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The Potential Effects of Unemployment and Inflation on Currency Crisis under Fixed Exchange Rate System in a Small Open Economy: Jordan Case

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Abstract

The paper investigates the potential effects of macroeconomic variables on currency deviations as indicator for currency crisis under fixed exchange rate system in a small open economy of Jordan; where larger currency deviation of the real exchange rate from the nominal exchange rate implies depreciation of Jordanian dinar and potentially may lead to currency crisis. Running ARDL regressions and DOLS estimator for robustness and sensitivity checks; the results indicates that high and persistent unemployment rates and high inflation rates have high long-run multiple significant effects on increasing currency deviations. Control variables such as reserves growth, trade openness, and terms of trades have negative significant in reducing currency deviations but their long-run multipliers shows small effects particularly reserve, implying temporary remedy role of reserves in reducing currency deviations; but the results of domestic and external debts, remittances and grants are found to be insignificant. The paper concludes that high unemployment rates may lead to currency crisis as predicted by Obstfeld (1996) model; in addition the multiple costs of high inflation and unemployment rates outweigh the benefits from reserves growth, trade openness, terms of trade that may lead to currency crisis. The results of this paper provides a guiding tool to the monetary authorities and policymakers in Jordan of the key macroeconomic variables that affects the Jordan's domestic currency, which needs to be considered or maintained in the design of an appropriate ER policy to avoid future currency crisis.

Keywords: RER, NER, CURRDC, Currency Crisis, Unemployment, Inflation

1. Introduction

The presumption that small developing countries suffer from economic instability around the world and the fear from high volatility in the exchange rate (ER) led to the belief that adopting a fixed ER system would be the most suitable to reduce the instability of domestic economy in terms of prices, inflations, and other economic variables, on the believe that sustainable growth and employment can be only achieved with pegged regime. However, in today's open economies and under the impact of the global dynamic economies there have been greater emphases and arguments on the effectiveness of fixed ER policy in maintaining price stability and promoting the growth of a domestic economy that can be conducted by monetary authorities in small open countries. The discussions of several models of exchange rate policies implies that the stability of real exchange rate (RER) in today's open economies reflect the stability of domestic economy in terms of the performance of macroeconomic variables such as inflation, consumption, production, income, employment, exports, imports, or growth indicators of the economy; where the RER depends on the supply and demand of domestic currency that is derived from the supply and demand of goods and services in an economy, in turn high deviations of the RER from the nominal exchange rate (NER) may lead to currency crisis.

In the late 80s Jordan country ran into a period of stagnation that incurred considerable costs on Jordan economy. Large deficits accounted for 20% of GDP in which brought the economy into economic and Balance of Payments (BoP) crisis. Jordan was unable to meet its debt obligations where total national debt reached twice the size of the country's GDP in 1989 resulted in the highest per capita debt burden in the world; reserves were depleted, real GDP per capita became the lowest since 1979, and unemployment rose to 20% (Hogan and Cavatorta, 2013; Abugattas-Majluf, 2012). The negative shocks to Jordan in 1988-89 led to high inflation and severe economic recession. The crisis brought serious problem in the confidence and credibility of the economy to meet its obligation where the Jordanian dinar lost more than 45% of its value in 1988 coupled with the lack of foreign reserves which forced the Central Bank of Jordan (CBJ) to float the dinar during crisis that contributed to further depreciation of the dinar and serious economic panics (Hogan and Cavatorta, 2013; Sweidan, 2013).

As a result of public debt accumulation, sharp currency depreciation and dramatic drop in the economic

activities, Jordan entered into a structural adjustment reform programme with the IMF and World Bank in the early 90s to support and fund the country in order to curb the effects of BoP crisis and to move the country into market oriented economy to investment climate and generate growth (Dejong, 1995; Abugattas-Majluf, 2012; Sweidan, 2013). The five year restructuring plan includes immediate devaluation of the dinar in order to stop reserves depletion and the continuous attacks on the domestic currency, encourage exports, lower the budget deficit, restructure public expenditure and reduce inflation (Dejong, 1995). Although the reforms brought trade liberalisation with US and EU, changed some aspects of macroeconomic policy by increasing the role of private sector but these reforms did not alter the way in which the Jordanian economy operates relying on significant amount of external sources of grants and remittances and the state sector remained the paradigmatic one (Hogan and Cavatorta, 2013). The fixed rate of the Jordanian dinar remained overvalued over time which meant there is a significant increase in domestic costs in terms of foreign currency that would bring implication on the allocation of investment (Abugattas-Majluf, 2012). While the reform plans led to a significant growth in GDP rates in the 90s, however such growth and the liberalisation of Jordan economy has not translated into reducing unemployment rates which remained stuck between 12-15% over more than twenty years (Hijazi and Haddadin, 2006).

Since the issue of Jordanian Dinar (JOD) in the fifties, the CBJ followed several approaches of fixed ER systems seeking the stability of the JOD as an essential monetary tool for investment and growth; from pegging with the US dollar, or basket of foreign currencies or Special Drawing Rights (SDRs). However, the ER policy would have implications on an economy in terms of its internal and external balance if it is not managed or applied properly relevant to the characteristics of domestic economy. We may then argue that the monetary authority's efforts in lowering inflation rate and attaining price stability are highly dependent on the strength and stability of the RER in which monetary authorities try to control economic fundamentals using appropriate fixed ER policy. This implies that the costs of fixing the ER will be harsher on the economy the more deviations of the RER from the NER that may lead to currency crisis. This study shall address the implications of the fixed ER system adopted in Jordan small open economy by investigating the potential effects on currency crisis that may result from the high deviations of the RER from the NER which may be derived from the effects of high and persistent unemployment rates and high inflation rates, together with the effects of other macroeconomic variables in Jordan.

The reminder of this paper shall be structured as follows: section two reviews the theoretical and empirical work. Section three defines the data and methodology that will be used for the investigation of the research problem. Section four reports the empirical results. Section five provides a conclusion of the results and analysis.

2. Literature Review

Levy-Yeyati and Sturzenegger (2003) finds that pegged regimes are exposed to larger and more frequent currency and financial shocks on the belief that the differences of negative effects of external shocks on developing economies are related to adopting different ER policies. The instability of macroeconomic policies and high inflation during the eighties among developing countries led to the desirability toward more flexible ER systems, on the belief that the gains from inflation under fixed ER are illusionary; there are high inflationary costs from such policies that are financed to by larger budget deficits to generate temporary growth (Harrigan, 2006). The financial crises of 1997-99 are associated with the abandonment of several pegged regimes, these crises in Latin America and Asian countries showed that countries with more flexible ER systems were able to adjust their RERs much better so that the nominal devaluation of ER was translated into a change in relative prices which helped prevent further costs in terms of output; implying that the price of targeting low inflation under fixed ER system ends with prevalent financial and economic instability (Chang and Velasco, 2000).

