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DO MONEY OR OIL AND CROP PRODUCTIVITY SHOCKS LEAD TO INFLATION: THE CASE OF PAKISTAN

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Abstract

The worst economic outcomes have been argued as a result of the mismanagement in money supply especially in 1929's Great Depression, 1970's Stagflation and 2008's Economic depression in the global economy. However, economic recessions tend to appear after oil price phenomenon. In particular, the global inflationary pressures of 2008 became severe with the spikes up in oil prices as well as crop productivity shocks in the world economy including Pakistan. The object of the present paper is to discuss inflation in the framework of Monetary and external Oil Price Shocks, Crop Productivity Propositions, Inflation Inertia, and real GDP growth. The empirical studies broadly uphold the monetary explanation of inflation in the Pakistan's economy. This paper offers the policy implication that the combination of monetary as well as productivity management is required to arrest inflationary pressures in the economy. In addition, we find the comprehensive evidence that food inflation is also a monetary phenomenon in the Pakistan's economy. On the other hand, the continuous persistence in inflation inertia does not hold as a result of the absence of autocorrelation in money supply in AR (2) or higher process in the data. Oil prices in terms of domestic currency highlight the fact that the transmission channel of world shocks via exchange rate fluctuations leaves significant impacts upon domestic inflation in the economy.

Section I: Economic Downturns Appear After Oil Price Phenomenon

The classical economic theory relates macroeconomic fluctuations to the role of money supply which has also received empirical support in the economic literature. In particular, the most popular explanation of 1930's Great Depression has been described in Friedman and Schwartz (1963) who blamed the Federal Reserve for monetary contraction which led to the worst economic outcome of the twentieth century. Similarly, the episodes of 1970's stagflation have also been argued in the framework of monetary channel as reported by Barsky and Kilian (2001) who conclude that the important factor behind the stagflation observed in 1970s was the expansion in monetary aggregates rather than the oil price phenomenon in the United States as well as in the global economy. Moreover, monetary growth can also lead to generate stagflation even without the occurrence of surges in the international prices of oil in the world economy. Finally, the economic depression of 2008 has also been linked up with the role of monetary expansion in the global economy. The financial crunch started from US sub prime mortgage led to the economic demise of financial institutions and, from where it had turned into economic depression spreading out to all over the Europe and Asia. In this behalf, Taylor (2009) describes monetary excesses as the major reason behind the financial crisis in general and recent economic depression of 2008 in particular in the global economy.

Contrary to all this, the notable common feature of the periods of economic downturns is that they tend to appear after oil price shocks in the global economy. In this behalf, Hamilton (2005) presents an important empirical conclusion that the spikes in oil prices have been the major factor behind episodes of the *Nine out of Ten* of the US recessions since WWII rather than monetary mismanagement in the economy. In particular, 2008's economic depression has also emerged after the exorbitant surge in oil prices which produced inflationary pressures in the whole global economy. Besides spikes up in oil prices, inflationary pressures also became severe with the 'unmentioned' global crop productivity shocks via volatility in

agricultural growth especially in the emerging economies. The United States also started promulgating the incentive based policies of the conversion of food crops into fuel generation as an alternative to the oil consumption which, in return, also contributed to the inflationary pressures in 2008. All these developments offer the notation that inflationary pressures can not be attributed to the underlined role of money supply and, hence Stiglitz (2008) emphasizes that the exercise of tight monetary policy (i.e. raising interest rate) can not show fruitful results to arrest *imported* inflationary pressures in this context. Similarly, Abbas (2008) also notes that inflationary pressures are more sensitive to the crop productivity shocks rather than the impact of monetary policy operations in the economy.

