Wealth Effects and Macroeconomic Dynamics – Evidence from Indian Economy

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14 February 2017

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Abstract

The wealth effects on consumption are a subject of continuing interest to economists. The conventional wisdom states that fluctuations in household wealth have caused major fluctuations in economic activity. This study analyses the macroeconomic dynamics of wealth effects in India and examines the nexus between the changes in housing wealth, financial wealth, and consumer spending. Using the quarterly data for the period 2005:1–2016:1, I estimate vector autoregression models and vector error-correction models, relating consumption to income and wealth measures. I find a statistically significant and rather large effect of housing wealth upon household consumption. The results show that (i) wealth effects are statistically significant and comparatively substantial in magnitude (ii) housing wealth effects tend to be greater while stock market wealth effects are considerable (iii) private consumption responses to the shocks to housing market wealth are relatively stronger than to the shocks in stock market wealth. There is a bidirectional causality running from private consumption to the two wealth forms and vice versa. Overall, the private consumption expenditure response to the changes in different wealth forms is observed to be substantial and significant.

Keywords: wealth effects; consumption; stock price; housing price; economic growth; inflation; fiscal deficit; exchange rate.

JEL Codes: E21; E31; F31; G12; H62; O4; R30.

1. Introduction

Wealth is a key determinant in explaining consumption. Economists often mention the 'wealth effect' - denoting the association between the level of personal wealth and the decisions about spending or savings. The "wealth effect" is mostly based on the premise that consumers tend to spend more when there is a bull market in widely-held assets like real estate or stocks because rising asset prices make them feel wealthy. Intuitively, the notion that the wealth effect stimulates private consumption is logical. The wealth effect is a psychological phenomenon that causes people to spend more as the value of their assets rises. The premise is that when consumers' homes or investment portfolios increase in value, they feel more financially secure, motivating them to spend more.

The conventional wisdom on the wealth effects informs that fluctuations in household wealth have driven major swings in economic activity. The topic of wealth effects has gained increased attention (see Sundaresan, 1989; Deaton, 1992; Muellbauer and Lattimore, 1995; Skinner, 1996; Rudd and Whelan, 2002) as the changes in stock and property prices become more important since the liberalization of financial markets and the deregulation of mortgage markets in the 1980s. Undeniably, the fall in wealth during the global financial crisis is often mentioned as an important contributing factor to the unusually slow economic recovery. This has brought new concerns about the response of consumer spending to the asset price shocks.

Theoretically, according to the '*life-cycle hypothesis*', an increase from stock or housing wealth should have the same effect on consumption as the marginal propensity to consume out of wealth is slightly bigger than the real interest rate in the long-run (Ando and Modigliani, 1963). According to Milton Friedman's '*permanent income hypothesis*', households consume a constant fraction of the present discounted value of their lifetime resources. Therefore, the changes in wealth that permanently alter households' resources should cause consumption to change in the same direction. Undoubtedly, the traditional macro-econometric models of wealth effects represent a workhorse tool for analysts seeking to gauge the influence of wealth on macroeconomic dynamics. Wealth effects literature also presents alternative views challenging the life-cycle hypothesis (Mishkin, 2007).

Relying upon aggregate data on consumer spending, financial wealth, and nonfinancial wealth, an early study by Elliott (1980) observed that the variations in wealth forms had no effect upon consumption. However, Elliot's findings were challenged by Peek

(1983) and by Bhatia (1987) who questioned the methods used to estimate real non-financial wealth. Further, Case (1992) provided evidence of a substantial consumption effect during the real estate price boom in the late 1980's using aggregate data for New England. Likewise, Engelhardt (1996) provided a direct test of the link between house price appreciation and consumption and estimated that the marginal propensity to consume out of real capital gains in owner-occupied housing is about 0.3, but this arose from an asymmetry in behavioural response.

Household consumption is affected not only by income but also by wealth, such as property/house / real estate and stock ownership, but also has macroeconomic dynamics. The renewed interest in the topic has regained ground against the background of the current financial turmoil which has led to concerns by numerous academics, central banks and governments about the potential macroeconomic implications of a downturn in house and equity prices. Of late, emerging market economies are developing their access to financial assets and hence the possibility to extract equity from them has also risen, thus, increasing the potential macroeconomic impact of domestic asset price movements (Dorrucci et al, 2008). Most of the empirical evidence on the topic refers to advanced economies and more so to the United States and OECD countries. However, there is a need to extend the literature to study the macroeconomic dynamics of the wealth effects in emerging economies as these economies are becoming a key engine of growth in the world economy.

Providing a comprehensive evidence of the dynamics of wealth effects is, therefore, of major relevance, and the main purpose of this study. First, I use quarterly data to obtain more precise estimates of the impact of wealth effects on private consumption. Second, I estimate the impact of wealth effects on the macroeconomic variables such as GDP, inflation, real exchange rate, and fiscal deficit. Of course, this analysis allows us to go beyond simple scatter diagrams, and to control for various factors as well as test for significance. This paper's approach is eclectic; presents analyses in levels, first differences, and in error correction model (ECM) forms, and with alternative assumptions about lag lengths, about error terms, and fixed effects. To preview the results, I present evidence that consumption is impacted by wealth effects. Besides, wealth effects have a significant long-term relationship between consumption and other macroeconomic indicators. Financial wealth assets and housing wealth assets are found to have a significant association with consumption.

Furthermore, I present suggestive evidence that the contribution to consumption from an increase in housing assets is stronger than that from stock market assets.

The remainder of the paper is as follows. Section 2 outlines the related literature on the theoretical underpinning for the analysis based on a rigorous review of wealth effects. Section 3 describes the data and the empirical strategy. Section 4 presents the empirical evidence and finally, Section 5 concludes.

2. Literature Review

Related literature that examines the wealth effect on private consumption can be mostly categorised as (i) studies that model the wealth effect based on aggregated macroeconomic data and (ii) studies that examine the wealth effect on the basis of microeconomic data. In addition, three sub-strands of literature can be distinguished: (a) those that model only the financial wealth effect on personal consumption, (b) papers that model only the housing wealth effect on personal consumption and, finally, (c) those that deal with both the housing and financial wealth effect on personal consumption (Paiella, 2009).

Private consumption may have different wealth effects depending upon the form in which wealth is held (Shefrin and Thaler, 1988). First, wealth increases are viewed by households differently. Second, the bequest motive of the households is influenced by the tax laws that favour holding appreciated assets. Third, some households may view some form of wealth accumulation as an end in and of itself. Fourth, the people's psychology of framing wealth into separate "mental accounts," may determine that certain assets are more appropriate to use for current expenditures and others earmarked for long-term savings. Differential impacts of wealth effects are demonstrated in a quasi-experimental setting. For instance, a sudden rise in unexpected wealth in the form of lottery winning leads to a surge in consumption (Imbens, Rubin, and Sacerdote, 1999).

The typical macroeconomic literature links private consumption with income and wealth. Theories like the permanent income hypothesis (Friedman, 1957) and life-cycle hypothesis (Ando and Modigliani, 1963) provide the premise for the simple consumption function model with household income and wealth as the only endogenous variables. Accordingly, private consumption is determined by income and asset wealth implying real estate and stock ownership. Theoretically, the linkage between consumption, income, and wealth can be delineated by the life-cycle model of household spending behaviour. The life cycle hypothesis by Ando and Modigliani (1963) observes that households accumulate and deplete their wealth to keep their planned consumption spending roughly steady. According to the life-cycle permanent income model, the consumers accumulate and deplete their wealth in order to keep the marginal utility of consumption smoothed over time. In models with stochastic interest rates, households may experience an unexpected change in wealth even with constant income, which may induce changes in optimal consumption plan, resulting in what is termed as "wealth effect". In line with the above argument, Blanchard (1985) confirms that aggregate consumption is roughly proportional to the sum of current wealth and expected future non-property income, the factor of proportionality being the marginal propensity to consume (MPC) out of wealth. Ciarlone (2011) estimates the impact of changes in real and financial wealth on private consumption for a panel of 17 emerging economies from Asia and Central and Eastern Europe and reports that both real and financial wealth positively affects households' consumption in the long run with the elasticity of housing wealth being larger than that of stock market wealth.

The empirical literature has also focussed on the link between credit constraints and heterogeneity in wealth effects. Lehnert (2004) observes increased propensities to consume out of housing wealth for younger U.S. households liken to their older counterparts. Similarly, in the case of United Kingdom, Campbell and Cocco (2007) present a comparable analysis. Literature also provides the evidence for formal modelling of the relationship between the macroeconomic series that has produced estimates of the timing and magnitude of the wealth effect. Davis and Palumbo (2001) provide an analysis based on typical forecasting models and construe that consumer spending grows by 3–6 cents for every additional dollar of wealth, with the effect occurring gradually over a period of several years (Lettau and Ludvigson 2004).

Housing Wealth Effects

Housing wealth effects assume greater significance due to the fact that households both own housing assets and consume housing services resulting from those assets. In case there is a rise in house prices, homeowners possibly will feel wealthier through both the realised and unrealized wealth effect. Furthermore, the rise in house prices could also lead to a rise in the value of housing services, hence generating a budget constraint effect on both homeowners and renters, which work in opposite directions with respect to the realised and unrealized wealth effect (Anita, 2014).

There exists a 'collateral channel' of housing wealth effects linked with high marginal propensities to consume, as the low financial wealth households are more likely than other households to lack access to uncollateralized credit and as a result, it is more likely to have consumption below their optimal level. On the contrary, the relatively high transaction costs of borrowing against home equity compel the households to do so occasionally and only when they really need access to the money, which (all else equal) should tend to reduce the response of consumption to home price increases.

The earliest study on the effect of housing wealth on consumption was by Elliott (1980). The study depended upon aggregate data on consumer spending, financial wealth, and nonfinancial wealth, and found that changes in the latter had no effect upon consumption. However, Case (1992) shows evidence of a substantial consumption effect during the real estate price boom in the late 1980's using aggregate data for New England. Relying on individual households' data, and using the Panel Study of Income Dynamics (PSID), Skinner (1989) found a small but significant effect of housing wealth upon consumption. Similarly, Engelhardt (1996) offer a direct test of the link between house price appreciation and consumption. Consistent with the perspective of Thaler (1990), investigating the correlation between individual savings rates and rates of capital gains in housing, Hoynes and McFadden (1997) observe little evidence that the households were changing their savings in non-housing assets in response to expectations about capital gains in owner-occupied housing. Further, housing wealth effects are found to be stronger (Case et al., 2005; Carrol et al., 2006). Evaluating the importance of the macroeconomic impact of the housing wealth effect on European post-transition economies, Ciarlone (2011) observe that the trend in real house prices changed rapidly after the financial and real estate crisis in late 2008.

Mostly the empirical studies on the impact of housing wealth on personal consumption focused on advanced economies. For example, studies by Skiner (1996), Campbell and Cocco (2007), Attanasio et al., (2009), and Disney et al., (2010) report a small but statistically significant housing wealth effect. However, the consensus is elusive regarding the magnitude of the housing wealth effect mostly due to the differences in the methodological approaches, sampling periods and or economic conditions. Thus, there exists a gap in the wealth literature, particularly in the case of developing economies.

Financial Wealth Effects

Financial wealth includes all financial assets held by the household (deposits, shares, mutual funds, whole life insurance, voluntary private pensions, and other financial assets) but excludes business assets. In general, much of financial wealth is concentrated in restricted accounts such as stocks, mutual funds, pension accounts and insurance. As such, households cannot easily withdraw funds from these accounts, and also it is often tedious to borrow against these assets. Further, among the lower-income families, unrestricted financial wealth to fund consumption is virtually nonexistent. Often, financial assets are concentrated among high-income families.

Financial wealth most often is considerably more volatile than housing wealth. Financial wealth has different components which may have different degrees of relative liquidity that affect the response of consumption to wealth changes. Muellbauer (1994) shows that differences between assets based on liquidity and the distribution of ownership could imply different aggregate propensities to consume. Studies like Byrne and Davis (2003) and Aron et al., (2012) further divide financial wealth into its liquid and illiquid components and focus on the relationship between consumption and asset price fluctuations after.

