0.049 ^c	-0.025	0.013	-0.010	-0.024	-0.025	-0.003	-0.026	0.048 ^c	0.001	-0.086 ^a	-0.007	0.017
$\ln M_{t-4}$	0.005	-0.012	-0.041 ^c	0.122 ^a	0.018	-0.061	0.020	-0.055	0.024	0.033	0.019	0.005	-0.029	0.003	0.035	-0.004	-0.019
$d2008$	0.010	0.002	-0.019 ^b	-0.101 ^a	-0.064 ^b	-0.051 ^b	-0.053 ^a	-0.014	-0.011	-0.056 ^a	-0.018	-0.001	-0.020	-0.027	0.059 ^b	-0.032 ^b	-0.031
$d2001$	-0.029 ^b	-0.012	0.003	-0.101 ^a	-0.006	-0.043	-0.066 ^b	-0.020	-0.050 ^a	-0.012	-0.045 ^c	-0.066 ^a	-0.092 ^c	-0.031	0.043	-0.017	-0.054 ^b
$d1999$	-0.039 ^b	-0.028	-0.043 ^a	-0.080 ^c	0.015	-0.034	-0.028	-0.018	-0.016	0.022	0.000	-0.064 ^b	-0.024	0.024	-0.023	-0.048 ^b	-0.045
Constant	0.983 ^a	0.584 ^b	0.621 ^a	1.580 ^a	1.777 ^a	1.076 ^a	0.910 ^a	1.026 ^a	1.055 ^a	0.846 ^a	0.668 ^a	1.177 ^a	1.481 ^c	1.018 ^a	0.220	0.874a	1.000 ^a

Notes: a, b and c respectively indicate significance at 1%, 5% and 10% levels.

Output of sectors (16), (21), (24), (29), (34) and (36) have no significant impact on employment level. That shows jobless growth in these sectors. In the rest of the sectors, output variables have positive impact on employment in general. Exports have no significant impact on employment level in low technology sectors such as (16), (20), (23), (24), (25), (27). But in high technology sectors such as (29), (30) and (31), exports are found to have significant and positive impact on employment level. More than half of the sectors, imports have no significant impact on employment level. The impacts of imports on employment level are significant and positive in sectors (17), (19), (25), (26), (29) and (36). This indicates that increase of imports in these sectors indirectly increase employment levels, since significant part of imports of Turkey is constituted by raw materials used in production (TURSTAT, 2011). The impacts of imports on employment level are found to be negative in sectors (20) and (32). According the results, economic crises in 1999, 2001 and 2008 were effective particularly in low technology sectors and decreased employment levels in these sectors.

Conclusion

This paper analyzes the impact of foreign trade on labor market by using the random coefficient panel data analysis and the quarterly data of 17 sectors in manufacturing industry of Turkey according to 2 digit level of NACE Rev. 1.1 and ISIC Rev.3 classification between the years 1994 and 2010. Data are seasonally adjusted by TRAMO/SEATS method before data evaluation, since the data used are quarterly. Data used in this study are more current with longer and much more frequency when compared with previous studies. Besides, the random coefficient panel data analysis used in this study enables to obtain sector specific estimations for trade variables.

The results of estimations show that impact of production on employment level is positive, while impact of wages on employment level is negative. Furthermore it is found that imports and exports have a significant and positive impact on employment level. Thus the results of the study point out that foreign trade positively affect the economy. In this framework, export supporting strategies applied by the governments

in Turkey since 1980 can be considered as meaningful steps for creating new job opportunities in manufacturing industry.

Sector specific estimations, which is the one of distinctive aspects of this study, derived from the random coefficient panel data analysis enable detailed analysis in manufacturing industry. Impact of the wages on employment is found to be positive high technology sectors, but negative in low technology sectors. Incentive policies for wages in high technology sectors can be implemented to increase employment in these sectors. Increase of output in some sectors has no significant impact on employment levels indicating jobless growth. Since exports have significant and positive impact in most of high technology sectors, policies such as export incentive policies and cost reduction measures should be considered in order to increase employment in these sectors. Tariff reduction policies can be implemented to increase employment in specific sectors in which imports have significant and positive impact on employment level, considering competitiveness of domestic firms.

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Appendix 1 Statistical Classification of Economic Activities
(NACE Rev.1.1)

15	Manufacture of food products and beverages
16	Manufacture of tobacco products
17	Manufacture of textiles
18	Manufacture of wearing apparel; dressing and dyeing of fur
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
21	Manufacture of pulp, paper and paper products
22	Publishing, printing and reproduction of recorded media
23	Manufacture of coke, refined petroleum products and nuclear fuel
24	Manufacture of chemicals and chemical products
25	Manufacture of rubber and plastic products
26	Manufacture of other non-metallic mineral products
27	Manufacture of basic metals
28	Manufacture of fabricated metal products, except machinery and equipment
29	Manufacture of machinery and equipment n.e.c.
30	Manufacture of office machinery and computers
31	Manufacture of electrical machinery and apparatus n.e.c.
32	Manufacture of radio, television and communication equipment and apparatus
33	Manufacture of medical, precision and optical instruments, watches and clocks
34	Manufacture of motor vehicles, trailers and semi-trailers
35	Manufacture of other transport equipment
36	Manufacture of furniture; manufacturing n.e.c.
37	Recycling

Source: EUROSTAT (2012)

Appendix 2 Classification of sectors in manufacturing industry according to their global technological intensity (NACE Rev 1.1)

<u>High-technology</u>	<u>NACE</u>
<u>Revision 1.1</u>	
1. Aerospace	35.3
2. Computers, office machinery	30
3. Electronics-communications	32
4. Pharmaceuticals	24.4
5. Scientific instruments	33
 <u>Medium-high-technology</u>	
6. Motor vehicles	34
7. Electrical machinery	31
8. Chemicals	24-24.4
9. Other transport equipment	35.2+35.4+35.5
10. Non-electrical machinery	29
 <u>Medium-low-technology</u>	
11. Rubber and plastic products	25
12. Shipbuilding	35.1
13. Other manufacturing	36.2 - 36.6
14. Non-ferrous metals	27.4+27.53/54
15. Non-metallic mineral products	26
16. Fabricated metal products	28
17. Petroleum refining	23
18. Ferrous metals	27.1 - 27.3+27.51/52
 <u>Low-technology</u>	
19. Paper printing	21+22
20. Textile and clothing	17 - 19
21. Food, beverages, and tobacco	15+16
22. Wood and furniture	20+36.1

Source: EUROSTAT (2012)

Efficiency of Zakat Institutions In Malaysia: An Application of Data Envelopment Analysis¹

Norazlina Abd. Wahab* and Abdul Rahim Abdul Rahman**

The aim of this paper is to measure the efficiency of zakat institutions in Malaysia during the period of 2003 to 2007. Using a Data Envelopment Analysis (DEA) technique, the results show that zakat institutions have exhibited mean technical efficiency of 80.6%. The results also suggest that pure technical inefficiency dominates the scale inefficiency effects in determining technical efficiency of zakat institutions in Malaysia. Further analysis of Spearman and Pearson correlation coefficients suggests that while higher Muslim population states tend to positively correlated to zakat collection, its correlation with efficiency score does not indicate a strong relationship, implying that it does not promise efficiency of zakat organization.

1. Introduction

Zakat is one of the five basic pillars in Islam. The term zakat has three different connotations; linguistically, theologically and legally. Linguistically, zakat means cleansing or purification of something from dirt or filth. Theologically, it means spiritual purification resulting from giving of zakat. Legally, zakat means transfer of ownership of specific property to specific individuals under specific conditions. It is an obligation of Muslims to give a specific amount of their wealth (with certain conditions and requirements) to beneficiaries called *al-*

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mustahiqqin with the main objective of the achievement of socioeconomic justice (Muhammad, 1980). Zakat institutions are trusted bodies that manage zakat in Muslim countries.

In Malaysia, such zakat institutions are State Islamic Religious Councils (SIRCs). The institutions are expected to play a key role in promoting the socio-economic objectives of zakat in Malaysia. Thus, it is of prime importance that these institutions are being managed effectively and efficiently. Being a public service organization which is accountable to the stakeholders and Muslim public at large, these zakat institutions have been subjected to intense public scrutiny and criticism. cursory examination would see various parties questioning the efficiency and effectiveness of these institutions in managing zakat affairs of their respective states. Given this continuously arising public concern, it is irony and surprising to find that research attempting to explore the efficiency of these zakat institutions is almost non-exist. Hence, this paper can be considered as the first to explore the productivity growth of zakat institutions in Malaysia. The structure of this paper is as follows. The next section provides an overview of the Malaysian zakat industry and literature on zakat and efficiency. Section 3 discusses the methodology and input-output specification. Section 4 reports the findings and the last section concludes.

2. Literature Review

In Malaysia, all aspects pertaining to the administration of zakat are under the jurisdiction of the states through the SIRCs. There are a total of fourteen SIRCs, one for each of the thirteen states and one for the federal territory. Due to the demand of more efficient and effective collection and distribution of zakat funds in Malaysia, some of the Religious Councils have privatized an institution that responsible on the matter of collection (and distribution) part of zakat in those particular states. Eight Religious Councils have so far privatized, starting with Pusat Pungutan Zakat (PPZ), Wilayah Persekutuan in 1991, followed by Pusat Pungutan Zakat Selangor, Pahang and Pulau Pinang in 1995, and lastly Pusat Pungutan Zakat Negeri Sembilan and Melaka in 2000. (Ahmad et al., 2006). It was followed by Tabung Baitulmal Sarawak in 2001 and the latest was Pusat Zakat Sabah that has been privatized in 2007.

