Consequences of Political Instability, Governance and Bureaucratic Corruption on Inflation and Growth: The Case of Pakistan

ADNAN HAIDER, MUSLEH UD DIN and EJAZ GHANI

> *"Countries that have pursued distortionary macroeconomic policies, including high inflation, large budget deficits and misaligned exchange rates, appear to have suffered more macroeconomic volatility and also grown more slowly during the postwar period. Does this reflect the causal effect of these macroeconomic policies on economic outcomes? One reason to suspect that the answer may be no is that countries pursuing poor macroeconomic policies also have weak "institutions," including political institutions that do not constrain politicians and political elites, ineffective enforcement of property rights for investors, widespread corruption, and a high degree of political instability."*
>
> Acemoglu, *et al.* (2003)

1. INTRODUCTION

Political regimes in Pakistan have strongly influenced the economic outcomes. Whereas the autocratic regimes have tended to exhibit good economic performance with low and stable inflation, robust growth, and fiscal discipline helped by relatively high revenue generation and checks on public expenditure, the democratic regimes have been marked by macroeconomic instability and sluggish economic growth. In addition, autocratic regimes also witnessed relatively stable external sector along with low trade deficit and high capital inflows in the form of foreign direct investments and portfolio investments, which indicates high level of confidence of foreign investors in the domestic economy. On the other hand, key economic indicators have generally deteriorated during different episodes of democratic regimes.[1] Table 1 summarises the relative performance of selected macroeconomic variables across different political regimes.

[1]For comprehensive comparison of both regimes, see Iqbal, *et al.* (2008) and Zaidi (2006).

Table 1

Performance of Selected Macroeconomic Indicators across Political Regimes

Regime*	RGDPgr	TFPgr	PINVgr	BBR	ER	INF	UR	M2gr	Corrp	Gov
1	3.18	2.10	22.14	−5.41	3.41	3.54	0.15	8.30	1.83	3.12
2	2.74	0.09	2.73	−9.11	4.55	4.38	0.10	10.41	3.13	3.75
3	5.69	1.19	7.45	−11.04	4.76	2.71	0.84	10.80	3.50	6.05
4	5.35	1.28	6.19	−9.24	4.76	3.80	1.85	9.42	3.00	6.50
5	3.67	−0.98	−2.46	−6.88	7.81	6.70	1.94	10.04	1.67	6.53
6	4.87	0.62	8.49	−9.44	9.90	16.69	2.32	18.87	1.50	3.73
7	6.45	1.67	4.94	−8.59	13.67	7.27	3.70	15.62	2.05	3.83
8	5.12	0.40	4.81	−9.57	22.87	9.30	4.37	16.48	2.00	6.11
9	2.44	−2.81	3.84	−9.09	28.11	9.83	4.70	17.77	2.00	5.25
10	4.69	−0.20	1.27	−7.01	34.85	11.72	5.43	15.35	2.23	2.06
11	2.17	−1.78	−0.33	−7.64	43.08	9.81	6.00	13.37	2.96	1.04
12	3.48	−0.02	0.84	−6.29	52.53	5.39	6.85	9.75	2.35	1.04
13	5.45	1.71	7.05	−4.52	60.02	6.57	7.06	16.35	2.67	4.40
14	3.68	1.90	7.28	−7.83	62.63	12.00	5.20	15.35	2.00	3.50
15	2.62	−0.77	−8.92	−5.47	82.68	15.43	5.78	12.63	1.00	1.40

Source: Author's calculations. For data sources and description of variables, please refer Section 3.
Variable List: RGDPgr = Average growth of real gross domestic product; TFPgr = Average growth of total factor productivity; PINVgr=Average growth of real private investment; BBR = Average of Budget Balance ratio to GDP (in percent); ER = Average Exchange rate; INF = Average inflation rate (in percent); UR = Average Unemployment rate; M2gr = Average growth in broad money (M2); Corrp = Aveage level of Corruption and Gov = Average Level of Governance.
* For political regime categorisation, please refer to Table A4 in Appendix. Further, shaded rows represent autocratic regimes.

The economy grew more than 5 percent per annum on average during autocratic regimes, which is 1.5 percentage points higher than the average growth rate observed during democratic regimes. Similarly, in all autocratic regimes, average economic growth remained above 5 percent with the exception of the second regime in which average economic growth was 2.74 percent. However, in the case of all democratic regimes average annual growth remained in the range from 2 percent to 5 percent. Therefore, more than 5 percent average annual growth across all autocratic regimes signifies the relatively strong macroeconomic fundamentals during these regimes. Similarly, growth in total factor productivity (TFP) during autocratic regimes outstripped the same in democratic eras: average annual growth of TFP during autocratic regimes was 1.19 percent as compared with TFP growth of –0.15 percent during the democratic regimes. A look at other macroeconomic indicators also shows that the economic performance during the autocratic regimes has been much better than that observed during the democratic regimes. For example, real private investment is a leading indicator of confidence the general public has in the government and its policies. Growth performance of real investment in autocratic eras has been far better than in the democratic regimes. Average growth in real investment in autocratic regimes was 5.67 percent per annum as compared with 3.70 percent during the democratic regimes.

Autocratic regimes have also outperformed the democratic regimes in terms of fiscal discipline and price stability. Consider, for example, the budget balance ratio which is the ratio of fiscal balance to GDP; the higher the ratio in absolute terms the worse is the

fiscal position. Barring short periods where democratic regimes have a slight edge over autocratic regimes, the former have mostly outperformed the latter in terms of fiscal discipline: average budge balance ratio in autocratic regimes is –8.1 percent whereas in democratic regimes the same is –7.9 percent. In terms of price stability, the democratic regimes have often been marked by high levels of inflation: average inflation in autocratic regimes stood at 4.9 percent per annum as compared with 10 percent for democratic regimes.

What factors could explain the differences in economic performance during autocratic and democratic regimes? A growing and influential body of empirical research has sought to identify the causes of poor economic outcomes as reflected in high inflation and low economic growth. There is a near consensus in the literature that poor economic outcomes are often associated with lack of good governance and poor state institutions which promote rent seeking and corruption thus impeding the process of economic growth.[2]

In the case of Pakistan, few studies have examined the role of governance and institutions in macroeconomic outcomes. For example, Khawaja and Khan (2009), Hussain (2008) and Qayyum, *et al.* (2008) note that good governance and better institutional quality are necessary conditions for batter economic outcomes. Siddique and Ahmed (2010a, 2010b) investigate the long run positive relationship between institutional quality and economic growth. They find unidirectional causality running from institutional quality to economic growth. Another recent study by Zakria and Fida (2011) finds indirect effects of democracy on economic growth. Similarly, Qureshi, *et al.* (2010) and Khan and Saqib (2011) find positive and significant impact of political instability (where political instability is defined as frequent cabinet changes and government in crises) on inflation in Pakistan.

The above studies are mostly empirical in nature and lack theoretical foundations without which it is difficult to explain how governance, democracy, political instability, quality of institutions and other deeper determinants impact inflation and growth. This study fills the gap in the literature by developing a theoretical model with micro-foundations that captures some of the highlighted features of Pakistan's economy. Furthermore, using actual data, computational modeling is done by applying Markov-Regime switching technique with maximum-likelihood procedures. The estimation results based on empirical modeling setup are in line with the stylised-facts and also confirm the intuitive implications of the theoretical model.

The rest of the paper is organised as follows: Section 2 reviews the literature that explores the links between corruption, quality of governance, inflation and economic growth. Section 3 presents theoretical model. Section 4 describes data and empirical methodology. Main findings are discussed in Section 5 and the concluding remarks are stated in Section 6.

2. HOW CORRUPTION AND GOVERNANCE LEAD TO INFLATION AND ECONOMIC GROWTH?

Cross country studies provide many plausible explanations of persistence of high inflation with low economic growth. In general, high inflation might be associated with

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[2] See for instance, Baumol (1990), Murphy, *et al.* (1991), Acemoglu (1995), Mauro (1995) and Baumol (2004).

market imperfections, exchange rates fluctuations, cost-push factors such as food supply shortages, energy inflation in the case of oil importing countries and conventional demand pull factors including private consumption and government expenditures. But research brings a common synthesis that in the long run inflation can persist only when there is excessive money supply growth [see for instance, McCandless and Weber (1995); David and Kanago (1998) and Fischer, *et al.* (2002)]. Several empirical studies on inflation-growth nexus have found that high and persistent inflation is harmful to economic growth whereas low and stable inflation is considered as conducive for the process of economic growth. For example, Khan and Senhadji (2001) estimate the threshold levels of inflation both for advance and emerging economies. They find that up to these threshold levels growth is positively related with inflation and beyond these levels, inflation exerts a negative effect on economic growth. In particular, the threshold estimates are 1-3 percent and 7-11 percent for industrial and developing countries, respectively. Figure 1 shows the relationship between CPI inflation and real GDP growth and between CPI inflation and M2 growth for OECD[3] (organisation for economic corporation and development) and developing countries[4] for the sample 1984 to 2010.

Fig. 1: Relationships of CPI Inflation with Economic Growth and Broad Money Growth
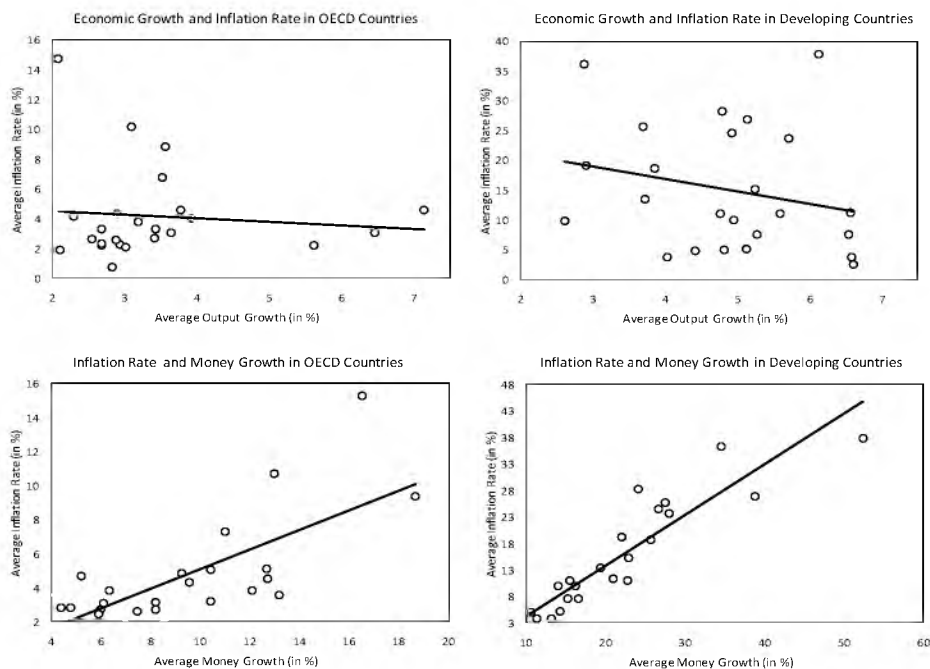
Source: Author's calculations based on International Financial Statistics of IMF Database.

[3]List of OECD countries: Australia, Austria , Belgium , Canada , Denmark, Finland, France, Greece , Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Netherland, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States.

[4]List of Developing Countries: Bangladesh, Chile, Colombia, Costa Rica, Egypt, Ghana, India, Indonesia, Israel, Jamaica, Jordan, Malawi, Malaysia, Morocco, Myanmar, Nigeria, Pakistan, Romania, South Africa, Sri Lanka, Thailand, Tunisia, Uganda, Venezuela and Zimbabwe.

