Deficits and inflation; Are monetary and financial institutions worthy to consider or not?

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Abstract

Institutions are important to analyze the relationship between deficits and inflation. This study examines whether deficits are inflationary or not in the presence of dependent central bank and fragile financial markets. A panel dataset has been used for eleven Asian countries from 1981 to 2010. Estimation results from system GMM show that deficits are inflationary for selected sample, while inflationary pressure of budget deficits is particularly stronger when financial markets are not fully developed and central banks are not free to follow their goals and objectives. Copyright © 2015, Borsa İstanbul Anonim Şirketi. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

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1. Introduction

Inflation can be explained by various factors. The schools of thoughts in Economics provide different theories in this context. Classical school of thought considers inflation as an outcome of monetary expansion and quantity theory of money as an explanation for this. But the proper transmission mechanism in explaining the relationship is lacking. The Keynesians emphasize demand side to be the major factor responsible in explaining changes in the price level. The Monetarists hold money supply as sole reason of inflation. However they did not support proportionality concept which was presented by classical economists. Friedman is the biggest proponent of this school of thought and regarded inflation everywhere is a monetary phenomena. Fiscalist school of thought is of the view that when there is persistent increase in fiscal deficits then governments opts for easiest choice of financing, monetization of deficit, which will eventually raise price level.

The developing countries face is low level of revenue due to structural bottlenecks like low tax base, tax evasion and reduction in tax rates.[2] However, deficits can be reduced either by enhancing tax revenue or reducing expenditure. Keeping in view the structural bottlenecks of developing countries, borrowing from public banks is easy option to finance deficits. If government finances budget deficits by selling government bonds to public then budget deficits will not create any inflation as no new money is created in the process. However, if borrowing is made from banks then monetary deposits will expand and causes inflation. (Dornbusch, Sturzenegger, Wolf, Fischer, & Barro, 1990; Easterly and Schmidt-Hebbel, 1993; Hamburger & Zwick, 1981).

Link between budget deficits, inflation and money supply always remained critical issue. Budget deficits and inflation

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[2] Tax evasion and tax administration cost is common feature of many developing economies as sited by (Edwards and Tabellini, 1991).

nexus studied from several perspectives and different views exist about this link. First argument is based on rationale that part of budget deficits financed by borrowing from central bank leads to increase in money stock and higher money stock causes inflation.[3]Conversely, in an un-utilized resource economy, high level of deficits may lead to higher demand which raises output. Second argument embark that higher demand due to large fiscal deficits will raise prices where output of essential commodities cannot be increased.

In case of developed economies, ample empirical studies showed that fiscal deficits do not exert inflationary pressure (Blanchard and Fischer, 1989; Click, 1998; King and Plosser, 1985). While in case of developing economies, studies indicated positive relationship between deficits and inflation.[4] However studies like Dwyer (1982), Brown and Yousefi (1996), Hondroyiannis and Papapetrou (1994) found insignificant relationship. Empirical literature presents a hazel picture on inflationary impact of deficits. So role of institution must be considered while studying this relationship in order to get clear picture of this phenomena.

Analysis of economic and political structure of economy is very important while studying the link between fiscal deficits and inflation. It was after Paldam (1987) work on political factors responsible for inflation, literature got different dimension to include development of financial structure and freedom of central bank to study inflation dynamics. Both factors are vital in analyzing the behavior of budget deficits and inflation in economy. It is well established fact in literature that independent central banks serve as mitigating inflation agents Cukierman (1992). Similarly, financial markets are very important for economic development. Financial markets are lending agents therefore they always support anti-inflationary policies and independent institutions, like autonomous and independent central bank (Posen, 1993).

In developed economies, central bank can adopt independent monetary policy for longer period without having sustained fiscal deficits. While in developing economies, financial sector is not fully developed and thus failed to grasp its basic roots in economic structure. Along with fragile financial sector, political pressure on central bank to monetize deficits is also one of the main reasons of positive relationship between fiscal deficits and inflation. Empirical studies have shown that causality between deficit and inflation run through money supply, if main source of financing is seigniorage. But due to ambiguity in literature this study attempts to elaborate the role of financial markets and central bank independence to analyze inflationary effect of deficits for selected Asian economies. For this purpose turnover rate of governor (TOR) is used as a measure of central bank independence which is effective in measuring political pressure on monetary authority, especially in case of developing economies.

Rest of the paper is organized as follow: Section 2 provides brief literature review on the topic, in Section 3 theoretical and empirical model is described, Section 4 explains econometric techniques and description of variables, empirical findings are discussed in Section 5 and final section concludes the paper.

2. Literature review

Vast and voluminous literature is available to explain theoretical and empirical basis, for inflationary impact of budget deficits. Both sides of coin were twisted and tossed by literature and different results appeared. Mostly, studies conducted for developing and emerging economies presented fact that budget deficits are potential culprit of inflationary pressure. But as far as most of developed nations are concerned evidence of deficits being responsible for price hikes appeared less significant. This study incorporated role of two major institutional structures of economy and analyzed basic relationship between fiscal deficits and inflation. Literature review is broadly categorized in two sections, theoretical and empirical literature review.

2.1. Theoretical literature

On theoretical ground deficit and inflation link is widely explored by Friedman (1968), Sargent and Wallace (1981); and Miller (1983). Sargent and Wallace (1981) presented a model where higher government deficits does not lead to higher taxes; rather higher deficit or debt result in higher money growth in current period or in future, and thus leads to inflation. Dornbusch et al. (1990), asserted that in economies where money creation is the only way to finance government budget deficits then it become a principal determinant of money growth and inflation. Easterly and Schmidt-Hebbel (1993) argued that money creation is cause of inflation. Critics also held deficits responsible for crowding out phenomena by affecting interest rate. When fiscal deficits are financed by borrowing, demand for credit by government increased and less is remained for private sector.

