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A Composite Indicator of Realty Sector Activity in India

Priyanka Upreti, Akanksha Handa, Dipak R. Chaudhari and Saurabh Ghosh*

Abstract

The realty sector plays a crucial role in India in terms of employment generation, access to housing and as a major source of saving in physical form, besides direct contribution to the country's Gross Value Added (GVA). In this study, we estimate a dynamic factor for housing (DFH) from a range of available high-frequency indicators of real estate activity. Our empirical findings indicate unidirectional causality from DFH to GVA with evidence of the first and second-round impact of revival in DFH driving recovery in GVA. Our empirical results also indicate the critical role of counter-cyclical fiscal and monetary policy measures, housing sector reforms and other policy incentives for the housing sector in reviving construction sector activity and GVA growth in the post- COVID period.

JEL Classification: C32, O4

Keywords: Construction sector, economic growth, dynamic factor model, Granger causality

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Introduction

The realty sector plays a pivotal role in the Indian economy. This sector provides the largest employment after the agriculture sector for both skilled and unskilled labourers (84 per cent share), including large immigrant workers from several parts of the country (GOI, 2021). The realty sector is also linked to upstream and downstream industries, creating second round positive spillover effects on them.

As per the World Economic Forum (WEF, 2020), urbanisation is one of the world's most powerful drivers of economic growth. The total number of internal migrants in India accounts for 45.36 crores or 38 per cent of the country's population, and between 2001 and 2011, while the population had risen by 18 per cent, the number of migrants escalated by 45 per cent (2011 census). India enjoys an enormous demographic advantage, and seizing the potential demographic opportunity can prove to be a turning point for India's economic and social development (GOI, 2013). Following the Lewis theory (1954) of economic development, as this unlimited young workforce moves from the subsistence sector to the capitalist sector, there will be a need for adequate social and economic infrastructure.

The realty sector¹ also provides an essential avenue for saving in physical form. The average household in India holds 77 per cent of its total assets in real estate which comprises constructions for residential purpose, farm and non-farm activities, recreational facilities, rural and urban land (Pandey *et al.*, 2018). The high-level real estate holding, on average, by Indian households could indicate real estate investments in addition to usual consumptions needs.

The COVID-19 pandemic impacted economic activities across key sectors of the economy, including the realty sector. This paper focuses on understanding the impact of the pandemic on the realty sector and assessing the relationship between the realty sector's performance and overall real economic activity. Because a significant portion of the realty sector and its feedback effects relate to the informal sectors, data availability issues pose a considerable challenge to research on this domain. We aim to address this by using both

¹ In the study, real estate and construction are being used interchangeably, however, there is some difference. As per GVA classification of MOSPI, realty sector activities come under two different heads, one is construction (account 8 per cent of share in total GVA in FY20) and another is financial, real estate and professional services (22 per cent share in total GVA in FY20). Construction includes construction of buildings, roads, railways, and other specialized construction related activities like demolition, electrical, plumbing *etc.* The financial, real estate and professional services include monetary intermediation, activities of holding companies, insurance, pension funding, legal, accounting too in addition to real estate activities with own or leased property.

conventional and unconventional data sources. In this vein, we start with a preliminary assessment of the developments in the real estate sector for the post-pandemic period. Further, we attempt to find a common factor underlying these series that represent construction sector developments and can be used for nowcasting construction Gross Value Added (GVA). Furthermore, we take a deep dive to examine the relationship between this sector and the aggregate output of the country. We also attempt to evaluate how fiscal policy, monetary policy and reforms undertaken in this sector influence developments in this sector.

The rest of the study is organised as follows: Section II gives a brief literature survey; Section III describes the data and their trends. Section IV reports relevant variable linkages, dynamic factor estimation and policy implications, and Section V concludes.

II. Review of Literature

Since growth in the construction sector is coincident with urbanisation, commercial activities and economic growth, there are ample studies available in the literature for analysing the relation between construction sector and economic growth. The common view that emerges is that construction activities have a positive relation with economic growth, however, it may be a lead, lagged or contemporaneous association.

For the emerging market economies (EMEs), Berk and Bicen (2017) have examined the relationship between investment in the construction sector and gross domestic product (GDP) growth. Applying the Granger causality test to quarterly frequency data, the authors found that investment in the construction sector leads to economic growth; however, in the case of a slowdown in the growth momentum, the construction industry's growth is found to decelerate more than the GDP growth. In country-specific studies, Erol and Unal (2015) examined the relationship for the Turkish economy. However, the authors got mixed results – for the full sample, economic growth was preceded by construction activities with 2 to 4 quarters lead time, but not *vice versa*. While for the post-global crisis period, the expansion in construction activities caused GDP growth over the next five years. The authors attributed the construction led economic growth to the low-interest rate environment and various reform measures taken up by the Turkish government. Munir et al. (2019) examined the interactions between the construction sector and urbanisation, energy consumption, economic growth, and carbon emissions for the Chinese economy. The authors found that the construction sector leads to urbanization, which is a key driver of economic growth. The authors also suggested that as

construction sector activity leads to a decline in transaction costs and intensifies industrial productivity, developing economies such as China need to invest more in the development of infrastructure to uplift the construction industry. In the case of Sri Lanka, Ramachandra *et al.* (2013) estimated the Granger causality between the construction and economic growth. They found a uni-directional relationship, *i. e.* economic activities lead to construction activities for all major economic indicators except construction investment and not *vice versa*. Hung *et al.* (2019) analysed the linkages of the construction sector with the total output of the economy using a multi-regional input-output table for Hong Kong and found similar results.

In the Indian context, there is limited literature that has examined the relation of construction activities to economic growth. Tiwari (2011) studied the relationship of construction activity to economic growth after incorporating structural breaks for the period 1950-52 to 2008-09. With the help of cointegration methodology, the study indicated the existence of bidirectional causality between economic growth and construction activities. Mallick and Mahalik (2010) examined this relationship under a basic production function framework. They observed that with the inclusion of accumulation of capital stock in the model, the construction had a minimal effect on GDP. However, the relationship between the two became significant upon exclusion of capital stock. A further investigation indicated that a positive impact of construction on economic growth might be because construction activities increase employment in the economy, leading to higher aggregate output. Kumar and Choudhary (2014) empirically investigated the effect of housing finance investment on GDP and found a strong positive correlation between housing, GDP and employment. The authors further expounded that investment in housing positively impacts other sectors of the economy *via* backward and forward linkages. Gayen and Maiti (2020) derived an alternative indicator for residential property prices using data from web portals of real estate agencies in India with the help of web scraping techniques. Though the study found a divergence between Housing Price Index (HPI) and alternative HPI calculated by authors in terms of lower residential house price and lower growth of price rise in advertisement data than that in registration data but the correlation between the two and year-on-year growth is assessed to be significantly positive.

Mitra *et al.* (2017) nowcasted sales growth of real estate companies by using Google search data and with the help of Big Data Analytics tools. The study used a dynamic factor model to nowcast the real estate sector growth and found improved precision while using google search intensity data. Palayi *et al.* (2018) examined the affordability of housing in India and found that though loan disbursements and new product launches have increased, there has

been an increment in non-performing housing loans too, especially for the lower slabs of loans. The study also found a higher level of non-performing assets (NPAs) in public sector banks (PSBs) as compared to housing finance companies (HFCs). Das *et al.* (2009) estimated the housing price indices by using hedonic pricing methods to capture the effect of the quality of house on housing prices. The study found a substantial impact of quality adjustments and hedonic house price indices were found lesser than the traditional median weighted average price indices indicating repressed housing price increase after controlling for the effect of quality. Besides construction activities, a body of literature has also examined the relationship between housing prices and GDP, particularly in the wake of the global financial crisis of 2008-09. Mahalik and Mallick (2011) investigated the short- and long-term determinants of housing prices. These include real income, real stock price index, short-run real interest rates, non-food bank credit, and real effective exchange rate. Their empirical findings indicated that real GDP has a positive impact on housing prices over the long term, while non-food credit has a negative impact on prices.

Another study by Mallick (2011) investigated the role played by monetary policy variables in influencing construction sector growth and housing prices. He argued that in the long run, commercial bank credit is responsible for driving the sector's growth from the supply side and the rise in disposable income can explain the growth from the demand side.

The real estate sector was severely hit during the pandemic due to a halt in many economic activities. According to various quarterly reports prepared by Knight Frank (Knight Frank, 2020) jointly with the National Real Estate Development Council (NARDECO) and Federation of Indian Chambers of Commerce & Industry (FICCI), the real estate sentiment index was the lowest at 22 in the second quarter of 2020 due to fall in disposable incomes, reverse migration *etc.*, however, the sector rebounded in the third and fourth quarter of 2020 on the back of revival in the economic macro indicators *viz.* Purchasing Managers Index (PMI), Goods and Services Tax (GST) collections, the power consumption *etc.* This surge in sentiments was reinforced by a number of measures announced by the Government and the Reserve Bank of India (RBI). History indicates that the impact of an adverse productivity shock from Asiatic Cholera (1826-37) or Spanish Flu (1918-19) impacted lives and livelihoods. While fastened economic growth helped economic recovery. However, it is often the "poor city dwellers" who remained most impacted by these pandemics. The COVID-19 pandemic could have a similar impact, as the World Bank predicts that its effects will push approximately 49 million people into extreme poverty in 2020 (Sanchez-Paramo, 2020), unless leaders and policy

makers around the world manage recovery, taking into account important policy issues relating climate change, resource exhaustion and socio-economic inequality.