This figure shows positive relationship between CPI inflation and M2 growth for both panels of countries. For developing countries this relationship is much stronger as compared with OECD case. Similarly, it shows negative relationship between CPI inflation and Real GDP growth for both the panels. In developing countries inflation normally persists at high levels so the negative relationship in this case is much stronger as compared with OECD countries where inflation remains below its threshold level. These observations confirm that high inflation is harmful for economic growth especially for emerging countries and it is mainly determined by high growth in money supply.

Apart from monetarist interpretations of high inflation coupled with low economic growth, recent research provides better explanations of the causes of high money growth and hence inflation. Rahmani and Yousefi (2009) classify these explanations into three broad categories: (a) political business cycle theories of inflation determination; (b) time inconsistency theory of optimal planning; and (c) seigniorage explanations of high rate of money growth and inflation.

The literature on political business cycle (PBC) theories provides two main explanations for sustained inflation: political instability with deficit bias hypothesis and war of iteration philosophy. The seminal attempts by Nordhaus (1975) and Alesina and Tabellini (1990) relate political instability to deficit bias as a possible determinant of inflation both in the long and short run spans. Nordhaus (1975) argues that with expectations augmented Phillips curve (EAPC) where expectations are assumed to be adaptive, there could be a likelihood of higher than social optimal inflation rate in the long-run. Alesina (1987), Alesina (1989), Rogoff and Sibert (1988) consider rational expectations approach as opposed to adaptive expectation schemes and come up with similar results. Alesina and Tabellini (1990) invoke deficit bias hypothesis and explain that alternating governments are either uncertain of each others' preferences or they disagree over the composition of public spending that gives rise to excessively high budget deficits. This deficit bias thus yields suboptimal outcomes which put pressure on inflation in both short and long run. Thus in this case inflation is a result of opportunistic behavior by alternative governments that are in office and try to influence myopic voters for reelection.

Alesina and Drazen (1991) expound the war of attrition philosophy which is the extension of Hibbs' (1977) findings. These studies focus on the cyclical behaviour of the economy and consider inflation as the result of ideological differences of political parties that come to power alternately within a setting of asymmetric information among key political parties. The higher the number of political parties in a legislative council, the higher the likelihood of conflict, the harder it is to reach agreements and the higher the increase in fiscal which ultimately leads to high inflation.

The second line of research attempts to explain the reasons of high inflation rates within an optimal planning framework with time inconsistency problems. These problems occur as a result of the game between policy making authorities and the private sector agents. The seminal attempts in this direction are Kydland and Prescott (1977), Barro and Gordon (1983a), Barro and Gordon (1983b), Backus and Driffill (1985) and Rogoff (1985). These studies explain the high money supply growth and inflation rates by using game theoretic approaches. The main argument is that the policy makers in certain cases take advantage of discretionary powers with the assumption of asymmetric

information while preparing policies to reduce unemployment or to increase economic growth at the cost of higher inflation. Private agents on the other hand are rational and aware of these hidden incentives. They do not trust policy rules unless some kind of strict commitments exist. Therefore, credibility plays a major role in such cases. This body of research also proposes reputation and delegation as possible solutions to lower money growth and inflation rates.
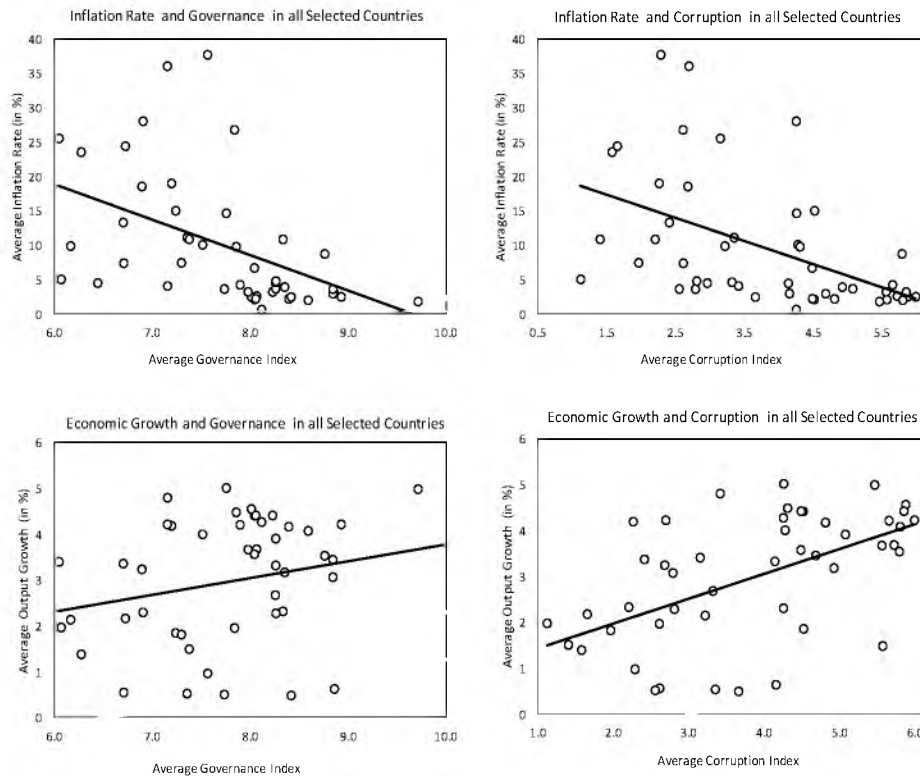
The third line of research for explaining high inflation rate is seigniorage. Khan and Saqib (2011) and Carlstom and Fuerst (2000) consider a weak form of fiscal theory of price level (weak-form FTPL) determination. According to the theory of optimal taxation,[5] the government tries to equate the marginal cost of inflation tax with the marginal cost of output taxes in order to minimise the distortions of taxation. Therefore, the government may choose to use seigniorage as a way to finance public expenditures and budget deficit. Recent studies including Telartar, *et al.* (2010), Aisen and Veiga (2008), Aisen and Veiga (2006), Cukeirman, *et al.* (1992) and Paldem (1987) also provide similar arguments that economies with political instability and weak institutions lack an efficient tax system, which results in reliance on seigniorage. To meet the demand for public expenditures governments print more money which eventually leads to higher inflation.

It is generally accepted that these three explanations for high money growth and high inflation can help in understanding the situation in developing countries. However, there could be some other plausible reasons due to the existence of bad governance, poor quality of institutions and high level of corruption activities in developing countries which can cause high inflation rates along with low economic growth. Figure 2 shows the relationship between governance and corruption with CPI inflation and real GDP growth for sixty OECD and developing countries.

This figure shows that less corruption and good governance is negatively related with average CPI inflation and positively related with real GDP growth. There are a number of reasons that can explain these stylised facts: (a) corruption may cause a misallocation of talent and skills away from productive (entrepreneurial) activities [Acemoglu (1995) and Murphy, *et al.*, (1991)]; (b) corruption may undermine the protection of the property rights, create obstacles to doing business and impede innovation and technological transfer [Hall and Jones (1999) and North (1990)]; (d) corruption may cause firms to expand less rapidly, to adopt inefficient technologies and to shift their operations to the informal sector [Svensson (2005)]; (e) corruption may limit the extent of a country's trade openness and reduce inflows of foreign investment [Pellegrini and Gerlagh (2004) and Wei (2000)]; (f) corruption may lead to costly concealment and detection of illegal income, resulting in a deadweight loss of resources [Blackburn, *et al.* (2006) and Blackburn and Forgues-Puccio (2007)]; (g) corruption may compromise human development through a deterioration in the scale and quality of public health and education programs [Blackburn and Sarmah (2008), Gupta, *et al.* (2000) and Reinikka and Svensson (2005)]; and (h) corruption may cause a general misallocation of public expenditures as certain areas of spending are targeted more for their capacity to generate bribes than their potential to improve living standards [Gupta, *et al.* (2001), Mauro (1995) and Tanzi and Davoodi (1997)].

[5] See, for instance, Phelps (1973), Vegh (1989) and Aizenman (1992).

Fig. 2. Relationships of CPI Inflation and Economic Growth with Corruption and Governance

Inflation Rate and Governance in all Selected Countries

Inflation Rate and Corruption in all Selected Countries

Economic Growth and Governance in all Selected Countries

Economic Growth and Corruption in all Selected Countries

Source: Author's calculations based on International Financial Statistics of IMF Database and International Country Risk Guide (ICRG) database.

In terms of public finances, corruption and poor governance may independently impact both the expenditure and revenue sides of the government's budget: for any given state of the latter, corruption can distort the composition of expenditures in ways described above; for any given state of the former, corruption can alter the manner by which revenues must be generated, as suggested by other empirical evidence. Thus Ghura (1998), Imam and Jacobs (2007) and Tanzi and Davoodi (1997, 2000) conclude that corruption reduces total tax revenues by reducing the revenues from almost all taxable sources. The implication is that, ceteris paribus, other means of raising income must be sought, and one of the most tempting of these is seigniorage. Significantly, it has been found that inflation is positively related to the incidence of corruption, see for instance, Al-Marhubi (2000) and Rahmani and Yousefi (2009). These studies also noted that corruption causes inflation to increase directly by increasing government expenditures and therefore budget deficit that is financed by seigniorage. However, there is an indirect channel through which corruption increase the inflation rate. Since the growth rate of GDP is lower when corruption is higher and since the inflationary effect of the growth in the money supply is higher when the growth rate of GDP is lower, the higher the inflation rate the higher is corruption.

3. DESCRIPTION OF THE THEORETICAL MODEL

This section provides a detailed description of the theoretical model explicitly outlining its micro-foundations.[6] The model economy consists of private households, public officials, firms and government as representative agents. Every agent tries to optimise its objective function subject to its constraints. The model links corruption motives of public officials and governance behaviour of government with different political regimes. These links have implications for the role of corruption and governance on inflation and growth which are discussed in the results section of the paper.

3.1. Agent's Preferences

The theoretical model considers an economy inhabited by a continuum of infinite-lived agents, who derive their lifetime utility based on consumption of private goods, C_t, consumption of public goods and services, S_t, and leisure, $(1-L_t)$. The agents-population is normalised to one and divided into a fraction, $\psi \in$ (0,1) of private agents (or assumed to be standard households), who provide labour to firms and the remaining fraction, $(1-\psi) \in$ (0,1) as bureaucrats, who work for the government as public officials. Labour supply decision of each agent follows standard Walrasian features.

At time t, the intertemporal utility function of the representative agent is specified as:

$$U = E_t \sum_{t=0}^{\infty} \rho^t U_t \{C_t, S_t, (1-L_t)\} \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \quad (3.1)$$

Where, $\rho \in$ (0,1) is a discount factor. It is assumed that utility function is separable in each of its argument and its specification is given as:

$$U_t \{C_t, S_t, (1-L_t)\} = \log(C_t) + \xi \log(S_t) + \frac{(1-L_t)^{1-v}}{1-v} \qquad \dots \qquad \dots \qquad \dots \quad (3.2)$$

Where, v is elasticity of labour supply and $\xi > 1$ is weight associated with consumption of public good in the agents welfare function. Utility function (3.2) also follows standard assumption about increasing with diminishing return in each of its argument, i.e., $\partial U_t / \partial(\bullet) > 0$ and $\partial^2 U_t / \partial(\bullet)^2 < 0$.

Each agent maximises his/her lifetime utility function (3.1) subject to the following intertemporal (flow) budget constraint:

$$C_t + S_t + \frac{M_t}{P_t} + A_{t+1} = W_t L_t + \frac{M_{t-1}}{P_t} + (1+R_t)A_t \qquad \dots \qquad \dots \qquad \dots \quad (3.3)$$

and a sequence of cash-in-advance (CIA) constraint:

$$\frac{M_{t-1}}{P_t} \geq C_t + S_t + A_{t+1} - A_t \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \quad (3.4)$$

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[6]This model is an extension of Blackburn and Powell (2011) and Del Monte and Papagni (2001).