Theoretical basis for central bank independence is rooted in concept of dynamic inconsistency of monetary policy under case of discretion presented by Kydland and Prescott (1977). It was explained that there is two way links between policy makers and rational public regarding expectations about inflation and employment. Monetary policy makers are keener about price stability and employment level and desired level is higher than natural level. Reasons behind this could be distortion created by tax and labor union attitude toward real wages. This requires desired rate to be set above market clearing prices, that's creates further unemployment. Under discretion, policy makers adopt the strategy of inflationary surprise to raise employment level to desired level, but as consumers are fully a-wear they exactly forecast expectations against inflation. Consumer acquainted with fact, that there will be no impact on employment, thus monetary policy result in sub-optimal inflationary bias. To reduce this bias Rogoff (1985) and Walsh (1995) presented two theories, which

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[3] See Olivera (1967) and Dutton (1971).
[4] Metin (1995, 1998), Darrat (2000), Catao and Terrones (2005) and Narayan and Seema (2006).

emphasize to pass authority to central banker who is more conservative toward inflation, than rest of the society. Two important Theories for central bank independence are conservative-central-banker approach of Kenneth Rogoff (1985), and principal-agent approach of Carl Walsh (1995). It is being asserted that institutional characteristics of central bank have important effects on inflationary outcome and ample empirical evidence is presented in this regard. Similarly development of financial sector leads to growth is a well establish fact. Financial sector development is positively related to the growth as explored by Schumpeter (1911), Shaw (1973), Levine (1997) and Singh (2007). Boyd, Levine, and Smith (1996) are pioneers who investigated relationship between inflation and financial sector development.

2.2. Empirical studies

Inconsistent results were presented by literature on budget deficits and inflation link. Many economists have given proposition of no causal relationship between inflation and deficits (see for example, Blinder, 1982; Friedman, 1981; Grossman, 1982; Hamburger and Zwick, 1981; Hein, 1981; Sprinkel, 1981; Weintraub, 1981). Most of the studies conducted in developed economies failed to provide strong evidence on inflationary effects of deficits. In a cross country study Guess and Koford (1986) used granger casualty test, to see are deficits really cause of inflation or recession in 17 OECD countries for data-set 1949 to 1981. Results indicate deficits are not responsible for changes in recession, inflation or crowding out phenomena of private investment. King and Plosser's (1985) used VAR and single equation OLS model to identify determinants of inflation for United States and 12 other countries, and did not found any empirical evidence on causal relationship between deficit, money growth and inflation. On empirical basis, Protopapadakis and Siegal (1987) extended literature by empirically investigating relationship between government deficit and money growth, for ten industrialized economies namely Canada, Finland, France, Germany, Holland, Japan, Italy, Switzerland, UK and USA for period 1974−1983. Rank correlation test used for simple estimation process and excess-money growth and excess debt growth were concerned variables. Results showed no positive association between government debt and money growth. Argument was given that financial structure of economy is responsible for such conclusion. Based on empirical evidence of panel data (1980−2008) of seventeen European countries including turkey, Czech Republic, Hungary, Poland, Austria, Belgium, Greece, Slovakia, Spain, Sweden, and England it was indicated that generally no long run relation exists between inflation and budget deficits. Relationship changes depending on developmental level and structural features of economy (Sahan and Bektasoglu, 2010). This gave a rationale that in order to examine inflationary impact of deficit it is necessary to analyze the financial structure of economy.

While on other side empirical studies conducted in different regions supports said hypothesis that deficits are inflationary. provide support from panel as well as from country specific data. Samimi (2000) and Samimi and Jamshidbaygi (2011) focusing on relationship for Iranian economy strongly confirmed positive relationship between budget deficits and inflation. Metin (1998), Özatay (2000), Seljuk (2001), Tekin-Koru and Özmen (2003) and Kia (2010) provided the empirical evidence from Turkish economy that deficits and government debt remained important factors behind inflation during different time spans. Evidence from African countries was established by Onwioduokit (1999) and Chimobi and Igwe (2010). Who explored relationship between deficit, money and inflation for Nigerian economy during different time period. Results indicate that deficits were responsible for inflationary pressure in the Nigerian economy. For empirical evidence Kilindo (1997) applied Aghevli and khan (1978) self-generating model used to investigate relationship between deficit, money growth and inflation for Tanzanian economy. Estimation results by OLS technique shows strong relationship between fiscal deficits, money growth and inflation in Tanzania. Ahmed and Suliman (2011) explored long run relationship between money-supply, real GDP and price level for economy of Sudan, using annual data for period 1960−2005. Lozano (2008) empirically tested relationship between deficit, money growth and inflation by using three different definition of money supply; Mo, M1, M3 for Columbian economy for period 1981−2007. Empirical results pinpoint that long run relationship exists between deficit, money growth and inflation. Habibullah, Cheah, and Baharom (2011), investigated relationship between budget deficits, money growth and inflation for thirteen Asian countries including Indonesia, Malaysia, Philippine, Myanmar, Singapore, Thailand, India, South Korea, Pakistan, Srilanka, Taiwan, Nepal and Bangladesh. Granger causality test and Error correction model confirmed long run relationship exists between deficits, money growth and inflation for time period 1950−1999. Dejtbamrong (2011) examined the impact of Budget deficits on money-supply and output for the selected sample of South East Asian Central Banks (SEACEN) countries, namely South-Korea, Malaysia, Philippines, Singapore, Srilanka and Thailand for the period 1974-II to 1989-IV. Empirical results based on reduced form equations of fiscal and monetary policy showed mixed results. No impact of fiscal policy on money supply in case of Korea and Philippines but there exist strong relationship in case of Srilanka and Singapore. Due to lack of strong capital market structure in Srilanka and Singapore, fiscal variables can affect foreign inflow of capital which may lead to increase in money supply. Fischer (1995), using fixed effects for a panel of 94 developing and developed economies, showed fiscal deficits are main driver of high inflation (defined in excess of 100 percent a year), and estimated that a 1 percentage point improvement (deterioration) in the ratio of fiscal balance-to-GDP typically leads to a 41/4 percent decline (rise) in inflation, if all else remain constant. However, it was also concluded that changes in budget balance have no significant inflationary effects in low-inflation countries.