Extant literature estimates wealth effects using aggregate data that include results from many different countries and time periods. Tan and Voss (2003) present related macroeconomic analysis using Australian data and find that consumption rises about 4 cents for every additional (Australian) dollar in wealth. Slacalek (2009) observes that the Anglo-Saxon countries experience relatively large wealth effects as they have well-developed mortgage markets. Boone and Girouard (2002) find long-run marginal propensity to consume (MPC) out of financial wealth between 4% and 10% in Canada and Japan. Studying the wealth effects in the United States, Japan, and the Euro area, Kerdrain (2011), finds that the long-run MPC out of financial wealth is very comparable for the different regions, at around 5 or 6 cents. Accordingly, it is viewed that wealth fluctuations – especially in the United States – are very significant in explicating the evolution of consumption during the recent financial crisis. There can be several possible explanations as to why consumption is so limited from financial wealth.

Comparison of the Financial and Real Wealth Effects

Extant literature provides ample evidence for the empirical investigation of the comparison between the stock and housing wealth effects. Ludwig and Slok (2004), Skudelny (2009), Slacalek (2009), and De Bonis and Silvestrini (2012) find that financial (stock) wealth effect is larger than housing wealth effect. On the other hand, Case et al., (2005), Carrol et al., (2006), Ciarlone (2011) point out that the housing wealth effect is larger than the financial wealth effect. However, some studies remain inconclusive stating housing related data inadequacy. In fact, some evidence has shown that no cointegration existing between consumption, income and wealth (Rudd and Whelan, 2002; Slacalek, 2004; and Benjamin et al., 2004).

The available wealth effects literature provides evidence of studies focusing on developed and emerging economies in groups. Individual country focused studies are found to be scarce. There is a need to estimate the wealth effects and related macroeconomic dynamics more particularly in the case of developing economies. As such, this study aims to fill the literature gap by providing a detailed study on the wealth effects in India. Furthermore, we do not find a systematic study on the wealth effects and the macroeconomic dynamics in the Indian context. This study aims to contribute to the literature and fill the gap.

3. Data and Methodology

I address the linkage between stock market wealth, housing wealth, and household consumption in the presence of control variables using a data set that contains substantial time series (45 quarterly data points) from March 2005 to March 2016 in each of the variables. All variables data are sourced from Reserve Bank of India database. I face some data limitations. First, data on housing and stock wealth are not available on a broad basis. I, therefore, use housing price index (HPINDEX) and stock market capitalisation (MC) as the major proxies for these wealth components. This is in line with some of the studies such as; Miles (1992), Miles (1995), Girouard and Blöndal (2001), Aoki et al., (2003), Ludwig and Slok (2004), Labhard et al., (2005), Case et al., (2005) and Carrol et al., (2006), which used housing price indices as housing wealth proxy and studies like Romer (1990), Poterba and Samwick (1995), and Ludwig and Slok (2004) which used stock market capitalisation in ascertaining the impact of stock market prices and housing price index on aggregate consumption. Second, since I consider the aggregate measure of per family consumption expenditure (*pfce*)[1], I am unable to distinguish between durable and non-durable consumptions. However, *pfce* relies upon consumption measures derived from national income accounts, not our imputations, and there is a reason to suspect that it is measured less accurately. Elliott (1980) also relied upon aggregate data on consumer spending, financial wealth, and nonfinancial wealth. Further, the consumption measure includes expenditures on housing services as well. I find support from Mehra (2001) in considering *pfce* as the variable of interest in assessing the consumption-wealth channel.

Other variables that go into the econometric specification include inflation, GDP_growth (GDPGR), nominal exchange rate (ER), real_exchange_rate (REER), gold_price (GP), silver_price (SP), fiscal _deficit (FD), and 5-year-bond-yield (BY). The description of variables and the summary statistics such as minimum, 25th percentile, mean, 50th percentile, 75th percentile, maximum and standard deviation are provided in Table 1. Graphical illustration of the covariates is presented in Figure 1. The correlations of the variables are reported in Table 2. Further, Figure 2 to 5 present the interaction effect of macroeconomic variables.

[Figure 1 is about here]

[Table 1 is about here]

[Table 2 is about here]

[Figures 2 to 5 are about here]

A disadvantage of these data is that the stock market capitalisation has trended upwards during most of the sample period, and the period may have been unusual. However, our sample period encompasses the home market boom in India during 2011 – 13. The data set contains substantial time series variation in cyclical activity and exhibits considerable variation in consumption and wealth accumulation.

Empirical Approach

The wealth effects on consumption are typically estimated by regressing consumption growth (or changes in consumption) on changes in wealth:

[1] PFCE refers to expenditure on final consumption of goods and services by resident households and non-profit institutions serving households.

[2] Where the drivers of house prices potentially influence wellbeing (i.e., house price capitalization of desirable area characteristics), house prices might provide a reflection of the benefits derived from living in better areas in addition to

$$\Delta C_{it+1} = \alpha + \beta \Delta W_{it+1} + X'_{it+1}\gamma + \varepsilon_{it+1} \qquad \text{----- Eq (1)}$$

Differencing is intended to address the issues arising from omission of unobservable variables such as risk aversion or discount factor, which might vary systematically across the wealth distribution and contaminate estimation of the true relationship between consumption and wealth. Several studies (Poterba, 2000; Dynan and Maki, 2001; Juster et al., 2006; and Christelis et al., 2011) consider the equation (1) as a starting point for a wealth effect analysis. The "wealth effect" is the response of consumption to exogenous changes in wealth (i.e., capital gains in housing or stocks). Accordingly, for the purpose of identifying the wealth effect, I rewrite equation (1) as:

$$\Delta C_{it+1} = \alpha + \beta \Delta W^X_{it+1} + X'_{it+1}\gamma + \varepsilon_{it+1}$$

$$\Delta C_{it+1} = \alpha + \beta \textstyle\sum_j r^j_{t+1} W^j_{it} + X'_{it+1}\gamma + \varepsilon_{it+1} \qquad \text{----- Eq (2)}$$

The β in equation (2) captures two different effects. One is the inter-temporal substitution, i.e. if asset prices are expected to increase; consumers will modify their current consumption and saving decisions. The other effect is due to unanticipated changes in asset prices which induce households to modify their optimal consumption path and which can be more plausibly interpreted as a "wealth effect". I can decompose the exogenous wealth increase to capture these two effects as:

$$\Delta W^X_{it+1} = \sum_j (p^j_{t+t} - p^j_t) A^j_{it}$$

$$\Delta W^X_{it+1} = \sum_j \left(E_t p^j_{t+t} - p^j_t\right) A^j_i + \sum_j (p^j_{t+t} - E_t p^j_t) A^j_{it}$$

$$\Delta W^X_{it+1} = \sum_j E_{t-1 r^j_{t+1}} r^j_{t+1} W^j_{it} + \sum_j (r^j_{t+t} - E_t r^j_{t+1}) W^j_{it}$$

$$\Delta W^X_{it+1} = \Delta W^{XA}_{it+1} + \Delta W^{XU}_{it+1} \qquad \text{----- Eq (3)}$$

where ΔW^{XA}_{it+1} and ΔW^{XU}_{it+1} denote the anticipated and unanticipated change in wealth respectively. Then, I rewrite the equation (3) as

$$\Delta C_{it+1} = \alpha + \beta_A \Delta W_{it+1}^{XA} + \beta_U \Delta W_{it+1}^{XU} + X_{it+1}'\gamma + \varepsilon_{it+1} \qquad \text{----- Eq (4)}$$

Eq (4) allows for potentially different responses to anticipated and unanticipated wealth changes. β_U captures the 'pure effect' on consumption. Further, both the anticipated and unanticipated changes affect consumption and this can be made out clearly in an Euler equation framework:

$$\Delta C_{it+1} = \frac{1}{\gamma}(E_t r_{t+1} - \delta) + \xi_{it+1} \qquad \text{----- Eq (5)}$$

The consumption reacts both to expected changes in asset prices $E_t r_{t+1}$ which determine the relative price of present and future consumption. The shocks to wealth caused by changes in prices are included in the innovation term ξ_{it+1}. The parameter β_A is related to the effect of expected changes in wealth effects denoted by $E_t r_{t+1}$ on ΔC_{it+1} and the parameter β_U is related to the effect of unexpected changes in wealth effects denoted by ξ_{it+1} on ΔC_{it+1} .

The Model

A vector autoregressive model (VAR) can be the best solution in testing the long-run dynamic relationship between the variables concerned in such situation where the prior assumption of endogeneity and homogeneity of variables concerned may not always be made. VAR model treats all variables systematically without making reference to the issue of dependence or independence. A VAR model additionally offers a scope for intervention analysis through the study of impulse response functions for the endogenous variables in the model. Moreover, a VAR model allows the analysis of 'variance decompositions' for these variables and further helps to understand the interrelationships among the variables concerned.

I use a vector autoregressive (VAR) approach coupled with vector error correction model (VECM) as advocated by Love and Zicchino (2006) to estimate the wealth effect on consumption. In fact, Lettau and Ludvigson (2004) confirm that both consumption and wealth are endogenous, and the conventional way which implicitly treats wealth as an exogenous variable may be biased since wealth also responds to the underlying exogenous shocks. Lettau and Ludvigson (2001, 2004) argue that in order to detect the response of consumption to a shock, it is important to take into account all the variables in the system. For this reason, the system estimation is necessary. Furthermore, the VAR model has the benefit of obviously allowing for feedback effects from consumption to wealth or income, something that single-equation approach cannot address. The VAR approach would be able to demonstrate how the response of consumption and wealth vary according to the nature of the shocks on them.

1. Wealth Effects on Consumption

The estimation sample has been chosen using a VAR model of the form:

$$Z_t = A(L)Z_{t-1} + \mu + \varepsilon_t$$

Z_t is a vector of endogenous variables, A(L) describes parameter matrices, μ is a vector of constant terms and ε_t is a vector of error terms that are assumed to be white noise.

The mathematical representation of a VAR is:

$$y_t = A_1 y_{t-1} + \ldots\ldots + A_p y_{t-p} + BX_t + \epsilon_t$$

where y_t is k vector of endogenous variables, X_t is a k vector of exogenous variables, A_1, ... …., A_p and B are matrices of coefficients to be estimated, and $\boldsymbol{\epsilon_t}$ is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables. Since only lagged values of the endogenous variables appear on the right-hand side of the equations, simultaneity is not an issue and OLS yields consistent estimates. Moreover, even though the innovations $\boldsymbol{\epsilon_t}$ may be contemporaneously correlated, OLS is efficient and equivalent to GLS since all equations have identical regressors.

A recursive VAR constructs the error terms in the each regression equation to be uncorrelated with the error in the preceding equations. This is done by judiciously including some contemporaneous values as regressors. Estimation of each equation by OLS produces residuals that are uncorrelated across equations. Seemingly, the result depends on the order of the variables: changing the order changes the VAR equations, coefficients, and residuals, and there are n! recursive VARs, representing all possible orderings. In the recursive VAR model, the vector Z_t comprises the following variables:

$$Z_t = (log\_PFCE_t + HPINDEX_t + log\_MC_t)$$

where log_PFCE is the per family consumption expenditure, $HPINDEX_t$ is the housing price index[2], and log_MC_t is the stock market capitalization.

4. Results and Discussion

In this section, I report the important results and related discussion of the study in six sub-sections. For brevity, results of all the stages of the analyses are not reported. However, they are available for verification on request.