Most studies conducted on zakat in Malaysia concentrates on various areas including theoretical (Mujitahir, 2003; Tarimin, 1995), legal and compliance (Idris, 2003; Ahmad, 2004), accounting (Abdul Rahman, 2002; Ismail & Sanusi, 2004), management (Nik Mustapha, 1991) and Muslim awareness and payment behaviour (Nor & Nor, 2004; Ahmad et.al., 2005; Idris, 2002). However, there are very few studies that examined the performance of zakat institutions. Some studies focused on the performance of zakat collection and distribution (Noor et al., 2005) and some other studies measure the impact of privatisation on the performance of zakat institutions (Nor Ghani et.al., 2001; Ahmad et.al., 2005). It can be seen that there is no study which comprehensively examining the efficiency of Malaysian zakat institutions

In terms of efficiency, economic efficiency is defined in economic theory as a term describing how well a system is performing, in generating the maximum desired output for given inputs with available technology. Efficiency is improved if more output is generated without changing inputs. An economic system is more efficient if it can provide more goods and services for society without using more resources. For instance, Husain, Abdullah & Kuman (2000) and Ibrahim & Md. Salleh (2006) are among studies that explores the efficiency of public sector in Malaysia. Husain, Abdullah & Kuman (2000) that studied the efficiency of Road Transport Department (RTD) using Data Envelopment analysis (DEA) found out that out of 46 service units, only 11 service units score above 50% of efficiency scores. Ibrahim & Md. Salleh (2006) for instance, in their studies of local governments in providing local public goods and services, found that the overall result showed that most of the local governments in Malaysia are cost inefficient, and that municipality councils were more inefficient than the district councils.

Studies on efficiency of public sector have been conducted using different inputs and outputs. For instance, efficiency of urban and rural bus in Norway examined by Odeck & Alkadi (2004) used total number of seats, driving hours, total number of staff, fuel consumption and equipment as inputs, while outputs used are seats taken and passenger kilometres. Other studies like Mante & O'Brien (2002) examined efficiency of secondary schools in Victoria using staff pupil ratio and adjusted learning needs index as inputs while outputs used were proportion of students with tertiary entrance rank scores of 50 and above and Year 12 apparent retention rate. The above studies show that the

choice of inputs and outputs in assessing efficiency is based on the subject of the efficiency analysis undertaken.

In terms of methodology, the measurement of economic efficiency is mainly focused on two different approaches, namely the parametric and non-parametric methods. Data Envelopment Analysis (DEA) and Frontier Approaches (FA) are among the common approaches used respectively. The term DEA was introduced by Charnes, Cooper and Rhodes (1978) based on the research of Farrell (1957). DEA involves the use of linear programming methods to construct a non-parametric piece-wise surface (or frontier) over the data. Efficiency measures are then calculated relative to this surface. It estimates efficiency under the assumption of constant return to scale (CRS) and variable return to scale (VRS). It assumes that linear substitution is possible between observed input combinations on an isoquant. It examines how a particular decision making unit (DMU) operates relative to the other DMU in the sample.

As stated by Berger & Humphrey (1997), there are three main parametric frontier approaches (FA) ie. the stochastic frontier approach (SFA), the Distribution free approach (DFA) and the thick frontier approach (TFA). The stochastic frontier approach (SFA) specifies a functional form for cost, production or profit relationship among inputs, outputs and environmental factors and allow random error. Similarly, the DFA specifies a functional form for the frontier, but separates the inefficiencies from random error in a different way. Lastly, the TFA specifies a functional form and assumes that deviations from predicted performance values within the highest and lowest performance quartiles of observations (stratified by size class) represent random error.

Nevertheless, there is still ongoing debate as to which methodology is preferred in determining efficiency. However, most of the applications of DEA have occurred in the public sector. Besides, it has become popular in evaluating public sector because it easily handles multiple outputs, is non-parametric and does not require input prices. The studies that employ DEA in public sector include Ruggiero & Vitaliano (1999), Husain, Abdullah & Kuman (2000) and Mante & O'Brien (2002). Hence, in this present paper, we choose to employ DEA to evaluate efficiency of zakat institutions in Malaysia.

3. Research Methodology

The term Data Envelopment Analysis (DEA) was first introduced by Charnes *et al.* (1978), (hereafter CCR), to measure the efficiency of each Decision Making Units (DMUs), that is obtained as a maximum of a ratio of weighted outputs to weighted inputs. This denotes that the more the outputs produced from given inputs, the more efficient is the production. The weights for the ratio are determined by a restriction that the similar ratios for every DMU have to be less than or equal to unity. This definition of efficiency measure allows multiple outputs and inputs without requiring pre-assigned weights. Multiple inputs and outputs are reduced to single ‘virtual’ input and single ‘virtual’ output by optimal weights. The efficiency measure is then a function of multipliers of the ‘virtual’ input-output combination.

The CCR model presupposes that there is no significant relationship between the scale of operations and efficiency by assuming constant returns to scale (CRS) and it delivers the overall technical efficiency (OTE). The CRS assumption is only justifiable when all DMUs are operating at an optimal scale. However, firms or DMUs in practice might face either economies or diseconomies of scale. Thus, if one makes the CRS assumption when not all DMUs are operating at the optimal scale, the computed measures of technical efficiency will be contaminated with scale efficiencies.

Banker *et al.* (1984) extended the CCR model by relaxing the CRS assumption. The resulting “BCC” model was used to assess the efficiency of DMUs characterized by variable returns to scale (VRS). The VRS assumption provides the measurement of pure technical efficiency (PTE), which is the measurement of technical efficiency devoid of the scale efficiency (SE) effects. If there appears to be a difference between the TE and PTE scores of a particular DMU, then it indicates the existence of scale inefficiency.

The input oriented DEA model with VRS technologies can be represented by the following linear programming problem:

$$\begin{aligned} & \min \varphi, \lambda, \varphi \\ & \text{subject to } -\varphi y_i + Y\lambda, \geq 0 \\ & x_i - X\lambda \geq 0 \end{aligned}$$

$$\begin{aligned} N1' \lambda &= 1 \\ \text{and } \lambda &\geq 0 \end{aligned} \quad (1)$$

where λ is an $N \times 1$ intensity vector of constants and ϕ is a scalar ($1 \geq \phi \leq \infty$). $N1$ is an $N \times 1$ vector of ones. For N number of firms, y_i and x_i are the $M \times N$ and $K \times N$ output and input vectors, respectively. Y comprises the data for all the N firms. Given a fixed level of inputs for the i th firm, the proportional increase in outputs to be achieved the firm indicated by $\phi - 1$. Note that without the convexity constraint $N1' \lambda = 1$, equation (1) becomes a DEA model with CRS technology. The convexity constraint implies that an inefficient firm is benchmarked against firms of a similar size and therefore the projected point of that firm on the DEA frontier will be a convex combination of observed firms. In other words, each firm would produce on or to the right of the convex production possibility frontier. If TE scores for a particular firm with or without the convexity constraint imposed are the same, then the firm is operating under CRS. If these scores are different, the firm operates under VRS technology. However, in such a case, it would be necessary to identify whether the firm or the DMU operates with IRS or DRS. To do this, assumption of non-increasing returns to scale (NIRS) is imposed in (1) and the convexity constraint $N1' \lambda = 1$ is substituted with $N1' \lambda \leq 1$. This is given as follows:

$$\begin{aligned} \min \phi, \lambda, \phi \\ \text{subject to } -y_i, -Y\lambda, &\geq 0, \\ \phi x_i - X\lambda &\geq 0, \\ N1' \lambda &\leq 1 \\ \lambda &\geq 0 \end{aligned} \quad (2)$$

Solution of the equation (2) reveals the nature of scale efficiencies. IRS exists if TE score obtained with NIRS technology differs from the TE estimates with VRS technology. If both of these efficiency scores are equal, then the corresponding firm operates with DRS. Because the number of zakat institutions is small, the scope to undertake this study using standard econometric methods is somewhat limited. Amongst the strengths of the DEA is that, DEA is less data demanding as it works fine with small sample size (Canhoto & Dermine, 2003).

The small sample size is among other reasons, which leads us to DEA as the tool of choice for evaluating efficiency of zakat institutions in

Malaysia. Furthermore, DEA does not require a preconceived structure or specific functional form to be imposed on the data in identifying and determining the efficient frontier, error, and inefficiency structures of the DMUs (Bauer *et al.*, 1998).

DEA can be used to derive measures of scale efficiency by using the variable returns to scale (VRS), or the BCC model, alongside the constant returns to scale (CRS), or the CCR model. Coelli *et al.* (1998) noted that the BCC model have been most commonly used since the beginning of the 1990s. A DEA model can be constructed either to minimize inputs or to maximize outputs. An input orientation aims at reducing the input amounts as much as possible while keeping at least the present output levels, while an output orientation aims at maximizing output levels without increasing use of inputs (Cooper *et al.*, 2000).

The standard approach to measuring scale effects using DEA is to run models on both a CRS and VRS basis. Scale efficiency is then found by dividing the efficiency score from the CRS model by the efficiency score from the VRS model. Because the data points are enveloped more tightly under the VRS model, the VRS efficiency scores will be higher and the scale efficiency measures will therefore be in the range 0 to 1. A useful feature of VRS model as compared to the CRS model is that it reports whether a decision-making unit (DMUs) is operating at increasing, constant, or decreasing returns to scale. Constant returns to scale will apply when CRS and VRS efficiency frontiers are tangential with each other; in other words, when the slope of the efficiency frontier is equal to the ratio of inputs to outputs (Cooper *et al.*, 2000). Increasing returns to scale must apply below that level, as the slope of the efficient frontier, which reflects the marginal rate of transformation of inputs to outputs will be greater than the average rate of conversion. Likewise, decreasing returns to scale must apply above the zone in which constant returns to scale apply. DMUs not on the efficient frontier must first be projected onto the efficient frontier before their returns to scale status can be assessed.

4. Input-Output Specification

The choice of inputs and outputs in this study is essentially determined by data availability. Three outputs and two inputs are considered for this study to investigate efficiency of 14 SIRC in Malaysia for the period of

2003 to 2007. The outputs are total collection of zakat, total distribution of zakat and total number of zakat payers, while the inputs are number of staff and total expenditure. Data was collected from the multiple years of Annual report of PPZ Kuala Lumpur², particularly for the data of zakat collection, distribution and zakat payers. As for the data of number of staff and total expenditure, both data were collected from the office of the SIRC's and Zakat Center in Malaysia.

For the purpose of this study, a production approach³ is employed in this study in the definition and measurement of inputs and outputs whereby it assumes that zakat institutions are primarily producing zakat collection and zakat payers (in a way of *dakwah*, promotion *etc.*) and distribute the funds to the *asnaf* (beneficiaries). According to Berger and Humphrey (1997) the production approach might be more suitable for branch efficiency studies. Prior studies on efficiency have used different set of inputs and outputs based on the operation of the firms or DMU. However, in this study, the inputs were adopted from the model which has been developed by Camanho & Dyson (1999) which analyze the efficiency of bank branches, while the outputs were developed based on the objective that is to analyze the ability of zakat institutions in producing zakat collection and zakat payers (in a way of *dakwah*, promotion *etc.*) and distribute the funds to the *asnaf* (beneficiaries). Table 1 depicts the descriptive statistics of the inputs and outputs employed in this study.