In the context of Pakistan's economy, the empirical studies conducted in early nineties and, thereafter confirm the monetary proposition that "*Inflation is always and everywhere a Monetary Phenomenon*". Khan and Qasim (1996) review the significant studies of late nineties such as Hossain (1990) and Nasim (1995) who report that the rise in inflation is directly related to monetary growth while Bilques (1988) and Naqvi *et al* (1994) focus on monetary growth, supply side bottlenecks as well as fuel prices as major drives of inflation in the Pakistan's economy. Contrarily, the latter empirical studies exclusively support for the monetary channel. Khan and Schimmelpfenning (2006) specify wheat support price as supply side factor along with monetary growth and, conclude that the monetary channel via private sector credit growth and broad money growth leads to inflation in contrary to real GDP growth, Nominal Effective Exchange Rate in the Pakistan's economy over the period of January 1998 to June 2005. Similarly, Qayyum (2006) reports the excessive growth in monetary aggregates which leads to inflation in the economy over the period of 1960-2005. However, Manzoor (2006) reports that there is a weak or even breakdown relationship between monetary variables and prices over the period of 1991:07 to 2006:01 while he does not specify the major driver of inflation in the economy. On the whole, the earlier empirical studies have summarily been conducted within the monetary framework in Pakistan. In the

present paper, we rebuild a general inflation model by incorporating monetary propositions, inflation inertia, crop productivity propositions, oil price shocks, exchange rate fluctuations and real GDP growth as equally important determinants of inflationary pressures in the Pakistan's economy. We directly accommodate major Food Crops Yield (tons/hec) (which includes wheat, rice, jowar, maize, bajra and barley) and Cash Crops Yield (tons/hec) (which includes sugarcane, cotton, tobacco, jute, sugarbeet and guar seed) as the proxy for crop productivity while the past level of inflation and money supply are independently and jointly added to the crop productivity shocks and oil price fluctuations. In particular, the addition of exchange rate variable as a separate independent variable highlights transmission channel of the world shocks into domestic inflation as pointed out by Bunicic and Melecky (2008) who compare the impacts of external and domestic shocks on macroeconomic fluctuations in the Australian economy. However, we do not use exchange rate as an independent variable in the regression model rather it is used only for converting oil prices (\$/bbl.) into domestic currency. This exercise clearly shows that the transmission channel of world shocks via exchange rate fluctuations shows significant impacts upon domestic inflation as oil prices in dollar terms does not appear statistically significant in the regression analysis. The paper also addresses the question if food inflation is also a monetary phenomenon in the Pakistan's economy. Section II discusses the relevant variables and data sources. We analyze the behavior of inflation in the context of Broad Monetary growth (M_2), Inflation inertia, Food and Cash Crops Yield (tons/hec) and fluctuations in Oil prices through the graphical and correlation analysis in this section. The empirical estimation of the model and discussion of results are presented in section III. This follows concluding remarks in the last Section IV.