4.1 Wealth Effects on Consumption

I begin by testing for stationarity of the covariates employing the ADF test that includes a constant in the test regression and employs an automatic lag length selection using a Schwarz Information Criterion (BIC) and a maximum lag length of 4. The results of the unit root tests are provided in Table 3. I notice that the statistic t_α value is greater than the critical values so that I do not reject the null at conventional test sizes. With the ADF test, based on the results, I find that log_PFCE, HPINDEX, log_MC are stationary at the first difference level. I determine the number of lags p of the VAR (p) model. Within the four usual criteria: Final prediction error (FPE), Akaike (AIC), Schwartz (SC) and Hannan-Quinn (HQ), Liew (2004) report that AIC and FPE are recommended to estimate autoregression Lag length. Lag length criteria test and AR Root Graph suggest the lag length at 4.

[Table 3 is about here]

To examine how changes in the covariates affect another set of variables, block exogeneity test was performed with the first block as LNPFCE and the second block consisting of other variables (Table 4). VAR Granger Causality/Block Exogeneity Wald Tests carry out Pairwise Granger causality tests and ascertain whether an endogenous variable can be treated as exogenous. For each equation in the VAR, the output displays χ^2 (Wald) statistics for the joint significance of each of the other lagged endogenous variables in that equation. The statistic in the last row (All) is the χ^2 statistic for joint significance of all other lagged endogenous variables in the equation. The results reported in Table 4 suggest a unidirectional causality running from changes in LNPFCE to another set of variables in view of the joint significance. In the case of HPINDEX, though the there is the absence of joint

[2] Where the drivers of house prices potentially influence wellbeing (i.e., house price capitalization of desirable area characteristics), house prices might provide a reflection of the benefits derived from living in better areas in addition to possible wealth shocks (Ratcliffe, 2015).

significance, I notice one to one significance. In the case of LNMC, I notice a joint significance in the unidirectional causality running from changes in LNMC to another set of variables. The results thus confirm that perceptions of current and future financial well-being are correlated with house prices. The evidence presented is consistent with the wealth effect hypothesis.

[Table 4 is about here]

I estimate an unrestricted VAR model and apply Cholesky decomposition to the VAR specification. Table 5 presents the vector autoregression estimates. I perform multivariate LM test to test the presence of the autocorrelations and the VAR residual portmanteau tests for autocorrelations to establish the residual autocorrelations. Further, I also perform the VAR Granger causality/block exogeneity Wald tests, residual normality tests, and VAR residual heteroscedasticity tests with without cross terms. Panel Granger causality tests also provide the evidence of bidirectional causality among the wealth effects and consumption.

[Table 5 is about here]

Any shocks to the i^{th} variable not only directly affect the respective variable i^{th} variable only, but also it would be transmitted to all of the endogenous variables in the model through the dynamic (lag) structure of VAR. An impulse response function traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables. Table 6 reports the accumulated response of consumption to wealth effects. The impulse responses show the effect of an unexpected 1 percentage point increase in PFCE on all other variables, as it works through the recursive VAR system with the coefficients estimated from actual data (Figure 6). Also plotted are ±1 standard error bands for each of the impulse responses. An unexpected rise in HPINDEX is associated with an increase in LNPFCE by a minimum of around 1.5 percent in the 4^{th} period and a maximum of 6.37 percent in the 10^{th} period. However, an unexpected rise in LNMC is associated with a decline in LNPFCE by a minimum of around 1 percent in the 4^{th} period and a maximum of 5.1 percent in the 10^{th} period.

[Table 6 is about here]

[Figure 6 is about here]

The impulse responses (IRs) discover the effects of a shock to one and thereby transmitted to other endogenous variables in the VAR System. However, it is also required to know the magnitude of shocks in the system. To overcome this problem, variance decomposition mechanism is applied to separate out the variation in an endogenous variable into the constituent shocks to the VAR system. Table 6 also reports the separate variance decomposition for each endogenous variable. The second column, labelled "SE", contains the forecast error of the variable at the given forecast horizon. The source of this forecast error is the variation in the current and future values of the innovations to each endogenous variable in the VAR. With the impulse responses, the variance decomposition based on the Cholesky factor can change dramatically if the ordering of the variables in the VAR is altered. For example, the first-period decomposition for the first variable in the VAR ordering is completely due to its own innovation. The variance of decompositions (Recursive VAR) is presented in Figure 7. I notice that at the 10^{th} period 67.09 percent of the error in the forecast of LNFCE is attributed to HPINDEX, and 12.65 percent is attributed to LNMC shocks in the recursive VAR.

[Figure 7 is about here]

Based on the lag length of 4, I test the models with lag interval (1, 1) by employing Johansen-Juselius (JJ) cointegration test. In Table 7, the JJ Cointegration trace and Max test results of all the models of analysis are furnished. Both the test results indicate that there is an evidence of Cointegration. The presence of a cointegrating vector implies that the covariates are related strongly in the long run.

[Table 7 is about here]

A vector error correction model (VECM) with the order ($p - 1$):

$$\Delta Y_t = \alpha_1 + p_1 e_1 + \sum_{i=0}^{n} \beta_i \, \Delta Y_{t-i} + \sum_{i=0}^{n} \delta_i \Delta X_{t-i} + \sum_{i=0}^{n} \gamma_i Z_{t-i}$$

$$\Delta X_t = \alpha_2 + p_2 e_{i-1} + \sum_{i=0}^{n} \beta_i \, Y_{t-i} + \sum_{i=0}^{n} \delta_i \Delta X_{t-i} + \sum_{i=0}^{n} \gamma_i Z_{t-i}$$

The above described VECM is equivalent to a Vector Autoregression (VAR p) presentation of the levels X_t. In a VAR model, each variable can be endogenous and the changes in a selected target variable in period t depend on the deviations from that specific equilibrium in the previous period and the short-run dynamics. Further, VECM allows for estimation of the long-run effects and to analyse the short-run adjustment process within one model. The variable vector X_t is assumed to be vector integrated of order 1 (I(1), i.e. ΔX_t is vector stationary. The VECM estimation method is used due to the presence of one cointegrating vector in the variables. The results reported Table 8 show that LNPFCE has a negative error correction term (ECT) coefficient meaning that LNPFCE has a feedback to long-run equilibrium: adjusting in the short-run to restore long-run equilibrium. The ECT coefficient for LNPFCE is statistically negative which implies that this variable fits into the model and suffers a shock and adjusts to restore their equilibrium. The error correction coefficient for LNPFCE was (-0.0131) and it measures the speed of adjustment of LNPFCE towards long run equilibrium. The coefficient carries the expected negative sign, significant at 1% level and less than one which is appropriate. The coefficient indicates a feedback of about 1.3% of the previous quarter's disequilibrium from the long run elasticity.

[Table 8 is about here]

4.2 Wealth Effects on Growth

In this section, I report the results of the analysis concerning the wealth effects on economic growth (log_GDP i.e. LNGDP). The VAR estimates and the cointegration test results evidence the long run relationship. The impulse responses reported in Table 9 indicate that an unexpected rise in HPINDEX is associated with an increase in LNGDP by a minimum of around 1 percent in the 3rd period and a maximum of 14.90 percent in the 10th period. However, an unexpected rise in LNMC is associated with a relatively smaller impact on LNGDP by a minimum of around 1 percent in the 2nd period and a maximum of 4 percent in the 10th period (Figure 8). The variance decomposition results indicate that at the 10th period, 10.836 percent of the error in the forecast of LNGDP is attributed to HPINDEX, and 1 percent is attributed to LNMC shocks in the recursive VAR. The VECM results suggest that LNGDP has a negative error correction term (ECT) coefficient meaning that LNGDP has a feedback to long-run equilibrium: adjusting in the short-run to restore long-run equilibrium. The ECT coefficient for LNGDP is statistically negative which implies that this variable fits into the model and suffers a shock and adjusts to restore their equilibrium. The error correction coefficient for LNGDP was (-0.0099) and it measures the speed of adjustment of LNGDP towards long run equilibrium. The coefficient carries the expected negative sign, significant at 1% level and less than one which is appropriate. The coefficient indicates a feedback of about 1% of the previous quarter's disequilibrium from the long run elasticity. The dominant impact of house price effect suggests that housing wealth shocks might be relevant.

[Table 9 is about here]

[Figure 8 is about here]

4.3 Wealth Effects on Inflation

I find significant wealth effects on inflation as well. The VAR estimates and the cointegration test results suggest the long run relationship. Table 10 reports the impulse responses and variance decomposition of inflation due to wealth effects. The impulse responses (Figure 9) indicate that an unexpected rise in HPINDEX is associated with an increase in INFL by a minimum of around 4 percent in the 3rd period and a maximum of 52.45 percent in the 10th period. However, an unexpected rise in LNMC is associated with a relatively smaller impact on INFL in the initial periods and a negative impact in the subsequent periods. The variance decomposition indicates that at the 10th period, 1.94 percent of the error in the forecast of INFL is attributed to HPINDEX, and 9.67 percent is attributed to LNMC shocks in the recursive VAR. The VECM results suggest that INFL has a negative error correction term (ECT) coefficient meaning that INFL has a feedback to long-run equilibrium: adjusting in the short-run to restore long-run equilibrium. The ECT coefficient for INFL is statistically negative, implying that this variable fits into the model. The ECT coefficient for INFL of -0.1648 measures the speed of adjustment of INFL towards long run equilibrium. The coefficient indicates a feedback of about 16% of the previous quarter's disequilibrium from the long run elasticity. The results suggest that the rise in the value of real assets creates an apparent increase in the wealth, which in turn motivates the people to spend more, even though there is no significant growth in their income.

[Table 10 is about here]

[Figure 9 is about here]

4.4 Wealth Effects on Real effective exchange rate

The estimations indicate significant wealth effects on the real effective exchange rate (REER). The VAR estimates and the cointegration test results emphasise the existence of the long run relationship. Table 11 reports the impulse responses and variance decomposition of REER due to wealth effects. The impulse responses (Figure 10) indicate that an unexpected rise in HPINDEX is associated with an increase in REER by a minimum of around 8.58 percent in the 1st period and a maximum of 98.89 percent in the 9th period. However, an unexpected rise in LNMC is associated with a negative impact on REER. A maximum impulse response of REER to LNMC shock is found to be around 12.8 percent in the 2nd period. The variance decomposition results indicate that at the 10th period, 6.21 percent of the error in the forecast of REER is attributed to HPINDEX, and 2.11 percent is attributed to LNMC shocks in the recursive VAR. The VECM results suggest that REER has a negative ECT coefficient meaning that REER has a feedback to long-run equilibrium and implies that this variable fits into the model and suffers a shock and adjusts to restore the equilibrium. The ECT coefficient for REER was -0.3134 and it measures the speed of adjustment of REER towards long run equilibrium. The coefficient indicates a feedback of about 31% of the previous quarter's disequilibrium from the long run elasticity. Our results find support from (Wang et al., 2016) who provide evidence for the significance of wealth effects in determining exchange rates.

[Table 11 is about here]

[Figure 10 is about here]

4.5 Wealth Effects on Fiscal deficit

Wealth effects enlarge the response of the price level and of all the other variables to fiscal expansions. The extant literature shows the linkages between fiscal variables and the dynamics of the price level and illustrates the directions in which wealth effects work. In this backdrop, we investigate the wealth effects of fiscal deficit. The results indicate significant negative wealth effects on the fiscal deficit (LNFD). The VAR estimates and the cointegration test results emphasise the existence of the long run relationship. Table 12 reports the impulse responses and variance decomposition of LNFD due to wealth effects. The impulse responses (Figure 11) indicate that an unexpected rise in HPINDEX is associated with a decline in LNFD by a maximum of around 2.24 percent in the 3rd period. Similarly, an unexpected rise in LNMC is associated with a relatively smaller negative impact on LNFD to a maximum of around 7 percent in the 10th period. The variance decomposition results indicate that at the 10th period, 58.57 percent of the error in the forecast of LNFD is attributed to HPINDEX, and 10.10 percent is attributed to LNFD shocks in the recursive VAR. The VECM results show that LNFD has a negative ECT coefficient of -01.312 which measures the speed of adjustment of LNFD towards long run equilibrium. The results emphasise the role of wealth effects particularly the financial wealth forms in the transmission mechanism from fiscal policy to price level dynamics.