Where, M_t denotes nominal money holdings at time t, A_t denotes real asset holdings at time t, P_t denotes the general price level and R_t is the real returns on assets. The optimisation process solves the following problem as:

$$\Im = \sum_{t=0}^{\infty} \rho^t \left[\begin{array}{l} \left\{ \log(C_t) + \xi \log(S_t) + \dfrac{(1-L_t)^{1-v}}{1-v} \right\} + \lambda_{1t} \left\{ W_t L_t + \dfrac{M_{t-1}}{P_t} + (1+R_t)A_t - C_t - S_t - \dfrac{M_t}{P_t} - A_{t+1} \right\} \\ + \lambda_{2t} \left[\dfrac{M_{t-1}}{P_t} - C_t - S_t - A_{t+1} + A_t \right] \end{array} \right] \quad (3.5)$$

Where, λ_{1t} and λ_{1t} are Lagrange-multipliers associated with the flow budget constraint (3.3) and CIA constraint (3.4) respectively. The solution to the above optimisation problem (3.5) yields the following first order conditions (FOC's):

$$\frac{\partial \Im}{\partial C_t} = 0 \Rightarrow \qquad \frac{1}{C_t} = \lambda_{1t} + \lambda_{2t} \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \quad (3.6)$$

$$\frac{\partial \Im}{\partial S_t} = 0 \Rightarrow \qquad \frac{\xi}{S_t} = \lambda_{1t} + \lambda_{2t} \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \quad (3.7)$$

$$\frac{\partial \Im}{\partial L_t} = 0 \Rightarrow \qquad (1-L_t)^{-v} = \lambda_{1t} W_t \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \quad (3.8)$$

$$\frac{\partial \Im}{\partial A_{t+1}} = 0 \Rightarrow \qquad \lambda_{1t} + \lambda_{2t} = \rho\left[(1+R_{t+1})\lambda_{1t+1} + \lambda_{2t+1}\right] \qquad \dots \qquad \dots \qquad \dots \quad (3.9)$$

$$\frac{\partial \Im}{\partial M_t} = 0 \Rightarrow \qquad (1+\pi_{t+1})\lambda_{1t} = \rho\left[\lambda_{1t+1} + \lambda_{2t+1}\right] \qquad \dots \qquad \dots \qquad \dots \quad (3.10)$$

Where, $\quad \pi_{t+1} = \dfrac{P_{t+1} - P_t}{P_t}$

3.2. Firm's Behaviour

Each firm hires labour from private households, ψL_t and produces output, Y_t with capital, K_t index of technological innovation,[7] Z_t and governance, G_t. The production function specification is Cobb-Douglas which is in line with the endogenous growth literature.[8]

$$Y_t = \vartheta Z_t^{\alpha} G_t^{\beta} (\psi L_t)^{\alpha} K_t^{1-\alpha-\beta} \qquad \alpha \in (0,1), \quad \alpha + \beta < 1 \qquad \dots \qquad \dots \qquad \dots \quad (3.11)$$

Where, $\vartheta > 0$. Following, Barro (1990), Huang and Wie (2006) and Choudhary, *et al.* (2010), governance, G_t can be defined as:

$$G_t = \chi \tau_t \qquad 0 < \chi \leq 1 \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \quad (3.12)$$

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[7]It captures positive externality effect associated with learning-by-doing process as similar with endogenous growth literature. See for example: Jones (1995) and Romer (1986).

[8] For seminal work, please refer: Barro (1990) and Barro and Sala-i-Martin (1992).

Where, τ_t is a lump-sum tax paid to government on behalf of the governance and χ denotes the parameter of governance efficiency scale. If it is less then unity then it implies that government is unable to translate tax revenue into effective governance.[9]

Due to long-run considerations, prices are assumed to be completely flexible and there is no fixed cost. The total variable cost of each firm consists of wages, $\psi W_t L_t$, lump-sum tax cost , τ_t and rate of return on capital, $R_t K_t$. Firm's profit maximisation problem implies:

$$\Pi = \vartheta Z_t^{\alpha} G_t^{\beta} (\psi L_t)^{\alpha} K_t^{1-\alpha-\beta} - \psi W_t L_t - R_t K_t - \tau_t \qquad \ldots \qquad \ldots \qquad \ldots (3.13)$$

From (3.12), we have,

$$\max_{L_t, K_t, G_t} \Pi = \vartheta Z_t^{\alpha} G_t^{\beta} (\psi L_t)^{\alpha} K_t^{1-\alpha-\beta} - \psi W_t L_t - R_t K_t - \frac{1}{\chi} G_t$$

FOC's are:

$$\frac{\partial \Pi}{\partial L_t} = 0 \Rightarrow \qquad \alpha \frac{Y_t}{L_t} = \psi W_t \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots (3.14)$$

$$\frac{\partial \Pi}{\partial K_t} = 0 \Rightarrow \qquad (1-\alpha-\beta) \frac{Y_t}{K_t} = R_t \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots (3.15)$$

$$\frac{\partial \Pi}{\partial G_t} = 0 \Rightarrow \qquad \beta \frac{Y_t}{G_t} = \frac{1}{\chi} \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots (3.16)$$

These FOC's simply state that on optimum marginal products are equal to their respective prices. Further due to the consideration of Walrasian features, there is no markup associated with any price.

3.3. Behaviour of Bureaucratic Corruption across Political Regimes

In order to model bureaucratic corruption, it is assumed that a fraction, $\Phi \in (0,1)$, of public officials is involved in corruption by embezzling public funds. This creates a leakage in the government revenues which puts pressures on government to make less expenditure on public infrastructure. This can be observed by simply linking corruption with governance efficiency scale. Following, Svensson (1995) we assume that Φ is inversely linked with χ. Therefore, (3.16) can be written as:

$$\beta \frac{Y_t}{G_t} = \frac{1}{\chi} = \Phi \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots (3.17)$$

This implies that an increase in the level of bureaucratic corruption leads toward less-effective governance. So in this way government can directly affect a firm's net-worth, an assumption consistent with Choudhary, et al. (2010). However, outcome of this

[9]Following, Choudhary, et al. (2010), Hall and Jones (1999) and North (1990), good governance is defined in terms of institutional credibility, effective laws/regulations and infrastructure stability which favours production process.

type of bureaucratic corruption is uncertain because of the changing nature of political regimes. An autocratic regime, where government aims at good governance, bears a monitoring cost in order to reduce the level of corruption. Following, Del Monte and Papagni (2001), it is assumed that on optimal government imposes a penalty of getting caught, which is exactly equal to the monetary value of monitoring cost. While maintaining the assumption of risk neutrality, the bureaucrat maximises expected profits as:

$$E(\Theta_B) = \omega \Phi \tau_t + (1-\omega)\Phi \tau_t - \omega \Omega \tau_t \quad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots (3.18)$$

Where, ω is the probability of getting caught which is defined as: $\omega = (1/2)\Phi^2$. This implies that as corruption rises, probability of getting caught also rises with the penalty rate Ω. The Optimisation problem yields the following solution:

$$\frac{E(\Theta_B)}{\partial \Phi} = \frac{\partial}{\partial \Phi}\left(\Phi \tau_t - (1/2)\Phi^2 \Omega \tau_t\right) = 0$$

$$\tau_t\left(1 - \Phi \Omega\right) = 0$$

$$\Phi = \frac{1}{\Omega} \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots (3.19)$$

Hence, as penalty rate rises bureaucratic corruption reduces. Using (3.19) it is easy to define political regimes as politically stable and politically instable as:

$$
\begin{cases}
\text{(a)} \quad \lim_{\Omega \to \infty} \Phi \to 0 \quad \Rightarrow \quad \chi \to 1 \quad : \qquad \text{Politically Sable Regime} \\[2em]
\text{(b)} \quad \lim_{\Omega \to 0} \Phi \to \infty \quad \Rightarrow \quad \chi \to 0 \quad : \qquad \text{Politically Instable Regime}
\end{cases}
$$

In politically stable regime, as penalty rate rises, bureaucratic corruption reduces. This reduction causes increase in governance efficiency scale. It promotes favorable conditions for firms to produce more and on aggregate, the economy wide output increases.

3.4. Government

In our model economy, the government performs the following tasks. It receives tax revenues from firms in exchange of the governance it provides. Among these tax revenues, it makes expenditures on public infrastructure at the rate, $\varphi \in (0,1)$ and also pays salaries to public officials, $(1-\psi)W_t L_t$. Since a fraction of public officials is involved in corruption there is a possible leakage of the available tax revenue which otherwise can be available for expenditures. Hence, corruption causes deficit in the government fiscal balance. This deficit is finance by monetary seigniorage, $(H_t - H_{t-1})$ which ultimately causes inflation in the economy. Thus, the government budget constraint is the following:

$$\frac{\overline{m}}{1+\overline{m}}\left[\frac{H_t}{P_t}\right] = (1 - \psi)W_t L_t + \varphi \tau_t - (1 - \Phi)\tau_t \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots (3.20)$$

Where, $((1-\Phi)\tau_t$ is the remaining amount of public funds after corruption and $\overline{m}$ is the rate of growth in monetary base defined as: $\overline{m} = \dfrac{H_t - H_{t-1}}{H_{t-1}}$. Therefore, in this way on aggregate both weak governance and corruption are positively associated with high inflationary due to high dependency on monetary seigniorage and, reduce output by effecting firm's net-worth via (3.17) and (3.19) channels.

Hence, as (3.17), (3.19) and (3.20) confirm that as stable political regime comes into power, governance increases and bureaucratic corruption reduces thus increasing output and slowing down the inflationary process. Unstable political regime reverses the whole scenario. Therefore, both governance and corruption have different implications on inflation and growth in different political regimes.

3.5. Solution of the Theoretical Model

Due to long run considerations, we will restrict our model solution to the balance growth equilibrium of the model. For simplicity, it is assumed that the steady state growth rate of all real variables is γ. For solution, we need to collect all equilibrium conditions of the model with the assumptions that capital and money markets are clear in the long run, i.e. $A_t = K_t$ and $M_t = H_t$. The equilibrium conditions, therefore, are:

(a) $\dfrac{1}{C_t} = \lambda_{1t} + \lambda_{2t}$

(b) $\dfrac{\xi}{S_t} = \lambda_{1t} + \lambda_{2t}$

(c) $(1 - L_t)^{-\nu} = \lambda_{1t} W_t$

(d) $\lambda_{1t} + \lambda_{2t} = \rho\left[(1 + R_{t+1})\lambda_{1t+1} + \lambda_{2t+1}\right]$

(e) $(1 + \pi_{t+1})\lambda_{1t} = \rho\left[\lambda_{1t+1} + \lambda_{2t+1}\right]$ $1 + \pi_{t+1} = \dfrac{P_{t+1}}{P_t}$

(f) $\dfrac{M_{t-1}}{P_t} = C_t - S_t - A_{t+1} + A_t$

(g) $C_t + S_t + \dfrac{M_t}{P_t} + A_{t+1} = W_t L_t + \dfrac{M_{t-1}}{P_t} + (1 + R_t)A_t$

(h) $G_t = \dfrac{1}{\Phi}\tau_t$

(i) $\alpha\dfrac{Y_t}{L_t} = \psi W_t$

(j) $(1 - \alpha - \beta)\dfrac{Y_t}{K_t} = R_t$

(k) $\beta\dfrac{Y_t}{G_t} = \Phi$

(l) $\dfrac{\overline{m}}{1+\overline{m}}\left[\dfrac{H_t}{P_t}\right] = (1 - \psi)W_t L_t + \varphi\tau_t - (1 - \Phi)\tau_t$