Till now we have seen both views on inflationary effects of fiscal deficits without involvement of any institutional

structure. Central bank independence and development of financial sector are two important institutional factors that can be used to refine relationship between inflation and fiscal deficits. Notable studies for central bank independence and inflation are of Bade and Parkin (1988), Alesina (1988, 1989), Grilli, Masciandaro and Tabellini (1991), Eijffinger and Schaling (1993), Alesina and Summers (1993). Different indexes has been used to measure central bank independence like Cukierman (1992) and Cukierman, Web, and Neyapti (1992) used turnover rate of governors for developing countries to study the central bank independence. Higher the turnover rate of governors, lower degree of freedom is enjoyed by central bank. Independent central bank gives more power to monetary authority to focus on its price stability motive with freedom. Central bank independence has negative impact on inflation as explored by Cukierman and Webb (1994) and Brumm and Krashevski (2003), De Haan and Kooi (1997). Loungani and sheets (1997) also found negative relationship between inflation and CBI in cross-country analysis.

Review of literature give us broad picture of existing work done in the area of budget deficits and inflation and what else could be done to further refine this relationship. This study will investigates inflationary effect of deficits under dependent central bank and less developed financial markets.

2.3. Theoretical and empirical model

Theoretical basis for model is taken from Neyapti (2003). Where she asserted that most of developing countries relies on seigniorage for financing fiscal deficits. So in period of time, fraction of deficit is financed by mode of money creation, which is negatively linked with central bank independence and financial market development. So we can write

$$\Delta M_t = \mu(G_t - T_t + rB_{t-1}) = \mu Def_t \tag{3.1}$$

Whereas $0 < \mu < 1$ and $\mu = (l\text{CBI or } l\text{FMD})$. lCBI and lFMD, are lack of central bank independence and financial market development and these are calculated on the inverted scale for central bank independence and financial market development indices. Lower value of μ indicates that higher degree of independence enjoyed by central bank, and financial sector is more developed. If μ takes value 0 it means that no money accommodation is done for deficits and central bank is fully independent and financial sector is fully developed so all financing is done by debt issuing. On other hand if μ is 1 then central bank independence and financial market development are at lowers values and all financing is done through money creation mode.

General form of inflation function presented by Neyapti is as follow

$$\pi_t = f[A(L)\pi; B(L)Def; C(L)(\mu Def); D(L)gM; E(L)gGDP] \tag{3.2}$$

Basic model for this study is established on the basis of different existing studies. The specification of the econometric

model is consistent with Neyapti (2003) and Aisen and Veiga (2006).

$$Inf_{it} = \alpha Inf_{i,t-1} + X_{it}\beta + \eta_i + \varepsilon_{i,t}$$
$$i = 1\ldots N, \quad t = 1\ldots T_i \tag{3.3}$$

Here *inf* is inflation level of country *i* at time period t, α and β are the parameters to be estimated and x is a vector consists of all exogenous variables, η_i is country specific effects and ε is error term.

The model in extended form could be written as

$$Inf_{it} = \alpha_0 Inf_{i,t-1} + \alpha_1 Deficit_{it} + \alpha_2 ExRate_{it} + \alpha_3 Money_{it}$$
$$+ \alpha_4 gGDP_{it} + \alpha_5 TOR_{it} + \alpha_6 FMD_{it} + \eta_i + e_{it} \tag{3.4}$$

Inf = CPI inflation rate
Deficit = fiscal deficit as percent of GDP,
gGDP = growth rate of real GDP
Money = M2 yearly growth.
TOR = Turnover rate of central bank governors
ExRate = Real Exchange rate
FMD: Financial Market Development

To see how budget deficits indirectly affect inflation through money supply equation is simplified as

$$Inf_{it} = \alpha_0 Inf_{i,t-1} + \alpha_1 Deficit_{it} + \alpha_2 gGDP_{it} + \alpha_3 Money_{it}$$
$$+ \alpha_4 DF + \varepsilon_{it} \tag{3.5}$$

$$\varepsilon_{it} = \eta_i + e_{it}$$

Here DF is dummy variable included in the Equation (3.5) to see impact of financial crisis, 2008, on inflation rate for selected countries. To see how central bank independence and financial sector development help to explain inflationary impact of deficits, in Equation (3.6) financial sector determinants and CBI are used as interactive terms with budget deficits. So we can write.

$$Inf_{it} = \alpha_0 Inf_{i,t-1} + \alpha_1 Deficit_{it} + \alpha_2 [\mu Deficit]_{it} + \alpha_3 gGDP_{it}$$
$$+ \alpha_4 gMoney_{it} + \varepsilon_{it} \tag{3.6}$$