[Table 12 is about here]

[Figure 11 is about here]

4.6. Wealth Effects on Bullion (Gold and Silver prices)

Stock markets provide another alternative for savers and investors. In general, equity prices are used for capturing the wealth effect on consumption and saving/investment (Shirvani and Wilbrate, 2000). Capital gains arising from an increase in equity prices in the medium-longer horizon may entice consumers for greater consumption of gold. This entails that the gains from financial assets have to be transformed into less risky real assets such as gold. Lawrence (2003) shows that in the US, returns on gold are less correlated with returns on equity and bond indices which is attributable to portfolio diversifier role of gold. Studying Indian markets, Vuyyuri and Mani (2003) find an insignificant effect of the stock price on the domestic gold price. However, Pulvermacher (2004) argues that empirical evidence on the effect of equity prices on gold market remains inconclusive. With this empirical backdrop, we study the wealth effects on gold and silver prices. Table 13 reports the accumulated response and the variance decomposition of bullion to the wealth effects in a VAR model. The impulse responses (Figure 12) indicate that an unexpected rise in HPINDEX is associated with a rise in LNGOLD by a maximum of 23.51 percent in the 10^{th} period (Table 13). However, an unexpected rise in LNMC is associated with a negative shock on INGOLD to the extent of 11.23 percent in the 10^{th} period. Likewise, an unexpected rise in HPINDEX is associated with a rise in LNSILVER by a maximum of around 46.54 percent in the 10^{th} period. However, an unexpected rise in LNMC is associated with a negative shock on INSILVER to the extent of 24.04 percent in the 10^{th} period. The variance decomposition of LNGOLD shows that at the 10^{th} period, 16.27 percent of the error in the forecast of LNGOLD is attributed to HPINDEX and 5.57 percent is attributed to LNMC shocks in the recursive VAR (Table 14). Similarly, the variance decomposition of LNSILVER shows that at the 10^{th} period, 29 percent of the error in the forecast of LNSILVER is attributed to HPINDEX and 8.28 percent is attributed to LNMC shocks in the recursive VAR. Our results show that housing wealth effects have positive effect on gold and silver and on the other hand, financial wealth effects have a negative effect.

[Table 13 is about here]

[Table 14 is about here]

[Figure 12 is about here]

The macro-econometric modelling in this study has thus provided useful guidance on the relationship between aggregate consumption and wealth. As suggested by Blundell et al., 1993, household wealth effect analysis using aggregate time series data can generate accurate estimates of the parameters under certain conditions (Cooper and Dynan, 2016).

5. Conclusion

To date, there has been much concerning research on and debate surrounding the influence of wealth effects on macroeconomic dynamics. Understanding wealth effects is crucial not only for forecasting consumption and broader economic growth well but also for estimating the risks to the economic outlook and determining suitable macroeconomic policy. Wealth effects research assumes greater significance particularly during the periods of large fluctuations in asset prices. This study has provided evidence of the wealth effects on the private consumption and the related macroeconomic dynamics in Indian economy. Employing recursive VAR approach in estimating the wealth effects, it is evidenced that the net housing wealth effect is greater compared to the stock market wealth effect. This study observes a potential ratchet effect of housing wealth on consumption. The results show that the gain in housing wealth generates a higher and more enduring increase in consumer spending than the decline in consumption for a similar reduction in stock market wealth. Wealth effects on growth, inflation, real effective exchange rate, fiscal deficit, and bullion show that housing wealth has a greater impact than the stock market wealth. There is a bidirectional causality running from private consumption to stock prices and vice versa. Our results provide important policy implications. The existence of ratchet asset price effect on consumption implies that policy intervention is more necessitated for the rise of the asset price to obviate inflationary pressures than the decline in the asset price. Essentially, policy makers need to identify the asset bubble in the early stage to avoid much larger bubble burst in the future.

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Table 1: Variables and Descriptive Statistics

	Units	min	p25	mean	p50	p50	p75	max	sd
Inflation	rate of change in index	3.70	5.61	7.93	7.20	7.20	10.10	15.30	2.83
GDP_growth	growth rate	0.16	6.33	7.64	7.43	7.43	9.25	13.70	2.42
Consumer Price Index	rate of change in index	-4.59	4.01	5.38	6.40	6.40	7.71	10.89	3.85
Nominal Exchange Rate	rate of change in index	39.41	44.65	50.90	47.87	47.87	59.70	67.75	8.35
gold_price	INR per 10 grams	6134.23	10311.00	19265.94	19055.63	19055.63	27427.40	31672.83	8684.83
Silver_Price	INR per 1000 grams	10820.60	19494.24	33666.07	32519.33	32519.33	45349.81	62134.57	15879.15
Fiscal_Deficit	INR billion	-821.32	-154.85	3.55	15.60	15.60	186.96	985.04	402.29
Weighted_average_call_money_rate	in percent	2.42	5.73	6.93	7.23	7.23	8.08	14.07	2.14
Weighted_average_lending_rate	in percent	10.00	10.50	11.40	11.40	11.40	12.00	13.20	0.91
Log of Market Capitalisation as % of GDP	in log	3.67	3.80	3.92	3.86	4.07	4.21	0.15	3.67
5-year_bond_yield	in percent	5.38	7.39	7.75	7.81	7.81	8.18	8.93	0.75
10-year_bond_yield	in percent	5.26	7.55	7.85	7.86	7.86	8.33	8.83	0.68
Household_final_consumption_expenditure	INR billion	4425.35	6518.74	11251.36	9759.48	9759.48	15412.48	21478.14	5424.99
GDP@market_price	INR billion	7353.63	11393.13	19455.14	17004.87	17004.87	27695.57	36768.32	9241.01
house_price_index	index	58.00	91.43	173.56	172.80	172.80	231.09	372.00	91.20
real_effective_exchange_rate	rate of change in index	84.31	92.02	94.63	93.96	93.96	98.08	102.88	4.72

Source: Reserve Bank of India database

Table 2: Correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Inflation (1)	1											
GDP_growth (2)	-.098	1										
nominal_exchange_rate (3)	-.070	-.398**	1									
log_gold_price (4)	.379*	-.399**	.754**	1								
log_silver_price (5)	.414**	-.319*	.564**	.949**	1							
log_fiscal _deficit (6)	-.069	.161	-.255	-.178	-.130	1						
5-year-bond-yield (7)	.086	-.035	.330*	.573**	.666**	-.009	1					
log_market_capitalisation (8)	-.041	-.416**	.989**	.766**	.581**	-.234	.329*	1				
log_pfce (9)	.145	-.342*	.893**	.943**	.833**	-.208	.530**	.890**	1			
log_GDP (10)	.160	-.357*	.880**	.952**	.847**	-.220	.528**	.876**	.997**	1		
log_house_price_index (11)	.324*	-.237	.460**	.828**	.877**	-.023	.475**	.474**	.718**	.731**	1	
real_exchange_rate (12)	-.155	.613**	-.366*	-.151	-.033	.206	.010	-.384**	-.132	-.131	.153	1

Source: author’s calculations

Table 3: Unit root tests

We report the test statistics for ADF, PP, and KPSS Test. ***, **, * indicate the significance of the result at 1%, 5%, and 10% respectively. For KPSS test results, asymptotic critical values are provided as per Kwiatkowski-Phillips-Schmidt-Shin (1992, Table1). PP test, ADF test (H0: series has a unit root).

	Test Statistic at level form			Test Statistic at 1st diff.		
Variable	ADF Test	PP Test	KPSS Test	ADF Test	PP Test	KPSS Test
log_PFCE	0.83	0.84	0.85	-26.58***	-22.04***	0.1337
HPINDEX	-1.55	-1.55	0.55	-6.35***	-6.35***	0.0914
log_MC	-0.16	-0.32	0.75	-5.48***	-5.39***	0.1186

Source: author's calculations

Table 4: Granger Causality Tests

Panel A: VAR Granger Causality/Block Exogeneity Wald Tests

Dependent variable: LNPFCE			
Excluded	Chi-sq	df	Prob.
HPINDEX	4.3615	3	0.2250
LNMC	16.1075	3	0.0011
All	**42.1473**	**6**	**0.0000**
Dependent variable: HPINDEX			
Excluded	Chi-sq	df	Prob.
LNPFCE	5.8761	2	0.0530
LNMC	5.2169	2	0.0736
All	**7.0180**	**4**	**0.1349**
Dependent variable: LNMC			
Excluded	Chi-sq	df	Prob.
LNPFCE	15.5410	3	0.0014
HPINDEX	5.6303	3	0.1310
All	**29.8635**	**6**	**0.0000**

Panel B: Panel Granger causality test:

Null hypothesis	lags	Obs	F-Statistic	Prob.
LNPFCE does not Granger Cause LNMC	4	41	3.37208	0.0207
LNMC does not Granger Cause LNPFCE	4	41	7.55758	0.0002
LNPFCE does not Granger Cause HPINDEX	4	41	0.24141	0.0912
HPINDEX does not Granger Cause LNPFCE	4	41	5.06050	0.0028

Source: author's calculations

Table 5: Vector Autoregression Estimates

	LNPFCE	HPINDEX	LNMC
LNPFCE(-2)	0.096184	23.11440	0.080293
	(0.08425)	(138.808)	(0.14285)
	[1.14170]	[0.16652]	[0.56209]
LNPFCE(-3)	0.045688	33.37772	0.029591
	(0.09924)	(163.517)	(0.16827)
	[0.46037]	[0.20412]	[0.17585]
LNPFCE(-4)	0.925191	57.59968	0.155996
	(0.08432)	(138.935)	(0.14298)
	[10.9719]	[0.41458]	[1.09106]
HPINDEX(-2)	0.000104	0.810483	-0.000623
	(0.00016)	(0.27127)	(0.00028)
	[0.63256]	[2.98776]	[-2.23070]
HPINDEX(-3)	7.69E-05	-0.061846	0.000369
	(0.00021)	(0.34980)	(0.00036)

	[0.36232]	[-0.17680]	[1.02562]
HPINDEX(-4)	3.12E-05	-0.211469	6.66E-05
	(0.00015)	(0.25084)	(0.00026)
	[0.20506]	[-0.84303]	[0.25796]
LNMC(-2)	-0.089513	121.2401	0.595441
	(0.14359)	(236.589)	(0.24347)
	[-0.62338]	[0.51245]	[2.44563]
LNMC(-3)	-0.093240	-329.6984	-0.066466
	(0.20423)	(336.502)	(0.34629)
	[-0.45654]	[-0.97978]	[-0.19194]
LNMC(-4)	-0.197480	-34.59834	-0.310212
	(0.14642)	(241.244)	(0.24826)
	[-1.34875]	[-0.14342]	[-1.24954]
Intercept	0.966752	-11.20628	0.667335
	(0.16253)	(267.784)	(0.27557)
	[5.94830]	[-0.04185]	[2.42162]
R-squared	0.996298	0.725249	0.911030
Adj. R-squared	0.995223	0.645482	0.885200
Sum sq. resids	0.031600	85785.54	0.090849
S.E. equation	0.031927	52.60490	0.054135
F-statistic	926.8756	9.092156	35.27009
Log likelihood	88.77095	-214.9202	67.12223
Akaike AIC	-3.842485	10.97172	-2.786450
Schwarz SC	-3.424541	11.38966	-2.368506
Mean dependent	9.280976	184.3422	3.931463
S.D. dependent	0.461924	88.35016	0.159774
Log likelihood		-53.33949	
Akaike information criterion		4.065341	
Schwarz criterion		5.319174	

Note: Standard errors in ( ) & t-statistics in [ ]
Source: author's calculations

Table 6: Impulse Responses and Variance decomposition of Consumption due to wealth effects