Empirical work confirmed the role of the behaviour of fundamentals in predicting currency crises of 1990s in Europe, Mexico and Southeast Asia which maintained a fixed ER over ten years, because macroeconomic policies became increasingly costly as the year of devaluation drew nearer as noted by the rundown of international reserves and the increase of current-account deficit with the arrival of currency crisis shocks (e.g. Edwards, 1989). Empirics found for 80 devaluation incidents in Latin American countries that the probability of exiting a fixed ER system had increased with the real overvaluation of ER and with the decline in the level of foreign assets; structural factors, such as the degree of openness of the economy, geographical trade concentration, and duration of the peg regimes also influenced the monthly probability of ending a fixed ER (e.g. Klein and Marion, 1997). These findings reinforce theoretical assumption that any economic objective is possibly part of the government's social welfare function involves a trade-off between fixing the ER and other

fundamentals goals particularly for developing economies that have much variance in their macroeconomic variables than industrial economies, which implies why the analysis of currency crises and fundamentals in developing economies led us understand the fragility of fixed ER system. (Flood and Marion, 1999)

Evidence shows that the RER is the key variable in the adjustment process for the stability of macroeconomic variables (Hoffmann, 2007); there are several indicators that would have effects on the RER movements and thereby on currency deviations. Empirical analysis found that unemployment rates have significant effects on the real value of domestic currency in China but have no effects on interest rate differentials, implying important role of unemployment rates in China's ER regime (Fu and Lin, 2012). Hazari et al. (1992) shows that unemployment rate is a key determinant of the RER movement in the short-run (SR) but not in the long-run (LR) for least developing countries. Cady and Gonzalez-Garcia (2007) finds that there is a significant effect of foreign reserves liquidity in reducing the volatility of ER; implying the important protective role of reserves against financial crises and thereby reducing risk perceptions regardless of the ER policy adopted by an economy (Gumus, 2016). Kohli (2015) finds that adequate reserves in India reduce the ER volatility irrespective of the two ER systems adopted in India before and after 2010; Kohli findings are in line with Obstfeld et al. (2010) that holding adequate reserves is important even when the ER movement is determined by the market, implying that the level of foreign reserves is critical to the stability of the RER in the uncertain financial environment.

Fuentes and Ibarraran (2012) stated that higher degree of trade openness for developing economies helps absorbing RER crisis through encouraging international trade and production and thereby improves the supply and demand dynamics of the country's ER. Mendoza (1995) empirical study on the business cycles in G-7 and 23 developing economies founds that deterioration in terms of trade (TOT) causes depreciation in domestic currency and the change in TOT produces deviations from PPP, where TOT shocks accounts for 45-60% in the variability of GDP and the RER. Chia and Alba (2006) concluded there are large fluctuations in prices and the RER in a small open economy when the economy is hit by TOT shocks but smoother impact under flexible ER than pegged currency in favour of Friedman hypothesis that the adjustment process under floating ER has the absorption advantage to the domestic activity in lessening the impact of external shocks on output and growth.

Results by Rueda et al. (2008) on 26 developing and emerging economies during the period 1970-1999 showed that international trade measured by the ratio of exports to imports, as well devaluation and reserve losses have significant effects in explaining currency crises. Kaminsky, Lizondo and Reinhart (1997) identified that exports, output, ratio of broad money to reserves, equity prices, and the deviations of the RER from the trend are reliable variables in predicting currency crises (Kruger et al., 2000). Karahoca et al. (2013) showed that an overvalued RER increase the probability of currency crises among other indicators such as the change in foreign reserves and in foreign interest rates; also high public debt raise the vulnerability of the economy and cause capital outflow thereby increases the probability of currency crisis. The Turkish currency crises in 1994 preceded with an increase in the deviation of the ER market value which thought to be a major cause of crisis (Ozatay, 2001). The empirical finding to investigate the distinctive characteristics of the behaviour of ERs in the pre-crisis period in the Asian countries shows that pegged ER systems contributed significantly to currency crisis of East Asia countries during 1997-98; the rigidity of ER systems in Asian countries resulted in macroeconomic imbalances (Alba and Park, 2007).

Murray (2000) highlighted that the inability of NER under pegged regime to adjust to economic shocks generates economic pressures shifting the effects of such shocks into the variability of other macroeconomic variables such as output and employment. Also, a fixed ER cannot alone maximise microeconomic benefits because the parity values from converting one currency into another can change and thereby generate ER uncertainty. Williamson (2007) indicated that most economist recognise two costs to fixed ER, one is the danger of ER deviation relative to the anchor currency and the second cost embedded in losing independency of monetary policy.

The general criticism against fixed ER system is the weak accountability of policymakers to achieve anti-inflation targets, and the probability of peg regime to increase financial fragility and speculative attacks on domestic currency that may lead to financial and currency crises. Obstfeld and Rogoff (1995) argued that countries peg their domestic currency by raising interest rates sharply in order to defend or maintain their fixed currency rate pay high costs resulted in increasing unemployment and damaging the balance sheet of financial institutions; the increased costs of maintaining the pegged currency may generate massive costs and intervention to defend the domestic currency as speculators starts to question the ability of the government to continue its commitment to peg the ER, as seen with the several incidences of Europe in 1992, Mexico in 1994, and more recently in South-East Asia witnessed currency crises of this kind. (Mishkin, 1998)

2.1 Theoretical Background

The theoretical properties of fixed ER system is built on the pre-commitment device of the NER by monetary authority that is expected to combat inflation rate in order to reduce unemployment rates and thus achieving its output targets; this pre-commitment assumed to shift the economy to low-inflation equilibrium (and thereby low-unemployment equilibrium) through adopting the nominal anchor of the fixed ER, in turn raise welfare. The theoretical base of this argument lay on the work of Barro and Gordon (1983); their model assumes a closed-economy environment so that nominal wages are set before the central bank decides on monetary policy (and hence determines the inflation rate) in order to minimise both inflation and unemployment, on the belief that the demand to increase nominal wages is sufficient to cover expected inflation. However, in a stochastic open economy environment, attempting to lower inflation may be too costly as this arise a trade-off between the benefits of disinflation and the costs of disability of monetary authority to respond to external shocks, because incredible disinflation will generate high ex-post real wages and correspondingly cause high unemployment. That is non-credible pegs raises expected inflation and therefore unemployment rate, which implies that no ER system is appropriate for all countries at all times and the benefit-cost of an ER system depends on country characteristics. The offsetting nature of the NER movements increases the variability of RER by higher percentages under fixed ER system than floating systems in low income countries that suffer from weak fundamentals. (Ghosh, et al., 2002)

Different generations' models of currency crises identified several factors that may lead to currency crises. While Krugman (1979) simple small open economy model attribute budget deficits and inconsistency of monetary policy that lead to the depletion of reserves and inflationary pressures under fixed ER system ultimately cause a sudden BoP crisis that lead to sharp depreciation of domestic currency; Obstfeld (1994) model argued that Krugman macroeconomic model is incomplete, other policies or factors must play role in affecting the real value of ER under pegged regime preceding speculative attacks on reserves, notably the effects of high interest rates, high inflation rates, and/or growing unemployment. If the natural level of unemployment is higher than the socially optimal then government may need to pursue a more expansionary domestic policy to raise output or reduce unemployment (Glick and Hutchison, 1999; Sarno and Taylor, 2002), and if the unemployment rate in an economy is high, the monetary authority will be less willing to defend the currency against speculative attacks by raising interest rates because this might aggravate the unemployment problem. Obstfeld (1994) and Bensaid and Jeanne (1994) argued that an increase in unemployment or the public debt increases the cost to the government of defending the peg, thereby increasing the probability of a speculative attack on the currency (Kruger et al., 2000).