III. Data and trends

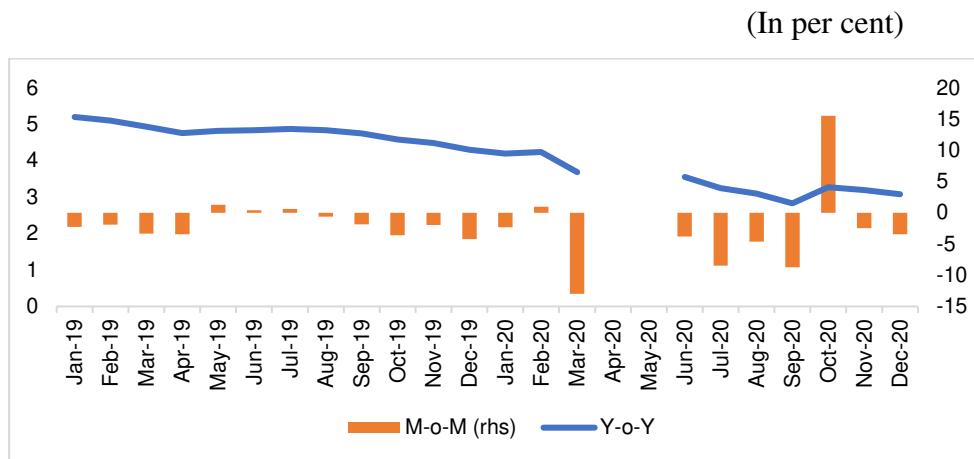
India is a services-driven economy, with the services sector accounting for more than 60 per cent of total GVA. In the lockdown period, the sector's growth (excluding construction) declined by over 20 per cent in Q1FY2021. While sub-sectors except agriculture and PADO² declined. The construction sector, which accounts for around 8 per cent of total GVA, recorded the steepest decline by around 50.3 per cent as sales and new launches contracted during the first quarter, primarily due to lockdown and sluggishness of consumer sentiments (MEPI, 2021). Centre for Monitoring Indian Economy (CMIE) Consumer Pyramid database indicates that unemployment figures for the construction sector were among the top few industries during the lockdown (Annex Chart 1A). Another component of services *i.e.*, financial, real estate and professional services, witnessed a decline in the first and the second quarter as compared to a year. However, it is difficult to gauge the direct and indirect impact of a slowdown in the realty sector on the overall economic data, especially for identifying the impact on the supply side *vis-à-vis* the demand side. We, therefore, analyse a large number of alternative data trends that include housing prices, rent, realty-indices, company performance in the realty sector, stamp duty collections and google trends data on a number of property searches, particularly for the last two years.

III.1 Housing Price Trends

As a starting point of our analysis, we take up price movements in the housing sector. We use Ministry of Statistics and Programme Implementation (MOSPI) data on housing inflation, indicating a secular decline since Q4 2017-18. Though during the lockdown period data was not reported/collected by MOSPI because of limited data availability, sequential price movement clearly indicates a change in housing prices pattern around October 2020. Besides a positive spike in the month of October 2020, there was also a shift in the year-on-year curve. It may be mentioned that October marked the beginning of the festive seasons in India and anecdotal pieces of evidence also suggest that promoters in major Indian cities were offering large discounts that could partially explain such a shift (Chart 1).

² Public administration, defence and other services

Chart 1: Housing Inflation

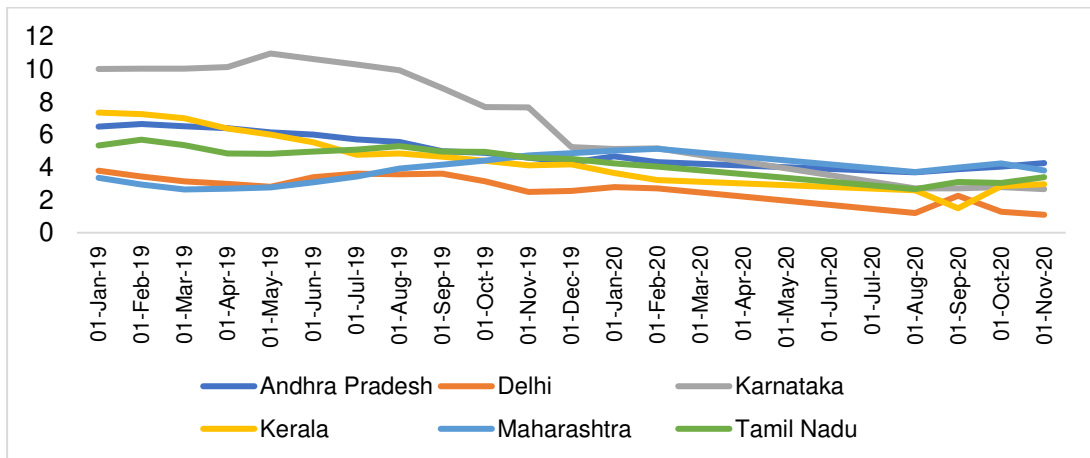


Source: Ministry of Statistics and Programme Implementation (MOSPI)

To get the regional dimension of housing inflation, we analyse the regional pattern of housing prices behaviour. Among major Indian states, we select the top 6 states based on the maximum number of COVID cases. These include Maharashtra, Kerala, Andhra Pradesh, Tamil Nadu, Delhi and Karnataka. There was a major decline in housing inflation in COVID impacted states. For instance, housing inflation reached a low of 1.1 per cent in Delhi as compared to 2.83 per cent at all India level (Chart 2). We also report the Housing Price Index computed based on the RBI surveys for four major metropolises during the pandemic (Chart 3). The observed pattern of the survey-based data was similar to those observed in the Consumer Price Index (CPI) data, and clearly indicates a decline in housing prices during the pandemic period. To have a deeper insight into the demand for housing in different cities, we also consider rental data (per square feet) from CEIC for these four cities. Though they are quarterly in nature and are available till Q2, 2020-2021, rental data clearly indicates a decline in demand and in rentals for housing across Indian cities.

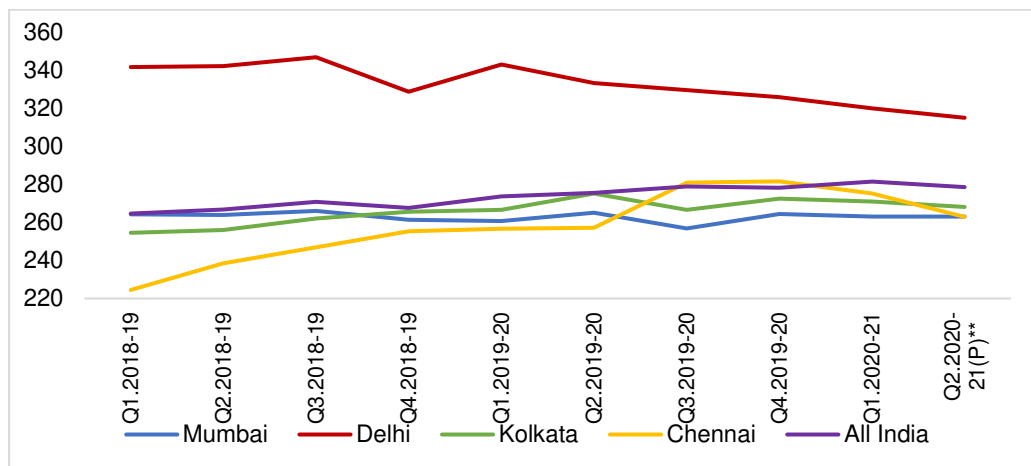
Chart 2: Housing Inflation in the Covid Affected States

(In per cent)



Source: MOSPI

Chart 3: Housing Price Index Across Metropolitan Cities



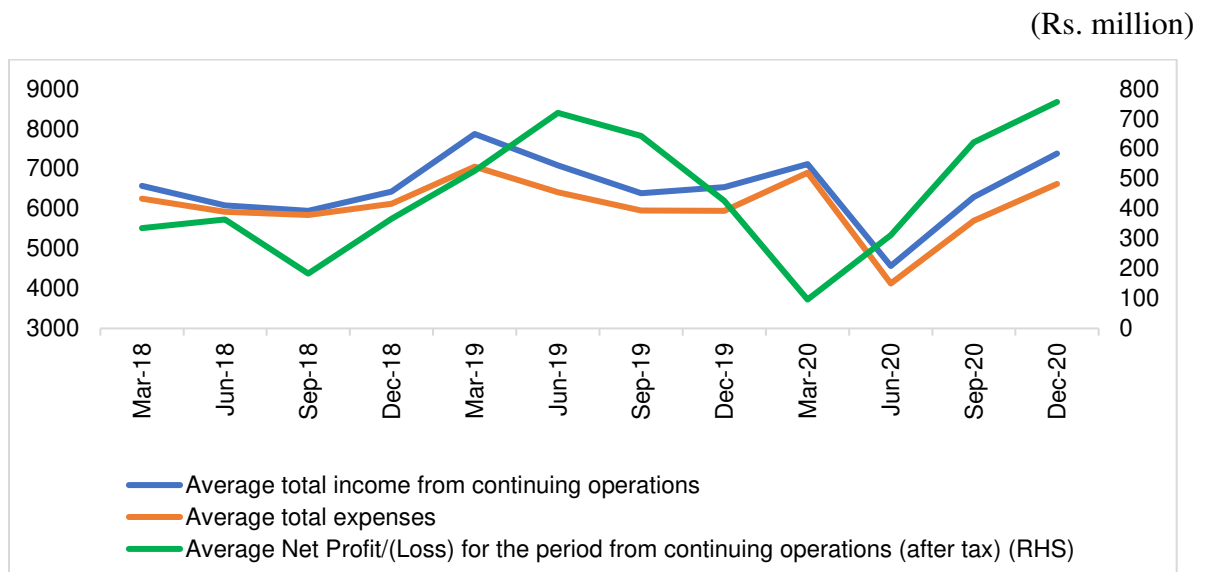
Source: DBIE, RBI

III.2 Corporate Balance Sheet and Stock Prices

A change in housing prices, rents and commercial real estate prices may have a negative impact on corporate profits in the realty sector. We use the Prowess dataset to access corporate data for the real estate (61 companies) and construction sector (133 companies) separately. Chart 4 shows that the average net profit of real estate companies started declining from Q2 2019-20. However, after the announcement of lockdown in March 2020, it declined very sharply, corresponding to higher expenses relative to income. In the subsequent quarter of June 2020, though income and expense of companies declined sharply due to pandemic induced shocks, however, the net profit of companies showed profit growth because expenditure