In the balanced-growth path C_t grows at a constant rate $(1+\gamma)$. So $(\lambda_{1t}+\lambda_{2t})$ grows at $(1+\gamma)^{-1}$. Thus condition (e) implies: $(1+\gamma-\rho)(\lambda_{1t+1}+\lambda_{2t+1})=\rho r\lambda_{1t+1}$. Substituting it in (f) implies:

$$(1+\gamma)(1+\pi_{t+1})\lambda_{1t+1}=\rho(\lambda_{1t+1}+\lambda_{12t+1})$$

By virtue of the binding CIA constraint (g), inflation is constant and inversely related to growth according to:

$$\frac{1+\overline{m}}{1+\pi}=1+\gamma \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots (3.21)$$

(f) and (g) also yield the following result:

$$(1+\gamma-\rho)(1+\gamma)=\frac{R\rho^2}{1+\pi} \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots (3.22)$$

In aggregate x_t comprises the income of all agents as:

$$x_t=\psi L_t W_t+(1-\Phi)(1-\psi)L_t W_t+\Phi(1-\psi)L_t\left[W_t+\frac{\tau_t}{(1-\psi)L_t}\right]$$

After simplification and substituting equilibrium conditions we have:

$$x_t=\alpha\frac{Y_t}{\psi}+\Phi\beta Y_t=\left[\frac{\alpha}{\psi}+\Phi\beta\right]Y_t \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots (3.23)$$

CIA and agents budget constraint simultaneously simplifies with equilibrium conditions as:

$$\frac{H_t}{P_t}=x_t+RK_t$$

Therefore,

$$\frac{H_t}{P_t}=\left[\frac{\alpha}{\psi}+\Phi\beta\right]Y_t+(1-\alpha-\beta)Y_t=\left[\frac{\alpha}{\psi}+\Phi\beta+1-\alpha-\beta\right]Y_t$$

Substituting it in (m) we get:

$$\frac{\overline{m}}{1+\overline{m}}\left[\frac{\alpha}{\psi}+\Phi\beta+1-\alpha-\beta\right]Y_t=(1-\psi)W_t L_t+\varphi\tau_t-(1-\Phi)\tau_t$$

After simplification we get:

$$\frac{\overline{m}}{1+\overline{m}}=\frac{[(1-\psi)\alpha+\beta\psi\eta-(1-\varphi)\psi\beta]}{[\alpha+\Phi\psi\beta-\psi-\alpha\psi-\beta\psi]}=\frac{[(1-\psi)\alpha+\beta\psi\Phi-(1-\varphi)\psi\beta]}{[(1-\psi)\alpha+\beta\psi\Phi+(1-\psi)\beta]}$$

$$\frac{\overline{m}}{1+\overline{m}} = \frac{\left[(1-\psi)\alpha + \beta\psi\Phi - (1-\varphi)\psi\beta\right]}{\left[(1-\psi)\alpha + \beta\psi\Phi + (1-\psi)\beta\right]}$$

$$\overline{m} = \frac{\left[(1-\psi)\alpha + \beta\psi\Phi - (1-\varphi)\psi\beta\right]}{(1-\psi\varphi)\beta}$$

Hence,

$$\pi \cong \overline{m} = \frac{\left[(1-\psi)\alpha + \beta\psi\Phi - (1-\varphi)\psi\beta\right]}{(1-\psi\varphi)\beta} \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots (3.24)$$

Hence, (3.19), (3.21) and (3.24) show that in the presence of corruption, an increase in governance inefficiency leads to inflationary pressure along with low economic growth.

4. DESCRIPTION OF EMPIRICAL MODELS

This section briefly outlines the empirical setup by illustrating data, specification of econometric models and regime switching estimation methodology used in this paper.

4.1. Data

To estimate the model parameters, data over the annual frequencies from 1950 to 2011 on fourteen macroeconomic/political variables are used: the inflation rate based on consumer price index (CPI); real gross domestic product (Real GDP); per capita output; trade shares in terms of GDP as a proxy of openness; agriculture output shares in terms of GDP; nominal exchange rate of Pak-Rupees in terms of US dollars; government borrowing; fiscal balance ratio as percent of GDP; private sector credit; international oil prices; avg. year of schooling as proxy of human capital; central bank governor turnover; index of corruption and index of governance. Details on the construction and the sources of the data set are provided in table A1 of Appendix-A. Descriptive statistics and pair-wise correlation matrix of above mentioned variables are also reported in Table A2 and table A3 of Appendix-A. These correlations are consistent with the standard theory. The results based on descriptive statistics show that average levels of corruption and governance for the complete sample are 2.24 and 6.21 respectively. The low values of corruption and governance indices indicate high levels of corruption along with poor governance. The average inflation and economic growth for the complete sample are 7.5 and 5.0 respectively. The correlation coefficients of corruption with inflation and growth are –0.48 and 0.11. These negative values show positive relationship of corruption with inflation and positive correlation values of corruption with growth shows negative relationship. Similarly, pair-wise correlation values show negative relationship of governance with inflation and positive relationship of governance with growth.

4.2. Specification of the Econometric Models

Following standard practices, we specify two econometric models, one for the explanation of inflation and second for economic growth. The approach followed here is to add corruption and governance in both the models as explanatory variables along with

the standard determinants of inflation and economic growth. In order to examine the interactions of governance and corruption with inflation and growth across different political regimes, we find it useful to estimate econometric models with Markov-Regime switching approach. This approach enables us to examine the varying nature of deeper determinants across different regimes. The specification of growth model is consistent with Barro (1991), Hall and Jones (1999), Ahmed and Danish (2010a, 2010b) and Zakaria and Fida (2011); whereas the specification of the econometric model for inflation is consistent with Al-Marhubi (2000), Rahmani and Yousefi (2009), Khan and Saqib (2011). These specifications are given as:

$$\inf_t = \alpha_0 + \alpha_1 pcy_t + \alpha_2 openn_t + \alpha_3 AgriOutput_t + \alpha_4 ExRate_t + \alpha_5 GovtBorrowing_t + \alpha_6 FBR_t$$
$$+ \alpha_7 PvtCredit_t + \alpha_8 Oilp_t + \alpha_9 CBGovernerTurnover_t + \eta_{1,st} corrup_t + \eta_{2,st} gov_t + \varepsilon_{\inf,t}$$

and

$$y_t = \beta_0 + \beta_1 \inf_t + \beta_2 openn_t + \beta_3 AgriOutput_t + \beta_4 GovtBorrowing_t + \beta_5 FBR_t + \beta_6 PvtCredit_t$$
$$+ \beta_7 Oilp_t + \beta_8 HC_t + \mu_{1,st} corrup_t + \mu_{2,st} gov_t + \varepsilon_{y,t}$$

Where; *inf*:= CPI inflation rate; *y*:=real GDP growth; *pcy*:=per capita output growth; *openn*:= trade shares as percent of GDP; *ExRate*:=nominal exchange rate; *GovtBorrowing*:= net budgetary borrowing as percent of GDP; *FBR*:= fiscal balance ratio as percent of GDP; *PvtCredit*:= growth in private sector credit; *Oilp*:= international oil prices; *CBGovernerTurnover*:= Central Bank Governer Turnover; *HC*:=Human capital; *corrupt*:= index of corruption; *gov*:= index of governance and ε's:= residual terms.

Here, $\alpha's$ and $\beta's$ are fixed coefficients and $\eta's$ and $\mu's$ are regime switching coefficients. S_t represents the state at time t with switching to take place between autocratic and democratic regimes. We also allow the variance of the error terms to switch simultaneously between the states.

4.3. Markov Regime Switching Approach

The Markov Regime Switching (hence after, MRS) modeling approach was originally introduced by Goldfeld and Quandt (1973) in the field of econometrics. Cosslett and Lee (1985) have extended this approach by providing iterative algorithms to compute likelihood functions. This seminal attempt was similar in spirit of the state-space modeling using Kalman filter approach. Later, this approach has been used extensively in various economic applications, including Hamilton (1989), in the case of business cycle modeling and Engel and Hamilton (1990) for exchange rate analysis. To validate the outcomes of this approach various statistical tests have been developed. Some of the tests based on moment conditions and stationarity diagnostics can be found in Tjøstheim (1986), Yang (2000) and Francq and Zakoïan (2001). A comprehensive textbook treatment of this approach can be found in Hamilton (1994).

In our case, this approach allows us to estimate how much bureaucratic corruption and governance quantitatively impacts inflation and economic growth across different political regimes. Some of the technical details are given below.

Let us assume a time series, π_t, (let it denotes inflation rate) with its conditional density function: $f(\pi_t \mid \Omega_{t-1}; \beta)$ where; Ω_{t-1} is the information set which contains past values and other explanatory variables and β is the vector of parameters to be estimated. The simplest two-state case in which the structural changes occur at the particular time, $t = t_1$, its density function changes to $f(\pi_t \mid 1, \Omega_{t-1}; \beta)$ for t_1 observations and $f(\pi_t \mid 2, \Omega_{t-1}; \beta)$ for other $t_n - t_1$ observations. The corresponding likelihood functions are: $\prod_{t=0}^{t_1} f(\pi_t \mid 1, \Omega_{t-1}; \beta)$ and $\prod_{t=0}^{t_n - t_1} f(\pi_t \mid 2, \Omega_{t-1}; \beta)$. For example, the time series $\pi_t = u_i + u_t$, where $u_t \sim i.i.d.\mathrm{N}(0, \sigma_i^2)$. For $i = 1, 2$, the density function is:

$f(\pi_t \mid i, \Omega_{t-1}; \beta) = \dfrac{1}{\sqrt{2(3.1416)\sigma_i^2}} \exp\left[-\dfrac{1}{2} \dfrac{(\pi_t - u_i)^2}{\sigma_i^2} \right]$. In order to model multiple regime

shifts, we can replace the index i in the density function $f(\pi_t \mid i, \Omega_{t-1}; \beta)$ by a discrete variable S_t, whose possible values are $1, 2, \ldots, k$ and the density function generalises to $f(\pi_t \mid S_t, \Omega_{t-1}; \beta)$. Thus S_t, can be considered as a regime indicator which is serially dependent upon $S_{t-1}, S_{t-2}, \ldots, S_{t-k}$, in which case the regime switching process is referred to as a kth order Markov switching process. It is important to note that S_t, has its own distribution which cannot be observed, which means that we cannot construct the likelihood function by using $f(\pi_t \mid S_t, \Omega_{t-1}; \beta)$. Consequently, we must have the density function $f(\pi_t \mid \Omega_{t-1}; \beta)$ by eliminating the unobserved term S_t. If the past information Ω_{t-1} does not help in evaluating the distribution of S_t, we can use an approach here: we consider a conditional likelihood, $P(S_t \mid \Omega_{t-1})$, and multiply it to the conditional density $f(\pi_t \mid S_t, \Omega_{t-1}; \beta)$:

$$f(\pi_t \mid \Omega_{t-1}; \beta) = \sum_{st=1}^{J} f(\pi_t \mid S_t, \Omega_{t-1}; \beta) \cdot P(S_t \mid \Omega_{t-1}) \qquad \ldots \qquad \ldots \qquad \ldots \quad (4.1)$$

The unobserved term S_t can be eliminated by summing up all the possible values of it. The corresponding likelihood is:

$$\prod_{t=1}^{T} f(\pi_t \mid \Omega_{t-1}; \beta) = \prod_{t=1}^{T} \sum_{st=1}^{k} f(\pi_t \mid S_t, \Omega_{t-1}; \beta) \cdot P(S_t \mid \Omega_{t-1}) \qquad \ldots \qquad \ldots \quad (4.2)$$

This log-likelihood function from (4.2) can be written as:

$$\ln L = \prod_{t=1}^{T} \ln f(\pi_t \mid \Omega_{t-1}; \beta) = \prod_{t=1}^{T} \ln \sum_{st=1}^{k} f(\pi_t \mid S_t, \Omega_{t-1}; \beta) \cdot P(S_t \mid \Omega_{t-1}) \qquad \ldots \quad (4.3)$$

This function is a weighted average of the density functions for multiple regimes, with weights being the probability of each regime. Finally this MRS representation is used to estimate the model with explanatory variables with endogenous regime switching.