Obstfeld (1996) model drawn from Barro and Gordon (1983) but assumes an open economy, showed that high unemployment rates may cause currency crisis under fixed ER system, which implies that high unemployment may leads to high deviations of the RER from the NER, that is the level of fundamentals such as employment affects the multiplicity of currency attack equilibrium, stating that “The tenacity with which the ER is defended can depend on a variety of developments in the domestic economy” (Obstfeld, 1996: 1040). More recently, Castren et al. (2010) developed a model showing that a persistent unemployment shock which accumulates overtime is a key factor undermines the credibility of the pegged currency that may lead to higher than average inflation and weaker currency; they argue that small open economy can accumulate output shocks with the persistence of LR unemployment making the fixed nominal currency more fragile that captures currency depreciation or abandoning the peg in the expectations of increases in the average inflation.

Flood and Marion (1999) developed a simplified version of Obstfeld (1996) model recognizes that government commitments to a fixed ER system is constraint by other policy goals such as unemployment, the fragility of the banking system, the size of the public debt or upcoming elections; that is the impact of macroeconomic variables is too costly to maintain the fixed ER and could shift the expectations and alter the relevant ER toward currency crisis; in other words, there is an exchange-market risk for some range of fundamentals embedded in the trade-off between fixing the ER and other goals of the economy that generates multiple equilibrium arising from nonlinearities in government behaviour. Flood and Marion (1999: 15) stated “Once we interpret the cost as (in part) the optimal degree of reserve commitment to the fixed rate, then the state variables influence that commitment as well”.

Other recent models of currency crises explain in the framework of an open economy version of the classic Barro-Gordon model by Benigno and Missale (2004) model, argued that government vulnerability is related to high level of public debt, as high public debt is usually associated with lower growth, high inflation rates that

may lead to currency crises. Whereas Corsetti and Mackowiak (2005, 2006) model extending Krugman (1979)'s classic model showed that a large share of foreign debt increase the vulnerability of a country and cause capital outflows by foreign investors which magnifies the instability of domestic currency, the impact of fiscal deficit and the probability of currency crisis. In short, debt accumulation deteriorates the credibility of fixed ER and increase the possibility of currency crises. (Fratzscher, et al., 2011)

The general definition of currency crises is the 'large changes in some indicator of the actual or potential value of currency'. The large changes in indicator could be in the large depreciation of the RER alone (e.g. Frankel and Rose, 1996), while other studies include speculative pressure on domestic currency. Other criteria employed in the literature by employing an exogenous threshold rate of depreciation relative to what is considered normal; the threshold rate of depreciation could be common to all countries or define a threshold in terms of country-specific moments (Glick and Hutchison, 1999). Fratzscher et al. identifies currency crises as the large infrequent rapid depreciation of ER, which focuses on the REER rather than the nominal ER in order to observe currency movements that have disruptive implications on the real economy performance and to capture the fundamental economic forces or pressures that possibly lead to currency crashes. A threshold rate of REER depreciation in excess of 10 percent annually and a median at 16 percent is taken as the benchmark indicator of currency crisis. Others defined currency crises as the nominal bilateral depreciation versus US dollar of at least 25 percent or when the country's exchange market pressure index is two standard deviations or more above the country average in emerging economies (Fratzscher, et al., 2011). Kaminsky et al. (1998) defines that ER instability or sharp depreciation of domestic currency or large decline in foreign reserves or combination of the two is indicators of currency crisis (Megersa and Cassimon, 2015).

In summary, most definitions of currency crisis identify that a sharp depreciation of domestic currency from the anchor rate is the major cause to currency crisis which implies that high deviations of the RER from the NER lead to currency crisis. The outcomes from Obstfeld (1996), Castren et al. (2010), and other models of currency crises imply that high inflation and unemployment rates may cause ER crisis. We then may argue the following hypothesis that 'A country with small open economy which uses a fixed ER system will have large deviations of the RER from the NER leading to currency crisis, if this country has high inflation and high unemployment rates'.

The hypothesis states that high and persistent unemployment (UN) and high inflation (INFL) rates increase the likelihood of currency deviations potentially leading to currency crisis. The developed hypothesis is derived from the empirics and the theoretical assumption that the overvaluation of domestic currency under fixed ER system is a result from the deviations of the RER from the NER, such deviations is dependent on the behaviour of macroeconomic variables in an economy that may lead to currency crisis. Control variables identified in the literature that have effects on the RER negatively or positively shall be investigated and tested in the research model; includes foreign reserves (RESVG), trade openness (OPEN), terms of trade (TOT), domestic debt (DDEBTG), foreign debt (EDEBTG), remittances (RMTG), and grants (GRANTG).

3. Methodology and Data

3.1 Data

This section shall discuss the methodology steps to investigate the potential effects of macroeconomic variables on currency deviations as indicator of currency crisis by using annual observations for the period 1980 to 2014. The sources of time series data are extracted from the electronic sites of the databases of the World Bank (WB), International Monetary Fund (IMF), and Direction of Trade (DOT) that is published by IMF, and the Central Bank of Jordan (CBJ).

3.1.1 The dependent variable 'Currency deviations'

To proceed with the objectives of this study in predicting the potentials effects on currency crisis under fixed ER system in Jordan, first we shall calculate the currency deviations of RER from the NER as a prime dependent variable to estimate the significance effects of inflation and unemployment in predicting the potentials to currency crisis.

Definitions of currency crisis surround that large changes in the real value of the currency or large depreciation of the domestic currency is major indicator for currency crisis whether by defining a threshold rate for depreciation or not. Frankel and Rose (1996) defines that large appreciation of the RER alone is an indicator that increases the probability of currency crisis (Glick and Hutchison, 1999); Fratzscher et al. (2011) focuses on the

large and rapid depreciation of the REER is strong indicator to currency movements that have disruptive implications on the real economy performance in order to capture the fundamental economic forces or pressures that possibly lead to currency crises. For the purpose of our study we shall calculate the crucial currency movements by the percentage deviations of the REER from the NER.

The nominal exchange rate (NER) is the fixed number of domestic currency units that can buy one unit of foreign currency. The NER is the nominal anchor of ER that is announced by monetary authority in a country adopting a fixed ER system and committed to that ER relevant to particular foreign currency or basket of foreign currencies. The Jordanian currency (JD) has been pegged to the US dollar since 1995, at ER of JOD0.71/USD1.00; which means the nominal value of Jordanian dinar is 0.71 units for every one unit of US dollar. The CBJ has maintained the means to support the domestic currency by committing to that ER with US dollar with adequate level of foreign reserves (Al-Maliki, 1996). Prior to 1995, the CBJ adopted fixed ER systems with other foreign currencies, basket of foreign currencies or Special Drawing Rights (Central Bank Issue, 1989; Central Bank Issue, 2004).