² PPZ Kuala Lumpur has taken its own initiative in combining data of zakat of all zakat institutions in Malaysia.

³ There are two main approaches in the literature to the choice of inputs and outputs in DEA, namely the production approach and the intermediation approach. Under the production approach, an institution is defined as a producer. The intermediation approach on the other hand, assumes that a firm act as an intermediary.

Table 1: Descriptive Statistics of the Inputs and Outputs used in the DEA model

	Mean	Median	Maximum	Minimum	Std. Dev.
Input					
No. of staff	127	100	461	22	91
Total Expenditure	37,742,331	25,727,861	214,767,671	1,957,135	42,735,550
Output					
Total collection	42,079,560	27,771,981	202,193,541	5,102,537	42,224,646
Total distribution	32,111,273	20,392,516	174,520,057	3,036,304	34,232,324
No. of zakat payers	304,079	62,408	2,100,562	1,482	505,887

Table 1 reports descriptive statistics of outputs and inputs of 14 zakat institutions in Malaysia during the study period. On the average, there is a wide range between the minimum and the maximum amount of inputs used and outputs produced by zakat institutions in Malaysia. This situation happened due to the differences in the state's area in Malaysia. For instance, Perlis, the smallest state in Malaysia should be using less inputs rather than a wide area state like Pahang.

5. Results And Analysis

The efficiency of zakat institutions in Malaysia was examined by applying the DEA method for each year under investigation using a common frontier. Table 2 displays the mean technical, pure technical and scale efficiency score of zakat institutions in Malaysia for the years 2003 (Panel A), 2004 (Panel B), 2005 (Panel C), 2006 (Panel D) 2007 (Panel E) and all years (Panel F).

Table 2: Summary statistics of efficiency scores (TE, PTE and SE) by year

Years/Types of Efficiency	Mean	Min	Max	SD
<i>Panel A: 2003</i>				
TE	0.810	0.325	1.000	0.223
PTE	0.845	0.462	1.000	0.205
SE	0.950	0.704	1.000	0.084
<i>Panel B: 2004</i>				
TE	0.828	0.363	1.000	0.199
PTE	0.882	0.518	1.000	0.178
SE	0.933	0.680	1.000	0.089
<i>Panel C: 2005</i>				
TE	0.812	0.337	1.000	0.227
PTE	0.834	0.389	1.000	0.229
SE	0.959	0.752	1.000	0.075
<i>Panel D: 2006</i>				
TE	0.802	0.336	1.000	0.210
PTE	0.857	0.464	1.000	0.193
SE	0.928	0.724	1.000	0.079
<i>Panel E: 2007</i>				
TE	0.779	0.331	1.000	0.224
PTE	0.874	0.515	1.000	0.182
SE	0.880	0.643	1.000	0.127
<i>Panel F: All years</i>				
TE	0.806	0.325	1.000	0.211
PTE	0.861	0.389	1.000	0.192
SE	0.929	0.643	1.000	0.094

Based on table 2, the TE score of zakat institutions are found to be the highest in 2004 (0.828), while in 2007, TE score of zakat institutions is the lowest (0.779). Similarly the PTE score is also found to be the highest in 2004 (0.882), but 2005 is the lowest PTE year score (0.834). However, based on the results, the efficiency score of zakat institutions in Malaysia does not change much over years. Hence, the concern of the differences between efficiency score of different zakat institutions should be paid more attention as the results between the minimum and the maximum score of zakat institutions are even bigger than its differences between years. Another interesting results that should be of concern is the higher results of SE compared to PTE which suggest that efficiency of zakat institutions in Malaysia may be due to the scale or size of the institutions rather than its technical aspect. The results show that pure technical inefficiency dominates scale inefficiency of Malaysian zakat institutions. In other words, it shows that zakat institutions in Malaysia relied more on its size of operation in gaining efficiency.

We now turn our discussion on the developments of the returns to scale of zakat institutions in Malaysia. The following Table 3 displays the results of developments in returns to scale of zakat institution in Malaysia.

Table 3: Returns to scale in zakat institutions in Malaysia

	2003		2004		2005		2006		2007	
	No. of ZIs	% Share	No. of ZIs	% Share	No. of ZIs	% Share	No. of ZIs	% Share	No. of ZIs	% Share
CRS	6	42.9	5	35.7	8	57.1	5	35.7	5	35.7
DRS	6	42.9	8	57.1	2	14.3	9	64.3	9	64.3
IRS	2	14.2	1	7.2	4	28.6	0		0	
Total	14	100	14	100	14	100	14	100	14	100

Table 3 displays the results of zakat institutions returns to scale. As the table shows, over the five periods, the zakat institutions were experiencing an inverted U-shape trend of inefficient zakat institutions, from 57.1% in 2003 and 64.3% in 2004, to 42.9% in 2005 before it rose

up to 64.3% in 2006 and 2007. It is apparent from the table that, the number of zakat institutions experiencing economies of scale (IRS) has decreased substantially from 2 (14.3%) in year 2003 to none (0%) in 2006 and in 2007, after it rose up to 4 (28.6%) in 2005. In contrast, zakat institutions that are experiencing diseconomies of scale (DRS) dominate the inefficient zakat institutions in all years except in 2005. For instance, in year 2003, there were 6 (42.85%) zakat institutions experiencing diseconomies of scale and it rose up to 8 (57.1%) in 2004 and 9 (64.3%) in 2006 and 2007 before it declined to 2 (14.3%) in 2005. The share of scale efficient zakat institutions (operating at CRS) on the other hand, are quite stable, where the share of efficient zakat institutions has increased from 6 (42.85%) in year 2003 to 8 (57.1%) in year 2005 before it declined to 5 (35.7%) in year 2007. Hence, there are a lot of improvements should be undertaken by zakat institutions to improve overall efficiency if scale inefficiency resulted from the scale inefficient institutions could be undertaken.

In the spirit of Bauer et al. (1998), in order to complement the results of the efficiency measures, we have further correlated a few available size and population effect with the efficiency scores derived from the DEA model. We have used Total Collection (as a proxy of Size) and Total Muslim Population across states in Malaysia. Other factors (such as Household Income, Poverty rate etc.) could have also be included. However, since these data are only censused by the Economic Planning Unit (EPU) twice in three years time, therefore, only 2 years data available⁴ (as compared to this study period). Following among others, Isik & Hassan (2002), we have calculated both the rank-order Spearman and the parametric Pearson correlation coefficients to examine the possible relationship among the efficiency measures and the size and population data. However, only PTE of efficiency measures is employed⁵. The Spearman [*s*] and Pearson [*p*] correlation coefficients are presented in Table 4. The null hypothesis is that the correlation coefficient between two variables is zero.

⁴ Data on poverty rate and percapita income are available for 2004 and 2007 only (with regards to this study).

⁵ According to Coelli, Rao and Battese (2005), VRS model (PTE) allows variable return to scale which is suitable with the firm which is run in imperfect competition, government regulations and constraints on finance. Since zakat institutions are under the state government list, hence, it is more suitable to consider the VRS model (PTE) compared to the CRS one (TE).

Table 4: Spearman Rho Rank Order [*s*] and regular Pearson [*p*] Correlation Coefficients among Efficiency Scores and Selected Variables

Variables	TE	PTE	SE	MPop	ZC
TE [<i>s</i>] [<i>p</i>]	1.000 1.000				
PTE [<i>s</i>] [<i>p</i>]	0.7195*** 0.7458***	1.000 1.000			
SE [<i>s</i>] [<i>p</i>]	0.5156** 0.4255**	0.4700** 0.3270*	1.000 1.000		
MPop [<i>s</i>] [<i>p</i>]	0.0564 0.0405	0.1357* 0.1712*	-0.1017 -0.2342	1.000 1.000	
ZC [<i>s</i>] [<i>p</i>]	-0.0763 0.0203	0.1652 0.2761	-0.1623 -0.3474	0.4467*** 0.4352***	1.000 1.000

TE, PTE, SE: Technical, Pure technical and Scale efficiency, respectively; MPop: Total Muslim Population; ZC: Total zakat collection

No. Of observations: 70

*** indicates significant at the 0.01 % level

** indicates significant at the 0.05 % level

* indicates significant at the 0.10 % level

Table 4 shows the Spearman [*s*] and Pearson [*p*] correlation coefficients between the efficiency scores and total Muslim population (MuslimPop) and total zakat collection (ZC). Levels of significance are also shown. As the results indicate, the Spearman [*s*] and the Pearson [*p*] correlations are all statistically different from zero indicating that there is a strong association between the variables evaluated. The results from the Spearman correlation coefficients shows that technical efficiency is highly positively and statistically significantly associated with other X-efficiency measures namely, PTE and SE (ρ TE – PTE = 0.7195, ρ TE – SE = 0.5156). The results also suggest that SE is more related to TE than PTE, confirming the dominant effect of pure technical efficiency in determining the technical (in) efficiency of zakat institutions in Malaysia.

The results suggest that total Muslim population are positively related to the efficiency scores (except SE) although it is not significant. It is also

apparent that total zakat collection (ZC) as a proxy of size is positively associated with efficiency score (except SE), suggesting that higher collecting zakat institutions tend to be more efficient. Another interesting result is the relationship between total Muslim population and zakat collection which is statistically and significantly positively correlated. The results indicate that there is a strong correlation between total Muslim population and zakat collection in Malaysia which suggests that higher Muslim concentration states tend to improve zakat collection. Overall, the results suggest that while higher Muslim population states tend to positively correlated to zakat collection, its correlation with efficiency score does not indicate a strong relationship, implying that it does not promise efficiency of zakat organization. In sum, the statistically and significantly different from zero correlation coefficients suggest that the efficiency measures are also associated with other related variables, i.e. they are robust and are not ‘meaningless’ of the technique used⁶.