μ shows the lack of central bank independence or lack of financial sector development, denoted as lCBI, or lFMD, and $0 < \mu < 1$. If $\mu = 0$ it mean maximum independence enjoyed by central bank and fully developed financial sector, and if $\mu = 1$ it mean lowest degree of independence enjoyed by central bank and developed financial sector is less developed. Developing economies are resource or revenue deficient and have to borrow money through public. Thus they can either monetize or accumulate debt by paying interest. In developing economies at least some portion is assumed to be financed by monetization process. μ, in model 3.6 is representing that part of budget deficits that is financed through money creation for each period and μ here is negatively associated with the degree of central bank independence as well as financial sector

development. Financial sector and central bank variables are used in "*absence*" form that is to see how less developed financial markets and dependent central bank will affect the inflationary pressure. Thus lack of financial sector development is introduced with the budget deficits as interaction term to see how less developed financial sector will affect deficits and then how inflation would finally be affected. Individual effects are captured by the first difference Generalized Methods of Moments (GMM) and to capture regional effects regional dummy was introduced. Prices are more volatile in South Asia than in East Asian economies and to capture this effect dummy of South Asia is introduced in Equation (3.7).

$$Inf_{it} = \alpha_0 Inf_{i,t-1} + \alpha_1 Deficit_{it} + \alpha_2 (Deficit*FMD)_{it}$$
$$+ \alpha_3 gMoney_{it} + \alpha_4 gGDP_{it} + \alpha_5 DF_{it} + \alpha_6 DSAsia_{it}$$
$$+ \varepsilon_{it}$$

$$(3.7)$$

Similarly to see how dependent central bank will effect inflation, turnover rate of central bank governors is used as proxy for central bank independence and TOR applied as interaction term with deficits in Equation (3.8). Higher turnover rate shows that political interference is high and central bank is not independent in following its targets.

$$Inf_{it} = \alpha_0 Inf_{i,t-1} + \alpha_1 Deficit_{it} + \alpha_2 (Deficit*TOR)_{it}$$
$$+ \alpha_3 gGDP_{it} + \alpha_4 gMoney_{it} + \alpha_5 DF_{it} + \alpha_6 DSAsia_{it} + \varepsilon_{it}$$

$$(3.8)$$

So final equation that is to be estimated with central bank independence and financial sector development as interactive term with budget deficits is as follows

$$Inf_{it} = \alpha_0 Inf_{i,t-1} + \alpha_1 Deficit_{it} + \alpha_2 (Deficit*TOR)_{it}$$
$$+ \alpha_3 (Deficit*FMD)_{it} + \alpha_4 gGDP_{it} + \alpha_5 Money_{it}$$
$$+ \alpha_5 DF_{it} + \alpha_6 DSAsia_{it} + \varepsilon_{it}$$

$$(3.9)$$

3. Econometric technique

Unit root test was applied to check stationarity of different variables. Fisher and panel Levin−Lin−Chu (LLC) test applied to all series to check stationarity conditions. Basic equation of our model is

$$Inf_{it} = \alpha Inf_{i,t-1} + \beta X_{it} + \varepsilon_{i,t}$$
$$i = 1...N, \quad t = 1...T_i$$

$$(4.1)$$

Lag of dependent variable is included in the model to control for persistence in inflation and also to analyze impact of previous period inflation on current inflation level. Traditional OLS technique for estimation gives inconsistent and biased results due to dynamic specification (Greene, 2003:221). Causality may run between inflation and deficits and between inflation and money supply so endogeneity may also present in model due to correlation of explanatory variables with the error term (simultaneity biased). Instrumental

variables are used to refine problem of endogeneity and to get efficient estimates. IVLS, 2SLS/3SLS and GMM are proposed techniques by literature for resolving problems of dynamic models.

Generalized Methods of Moments (GMM) is most appropriate technique for dynamic panel data as used in many empirical studies (Rao, Tamazian, and Singh et al., 2009; Das and Paul, 2011; Presbitero, 2006). Panel data combine both cross-section and time series and allows us to see inflation and deficits over long period of time for different Asian economies. Panel data some time employed to detect those dynamics that cannot be detected in cross-sectional data. A country-specific effect which occurs in panel can be controlled and tackled using suitable and appropriate GMM techniques. Sample period is quite large and possibility is there that variables used for estimation procedure may be non-stationary. If dependent variable is non-stationary then GMM will not be appropriate technique.

Arellano and Bond introduced the concept of difference GMM in 1991 to tackle the various problems raised in estimation of dynamic panel model. Possible problems that are suspected in dynamic panel are.

1. Endogeneity could emerge, due to feedback relation between deficit and inflation and money supply and inflation, simultaneity biased, so in presence of endogeneity usual OLS technique fails and give biased and inconsistent estimates.
2. There may present country specific time invariant effects (fix effects), such as demographics and geography which may be correlated with regressor, fix effects are often part of error term in equation one, which contain both unobserved country specific effects η_i, and observation specific effects e_{it}, $\varepsilon_{it} = \eta_i + e_{it}$.
3. Lag dependent variable, $Inf_{i, t-1}$, present as regressor in model, give rise to autocorrelation.

To tackle all these problems two stage least square method can be applied but level variables used as instruments may raise the problem of weak instruments. So Arellano and Bond (1991) GMM method is more appropriate which not only uses exogenous variables but also use lag levels of endogenous variables as instruments. So now endogenous variables become predetermined variables and remain no more correlated with error term in above equation. To cope with second problem GMM uses first difference so equations takes the form

$$\Delta Inf_{it} = \alpha \Delta Inf_{i,t-1} + \Delta \beta X_{it} + \Delta \varepsilon_{it}$$

$$(4.2)$$

Country specific effects removed after taking first difference of regressor because it is no more correlated to time. As now

$$\Delta \varepsilon_{it} = \Delta \eta_i + \Delta e_{it}$$

$$(4.3.1)$$

$$\varepsilon_{it} - \varepsilon_{i,t-1} = (\eta_i - \eta_i) + (e_{it} - e_{i,t-1}) = e_{it} - e_{i,t-1}$$

$$(4.3.2)$$

To tackle with third problem further lags of dependent variables are used. The lag dependent variables will be less or insignificantly correlated with error term as T increases.