Section II: Inflation is Not Just a Monetary Phenomenon in Pakistan

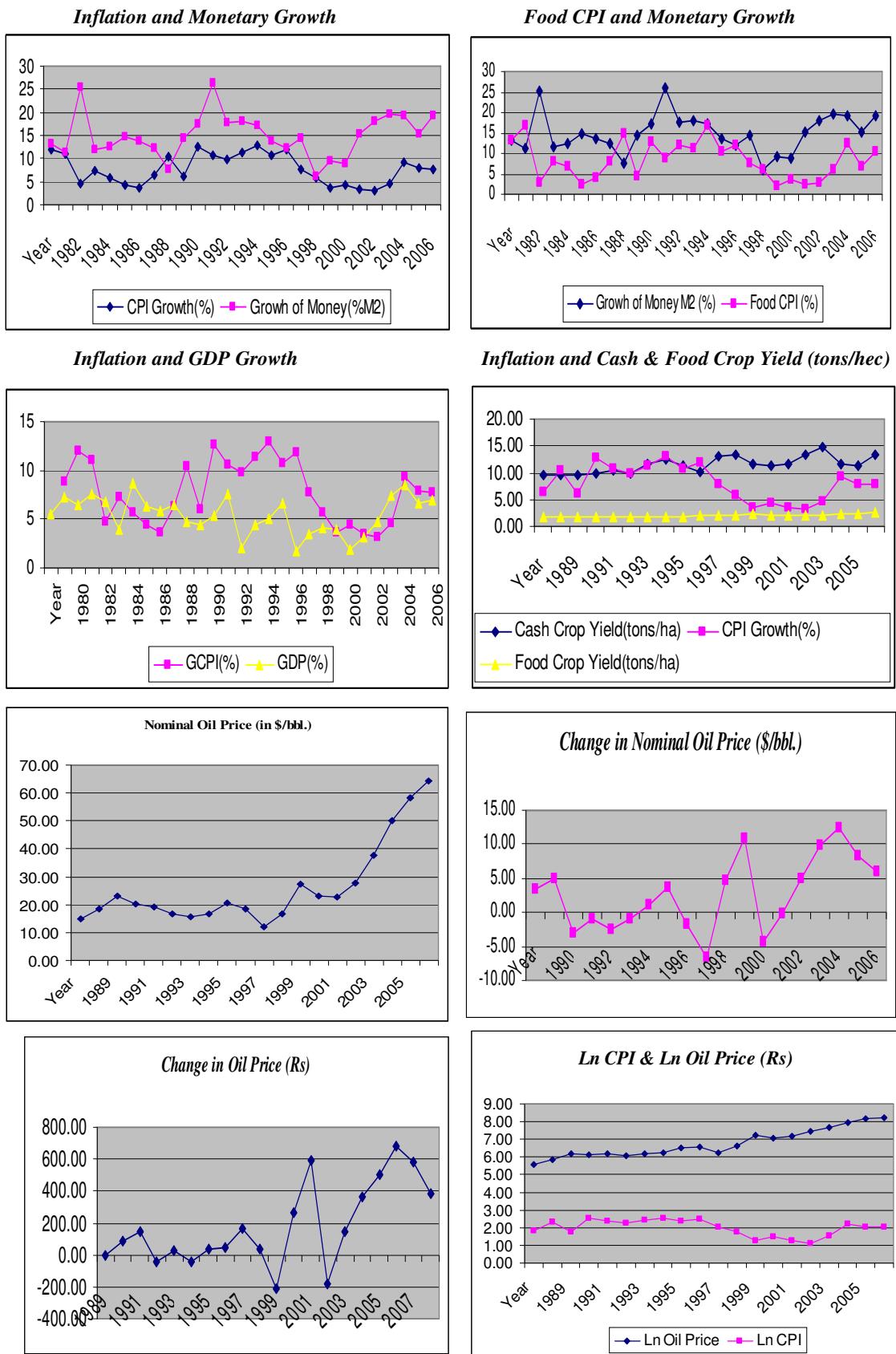
Though the empirical findings uphold monetary explanation of inflation in the Pakistan's economy, there are also other internal and external factors such as performance of commodity producing sector, exchange rate volatility, the global economic environment, backward

looking as well as forward looking expectations of the people about inflation etc. which have equally played the significant role to fuel inflationary pressures in one way or the other. Moreover, the practical experience of tight monetary policy since April 2005 does not show fruitful results to arrest inflationary pressures in the economy which signifies the fact that inflationary stance is not confined to the monetary growth rather it is a widespread phenomenon in the Pakistan's economy. In this context, we discuss the behavior of inflation (both CPI & Food CPI) in lines with Broad Monetary growth (M_2), Inflation inertia, Food and Cash Crops Yield (tons/hec) and fluctuations in Oil prices through the Graphical and Correlation analysis in this section.

Data and Variables: We use time series data of General Consumer Price Index (CPI), Food CPI, Broad Money (M_2), Food Crops Yield (tons/hec) (which includes wheat, rice, jowar, maize, bajra and barley), Cash Crops Yield (tons/hec) (which includes sugarcane, cotton, tobacco, jute, sugarbeet and guar seed) and annual average of crude oil prices (\$/bbl.). We use Broad Money (M_2) in view of the consideration of State Bank of Pakistan to control inflation while we use Food and Cash Crops Yield (tons/hec) as a proxy for crop productivity in the economy. The data is obtained from Agricultural Statistics of Pakistan 2006-2007, MINFAL, Government of Pakistan, Economic Survey 2007-08, Government of Pakistan, Annual Report 2007-2008, State Bank of Pakistan while the data on oil prices is obtained from Financial Trend Forecaster. A number of studies use both oil prices in dollar terms and oil prices in domestic currency terms after using the respective exchange rate. However, we check the impacts of oil prices on domestic inflation both in terms of domestic as well as dollars terms.

We begin with monetary growth and CPI inflation for preliminary ***Graphical analysis***. Figure # 1 shows that the growth in money supply remains substantial in general and, the movements in CPI are quite sensitive to the one period lagged money supply in particular in the economy.