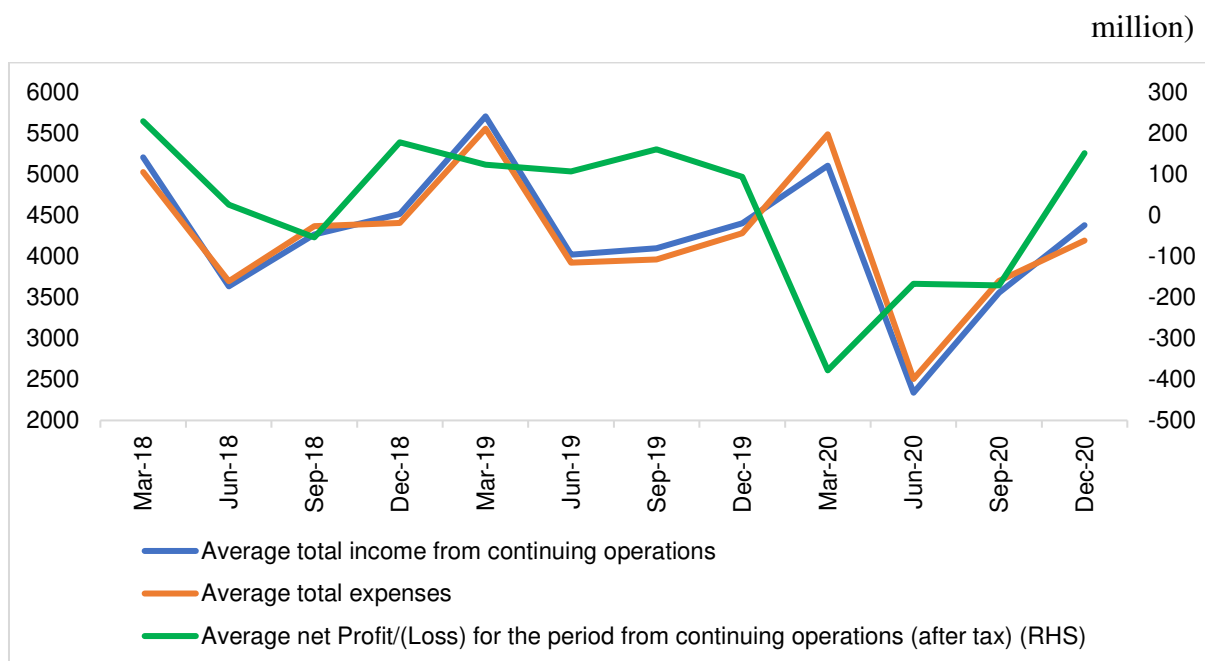
declined more sharply than income. After that, profit has shown positive growth in the subsequent phases of unlock. A similar trend was observed in the infrastructural and industrial companies too. Net profit of companies went negative in March 2020, which then started recovering in the subsequent period as the lockdown measures were eased (Chart 5). As balance sheet data are published with a lag and may not capture forward-looking expectations relating to the housing sector, we decide to take a deep dive into the stock prices.

Chart 4: Corporate balance sheet (Real Estate)



Source: CMIE Prowess.

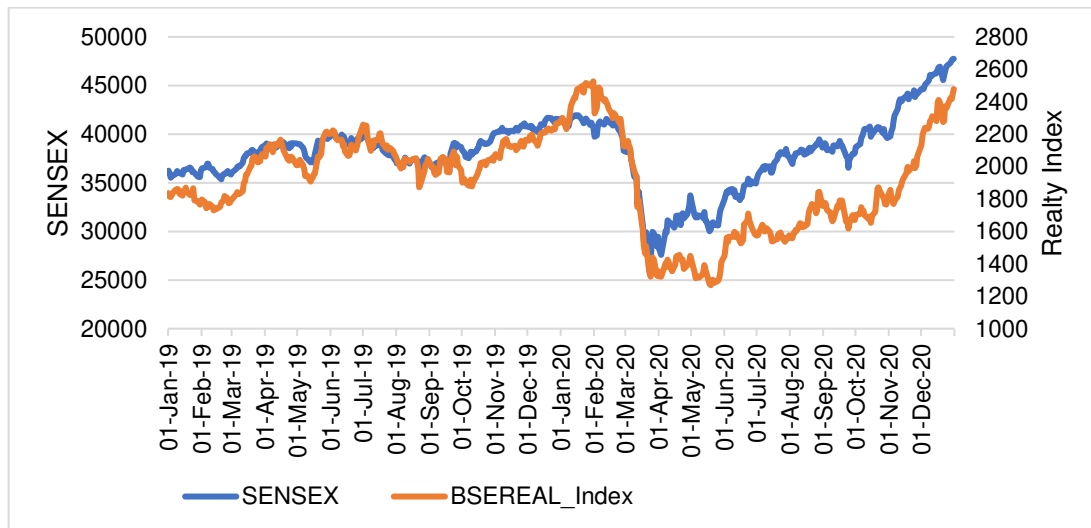
Chart 5: Corporate balance sheet (Industrial & Infrastructural Construction)



Source: CMIE Prowess.

The stock market realty index as well as Stock Exchange Sensitive Index (SENSEX) started declining from February 2020, even before the announcement of a nationwide lockdown (Chart 6). The market indices moved south with the increase in COVID confirmed cases, and the Bombay Stock Exchange (BSE) Realty Index was no exception. Since April 2020, there have been gradual improvements in the realty sector that surpassed the pre-COVID levels around November 2020. In line with broad indices, the Realty index also achieved the pre-COVID level by around the same time, and in recent months it has been recovering faster than the market index, as indicated by the slope of these indices.

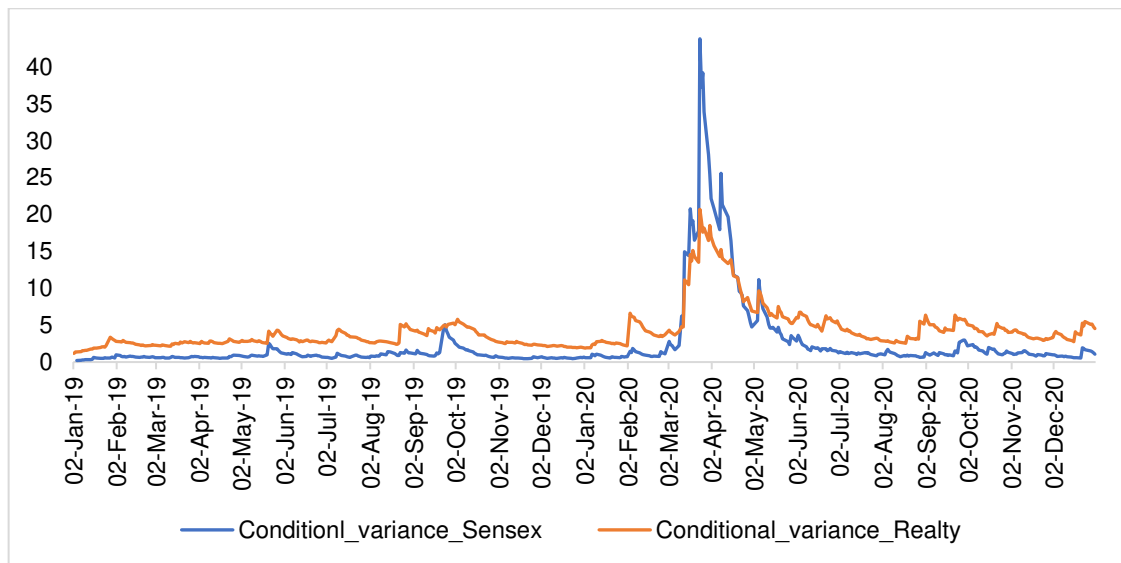
Chart 6: Comparison of BSE Realty Index and SENSEX



Source: BSE

Turning to the second-moment volatilities, the Generalized Auto-regressive Conditional heteroscedasticity (GARCH) (1,1) for SENSEX and BSE Realty returns indicate that while the increase in volatility due to the pandemic was more for the broad market index, volatility for the realty returns remained higher for the BSE-Realty returns in the aftermath of the lockdown (Chart 7). As indicated by the increase in the realty index volatility, this increased uncertainty could be due to heterogeneity across regions, sectors (residential vs commercial real estate), and the performance of firms in the realty sector.