6. Conclusion

This paper investigates the efficiency of zakat institutions in Malaysia during the period of 2003-2007. The preferred non-parametric Data Envelopment Analysis (DEA) methodology has allowed us to distinguish between the three different types of efficiency, ie. technical, pure technical and scale efficiency. The results suggest that zakat institutions have exhibited mean technical efficiency of 80.6%. The results also suggest that pure technical inefficiency dominates the scale inefficiency effects in determining technical efficiency of zakat institutions in Malaysia. This implies that a more efficient use of inputs should be paid more attention in order to improve efficiency.

In terms of the returns to scale, the results suggest that most zakat institutions were operating at non-CRS. Hence, there are a lot of improvements could be undertaken by zakat institutions to improve overall efficiency if scale inefficiency resulted from the scale inefficient institutions could be undertaken. The results of the Spearman [*s*] and Pearson [*p*] correlation coefficients between efficiency scores and total Muslim population (MuslimPop) and total zakat collection (ZC) suggests that while higher Muslim population states tend to positively correlated to zakat collection, its correlation with efficiency score does

⁶ The results are only correlations, not causations which is one of the limitations of this study.

not indicate a strong relationship, implying that it does not promise efficiency of zakat organization. Hence, there could be other factors which affect the efficiency of zakat institutions in Malaysia which needs further investigation.

Owing to its limitation, this paper could be extended in a variety of ways. First, investigation of changes in productivity over time as a result of technical change or technological progress or regress could yet be an extension to this paper. Second, the scope of this study could be extended to investigate factors determining the efficiency of zakat institutions over time. Despite these limitations, the findings of this study are expected to contribute to the existing knowledge on the performance of zakat institutions in Malaysia. Nevertheless, the study have provided further insight to the policymakers with regard to attaining optimal utilization of capacities, improvement in managerial expertise, efficient allocation of scarce resources and most productive scale of operation of zakat institutions in Malaysia.

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Pension Reforms: A Case for Pakistan

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The study deals with pension system reforms for the Pakistan economy and highlights the current situation and future prospects. The study presents an overview of empirical evidence on pension system reforms, the strengths and weaknesses of the pension system of Pakistan and the institutional development pertaining to pension reforms. Fully funded pension system can help to strengthen the formal channels of retirement savings and can help to get rid of problems prevailing in current pension system. If the decision to reform the pension system is not taken in time then in the near future rising pension expenditure would lead to increase in indirect taxes, reduction in development expenditure and/or increase in government borrowings. Although some efforts to reform the pension system had been made to reduce the government's rising pension bill, yet despite realization of the problem no serious effort had been made to reform the pension system in a fundamental way.

1. Introduction

Pension systems are intended to give income support to those individuals who bear losses in earning capability during old age, incident of disability or death of wage earner in the family. Thus, pension systems aim to reduce poverty among the old individuals and strive to smooth consumption between the working years and the retirement years, in such a way that individuals do not bear a massive drop in living standards when old age and disability reduces their earning ability. The former objective is obtained through non-contributory pension system and the later through contributory pension system.

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Most of the systems of old age security are publicly managed schemes and are financed by payroll taxes on a pay-as-you-go basis. This system is under increasing strain throughout the world. Schwarz *et al.* (1999) and James (1998) pointed out that over the next 35 years, the fraction of world's population that is above 60 would roughly double, from 9 percent to 16 percent. The continuous fall in fertility rates coupled with rising life expectancy leads to a decline in the proportion of children and an increase in the proportion of elderly. The number of pensioners per worker is increasing continuously; hence as a result higher wage taxes are required to provide pension benefits to growing number of retirees. [James (1998), Sarrapy *et al.* (1996), Corsetti *et al.* (1995), Holzmann *et al.* (2005)]. This situation results in high evasion, pushes labor into informal sector and raises the burden on public treasury.

The public pay-as-you-go pension system is expected to become fiscally unsustainable in near future. The most important threat comes from the changing demographic structure, especially fall in fertility rates coupled with rising life expectancy. The resulting increase in the number of pensioners per worker leads to higher wage taxes and/or growth in implicit pension debt coupled with financing gap, thereby making the current pay-as-you-go pension system unsustainable in many countries.

If safety measures are not undertaken in response to aging of population then it is expected that the existing pay-as-you-go pension system will become insolvent in many countries. In order to avoid the dangers associated with pay-as-you-go pension system, the World Bank has recommended a multipillar pension system. These new arrangements contain three pillars [Holzmann (2000), Holzmann *et al.* (2005), James (1998)]:

- A mandatory, publicly managed, tax-financed pillar for redistribution,
- A mandatory, privately managed, fully funded pillar for savings, and
- A voluntary pillar for people who want more protection in their old age.

The most important of these arrangements is the second pillar. The justification for mandatory fully funded pension system is workers' myopia. A large number of people possibly will be shortsighted, might not save sufficient amount of money for their old age on a voluntary basis, and possibly will turn into a burden on society when they become old.

The rationale here for defined contribution system is that the close association between contributions and benefits in this new arrangement will discourage evasion, escape to the informal sector, and other labor market distortions because in this system people do not consider their contribution as a tax.

The justification for fully funded pension system is that under this system countries are not required to make promises today that they will be unable to fulfill tomorrow and it prevents large payroll tax increases that are required in a pay-as-you-go system with the problem of changing demographic structure. Furthermore it avoids large unintended intergenerational transfers from younger to older generations.

The characteristic of privately managed pension system implies that the investment strategy will be determined by the economic objectives instead of political interest. This produces the best allocation of capital and the highest return on savings. It helps countries develop their financial markets.

Several Latin American, OECD, and transition countries have already adopted multipillar systems, and many other countries are seriously thinking about the new system. Countries with large implicit pension debts are having difficulty in overcoming political opposition and transition costs. However, developing countries can choose a multipillar system almost from the start because they are at a relatively early stage.

The pension system reforms are taking place at a growing speed and it ranges from Latin America (Chile 1981, Mexico 1991, Peru 1993, Argentina 1994 and Columbia 1994) to OECD countries (Switzerland 1985, Australia 1992, United Kingdom 1986, Italy 1996). Moreover, debates on major reform options are in process in other Latin American

countries, some OECD countries, and many developing countries in Asia and Eastern Europe [Madrid (2002), Queisser et al. (1997), Disney et al. (2000), Schieber et al. (1996)].

Pension reforms can be grouped into at least two different categories involving minor reforms and major reforms. Minor or parametric reforms involve changes in parameters of current pension system such as contribution rate, structure of benefits and eligibility criteria [Aiyer (1997), Schwarz (2006) and Chand (1999)] whereas major or systematic reforms involve introduction of a new type of pension system like fully funded pension system to replace or complement the existing system [Schwarz et al. (1999), Holzmann (2000), Holzmann et al. (2005), James (1998)].

Since we are unable to find any relevant theoretical or empirical study with reference to Pakistan, there is need to probe this issue in detail and look for evidence on the need for pension system reforms for Pakistan. The present study explores the following issues with reference to Pakistan i.e.

- Whether there is a need for reforms in the pension system of Pakistan?
- Are we facing or are expecting to face in the next 20 or 30 years the same problems in our pay-as-you-go pension system as faced in several other developing countries?
- In case we are facing the same problems then should we substitute defined-benefit pay-as-you-go system by fully-funded defined contribution system based on individual account with minimum pension guarantee provided by government?

The remaining portion of the study is organized as follow. Section 2 discusses the theoretical and empirical literature on this area briefly. In section 3 motivations of reforming the current pension system are discussed. Recent institutional developments pertaining to pension are presented in section 4 and major issues for reforms are discussed in section 5. Section 6 discusses issue in new system design and section 7 concludes the study. Finally section 8 gives some policy guidelines for successful implementation of pension reforms.

2. Literature review

Most of the systems of old age security are publicly managed schemes and financed by payroll taxes on a pay-as-you-go basis. Pay-as-you-go public pension system is under increasing strain throughout the world. Over the next 35 years, the fraction of world's population that is above 60 would roughly double, from 9 percent to 16 percent [Schwarz et al. (1999) and James (1998)]. Rising life expectancy and declining fertility rates are resulting in problem of population ageing. More and more countries are facing this problem.

The actuarial projection that the Social Security trust funds will exhaust by the year 2030 in the U.S.A and most European countries has promoted interest in alternatives to shift from the pay-as-you-go system to a funded or privatized system Feldstein et al. [(1996), Boldrin et al. (1999)].

In many countries around the world the transition from unfunded pay-as-you-go pension system to fully funded pension system is now taking place. The specific rules and transition arrangements are different in all these countries but they all have the common feature of creating individual accounts [Feldstein (1997), Mitchell et al. (1997) and Carpio et al. (2002)].

Pension system reforms are usually necessitated by changes in demographic structure and the consequential financial unsustainability of many public systems. Pension system reforms are also necessitated several issues that are associated with pay-as-you-go pension system. One impediment of pay-as-you-go defined benefit systems is that the high payroll tax will possibly direct to labor market inefficiencies and results in evasion and escape to the informal sector, where efficiency is lower [James (1998), Sarrapy et al. (1996) and Corsetti et al. (1995), Wise (1997)].

Pay-as-you-go public pension system results in unintended intergenerational transfers, especially to high-income groups. In an unfunded system, intergenerational transfers take place routinely as a result of the aging and maturation process [James (1998) and Schwarz

(2006)]. Pay-as-you-go public pension system results in misallocation of public resources as scarce tax revenues are used for pensions rather than for health, education, or infrastructure [Schwarz (2006)].

Goswami (2002) and Gillingham et al. (2001) stated that the most serious trouble with the current pension system is that it fails to get in touch with the vast majority of population and no safety net is available for those who are not covered under the system.

The question is whether the reforms that will eventually be undertaken will be parametric or systematic that will not only protect elderly and lower income workers but also bring benefits to the macro economy. Parametric or minor reforms involve changes in eligibility criteria such as retirement age, the rate of contribution or the structure of benefits. These changes are representative of many pension reforms that are taking place around the world [Aiyer (1997), Schwarz (2006) and Chand (1999)].

Countries in the Latin American region have been at the front compared to other countries in initiating systemic major reform from pay-as-you-go defined benefit to fully funded, defined contribution pension plans [Schwarz et al. (1999)]. Although parametric or minor reforms alleviate some of the fiscal burden but fiscal problems reappear in the long run. The study concludes that the only way to effectively solve the pension system issue on a permanent basis is to move toward the fully funded system currently underway in Latin America, Australia, Poland, and Kazakhstan and under consideration in a number of other countries.

