

The impact of COVID-19 on dwelling approvals in QLD: Preliminary macro-economic analysis using CCF-TCM hybrid approach

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Study Context: The Queensland Government's annual Land Supply and Development Monitoring (LSDM) Report aims to understand and forecast changes in development activity and housing demand. The 2019 LSDM report provided a market factors section to discuss macro and micro-economic factors and their interrelations on short-medium term demand for housing. Since the release of the 2019 LSDM report, the Coronavirus Disease 2019 (COVID-19) pandemic emerged, and continues to pose evolving risks to economic activity (Binder, 2020). In this context, there has since been a heightened need to understand and forecast impacts COVID-19 is having, and may have, on the demand for housing and development activity.

Development activity helps support a healthy economy and adequate housing supply. Through the course of the COVID-19 pandemic, many initiatives have already been put in place to lessen the impact COVID-19 is having across many sectors. For example, reduced interest rates, introduction of cash flow boosts to small businesses, first home buyer increased grants, loan deferral, rental relief and job keeper payments.

Current evidence-based information is needed to support decision making for targeted and effective interventions – particularly through the COVID-19 pandemic. This preliminary study presents data-driven methods, and methodologies, to better understand and forecast changes in development activity and housing demand. It sets out a measured approach to forecast development activity change from economic factors. The approaches help explain any past, current or future change by establishing links to key contributing economic factors.

Objective: In this preliminary study, the impact of COVID-19 on development approvals in Queensland has been investigated considering macro-economic indicators.

Method: The study method encompasses the forecast of development approvals in Queensland based on Cross-Correlation Functions (CCF) and Temporal Causal Models (TCM) of macro-economic time series and development approvals from September 1990 to March 2020 on a quarterly basis. The variability of macro-economic indicators was used to forecast quarterly development approvals from June 2020 (Q4 2019-20 FY) to December 2021 (Q2 2021-22 FY).

The selection of macro-economic indicators was based on the variables described in the 'baseline' scenario of the 'May 2020 Statement on Monetary Policy' issued by the Reserve Bank of Australia (RBA, 2020). In addition, the 'June 2020 World Economic Outlook Update' from the International Monetary Fund (IMF, 2020) provided the basis to estimate the economic recovery path of major trading partners, e.g. China and the United States. It is important to note that the representativeness of each trading partner may vary significantly due to both potential trading tensions and new trading agreements as part of the global economy recovery.

The national and international economic recovery outlined in the baseline scenario by RBA and IMF, respectively, assume a V-shaped recession. However, the recovery may be

extended into a U-shaped or W-shaped recession depending on the effectiveness of the health response to COVID-19. Table 1 shows the macro-economic indicators adopted in the study. The total number of dwellings classified as houses for all industry types in Queensland was selected as the dependent variable (target) in the analysis. Information on this parameter was sourced from the Australian Bureau of Statistics (ABS) database, i.e. 8731.0 Building Approvals. The frequency of house approvals was converted from monthly to quarterly in order to align with the frequency of selected macro-economic indicators.

Table 1. Some key macro-economic indicators used in the preliminary study.

Indicators	Forecast (%)				Source
	June 2020	Dec 2020	June 2021	Dec 2021	
National GDP	-8	-6	7	6	RBA (2020)
Household consumption	-15	-9	13	9	RBA (2020)
Unemployment rate	10	9	8.5	7.5	RBA (2020)
Wage Price Index	2.00	1.50	1.50	1.75	RBA (2020)
Consumer Price Index	-1.00	0.25	2.75	1.25	RBA (2020)
United States GDP	-8.0	-8.0	4.5	4.5	IMF (2020)
China GDP	1.0	1.0	8.2	8.2	IMF (2020)

Note: Gross Domestic Product (GDP).

Results: The CCF analysis showed the degree of correlation between macro-economic indicators and dwelling house approvals in Queensland. Results are summarised in Table 2.

Table 2. Cross-correlation of some key macro-economic indicators with house dwellings.

Time step in quarters	Correlation of indicators with house dwellings approval (%)							
	National GDP	Household consumption	Unemployment rate	Wage Price Index	Consumer Price Index	United States GDP	China GDP	
(Lead)	-7	-5	0	-32*	29*	-4	-11	23*
	-6	-13	2	-34*	30*	0	-19	25*
	-5	-16	8	-38*	31*	11	-18	32*
	-4	-5	18	-40*	29*	16	-8	40*
	-3	10	29*	-40*	22*	13	-4	43*
	-2	28*	36*	-35*	16	5	2	43*
	-1	38*	42*	-26*	11	-8	14	40*
	0	35*	45*	-13	11	-17	26*	33*
	1	23*	37*	-4	12	-15	15	19
	2	11	27*	2	13	-8	4	10
	3	4	16	6	15	3	-10	1
	4	1	5	7	14	18	-10	-1
	5	-2	-3	7	12	30*	-8	-2
6	-6	-9	6	11	34*	-9	-3	
(Lag)	7	-7	-11	3	10	34*	0	-3

Note: * Significant cross-correlation at a 95% confidence level.

