Comments on econometric analysis of the relationship between the home loan interest rates of Kiwibank and larger banks

Prepared for Kiwibank

27 February 2024

1. This note provides our comments on the econometric analyses presented by Deloitte Access Economics (DAE)[1] and Frontier Economics[2] in cross-submissions in the context of the Commerce Commission's consultation on its Preliminary Issues Paper on the Market Study into Personal Banking service.

2. In summary, the difficulties with the analyses prepared by DAE and Frontier Economic are:

    - DAE's model examines significantly lagged relationships that do not reflect contemporaneous competition (for example, it examines how the rates of each of the largest 4 banks are affected by Kiwibank's rates from 3 to 9 weeks prior). Excluding contemporaneity is tantamount to avoiding an analysis of the potential strongest interrelationships between interest rates. More generally, the vector autoregressive model that DAE uses is not well-suited to the data set – this type of econometric technique is best suited to time series data sets that are highly cyclical with significant volatility.

    - Frontier Economics uses a contemporaneous model but attempts to include the rates of the large banks as separate independent variables. However, these variables share a +99.7% correlation between each other and it is therefore impossible, statistically, to separate their individual influence on the dependent variable. Attempting a regression in this way typically leads to coefficients with the incorrect signs and biased estimates of standard errors. This is precisely what has happened with the Frontier approach and is the reason why Link Economics instead chose to use an average of the interest rates of the large banks in our regression analysis.

[1] Deloitte Access Economics, *Personal home loans: Price responsiveness as one dimension of assessing competition – A report for BNZ,* 1 December 2023.
[2] Frontier Economics, *Memo to ANZ: Review of Link Economics report on behalf of Kiwibank*, 7 December 2023.

1 Deloitte Access Economics Submission

3. DAE choose to use a vector autoregressive (VAR) approach to model the responsiveness of banks' personal home loan advertised rates to each other. A vector autoregressive approach is a time-series system-estimator that regresses the endogenous variables, in this case the advertised interest rates of banks, on lags of those variables and on contemporaneous and lags of other exogenous variables. DAE used only one exogenous variable, a cost benchmark rate, which appears to enter the VAR only as a contemporaneous variable. The banks analysed by DAE include ANZ, ASB, Westpac, BNZ, Kiwibank and a catch-all "other" set of banks, the interest rate for which was determined as the unweighted average of the advertised rates of these other banks.

4. A VAR approach was not considered by Link Economics because it is not a suitable estimation routine for the data that is to be modelled. VAR models are typically used in academic settings to understand the time series movements in the cycles of aggregate macroeconomic variables. The approach is mainly used to examine the impact that a shock to one macroeconomic aggregate has on another macroeconomic aggregate both in the short and long terms. It works best in the case of data that is highly cyclical, with significant volatility, because this generates the best environment for capturing the dynamics of the co-movement between variables.

5. While DAE does not present a graph of the dependant variables in its VAR system, it is highly likely that the weekly data that is used displays a series of horizontal lines that are interrupted by step changes each time interest rates move up and down.[3] The VAR estimation procedure was not designed to explain variables that move over time in this fashion. Instead, the VAR procedure requires significantly greater volatility so that it can identify dynamic co-movements between variables. The likely impact of using a VAR procedure to explain variables that lack strong cyclical movements at each observation point is a lack of explanatory power, coefficients that present non-logical signs, and high standard error estimates for individual coefficients. DAE does not present its full set of results and so it is not possible to determine if these issues are a part of the estimated DAE VAR.

6. A problem that DAE is likely to have encountered in the use of a VAR estimation procedure is the correct selection of the lag length. This is typically an exceptionally difficult exercise with data that is highly cyclical, but the problem is magnified when it displays long periods of side-ways movement then step jumps. The lag length that is chosen depends on the lag length selection strategy that is adopted. This strategy will require answers to the following questions:

    i. What is the starting (maximum) lag length?

    ii. Does every right-hand side variable have the same starting lag length?

    iii. Does the final specification continue to assume that every right-hand side variable has the same lag length, or does it somehow use an approach that

[3] See for example, Figure 1 of the Link Economics report, "The nature of competition for personal banking services – 5 October 2023," which contains variable home lending rates.

allows the final VAR specification to arrive at different lag lengths for different variables?