For solution algorithms, Hamilton (1994) simplifies the analysis to the cases where the density function of π_t depends only on finitely many past values of S_t:

$$f(\pi_t \mid S_t, S_{t-1}, \Omega_{t-1}; \beta) = f(\pi_t \mid S_t, St-1,\ldots, St-m, \Omega_{t-1}; \beta) \qquad \ldots \qquad \ldots \quad (4.4)$$

for some finite integer m, and the corresponding conditional likelihood is $P(S_t, St-1,\ldots, St-m \mid \Omega_{t-1})$, with the assumption that S_t follows a first-order Markov chain: $P(St \mid St-1, \Omega_{t-1}) = P(St \mid St-1) \equiv p_{st-1st}$, where the transition probability, p_{st-1st}, is specified as a constant coefficient that is independent of time t (time-invariant). The conditional likelihood $P(S_t, St-1,\ldots, St-m \mid \Omega_{t-1})$ can then be calculated iteratively through two equations as follows:

$$P(St,\ldots, St-m \mid \Omega_{t-1}) = \sum_{St-m-1=1}^{k} P(St \mid St-1,\ldots, St-m-1, \Omega_{t-1}) \cdot P(St-1,\ldots, St-m-1 \mid \Omega_{t-1})$$

$$= \sum_{St-m-1=1}^{k} p_{st-1st} \cdot P(St-1,\ldots, St-m-1 \mid \Omega_{t-1})$$

$$= \begin{cases} p_{st-1st} \cdot P(St-1,\ldots, St-m \mid \Omega_{t-1}), m > 0, \\ \sum_{st-1}^{k} p_{st-1st} \cdot P(St-1 \mid \Omega_{t-1}), m = 0 \end{cases} \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \quad (4.5)$$

for $t = 2, 3. \ldots, T$. Note that the left-hand side term $P(S_t, St-1,\ldots, St-m \mid \Omega_{t-1})$ differs from the second term on the right-hand side $P(S_t, St-1,\ldots, St-m \mid \Omega_{t-1})$ in that all of the S_t terms are one period ahead. The term, $P(S_t, St-1,\ldots, St-m \mid \Omega_{t-1})$, in which the first S_{t-1} term and Ω_{t-1} are both subscripted by the same period of time, is then computed as follows:

$$P(St,\ldots, St-m \mid \Omega_t) = \frac{f(\pi_t \mid St,\ldots, St-m, \Omega_{t-1}) \cdot P(St,\ldots, St-m \mid \Omega_{t-1})}{\sum_{st=1}^{K} \cdots \sum_{st-m=1}^{k} f(\pi_t \mid St,\ldots, St-m, \Omega_{t-1}) \cdot P(St,\ldots, St-m \mid \Omega_{t-1})} \qquad \ldots (4.6)$$

$$= \frac{f(\pi_t \mid St,\ldots, St-m, \Omega_{t-1}) \cdot P(St,\ldots, St-m \mid \Omega_{t-1})}{f(\pi_t \mid \Omega_{t-1})}$$

for $t = 1, 2, \ldots, T$. Given initial values, $P(S_t, St-1,\ldots, St-m \mid \pi_0)$, we can calculate $P(S_t, St-1,\ldots, St-m \mid \Omega_{t-1})$ by using (4.5) and (4.6) iteratively, as discussed in Kim and Nelson (1999). Now to determine the initial values, $P(S_t, St-1,\ldots, St-m \mid \pi_0)$, we first note that if we further assume that $P(S-j \mid S-j-1, S-j-2,\ldots, \pi_0) = P(S-j \mid S-j-1) \equiv P_{s-j-1s-j}$, for $j = 0, 1, 2, \ldots$, then we have: $P(S_1, S_0, S-1,\ldots, S-(m-1) \mid \pi_0) = p_{s0s1} \cdot p_{s-1s0} \cdots p_{s-(m-1)s-(m-2)} \cdot P(S-(m-1) \mid \pi_0)$.

Given the m terms of transition probabilities $p_{s0s1} \cdot p_{s-1s0} \cdots p_{s-(m-1)s-(m-2)}$, we have to determine k values for the $P(s-(m-1) \mid Y_0)$ term for the k possible states of $s_{-(m-1)}$. The easiest approach is to assume they are some given constants such as the same number $k-1$ for each of them. Hamilton (1994) also provides an alternative way to find these initial values, i.e. to consider these as fixed parameters just like the way the transition probabilities p_{st-1st} are assumed to be fixed parameters. Therefore, this approach starts the filter at time $t = 1$, and the initial values are obtained from ordinary

least square regression. Once the coefficients of the model are estimated using an iterative maximum likelihood procedure and the transition probabilities are generated, it can provide an easy way to use the algorithm in Kim and Nelson (1999) to derive the filtered probabilities for S_t using all the information up to time t.

5. THE RESULTS

This section provides a discussion of the main results based on calibration of the theoretical model and estimation of regime switching models of inflation and economic growth. Calibration results are presented in Appendix B, whereas estimation results are reported in Appendix C.

5.1. Calibration Results of the Theoretical Model

The deep parameter values for model calibrations are given in Table B1 of section B. Most of these parameter values are based on authors' calculations except that the share of governance in the production function is taken from Choudhary, *et al.* (2010). The parameter value of discount factor (ρ) is set in order to obtain historical mean of the nominal interest rate in the steady state which turns out to be 0.987 for Pakistan's case. The value of steady state growth (γ) is 6.0, which is calculated by taking long-run average of real GDP of the whole sample. Share of governance (β) in production function is set to be 0.25. The share of expenditure on public infrastructure (φ) is calculated by taking the ratio of total expenditure on public infrastructure to GDP which turns out to be 0.45. The share of public officials (bureaucrats) in the economy ($1-\Psi$) is calculated by taking the ratio of employed labor in public sector to total labor force and the obtained value is 0.25. The parameter of corruption (Φ) and governance (χ) are calculated from indices of bureaucratic corruption and governance. Using these parameter values, the theoretical model is calibrated recursively. The process of iteration is performed up to forty years, where the initial period is taken as 1970. It covers the full post-partition episode of Pakistan's economy.[10] Model simulation results for CPI inflation and real GDP growth are given in Table B2 and Figures B1, B2 and B3 of Appendix B. These results show that simulated series of the theoretical model closely mimic the actual series. The subsample results across different political regimes are also robust. It confirms the implications of the theoretical model that when any autocratic regime comes into power macroeconomic fundamentals tend to improve with slowdown in inflation, robust growth, and lower bureaucratic corruption due to good governance. But in the case of democratic regimes, these results are reversed: governance becomes weak with increase in the level of corruption. Also, the elected governments tend to rely more on seigniorage to finance their expenditures with adverse consequences for inflation and growth. The model calibration results also indicate that the model is quite suitable for analysing the inflation dynamics in Pakistan: within sample inflation predictions outperform growth predictions which implies that inflation in Pakistan is more sensitive to political instability, corruption and poor governance.

[10] East, West Pakistan separation.

5.2. Estimation Results of Regime Switching Models

The estimation results[11] of regime switching models (RSM) are reported in Table C1. Both econometric models of inflation and economic growth are subdivided into two forms: one with corruption and second with governance. This is due to computational simplicity as parameters associated with these variables are varying (not fixed) subject to regime change. It reduces computational complexity in terms of state selection and also provides independent smoothed probabilities at high and low frequencies across sub political regimes. The parameters associated with all other explanatory variables are treated as fixed and their estimated values can be interpreted in the usual way.

The first term in all RSMs is intercept which is insignificant in all the cases. It indicates the fitness of these RSMs showing that there are minimum risks of omitted variable bias. The per capita output growth is negatively related with CPI. The estimates of agriculture output shares in inflation regressions also provide similar results. In case of growth models, these results are robust. The estimation results of growth model show that Inflation contributes negatively to output growth. It implies that to have sustained output growth, inflation should be curtailed at non-harmful levels.

Trade openness estimates in the case of inflation models appear are positive and significant. One possible interpretation may be the higher propensity of imports which may put pressure on balance of payment position through the trade account. Worsening of balance of payment position means depreciation of local currency and hence ends up with high inflation. Similarly, estimation results of growth models show trade openness as a positive and significant determinant of output growth, because it is associated with productivity improvements resulting from enhanced competitiveness.

The results of RSM1 and RSM2 show that Inflation is positively related to nominal exchange rate and negatively to output growth. Again being a net importer, any depreciation of local currency will have an adverse impact on inflation and economic growth. The government borrowing ratio is positively associated with inflation and negatively with output growth. The higher is the government borrowing from the domestic financial sector the higher will be the crowding out of the private sector resulting in low economic activity and low level of output growth.

The fiscal balance ratio is negatively related to inflation which basically shows that higher deficit is accompanied with higher inflation. As with the majority of developing countries, due to lower credit rating in international market, the main source of financing the fiscal deficit is borrowing from internal sources. Higher fiscal deficit affects the rate of inflation in two ways; first by directly increasing inflation and, second by increasing the government borrowing which in turn impacts the rate of inflation. But surprisingly, it has a negative association with output growth which means that higher fiscal deficit will bring a higher level of output growth. The fiscal balance ratio is statistically significant in the model but its contribution in explaining output growth is marginal.

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[11]MATLAB package MS-Regress [developed by Marcelo Perlin (2009)] is used to estimate Multivariate Markov-Regime Switching models with Maximum likelihood procedures. This toolkit is freely available on internet on the following link: www.mathworks.com [Reference: Parlin (2009). *MS-Regress: A package for Markov-Regime Switching Models in MATLAB*. Matlab central: File Exchange].

The private sector credit is negatively associated with inflation, which shows that private sector credit stimulates output which helps in curtailing inflation. This result is in contrast with earlier findings. Although private sector credit is statistically significant but its contribution in the explanation of inflation in the model is marginal. The private sector credit is positively related to output growth showing that access to the financial resources stimulates economic activity and hence output growth.

As Pakistan is a net oil importer, inflation is positively related to international oil prices. The estimation results of inflation models confirm this scenario. Due to scarce financial resources, any hike in international oil prices is passed on to domestic consumers leading to higher cost of transportation and increase in prices of consumer items. Similar to the estimates of the inflation model, the growth model estimates show that international oil prices are negatively associated with economic growth.

Inflation is positively associated with central bank governor turnover, which means that frequent changes in the top leadership of the central bank could be inflationary. One possible interpretation of this positive relationship may be the validity of fiscal dominance hypothesis that potentially undermines central bank policy decisions on price stability. Output growth is positively related to human capital which is in line with the predictions of the endogenous growth models. A well-educated and skilled human capital can be instrumental in research and development, adoption of new technology and productivity improvements resulting in higher output growth.

The regime switching estimates of corruption in the case of inflation model show positive linkages with inflation both in autocratic and democratic regimes. However, in autocratic regime, its magnitude is negligible, whereas in democratic regimes corruption significantly contributes towards high inflation. Similar results are found in the case of governance, which is negatively related to inflation in both the regimes. In autocratic regimes, high magnitude of governance implies a significant slowdown of inflation in such regimes. These dynamics can also be observed from Figure C1 and Figure C2 of Appendix-C, where Markov-regime switching probabilities of corruption and governance are plotted along with inflation. These figures show that democratic regimes are more vulnerable with high level of corruption and bad governance.

The results of growth model show a negative association of corruption with economic growth both in autocratic and democratic regimes. Corruption significantly declines economic growth in democratic regimes but autocratic regimes show insignificant results. Governance appears is positively related to economic growth in both the regimes. In autocratic regimes, high magnitude of governance implies a significant surge in growth process. These results are robust in the case of Markov-Regime switching plots which are shown in Figure C3 and Figure C4 of Appendix-C, where smoothing probabilities of corruption and governance are plotted with real GDP growth. These figures show that autocratic regimes tend to show better economic performance with robust economic growth, low level of corruption, and good governance.