Chart 7: Conditional Variances



Source: BSE, Authors' estimates

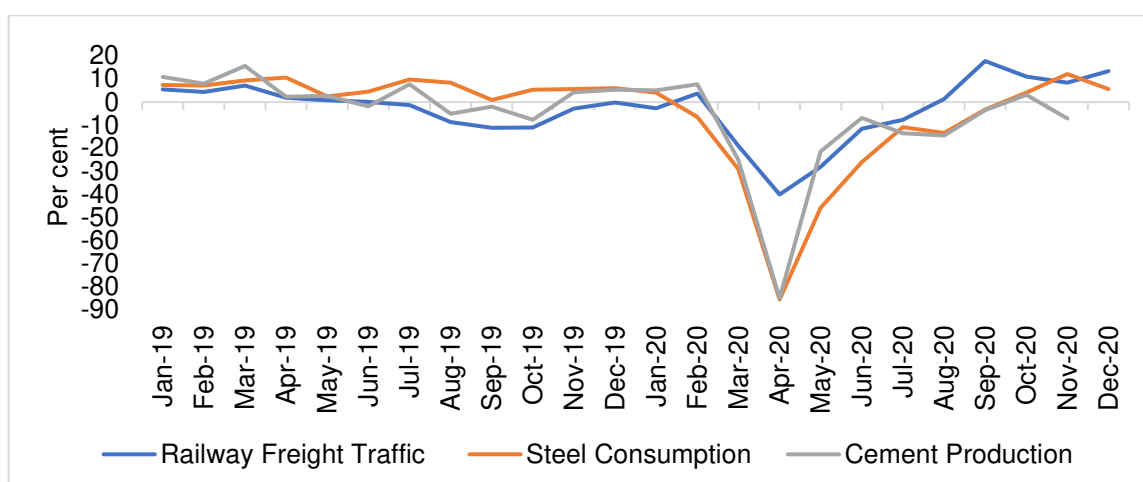
III.3 Steel and Cement

Steel and cement are key inputs for the construction sector. Given the high-frequency data releases in these industries, their performance is often tracked as a representative indicator of the construction sector and for nowcasting GDP (Bhadury *et al.*, 2020). In many policies related research, the performance of steel and cement have been used as lead indicators of GDP and the construction sector.

Immediately after the imposition of the pan-India lockdown, there was a halt in construction activity and reverse-migration of construction labourers due to which the consumption of steel and production of cement had plummeted since March 2020 (Chart 8). Notwithstanding the deceleration, Cement production and Steel consumption recovered sharply in the subsequent months with the gradual relaxation of lockdown. As the economy unlocked, they headed towards a “V” shape recovery, and the momentum turned positive for the steel consumption since October 2020.

Besides heavy goods like coal, petroleum products and fertilizer, other construction-related commodities like steel and cement account for a considerable proportion of railways freight. Therefore, we track the railway freight movements, which indicate a similar pattern as observed in steel consumption and cement consumption, which could indicate a revival in the realty sector.

Chart 8: Movement in Steel, Cement and Railway Freight Traffic



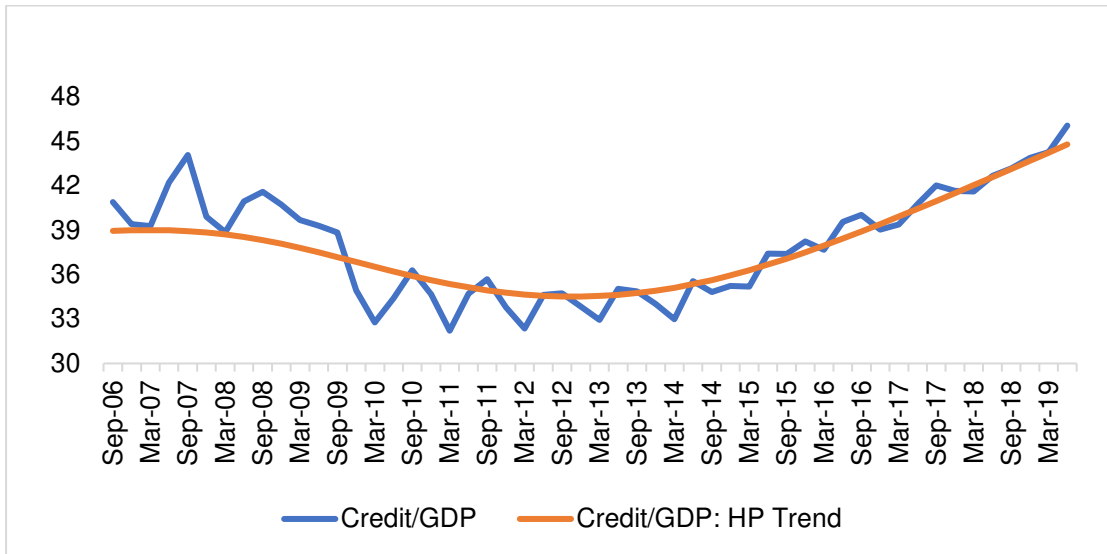
Source: Centre for Monitoring Indian Economy (CMIE).

III.4 Housing Credit Trends

Historically, a large portion of household debt is unsecured, which may also explain the high dependency of Indian households on informal and non-institutional sources of loans, such as moneylenders and intrafamily loans. The situation stated has changed since the aftermath of the global financial crisis, as the personal loan segment of the non-food credit started growing at double-digits and continued to grow at this pace for around a decade. However, the long-term credit-to-GDP ratio gap (*i.e.*, deviation from trend), an indicator of asset price bubble and vulnerability, hovered largely around zero in the personal-loan segment indicating stability. Scheduled commercial banks share in the housing sector credit is above 60 per cent with y-o-y growth of 16 per cent, while the share of housing finance companies (HFCs) is around 38 per cent with y-o-y growth of 0.7 per cent in 2019-20 (RBI, 2020). As HFCs faced headwinds in 2019-20 mainly due to liquidity stress and adverse market sentiments due to DHFL and ILFS episodes/events, the bank credit to the HFCs decelerated. Housing credit (including priority sector housing) growth which was 19.4 per cent y-o-y in Oct 2019, declined to around 8 per cent in December 2020. In the case of m-o-m housing credit growth, which bottomed out at (-)26.42 per cent in September 2020, bounced back to 3.30 per cent in October 2020 and, thereafter, the positive momentum continued in comparison to credit disbursement in the other sectors.

Chart 9: Personal Loans: Credit to GDP Ratio

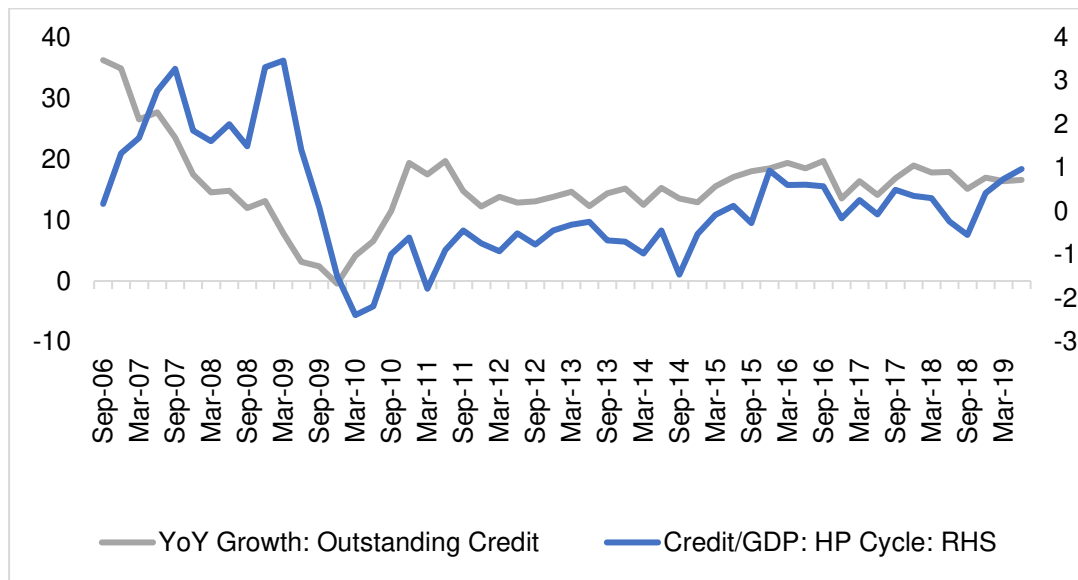
(In per cent)



Source: CEIC, Authors Calculations

Chart 10: Personal Loans

(In per cent)

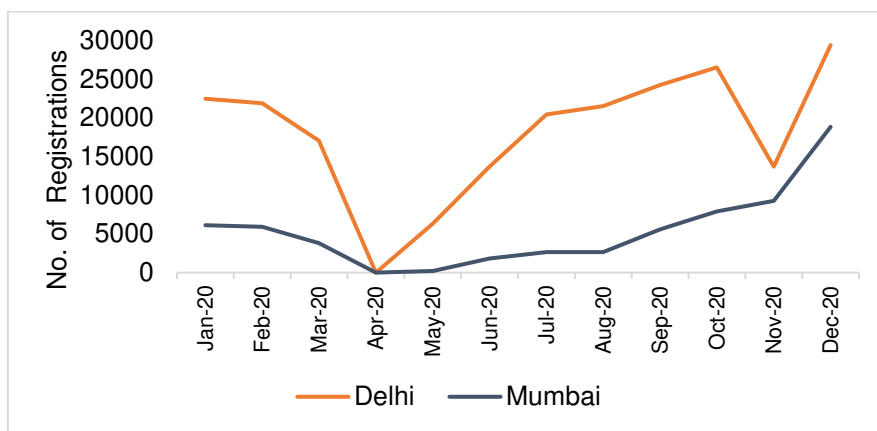


Source: CEIC, Authors Calculations

III.5 Housing Registration and Google Trends data

As per the Registration Act 1908, property transactions are registered all over India. Stamp Duty collections and Registrations are the indicators of official purchases made in the realty sector. We attempt to analyse the housing registration data for different cities. For Delhi and Mumbai, Chart 11 shows that the number of registrations fell drastically in both the metros in the month of April immediately after the lockdown. They, however, gradually started recovering since September 2020 and by December 2020, monthly registrations had surpassed the pre-COVID level in both these cities³.