Privatizing social security system can offer extensive long run economic gains but these gains are neither free nor immediate. Some transitions have to face higher fiscal pressures [Kotlikoff (1996) and Kotlikoff et al. (1998), Serrano's (1999)]. Privatization of social security can generate substantial long run increase in output, capital stock and real wages in spite of the fact that initial elderly are compensated for their higher fiscal burden arising from the consumption tax [Kotlikoff (1996), Kotlikoff (1995)]. Corsetti et al. (1995) found much larger and sustained effects of replacing a pay-as-you-go pension system by a fully funded system in the framework of an overlapping generation model with endogenous growth and formal-informal production sectors.

The above empirical evidence on pension system reforms makes it clear that reforming the current pay-as-you-go pension system is inevitable in the light of changing demographic structure and to control the rising financial burden of public pension schemes. Several Latin American, OECD and transition countries have reformed their pension systems and many others are thinking to take initiative. The analysis of all these studies indicates that countries have to bear the short-term cost for reforming their pension system but the long-run benefits tend to outweigh the short-term costs. Furthermore, fully-funded pension system provides permanent solutions to fiscal problems of pay-as-you-go pension system and it will enhance economic growth and development through its positive effects on savings, capital accumulation and financial market development.

3. Old Age Protection .in Pakistan: Current State and Future Prospects

The debate on pension reform is gradually intensifying in Pakistan. The current pension system in Pakistan can be referred to as pay-as-you-go (PAYGO) system, which is hampering the economic performance of many developed countries e.g. those included in OECD[Disney (2000)]. Pakistan does not have a complete population wide-old-age income security system. Majority of old people continue to rely on support from their children for obtaining consumption in old age. A number of problems plague the pension system in Pakistan, including the following.

- There is a need for strengthening the formal channels of retirement savings because of the ongoing collapse of the traditional old age support mechanism and the rise in the elderly population.
- The existing pension system has low coverage, favoring the organized workforce while informal sector growing in size.
- The financial situation of government pension scheme is worsening because of rising system expenditure.
- Private sector workers are treated unfairly vis-à-vis public sector employees.
- Private annuity market is quite underdeveloped.

- Finally, the lack of proper and well covering pension scheme has hindered growth in saving rate, so crucial for promoting economic growth without reliance on external borrowing.

Major retirement saving schemes in Pakistan like provident and pension funds have coverage for workers in the organized sector. Most of the workers are engaged in the unorganized sector and have no access to any formal system of old-age security. Moreover, pension reforms are needed because of the fragmented nature of the existing benefit schemes. The existing retirement schemes have created great inequality between public and private sector workers. Public sector employees are honored with generous pension provision whereas workers in the private sector are either not getting any pension or pension granted to them is not sufficient to meet their old-age requirements.

In recent years, there have been some attempts to solve these problems. However, these efforts have largely been insignificant. The miscellaneous and conflicting set of problems faced by the pension system of Pakistan requires a more serious and consistent approach. On the one hand, there is a need to watch the growing expenditure on public pension programs despite a need to extend the coverage to the unorganized sector. Various government initiatives in the recent years such as suggested parametric reforms by the pay and pension committee and introduction of voluntary pension scheme by the Security Exchange Commission of Pakistan are inadequate, and further underline the need for an early and lasting reform of the current system.

Parametric/reform in defined benefits Pay-As-You-Go system will either reduce the level of pension benefits or require greater contribution from workers. Parametric/minor reform do not provide permanent solution to fiscal problems pay-as-you-go pension system as those just postpone the fiscal burden for the short period of time and open the door for yet another reform [Schwarz (2006)] as projections about fertility rate and life expectancy shows rising trend in life expectancy and falling trend in fertility rate [WDI (2009)] that results in increasing the number of pensioners per worker. Systematic reform in pension system provides permanent solution to fiscal problems of pay-as-you-go pension system. Many countries in the past 15 years have shifted from pay-as-you-go

defined benefit system to fully funded defined contribution system or to a mixed system having both components.

3.1 Pension Structure in Pakistan³

Pakistan, like most other developing countries, does not have a wide pension system to care for the elderly population against economic deprivation and difficulties. Perhaps the main hurdles in introducing a payroll-tax finance public pension system for each and every citizen attaining old age are the persistently high rates of poverty and unemployment. Instead Pakistan has adopted a pension policy that is restricted to cover the organized sector workers and ignores the vast majority of the work force in unorganized sector.

The present pension system in Pakistan was introduced in 1954 in the form of pension-cum-gratuity scheme, 1954 and has since been adjusted from time to time. Its main features are as follow.

- Retirement age is 60 years.
- Voluntary retirement is possible on completion of 25 years of service.
- No pension shall be given to a government servant who resigned from government job before completion of 25 year service; however gratuity may be payable.
- Pension rate is 70% of the last drawn salary on completion of 30 years service.
- If service is less than 30 years, proportionate reduction in pension is made.
- Commutation is restricted to 35% of gross pension whereas the remaining is paid in the form of net pension.

The pension system prevailing in Pakistan can be referred to as pay-as-you-go pension system. Under the pay-as-you-go pension system the pension contributions of active workers are used to finance the pension benefits of current retirees. A specified pension on retirement is

³ The discussion in this section is partly based on information taken from The World Bank (1998), Raziq (2005) and *Year Book of Finance Division* (2007).

provided to workers who contribute for a certain period of time, equal to a certain fraction of their salary.

According to Raziq (2005), Pakistan's present pension scheme for its public servants is a defined benefit in nature. Pension is determined as a percentage of final salary and length of service. There are no contributions to the scheme and the system is maintained on an unfunded basis, that is, presently there is no pension fund. Government of Pakistan exclusively finances the expenditure by obtaining a provision in the yearly budget for this purpose.

Employees having the government service of 30 years but not less than 25 years, retire with a pension of 70 percent of the value of basic pay plus certain other emoluments. Pension is not systematically indexed for inflation, though pension scales are revised occasionally to compensate pensioners for some of the loss of purchasing power caused by inflation. On the other hand, the provision of commutation facility at the time of retirement practically doubles the lifetime value of pension [World Bank (1998)].

Our analysis concentrates on pension because it is the main source of income support for civil service retirees. But as stated in World Bank (1998) and Raziq (2005), civil service retirees in Pakistan also receive several additional benefits including the following.

Gratuities to short-service employees

An employee receives 1 month's pay for every year served in case of having less than 10 years of service, or in case of job being abolished before 25-year minimum entitlement period, or 1.5 month's pay in the case of death or disability.

Family (survivor) pensions

The widows of pensioners collect 50 percent of the pensions at the time of death, to be paid for life or till remarriage.

Mandatory savings accumulated in General Provident Fund

It is mandatory for employees to contribute to this fund against which borrowings can be made during one's working career. Government does

not contribute to this account but pays an interest rate higher than market rates.

Survivor benefits provided by the Benevolent Fund

Employees must contribute 2 percent of pay to this fund, which pays a widow (or widows) generally 35 percent of wages for premature death or disability up to age 70.

Life insurance provided by the Group Insurance Fund

This fund contributes about 2.5 times the annual salary. Government pays premiums for the lower-grades employees only, while the higher-grade employees pay their own premiums.

Access to health facilities

Retired government servants are entitled and permitted to medical treatment at government expense at parity with facility accessible to the serving government employees. They also have the facility of reimbursement of medical charges.

To sum up, the government employees are provided with a broader social safety net than is available to population in general. Private sector workers are less fortunate in this regard. Under the current law, all employers with 10 or more workers are required to register themselves in Employees Old Age Benefit Institution, (EOBI), an old age, disability, and survivor benefit program. Employers are required to contribute five percent of the first Rs.3000 of an employee's wage per month to EOBI. However, most of the private sector employers do not register themselves in EOBI to avoid contribution that they have to make for the provision of old age security to their employees. This situation results in the growth of informal sector in Pakistan.

Hasan (2005) pointed out that at present in Pakistan the retirement savings tools and instruments are not adequate and a small number of them available are also not fully utilized because majority of the workers are self-employed. Public sector, which has vast coverage of pensions, is also a large employer. As a result, a greater part of the pensions given is by the government and these are typically defined benefit in nature. The defined benefit pay-as-you-go pension system generates a liability

and burden for the government. Moreover it also diminishes the motivation to save more than the requirement of the scheme. The employees miss the chance of getting pensions if they leave or switch to private sector too early.

Most common and familiar forms of private occupational saving schemes in Pakistan are gratuity funds and provident funds [Hasan (2005)]. With these schemes the contributed 'savings' can be used by participants as they change their jobs instead of retirement, so these schemes cannot be considered and classified as pension schemes. Presently, private occupational savings schemes, including pension funds, gratuities and provident funds are not being regulated by any agency [Finance Division Year Book (2007)]. There is no registration of occupational pension and saving schemes, nor are their statistics published on the number, assets, memberships or any demographics of pensions.

A number of tax advantages are provided to the employers, participants of pensions and invested assets holders under the regulation of private occupational pension and saving schemes documented by CBR. So CBR can be seen as a regulator of these schemes.

The Security Exchange Commission of Pakistan is trying to develop a regulatory framework for private occupational pension and saving schemes in order to develop a uniform system of pensions in the country. The Commission has recently introduced voluntary pension system (VPS). This is a voluntary defined contribution system in which anyone in Pakistan over the age of 18 years (salaried or self employed) with a valid National Tax Number is eligible to participate.

The VPS involves several tax incentives to make it attractive to potential participants. Under the VPS those individuals who are not covered under any pension scheme would also be capable to save for their old age by making tax-free contributions. Under the new system the contributions as well as the gains from investing them will be tax-free and tax shall be levied at the time of withdrawal of money. The most important advantage of VPS over defined benefit system is portability. Under this system people will have the power to make decision regarding the amount of investment, type of investment; moreover their savings would

remain with them even if they change jobs. The participants in VPS would also have the choice to change their pension fund managers if they are not satisfied with the performance of their existing fund managers.

The formal old age income security in Pakistan can be classified into two categories. The first category consists of statutory pensions with provident funds for the organized sector employees and the second category consists of voluntary pension system for self employed and unorganized sector workers

3.2. Motivations for Pension Reforms⁴

There are several compelling reasons that call for major reforms in the pension system in Pakistan to make it an efficient, equitable and ethically desirable social security system, thus fulfilling its goals in the long run. These motivational factors are discussed as under.