Figure # 1



On the other hand, Food CPI also follows lagged money supply suggesting that growth in money supply also leads to determine food inflation in the economy. Secondly, the behavior of CPI and GDP growth shows the mixed but positive trend in the data. Moreover, the growth in money supply is roughly three times the GDP growth which reflects exorbitant inflationary gap over the period under discussion. Thirdly, inflation tends to behave negatively with the higher level of Cash Crop Yield (tons/hec) especially over the last decade (1997-2007). Contrarily, the graph of Food Crop Yield (tons/hec) appears to be constant and, inflation fluctuates around these constant levels over the whole period under discussion. Lastly, the sharp spikes in oil price (\$/bbl) are noted in 1990, 1999 and 2002 to onward from the figure. The changes in prices of oil in domestic currency are exorbitant and volatile in comparison to the changes in prices of oil in dollar terms especially in 1999 and onwards. This highlights the notation that the effects of external oil price shocks have significant impact upon domestic inflation via exchange rate fluctuations in the economy. In particular, the log CPI and log Oil prices in domestic currency exhibit inverse movements over the last decade.

The ***Correlation analysis*** in Table # 1 shows that inflation (CPI & Food CPI) tends to be positive and highly correlated with lagged money supply over 1981-2007. The split of inflation and monetary data shows that inflation (CPI & Food CPI) and one period lagged level money supply turn out to be highly correlated over 1990-2007. In particular, Food CPI & monetary growth are also highly correlated against CPI & monetary growth over this period. Moreover, the correlation between Food CPI and money supply remains stronger against the correlation between CPI and money supply over the whole period of 1981-2007. Another notable feature is that the correlation between inflation (CPI & Food CPI) and monetary growth is weaker in level-level correlation in the data. This finding is consistent with the earlier studies on Pakistan's economy. In this context, Kemal (2006)

Table # 1

Correlation among Different relevant Variables

1988-2007	<i>Ln CPI</i>	<i>Ln Food CPI</i>	<i>Ln Cash Crop Yield (tons/ha)</i>	<i>Ln GDP</i>	<i>Ln M2</i>	<i>Ln Food Crop Yield (tons/ha)</i>	<i>Ln Oip (Rs)</i>	<i>Ln M2(-1)</i>	<i>Ln CPI (-1)</i>
<i>Ln CPI</i>	1.0	0.95	-0.46	0.12	0.24	-0.47	-0.47	0.55	0.69
<i>Ln Food CPI</i>		1.0	-0.28	0.17	0.24	-0.36	-0.35	0.68	0.52
<i>Ln Cash Crop Yield (tons/ha)</i>			1.0	0.3	0.07	0.63	0.54	0.11	-0.36
<i>Ln GDP</i>					1.0	0.23	0.35	0.22	-0.06
<i>Ln M2</i>						1.0	0.04	0.49	0.11
<i>Ln Food Crop Yield (tons/ha)</i>							1.0	0.94	-0.02
<i>Ln Oip(Rs)</i>								1.0	0.03
<i>Ln M2(-1)</i>									1.0
<i>Ln CPI (-1)</i>									1.0

Correlation of CPI Inflation & lagged Monetary Growth

	<i>Ln Inflation</i>	<i>LN M2 (-1)</i>
1982-2007		
<i>Ln Inflation</i>	1	
<i>LN M2 (-1)</i>	0.49	1
1985-1995		
<i>Ln Inflation</i>	1	
<i>LN M2 (-1)</i>	0.46	1
1990-2007		
<i>Ln Inflation</i>	1	
<i>LN M2 (-1)</i>	0.58	1
1990-2000		
<i>Ln Inflation</i>	1	
<i>LN M2 (-1)</i>	0.77	1
1997-2007		
<i>Ln Inflation</i>	1	
<i>LN M2 (-1)</i>	0.52	1