Chart 11: Property Registrations



Source: <https://esearch.delhigovt.nic.in/DeedWiseDocCount.aspx>

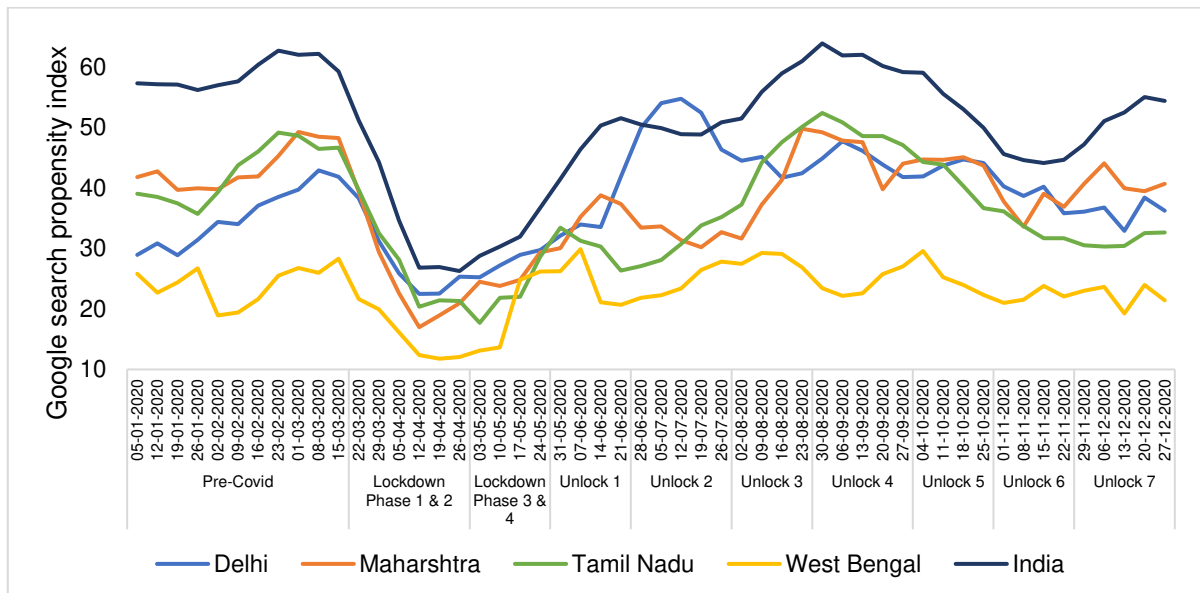
In the absence of publicly available property registration data at the pan-India level and for other metropolitan cities, we analyse the Google Trends data (related to real estate keyword). It can assist us in determining the level of interest in a given issue depending on the number of Google searches. The information on the frequency of Google searches on any topic is normalised in Google Trends as a fraction of the overall number of searches in a region over the specified period. This normalisation eliminates the bias due to changes in overall Google search activity over time. For example, due to a global increase of internet accessibility, today's overall search volume is substantially higher than it was in 2004. As a result, a comparison of general imputation based on the absolute amount of searches on any topic may be misleading. Further, Google Trends report the 'normalised' search frequencies for the chosen keywords. The

³ It may be mentioned that Maharashtra Government on December 24, 2020 has announced a reduction in stamp duty on leased agreements of immovable property to 2 per cent from 5 per cent upto December 2020 and 3 per cent for the period of January 1, 2021 to March 31, 2021.

maximum value of the ‘normalised’ search frequency for each country is set at 100, and the figures for other months for that city / country are proportionally adjusted.

Chart 12 shows the trends in the composite real estate search propensity indicator which is calculated by taking a weighted average of search propensity of some keywords related to commercial property (real estate, commercial property, residential property, 99 acres, Magicbricks, No Broker), weights being the inverse of the variance of search propensity of each keyword. This composite indicator shows a sharp fall in search propensity as and when phase 1 of lockdown was announced, and it remained low up to the second phase of lockdown, after which it recovered to pre-COVID level across all the four metropolitan cities.

Chart 12: Composite Search Propensity Indicator (Google Trend Data)



Source: Google Trend

To sum up, we considered a slew of available high-frequency indicators that are related to the realty sector in India. They include conventional variables, *e.g.*, housing prices, credit and profits of real estate companies. Housing prices data indicate a secular decline starting in Q3FY20, which reached its lowest in Q1FY21. Recently, however, prices data indicate evidence of a revival in this sector. Available corporate performance data and stock market indices indicate mixed evidence. While the former shows signs of deterioration, the realty index stock indices have surpassed its pre-COVID level, indicating future promises for the sector. Further, we included high-frequency variables such as cement and steel production, which may be related to the construction sector through up-stream or down-stream supply chain linkages.

Since many of these are bulk inputs and are commonly transported by railways, we have also included different components of railway freight in our analysis. Furthermore, in view of the infotech revolution and stock market developments, we use a few unconventional variables in our analysis. These include Realty Index (adjusted for broad market movements) and Google Search Propensity related to the realty sector. While these variables indicate divergent movements in the short run, the figures indicate that there could be a hidden common factor that drives all realty sector-related variables in the long run. In the following empirical section, we intend to decipher this common factor based on a select list of variables.

IV. Empirical Section

In view of mixed signals from several conventional and unconventional indicators, we attempted to extract a common factor relating to the realty sector from the most relevant high-frequency variables. We analysed a set of variables that are related to the realty sector across different phases of business cycles. Here, we have focused on the post-Global financial crisis (GFC) period, *i.e.*, 2009 onwards. The period of the study is March 2009 to December 2020. We evaluated the correlation of these variables with construction sector GVA and overall GDP and computed dynamic correlations. We then estimated a common trend using dynamic factor analysis. After appropriately validating the common trend from alternative data sources, we use the same, to evaluate whether the realty sector drives GDP growth in India and the impact of fiscal and monetary policies on the realty sector.

IV.1 Dating of GDP Growth Cycle and Growth Rates of Important Housing Variables

In order to determine the turning points in India's GDP cycle, we identify local maxima/minima by using the 1st and 4th quartiles of GDP growth, *i.e.*, the lowest 25 per cent and the highest 25 per cent of growth rates. In addition, we apply a few censor rules to clearly recognize the turning points in the GDP cycle. Annex Chart 2A dates turning points and helps identify phases of upcycle and down-cycle in the GDP growth cycle over the last two decades.

Table 1 brings out a clear pattern in most of the construction sector related variables. Construction GVA remained mostly pro-cyclical except during the last phase. We observe a common trend in the construction-related variables, namely steel, cement and railway freights. The other variables, namely housing prices, stock indices (adjusted realty index) and housing credit appear to be mostly pro-cyclical. Google search propensity index has also shown

divergence from the phases of the business cycle indicating more search intensity of the terms related to the real sector during slowdown phases (opportunistic behaviour).

Table 1: Average Growth Rate of Important Housing Variables during Various Phases of Business Cycle

Business Cycle	Recovery	Slowdown	Recovery	Slowdown
	Jun-2009 to Mar-2010	Jun-2010 to Mar-2013	Jun-2013 to Sep-2016	Dec-2016 to Dec-2020
Non-Agri. GVA	15.11	7.16	8.47	4.05
Construction GVA	7.88	6.03	3.93	10.01
GVA Business Service	8.81	9.81	10.53	1.55
GVA Excluding Construction	13.21	6.80	7.94	3.52
Housing Credit	7.58	14.28	16.49	13.36
Steel Prod.	6.00	10.20	5.53	7.69
Cement Prod.	9.00	7.24	3.50	5.66
IIP Core	8.77	4.50	3.91	2.11
Housing Prices			6.58	5.11
Rail freight	5.31	3.38	-1.34	5.73
Rail_pig_iron	6.20	2.34	6.15	8.89
Rail_cement	4.89	3.47	-0.24	13.42
Govt Capex	18.82	8.94	32.54	67.42
Sensex Adjusted Realty Index	30.06	-20.91	-15.08	-0.58
Google Housing Search				
Propensity Indicator	-22.33	9.23	4.72	13.88

Source: CMIE, MOSPI, BSE, RBI, Google and authors estimation.

IV.2 Dynamic Correlation with GDP and Construction sector GVA

Next, we carry out the dynamic correlation analysis for our Q-o-Q seasonally adjusted annualised growth of construction-GVA as it is a more representative indicator for output in the real estate sector (Table 2). The exercise is conducted for the period 2009:Q2 to 2020:Q4, with 46 observations, at different leads and lags of construction GVA. The variables have a Contemporaneous ('C'), Leading ('L+') or Lagging ('L-') relationship with Construction GVA.

It can be clearly seen from Table 2 that steel, cement production, Index of Industrial Production (IIP) core, Sensex-adjusted realty index and rail freight exhibit high contemporaneous correlation with construction GVA. Housing prices are found to be significantly correlated with past construction GVA. A similar analysis is performed with GVA and we get similar correlation results (reported in Annex Table 1).

From these two exercises, five variables are found to be having a high contemporaneous relationship with construction GVA and one variable is found to be having a lagging relationship with construction GVA. They are steel and cement production, IIP core, rail-freight, adjusted realty index and housing prices, which will be considered for extracting the common factor in a dynamic factor model.