However weak instrument still remain an issue and lag levels can be poor instruments of first difference regressor. To tackle this problem Blundell & Bond, 1998 proposed system GMM and argued that weak instruments may produce biased results and suggest extra conditions to be used to tackle this problem.

4. Data description and analysis

Our empirical analysis is based on panel data covering time period from 1981 to 2010 for eleven Asian economies including Bangladesh, India, Indonesia, Japan, Korea, Malaysia, Nepal, Pakistan, Philippines, Srilanka, and Thailand. Initially fifteen countries were chosen but due to missing data on some important variables sample shrink to eleven countries. Particularly this time period was selected as a) financial liberalization starts in 1980s in East Asian region and in late 1990s in southern part of the Asia. But still central banks in selected countries are not free and independent in its true sense and often face political pressure in following its goals. b) Soaring fiscal deficits and high inflation rates are important characteristics of selected economies. For most of the variables, data is collected from World Development Indicators (WDI), International Financial Statistics (IFS), and World Economic Outlook (WEO). For Central back independence, turnover rate of Governors (TOR) is used as proxy and data is extracted from index developed by Sturm, Jan-Egbert and Jakob de Haan (2001a, 2001b). Updated data is taken from KOF Swiss Economic Institute website.[5] Description of each variable is given in appendix however construction of the most important variables is discussed below.

4.1. Financial markets

Different measures are available in literature to see development level of financial sector. However we employed private sector credit to GDP and bank deposits. More provision of credit to private sector shows less dependency of state/fiscal authority on monetary or financial institutions, as more involvement of private sector will make possible more availability of credit to the fiscal authority. For estimation procedure private sector credit as percentage of GDP is used for selected sample. This variable is also used by King and Levine (1993), Boyd, Levine, and Smith (1996). Data on both variables is taken from World Development Indicators (WDI).

Basic objective is to use institutional variables in "absence/lack" form that is to see what would happen to deficits and inflation relationship if financial markets are not developed and central bank is not independent, so for this purpose variables are normalized and inverted. Each institutional variable before multiplying it with the deficit variable is normalized between 0 and 1 on inverted scale. Variable now takes values 1

to show complete lack of central bank independence or financial market are not developed (CBI = 0, FMD = 0; it implies LCBI = 1 and LFMD = 1), when variable takes value 0 it shows fully independent central bank and developed financial markets (CBI = 1 and FMD = 1; it implies LCBI = 0 and LFMD = 0). Basic objective for normalization process is to convert index to takes value either 1 or 0 and after normalization index is inverted such that 1 means complete lack of central bank independence or less developed financial market. The normalization process is as follows.

To normalize private sector credit, between 0 and 1, each value of the variable is divided by the maximum value it takes in whole sample. To invert scale, such that one means complete lack of financial development, subtract the resulting variable from 1. Subtracting resultant series from its maximum value such that new series becomes equal to one; that shows lack of financial sector development.[6] Normalization and inversion process is done by method given in detail in Neyapti (2003).

$$FMD = [1 - (FMD_i/FMD_{max})]/[1 - (FMD_i/FMD_{max})]_{max}$$

4.2. Bank deposits

Rationale behind using this measure is to see how much banking sector is effective in providing credit, as banking is most developed sector of financial structure. It is a ratio of deposit money bank domestic asset to deposit money bank domestic assets plus central bank domestic assets. Banking sector is more efficient in provision of services than central bank. This variable is referred as, *BANK*, by King and Levine, so higher values corresponds to more financial services provided by banks and thus higher levels of financial development. Variable is used as interactive term with deficits and thus for easier interpretation firstly it is normalized through same process as explained earlier. Variable is taken from database of World Bank constructed by Beck, Demirguc-Kunt, and Levine (2009).

4.3. Central bank independence

To measure independence of central bank different measures are adopted by empirical studies. Legal and political independence of central bank is mostly focused by literature. Economically more independent central bank will be restrictive in monetizing fiscal deficits while political independence assures less involvement of government in appointment and dismissal of governor of central bank. To measure independence of central bank turnover rate of central bank governors, TOR, is used as proxy of political measurement of independence of central bank. Turnover rate is used in many studies like Cukierman (1992), De Haan and Kooi (2000) etc. More TOR mean less freedom monetary policy enjoys in following

[6] See Neyapti (2003), p.463.

Table 1
Correlation matrix of all variables.

	Inflation	Deficit	Money growth	rgdpg	Exchange rate	Def* LBD	Def*Lack PVT sector credit	Def*TOR	TOR	Pvt sector credit	Bank deposit
Inflation	1										
Deficit	0.0138	1									
Money growth	0.2608	0.0272	1								
rgdpg	0.0907	0.2404	0.1248	1							
Exchange rate	0.0528	0.1108	0.087	−0.0681	1						
Def*lack bank deposit	0.397	−0.1415	−0.3302	−0.2049	0.0116	1					
Def*lack pvt sector credit	0.4114	−0.0999	−0.3226	−0.2163	0.0313	0.2757	1				
Def*TOR	−0.065	0.3169	−0.0316	0.0997	0.0341	−0.0044	−0.0141	1			
TOR	0.0432	−0.0164	0.061	−0.1381	0.0513	−0.0292	−0.0107	−0.59	1		
Pvt sector credit	−0.3949	0.1346	−0.3975	−0.1802	−0.1028	0.3994	0.5262	0.0793	−0.0264	1	
Bank deposit	−0.101	0.4423	−0.1159	0.1059	−0.0997	0.3504	0.3752	0.18	−0.0125	0.4448	1

its targets, severe pressure of fiscal dominance and frequent dismissal of governors can be observed. Turnover rate data is extracted from index calculated by Sturm, Jan-Egbert and Jakob de Haan (2001a, 2001b).