7. Answers to these three questions deeply influence the results that are generated by the VAR. The fact that the estimated VAR finds that lags of up to 9 weeks are present in the interest rate data would suggest that the estimation routine found it difficult to find a suitable lag length, because one would not expect a bank to wait 9 weeks before it reacts to changes in the rate of interest of other banks against which it competes.[4]

8. The VAR procedure is also not suitable because it does not enable the analyst to model the contemporaneous movements between interest rates. This is likely to be the strongest set of movements between rates. Without considering these movements, the model or estimation procedure is omitting the most important set of interest rate relationships. In our view, DAE should have attempted to use a different technique that accommodates a contemporaneous set of relationships as opposed to using a technique that assumes them away, which is tantamount to "throwing the baby out with the bathwater".

9. In paragraph 74 of the DAE submission, the suggestion is that DAE has estimated a VAR with a given lag length, and then the lag length has been increased to generate residuals that are well behaved. This would imply that the initial VAR was estimated with relevant variables omitted, which in turn is likely to generate omitted variable bias. The approach that should have been used is a general-to-specific approach in which a sufficiently general VAR is estimated, and then variables that are not contributing to explanatory power can be omitted without upsetting the properties of a spherical residual variance/covariance matrix.

10. DAE also use a method called Granger Causality to test the hypothesis that a set of lagged interest rates on a particular bank jointly cause the interest rates of a particular bank. The problem with this test is that it provides no information about the sign of the causality. It does not enable us to answer the question: Does bank A increase its interest rates in response to bank B raising its interest rates? It will only allow us to answer the question: Does bank A change its interest rates when bank B changes its interest rates? To understand the direction of impact of one banks interest rates on another banks interest rates one would need to deep dive into the signs of the coefficient estimates that are a part of the VAR, however given the problems presented above one suspects that a number of these coefficients will have the incorrect negative sign attached to them, rendering them difficult to interpret.

2 Frontier Economics Submission

11. A key criticism of the Link Economics submission that is erroneously highlighted by Frontier Economics is that the contemporaneous regression that Link Economics estimates should not include the average of the interest rates of the big banks. Instead, Frontier Economics takes the view that three separate variables for the interest rates of the other big three banks should be used. In other words, the interest rates of the big three banks should be stand-alone independent variables in the contemporaneous regression.

[4] See Table 8 of the DAE report, which describes the lags that were used in the VAR analysis that generates the results that are presented in Tables 5 and 6 of that report.

12. The problem with the Frontier Economics proposal is that it is not possible to disentangle the impact of the big banks rates because they share a +99.7% correlation. This means that there is unlikely to be any information in the interest rates of one of the other big banks that is not already contained in the interest rates of the other two big banks to explain the movement in the dependent variable. The only feasible way to treat this problem is to use a single variable on the right-hand side of the regression that is the average of the interest rates of the three big banks, which is precisely the method that is used by Link Economics.

13. The problem with using each of the other three big bank interest rates on the right-hand side of the regression is well-highlighted by the estimated regression equation that Frontier Economics presents. The coefficient attached to the Westpac (WBC) interest rate variable in the Frontier regression has the incorrect negative sign. The negative sign on WBC is a direct result of the high levels of correlation between the interest rates of Westpac and the other major banks. This indicates precisely why the big banks interest rate variables should be averaged and this average used as the right-hand side variable. The negative coefficient on WBC simply means that you cannot trust the regression results presented by Frontier Economics because this variable generates an abnormal sign.

14. If you were to remove the WBC interest rate variable from the regression, the whole regression falls apart and cannot be used. The results of omitting the Westpac interest rate variable as follows:

Dependent Variable: ANZ
Method: Least Squares
Date: 02/15/24 Time: 13:52
Sample (adjusted): 2018M04 2023M08
Included observations: 65 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.408205	0.313801	7.674307	0.0000
ASB	0.173292	0.100125	1.730760	0.0886
BNZ	0.208249	0.116363	1.789649	0.0786
CASH	0.471550	0.051703	9.120439	0.0000
KBRATES	0.057815	0.031469	1.837190	0.0711

R-squared	0.996930	Mean dependent var	5.688462
Adjusted R-squared	0.996725	S.D. dependent var	1.314224
S.E. of regression	0.075209	Akaike info criterion	-2.263283
Sum squared resid	0.339385	Schwarz criterion	-2.096023
Log likelihood	78.55670	Hannan-Quinn criter.	-2.197288
F-statistic	4870.590	Durbin-Watson stat	0.887869
Prob(F-statistic)	0.000000		

15. In these new set of results with the Westpac variable omitted, no variable is statistically significant at the 5% level except the cash rate. The most significant interest rate variable on the right-hand side of the regression is the Kiwibank variable, which is significant at the 7.1% level while the interest rates of the other banks are significant at the 8.9% and 7.9% levels.