Table 2: Dynamic Correlation of selected variables with construction GVA

Variables	Construc tion GVA(-t)	Constructio n GVA	Construction GVA(+t)	Comments
Housing credit	0.1336	-0.1094	-0.1127	L+ significant at 12 lag
Housing credit	-0.0086	-0.0676	0.1533	X (excluding COVID period)
Steel Production	-0.3772**	0.9454**	-0.5187**	C
Cement Production	-0.3726**	0.9429**	-0.5016**	C
IIP Core	-0.3343**	0.921**	-0.6141**	C
Housing prices	0.1433	-0.0078	-0.0907	X
Housing prices	0.3462**	0.2344	-0.0579	L- (excluding COVID period)
Rail freight	-0.399**	0.9406**	-0.4636**	C
Rail_pig_iron	-0.2677	0.4479**	0.1904	C
Rail_cement	-0.1506**	-0.3677**	0.7448**	C
Govt_capex	0.1014	-0.161	0.1027	L+ significant at 8th and 9th lag
Realty Index	-0.0963	0.3373**	-0.2591	C
Sensex	-0.0723	0.2278	-0.0272	X
Adjusted Realty	-0.0918	0.3395**	-0.3655**	L+/C
Google Search Propensity Index	-0.2706	0.5524**	-0.3128**	C

Note: The symbols *, **, *** denote the cases where we reject the null at the 10%, 5%, 1% significance levels, respectively.

Source: Authors' estimates

IV.3 Dynamic Factor for Realty Sector

We attempt to use a data shrinkage technique to extract the common trend in the realty sector after selecting the relevant variables related to the realty sector. The trend is obtained by estimating a dynamic factor model (DFM) using 6 shortlisted indicators. The procedure is in line with Stock & Watson (1989), which specifies an “unobserved single index” and can be summarised as follows:

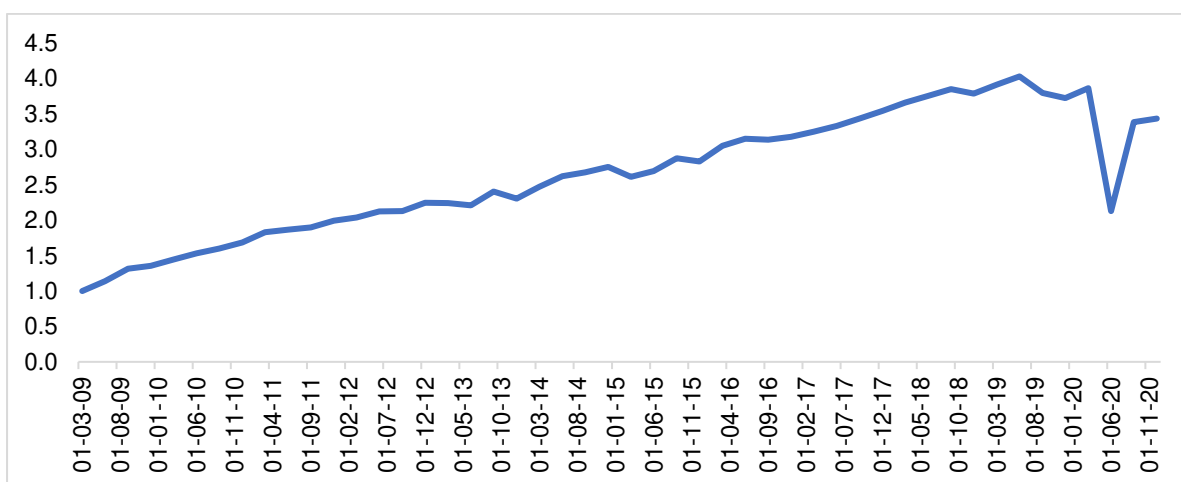
$$x_t = Bx_{t-1} + w_t \text{ where } w_t \sim MVN(0, Q)$$

$$y_t = Zx_t + a + v_t \text{ where } v_t \sim MVN(0, R)$$

$$x_0 \sim MVN(\Pi, \Lambda)$$

The observation equation contains y_t which is a $n \times 1$ matrix of economic indicators at a time t . In the current specification x_t extracts the common underlying trend in y_t into a single-index dynamic factor. In this specification, Z represents Factor loading and “ a ” refers to an offset factor, both Z and a are $n \times 1$ matrices. We start with each of the variables- steel and cement production, IIP core, rail-freight, adjusted realty index, Google Search Propensity Index and housing prices- in their levels, de-seasonalised them using Census X-12 techniques which are then z-score transformed for standardisation (Holmes *et al.*, 2014). The estimated dynamic factor using the expected mean methodology is reported in Chart 13.

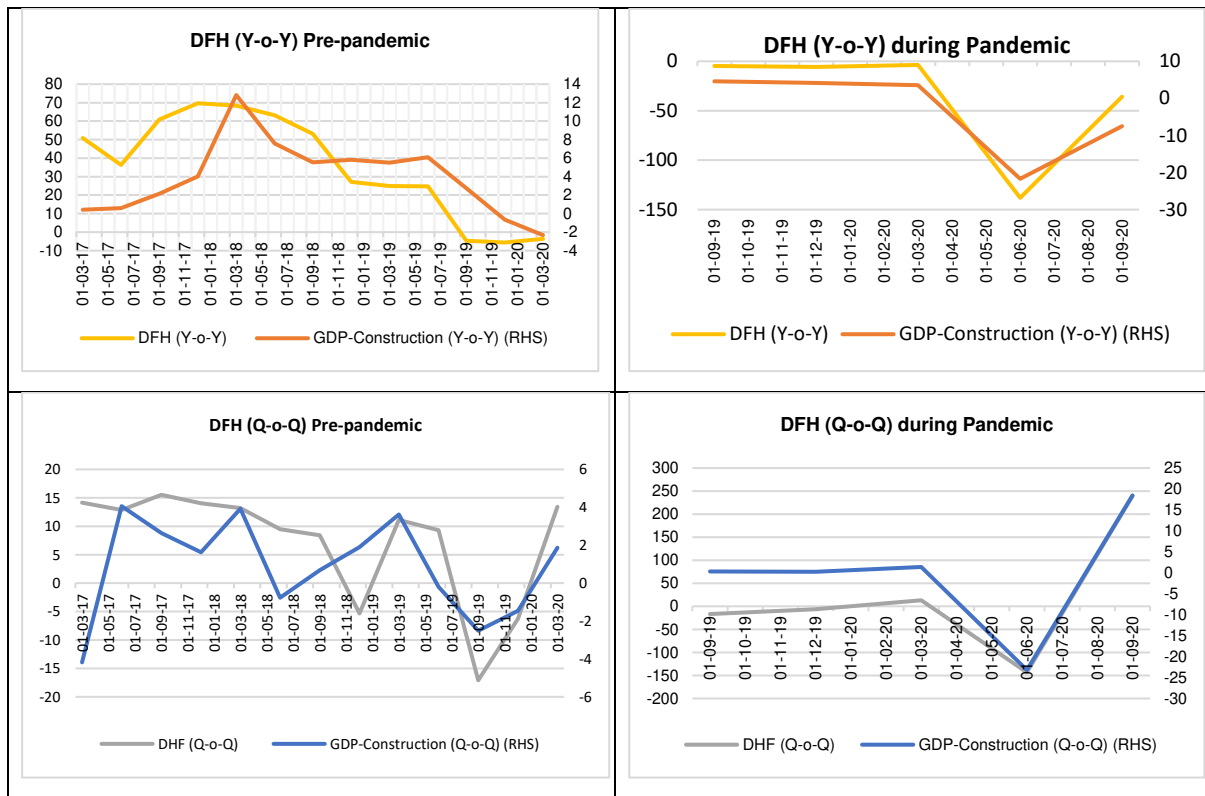
Chart 13: DFH Index



Source: Authors’ estimates

The dynamic factor for housing (DFH) is non-stationary in nature, which portrays an increasing trend in the Indian realty sector. Both sequential and y-o-y growth (which are stationary) are in sync with the developments in the GVA-construction sector (Chart 14). DFH tracked recent movements in the housing sector and also during the pandemic.

Chart 14: Q-o-Q and Y-o-Y Growth Rate of DFH

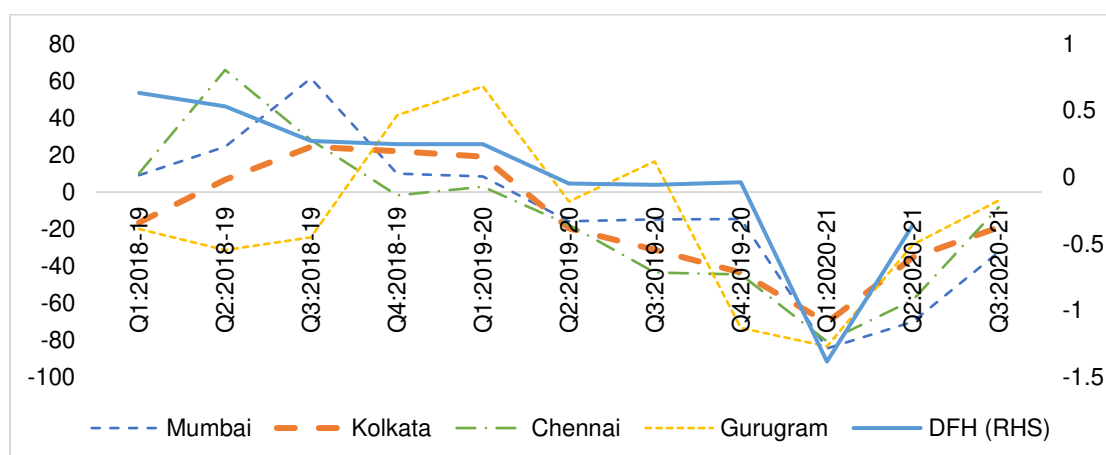


Source: Authors' estimates

In order to validate the DFH index with an alternative data source, we use data collected by a private agency, Proptiger, that reports the number of housing units sold across different cities. This helps us to assess how DFH fares as compared with the housing units sold. It appears that DFH is able to capture the broad trends that is observed in the housing sell-purchase market further confirming our dynamic factor-based index in capturing the overall trend in the realty sector (Chart 15).