5. Empirical findings

Empirical Models are dynamic in nature and time period is large enough that requires testing of unit root for selected variables, as non-stationary variables may produce spurious results. Results of Fisher test and LLC test are shown in Table

A of appendix which shows that null hypothesis is rejected at 5% level of significance and no unit root exists in all variables. So now we can proceed with the estimation by System GMM technique. Table 1 shows correlation matrix and it can be clearly seen that there is positive association of budget deficits with inflation. Similarly it is also evident that problem of multi-collinearly is not serious between different variables.

In column 1 of Table 2 basic equation is estimated to check whether deficits are inflationary or not and it is clearly visible that deficits are inflationary for selected economies. One possible reason could be that in sample, most are developing

Table 2
GMM estimates: dependent variable (inflation rate).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Inflation(-1)	0.5168*	0.3791*	0.4989*	0.3774*	0.3864*
	(8.43)	(5.19)	(7.45)	(7.33)	(6.19)
B.deficit	0.0238***	0.0234**	−0.0320	−0.1631**	−0.2899*
	(1.88)	(2.06)	(−1.00)	(−2.86)	(−3.70)
Rgdpg	0.0202	0.0096	0.0159	0.0093	0.0118
	(0.93)	(0.45)	(0.40)	(0.47)	(0.60)
Real exchange	0.4475**	0.3035**	0.5802*	0.0474	0.0794**
	(2.79)	(2.96)	(4.37)	(1.70)	(2.92)
Money growth		0.2258**	0.0711*** (1.74)	0.0779***	0.0824**
		(2.05)		(1.75)	(1.99)
Deficit*PVT				0.0485**	0.0660*
				(3.09)	(4.18)
Deficit*bank-deposit				0.0214**	0.0342***
				(2.04)	(1.86)
Deficit*TOR			0.2614**		0.2634***
			(2.08)		(1.76)
Constant	0.1211	0.3449	−0.2774	0.1198**	0.2231***
	(1.05)	(−1.29)	(−1.23)	(2.25)	(1.76)
South Asia dummy	0.1563***	0.1914***	0.2762**	0.2848**	0.1914***
	(1.77)	(1.82)	(2.06)	(2.42)	(1.82)
Financial crisis 2007−08 dummy	0.3536***	0.3721***	0.3801***	0.3786***	0.3026**
	(1.75)	(1.71)	(1.84)	(1.91)	(2.53)
Sargan test P-value	0.260	0.374	0.349	0.303	0.298
F-test	246.64	373.16	497.43	524.62	574.26
	0.000	0.000	0.000	0.000	0.000
AR(1) P-value	0.155	0.127	0.145	0.148	0.153
AR(2) p-value	0.338	0.283	0.314	0.285	0.294
Observations	297	297	319	297	308

NOTES: All values in parenthesis denote t-stat.*, **, *** shows level of significant at 1, 5 and 10% respectively.
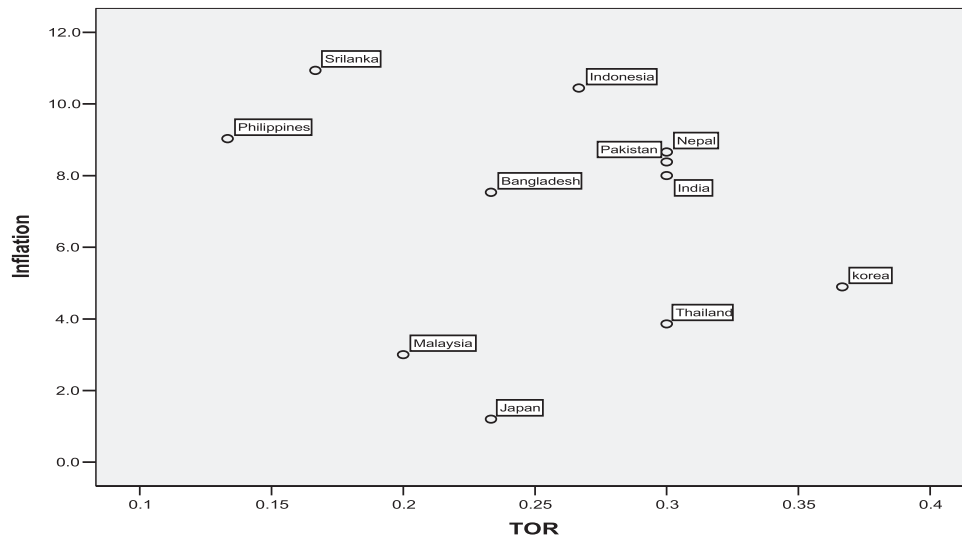Panel regression, 1981−2010, estimated by GMM.

Fig. 1. Governor's TOR and Average Inflation over the Period 1981−2010 in Sample Economies (scatter plot).

and emerging economies and seigniorage dependence for financing fiscal deficits is common norm in these developing countries. Budget deficits coefficient 0.024 shows that if there is one unit increase in deficits, price level will raise by 0.02 units, showing positive association of fiscal deficits with inflation for sample Asian economies. Facts also certify results as many Asian economies have persistent and sustained fiscal deficit, like Pakistan and Srilanka. The lag impact of inflation on current inflation level is significant with coefficient 0.517, this shows that inflation is dynamic phenomena and previous level of inflation do affect behavior of individuals in current period.

Growth rate of real GDP is used as a proxy to capture effect of business cycle fluctuation on price level. Coefficient shows positive impact but it is insignificant. Exchange rate is also important in analyzing the dynamics of inflation. Results show that coefficient is positive and significant throughout all models. This reveals that exchange rate fluctuations impact policies adopted by monetary authority (Mishkin, 2008). This result gives one interesting insight that exchange rate and inflation are inter-linked or pass-through impact will be stronger under unstable monetary policy environment. But stable monetary policy − such institutional setup allows central bank to pursue its objectives without interference and pressure of fiscal authority − −effectively minimize potential source of pass-through of exchange rate to domestic prices (Mishkin, 2007; Taylor, 2000). This result indicates that in sample economies, unstable monetary policy environment prevails and exchange rate fluctuations exert pressure on price level.