3.2.1. Population Ageing

The process of population ageing is a product of demographic transition caused by reduced mortality and fertility levels. The continuous fall in the fertility levels coupled with improvement in the mortality rate leads to a decline in the proportion of children and an increase in the proportion of population in higher ages, resulting in ageing of population. With increasing number of elderly population (consisting of those aged 60 years and above), the issue of evaluating pension and social security system has attained greater importance at both regional and global levels. It becomes essential for policy makers to adjust their pensions and social security systems according to the ageing population.

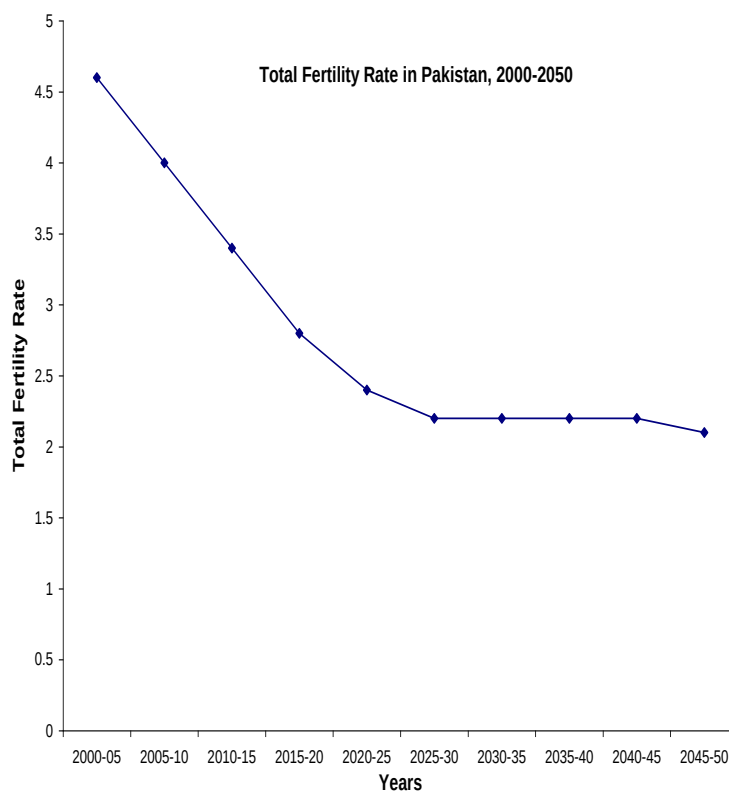
The population-ageing problem has recently gained greater importance across the world. The process of population ageing is more severe for developed region of the world. The developed region of the world has already experienced demographic transition, consequences of rising

⁴ The discussion in this section is partly based on information taken from Kanwer *et al.* (2005), The World Bank (1998) and Kardar (2006).

dependency ratio and the related challenges of developing pension systems. However, in many developing countries the problem of population ageing is in process.

In Pakistan, the process of demographic transition had started in early 1990s. A number of studies in the recent years have shown consistent decline in mortality with resultant rise in life expectancy and a reduction in total fertility rate in recent years [Sathar et al. (1998), Ali et al. (2001) and Hakim et al. (1998)]. So the proportion of elderly is expected to increase in coming years due to rising life expectancy and declining fertility rates. Figure i and Figure ii about future projections shows rising trend in life expectancy at birth coupled with falling trend in fertility rate in Pakistan [WDI (2006)].

Figure i: Future Projections for Total Fertility Rate at Birth in Pakistan



Source: WDI (2009)

Figure ii: Future Projections for Life Expectancy at Birth in Pakistan

Source: WDI (2009)

In Pakistan the proportion of elderly is still relatively low like some other developing countries that have recently started their demographic transition, but they have large number in absolute term because of the large population base. According to Population Censuses 1998, the proportion of elderly has ranged between 5.5 and 7 percent. The absolute number of elderly population has increased from 1.9 million in 1951 to 7.3 million in 1998 [Shresth (2003)].

According to Palacios (1996) the proportion of elderly population in Pakistan is expected to increase further, to 12 percent by the year 2020. The study focuses on the demographic indicators including the

percentage of population over 60, 65, and 75, the ratio of old to working age population and dependency ratio. In most cases the old age dependency ratio is defined as the ratio of persons over 60 years old to persons aged 20-59. The study has also chosen this ratio over other possible combinations based on the observed age distribution of contributors and pensioners in most public pension schemes around the world. Table i shows the projections of demographic indicators for Pakistan presented in Palacios (1996).

Table i: Projected Percentage of Elderly Population in Pakistan and Dependency Ratio

Years	Percentage of population aged 60 and above	Percentage of Population aged 65 and above	Percentage of Population aged 75 and above	Population aged 65 and above / population aged 15 to 64	Population aged 65 and above / population aged 20 to 64	Population aged 60 and above / population aged 20 to 59
1990	4.6	2.8	1	5.3	6.6	11.3
2000	4.7	3	1.1	5.5	6.8	11
2010	4.9	3.1	1.4	5.2	6.4	10.3
2020	6.3	3.8	1.9	6.1	7.2	12.4
2030	8.4	5.3	3	7.9	9.2	15.5
2050	14.2	9.3	6.3	13.7	15.3	25.5
2075	22.8	16.9	11.1	26.7	29.7	44.7
2100	26.7	21	12.7	34.7	38.7	54.9
2125	28.8	23.21	13.7	39.4	43.9	61
2150	29.8	24.2	14.2	41.7	46.4	64

Source: Extracted from the tables appendix I.B.2, I.B.3, I.B.4, I.B.6, I.B.8 and I.B.10 in Palacios (1996)

The table shows rising proportion of elderly, rising dependency ratio and falling support ratio. If the dependency ratio is defined as the ratio of persons over 60 years old to persons aged 20-59 then population-ageing problem is expected to become severe for Pakistan after the year 2010. Approximately the same situation prevails if we change this ratio with other possible combinations.

In Pakistan majority of the labor force is engaged in the informal sector. As a result most of the old people do not have access to any formal

pension or social security scheme. So, in the situation of rising poverty in Pakistan, it is expected that older people will have to face more difficulties in life. This is because the old values and traditions of providing care and respect to older people are becoming uncommon due to rapid modernization, urbanization, and the resulting economic and financial pressures.

In view of the expected rising proportion of elderly in Pakistan, it becomes important for policy makers to amend their pension and social security system according to the ageing population. Moreover, given the continuing trend of declining informal support channels for older people, this population ageing emphasizes the need for proper formal system for old age economic security.

3.2.2. Breakdown of Traditional Support Mechanism

Pakistan is experiencing the breakdown of traditional support mechanism for older people based on strong family institution. In the past elderly were able to live with their children and derive support from them but now the breakdown of joint family system side by side with pressures of urbanization and migration are leading to deteriorate the traditional means of support for elderly population. [Shresth *et al* (2003), Silva (2004)].

3.2.3. Low Coverage and Focus on the Organized Sector

Existing pension system in Pakistan covers the organized sector workers, constituting less than 10 percent of aggregate labor force. The pension system covers close to 3.5 million government employees (of whom 0.6 million are in armed forces. Pension payments to them account for more than 45 percent of total pension expenditure), representing a mere two percent of the population and under 10 percent of labor force [Kanwar *et al.* (2006)].

3.2.4. Inequity within the Organized Sector

The current pension system has been highly fragmented because of the unequal benefit levels within the organized sector as public employees

are treated generously and liberally in comparison to private organized workers. A prominent feature of current pension system is the difference in range and levels of benefits within the organized sector. In addition to a self-contributory provident fund, generous defined-benefit pension privileges, which provide protection against long life and possibly the inflation risk, are given to public employees. On the other hand, in the private sector either the workers are not getting any pension benefits or the pension benefits given to them are not adequate to meet their old age requirements.

3.2.5. Rising Financial Burden of Public Pension Scheme

The expenditure pattern of the noncontributory, unfunded pay-as-you-go public pension program is exerting pressure on budgetary allocations. There is rising trend in pension expenditure of Pakistan and it is expected to increase further as more and more civil servants retire.

Figure 4.3 shows moderately rising trend in pension expenditure of federal civil servants pension. The public sector encompasses provincial, municipal as well as central governments. It also includes military pension spending, but information on provincial, municipal and military authorities cannot be displayed due to complications in data availability.

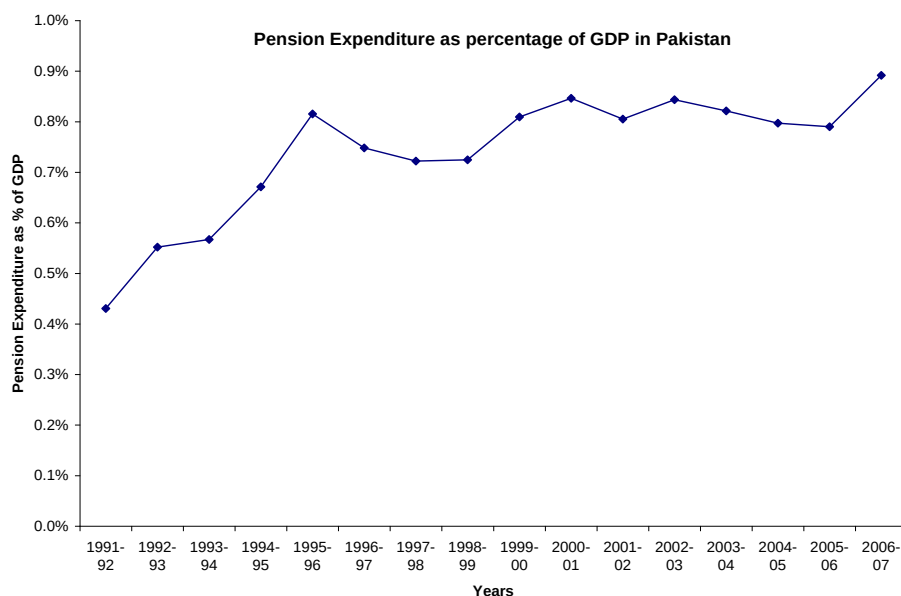
Palcious (2006) stated that in large countries with federal system of government, the magnitude involved in provincial and local governments can be substantial. In some cases like India, Mexico, and Pakistan, the number of civil servants in sub-national government are greater than those at federal level. In most countries, pensions paid to retired soldiers encompass a major part of pension bill. This is especially true in India Jordan and Pakistan, having large armies.