Macro-economic indicators showed different signals in the dwelling house market. National GDP had a slight concomitant trend with dwelling growth. Household consumption, measured as the household final consumption expenditure growth, was the indicator with the highest correlation and concurrency; thus, this indicator provided the real-time confirmation of the state of the dwelling house market, and hence may be used for now-casting house approvals. Unemployment showed an inverse correlation with an extended leading with development approvals, ranging from 1 to 7 quarters lead. Similarly, the Wage Price Index (WPI) was a leading indicator; yet, it was associated with a positive effect on the house market with a lead from 3 to 7 quarters. CPI showed a significant correlation as a response to the house market with a lag between 5 and 7 quarters (30 to 34% correlation) and an immediate negative economic ripple effect on the house market at a lower extent (15 to 17% correlation).

The GDP of trading partners were also correlated with house approvals. For instance, the Chinese GDP showed a strong correlation as a leading economic indicator of house approvals; whereas, the United States GDP had a lesser significant correlation characterised by a corresponding market response in relation to house approvals, which is indicative of widespread global economic conditions. The strong correlation with the Chinese market is an indication of the importance of major export markets for the housing market in Queensland, including export values of 32.9% to China (34% and 45% related to coal and LNG exports, respectively), 14% to Japan, 12% to India and 11% to South Korea in 2018-19 FY (TIQ, 2020). New trading agreements and commodities are likely to be developed in response to new requirements from the global economy with a direct influence on the economic dynamics with major export markets in Queensland.