	Accumulated Response of Consumption			Variance decomposition of Consumption			
Period	LNPFCE	HPINDEX	LNMC	S.E.	LNPFCE	HPINDEX	LNMC
1	0.031713 (0.00350)	0.000000 (0.00000)	0.000000 (0.00000)	0.0317	100.0000	0.0000	0.0000
2	0.031713 (0.00350)	0.000000 (0.00000)	0.000000 (0.00000)	0.0317	100.0000	0.0000	0.0000
3	0.031713 (0.00350)	0.000000 (0.00000)	0.000000 (0.00000)	0.0317	100.0000	0.0000	0.0000
4	0.041750 (0.00669)	0.015109 (0.00776)	-0.008633 (0.00777)	0.0375	78.5127	16.1985	5.2888
5	0.074189 (0.00959)	0.021032 (0.00595)	-0.021261 (0.00567)	0.0515	81.2747	9.9155	8.8099
6	0.074189 (0.00959)	0.021032 (0.00595)	-0.021261 (0.00567)	0.0515	81.2747	9.9155	8.8099
7	0.080647 (0.01228)	0.035142 (0.01211)	-0.025185 (0.01010)	0.0540	75.5573	15.8791	8.5636
8	0.093440 (0.01617)	0.051365 (0.01530)	-0.040971 (0.01407)	0.0599	65.8830	20.2221	13.8949
9	0.120668 (0.01822)	0.052648 (0.01621)	-0.049698 (0.01427)	0.0664	70.4588	16.5009	13.0403
10	0.125714 (0.02042)	0.063787 (0.02075)	-0.051160 (0.01709)	0.0675	68.6732	18.6734	12.6534

Source: author's calculations

Table 7: Johansen Cointegration Test Results

H_0	H_a	Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
Unrestricted Cointegration Rank Test (Trace)						
r =0	r >0	None *	0.2336	14.7776	29.7971	0.7943
r ≤1	r >1	At most 1 *	0.0974	4.1365	15.4947	0.8922
r ≤2	r >2	At most 2 *	0.0010	0.0393	3.8415	0.8429
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)						
r =0	r >0	None *	0.2336	10.6411	21.1316	0.6830
r ≤1	r >1	At most 1 *	0.0974	4.0973	14.2646	0.8489
r ≤2	r >2	At most 2 *	0.0010	0.0393	3.8415	0.8429
1 Cointegrating Equation(s):		Log likelihood = -27.6741				
Normalized cointegrating coefficients (standard error in parentheses)						
		LNPFCE	HPINDEX	LNMC		
		1.0000	-0.0023	-1.9370		
			-0.0006	-0.3444		
2 Cointegrating Equation(s):		Log likelihood = -25.6255				
Normalized cointegrating coefficients (standard error in parentheses)						
		LNPFCE	HPINDEX	LNMC		
		1.0000	0.0000	-2.8006		
				-0.6675		
		0.0000	1.0000	-383.3470		
				-281.9350		

Trace test indicates 2 cointegrating Eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Source: author's calculations

Table 8: Vector Error Correction Estimates

Cointegrating Eq:	CointEq1	CointEq2	
LNPFCE(-1)	1	0	
HPINDEX(-1)	0	1	
LNMC(-1)	-2.315895	-293.8386	
	(0.73683)	(310.516)	
	[-3.14305]	[-0.94629]	
Intercept	-0.175268	969.9960	
Error Correction:	D(LNPFCE)	D(HPINDEX)	D(LNMC)
CointEq1	-0.013149	3.832660	0.104100
	(0.03388)	(45.6272)	(0.04660)
	[-0.38813]	[0.08400]	[2.23373]
CointEq2	2.90E-05	-0.157529	-0.000149
	(9.1E-05)	(0.12269)	(0.00013)
	[0.31844]	[-1.28396]	[-1.18747]
D(LNPFCE(-3))	0.004968	9.206788	0.033132
	(0.07806)	(105.128)	(0.10738)
	[0.06365]	[0.08758]	[0.30855]
D(LNPFCE(-4))	0.860807	83.75092	0.212684
	(0.07845)	(105.662)	(0.10792)
	[10.9721]	[0.79263]	[1.97071]
D(HPINDEX(-3))	9.86E-05	0.123600	0.000257
	(0.00015)	(0.20271)	(0.00021)
	[0.65485]	[0.60975]	[1.23957]
D(HPINDEX(-4))	-2.47E-05	0.020390	1.16E-05
	(0.00014)	(0.18805)	(0.00019)

	[-0.17714]	[0.10843]	[0.06055]
D(LNMC(-3))	-0.094874	-4.984386	-0.049986
	(0.12277)	(165.344)	(0.16888)
	[-0.77279]	[-0.03015]	[-0.29598]
D(LNMC(-4))	-0.183564	-88.33056	-0.369698
	(0.12342)	(166.217)	(0.16977)
	[-1.48736]	[-0.53142]	[-2.17760]
Intercept	0.006856	0.885789	0.003999
	(0.00668)	(8.99875)	(0.00919)
	[1.02604]	[0.09843]	[0.43506]
R-squared	0.823350	0.104683	0.334937
Adj. R-squared	0.777763	-0.126366	0.163308
Sum sq. resids	0.028080	50933.79	0.053137
S.E. equation	0.030097	40.53425	0.041402
F-statistic	18.06103	0.453076	1.951517
Log likelihood	88.47380	-199.7456	75.71774
Akaike AIC	-3.973690	10.43728	-3.335887
Schwarz SC	-3.593692	10.81728	-2.955889
Mean dependent	0.036000	4.002250	0.010250
S.D. dependent	0.063843	38.19287	0.045262
Log likelihood		-32.50709	
Akaike information criterion		3.275355	
Schwarz criterion		4.668680	

Note: Standard errors in ( ) & t-statistics in [ ]
Source: author's calculations

Table 9: Impulse Responses and Variance decomposition of Growth

	Accumulated Response of Growth			Variance decomposition of Growth			
Period	LNGDP	HPINDEX	LNMC	S.E.	LNGDP	HPINDEX	LNMC
1	0.063146 (0.00681)	0.000000 (0.00000)	0.000000 (0.00000)	0.063146	100.0000	0.000000	0.000000
2	0.117883 (0.01650)	-0.002803 (0.00990)	0.008379 (0.00989)	0.084033	98.89444	0.111269	0.994294
3	0.173091 (0.02657)	0.000733 (0.02023)	0.015532 (0.02190)	0.100862	98.60673	0.200171	1.193103
4	0.226800 (0.03748)	0.010557 (0.03208)	0.022467 (0.03565)	0.114902	97.83121	0.885135	1.283652
5	0.279484 (0.04857)	0.025569 (0.04597)	0.028843 (0.05094)	0.127452	96.59964	2.106810	1.293550
6	0.331311 (0.05988)	0.044657 (0.06210)	0.034028 (0.06729)	0.139001	95.11631	3.657062	1.226629
7	0.382320 (0.07141)	0.067064 (0.08039)	0.037525 (0.08424)	0.149792	93.50245	5.386752	1.110801
8	0.432424 (0.08321)	0.092238 (0.10059)	0.039194 (0.10153)	0.159952	91.81380	7.201145	0.985052
9	0.481504 (0.09531)	0.119707 (0.12247)	0.039139 (0.11911)	0.169552	90.08982	9.033513	0.876667
10	0.529453 (0.10773)	0.149034 (0.14578)	0.037570 (0.13693)	0.178632	88.36865	10.83383	0.797521

Source: author's calculations

Table 10: Impulse Responses and Variance decomposition of Inflation

	Accumulated Response of Inflation			Variance decomposition of Inflation			
Period	INFL	HPINDEX	LNMC	S.E.	INFL	HPINDEX	LNMC
1	1.352386	-1.458117	0.003622	1.352386	100.0000	0.000000	0.000000
	(0.14583)	(5.38854)	(0.00674)				
2	2.704798	-1.170566	0.011989	1.929470	98.25708	0.226699	1.516218
	(0.36691)	(11.8979)	(0.01591)				
3	3.800666	4.000790	0.016665	2.248539	96.10289	0.814825	3.082283
	(0.64158)	(19.1205)	(0.02653)				
4	4.680743	11.15797	0.015821	2.441407	94.51317	1.322765	4.164062
	(0.92071)	(26.4922)	(0.03768)				
5	5.408480	18.37881	0.011363	2.569965	93.31250	1.638286	5.049209
	(1.20869)	(34.3086)	(0.04986)				
6	6.019707	25.38915	0.005040	2.661905	92.25051	1.822927	5.926559
	(1.50713)	(42.6023)	(0.06334)				
7	6.535928	32.31568	-0.002236	2.730676	91.23623	1.925129	6.838645
	(1.81048)	(51.2265)	(0.07799)				
8	6.974406	39.17444	-0.009950	2.783992	90.25578	1.968377	7.775845
	(2.11216)	(60.0109)	(0.09363)				
9	7.349656	45.90520	-0.017717	2.826791	89.30565	1.969545	8.724807
	(2.40715)	(68.8068)	(0.11010)				
10	7.673169	52.45408	-0.025238	2.862327	88.37938	1.944830	9.675794
	(2.69229)	(77.4939)	(0.12728)				

Source: author’s calculations

Table 11: Impulse Responses and Variance decomposition of Real effective exchange rate

	Accumulated Response of REER			Variance decomposition of REER			
Period	REER	HPINDEX	LNMC	S.E.	REER	HPINDEX	LNMC
1	2.893863	8.589981	-0.024612	2.893863	100.0000	0.000000	0.000000
	(0.31205)	(4.86721)	(0.00606)				
2	5.513265	21.24299	-0.058153	4.004126	95.02704	1.810469	3.162493
	(0.75224)	(11.2827)	(0.01416)				
3	7.780909	29.41973	-0.084692	4.614235	95.71069	1.897974	2.391332
	(1.27770)	(18.6818)	(0.02399)				
4	9.272863	39.93127	-0.103277	4.850526	96.07372	1.728364	2.197915
	(1.84174)	(26.8107)	(0.03490)				
5	10.31510	51.35673	-0.115207	4.966578	96.04007	1.861559	2.098367
	(2.40468)	(35.6399)	(0.04676)				
6	10.97706	63.84831	-0.122631	5.025367	95.54130	2.409134	2.049562
	(2.96060)	(45.0783)	(0.05956)				
7	11.38840	76.17152	-0.126628	5.064964	94.71284	3.262097	2.025067
	(3.47145)	(54.8258)	(0.07293)				
8	11.59618	87.98188	-0.128034	5.096067	93.72648	4.252985	2.020537
	(3.91143)	(64.5253)	(0.08656)				
9	11.65846	98.89109	-0.127425	5.125044	92.68436	5.266184	2.049455
	(4.26836)	(73.9002)	(0.10030)				
10	11.61361	108.7905	-0.125323	5.153476	91.67209	6.210533	2.117379
	(4.54310)	(82.7504)	(0.11409)				

Source: author’s calculations

Table 12: Impulse Responses and Variance decomposition of Fiscal deficit

	Accumulated Response of Fiscal deficit			Variance decomposition of Fiscal deficit			
Period	LNFD	HPINDEX	LNMC	S.E.	REER	HPINDEX	LNMC
1	0.723057 (0.07797)	-0.896130 (5.39263)	-0.005159 (0.00623)	0.723057	100.0000	0.000000	0.000000
2	0.604722 (0.17373)	-1.500428 (11.0633)	-0.019693 (0.01385)	1.203055	37.08971	61.71341	1.196881
3	0.586874 (0.18169)	-2.246061 (17.0081)	-0.029029 (0.02231)	1.275866	32.99684	58.36838	8.634784
4	0.597123 (0.17037)	-2.081906 (22.5072)	-0.037490 (0.02939)	1.289001	32.33412	59.17467	8.491213
5	0.628049 (0.13817)	-1.805180 (27.6278)	-0.045691 (0.03581)	1.296291	32.02836	58.93735	9.034297
6	0.632378 (0.12867)	-1.565994 (32.4000)	-0.053612 (0.04196)	1.299807	31.85642	58.70920	9.434386
7	0.634229 (0.12491)	-1.344406 (36.8186)	-0.060780 (0.04822)	1.303190	31.69144	58.72486	9.583698
8	0.638140 (0.12141)	-1.093745 (40.8303)	-0.067309 (0.05444)	1.306930	31.51120	58.73136	9.757435
9	0.642852 (0.11992)	-0.835905 (44.4722)	-0.073309 (0.06064)	1.310231	31.35392	58.70204	9.944043
10	0.646343 (0.12193)	-0.583684 (47.7995)	-0.078824 (0.06685)	1.312988	31.22310	58.67253	10.10436