Figure iv shows military versus civil servants pension expenditure in India and Pakistan during the period 1993-2004. In case of Pakistan expenditure on defense pension has been more than the spending on civil servants pensions. If military pensions continue to be financed on a pay-as-you-go basis and early retirement is allowed then the ratio of pensioners to contributors will increase. Consequently the required contribution rate will grow rapidly over time to finance pension benefits.

Moreover, military pensions that begin to be paid when retired soldiers are young are not consistent with the objectives of pension system that are established to deal with old age.

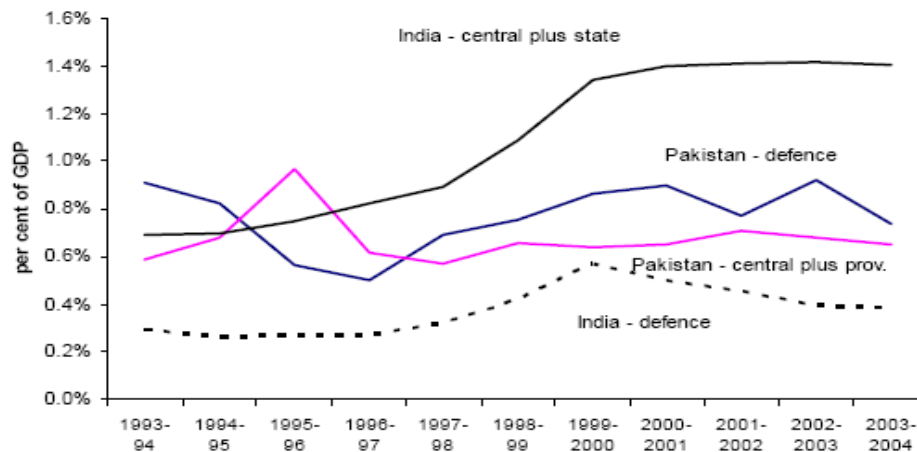
The annual federal civil servants pension payments have increased from rupee 12 billion in 1991-92 to rupee 46 billion in 2006-07 (Figure iii) and the system is threatening to become unmanageable as more civil servants retire. If attempts are not made to control pension expenditure then in the near future it can be harmful for Pakistan economy because the increment in pension expenditure would lead to increase in indirect taxes, reduced development expenditure or increased government borrowings. Moreover, the most interesting fact of pension system in Pakistan is that in armed forces there are more pensioners than active workers. As life expectancy increases, this situation will become even worse.

Figure iii: Actual Expenditure on Civil Servants Pension as % of GDP, 1991-2007



Source: Based on data taken from AGPR Pakistan and various issues of Economic Survey

Figure iv: Pension Spending for Civil Servants and Military in India and Pakistan, 1994-2004



Source: Palacios et.al (2006)

3.2.6. Commutation Facility to Government Employees

Civil servants are given a facility called commutation, under which they can commute 35% of their pension in lump-sum form at the time of retirement. Lump-sum provisions are also available around the world. But the terms and conditions under which commutation facility is available to government employees in Pakistan are unique in the sense that commutations, which in essence all advance payments, are available without discounting. However, in other pension system the amount paid is discounted to reflect the time value of money.

So, in Pakistan the entire interest cost associated with commutation is borne by the government. The payment of commutation without discounting doubles the government's long-term and unfunded fiscal liability for such pensions. So, in Pakistan the current commutation facility is more generous than it should be. It is subject to the following major problems.

3.2.6.1. Pensions as Insurance

The fundamental function of pension is to provide insurance against long life. There is no reliable way to assess longevity of government employees. The long-lived person could be at risk of outliving his or her assets. The losses on long-lived persons can be offset by savings on those who die earlier. So, with practice of commutation the employer's ability to pool longevity risks is reduced and the cost of pension provision is increased for the government because both long-lived and short-lived persons receive large portion of their pension payments on the day of retirement. Moreover, there is greater possibility that pensioners may outlive his or her assets, because people who receive a big amount once in life face the risk of making mistakes with this money. Ultimately, we can say that the current practice of commutations is more generous and risky for its beneficiaries.

3.2.6.2. Complications in Reforming Compensation Package

The practice of commutation creates hurdles in reforming compensation package as a whole. For example, government cannot consider monetizing certain in-kind pay and allowances without revising the structure of commutation because doing this would mean that government pension liabilities would explode. There can be the possibility that pension payments would exceed the pre-retirement compensation.

3.2.7. Early Retirement

In other countries employees who want to retire before the normal retirement age have to accept reduced benefits, calculated on the basis of their life expectancy, to reflect the longer period during which they will collect benefits. But the system prevailing in Pakistan is unique in the sense that employees who want to retire earlier reap higher benefits because the practice of commutation allows them to get half of a larger number of year's benefits in lump sum form. This situation will further explode the government pension liabilities in future due to population aging.

While early retirement can be used to have rapid changes in workforce than could be achieved through natural phenomena but the government should be careful not to commit the mistakes that some countries have made. In this regard the examples of Hungary and Poland are notable. Both countries are now paying a significant share of their budgets and GDP for retirement benefits and are unable to finance many needed expenditures notably on improvement in health and education [World Bank, (1998), European commission (2007)].

3.2.8. Income Security Gaps to Civil Servants

Civil servants are still facing income security gaps both during their work careers and after retirement. The current pension system ignores short service employees. Any employee who serves less than 25 years receives no pension, although a gratuity might be payable. Employees are entitled to disability pensions after meeting the criteria of at least 10 years of service.

3.2.9. Lack of Indexation

Pension benefits are not systematically indexed for inflation. Although retirees receive only half of their pension in annuity form but inflation will quickly erode the purchasing power of pensions. Though occasional increases have compensated pensioners for some of the losses in purchasing power caused by inflation but these occasional increases depend entirely on the will of government. Therefore, employees face further threats to their income security after retirement.

3.2.10. Pension Related Obstacles to Job Mobility

The current pension system does not serve the interest of emerging markets. Government employees are facing pension related obstacle to job mobility. They cannot leave their jobs before reaching pension eligibility because of the cost of losing their pensions even if better job opportunities are offered to them. Most of the government employees getting better job opportunities take leave from their government jobs and perform their duties in private sector. Because of this situation both the government and economy at large are worse off.

3.2.11. No Private Annuity Market

In Pakistan there is no formal private annuity market. Lack of pension annuities further complicates old age economic security. The insurance companies do offer something but at a very high cost, as they have very high administrative cost [Kanwer et al. (2005)]. Therefore, some incentives are needed to provide equity exposure to the investors at a feasible cost.

4. Recent Trends in Pension Reforms⁵

The government of Pakistan is gradually thinking to reform the pension system to reduce government's rising pension bill that has increased enormously during the last several years.

The Pay and Pension Committee of 2001 observed the above issues, and recommended a number of changes to pension system that were later implemented. It recommended that a new Defined Contributions (DC) system should be introduced for new employees. In the year 2002, Cabinet took the decision that a contributory pension scheme be launched for employees entering the service after a set date.

Keeping in view the Cabinet decision, the federal government recognized an Actuarial Office (AO) under the Ministry of Finance (MoF) at the end of the year 2002. The AO took the responsibility of estimating the existing liability of pension payments and suggesting different alternatives to reform the pension system.

In 2004, Government of Pakistan established a special Pension Reform Working Group (PRWG) to assess different proposals and to develop recommendations for reforming the pension system in the country. PRWG consisting of the members from the Ministries and Actuarial Office presented its report to the Pay and Pension Committee in March 2005.

⁵ The discussion in this section is partly based on information taken from Kanwer, *et al.* (2005), Raziq (2005), and Hasan. (2005).

On the basis of suggestions of the PRWG, Actuarial Office and Pay and Pension Committee of 2004, the government has now been considering introducing Defined Contributions (DC) scheme for workers who joined the service after 1st July 2006.

Furthermore, parametric reforms were suggested to reform the existing Pension Scheme for the existing employees. The Government of Pakistan took into account these recommendations during the finalization of the Budget proposals for the FY 2005-06. However, government only reduced the commutation percentage by 5%, keeping in view the affordability and other factors.

The existing pensions system, which is also being reformed for the existing employees, is recommended to be withdrawn for future employees to reduce the government pension liabilities. The Pay and Pension Committee pointed out that if the pension reforms were not introduced instantly, the pension bill would rise enormously in the years to come, thus becoming the main burden after defense spending. The pay and pension committee recommended that new employees should be covered under a new Defined Contributory Scheme after which existing pension and commutation schemes would not be available for the new employees.

The previous pay and pension committee had also recommended the eradication of distortions in the pension system. The committee had clearly pointed out that existing pension scheme should be discarded and replaced either by a restructured affordable scheme or by a gratuity scheme.

To reduce the pension cost under the first option it suggested measures like alteration in pension formula, discouraging early retirement, reduction in commutation, discontinuation of the extra benefits given on occupation related disability, suspending the policy of indexing the pension. In the second option, it was suggested that the most preferred alternative, which would significantly reduce the cost, was to replace the pension facility by a gratuity scheme for all existing employees and new entrants in future.

However, Pay and Pension Committee had observed that no serious attempt had been made to take action now in order to prevent the situation from becoming out of control in near future.

While discussing the recent trends in pension reforms, it is worth noting that Pakistan has taken a step forward in pension reforms by introducing Voluntary Pension System. The Security Exchange Commission of Pakistan has designed a new Voluntary Pension System (VPS) under the Voluntary Pension System Rules, 2005. The new Voluntary Pension System is based on several tax incentives and it is also flexible in terms of contribution, asset allocation choice and, above all, portability.

Under the VPS those individuals who are not covered under any pension scheme would also be eligible to save for their old ages. The main argument for the introduction of private pension system in Pakistan is that it provide an option for old-age security to the large number of people that are not covered under any pension scheme. As the contributions into the pension fund are tax free in VPS, the tax inducement in private pension system is expected to boost both investment and saving.