However, the NER does not take into account of the differences in purchasing power parity (PPP) between the country adopting a fixed ER policy and other countries. The RER is a measure of international competitiveness, it estimates the overvaluation or undervaluation of domestic currency; an overvalued RER increases the probability of currency crisis. The RER takes into account the differences in PPP between the home country and the foreign country in which the domestic currency is pegged. A common measurable form of the RER is the ratio of CPI indexes adjusted by the NER – national currency per dollar (Hoffmann, 2007; Bucacos, 2008). But since international trade involves countries in the export and import of goods and services to and from the rest of the world, the real effective exchange rate (REER) measures the real value of the domestic currency by calculating the RER with each of the major trading partner of the home country, as per the following sequence of expressions (Wang et al., 2015; Bucacos, 2008; Bahmani and Harvey, 2007);

$$RER_i = NER * \left(\frac{CPI_i^*}{CPI}\right) \qquad (3.1)$$

$$REER = \sum_{i=1}^{n} (RER_i * W_i) \qquad (3.2)$$

Where,

RERi: is the RER with each trading partner; is the real exchange rate measured by the ratio of CPI indexes, adjusted by the NER (Hoffmann2007)

NER: is the fixed number of domestic currency units that can buy one unit of foreign currency.

CPI_i^*: is the consumer price index for each trading partner (i).

CPI: is the consumer price index in the home country that is adopting a fixed ER system

Wi: is the percentage share of each trading partner; it is the trading weight of country i to the overall trade of Jordan. The percentage share of each trading partner is calculated by summing the exports (X) and imports (M) of each trading partner for each annual observation and divides the sum by the total exports and imports of the country in the same year [i.e. Wi = [(Mi + Xi)/ (∑Mi + ∑Xi)].

REER: is the sum of the RERi representing the real effective value of domestic currency relative to major trading partners of the country adopting a fixed ER system.

The calculated REER then measures the depreciation or appreciation (i.e. overvaluation or undervaluation) of the domestic currency. As we calculate the REER time series of Jordan, then can calculate the percentage deviation of the REER from the NER as indicator for currency crisis. CURRDC is calculated as the percentage change in the deviations of the REER from the NER (i.e. CURRDC = [(NER – REER)/REER)*100]. A negative percentage of CURRDC shows percentage depreciation of domestic currency which implies overvalued domestic currency that may lead to currency crisis.

The CURRDC is the dependent variable or the measure that we shall investigate its variations in relation to the macroeconomic explanatory forces that may lead to higher currency deviations and therefore increases the probability of currency crisis. Table 3.1 shows the calculated REER versus the anchor NER and the percentage deviations between the two variables of the Jordanian currency; it is clear that there are high CURRDC indicating an overvalued dinar in Jordan (i.e. depreciation in the Jordanian dinar) that may lead to currency crisis.

Table 3.1 Descriptive analysis of the REER, NER, and Currency Deviations

Years period		NER	REER	CURRDC%
Pre-crisis period:1980 to 1987	Mean	0.351	0.763	-53.83
	Median	0.351	0.772	-55.51
	St. Dev	0.031	0.066	3.67
Crisis period: 1988 to 1991	Mean	0.573	0.881	-35.63
	Median	0.619	0.923	-33.70
	St. Dev	0.141	0.101	10.51
Post-crisis period:1992 to 2014	Mean	0.707	0.968	-26.97
	Median	0.708	0.968	-26.95
	St. Dev	0.003	0.013	1.17

The Jordanian currency was overvalued even before the economic and currency crisis of 1988-89, on average, there was a depreciation in the Jordanian dinar between 1980 to 1987 of more than 50% but the monetary authority was reluctant to devalue its currency due to its fears from the fluctuations in the RER which was led to the sudden shock in the crisis of 1988-89 and forced the Jordan authorities to re-devalue its currency, which implies that the high costs of sharp depreciation during currency crisis was already existed in the years before the crisis has paced high burden costs on Jordan economy and led to sudden economic and currency crisis.

Currency deviations remained large in the recent twenty five years after crisis, where the domestic currency of Jordan shows high depreciation rates of 25% to 29% between 1992 and 2014; as with Fratzscher et al. (2011) definition of currency crisis that a threshold rate of REER deviation in excess of 10% annually and a median of at least 16% is a benchmark indication of currency crisis.

3.1.2 Explanatory variables

The outcomes from Obstfeld (1996), Castren et al. (2010) and other models of currency crises imply that high inflation and unemployment rates may cause ER crisis. The developed hypothesis states that if a small open economy has high persistent unemployment and inflation rates there will be large deviations of the RER from the NER leading to currency crisis under fixed ER system.

Inflation (INFL) is the change in price level taken as inflation; it is the annual percentage change in CPI (Levy-Yeyati and Sturzenegger, 2003). We expect that inflation will have positive relation with CURRDC, where high inflation rate reduces the purchasing power in the domestic economy that reduces the demand for domestic currency in turn leads to high currency depreciations and overvalued currency.

Unemployment rate (UN) is the number of unemployed people of total labour force in an economy. High rates of unemployment is an indicator for lower production, investment and consumption in the economy and increases the expenditure burden on the economy that reduces the demand for domestic currency in turn depreciate the domestic currency and leads to high deviations, increasing the probability toward currency crisis. Therefore, we expect UN to have positive relationship with CURRDC.

The selection of control variables would be based on economy theory and findings discussed in the literature of those variables that have effects on the RER movements, negatively or positively, and thereby on currency deviations. Control variables shall reflect Jordan's small open economy; includes reserves, trade openness, terms of trade, domestic debt, external debt, grants, and remittances. The effects of these control variables on currency deviation shall be overviewed as follows:

Reserves growth rate (RESVG) is the percentage change in foreign reserve money. The level of foreign reserves captures the ability of central bank to meet the demand of public for foreign reserves. The liquidity of reserves position of monetary authority increase transparency and credibility of the economy on international and domestic environments and is crucial to the stability of the RER and reduces the risk perceptions regardless of the ER policy adopted in an economy (Kohli, 2015; Gumus, 2016; Cady and Gonzalez-Garcia, 2007). The CBJ enjoys high level of foreign reserves in the recent years enough to cover ten months of imports (Country Risk Report, 2016). We expect that RESVG to have a negative relationship with CURRDC reducing the effects toward currency crisis.

Trade openness (OPEN) is defined as the sum of imports plus exports (both goods and services) divided by GDP (Levy-Yeyati and Sturzenegger, 2003). Trade openness is crucial for international competitiveness of the economy on the LR. It is generally noted that trade openness play larger role in small economies than large economies in affecting production, growth, the real value of domestic currency. Declining of exports relative to imports reduces the demand for domestic currency leading to an overvalued currency (Department for Business Innovation & Skills, 2015). Currency depreciation is often associated with a decline in economic activity; thereby an increase in trade openness reduces the effects of RER shocks in developing economies (Fuentes and Ibarraran, 2012). It is expected that larger trade openness of an economy to reduce currency deviations, so openness is negatively related to CURRDC.

Terms of Trade (TOT) is measured as the ratio of exports in capacity to imports. It is believed that small open economies have less capability to influence the change in the TOT with the rest of the world (Chia and Alba, 2006); the characteristics of exports in small developing economies are concentrated around primary exports that are subject to high price volatility in the international markets; such characteristics deteriorate the TOT leading to an overvalued currency (Mendoza, 1995). Improvements in TOT increase the real value of domestic currency and reduce the potential effects of currency crisis; therefore we expect negative relationship between TOT and CURRDC.