The difference between two regions is captured by dummy variable which takes value 1 for South Asian countries and zero for South East Asian countries. Results indicate significant difference with expected positive sign. Most of the models indicate South Asian countries are more inflationary. Deficits are crucially linked with inflation in these economies including Pakistan, India, Srilanka, Bangladesh and Nepal. In these economies political pressure plays important role in

extensive public expenditure. Thus in South Asia fiscal deficits are relatively higher and tax revenue rate is quite low due to structural and administrative issues. Political and institutional factors plays important role in high deficits. Low transparency and high corruption rates further increases fret of economies. India however has improved its transparency and corruption index while Pakistan performance has worsened over time on scale of transparency, accountability and corruption in public sector World development Indicators (2010).

In column 2, money supply is introduced to check indirect link of fiscal deficits to inflation and deficits effect becomes more significant with inclusion of money supply. This confirms that money supply is a channel that links deficits to inflation and also supports monetarist school approach. Money growth M2 is statistically significant for sample economies. Result of model 2 highlights the fact that money creation is noteworthy mean of deficit financing. In second and third model's estimation, TOR is used as interactive term with budget deficits to estimate how dependent central banks affect deficit. Coefficient of TOR*-deficit is positive with value 0.26 and it is statistically significant with t-value 2.08. This shows that when TOR is higher deficits will be more inflationary. Higher coefficient of TOR shows that Central bank is not enjoying independence in its real sense. As TOR is political measure of central bank independence, so it signifies that political pressure is greater in selected Asian economies, and there is frequent dismissal of governors with change of government or during the tenure of new government. This shows that political agents are very much influential in business of central bank. Variation in turnover rate of central bank governors and inflation rate for selected Asian economies is shown below in Fig. 1.

Fig. 1 shows variation in freedom enjoyed by central banks in selected economies. For sample countries where turnover rate is higher[7], central bank enjoys low level of independence.

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[7] If TOR is 0.25 or above it shows low level of independence central bank enjoys (Cukierman, 1992).

Countries in selected sample mostly lie in higher inflation and higher turnover range. Korea is exceptional case where mild inflation prevails but TOR is also higher. This shows there is significant variation between inflation level and turnover rate of governors among selected economies.

After inclusion of TOR as interactive term with budget deficits, deficit to GDP variable now changes sign and become negative however it is insignificant. Negative impact could be either a) multicollinaertiy between TOR*deficits and deficits, but as already discussed problem of multi-collinaertiy is not critical or b) selected variables are not good proxy for CBI; but as per Cukierman (1992), TOR, is good proxy for developing countries to measure central bank independence, as legal independence is low in most of developing countries, or c) due to interaction term; as impact of fiscal deficits is captured by central bank dependence, it is safe to say, when institutions are independent and strong deficits may not directly be correlated to inflation. Price hikes may be due to external or structural factors. Deficits*TOR shows that deficits have stronger positive impact on inflation when central bank is not independent from political pressure. When monetary policy is not independent central bank adjusts deficits. Financial sector development is measured with private sector credit to GDP and bank deposits. In model 4, two separate interaction terms of deficit with lack of financial sector development have been introduced. Coefficient values and signs of both interaction terms are positives and are statistically significant at 5% level of

significance. It shows that deficits are strongly linked with inflation as financial development depth is low for sample economies. One point to ponder is that government is very much dependent on seigniorage because no other measure is available and financial intermediation is low. Estimations of model 3 to 5 present the fact that deficits are inflationary for sample economies and particularly more inflationary when central bank independence is low and financial markets are less developed.

To capture the impact of financial crisis of 2007−08, dummy variable is introduced in model. Results of estimated models show that financial crisis intensified inflation rate in Asian economies. The difference between two regions is captured by including a dummy, indicating that in South Asian countries, inflation is severe. Sargen test is used for validity of instruments employed in estimation process of GMM. All instruments used to reduce problem of suspected endogeneity and serial correlation, are valid. All exogenous variables and higher lags of dependent and independent variables are used as instruments. The F-test for overall significance of regression and Arellano-Bond tests AR (1) AR (2) for serial correlation, are supporting model specification.

As south Asian dummy variable remained significant in all models so we estimated GMM for selected six Asian economies presented in Table 3. Coefficients of deficits and money growth are bigger in magnitude than overall sample. The deficit variable is significant with coefficient of 0.07 at 5 percent level of significance. If there is one unit increase in

Table 3
GMM Estimates: Dependent variable (Inflation rate).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Inflation(-1)	0.4559**	0.3945**	0.2878*	0.4466*	0.4559**
	(3.06)	(2.62)	(4.87)	(3.15)	(2.88)
B. deficits	0.0655**	0.0471**	0.0091**	−0.0197**	−0.0410**
	(3.39)	(3.42)	(2.08)	(−2.19)	(−2.78)
rgdpg	0.0045	0.0049	0.0033	−0.0027	0.0044
	(−0.82)	(−0.89)	(−1.54)	(−0.47)	(−0.76)
R. exchange rate	0.0940***	0.0712***	0.0747**	0.0851**	0.0097**
	(1.95)	(−1.86)	(−2.47)	(2.11)	(2.17)
Money growth		0.0721**	0.0532*	0.0613**	0.0578***
		(2.29)	(5.42)	(2.09)	(1.81)
Deficit*PVT				0.0059**	0.0110**
				(2.26)	(2.98)
Deficit*bank-deposit				0.0039**	0.0062*
				(2.06)	(4.06)
Deficit*TOR			0.0319***		0.0149**
			(1.86)		(2.56)
Constant	0.6189*	0.4484*	0.5709*	0.3395*	0.3463*
	(4.00)	(5.52)	(5.54)	(4.46)	(3.73)
Financial crisis 2007−08 dummy	0.0316***	0.0439	0.0425***	0.0609***	0.0351***
	(1.76)	(1.70)	(1.79)	(1.73)	(1.81)
Sargan test P-value	0.189	0.534	0.457	0.476	0.560
F-test	106.83	303.35	325.27	410.76	232.36
	0.000	0.000	0.001	0.000	0.000
AR(1) P-value	0.039	0.039	0.033	0.039	0.032
AR(2) P-value	0.546	0.730	0.602	0.679	0.707
Observations	145	145	145	145	145

