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The Impact of Credit Supply on Housing Prices

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ABSTRACT: Economic researchers have taken a special interest in exploring the relationship between housing prices and credit supply (and demand), especially after the subprime mortgage crisis. This paper attempts to add to this debate by defining credit supply as the growth rate of aggregate loans. We also look at the response of housing prices to monetary policy, credit risk and output growth shocks in the US economy. We use a VAR time series model through which we find significant effects on house prices from all these variables.

JEL classification: C11, C22, C51, E51 G21, R31, E51

Keywords: Housing prices, Credit supply, Lending constraints, Mortgage rates, Credit market conditions, Output

1. Introduction

The credit environment of an economy is a strong influencer of the housing market conditions. Potential home owners need access to credit to be able to finance their purchases. So changes in the credit supply must trigger a significant reaction in the housing market. Whether or not this is true - and if so, to what extent? - has been a debate in question for some years now. The aftermath of subprime mortgage crisis especially impelled researchers to delve into this relationship and other variables such as the federal funds rate (Taylor, 2007), mortgage rates, housing supply, income etc. that have a potential impact on housing prices. While some researchers suggest that credit plays a significant role in the housing price cycles, there are some who argue that it has no effect. This paper looks at credit supply as a determinant of housing prices in the US economy. We use the growth rate of total loans as our measure of credit supply. We want to look at the impact of the aggregate access to credit on the housing prices. Further, we use mortgage rate, credit spread and the growth rate of output as control variables. We affirm that credit supply plays a significant role in determining housing prices. Moreover, controlling for monetary policy, credit risk and output growth helps us define these relationships as well.

Section 2 of this paper identifies and explores some of the existing literature. Section 3 describes the data and the model used and evaluated. Section 4 provides the results followed by a brief discussion and comments in section 5. We conclude our findings and discuss the limitations in section 6.

2. Literature Review

Most literature shows a causal link between credit supply and housing prices. This includes Justiniano et al. (2019), Blickle (2022), Ma and Zhang (2022), Adelino et al. (2012), Milcheva (2013), Mian and Sufi (2019), Duca et al. (2012) etc. Justiniano et al. (2019) argue that when attempting to understand the boom phase, the focus of the investigator should be more on the credit supply than its demand. So they "reconstruct" the boom in their calibrated model to account for the looser lending constraints in addition to relaxing the borrowing constraints. They show that it was the lending barriers that were behind the huge increases in housing prices and mortgage debt. Milcheva (2013) shows that the credit supply shocks affect the housing prices exogenously and not necessarily through the bank lending channel, implying that both monetary policy and exogenous credit supply play a key role in determining housing prices. Blickle (2022), through utilizing a natural experiment from Switzerland offers a similar hypothesis. Ma and Zhang (2022), while exploring what plays a greater role in housing price fluctuations report that both mortgage rate and credit supply shocks exert about the same amount of influence, with both explaining more or less around 20% of forecast error variance of house prices. Duca et al. (2012) find that it is the "unsustainable" availability of credit that was one of the major driving forces of the subprime mortgage crisis, indicating that changes in credit supply play a significant role in determining the housing prices. Taking a somewhat unique approach, Greenwald and Guren (2021) show that credit supply changes account for 34% - 55% of the increases in price-rent ratio over the boom period. Favara and Imbs (2015) emphasize on the relevance of economic meaning of increases in housing prices through deregulation and expansion of mortgage credit. Deregulation is responsible for a two-thirds increase in the credit supply which then contributed to change in housing prices over their observed period of interest. Coleman et al. (2008) take an interesting stance and claim that the increase in credit supply may infact be due to the increase in housing prices (and deregulation) and not the other way round.