Domestic debt growth rate (DDEBTG) and external debt growth rate (EDEBTG) is the percentage change of the outstanding stock of domestic debt and external debt in an economy, respectively. The theoretical model by Bleaney and Ozkan (2011) implies that an increase in domestic debt increases inflation and expose the economy to severe domestic shocks embedded in output deviations, while an increase in foreign debt undermines the credibility of pegged ER system leading to extra burden of currency depreciation. The debt crisis of the 1980s in developing economies brought high ER deviations and current account deficits (Faini and Gressani, 1998); high public debt runs developing economies eventually in crisis advising lower debt ratio to GDP and to move toward more flexible ER systems (Rogoff, 2005). Some studies showed that the effect of public debt on the RER is dependent on the net foreign liabilities of high indebted economies while other studies indicated that the effect of high public debt is independent from the net foreign position of a country (Farmer, 2011). Studies are inconclusive to the effects of different debt composition in the economy; we shall then use both domestic and external debt to test their effects on CURRDC. Public debt increases the vulnerability of an economy and thereby reduces the credibility in its domestic currency leading to high currency deviations and potentially to currency crisis. We expect that DDEBTG and EDEBTG to have positive relationship with CURRDC.

Remittances growth rate (RMTG) and grants growth rate (GRANTG) is the percentage change in remittances and foreign grants, respectively. Small open economy relies heavily on remittances and grants as considerable inflows to generate higher investment activities in their economy; both contribute a considerable proportion of the GDP in Jordan. The increase of worker remittances and grants inflows to an economy increases the resources available, in turn raises the demand for domestic goods and increase prices. The increase in consumption and investment due to the increase of these inflows leads to an improvement in the real value of domestic currency under both flexible and fixed ER system. However, studies show different effects of remittances and grants on the RER. While the grants or aids are consumed or invested by the government and public sector on non-tradable goods and wages and usually consume most of these inflows, but worker remittances are invested or consumed on tradable and non-tradable goods by the families in the private sector and they usually save considerable proportion of these remittances in the domestic economy that is expected to have higher effect on the RER performance (Rajan and Subramanian, 2011). Other studies indicate no effects of remittances on the RER in developing economies but contribute only to the improvements in the structure of exports for those economies that have adequate economic policies (Zcan, 2011; Barajas et al., 2010). We expect that GRANTG and RMTG to have negative relationship with CURRDC reducing the effects toward currency crisis.

3.2 Methodology

The estimation of the LR time series relationships shall use the Autoregressive Distributed Lag Model (ARDL); where the ARDL estimation method has the advantage of measuring the LR and SR relationships in a small sample regardless whether the degree of cointegration is at level or at first difference of the series variables in the model designed for estimating.

The time series testing procedures shall follow stationary tests, bounds cointegration tests, and diagnostic tests for the errors and stability of parameters of the estimated model. Further, to ensure for the reliability of our estimates, robustness and sensitivity checks may include ARDL with different control variables and alternative

method of estimation such as Dynamic OLS which is another of cointegration regression that investigate the LR relationships.

The ARDL econometric estimator shall take the following form:

$$CURRDC_t = \alpha + \sum_{i=1}^{m} \beta_{1,i} CURRDC_{t-i} + \sum_{i=0}^{n} \beta_{2,i} INFL_{t-i} + \sum_{i=0}^{p} \beta_{3,i} UN_{t-i} + \gamma_1 RESVG + \gamma_2 OPEN + \gamma_3 TOT + \gamma_4 DDEBT + \gamma_5 EDEBT + \gamma_6 RMTG + \gamma_7 GRANTG + U_t \quad (3.3)$$

Pesaran and Shin (1999) showed that cointegrating systems can be estimated by ARDL models with the advantage that the series variables in the cointegrating relationship can be either I(0) or I(1) without the need to pre-specify which are I(0) or I(1). Since ARDL estimates the dynamic relationship between dependent variable and independent variables it is possible to transform the model into a LR representation, showing the LR response of the dependent variable to a change in the explanatory variables. The cointegrating regression form of ARDL is obtained by transforming the original equation into differences and substituting the LR coefficients from equation this is called the Unrestircted Error Correction Model (UECM) and shall produce SR and LR coefficients of explanatory variables and the Error Correction Term (ECT).

The UECM representation of the ARDL approach shall be given by differencing equation 3.3 to express lags of the SR and LR parameters of dynamic regressers; whereas control variables will be used as fixed regressers in the equation. The UECM explore the SR adjustments with LR equilibrium of the variables in the model, as follows:

$$\Delta CURRDC_t = \alpha + \sum_{i=1}^{m} \beta_{1,i} \Delta CURRDC_{t-i} + \sum_{i=0}^{n} \beta_{2,i} \Delta INFL_{t-i} + \sum_{i=0}^{p} \beta_{3,i} \Delta UN_{t-i} + \gamma_1 CURRDC_{t-1} + \gamma_2 INFL_{t-1} + \gamma_3 UN_{t-1} + \gamma_4 RESVG + \gamma_5 OPEN + \gamma_6 TOT + \gamma_7 DDEBTG + \gamma_8 EDEBTG + \gamma_9 RMTG + \gamma_{10} GRANT + U_t \quad (3.4)$$

The ECT is the LR coefficient of the dependent variable at first lag and explains the speed of adjustment from the SR to the LR; it should be negative and significant.

Finally, ARDL generate the LR multipliers effects of each explanatory variable on CURRDC. The LR multiplier is calculated by dividing the LR coefficient of each of the independent variables over the ECT coefficient. The LR multiplier measures the permanent effects in the change of explanatory variable on dependent variable, so that the difference between the old and new equilibrium values of the dependent variable can be interpreted as the LR effect of the independent variable on the dependent variable, in other words, if a sudden change in the explanatory variable, from steady state, by one unit affecting the dependent variable which starts to change eventually, this effect will be settling down in the LR to a new equilibrium value (Koop, 2006).

4. Empirical Results and Analysis

The analysis of the estimated results shall involve comparisons, discussions, and synthesis of these findings with the theoretical and empirical studies that are presented and investigated in the field of this research. Robustness and sensitivity checks are also applied as highlighted in the methodology section.

4.1 Stationary Tests

The stationary tests of variables are unit root tests to identify whether the time series are stochastic or whether there are temporal dynamics in the series. A stochastic series is the one that have unit root implying that the mean and variance is not constant and increases in time indefinitely, the series is then denoted as non-stationary series. If the mean, variance and covariances of the series are constant over time then the series is said to be stationary at the level I(0); in economic view a stationary series are temporary, and the shocks effects will be absorbed over time. Differencing series can make the series stationary and denoted as integrated series at first difference I(1) or I(2) at second difference (Thomas, 1997; Greene, 2012; Ghiorghe et al., 2014).

Stationary tests can be applied with constant, constant and trend, or none. Famous tests for stationary of variables time series is the Augmented Dickey Fuller (ADF) and Phillips Perron (PP) unit root tests. Testing stationary of variables to ensure that all variables are stationary at I(0) or I(1) as a condition to apply ARDL or DOLS estimators that none of the variables are stationary at I(2). Using ADF and PP unit root tests, the results in table 4.1 shows that all variables are stationary at level I(0), except that CURRDC and TOT are stationary at first difference I(1), while UN and OPEN are I(0) with ADF tests but I(1) with PP tests.