16. Frontier separately pointed out that it could not replicate the Link Economics regression of the Bank of New Zealand interest rates. We have corrected the regression and present the

amended results in the following. These results are for the standard variable rate regression that includes the correct weighted average interest rates of the big banks.

Variable	Coefficient	Standard Error	t-value	Probability
Constant	-0.143177	0.424510	-0.337275	0.7371
$\frac{\text{ASB Rate}_t + \text{ANZ Rate}_t + \text{WBC Rate}_t}{3}$	1.003488	0.110069	9.116864	0.0000
Cash Rate_t	-0.118489	0.085640	-1.383560	0.1716
Kiwi Rate_t	0.063671	0.034475	1.846878	0.0697
Kiwiup_t	-0.009867	0.018216	-0.541657	0.56901
R^2 = 99.6%				

17. The results indicate that the Kiwibank standard variable mortgage rate does not statistically significantly cause the standard variate mortgage rate of BNZ at the 5% level of significance. The average standard variable mortgage rate of the other big banks does statistically significantly cause the standard mortgage rate of BNZ at the 5% level of statistical significance. If the Kiwiup variable is omitted from the multivariate regression, the estimated regression becomes:

Variable	Coefficient	Standard Error	t-value	Probability
Constant	-0.214386	0.401295	-0.534236	0.5951
$\frac{\text{ASB Rate}_t + \text{ANZ Rate}_t + \text{WBC Rate}_t}{3}$	1.013086	0.108003	9.380186	0.0000
Cash Rate_t	-0.144482	0.070521	-2.048780	0.0448
Kiwi Rate_t	0.073088	0.029598	2.469345	0.0164
R^2 = 99.6%				

18. The Kiwibank standard variable mortgage rate is statistically significant in this case at the 1.6% level, indicating that Kiwibank's standard variable mortgage rate does statistically significantly influence BNZ's standard mortgage rate, although the regression is difficult to interpret given that the cash rate has a statistically significant negative sign.

About the authors

Dr. Anthony (Tony) G. Webber is an economist and a quantitative modelling expert. He has a PhD in economics with coursework majors in advanced time series econometrics, and has three decades of applied experience in statistical, mathematical, and economic modelling. These skills have led him to be engaged as an expert witness in a number of Federal Court cases in Australia.

Tony has held academic positions at the University of New England, the University of Wollongong, the University of NSW, the University of Sydney, Swinburne University of Technology and the University of Technology Sydney. Dr Webber has also been involved with overseas universities including the University of Lund in Sweden, Copenhagen University in Denmark, and Embry Riddle Aviation University in Florida, U.S.A. He has lectured on a range of subjects, including advanced time series econometrics, advanced microeconomics and macroeconomics, and quantitative methods, and he has published numerous journal articles and books on the topic of applied econometrics.

Emma Ihaia

Emma Ihaia specialises in competition analysis and regulatory economics, with 25 years of experience in this field. Emma has been retained as an expert in the context of regulatory investigations and consultations, and has prepared competition assessments for merger clearances, authorisations, and market reviews. She has also provided expert evidence for legal proceedings.

Emma has previously worked for several international economics consultancies and established Link Economics in 2012. She holds a Master of the Arts (First Class Honours) in Economics from the University of Auckland, where she specialised in microeconomics and advanced econometric analysis.

David de Boer has a focus on regulatory economics and the application of regulatory systems in the real world. David has advised on regulatory determinations and on the establishment and periodic review of regulatory regimes. He has also undertaken market reviews, advised on mergers, and has published research on regulation and market performance.

David has a professional career that spans both economic consulting and the management of regulated entities. David has worked on the design and implementation of the regulatory regimes across multiple sectors. He spent several years as a senior consultant at the New Zealand Institute of Economic Research (NZIER). David is experienced in implementing structural market change to improve consumer outcomes. David holds an MCA (Economics) and an MBA (Finance & Strategy) from Victoria University.

Disclaimer

Although every effort has been made to ensure the accuracy of the material and the integrity of the analysis presented in this report, Link Economics Ltd accepts no liability for any actions taken based on the report's contents.

© Link Economics Ltd 2024