Correlation of CPI Food Inflation & lagged Monetary Growth

	<i>Ln Food Inflation</i>	<i>LN M2 (-1)</i>
1982-2007		
<i>Ln Food Inflation</i>		1
<i>LN M2 (-1)</i>		0.57
1985-1995		
<i>Ln Food Inflation</i>		1
<i>LN M2 (-1)</i>		0.50
1990-2007		
<i>Ln Food Inflation</i>		1
<i>LN M2 (-1)</i>		0.73
1990-2000		
<i>Ln Food Inflation</i>		1
<i>LN M2 (-1)</i>		0.85
1997-2007		
<i>Ln Food Inflation</i>		1
<i>LN M2 (-1)</i>		0.71

reports that, “One year lagged-level correlation between money growth and inflation is higher than the level-level correlation”. Qayyum (2006) also notes positive and strong correlation between inflation and one year lagged money supply. Secondly, the correlation between inflation (CPI& Food CPI) and Cash & Food crop productivity yields (tons/hec) is negative which represents the notation that the higher level of crop productivity leads to relieve inflationary pressures in the economy. Thirdly, the correlation between CPI inflation and GDP growth is positive but weaker in comparison to the correlation between GDP growth and Oil prices in domestic currency over the period of 1988-2007. Finally, Oil prices in domestic currency and CPI are more correlated than the correlation between Oil prices in domestic currency and Food CPI in the data. This highlights the fact that the international oil prices and domestic oil prices have not been proportionally adjusted and, hence the differences have also not been passed on to the domestic consumers in the economy.

Section III: The Empirical Estimation & Results

The graphical as well as correlation analysis gives the message that inflation (CPI & Food CPI) and one year lagged level money supply exhibit notable and positive relationship over the period of 1981-2007. Contrarily, the prices of oil in domestic currency and Cash & Food crop yields (tons/hec) record negative movements with the domestic inflation in the economy. We now proceed further by specifying the econometric model which defines inflation as a function of Monetary propositions, Inflation inertia, Crop productivity propositions, Oil price shocks and real GDP growth as reported in Eq 1.

$$\pi_{It} = \alpha_0 + \sum_{i=1}^N \alpha_{1i} \pi_{t-i} + \sum_{i=0}^N \alpha_{2i} M_{t-i} + \sum_{i=0}^N \alpha_{3i} Z_{t-i} + \sum_{i=0}^N \alpha_{4i} Y_{t-i} + \sum_{i=1}^N \alpha_{5i} \Delta OP_{t-i} + \varepsilon_t \quad \text{Eq (1)}$$

Where

$$\Delta OP_t = OP_t - OP_{t-1}$$

π denotes inflation, M is for broad money growth, Y is the real GDP growth, Z shows crop productivity yield (tons/hectare) and OP is oil prices. The Cash Crops Yield (tons/hectare) (which includes Sugarcane, Cotton, Tobacco, Jute, Sugarbeet and Guar seed) and Food Crops Yield (tons/hectare) (which includes Wheat, Rice, Jowar, Maize, Bajra and Barley) are used as a proxy for crop productivity in the economy. ΔOP is the simple change in oil price in period t from period t-1 both in terms of domestic and dollars terms. ε_t is the error term.

Firstly, we exercise for lagged inflation and money supply to check the impact of inertia on current inflation as described in Eq.2 while leaving out other drivers at this stage. In particular, Mankiew and Reise (2001) mention Christiano, Eichenbaum and Evans (1998) regarding the pattern of monetary policy shock in a way that “AR (1) process offers a good description of monetary policy shocks when using M_2 as the measure of money” as defined in Eq.3. The important concern prior to running regressions is to overcome existing heteroscedasticity in the data set as revealed in figure 1. We use log form of all the variables and estimate Standard Errors by regressing against the constant. The data is divided by the respective Standard Error prior to running all the regressions. After which, the battery of diagnostic tests does not detect auto-correlation as well as heteroscedasticity problem in all the reported regression results.

$$\pi_{it} = \alpha_0 + \sum_{i=1}^N \alpha_{1i} \pi_{t-i} + \sum_{i=0}^N \alpha_{2i} m_{t-i} + \varepsilon_t \quad \text{----- Eq. (2)}$$

$$\text{AR (1) Process for } M_2: \quad \Delta m_t = \alpha + \rho \Delta m_{t-1} + \varepsilon_t \quad \text{----- Eq. (3)}$$

According to the well established empirical facts, monetary shocks have delayed impacts on inflation with different periods of time lag in the economy. Mankiew and Reise (2001) opine that “In the sticky-information model, the maximum impact of monetary shocks on inflation occurs after seven quarters”. Nicoletta Batini and Edward Nelson (2002) point out that “it takes over a year before monetary policy actions have their peak effect on inflation”.