Table 4.1: Stationary tests of variables

Variables	Tests	Level				First Diff				Order of integ
		Constant		Constant, Trend		Constant		Constant, Trend		
		t-statistic	Prob	t-statistic	Prob	t-statistic	Prob	t-statistic	Prob	
CURRDC	ADF	-2.0172	0.2784	-1.1357	0.9077	-4.1388	0.003*	-4.4201	0.007*	I(1)
	PP	-1.9886	0.2902	-1.1774	0.8993	-4.1108	0.003*	-4.7195	0.003*	I(1)
INFL	ADF	-3.7338	0.008*	-3.7176	0.04**	-6.8342	0*	-6.7177	0*	I(0)
	PP	-3.5179	0.02**	-3.4664	0.05**	-16.433	0*	-16.186	0*	I(0)
UN	ADF	-1.6071	0.4637	-4.4549	0.008*	-4.1558	0.004*	-3.7191	0.04**	I(0)
	PP	-2.5934	0.1054	-2.1735	0.4863	-4.7349	0.001*	-5.1813	0.001*	I(1)
RESVG	ADF	-6.0138	0*	-10.2437	0*	-3.6371	0.011*	-3.6699	0.041*	I(0)
	PP	-6.0489	0*	-5.9452	0.000*	-24.9428	0.000*	-25.4403	0*	I(0)
OPEN	ADF	-3.4825	0.02**	-3.5344	0.05**	-4.9118	0.000*	-4.83	0.002*	I(0)
	PP	-2.4574	0.1345	-2.4134	0.3666	-4.9355	0.000*	-4.8558	0.002*	I(1)
TOT	ADF	-2.0419	0.2684	-2.0471	0.5555	-5.3384	0.000*	-5.5986	0.000*	I(1)
	PP	-2.1687	0.2208	-2.0471	0.5555	-5.6673	0*	-6.7024	0*	I(1)
DDEBTG	ADF	-3.952	0.005*	-3.9422	0.02**	-8.3143	0*	-8.1742	0*	I(0)
	PP	-3.9305	0.005*	-3.9214	0.02**	-19.8912	0.000*	-19.2833	0*	I(0)
EDEBTG	ADF	-4.8411	0.000*	-4.9713	0.002*	-8.1065	0*	-7.9729	0*	I(0)
	PP	-4.845	0.000*	-4.9154	0.002*	-23.1743	0.000*	-24.6803	0*	I(0)
RMTG	ADF	-4.77	0.001*	-4.7552	0.003*	-8.4727	0*	-5.753	0.000*	I(0)
	PP	-4.752	0.001*	-4.7088	0.003*	-13.4694	0*	-14.5836	0*	I(0)
GRANTG	ADF	-5.5205	0.000*	-6.3008	0.000*	-7.8335	0*	-7.6828	0*	I(0)
	PP	-6.924	0*	-16.1773	0*	-21.2889	0.000*	-20.6288	0*	I(0)

* Significance at 1%; ** Significance at 5%

4.2 Cointegration test and ARDL results

To check for LR cointegration relationship between the variables in the model, a Bounding cointegration test is applied, which relies on comparing F-statistic with the upper critical bounds (UCB) and lower critical bounds (LCB) values obtained from Pesaran et al. (2001).

The calculated F-statistic (i.e. 16.975) of bounds test for currency deviations in relation to explanatory variables is higher than the critical value (i.e. 6.36) of the UCB at 1% significance. We reject the null hypothesis of no LR relationship; confirming that there is a LR cointegration relationship between variables of the tested model. The cointegration results indicates that there is a LR relationships between currency deviations and other variables in the model, which then we can estimate the ARDL with appropriate lags following Akaike info criterion (AIC).

The results of ARDL indicate the significance of the model where the value of F-statistic (i.e. 13.5927) is significant at 1%; we reject the null hypothesis indicating that all coefficients slopes of independent variables in the regression are different from zero. R-square is 96.45%; adjusted R-square indicate that explanatory variables explains 89.4% of the variance in the dependent variable, in other words, the tested model proves the theoretical assumptions that high employment and inflation rates and control variables significantly affects currency deviations. The Durbin-Watson (DW) measures the serial correlation in the residuals; results show strong evidence of no serial correlation in the residuals of the model tested at 5% significance, where DW statistic is higher than two (i.e. 2.8737).

Table 4.2 Error Correction Representation for the CURRDC of ARDL model

Dependent Var.	D(CURRDC)			
Selected lags ***	ARDL (5, 1, 3)			
Regressor	Coefficient	St.Error	T-statistic	Prob.
D(CURRDC(-1))	-0.06778	0.177781	-0.38127	0.7118
D(CURRDC(-2))	0.122102	0.113805	1.072904	0.3112
D(CURRDC(-3))	-0.04033	0.107439	-0.37533	0.7161
D(CURRDC(-4))	-0.24437	0.110188	-2.21778	0.0538**
D(INFL)	0.780004	0.108909	7.161981	0.0001*
D(UN)	0.466822	0.254164	1.836695	0.099***
D(UN(-1))	-1.17595	0.317842	-3.69978	0.0049*
D(UN(-2))	-0.32356	0.241752	-1.3384	0.2136
RESVG	-0.01627	0.005518	-2.94817	0.0163*
OPEN	-0.15205	0.042377	-3.58793	0.0059*
TOT	-0.06793	0.028479	-2.38516	0.0409**
DDEBTG	-0.00033	0.019968	-0.01657	0.9871
EDEBTG	-0.0072	0.008635	-0.83378	0.426
RMTG	-0.02402	0.023757	-1.01108	0.3384
GRANTG	-0.00463	0.007036	-0.65859	0.5266
C	-4.02544	4.245926	-0.94807	0.3679
INFL(-1)	1.062306	0.159046	6.679249	0.0001*
UN(-1)	1.271478	0.318506	3.992005	0.0031*
CURRDC(-1)	-0.28726	0.073569	-3.90456	0.0036*

* Significance at 1%; ** Significance at 5%; *** Significance at 10%;
Model selection method: Akaike info criterion (AIC)

The results of LR and SR coefficients of currency deviation model are shown in table 4.2. There are significant positive effects of inflation on currency deviation in the SR and the LR. Unemployment has significant effects on currency deviations in the SR but the SR effects changes from positive to negative. Whereas on the LR there are consistent positive effects of unemployment and inflation on increasing currency deviations; which is consistent with Freidman LR hypothesis that the relation between unemployment and inflation shift upward in the LR, that is the inverse relationship of the SR Phillips Curve between the two variables disappears with sustainable inflation in the LR so that higher inflation will not produce lower unemployment in the LR (Hetzel, 2007).

Since the paper is more inclined to investigate the LR effects on currency deviations, a further explanation of the LR equilibrium relationship between the explanatory variables and the dependent variable can be interpreted by the LR multipliers. From Table 4.2 the ARDL calculates the LR multipliers equilibrium effects of each of the explanatory variables on currency deviations; the LR multiplier explains how much percentage change in the independent variable can make a permanent change of the dependent variable into a new equilibrium value in the LR. The error correction term (ECT) is the LR coefficient at first lag of the dependent variable represents the cointigrating (CointEq(-1)) for LR adjustment process of the estimated model from the SR to the LR. The ECT coefficient is negative and significant at 1% implying the system is getting adjusted toward LR equilibrium at a speed of 28.75%.