Chart 15: Housing Unit Sold Across Cities v/s DFH

(Y-o-Y percentage change)



Source: Proptiger

Given that quarterly construction, GVA is available with two months lag and undergoes revisions over the next two years, we can use DFH to nowcast construction GVA.

IV.4 Causality Analysis

Before extending this analysis to policy analysis to evaluate how a change in housing impacts the macro variables, the first step could be to evaluate pairwise causality to analyse the direction of a causal relationship between housing and other macro segments. Granger causality tests indicate a unidirectional causality from DFH (Y-o-Y) to GVA (Y-o-Y); however, there was no statistically significant evidence supporting GVA to cause DFH (Table 3). Causality results also indicate DFH (Y-o-Y growth) causing Non-Agri GVA growth. Further, we also attempted to evaluate the nature of the causal relationship after excluding construction from Non-Agriculture GVA. The last two columns confirm the causal relationship running from the DFH growth to Non-Agri-Non-Construction GVA, but not *vice-versa*.

Table 3: Results of Granger Causality Analysis

Null Hypothesis (at lag 1)	F stat	Probability
GVA does not Granger Cause DFH	0.01	0.95
DFH does not Granger Cause GVA	3.12*	0.08
Non-Agri GVA does not Granger Cause DFH	0.02	0.91

DFH does not Granger Cause Non-Agri GVA	3.20*	0.08
Non-Agri GVA less Construction does not Granger Cause DFH	0.09	0.77
DFH does not Granger Cause Non-Agri GVA less Construction	2.67*	0.10

Note: All variables are in y-o-y growth terms. The symbols *, **, *** denote the cases where we reject the null at the 10%, 5%, 1% significance levels, respectively.

Source: Authors' estimates

IV.5 Business Cycles and the Realty Sector

Having established unidirectional causality from Dynamic Factor Housing (DFH) growth to GVA growth, we now attempt to analyse their association across business cycles. For this, we use the same business cycle dating as indicated in section *IV.1* and create an upcycle dummy. We then regress lags of DFH and upcycle dummy using each of GVA, Non-Agricultural GVA, Non-Agricultural-Non-Construction GVA as our dependent variables. While the first two indicate the overall association, Non-Agricultural-Non-Construction GVA essentially indicates the second-round impact of a boost in the realty sector on Indian GVA. We attempted to find the magnitude of the relationship between the dynamic factor growth and GVA growth through Ordinary Least-Square regression, using Akaike information criteria (AIC) criterion to select among alternative model-specifications (Table 4).

The results show that the dynamic factor of housing growth impacts GVA after a lag and has positive and significant coefficients for Non-Agricultural GVA and Non-Agricultural-Non-Construction GVA. The positive and significant coefficient of GVA captures the direct impact of construction. We checked the regression coefficient using non-agricultural GVA as a dependent variable. The coefficient of lagged Dynamic Factor Housing growth was found to be positive. Further, when an interactive dummy for an upcycle period was used in this regression, the coefficient of the interactive dummy turned out to be positive and significant, which indicates the contribution of growth in the realty sector during the cyclical upturns.

Table 4: Regression Results

	GVA	Non-Agri GVA	Non-Agri GVA - Construction		
	1	2	3	4	5
C	1.391	7.062	6.727	7.345	7.077
GVA (-1)	0.739***				
DFH (-1)	2.194**		2.204*		2.334*
DFH (-2)	-1.668				
DFH (-3)		-0.228		-0.345	
Lagged		2.20*		2.50*	
DFH*Upcycle					
Lagged			-0.879		-1.259
DFH*Downcycle					
R-Sq	0.578	0.125	0.097	0.136	0.099
F-Stat	13.263	2.067	1.662	2.286	1.702

Note: All variables are in y-o-y growth terms. The symbols *, **, *** denote the cases where we reject the null at the 10%, 5%, 1% significance levels, respectively.

Source: Authors' estimates

To decipher the second-round impact of an upturn in the housing sector on Non-Agricultural GVA, we exclude the contribution of the construction sector from the dependent variable. The regression result indicates similar positive significant coefficients. This indicates a positive second-round effect of the DFH lagged the index. Moreover, an interactive dummy for the upturn period was also found to have a positive coefficient, which indicates the buoyancy of the realty sector in second-round impact to growth during the upcycle period. It may be because of upstream and downstream linkages of the realty sector, which connects not only to capital-intensive sectors like cement and steel but also to several ancillary industries that are typically labour-intensive.

IV.6 Policy Analysis

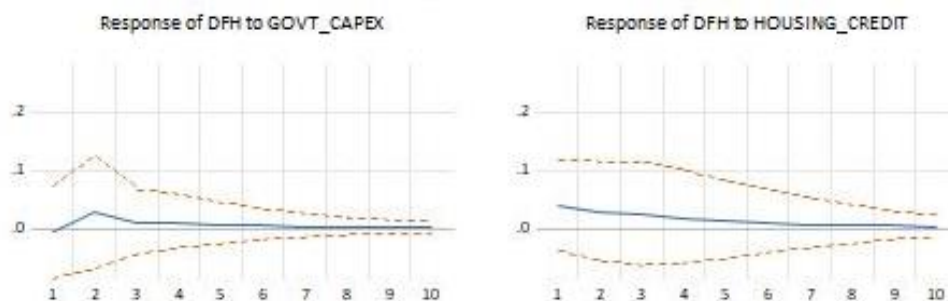
Finally, we come to the policy analysis, and for this, we consider representative fiscal and monetary policy variables. From the fiscal side, we consider Government's capital expenditure, which plays a positive role in economic growth. Keynes postulated that higher

government spending caused by expansionary fiscal policy could lead to higher economic growth (Romer, 1986). Empirical evidence also suggests positive Capex multipliers and their second-round impacts (Landau D., 1986; Diamond J., 1989; Bose *et al.*, 2007; Butkiewicz *et al.*, 2011; Onifade *et al.*, 2020). It may be important to consider the centre and states' Capex, because a major chunk of social infrastructure expenditure is undertaken from state budgets. Data indicate the government Capex to be counter-cyclical. However, in the case of other cases the govt. Capex shows pro-cyclical behaviour as it moves in line with the business cycle.

Second, we consider housing credit, as a proxy for monetary policy. While in the conventional literature, the interest rate on housing credit is generally considered as the monetary policy indicator (Joshi, 2006) we have considered a change in the quantum of housing credit, as it captures the ultimate transmission (flow of credit) to the housing sector incorporating the effects of interest rate changes.

Considering the fact that government (combined) Capex expenditure, banks credit creation and a dynamic factor representing housing sector developments (DFH) could have endogeneity issues which could bias regression coefficients, we use a Vector Autoregressive (VAR) framework to evaluate impulses on this set of endogenous variables. We select appropriate VAR lag structure using AIC/ Schwarz's Bayesian Criterion (SBC) and use this estimated set to evaluate the impulses of one standard deviation (SD) orthogonal shock to change in Government Capex expenditure and change in banks' housing credit. The impulse responses indicate positive responses of change in Government Capex expenditure and change in bank credit on change in DFH (Chart 16).

Chart 16: Impulse Response Functions



Source: Authors' estimates

Taking cognizance of the fact that Cholesky decomposition in unrestricted VAR is often criticized on account of variable ordering problems, we estimated generalised impulse responses (Pesaran & Shin, 1998), that are independent of variable ordering. We also attempted to incorporate the positive impact of various initiatives taken by the government, like the Real Estate Regulatory Authority (RERA) Act, housing for all and various subsidies given to affordable housing. Though individual contributions of these variables are difficult to identify and decipher, as many of these policies were operating simultaneously, we introduce dummies incorporating these policy changes in the exogenous set of variables in the VAR framework. The combined dummy (for the common period) was found to be significant in VAR equation(s). The generalised impulses from this policy augmented VAR is reported in the Annex (Chart 3A). Generally, these impulse responses confirm those reported in Chart 16, indicating the robustness of our findings relating to the positive impact of government Capex and housing credit on overall housing sector performance.

V. Conclusion

In view of the importance of the realty sector for growth and employment generation, we explore the relationship between the realty sector and economic activity across business cycles. First, we examine various conventional indicators (such as housing prices, realty sector balance sheet, steel and cement production) and unconventional indicators (such as realty index adjusted for broad market movements and google search propensity indicator) related to the real-estate sector, all of which slumped during the nation-wide lockdown period and have recovered thereafter. To get a better view of the association of movements in realty variables with GDP, we analyse the dynamic correlation between them and extract a common factor using a dynamic factor model. The dynamic factor housing (DFH) tracked movements in the construction sector GVA, highlighting as a composite lead indicator of economic activity for the construction/realty sector.

Our empirical analysis indicates unidirectional causality running from housing dynamic factor (DFH) to GVA, non-agri-GVA and non-agri-non-construction GVA growth. After confirming causality, the regression analysis found a positive and statistically significant impact of lags of DFH on GVA and non-agri GVA, including through second-round impact. A dynamic factor based on a select set of high-frequency indicators could help to nowcast construction GVA.

After establishing the importance of the realty factor to recovery in GDP/GVA growth, we examine the impact of monetary and fiscal policies on the realty sector. For this, we examine the responses of government Capex expenditure and housing credit impulses on the dynamic factor housing (DFH) in a VAR framework. Policy stimulus seems to have a positive impact on DFH. These findings also hold when we augment the VAR structure to incorporate various other policy interventions such as RERA, housing for all initiation and income tax deductions on loans.