Olafsson (2006) reports that the tight monetary policy does not initially affect inflation in the short run rather it will have its impacts with the lags of up to two years. On the other hand, the use of lagged values of inflation as key determinant of current inflation offers the notation that economic agents do not ignore backward looking rules in economic decisions. Ball (2000) justifies the importance of lagged values of inflation as determinant of current inflation on the grounds that inflation moves slowly onwards except occupational changes occur (such as OPEC prices) over time and, hence current inflation will be equal to the past inflation in the economy. In the context of Pakistan's economy, Khan and Schimmelpfenning (2006) report that monetary growth affects inflation after a lag of around 12 months. Husain and Abbas (2000) also find that money supply leads to affect inflation after one year while Ali Kemal (2006) reports that growth in monetary aggregates will affect inflation with a lag of nine months in the economy. In conformity with other studies on Pakistan's economy, our regressions of inflation on its own lags as well as on lagged money supply show that it is *ONLY* one year lagged money supply as well as inflation which remain statistically significant over the sample period of 1981-2007. The similar results also hold even after using first difference form of CPI inflation and money supply over the period under discussion. Moreover, the AR (1) process yields the statistical significant value for ρ both in log levels and log difference form while the value of ρ does not turn out to be statistical significant in AR (2) or higher process. As a result, inflation persistence is not found in higher lags in view of absence of autocorrelation in money supply in AR (2) or higher process in the data. On the other hand, we also run different regressions specifying food CPI as a function of money supply as well as lagged food CPI. It is observed that the one year lagged level money supply positively and statistically determine the food inflation. However, the lagged food inflation does not appear statistically significant which implies that the backward looking rule does not hold in the case of Food inflation. The similar results are also obtained in running direct regressions of Food CPI on money supply over the period under

discussion. It is also important to point out that the impact of money on commodity prices has also been documented in the literature. In this behalf, Browne and Cronin (2007) report the empirical evidences for the US economy that both Commodity and Consumer prices are money-driven in the long run.

Now, along with one year lagged inflation and money supply we add Cash & Food Crop Yield (tons/hec) as determinants of current inflation which yields the following results as reported in Eq # 4 & 5 respectively.

$$\pi_t = 6.20 - 0.04 m_t - 1.33 (\ln \text{Cash Crop})_t + 0.66 m_{t-1} + 0.44 \pi_{t-1} + \text{Error} [R^2 = 0.74] \text{--Eq. (4)}$$

(1.82)*	(-0.21)	(-2.35)*	(3.06)*	(2.85)*	{S.E=0.62}
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$$\pi_t = 0.24 - 0.03 m_t - 0.93 (\ln \text{Food Crop})_t + 0.59 m_{t-1} + 0.46 \pi_{t-1} + \text{Error} [R^2 = 0.69] \text{--Eq.(5)}$$

(0.28)	(-0.14)	(-1.56)	(2.54)*	(2.69)*	{S.E=0.33}
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The lower case letters denote logarithm form of the variables. T-ratios are reported in parenthesis while * shows that the variable is statistically significant at 5 % level of significance here and afterwards. It is observed that the coefficient on Log Cash Crop Yield (tons/hec) and one period lagged inflation and money supply remain statistically significant while the coefficient on Log Food Crop Yield (tons/hec) does not turn out to be statistically significant in the above regressions. Similarly, the *ONLY* Cash Crop Yield (tons/hec) remains negative and statistically significant even after running a number of direct regressions of inflation on Cash & Food Crop Yield (tons/hec) over the period of 1988-2007.

A number of studies use oil prices in US dollar per barrel and in terms of domestic currency. Cunado and Fernando (2004) point out that the conversion of oil prices into domestic currency will “takes into account the differences in the oil prices that each of the countries faces due to its exchange rate fluctuation”. Hamilton (2005) points out that though the use of nominal oil price or real oil price does not lead to significant changes in the statistical inference, the use of nominal oil price is important to interpret the statistical exogeneity of the

right hand variable in the regression analysis. Taking into account this perception, Blanchard and Gali (2007) use the nominal oil prices instead of real oil prices mentioning this particular intention. We convert the US annual average crude oil price (\$/bbl.) in domestic currency by using exchange rate index of the respective year and, rerun the regression by adding oil prices in domestic currency to productivity propositions, one period lagged CPI & monetary growth and real GDP growth as reported in Eq 6.