Table 4.3 Estimating LR multipliers for ARDL (5,1, 3) approach

Depd. Var. CURRDC	Coefficient of LR Multiplier	Standard Error	T-Ratio	Prob.
INFL	3.698127	0.93351	3.961529	0.0033*
UN	4.426302	0.985168	4.492943	0.0015*
RESVG	-0.05663	0.021951	-2.57984	0.0297**
OPEN	-0.52931	0.147461	-3.58944	0.0058*
TOT	-0.23647	0.091025	-2.59783	0.0288**
DDEBTG	-0.00115	0.069538	-0.01657	0.9871
EDEBTG	-0.02507	0.028909	-0.86703	0.4084
RMTG	-0.08362	0.089519	-0.93409	0.3746
GRANTG	-0.01613	0.023497	-0.68651	0.5097
C	-14.0135	13.98354	-1.00214	0.3425
CointEq(-1)	-0.28726	0.073569	-3.90456	0.0036*
Cointeq = CURRDC - (3.6981*INFL + 4.4263*UN -0.0566*RESVG -0.5293*OPEN -0.2365*TOT - 0.0012*DDEBTG -0.0251*EDEBTG -0.0836*RMTG -0.0161*GRANTG -14.0135)				

Table 4.3 shows the LR multiplier for each explanatory variable. The table confirms that there is a LR effect of inflation and unemployment and control variables such as trade openness, TOT and reserves growth on currency deviation at 1% significance with the correct expected sign. However, growth rates of domestic and external debts, remittances, and grants are not significant. Debts growth rates shows negative signs which is inconsistent with the literature.

The LR multiplier effect of unemployment on CURRDC indicates that if unemployment permanently increases by 1%, the equilibrium value of currency deviations will increase by 4.43%. This result of ARDL regression shows that a small increase in unemployment leads to multiple increase in currency deviation that may lead to currency crisis which is in line with Obstfeld (1996) model of currency crises, in that persistent high unemployment in a small open economy which accumulates overtime leads to a weaker domestic currency and makes the fixed NER more fragile capturing currency depreciation. That is the deviation of the RER from the NER is a reliable variable in predicting currency crises (Kruger et al., 2000); in other words, an overvalued currency increases the probability of currency crisis under a rigid monetary policy and high unemployment rates (Karahoca, 2013). The argument of unemployment effects on currency value can be interpreted in its ripple effects on the economy; where the costs of unemployment embedded in reducing the level of output in the economy and therefore leads to lower consumption and investment levels that reduces the demand for goods and services eventually lessen the demand for domestic currency and leads to high currency deviations under fixed ER system.

The LR impact of inflation shows significant effects on increasing CURRDC, in contrast to the assumptions that pegged regimes can control inflation rates. The LR multiplier denotes that an increase of 1% in inflation rate leads to a 3.69% increase deviation of the RER from the NER potentially drives to currency crisis. The ARDL result of inflation is in line with the mixed results identified in the literature that inflation performance under pegged regimes depends on the performance of other variables in an economy such as trade openness, TOT, current account restrictions, and/or industrial development as concluded by Mundell-Fleming (Klein and Shambaugh, 2010; Ghosh, et al., 2002; Pilbeam, 1998). Our result corresponds with the literature that the gains from inflation under fixed ER are illusionary because there are high inflationary costs from pegged regimes that are financed by larger budget deficits in small developing economy generate temporary growth (Harrigan, 2006).

The ARDL results shows that control variables such as openness, TOT, and reserves growth rate are significant in their effects on CURRDC and with the expected negative sign as in the empirical literature. That is more trade openness with the rest of the world, stronger TOT, or increase in the reserves growth rates reduce currency deviations, potentially appreciate the domestic currency of Jordan and reduce the effects toward currency crisis. However, the LR multiplier of each of the three variables is very small, where 1% increase in openness, TOT, or reserves growth leads to less than 0.5% decrease in currency deviations. Overall, ARDL results indicate that the costs of high unemployment and inflation rates on increasing currency deviations outweigh the benefits from reserves, trade openness, and TOT in reducing currency deviations; in other words, both unemployment and inflation rates leads to high and sharp depreciation in the domestic currency in Jordan under fixed ER system

that may leads to currency crisis.

The LR multipliers of remittances and grants have negative coefficients which are in line with the literature that increases of remittances or grants appreciate the value of domestic currency reducing currency deviations. These capital inflows have sizable contribution to the GDP in Jordan playing important role in the investment and consumption activities, thereby increases the demand for domestic currency leading to an appreciation of the Jordanian dinar. But the results indicate that the coefficients of remittances and grants are not significant, implying ineffective role of both variables in explaining the LR deviations in Jordan's currency. Although domestic and external debt are usually considered major causes for currency crisis leading to sharp currency depreciation (Faini and Gressani, 1998), but the ARDL results shows insignificant coefficients of both variables with wrong sign.

A further robustness of the LR relationships between CURRDC and explanatory variables can be conducted with the Wald test. The F-Statistic value of the Wald test is 8.437 with probability of 0.0018 that is significant at 1%; we reject the null hypothesis indicating that the coefficients of the tested variables are different from zero, implying that there is a LR association between the variables in ARDL model.

The diagnostic tests of residuals support the stationary of the model and the reliability of its results. Jarque-Bera test for normal distribution of residuals shows probability of 0.169, accepting the null hypothesis that there is a normal distribution in the model residuals. There is no serial correlation of residuals where the probability in LM test is 0.1545. The results accept the null hypothesis of no variability of the variance in the heteroskedasticity tests where the probability of Breusch-Pagan-Godfrey, ARCH and White tests are 0.82, 0.81 and 0.87, respectively. The Ramsey RESET test accepts the null hypothesis of no existence of error problem in defining the model with probability of 0.5198. F-statistic used for all tests, except for Jarque-Bera Normality test Chi-Square is used.

To test of the stability of the SR and LR coefficients, Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Squares of Recursive Residuals (CUSUMSQ) tests are used. The results in Figure 4.1 indicate that the coefficients of the model are stable, where the curves of CUSUM and CUSUMSQ fall within the critical boundaries at 5% significance.

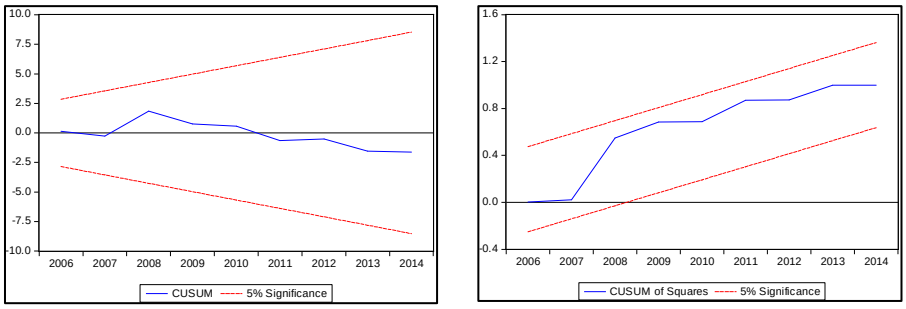

Figure 4.1: CUSUM and CUSUM of Squares stability tests, first regression of ARDL

4.3 Robustness and Sensitivity Checks

4.3.1 Robustness of ARDL model

To ensure the robustness of our results, we will rerun ARDL by excluding insignificant variables from the first ARDL regression. Table 4.4 shows comparison of LR multipliers between first and second ARDL outputs; where both regressions deliver significant results that inflation and unemployment have multiple effects in increasing currency deviations; whereas reserves growth, trade openness and TOT have smaller effects in decreasing currency deviations; confirming that persistent high unemployment and high inflation rates leads to higher deviation of the RER from the anchor currency, indicating these variables are important macroeconomic variables in explaining the potentials to currency crisis.