Table 13: Accumulated Response of Bullion to Wealth effects

	Accumulated Response of LNGOLD				Accumulated Response of LNSILVER			
Period	LNGOLD	LNSILVER	HPINDEX	LNMC	LNGOLD	LNSILVER	HPINDEX	LNMC
1	0.068327	0.000000	0.000000	0.000000	0.069581	0.088185	0.000000	0.000000
	(0.00737)	(0.00000)	(0.00000)	(0.00000)	(0.01540)	(0.00951)	(0.00000)	(0.00000)
2	0.125684	-0.014567	0.023492	-0.002117	0.142773	0.157475	0.044009	-0.018888
	(0.01833)	(0.01181)	(0.01108)	(0.01046)	(0.03507)	(0.02603)	(0.01857)	(0.01731)
3	0.182943	-0.025798	0.046114	-0.000669	0.215701	0.208891	0.107351	-0.035159
	(0.02988)	(0.02544)	(0.02317)	(0.02213)	(0.05579)	(0.04977)	(0.04020)	(0.03749)
4	0.237943	-0.035332	0.068106	-0.004157	0.283675	0.240854	0.172671	-0.051545
	(0.04195)	(0.04129)	(0.03810)	(0.03610)	(0.07601)	(0.07691)	(0.06611)	(0.06101)
5	0.291448	-0.040301	0.091309	-0.013266	0.345201	0.260333	0.233202	-0.072064
	(0.05382)	(0.05903)	(0.05494)	(0.05229)	(0.09451)	(0.10605)	(0.09409)	(0.08731)
6	0.344059	-0.040733	0.116671	-0.027119	0.401477	0.274704	0.287598	-0.098184
	(0.06593)	(0.07814)	(0.07316)	(0.07065)	(0.11201)	(0.13592)	(0.12281)	(0.11598)
7	0.395553	-0.038036	0.144347	-0.044700	0.453732	0.287931	0.336960	-0.129513
	(0.07857)	(0.09825)	(0.09273)	(0.09105)	(0.12929)	(0.16574)	(0.15202)	(0.14662)
8	0.445487	-0.033528	0.173814	-0.065143	0.502609	0.301231	0.382627	-0.164651
	(0.09178)	(0.11908)	(0.11373)	(0.11323)	(0.14675)	(0.19511)	(0.18197)	(0.17880)
9	0.493442	-0.028084	0.204308	-0.087846	0.548247	0.314431	0.425377	-0.202047
	(0.10546)	(0.14049)	(0.13611)	(0.13690)	(0.16443)	(0.22393)	(0.21284)	(0.21210)
10	0.539126	-0.022161	0.235119	-0.112364	0.590553	0.327009	0.465440	-0.240429
	(0.11946)	(0.16236)	(0.15969)	(0.16176)	(0.18216)	(0.25225)	(0.24454)	(0.24613)

Table 14: Variance decomposition of Bullion to Wealth effects

	Accumulated Response of LNGOLD					Accumulated Response of LNSILVER				
Period	S.E.	LNGOLD	LNSILVER	HPINDEX	LNMC	S.E.	LNGOLD	LNSILVER	HPINDEX	LNMC
1	0.068327	100.0000	0.000000	0.000000	0.000000	0.112331	38.36970	61.63030	0.000000	0.000000
2	0.093418	91.19327	2.431535	6.323830	0.051369	0.158334	40.68060	50.17069	7.725667	1.423040
3	0.112453	88.86117	2.675559	8.411225	0.052045	0.193155	41.59090	40.79804	15.94525	1.665800
4	0.127504	87.72693	2.640222	9.517516	0.115328	0.217913	42.40713	34.20559	21.51302	1.874268
5	0.140592	86.63726	2.296456	10.55168	0.514606	0.236085	42.92199	29.82332	24.90246	2.352226
6	0.152870	85.12310	1.943180	11.67722	1.256499	0.250501	43.17072	26.81858	26.83417	3.176525
7	0.164631	83.17940	1.702311	12.89455	2.223739	0.262820	43.17167	24.61668	27.90499	4.306658
8	0.175793	81.01976	1.558745	14.11875	3.302752	0.273789	42.96866	22.91974	28.49600	5.615603
9	0.186220	78.83251	1.474554	15.26344	4.429493	0.283626	42.62909	21.57411	28.82552	6.971290
10	0.195833	76.72524	1.424823	16.27715	5.572788	0.292352	42.21628	20.49049	29.00832	8.284909