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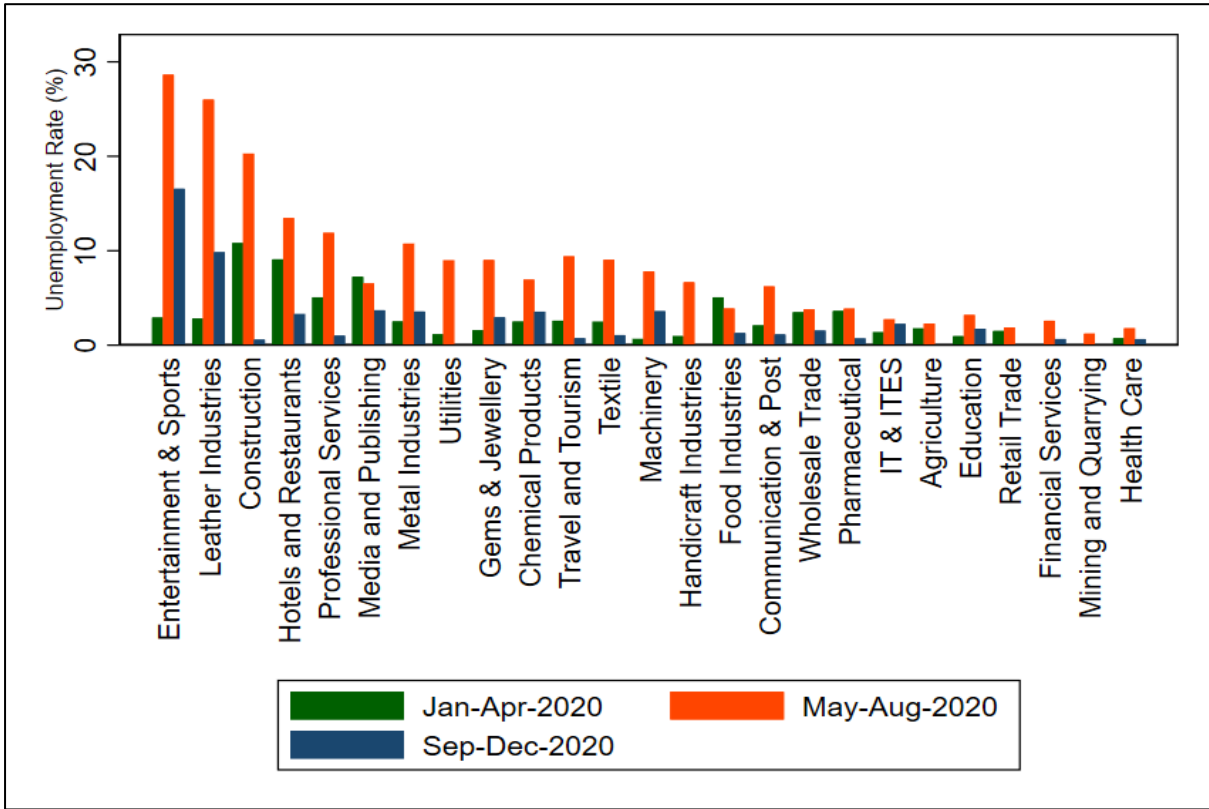
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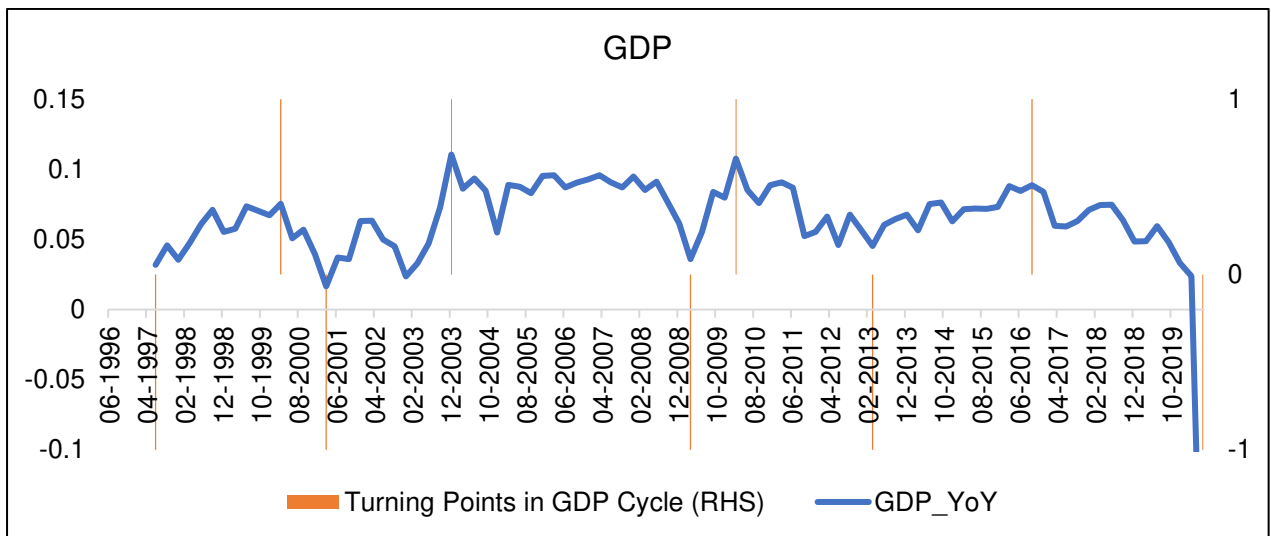
Annexure

Chart 1A: Unemployment rate, by Industry



Source: Consumer Pyramid Data, CMIE

Chart 2A: GDP Cycle Dating



Source: Bhadury *et al.* (2020)

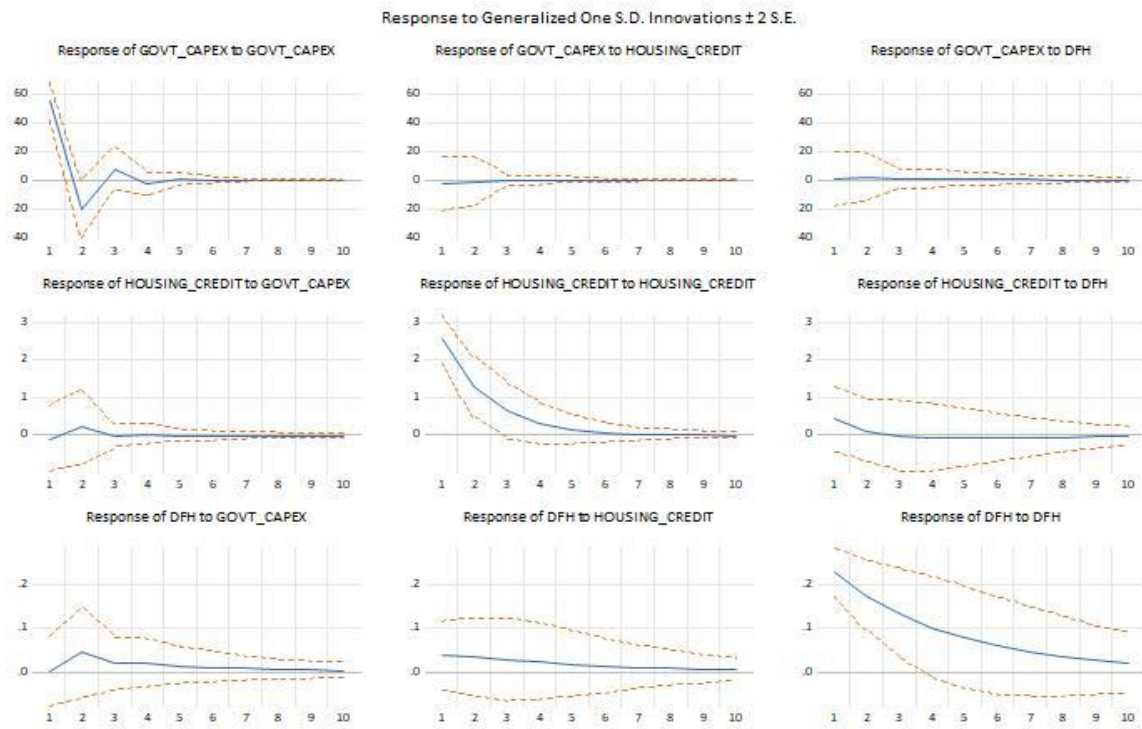
Table 1A: Dynamic Correlation: GDP

Variables	GDP(-t)	GDP	GDP(+t)	Comments
Housing credit	0.1815	0.0176	-0.0882	L+ significant at 11,12 lags
Housing credit	-0.1174	0.0148	-0.1393	X (excluding Covid period)
Steel Production	-0.5487**	0.9162**	-0.3648**	C
Cement Prod.	-0.5456**	0.9237**	-0.3257**	C
IIP Core	-0.4698**	0.9601**	-0.4413**	C
Housing Prices	0.1556	0.0275	0.0343	X
Housing Prices	0.0556	-0.2093	0.1089	X (excluding COVID period)
Rail freight	-0.5863**	0.9044**	-0.3332**	C
Rail_pig_iron	-0.4228**	0.3738**	0.305**	L-/C/L+
Rail_cement	-0.1506	-0.3677**	0.7448**	L+/C
Govt_capex	0.1112	-0.0997	0.0711	L+ significant at 8th and 9th lag
Realty Index	-0.1246	0.4056**	-0.1531	C
Sensex	-0.0704	0.316**	0.105	C
Adjusted Realty Index	0.1351	0.3783**	-0.3017**	L+/C
Google Search Propensity Index	-0.3749**	0.55**	-0.215	L-/C

Note: The symbols *, **, *** denote the cases where we reject the null at the 10%, 5%, 1% significance levels, respectively.

Source: Authors' estimates

Chart 3A: Generalised Impulse Response Functions (with Policy Dummy)



Source: Authors' estimates