Table 4.4 Comparison between first and second ARDL Regressions

	First Regression		Second Regression	
Depd. Var.: CURRDC	Coefficient of LR Multiplier	Prob.	Coefficient of LR Multiplier	Prob.
INFL	3.698127	0.0033*	3.537664	0.0008*
UN	4.426302	0.0015*	4.24099	0*
RESVG	-0.05663	0.0297**	-0.0494	0.0252**
OPEN	-0.52931	0.0058*	-0.4785	0.0021*
TOT	-0.23647	0.0288**	-0.18334	0.021**
DDEBTG	-0.00115	0.9871		
EDEBTG	-0.02507	0.4084		
RMTG	-0.08362	0.3746		
GRANTG	-0.01613	0.5097		
C	-14.0135	0.3425	-23.3301	0.073***
CointEq(-1)	-0.28726	0.0036*	-0.2664	0.0008*
Bound Tests of Cointegration				
F-statistic	16.97521*		22.2109*	
Regressions Diagnostics				
R-Squared	0.964521		0.955062	
Adjusted R-Squared	0.893562		0.906667	
Durbin-Watson Statistic	2.873699		2.588652	
F-statistic	13.59268*	0.000191	19.73485*	0.000002

* Significance at 1%; ** Significance at 5%; *** Significance at 10%

The diagnostic tests of residuals support the stationary of the model and the reliability of results that there are no errors in the second regression of ARDL model. The coefficients stability tests of the CUSUM and CUSUMSQ in Figure 4.2 shows that the model coefficients are stables where the cumulative sum of recursive residuals curve falls within the critical boundaries at 5% significance.

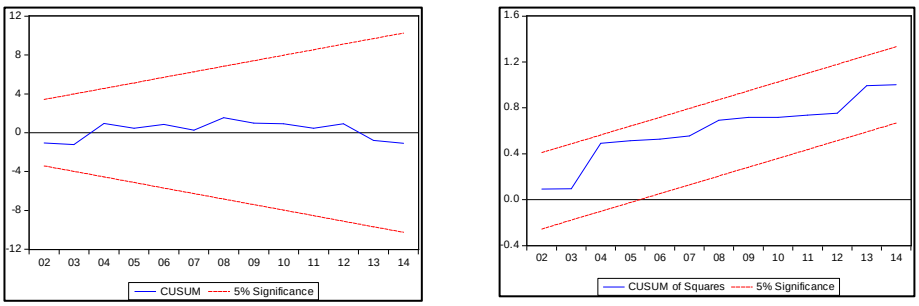

Figure 4.2: CUSUM and CUSUM of Squares stability tests, second regression of ARDL

4.3.2 Alternative Estimation method, DOLS sensitivity checks

The Dynamic Ordinary Least Squares (DOLS) developed by Stock and Watson (1993) provide LR coefficients of the independent variables in explaining the dependent variable; it is a reliable estimation method in small sample and can be used whether the series are conintegrated at I(1) or stationary at level I(0). The general form of DOLS estimator as follows,

$$Y_t = \beta + \gamma X_t + \lambda D_t + \sum_{j=-q}^{r} \delta \Delta X_{t+j} + \varepsilon_t \qquad (4.1)$$

Where, q lags and r leads of the differenced regressors soak up all of the LR correlation between the errors in the model. γ is the cointegration vector and D is the deterministic regressors.

The DOLS estimation has the advantage of using lags and leads of the independent variables to orthogonalise the error term to eliminate asymptotically biased due to endogeneity or serial correlation; it is a single equation estimator provide LR coefficients in current context (MacDonald, 2002; Tsen, 2014; Abdul Wahab, 2016). The results of DOLS are in Table 4.5.

Table 4.5 Dynamic OLS Representation for the CUDDC

Depd. Var.	CURRDC			
Selected lags and leads **	2 Lags, 1 Lead			
Regressor	**Coefficient**	**St.Error**	**T-Ratio/statisti**	**Prob.**
INFL	0.90043	0.289606	3.109152	0.0099*
UN	2.260422	0.370976	6.09318	0.0001*
C	-23.7279	7.42167	-3.19711	0.0085*
RESVG	-0.02013	0.008528	-2.35999	0.0378**
OPEN	-0.16099	0.062371	-2.58119	0.0255**
TOT	-0.19649	0.046406	-4.23412	0.0014*
RMTG	-0.01269	0.03932	-0.32281	0.7529
GRANTG	-0.02243	0.010951	-2.04853	0.065***

* Significance at 1%; ** Significance at 5%; *** Significance at 10%

The cointegrated coefficients of DOLS estimation method confirm that there is a LR effects of unemployment and inflation rates on currency deviations. R-square is 91.7%; whereas the adjusted R-square indicates that explanatory variables explain 81% of the variance in the dependent variable. As with ARDL results, the coefficient of unemployment has the largest effect on currency deviations supporting Obstfeld (1996) that high unemployment rates have significant effects toward currency crisis; a 1% increase in unemployment rate leads to a 2.26% increase in currency deviation. Similar to ARDL results, control variables of RESVG, OPEN, and TOT shows negative coefficients implying that reserve growth, trade openness and terms of trade reduces currency deviations; that is improvements in Jordan's terms of trade and increase in its international trade, or increase in foreign reserves improves the real value of the Jordanian dinar. The DOLS regression included grants and remittances due to the importance of these variables in Jordan's small open economy which contribute high proportion of Jordan's GDP; the results indicate negative coefficient which is consistent with the theory that capital inflows of remittances and grants reduce currency deviations and thereby increase the real value of the currency. The coefficient of remittances is not significant, while in contrast to ARDL regression grants has a weak significance at 10% implying that grants may play important role relatively in affecting the real value of the Jordanian dinar than remittances.

5. Conclusion

The literature discusses that developing countries needs to evaluate the costs and benefits from adopting a particular ER policy (Gulzar and Feng, 2008) in order to avoid economic imbalances. The LR multipliers results of ARDL regressions and DOLS cointegration estimator imply that there are high costs of unemployment and inflation rates in increasing currency deviations which outweigh the benefits from reserves growth, openness, and TOT in reducing currency deviations under fixed ER system in Jordan, potentially leading to currency crisis. The results of this paper provides a guiding tool to the monetary authorities and policymakers in Jordan of the key macroeconomic variables that affects the Jordan's domestic currency, which needs to be considered or maintained in the design of an appropriate ER policy to avoid future currency crisis. The paper recommends that capping the potential effects to currency crisis is possible by moving to a flexible ER system that would lessen the costs of currency deviations under fixed ER and adopt macroeconomic policies that may resolve Jordan's internal balance problems such as the high unemployment rates and improve external performance in terms of trade openness and TOT that would support the appreciation of Jordanian currency.

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