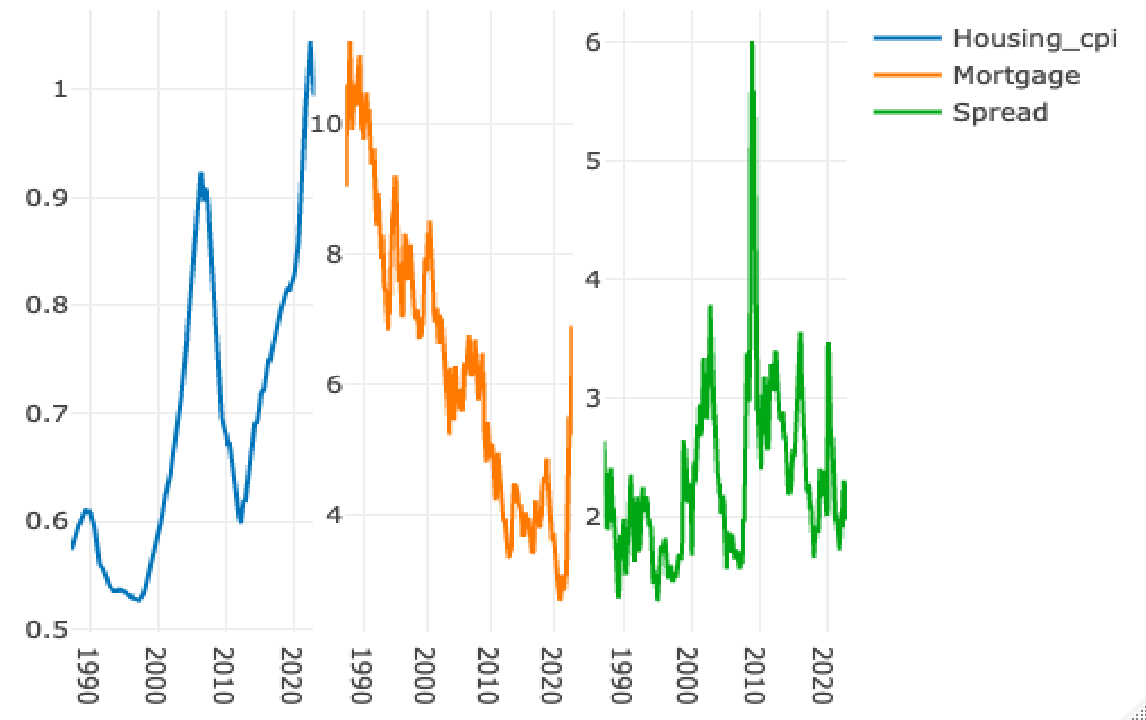
3. Methodology

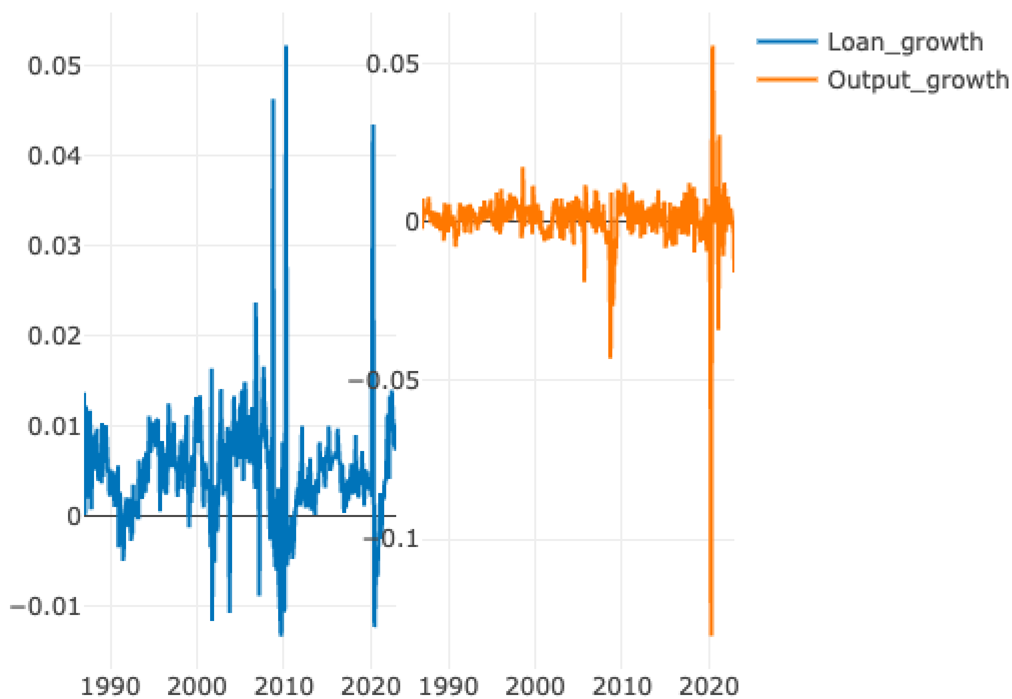
3.1. Data

All the data for this research was obtained from the Federal Reserve Economic Data (FRED) website. In our model, we used housing prices as our dependent variable and growth rate of (all) loans, mortgage rate, credit spread and the output growth rate as our independent variables. S&P/Case-Shiller U.S. National Home Price Index (CSUSHPISA) represents the housing prices. It measures the change in the value of the U.S. residential housing market by looking at the purchase prices of single family homes. It is usually viewed as one of the most standard datasets to represent the housing market in the United States. However, these values are nominal, so we deflated these values using the Consumer Price Index (CPI) for all urban consumers. CPI give us the price index of a basket of goods and services paid by the consumers, in this case, the urban consumers. A percentage change in CPI between two time periods gives us the inflation for that time period time. Hence, dividing the the housing price index by this value will give use the deflated values which will make our results more meaningful. We use growth rate on loans as our measure of credit supply. We obtain the data on total loans for all US commercial banks (TOTLL) and then convert the values into monthly growth rates. We also include the 30-year mortgage rates published by Freddie Mac in the model (MORTGAGE30US) which also serves as a proxy for monetary policy. To estimate our credit spread as a broader measure that is not directly related to housing in the model, we used Moody's Seasoned Baa Corporate Bond Yield (BAA) and Market Yield on U.S. Treasury Securities at 10-Year Constant Maturity (GS10), as proxies for risk rate and safe rate, respectively. Moody’s Seasoned Baa Corporate Bond Yield measures the yield on corporate bonds that are rated Baa. Baa rating means that these bonds are considered relatively low risk (though they are only one level above a junk bond rating) and viewed as investment grade. Hence, while they are not directly related to the housing market, the inclusion of this yield in our credit spread is still relevant to our research. We also control for the growth rate of output using total industrial production (INDPRO). After obtaining the data on total industrial production we converted it into output growth rates. The time period of interest is 1987-2022 with the frequency of data as monthly throughout the dataset.

Figure 1 below shows the trends of our variables.

Figure 1





On the first panel of Figure 1, we could see that the housing prices variable reached its peak in two periods, one in around 2008 and the other in 2020. These peak periods could be explained by the financial crisis and the Covid-19 pandemic, respectively. Such peaks could also be observed on the credit spread. It has its highest peak in around 2008, which signals heightened credit risk in the bond market during that period. The other variables show a more volatile trend throughout.