NOTES: All values in parenthesis denote t-stat.*, **, *** shows level of significant at 1, 5 and 10% respectively. Panel regression, 1981−2010, estimated by GMM.

budget deficit, then prices will increase by 0.07 units. It shows magnitude of deficits to influence inflation is higher. This result confirms positive association of deficit with inflation and also presents facts that budget deficits are important determinants of inflation in South Asia as well.

When we compare two regions, it is evident that East Asia is at much better position in financial integration and intermediation than South Asia. However one interesting and noteworthy aspect is that there is large variation in development level of the financial structure for selected sample. As for some countries, equity market is more developed like in Hong Kong and Singapore, while Korea and China have voluminous bond markets, Malaysia have strong bond and equity market with relation to its GDP. Similarly Thailand's bond market is also growing. While in South Asia only India has strongest and vibrant stock market, while other economies for example Pakistan bond market development is very slow and domestic bond outstanding is 30% of GDP[8]. Mainly it consists of government bonds so there is long way to develop bond market in Pakistan. Overall model specification test are satisfied and overall significance of model is also statically significant.

6. Conclusion

This study investigated role of monetary and financial institutions in explaining inflationary impact of deficits. A panel data technique has been to estimate equations by system GMM for eleven Asian economies for period 1981−2010. Most concerned results are significant as well as according to the expectations. Results indicate that deficits are inflationary for sample Asian economies as government finances its budget deficits mainly through seigniorage. Secondly, results showed that deficits are more strongly linked to inflation where institutions are not well established and not strong enough. When financial markets are fragile, there is no other option for government to finance its deficits so they find printing of money as an easy option. Study reveals that independence of central bank is very important when studying relationship between deficits and inflation. When central bank is not free from political pressure then it has minimal say in refusing government to monetize deficits. Political pressure hinders monetary authority to follow her goals and makes it difficult for central bank to stick to price stability motive with keen devotion. So whenever deficits are monetized, they will ultimately lead to increase in price. Besides always regarding money supply as main culprit, there is need to have deep analysis of institutions to see how they play role in aggravating inflationary impact of budget deficits. Thus this study concludes that institutions are worthy to consider in explaining deficits and inflation relationship.

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[8] According to state bank of Pakistan and securities and exchange commission of Pakistan, 2012.

Appendix.

Table A
Results of Unit root-test.

Variables	Test statistics LLC test	Test statistics fisher
Inflation	−9.5818	228.6462
Deficit	−8.3345	107.7259
Rgdpg	−9.6133	227.0069
M2	−8.4011	224.9251
Def*Pvt credit	−11.6752	116.2301
Def*deposits	−8.3413	117.4302
Turnover rate	−8.3369	572.9248
Exchange rate	−6.3750	64.2643***

Null hypothesis all panels contain unit root.
*** indicates significance is at 5% level.

Table B
Summary statistics.

Variables	Obs	Mean	Std. dev	Min	Max
Inflation	330	0.722085	0.784563	−8.9679	3.88418
Deficits	330	3.398458	3.425382	−16.652	4.84354
Growth of M2	330	2.541406	0.800742	−1.4716	4.27544
R. exchange rate	330	0.728276	0.389814	−0.53635	1.58477
Real GDP growth rate	330	4.936431	3.26972	−13.1267	13.2881
Pvt sector credit to GDP	330	55.43072	50.56078	6.96069	227.753
Bank deposits	330	88.89923	11.81779	43.9535	99.9978
TOR	330	0.245454	0.068755	0.133333	0.36666

Table C
Description and sources of selected variables.

S. no	Variable	Description
VAR 1	Inflation	Annual average rate of change in consumer prices. Annual series is taken from WDI for the period 1981−2010.
VAR 2	Deficit	Overall deficit as percentage of GDP are taken for analysis defined as "difference between total revenue and total expenditure". Data is gathered from IFS.
VAR 3	Money supply	Growth rate of M2 is taken as measure of growth of money supply defined as "money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government". WDI is source of data.
VAR 4	Real GDP growth	This variable is included to see how business cycle fluctuation effects the domestic price level. Data is taken from world Economic Outlook.
VAR 5	Private sector credit to gdp	Private sector credit is used in study to measure financial sector development.Data is gathered from WDI.
VAR 6	Bank deposits	This indicator is used to measure depth and degree of the financial sector development. It is measure as ratio of deposit money bank domestic asset to deposit money bank domestic asset plus central bank domestic assets. Data taken from database of IMF constructed by Beck et al. (2009)

Table C (*continued*)

S. no	Variable	Description
VAR 7	TOR	Central bank Turnover rate of central bank governors is used as proxy of political measurement of independence of central bank. Turnover rate data is extracted from index that is calculated by Sturm, Jan-Egbert and Jakob de Haan (2001a, 2001b).
VAR 8	Real Exchange rate	Defined as a unit of domestic currency relative to U.S dollar, means higher value is associated to real exchange rate depreciation and vice versa. Data taken from Penn world tables 7.0

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