Figure 1: The Covariates

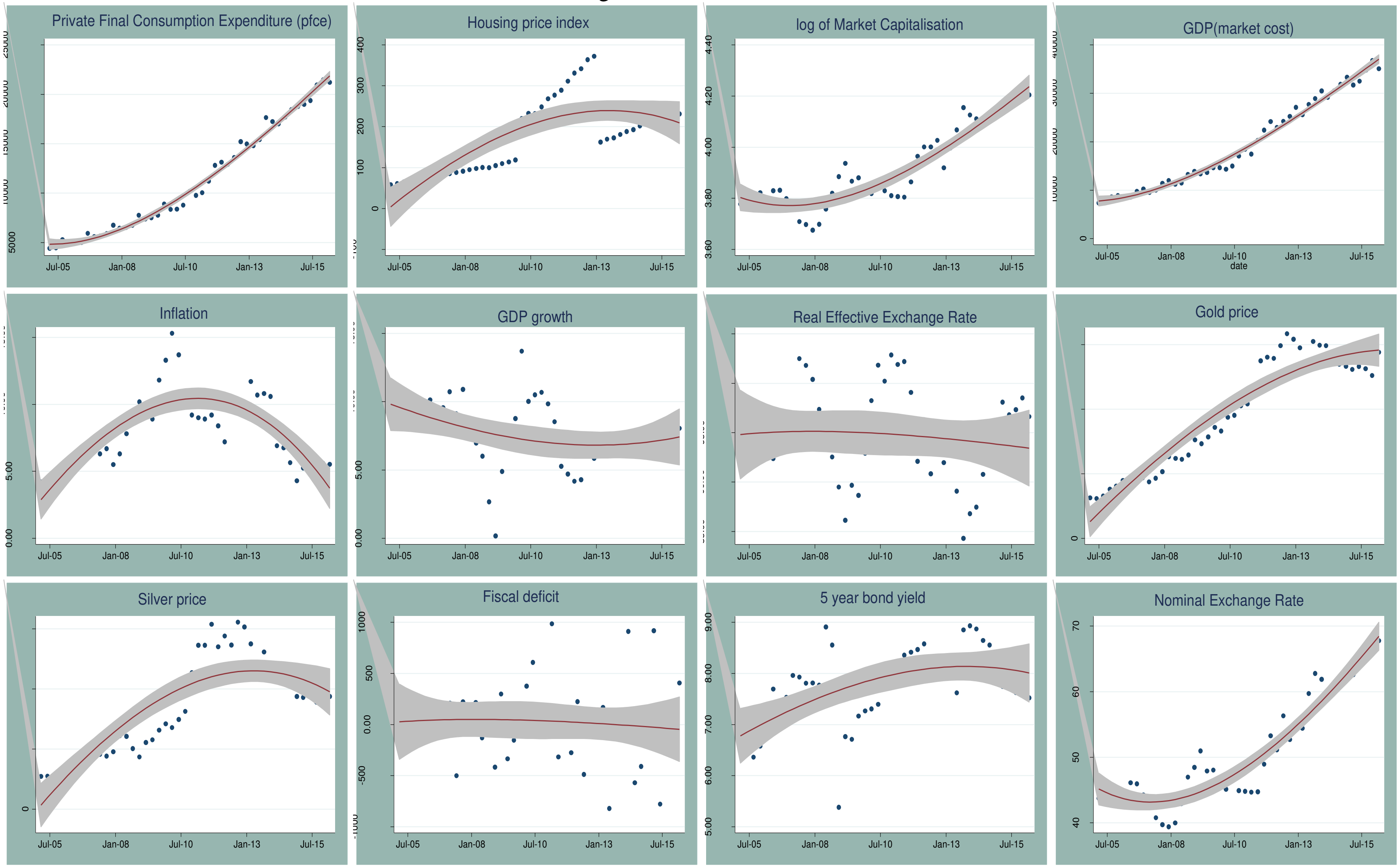

Figure 2: Interaction effect of Inflation and macroeconomic variables

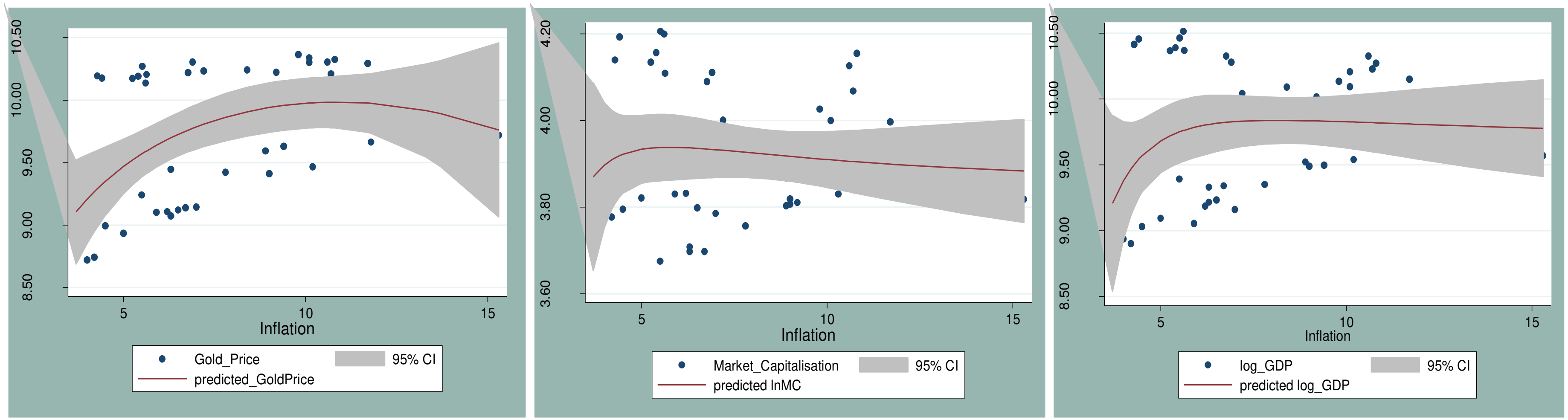

Figure 3: Interaction effect of GDP and macroeconomic variables

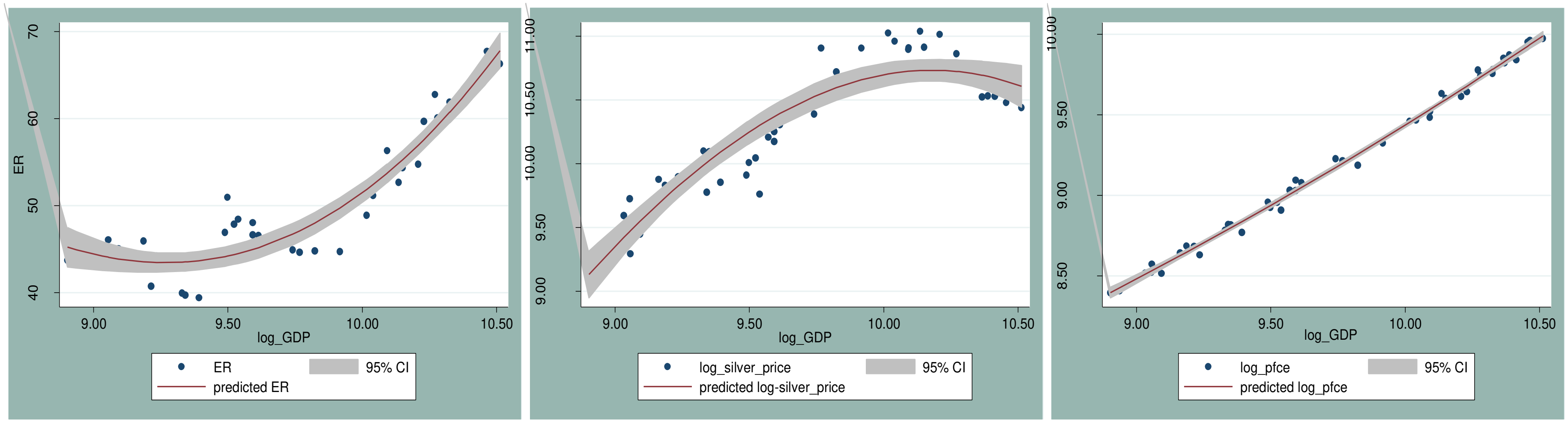

Figure 4: Interaction effect of Fiscal deficit and macroeconomic variables

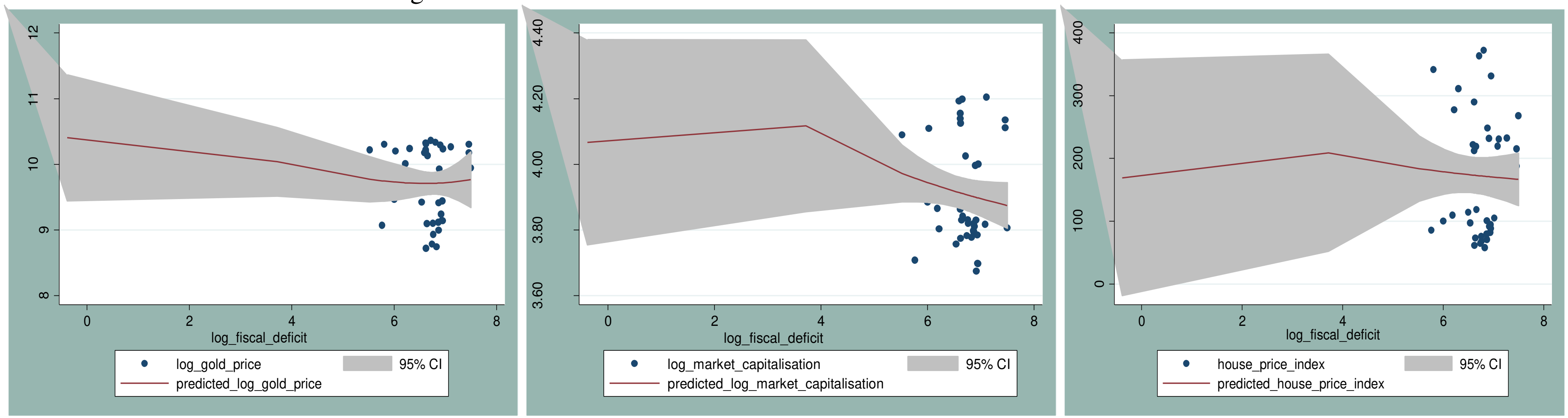

Figure 5: Interaction effect of real effective exchange rate and macroeconomic variables