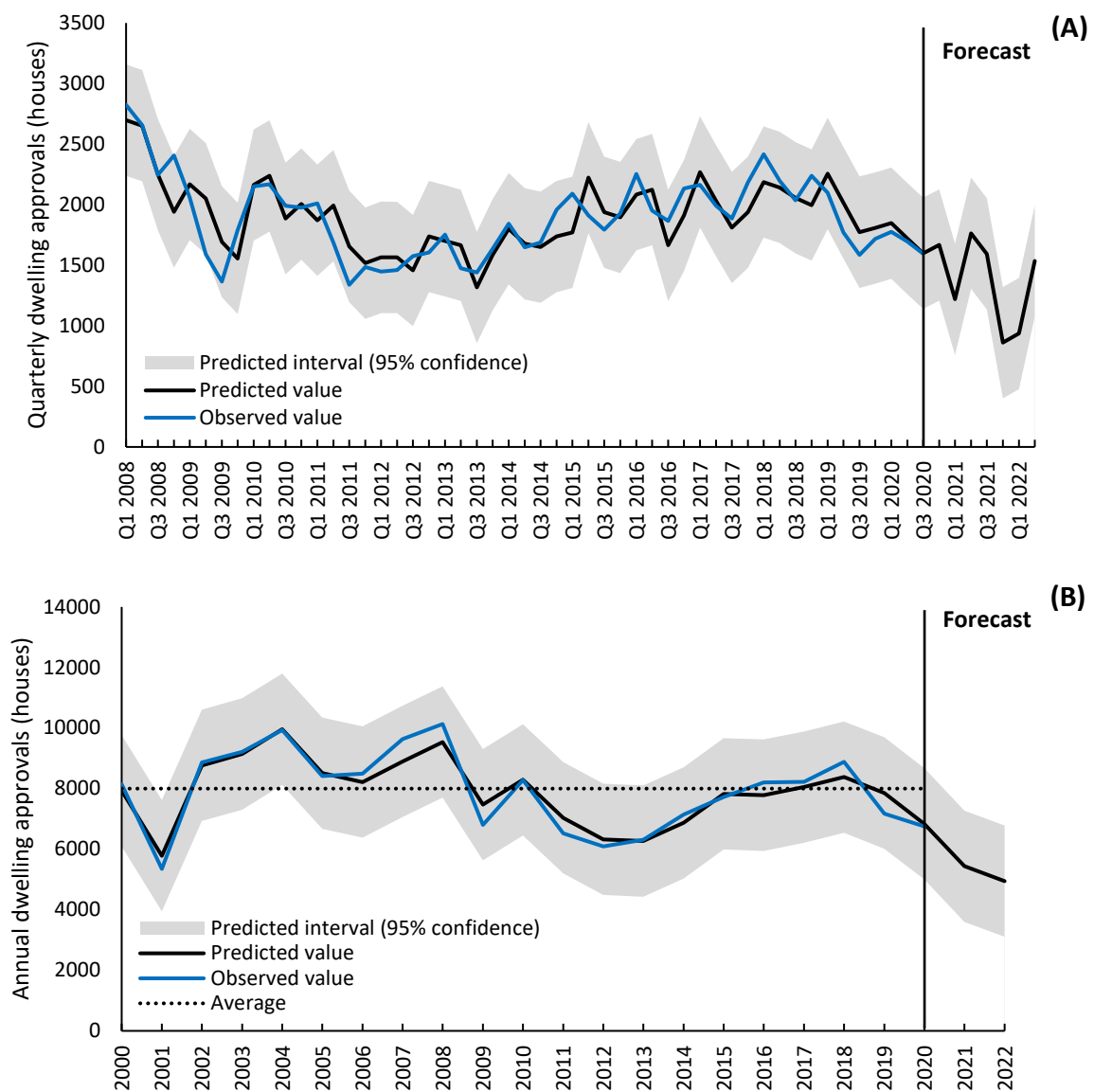


Figure 1. Temporal Causal Model (TCM) of Queensland's dwelling house approvals.

Note: Quarters based on FY ending in 30 June.

The Temporal Causal Model (TCM) forecast for the total number of dwelling houses on a quarterly basis in Queensland showed a training accuracy equivalent to a coefficient of determination (R^2) of 0.78 with a Root Mean Square Error (RMSE) of 230 dwellings and a Root Mean Square Percentage Error (RMSPE) of 20%. The macro-economic indicators with

the highest influence were the CPI followed by the GDP of major trading partners and the national GDP. Figures 1a and 1b show the observed value, predicted value (mean) and predicted interval at a 95% confidence of house approvals on a quarterly and yearly basis, respectively.

Conclusion: This study was based on a data-driven TCM underpinned by quarterly observations of house approvals in Queensland from September 1999 to March 2020. Macro-economic indicators and associated economic scenarios reported by RBA and IMF for the 2020 and 2021 FY were used to forecast the number of house approvals in the short-term in Queensland. The key finding of the study indicates a considerable impact of the present health-economic crises on the total number of house approvals. The predicted number of quarterly dwellings ranged from 1200 to 2100 (1700 on average) in 2020 (Fig. 1A). In 2021, the TCM forecasted an increase in house approvals from approximately 1,200 in Q1 to 1,800 in Q2, followed by a decrease to approximately 1,600 in Q3 and 860 in Q4, then a rebound in the first two quarters of 2022. Therefore, the forecast for 2021-22 followed a W-shaped recovery due to economic shocks from the international market, which is to date undergoing its deepest recession since the Great Depression according to the International Monetary Fund (IMF, 2020). As a result, the house market in Queensland is forecasted to follow an oscillating quarterly trend in its recovery path due to the compounded effect and the interplay of national and global macro-economic factors. In terms of annual housing approvals (Fig. 1B), the yearly trend is downwards with 6,800 in 2020, 5,400 in 2021 (20% decrease) and 5,000 in 2022 (9% decrease) for the assessed macro-economic scenarios.

Opportunities for future research: Considering the dynamic nature of the COVID-19 pandemic and associated response actions to minimise and mitigate health and economic impacts, the herein findings could be enhanced further through a comprehensive sensitivity analysis in order to understand the influence of a range of indicators and the outcome of multiple scenarios which may arise as a result of the pandemic. Moreover, forecasting accuracy would be improved by including relevant socio-economic parameters (e.g. migration, consumer sentiment, age distribution, etc.), as well as emerging trends in housing choice (e.g. potential preference of expansion over consolidation areas) due to a shift in employment arrangements (e.g. transition from office to home based work), etc. This is likely to lead to a profound change in the development pattern observed in Queensland, in particular in the SEQ region. Finally, location-based analysis (i.e. GIS associated with advanced statistics) will enable more granular localised forecasts, e.g. SEQ region, LGAs, statistical areas, etc. For this purpose, data-driven statistical models are powerful instruments to understand new patterns emerging in the housing market. Such techniques include, but are not limited to, Artificial Neural Network, Bayesian Network, Temporal Causal Model, Time Series Cross-Correlation analysis, to name a few. These statistical techniques enable the use of big data (>60 parameters and extended time series). The experience of Griffith University researchers is that the selection of optimal models is a function of the characteristics of target variables and predictors, i.e. trend, frequency, coverage and consistency. Advanced economic analytics provides valuable insights into both the most relevant predictors and forecasts for specific target variables (e.g. dwelling approvals, etc.) as demonstrated in this preliminary study.

References

- Binder, C. (2020). Coronavirus Fears and Macroeconomic Expectations. The MIT Press Journals, May 06, 2020.
- IMF (2020). World Economic Outlook Update, June 2020: A crisis like no other, an uncertain recovery. Available at: <https://www.imf.org/en/Publications/WEO/Issues/2020/06/24/WEOUpdateJune2020>
- RBA (2020). Statement on Monetary Policy, May 2020. Reserve Bank of Australia (RBA). ISSN 1448-5141.
- TIQ (2020). Queensland export values rise 17.1% in 2018-19. Trade & Investment Queensland (TIQ), Australia. Available at: <https://www.tiq.qld.gov.au/queensland-export-values-rise-17-1-in-2018-19>