Figure 2

Figure 2 shows the relationships between our variables. There is a positive correlation between credit spread and housing prices, as well loan growth and housing prices. An increase in loan growth could see the demand side have access to more loans, thereby demanding for more houses. This would eventually raise housing prices. Higher mortgage rates would naturally discourage households and individuals from going for mortgage loans and with time the housing demand would fall and eventually lead to a decline in housing prices. As output growth is represented by the total industrial production here, an increase in output growth would boost the supply of housing (more than demand), thereby decreasing housing prices.

3.2. Model

We implemented the Vector Autoregressive (VAR) model to see the how the aggregate access to credit as well as monetary policy, risk and output growth affect housing prices. VAR is one of the most successful, flexible, and easy to use models for the analysis of multivariate time series ([Gupta, 2021](#)). It extends univariate autoregressive model to dynamic multivariate time series. It comprises of a system of 'n' equations of 'n' distinct, stationary response variables as linear functions of lagged responses and other terms. We used R software for implementing our model and all the related tests. When implementing the VAR model, it is customary to conduct certain tests that are prerequisites to producing robust results. Time series variables are supposed to be stationary before fitting them to the model. A stationary time series is one whose properties do not depend on the time at which the series is observed. Thus, time series with trends, or with seasonality, are not stationary. The trend and seasonality will affect the value of the time series at different times. We used the Philips-Perron (PP) unit root test to check for stationarity. The basis behind VAR is that each of the time series in the system influences each other. We implemented the Granger Causality test to see if this assumption holds for our data set. According to Granger causality, if a series X1 "Granger-causes" a series X2, then past values of X1 should contain information that helps predict X2 above and beyond the information contained in past values of X2 alone. However, it is important to note that Granger causality does not necessarily imply causality. To determine the optimal number of lags to use for our model, the "vars" package has a function which gives the optimal lag based on the Akaike Information Criterion (AIC), Schwarz Criterion (SC) and Hannan Quinn (HQ) Criterion.