5. Key Issues for Reform

The preceding section point out certain limitations of the current pension system and bring some serious issues related to reforms in focus. The deficiencies of the existing pension scheme highlight the need to commence some reformatory steps. The most important is how to compose the reform and what are the critical issues that need to be considered. The following issues come out from the previous discussion.

- Firstly, the instant challenge for Pakistan is to propose and put into practice a reform strategy that can restore the long-run financial feasibility of public pension schemes. There is a need to control rising trend in the expenditure pattern of the defined-benefit, pay-as-you-go, public pension program. Generous pension benefits coupled with health benefits provided to the retirees can threaten the financial sustainability of public pension scheme. A reassessment of the benefit and contribution

structures can make certain the fiscal sustainability of the public pension schemes.

- Secondly, without reforms in investment policies, the provident and pension funds cannot provide sufficient replacement rate to elderly people. Moreover policies pertaining to withdrawal of accumulated balances need to be reviewed. The current provision of liberal non-refundable withdrawal often results in insufficient stipulation during old age. Thus, limited withdrawal services coupled with some form of compulsory annuitization is essential for adequate provision in old age.
- The most important issue of extension of coverage to control poverty among the aged population needs to be considered. It is not feasible to move towards a universal, publicly managed social security system covering every citizen attaining old age. There are a number of reasons for this. First, public pension schemes are already under great financial stress due to generous and liberal benefit structure. Second, massive poverty, unemployment, low tax base, and tax evasion entail that capacity and eagerness to contribute in a joint system may have narrow scope in Pakistan.

So, there is a need for adopting a realistic approach to expand pension coverage in Pakistan. This approach basically necessitates a right strategy to strengthen the second and third pillars (the second pillar for mandatory savings and the third for voluntary retirement savings) of pension system. Coverage can be expanded through introducing mandatory, individual account based, defined contribution pension schemes and voluntary retirement saving schemes to enhance the retirement income.

An individual account, in defined contribution system gives significant choices to participants regarding risk exposure. The main advantage of individual account is that the participants consider their account balances as personal wealth. This creates incentives for the individual participants to take interest in governance issues and functioning of the system.

Since individuals make choices regarding risk exposure and the choice of fund manager/investment type, the system necessitates condensed efforts in terms of good governance. Moreover, the system of individual

accounts provides security against the political risk that people have to face in pay-as-you-go defined-benefit system. The recent introduction of Voluntary Pension System in Pakistan suggests that Pakistan is moving in the right direction.

6. Issues in System Design

6.1 Disjointing Fund Management and Annuities

The pay-as-you-go defined benefit pension system results in vertical integration between two activities

- Fund management in accumulation phase
- Paying annuities in benefit phase

There is strong consensus that these two activities should be decoupled [Shah (2005)]. The main reason for this division is the elimination of assurance about the pension that will be paid in future. Promises about monthly pension payments are made only at retirement date based on the switching of stock of pension assets into flow of annuities calculated on the basis of mortality projections and interest rate that will then prevail. So the key aspect of modern pension design is the separation of the accumulation phase from the benefit phase. In the accumulation phase the employee requires fund management services from the institution where he is working and in benefit phase the pensioner has need of a life insurance company to sell him an annuity. Hence, the decoupling of accumulation phase from benefit phase requires a pension regulator that deals with all the problems of pension system, from the date a person starts his/her job career until the date that annuity is purchased.

6.2 Function of Individual Accounts

An individual account, in defined contribution system gives significant choices to participants regarding risk exposure. The main advantage of individual account is that the participants consider their account balances as personal wealth. This creates incentives for individual to take interest in governance issues and functioning of the system.

As individual makes choices regarding risk exposure and the choice of fund manager/investment type, so the system necessitates condensed efforts in terms of good governance. Moreover, the system of individual

accounts provides security against the political risk that people have to face in pay-as-you-go defined benefit system

6.3 Administrative Cost

The most important issue with individual account is administrative overhead and transactions costs, especially when contributions or account balances are small [Whitehouse (2000)]. This issue is particularly important in developing countries like Pakistan where average contribution and average account balance would be small. So large transaction cost can adversely and negatively affect the pension accumulation

The OASIS (Old age social and income security) committee had proposed that centralization of recordkeeping, at an agency called Central Recordkeeping Agency (CRA), could yield significantly lower transaction costs [Shah (2005)].

6.4 Redistributive Feature in Benefits

The design of pension system should include a redistributive component for individuals who have assets below a certain threshold level. But without having a system of unique citizen identity number, it is not possible to have a redistributive component in pension system of because without having this system individuals would have incentives to open more than one account and received improved benefits.

Once we have this system then it is possible and feasible to think of redistributive mechanism, where the poor individuals in the pension system are provided with the state financial help when they retired with scarce pension asset.

6.5 Strategy for Premature Withdrawals

Many low-income individuals in a pension system face credit constraints. So when faced with consumption shocks, they find it reasonable to look for some ways in which pension wealth can be used in consumption smoothing.

A system where there is no restriction on premature withdrawal is not realistic. As in India there is experience employee provident fund (EPF), where withdrawals are permitted. EPF uses a tax treatment where contributions, asset returns and premature withdrawals are all tax-free. This has given an outcome with a high rate of withdrawals [Shah (2005)]. This policy is not desirable.

As for as Pakistan is concerned, government employees have the facility of non-refundable advances from general provident fund to the extent of 80% of their balance in the fund on attaining the age of 45 years and 100% on attaining the age of 50 and 55 years[Raziq (2005)]. Government employees further have the capacity to obtain an advance against their credit in the fund that is to be repaid in installment from their pay. This situation also results in high rate of withdrawals.

Besides, prohibition of premature withdrawal is also not realistic in a country with heterogeneous mortality. So the pension system which forces pension wealth to be illiquid until age 60 will not serve the need of each and every citizen. This situation suggests that the design of pension system for Pakistan should avoid complete illiquidity.

6.6 Simplicity in Pension System Design

The issue of simplicity in pension system design is most important due to a large number of unsophisticated users of pension system that we expect in Pakistan. Moreover the design choices that support simplicity are also favorable in terms of lower transaction cost. The goal of simplicity is associated with having a small set of choices with special provisions to make it easy for unsophisticated users to engage in performance comparisons of investment product types and pension fund managers.

6.7 Feature of Portability

A key feature of new pension system is portability. There are two levels of portability:

- The first level of portability is related to the movement of an individual between government jobs and non-government jobs.

The pension wealth of the individual should stay with him/her even if he/she leaves a government job and join the other one, government or private.

- The second level of portability is related to shifting of pension accounts across job changes, portability of pension assets across multiple fund managers and investment products.

7. Conclusion

In this section we conclude the study and suggest an alternative approach to avoid the problems associated with pay-as-you-go pension system in Pakistan. The problems that the current system is facing now are as under.

- Rising life expectancy coupled with declining fertility rates are resulting in changes in the age structure of the population. This demographic transition will soon lead to an increase in the proportion of elderly population in Pakistan. Thus the economic burden on the current and future young generations to support their elderly is expected to rise in future.
- The conventional means of support for the elderly through strong inter-generational family ties are also likely to dry up as the joint family system in Pakistan is gradually breaking down.
- The existing pension system in Pakistan has very low coverage and the fiscal resources are collected from broader population to cover pension for the minority.
- The current pension system in Pakistan is highly biased in favor of public sector employees who are treated quite generously in comparison to private sector workers who do not generally have access to any worthwhile old-age security system.
- The pension system for the public sector employees operates as unfunded (pay as you go) system, which places substantial financial pressure on budgetary allocations.
- The payment of commutation without discounting doubles the government's long term and unfunded fiscal liability for pensions. Employers' ability to pool longevity risk is reduced with the practice of commutation, so the cost of pension is increased for the government. This practice also creates hurdles

in reforming compensation package as a whole, e.g. monetizing compensation without revising the structure of commutation would mean that government pension liabilities would explode.

- Efforts to reduce the burden of pensions by early retirement schemes, mostly in the form of the so-called golden handshake schemes, are on the rise in Pakistan. Most of these scheme aim at downsizing the pool of employees in various public sector and semi-government organizations that are up for privatization. This practice has reduced the supply of experienced labor in many professions.
- Uneven pension schemes across sectors and across professions have created unwarranted obstacles to job mobility.
- Properly functioning private annuity market is almost non-existent in Pakistan.

The above-mentioned problems indicate that there is a need to reform the pension system of Pakistan. Fully-funded pension system can help to strengthen the formal channels of retirement savings and can help to get rid of these problems. If the decision to reform the pension system is not taken in time then in the near future rising pension expenditure can be harmful for Pakistan economy on various accounts. The foremost impact will be the increase in pension expenditure, which will in turn lead to increase in indirect taxes, reduction in development expenditure and/or increase in government borrowings. Other consequences include increased inequality among elderly population segmentation of labor between public and private sectors and the resulting incoherence in the society.

Although some efforts to reform the pension system had been made to reduce the government's rising pension bill, yet despite realization of the problem no serious effort had been made to reform the pension system in a fundamental way to avoid the situation from getting out of control in future. Moreover, systematic reforms or a shift to a fully-funded pension system can solve the fiscal problems of pay-as-you-go pension system forever, whereas parametric or minor reforms just postpone the fiscal burden for a short period of time and open the door for additional minor reform in future.

The existing theoretical and empirical literature on efficiency and growth effects of pension reforms indicates that pension system reforms have positive impact on national savings and financial market development, which in turn contribute to long-run economic growth.

8. Policy Guidelines

A number of initial conditions need to be in place before a shift from pay-as-you-go to fully funded system can be implemented successfully. These initial conditions include the following.

- There is a need to create an enabling environment for the successful implementation of pension system reform. Awareness about the strengths and weaknesses of pay-as-you-go and fully-funded pension systems need to be created through information dissemination both at intellectual and academic levels.
- There is a need to have at least a small number of sound and well-functioning banks and insurance companies. Pension-fund managers need to be carefully selected based on past performance and current management and services. To minimize the investment risk, international diversification may also be allowed to pension-fund managers.
- Finally, pension system reforms require a strong role of the government. There is a need to develop a regulatory framework to protect pension participants from the whole range of capital markets, insurance, inflation and other risks.
- Above all, further research on the issue needs to be undertaken. The present study is primarily academic in nature. It is hoped that this study will create awareness of the problem and contribute to understanding of the issue among academic circles as well as policy makers. Future research needs to be undertaken with a more practical approach.

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