Along with regime switching estimates, autoregressive coefficients (of order 1) of the inflation models show high persistence. Such high persistence means inflation takes a fair amount of time in changing its curvature. Once the economy enters in high inflationary period, sustained efforts are required to get the economy back to a low level of inflation. The level of corruption and poor quality of governance are the main

determinants of high persistence rate in inflation indicating that both corruption and poor governance cause continuous distortions in market mechanisms and price structures making inflation stubborn. However, in the case of economic growth, low level of persistence in output is observed indicating that output is more vulnerable to different types of political regimes. Sustained output growth requires corruption free implementation of development activities which could only be achieved with good governance. These findings are consistent with the implications of the theoretical models.

6. CONCLUDING REMARKS

This study mainly focuses on analysing the consequences of political instability, governance and bureaucratic corruption on inflation and growth in the case of Pakistan. A representative agent model with micro-foundations and two Markov-Regime switching models of inflation and growth have been used. The analyses based on both these approaches show that high corruption along with weak governance cause high inflation and low growth. In an environment with weak governance, agents enhance their level of corruption resulting in leakages in public revenues and forcing the government to rely on seigniorage to finance public expenditures with adverse consequences for inflation and economic growth. Based on stylised facts, the paper shows that both corruption and poor governance typically coincide with political instability during the democratic regimes signifying the critical need to achieve political stability and to enhance the quality of governance for better economic outcomes.

Table A1

Description and Sources of Selected Variables

S. No.	Variable	Description / Source
VAR1	CPI Inflation Rate	Overall domestic inflation. This series is the annual growth rates of consumer price index (CPI: base 2000=100) for Pakistan. Data source of this variable is FBS, Islamabad, Pakistan.
VAR2	Real GDP Growth	Real Gross Domestic Product (Real GDP). This series is the annual growth rates of Real GDP with base 2000-01. Data source of this variable is Pakistan Economic Survey, MOF, Islamabad, Pakistan.
VAR3	Per Capital Output Growth	Per capita output is calculated by taking ratio of Real GDP to total population. Then series is constructed by taking annual growth rates of per capita output. Data on total population is taken from Pakistan Economic Survey, Various issues, MOF, Islamabad, Pakistan.
VAR4	Trade Share	Trade Shares are computed by taking ratio of total trade (total exports + total imports) to nominal GDP. This series is taken as proxy of trade openness. Data on total exports and total imports are taken from FBS, Islamabad, Pakistan.
VAR5	Agriculture Output Share	Agriculture output shares are calculated by taking ratio of total agriculture output to real GDP. Data on agriculture output is taken from Pakistan Economic Survey, MOF, Islamabad, Pakistan.
VAR6	Exchange Rate	Bilateral nominal Exchange rate of Pakistan Rupees in terms of US Dollars. The data of this series is taken from the Statistics Department of the State Bank of Pakistan, Karachi, Pakistan.
VAR7	Government Borrowing Ratio	Government Borrowing ratio is computed by taking ratio of net budgetary borrowing to GDP. The data on net budgetary borrowing is taken from Statistics Department of the State Bank of Pakistan, Karachi, Pakistan.
VAR8	Fiscal Balance Ratio	Fiscal Balance Ratio is computed by taking ratio of total budget balance (total revenue - total expenditure) to nominal GDP. The data on fiscal balance is taken from Pakistan Economic Survey, various issues, MOF, Islamabad, Pakistan.
VAR9	Growth in Private Credit	The series is the annual growth rates of total private sector credit. Data of this series is taken from Statistics Department of the State Bank of Pakistan, Karachi, Pakistan.
VAR10	International Oil Prices	Data on international oil prices is taken from International Financial Statistics (IFS) of International Monetary Fund database.
VAR11	Human Capital	Data on Human capital formation is proxy by average year of schooling. Data source of this variable is Barro and Lee (2010).
VAR12	Central Bank Governor Turnover	This variable is proxy by a dummy variable. In this series, value 1 being assigned to all those years where governor turnover (State Bank of Pakistan) is taking place.
VAR13	Index of Corruption	Index of Corruption is taken from Barro (1991) and International Country Risk Guide (ICRG) database. This index is ranked from 0 to 10. Low index value of corruption shows high level of corruption.
VAR14	Index of Governance	Index of Governance is also taken from Barro (1991) and International Country Risk Guide (ICRG) database. This index is ranked from 0 to 10. Low index value of governance shows poor level of governance.

Note: MOF: Ministry of Finance; FBS: Federal Bureau of Statistics.

Table A2

Descriptive Statistics of Selected Variables Included in Regime Switching Regressions

S. No.	Variables	Mean	Median	Maximum	Minimum	Variance	Std. Dev.	Kurtosis	No. of Obs.
1.	CPI Inflation Rate	7.45	6.04	27.98	−3.23	31.96	5.65	5.08	61
2.	Real GDP Growth	4.94	5.03	9.83	−1.33	5.53	2.35	−0.44	61
3.	Per Capital Output Growth	2.25	2.18	7.78	−3.70	5.30	2.30	−0.12	61
4.	Trade Share	29.45	30.14	39.30	16.56	32.25	5.68	−0.58	62
5.	Agriculture Output	0.33	0.30	0.53	0.21	0.01	0.10	−1.04	62
6.	Exchange Rate	23.50	9.99	85.55	3.31	565.19	23.77	0.11	62
7.	Government Borrowing Ratio	7.97	3.10	25.32	−2.75	75.01	8.66	−1.12	62
8.	Fiscal Balance Ratio	−8.04	−8.25	−2.48	−15.80	7.41	2.72	0.02	62
9.	Growth in Private Credit	15.48	15.01	46.23	−13.82	109.33	10.46	1.01	61
10.	International Oil Prices	20.28	14.77	97.04	1.62	533.12	23.09	3.16	62
11.	Human Capital	2.18	1.83	4.90	0.85	1.59	1.26	−0.34	62
12.	Central Bank Governor Turnover	0.25	0.00	1.00	0.00	0.19	0.43	−0.55	62
13.	Index of Corruption	2.24	2.00	3.50	1.00	0.63	0.79	−1.02	62
14.	Index of Governance	3.89	3.88	6.53	1.04	4.96	2.23	−0.95	62

Table A3

Pairwise Correlation Matrix

	Var1	Var2	Var3	Var4	Var5	Var6	Var7	Var8	Var9	Var10	Var11	Var12	Var13	Var14
Var1	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–
Var2	−0.05	1.00	–	–	–	–	–	–	–	–	–	–	–	–
Var3	−0.05	−0.21	1.00	–	–	–	–	–	–	–	–	–	–	–
Var4	0.43	0.02	0.09	1.00	–	–	–	–	–	–	–	–	–	–
Var5	−0.42	−0.13	−0.19	−0.72	1.00	–	–	–	–	–	–	–	–	–
Var6	0.27	−0.12	0.01	0.54	−0.76	1.00	–	–	–	–	–	–	–	–
Var7	−0.47	−0.04	−0.07	−0.66	0.72	−0.57	1.00	–	–	–	–	–	–	–
Var8	0.09	−0.11	−0.04	0.26	−0.32	0.57	−0.53	1.00	–	–	–	–	–	–
Var9	−0.16	0.42	0.37	0.00	−0.01	−0.13	0.09	−0.13	1.00	–	–	–	–	–
Var10	0.36	0.01	0.10	0.56	−0.71	0.82	−0.53	0.45	−0.04	1.00	–	–	–	–
Var11	0.32	−0.01	0.10	0.62	−0.85	0.97	−0.63	0.55	−0.05	0.87	1.00	–	–	–
Var12	0.23	−0.21	−0.19	0.05	−0.18	0.20	−0.11	−0.06	−0.16	0.18	0.19	1.00	–	–
Var13	−0.48	0.11	0.08	−0.38	0.53	−0.50	−0.76	−0.62	0.17	−0.53	−0.55	−0.25	1.00	–
Var14	−0.04	0.13	0.03	−0.29	0.42	−0.67	0.58	−0.58	0.07	−0.44	−0.61	−0.03	0.44	1.00

Table A4

List of Pakistan's Political Regimes

Regime*	Duration	Type**	President / Governor	Prime Minister(s)
1	Oct 19, 1951 to Aug 07, 1955	Democratic	Malik Ghulam Mohammed	Khawaja Nazimuddin / Mohammad Ali Bogra
2	Aug 07, 1955 to Oct 27, 1958	Autocratic	Major General Iskandar Mirza	Chaudhry Mohammad Ali / Hussain Shaheed Suharwardy / I.I. Chundrigar / Malik Feroze khan Noon
3	Oct 27, 1958 to Mar 25, 1969	Autocratic	Field Marshal Mohammad Ayub Khan	Post Abolished
4	Mar 25, 1969 to Dec 20, 1971	Autocratic	General Agha Mohammad Yahya khan	Nurul Amin
5	Dec 20, 1971 to Aug 14, 1973	Democratic	Zulfikar Ali Bhutto	Post Abolished
6	Aug 14, 1973 to Sep 16, 1978	Democratic	Chaudhry Fazal Illahi	Zulfikar Ali Bhutto
7	Sep 16, 1978 to Aug 17, 1988	Autocratic	General Mohammad Zia-ul-Haq	Muhammad Khan Junejo
8	Aug 17, 1988 to Jul 18, 1993	Democratic	Ghulam Ishaq Khan	Benazir Bhutto /Ghulam Mustafa Khan Jatoi /Mian Mohammad Nawaz Sharif/Balakh Sher Mazari/Mian Mohammad Nawaz Sharif
9	Jul 18, 1993 to Nov 14, 1993	Democratic	Wasim Sajjad	Moin Qureshi
10	Nov 14, 1993 to Dec 2, 1997	Democratic	Sardar Farooq Ahmad Khan Leghari	Benazir Bhutto / Malik Miraj Khalid/Mian Mohammad Nawaz Sharif
11	Dec 2, 1997 to Jan 1, 1998	Democratic	Wasim Sajjad	Mian Mohammad Nawaz Sharif
12	Jan 1, 1998 to Jun 20, 2001	Democratic	Justice (Ret.) Rafique Tarrar	Mian Mohammad Nawaz Sharif
13	Jun 20, 2001 to Aug 18, 2008	Autocratic	General Parvez Musharraf	Mir Zafarullah Khan Jamali / Chuadhary Shujaat Hussain / Shaukat Aziz
14	Aug 18, 2008 to Sep 9, 2008	Democratic	Muhammad Mian Soomro	Muhammad Mian Soomro / Syed Yousaf Raza Gillani
15	Sep 9, 2008 to Dated	Democratic	Asif Ali Zardari	Syed Yousaf Raza Gillani

Notes: Khan and Saqib (2011). Shaded rows represent autocratic regimes.

    *Our data sample starts from 1950. Therefore, we have excluded initial two regimes,
    [Aug 14, 1947 to Sep 11, 1948, Governor: Quaid-e-Azam Mohammed Ali Jinnah] and
    [Sep 14, 1948 to Oct 19, 1951, Governor: Khawaja Nazimuddin].

    **Type of political regimes is specified on the basis of the selection of presidents where autocratic type indicates military regime.