4. Results

The results from the stationarity test indicated that only *housing price* and *mortgage rate* were not stationary and all the other three variables were stationary. We took the first difference of the non-stationary variables except for the mortgage rates. This is because interest rate variables, by nature, do have trends and it would defy economic meaning in terms of interpretation to take the first difference of the mortgage rate.

For the optimal number of lags, our methods produce two sets of results, the AIC and FPE selected 3 lags to be the optimal lags, the HQ and SC selected 2 lags to be the optimal lags. We find that going with either of these lag values do not produce any noticeable difference. Therefore, we chose 3 as the number of lags for our model. The results produced by the Granger causality test show that all our variables Granger-cause one another. This means that past values of each of those variables are important in predicting the others. Finally, the last trick we applied was that after deflating the housing prices using CPI, we multiplied the values by 100 to make them consistent with the scales of other variables. We realized that the deflated housing price values were very small such that the impulse response function (IRF) showed no changes on the variable. At this point, we fitted the final data on our model. We only report results on the housing price equation as it is our response variable.

Table 1

	Estimate	Std. Error	t value	Pr(>|t|)	
Output_growth.l1	-0.019811	0.014074	-1.408	0.160005	
Loan_growth.l1	-0.032421	0.021937	-1.478	0.140185	
dif_Housing_cpi_1.l1	0.798672	0.048839	16.353	< 2e-16	***
Mortgage.l1	-0.085272	0.062093	-1.373	0.170406	
Spread.l1	-0.163413	0.074577	-2.191	0.028998	*
Output_growth.l2	-0.003238	0.013308	-0.243	0.807905	
Loan_growth.l2	-0.019729	0.022283	-0.885	0.376484	
dif_Housing_cpi_1.l2	-0.058333	0.062460	-0.934	0.350891	
Mortgage.l2	0.061816	0.100073	0.618	0.537108	
Spread.l2	-0.125921	0.123577	-1.019	0.308817	
Output_growth.l3	-0.007363	0.013392	-0.550	0.582750	
Loan_growth.l3	0.029117	0.020517	1.419	0.156616	
dif_Housing_cpi_1.l3	0.110825	0.049152	2.255	0.024675	*
Mortgage.l3	0.015012	0.061262	0.245	0.806545	
Spread.l3	0.275589	0.080582	3.420	0.000689	***
const	0.112749	0.079450	1.419	0.156622	