$$\pi_t = 1.97 - 0.31m_t + 0.35y_t - 1.58z_t - 0.65\Delta op_t + 0.61m_{t-1} + 0.41\pi_{t-1} + \text{Error}[R^2 = 0.82] \text{--Eq (6)}$$

$$(2.68)^* (-1.44) (2.18)^* (-3.00)^* (-1.83)^* (3.07)^* (2.94)^* \{S.E=0.13\}$$

The lower case letters denote logarithm form of all the variables while T-ratios are reported in parenthesis. ΔOP_t shows the simple change in oil prices in domestic currency in period t from period t-1. It is observed that the addition of oil price does not change the statistical significance of the all variables. The coefficient on change in oil prices remains negative but statistically significant while GDP growth tends to be positive and statistically significant in the regression. However, the *ONLY* Cash Crop yield (tons/hec) as a proxy for crop productivity remains negatively and statistically significant in this and through out all the other regressions. The similar results also hold even after using real oil prices in domestic currency over the period of 1988-2007. However, oil prices in dollar terms do not turn out to be statistically significant against oil prices in domestic currency in the regression analysis.

Section IV: Conclusion

The worst economic outcomes have been advocated in the context of the mismanagement in money supply especially in 1930's Great Depression, 1970's Stagflation and 2008's Economic depression in the global economy. Contrarily, the common feature of the episodes of economic recessions is that they tend to appear after oil price phenomenon. In particular, the global inflationary pressures of 2008 ignited with the spikes up in oil prices as well as crop productivity shocks in the world economy including Pakistan. The earlier empirical

studies on Pakistan's economy broadly uphold the monetary explanation of inflation in the economy. In the present paper, we discuss inflation in the framework of Monetary Propositions, Crop Productivity Shocks, Inflation Inertia, Oil Price Shocks, Exchange rate fluctuations and real GDP growth in the economy. We draw the policy implication that the combination of both monetary and productivity management is required to arrest inflationary pressures in the Pakistan's economy. The other important empirical findings are also as given below:

The paper in conformity with the earlier studies on Pakistan's economy finds that One year lagged **Monetary Aggregates** (both in Level & Difference form) positively and statistically determines current inflation over the period of 1981-2007. In addition, we find the comprehensive evidence that food inflation is also a monetary phenomenon in the Pakistan's economy. Moreover, the growth in money supply is roughly three times the GDP growth which reflects exorbitant inflationary gap over the period under discussion. *Secondly*, the continuous persistence in **Inflation Inertia** does not hold over time rather the only one period lagged inflation statistically determines current inflation and, this lack of inflation persistence in higher lags is due to the absence of autocorrelation in money supply in AR (2) or higher process in the economy. However, we remain unable to document that the one period backward looking rule does hold in the case of food inflation. In particular, there is also scope for further research to determine the important policy implication that, even without exercising monetary policy operations, current inflation can also be targeted through the combination of forward looking expectations of inflation and the backward looking rule in the economy. *Thirdly*, one of our two proxies for **Crop Productivity**, the Cash Crop Yield (ton/hec) which includes the crops of Sugarcane, Cotton, Tobacco, Jute, Sugar beet and Guar seed turns out to be negative and statistically significant in the regression analysis while the correlation as well as graphical analysis also record negative movements between inflation (CPI& Food CPI) and Cash crop yield (tons/hec) in the data. This offers the notation that the

higher crop productivity yields ‘do matter’ to arrest inflationary pressures in the economy. The other proxy for Crop productivity, Food Crop yield (tons/hec) which includes Wheat, Rice, Jowar, Maize, Bajra and Barley remains statistically insignificant in all the regressions over the period of 1988-2007. Finally, **Oil prices** in terms of domestic currency highlight that the transmission channel of the world shocks via exchange rate fluctuations has significant impacts upon inflation in the economy. The negative movements between inflation (CPI & Food CPI) and oil prices (nominal and real) offer the notation that differences (i.e. increases or decreases) in international oil prices have not been proportionally adjusted and, hence passed on to the domestic consumers through using oil price caps and/or subsidies over the period of 1988-2007.

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