Table A4

APPENDIX – B

CALIBRATION RESULTS OF THEORETICAL MODEL

Table B1

Parameter Values for Calibration

Parameter	Description	Value	Source
ρ	Discount Factor	0.987	Author's Calculations
γ	Steady State Growth Rate	6.000	Author's Calculations
β	Share of 'G' in production function	0.250	Choudhary *et al.*, (2010)
ϕ	Share of expenditure on public infrastructure	0.450	Author's Calculations
$(1-\psi)$	Share of Public Officials in the economy	0.250	Author's Calculations based on Labor Survey Data
Φ	Parameter of Corruption	[0,10]	Recursive calculation based on Index of Corruption
χ	Parameter of Governance	[0,10]	Recursive calculation based on Index of Governance

Table B2

Model Calibration Results

Regime*	RGDP Growth (Actual)	RGDP Growth (Simulated)	CPI Inflation (Actual)	CPI Inflation (Simulated)
4	5.35	8.61	3.80	3.76
5	3.67	8.66	6.70	5.97
6	4.87	5.80	16.69	9.25
7	6.45	7.48	7.27	7.08
8	5.12	5.63	9.30	9.36
9	2.44	5.38	9.83	9.61
10	4.69	4.54	11.72	11.56
11	2.17	5.94	9.81	9.27
12	3.48	5.37	5.39	4.88
13	5.45	6.11	6.57	6.19
14	3.68	6.20	12.00	8.23
15	2.62	4.48	15.43	12.03

Note: For list of regimes, please refer Table A4.

Fig. B1.

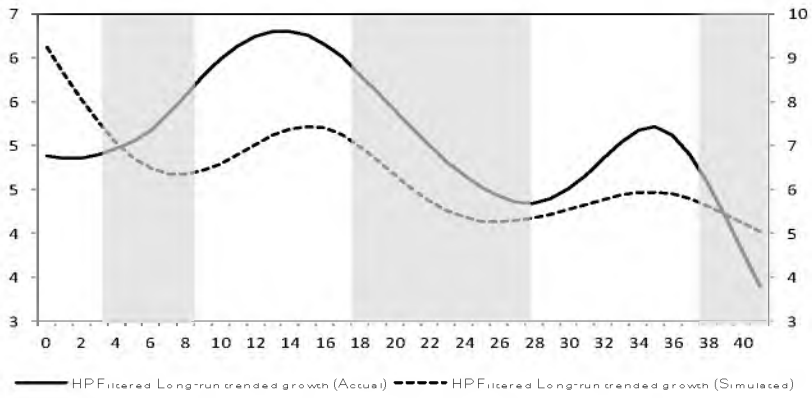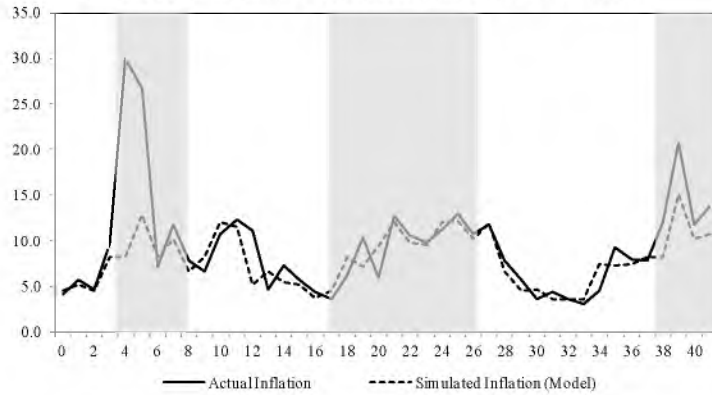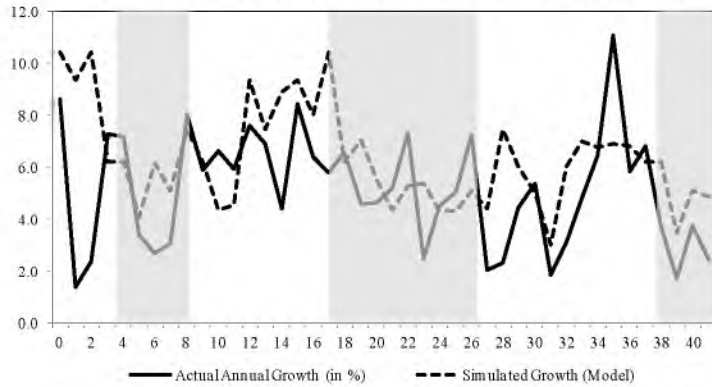**Recursive Calibrations of Theoretical Model for Real GDP Growth: Long Run Trend Analysis**

HPFiltered Long-run trended growth (Actual) ----- HPFiltered Long-run trended growth (Simulated)

Fig. B2.

Recursive Calibrations of Theoretical Model for CPI Inflation

—— Actual Inflation   ----- Simulated Inflation (Model)

Recursive Calibrations of Theoretical Model for Real GDP Growth

—— Actual Annual Growth (in %)   --- Simulated Growth (Model)

Notes: Shaded area in these figures represent democratic regimes.
        Horizontal axis shows annual periods (starts from 1970).

APPENDIX – C

REGIME SWITCHING MODELING RESULTS

Table C1

Estimation Results Based on Regime Switching Modeling Approach

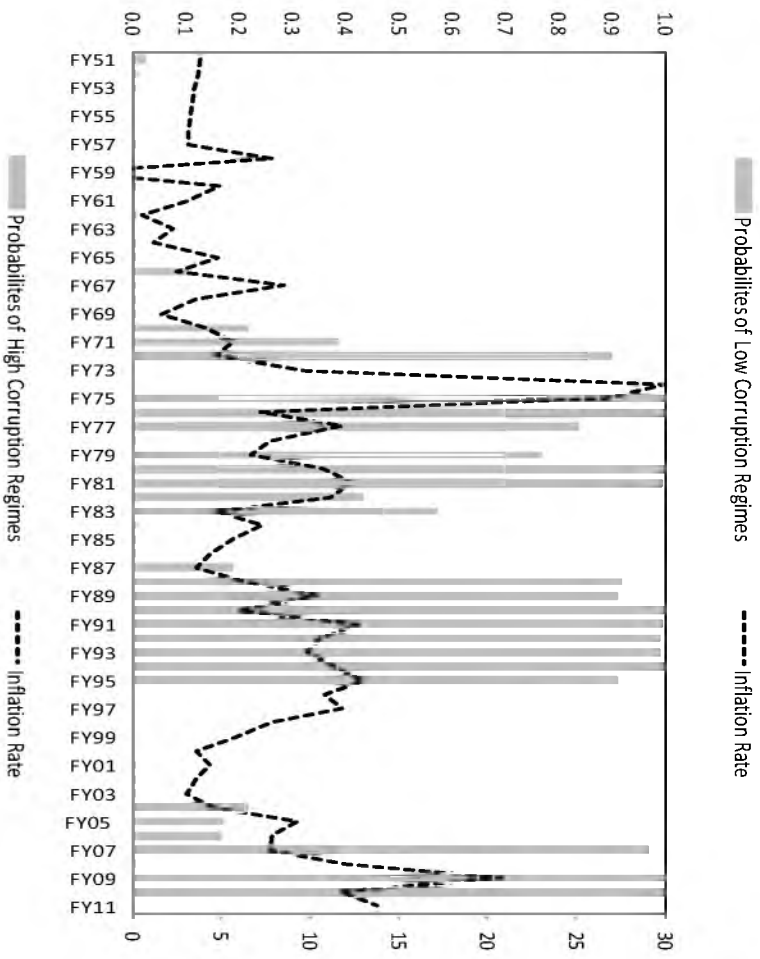| Regressors with Fixed Coefficients	RSM1	RSM2	RSM3	RSM4
	Dependent Variables			
	CPI Inflation Rate	CPI Inflation Rate	Real GDP Growth	Real GDP Growth
Intercept	0.061	0.064	0.051	0.053
	(0.184)	(0.196)	(0.152)	(0.183)
CPI Inflation Rate	–	–	–0.049	–0.057
	–	–	(0.047)	(0.034)
Real GDP Growth	–	–	–	–
	–	–	–	–
Per Capital Output Growth	–0.124	–0.119	–	–
	(0.031)	(0.027)	–	–
Trade Share	0.314	0.268	0.081	0.072
	(0.117)	(0.023)	(0.053)	(0.061)
Agriculture Output Share	–0.247	–0.133	–	–
	(0.098)	(0.071)	–	–
Exchange Rate	0.063	0.052	–0.012	–0.014
	(0.030)	(0.028)	(0.009)	(0.011)
Government Borrowing Ratio	0.307	0.249	–0.032	–0.028
	(0.075)	(0.064)	(0.015)	(0.014)
Fiscal Balance Ratio	–0.192	–0.271	–0.097	–0.084
	(0.026)	(0.037)	(0.051)	(0.044)
Growth in Private Credit	–0.087	–0.081	0.094	0.089
	(0.069)	(0.064)	(0.030)	(0.026)
International Oil Prices	0.081	0.076	–0.014	–0.017
	(0.029)	(0.021)	(0.008)	(0.010)
Human Capital	–	–	0.0314	0.028
	–	–	(0.012)	(0.011)
Central Bank Governor Turnover	0.027	0.025	–	–
	(0.016)	(0.014)	–	–
AR(1)	0.586	0.421	0.042	0.038
	(0.049)	(0.043)	(0.014)	(0.013)
Regressors with Regime Switching coefficients				
Avg. regime switching estimates of Corruption on autocratic regimes	–0.012	–	0.034	–
	(0.097)	–	(0.019)	–
Avg. regime switching estimates of Corruption on democratic regimes	–0.109	–	0.019	–
	(0.039)	–	(0.011)	–
Avg. regime switching estimates of governance on autocratic regimes	–	–0.063	–	0.064
	–	(0.016)	–	(0.021)
Avg. regime switching estimates of governance on democratic regimes	–	–0.021	–	0.020
	–	(0.041)	–	(0.008)
Avg. Probability of autocratic Regime Switching States	0.92	0.91	0.93	0.92
Avg. Probability of democratic Regime Switching States	0.95	0.94	0.94	0.92
Avg. Duration of Autocratic Regimes	35	35	35	35
Avg. Duration of Democratic Regimes	29	29	29	29
Final Log Likelihood Ratios	–169.24	–168.48	–126.76	–127.23

Note: Standard Errors are given in parentheses.

Probabilites of Low Corruption Regimes

Probabilites of High Corruption Regimes

- - - - Inflation Rate

- - - - Inflation Rate

Fig. C1. Markov Regime Smoothed Probabilities (Inflation Rate and Corruption Case)