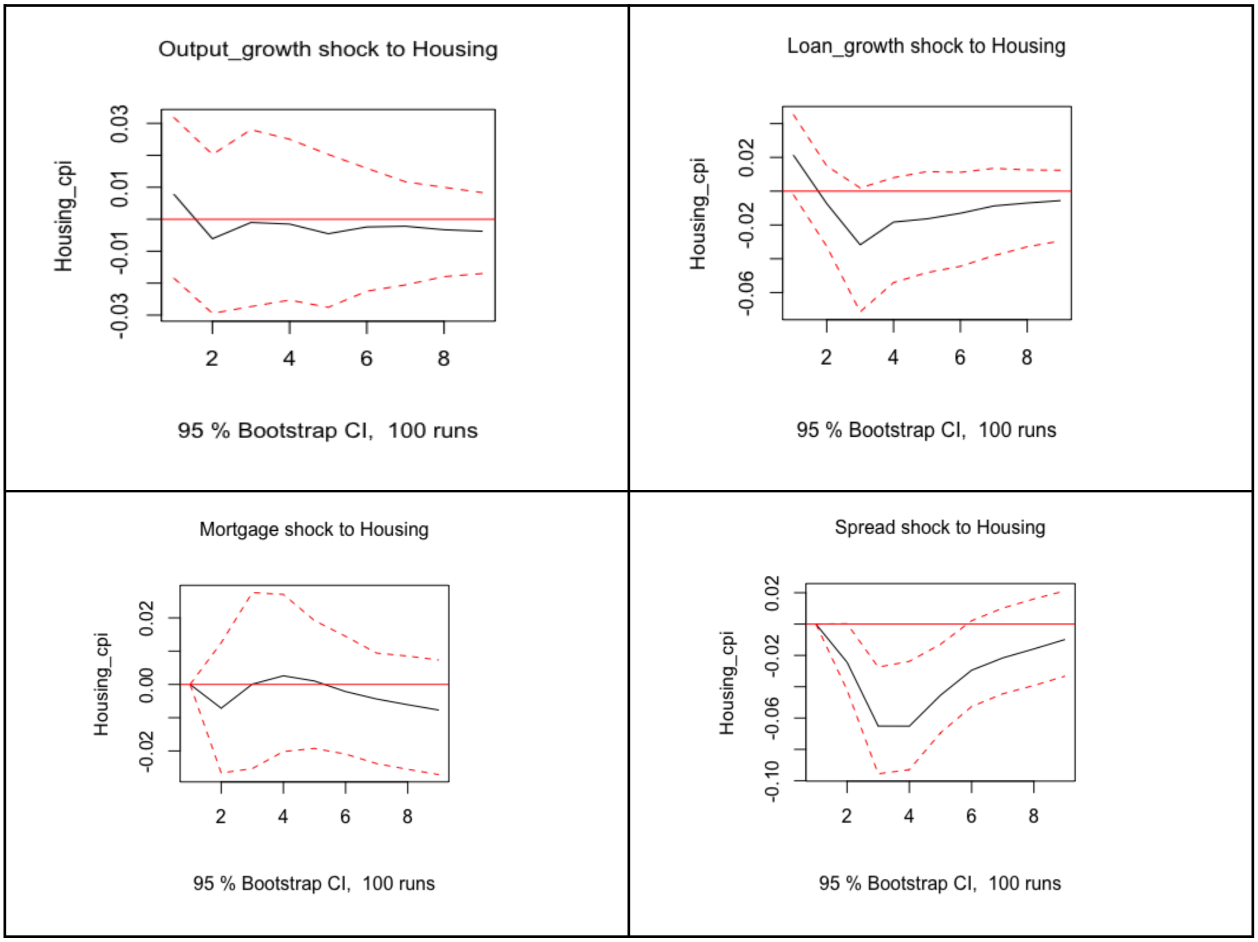
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2267 on 412 degrees of freedom
Multiple R-Squared: 0.7414,   Adjusted R-squared: 0.732
F-statistic: 78.76 on 15 and 412 DF, p-value: < 2.2e-16

It is worth noting here that we also ran a model parallel to the one described above where we did not include the output growth. Our estimates from the two models did not show any significant difference in terms of the coefficients on the various lags of the variables, the estimates on R-square, adjusted R-squared and the p-values. However, they showed significant difference in the Loglikelihood estimates. Loglikelihood is a measure of goodness of fit of a model and can be used to compare the performance of models. Therefore, the inclusion of output growth substantially improved our model performance and accuracy so we decided to drop the parallel model and report the results only from the more inclusive model. Table 1 above describes these results.

We now show the IRF plots to help us derive the meanings of the estimates from our model. That is to say, to see how housing prices respond to various shocks of variables representing credit supply and other conditions. On the implementation of the IRF, we ordered the variables and plotted the IRF in an orthogonalized format. We are using Cholesky decomposition to generate our IRFs. Hence we need to be careful of the ordering, putting the most exogenous variable first and the least exogenous variable which is affected by all other variables last. The rule of thumb is that whichever variable is ordered first is the slowest as it only responds to its own shock and whichever variable is ordered the last is the fastest because it responds to its own shock and all the other shocks contemporaneously. In our model, the order starts with output growth, followed by loan growth, housing prices, mortgage rate and lastly credit spread. The output, a quantity variable representing the production sector, would respond with a lag and hence is ordered first. The loan growth, also a quantity variable, would respond faster than output but slower than interest rate. Mortgage rate, being an interest rate, tends to be slower than credit spread as credit risk is always the fastest to respond to most shocks. The credit spread, representing credit risk would typically respond fastest, hence it is last in our ordering.