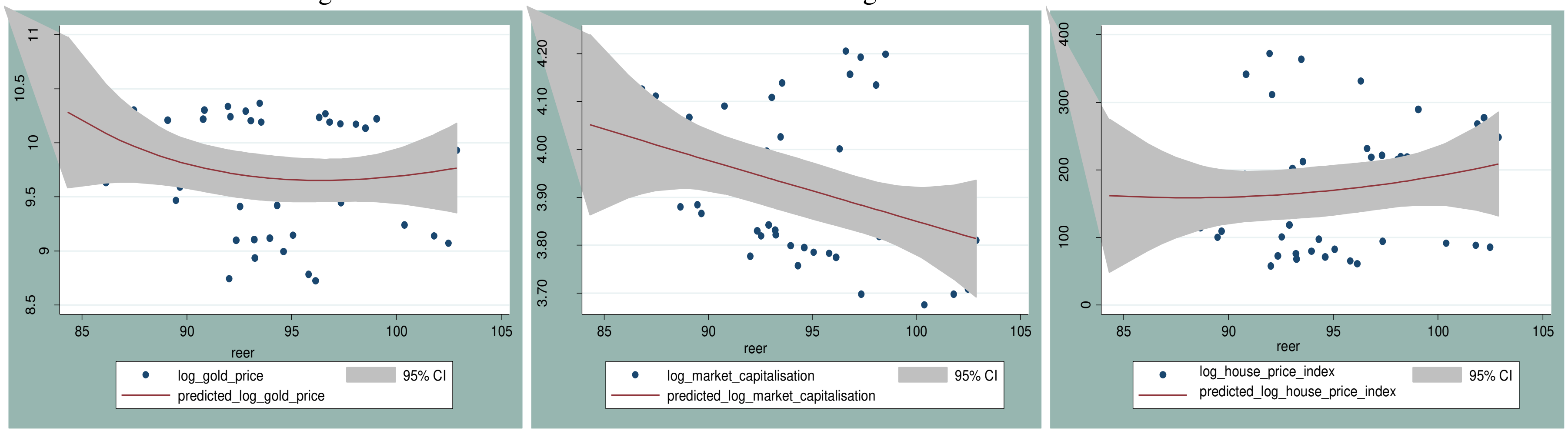

Figure 6: Impulse responses of Consumption

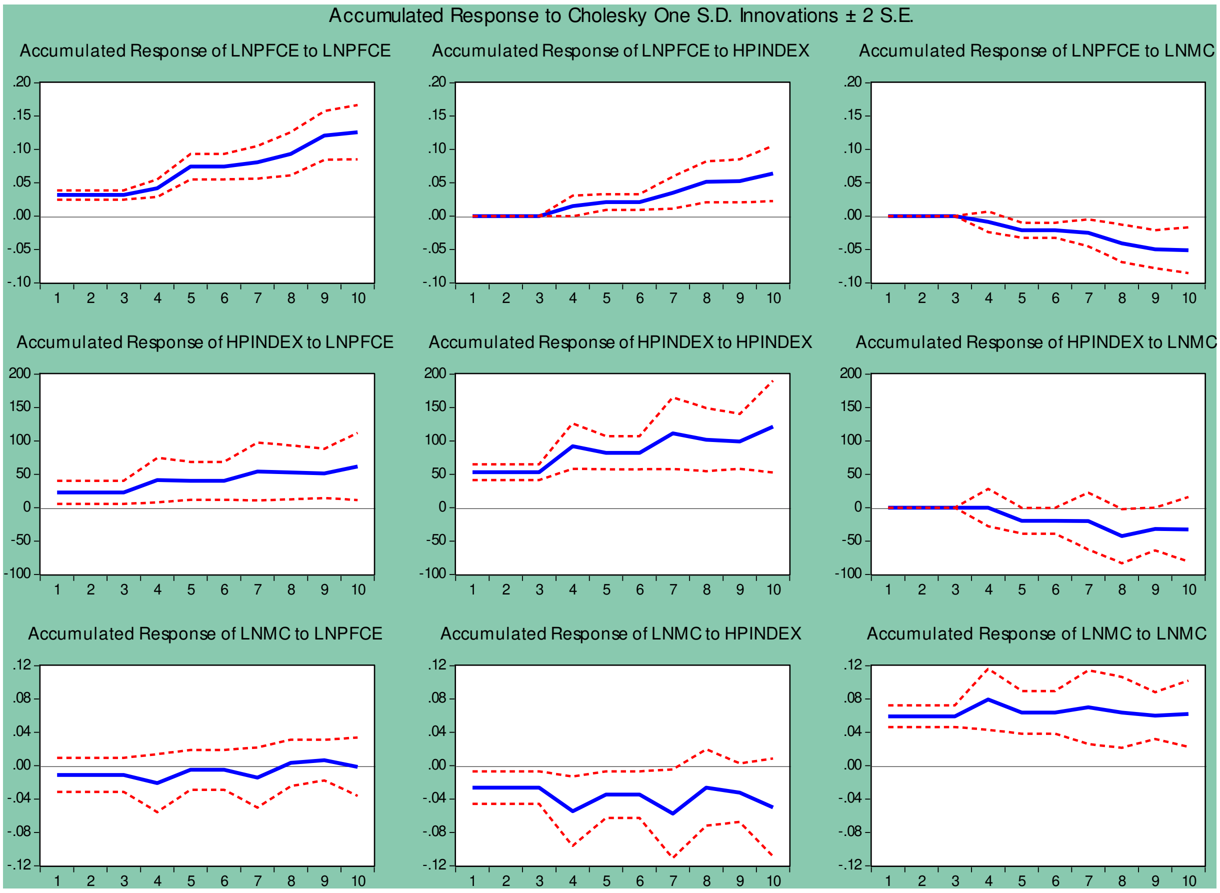

Figure 7: Variance decomposition of Consumption

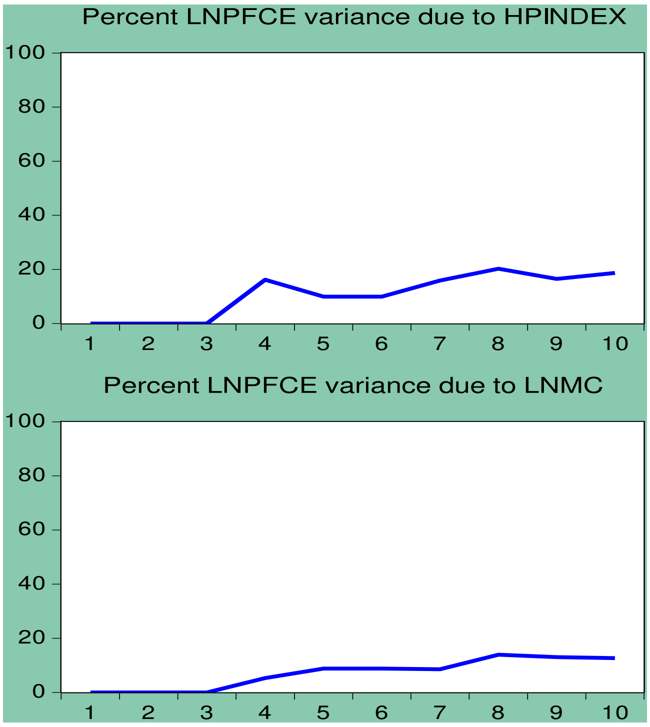

Figure 8: Impulse responses of Growth

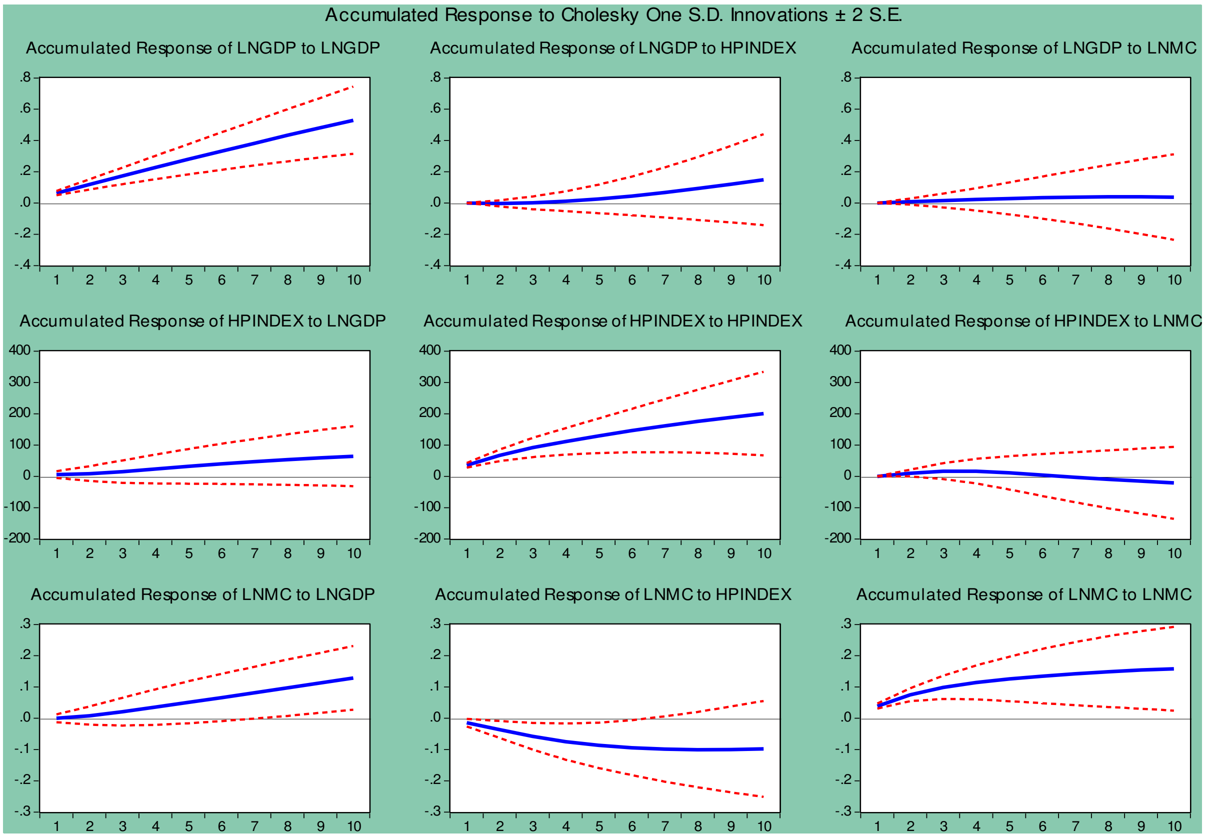

Figure 9: Impulse responses of Inflation

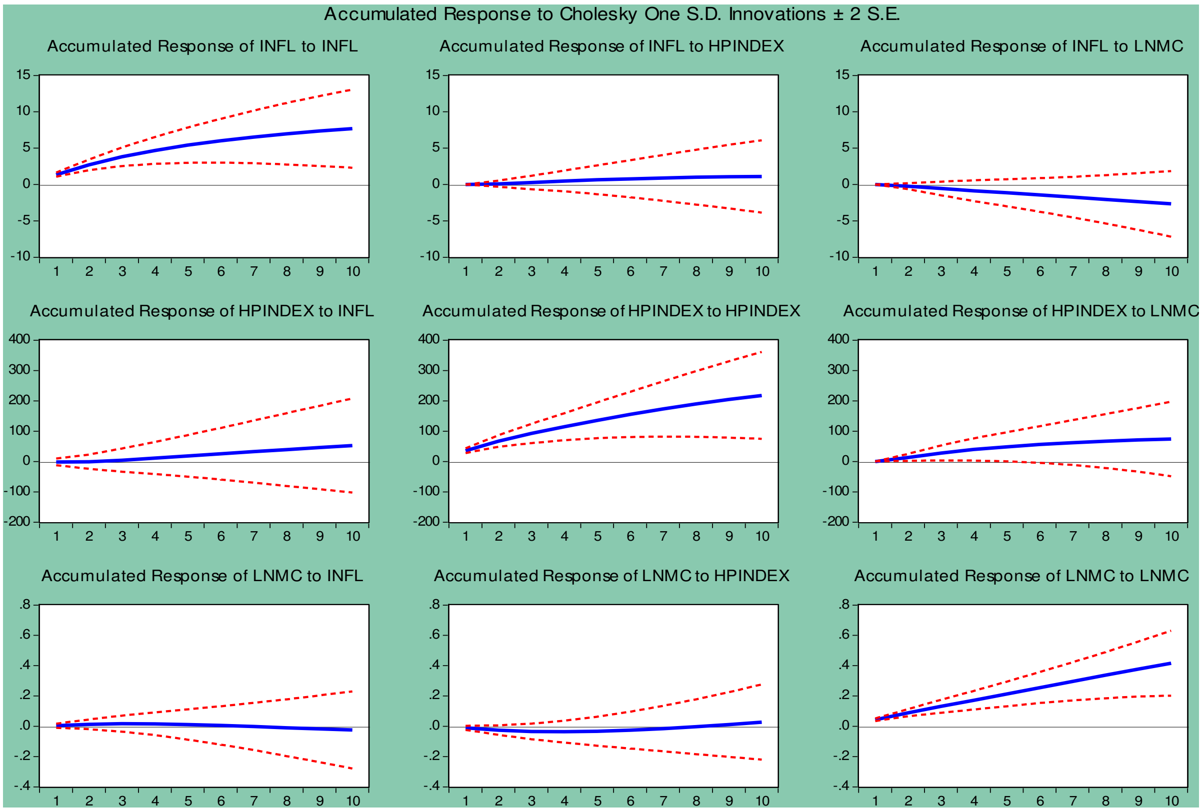

Figure 10: Impulse responses of Real effective exchange rate

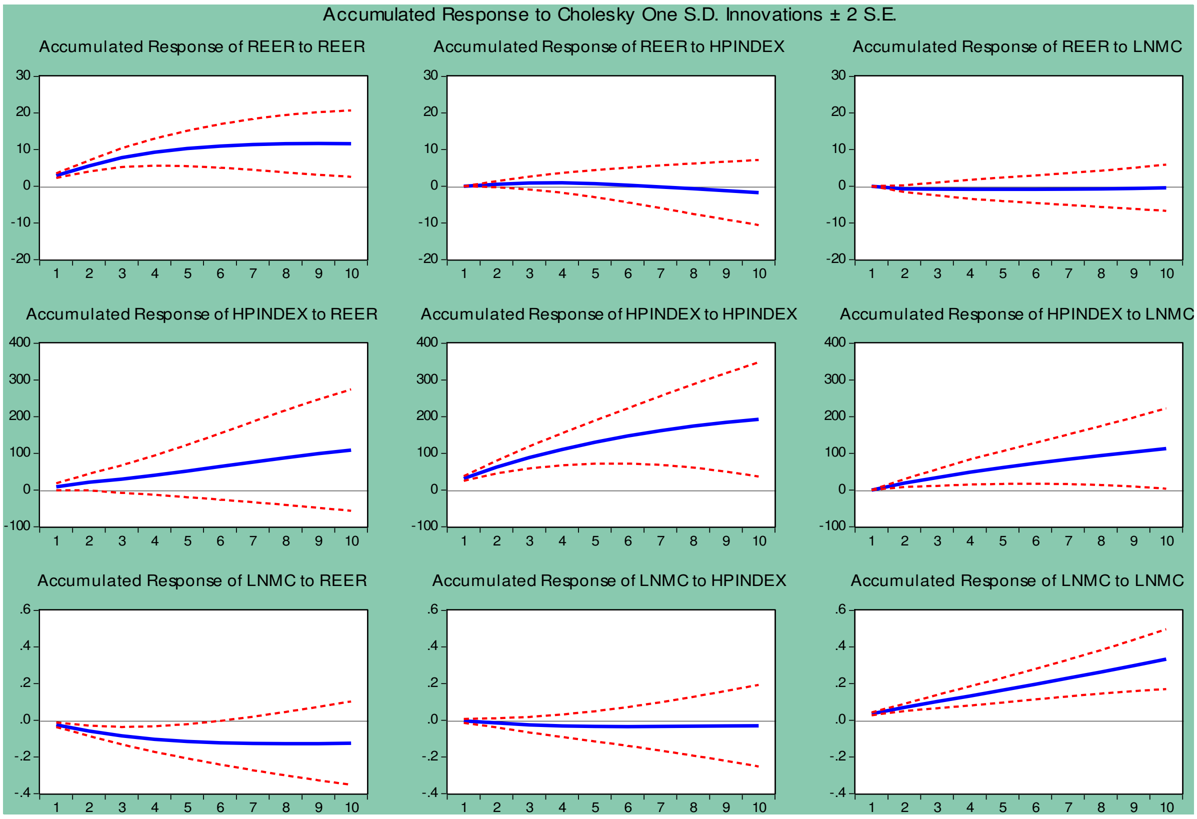

Figure 11: Impulse responses of Fiscal Deficit

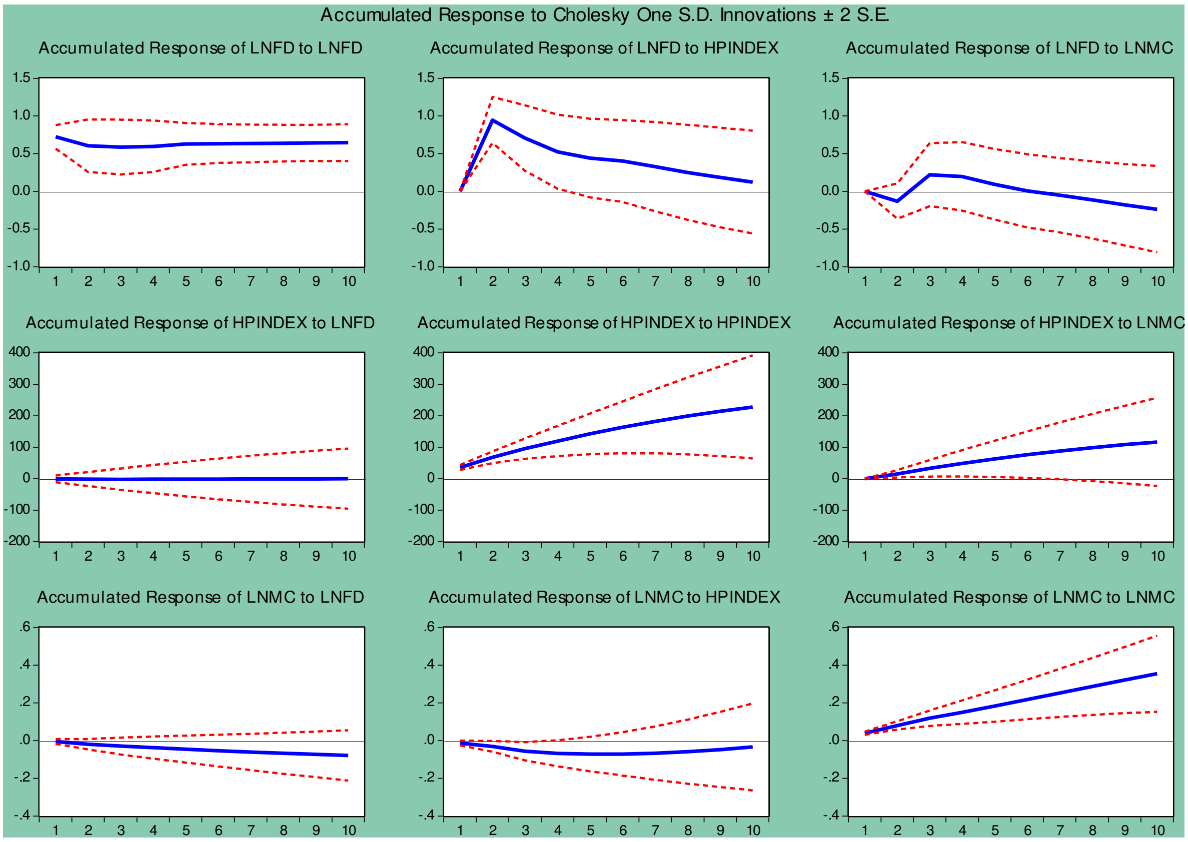

Figure 12: Impulse responses of Bullion