Probabilites of Low Governance Regimes

----- Inflation Rate
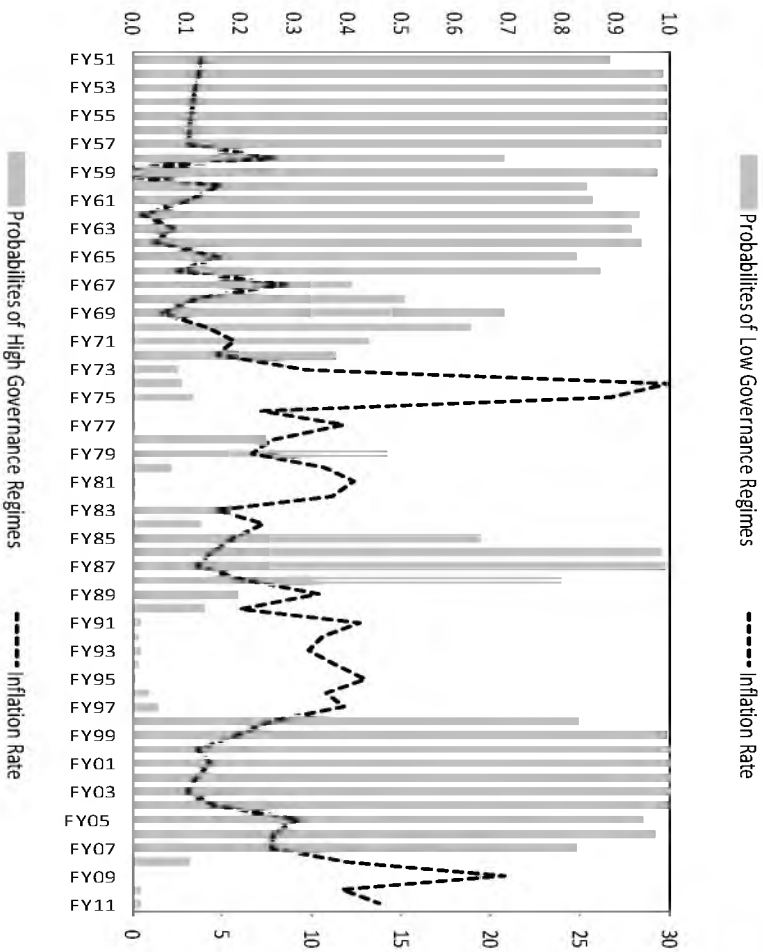
Probabilites of High Governance Regimes
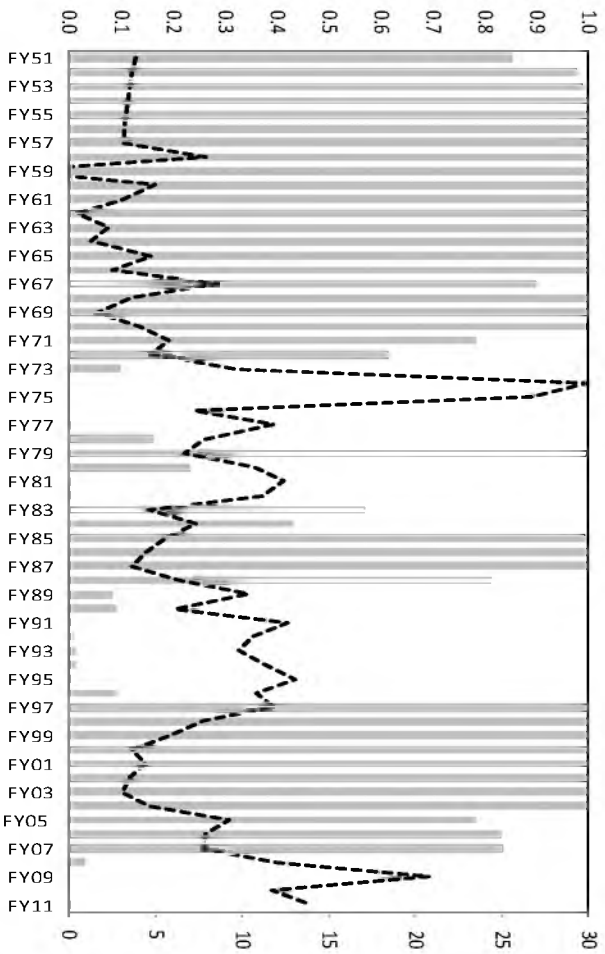
----- Inflation Rate

Fig. C2. Markov Regime Smoothed Probabilities (Inflation Rate and Governance Case)
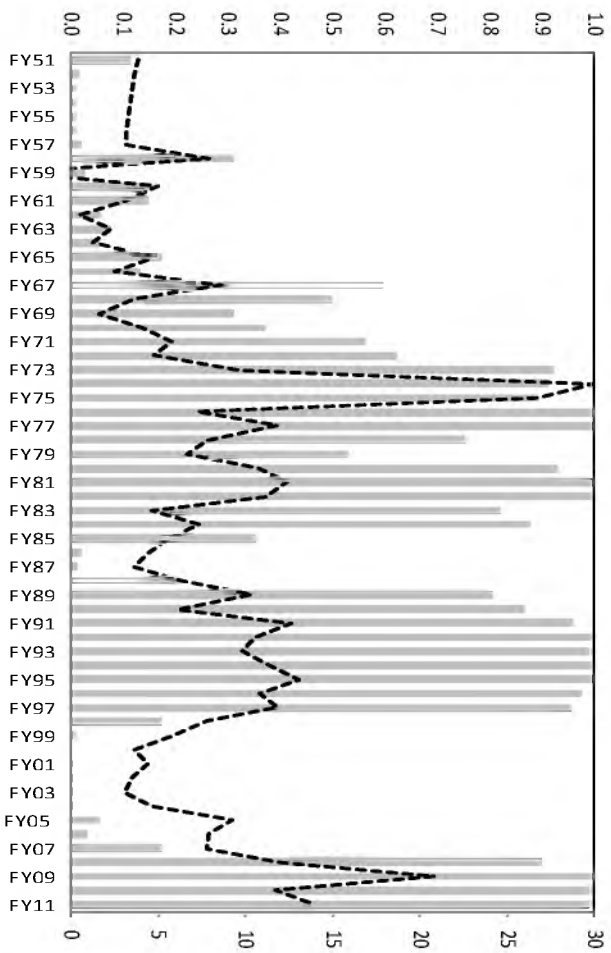
Fig. C3. Markov Regime Smoothed Probabilities (Output Growth and Corruption Case)
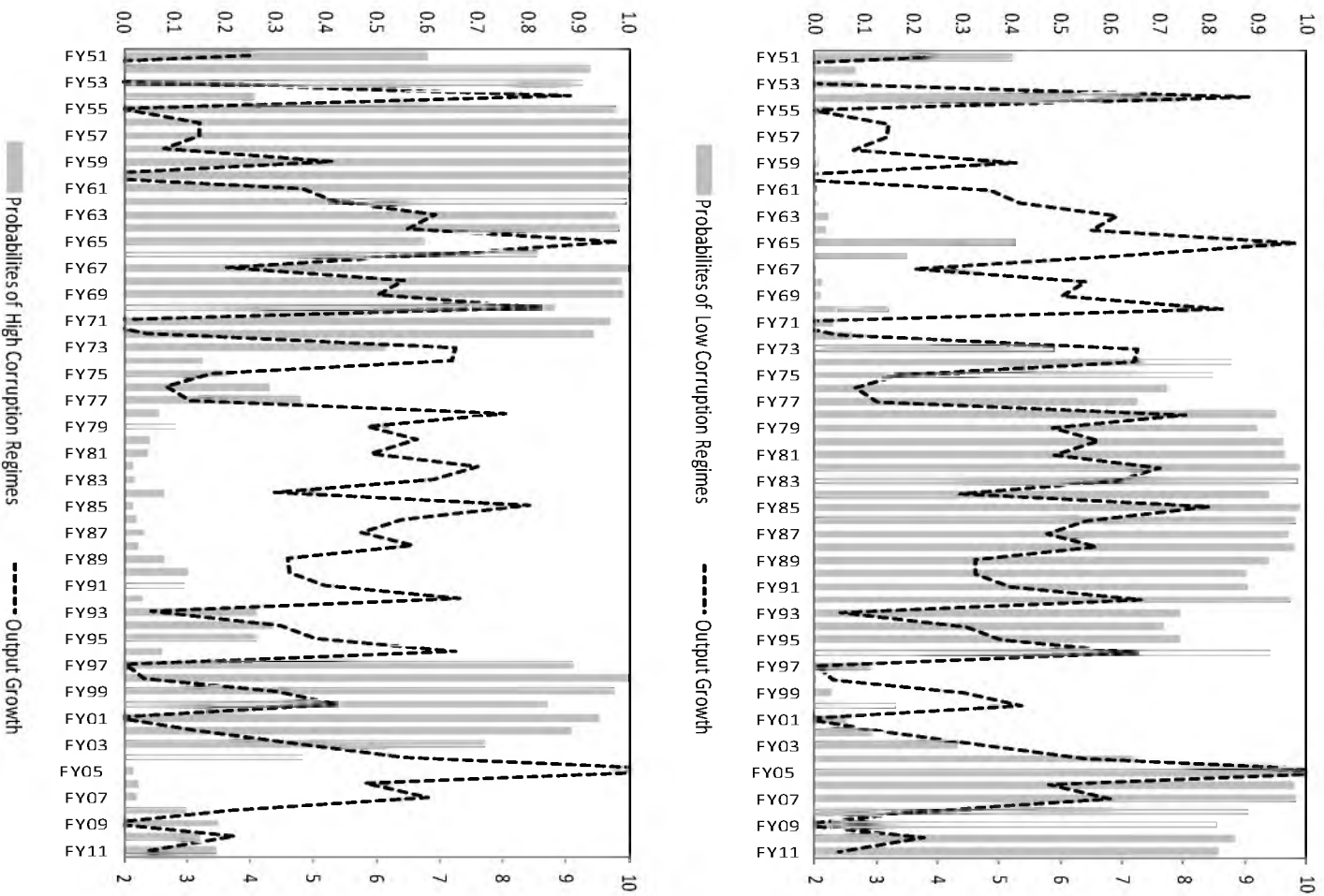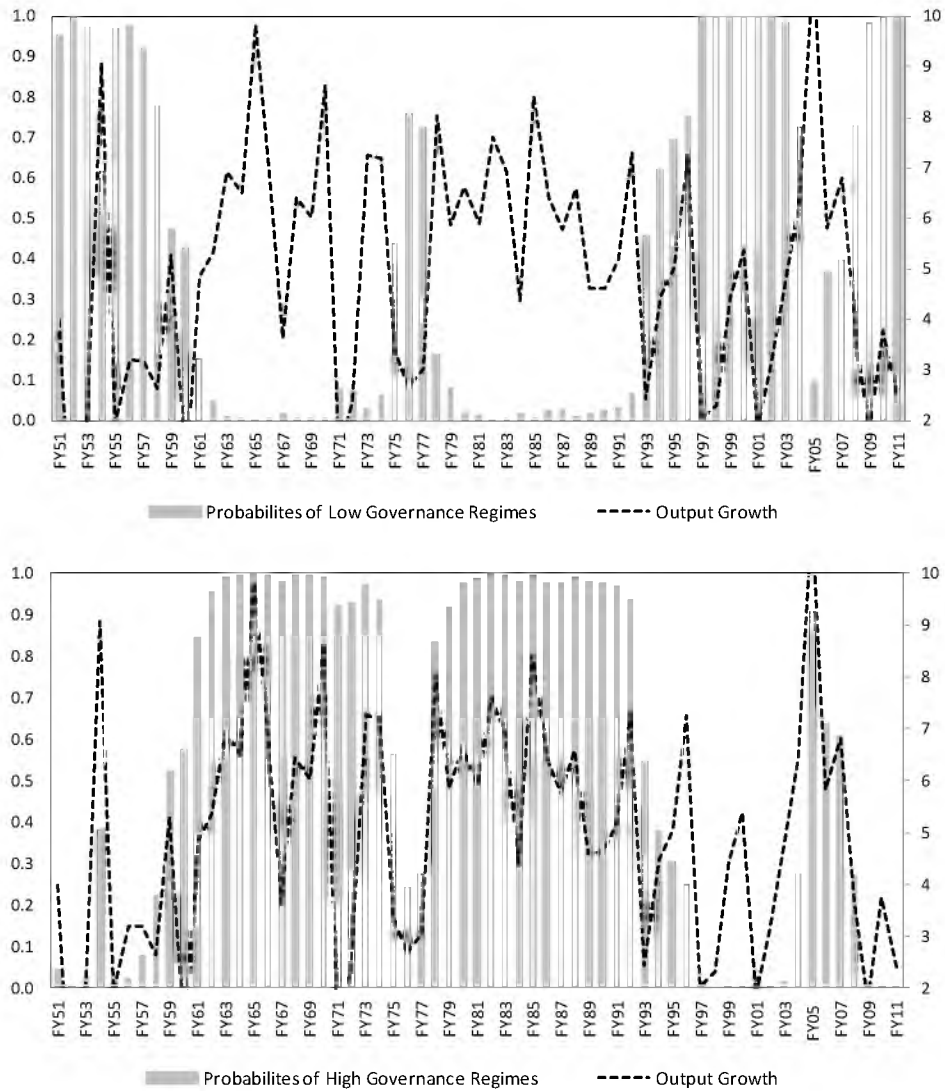
Fig.C4. Markov Regime Smoothed Probabilities (Inflation Rate and Governance Case)

Probabilites of Low Governance Regimes   ----- Output Growth

Probabilites of High Governance Regimes   ----- Output Growth

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