Figure 3: IRF



The first graph in Figure 3 gives us the IRF from output growth on housing prices. We see that at the initial shock from output growth, the response is positive, following which it is mostly negative, but closer to the zero-axis. The next graph (top-right) shows the IRF from loan growth where we again see that the initial shock has a positive response on housing prices until about the second time period. This effect, however, has a decreasing magnitude. Following this initial response, the effect is negative through the rest of the time periods, however the magnitude of the effect is reduced with successive time periods. As for the mortgage rate effect on housing, the response is almost null at the first shock and becomes negative until the third time period (where we see almost a zero response) after which it plummets again till the 8th horizon. Housing prices do not respond to the initial credit spread shock. However, the response plummets sharply until the fourth time period and then stays negative but at a decreased rate.

Discussion

We saw above that initially, housing prices respond positively to aggregate loan shock and later the response becomes negative. We could interpret this in the following steps: a growth in loans would increase the amount of loanable funds in the market. This would initially raise the demand for houses as individuals and households would have quick access to loans, which will in turn raise the housing prices. With time, real estate businesses, industrial businesses, etc. would increase the supply of houses as they have more access to loanable funds. This would offset the initial increase in house prices and eventually prices would fall as seen in both IRF plots for loan growth. This result is consistent with the literature. For example, Greenwald and Guren (2021) prove that credit supply changes account for 34% - 55% of the changes in price-rent ratio over the boom period. Further, Duca et al. (2012) assert that the excessive availability of credit supply was a major driving force of the subprime mortgage crisis.

As we turn to the mortgage rate shock, we see that at the initial shock there is no significant effect on the housing prices after which we see a negative response. Let us try to interpret this: When there is an increase in mortgage rate, we typically expect a sudden fall in prices. This is because mortgage becomes less affordable to buyers and so the demand falls. However, in order for the housing prices to fall, supply has to significantly overthrow demand which would typically not happen overnight. Hence, an almost zero initial effect makes sense in this context. Once supply significantly exceeds demand, we can see the housing prices react negatively to the mortgage shock. Another way to look at this is that when we look at aggregate loan growth we are essentially looking an a loosened credit supply that is causing a positive effect on housing prices through increased demand. However, a mortgage rate shock would be the exact opposite: a tighter credit supply. So it is completely plausible that a mortgage shock will negatively affect prices through reduced demand (and excess supply). Existing literature also supports this view. For example, Favara and Imbs (2015) show that deregulation continued immensely to increased credit supply which eventually caused changes in housing prices.

The Credit spread indicates measures credit risk. In a broader sense, when the credit spread is wide it indicates a slow economy whereas when is is narrow, it means that the market conditions are improving. Now let us turn to the IRF: We see that in both models, there is an almost zero initial shock and then there is a negative relationship. Economically, this makes sense because when there is a recession, the housing prices fall due to a lack of demand. It also makes sense for it remain on the negative side because historically, housing markets take time to recover from recessions. For example, home prices dropped and/or kept falling after 2007 until 2011 when they started recovering (Kahramaner, 2018).

Lastly, we saw that there was an initial positive response followed by negative responses over the next time periods. Here is how we interpret it: The initial positive response is straightforward because if we think of an output growth shock as an indicator of economic growth, it is only natural that housing prices would be positively related to this growth through increases in income. However, a growth in output may increase housing prices at first but in the subsequent time periods this effect will most likely not last because there is only so much income that the output shock may have raised and further price increases would not be sustained by the demand which will eventually fall leading to excess supply and therefore fall in prices.

5. Conclusion

We explore the relationships between housing prices and measures of credit supply, monetary policy, credit risk and output growth. We attempt to provide the reasoning and economic rationale behind these as well.

As for the limitations of our work, although we use access to aggregate loans as our measure of credit supply, there can be other aspects of the credit market that can be explored. In other words, credit supply can be interpreted and defined in multiple ways. Incorporating other measures would be a good topic for future research. Moreover, we found an initial positive response on housing prices from credit supply. Some researchers, including Coleman et al. (2008), are of the view that there exists a reverse causality between the two variables. We only relied on granger causality which showed us instantaneous causality. Perhaps exploring with other tests may have proven otherwise. Moreover, somehow accounting for the specific impacts of business cycles in more detail would help make the research more dynamic. Studying these relationships outside the context of a term project may allow us to delve into greater detail to address these limitations.

Ethics Statement

Following research ethics is paramount amongst research guidelines. All sources have been duly acknowledged in this paper. Secondary data has been used in this study and has been duly acknowledged in the references section.

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