Final Plan Attachment 10.2

Replacement and Extension of Henry's Beta Analysis

A Report by CEG

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1   Executive summary

1.   Johnson Winter & Slattery commissioned CEG to replicate and extend the beta analysis from Henry[1] (2014) to the most recent period (June 2015). Henry's original analysis was based on the daily closing price, historical market capitalisation and net debt value of a collection of nine stocks ending on 28 June 2013. We have extended Henry's sample to include an additional three year of data up until 18 June 2016.

2.   Our replication results are derived by regressing return series we have constructed for the relevant assets/portfolios. These have been compared to, and found to be consistent with, the "Historical Beta" estimates sourced directly from the Bloomberg terminal using "ASX 300 accum[2]" as the benchmarking index. However, while our results are broadly similar to Henry's raw equity betas in his Appendix A there are some slight differences (as detailed below).

3.   Our extension of Henry's analysis shows that the average re-levered equity beta has increase materially by 0.1 using the most recent five years of data. This reflects a number of factors including an increase/decrease in the raw equity betas/gearing ratios of the remaining listed stocks (APA, DUE, SKI, AST) and an increase in the weighting of high-beta stocks (e.g. APA) in the value-weighted portfolios.

4.   We note that the measured increase in beta is consistent with the observation from our DBP report[3] which identifies a structural break in the average rolling beta series at 2014/15.

5.   This report is structured as follows:

   - Section 3 replicates and extend Henry's analysis on individual firm betas;

   - Section 4 replicates and extend Henry's portfolio analysis;

   - Section 5 discusses the most recent 5 and 1 year estimates of the equity beta; and

   - The final section provides a summary of the replication and extension results.

1.1   Key results

6.   Table 1 below summarises the result from our extension to Henry's individual stock beta analysis. This table is directly compared with Table 3-30 from the AusNet

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[1]   Olan T. Henry, *Estimating β: An update*, April 2014

[2]   The same benchmarking index used by Henry (2014).

[3]   CEG, Estimating beta to be used in the Sharpe-Lintner CAPM, February 2016, Section 5

Services draft decision (July 2016). Evidence suggests that beta has increased around 0.10 or more since the end of Henry's sampling period.

Table 1: Summary of extension results for re-levered OLS weekly individual beta estimates

	Longest available period	Longest available period (excl. tech boom and GFC)	Last five years
Henry original results	0.52	0.56	0.46
CEG extension results	0.60	0.66	0.65
Change	**0.08**	**0.10**	**0.19**

Bloomberg data, CEG analysis

7. It should be noted that Henry's average "last five years" beta estimates includes six firms (APA, DUE, DNV, HDF, SKI and AST), among which ENV and HDF were delisted in 2013 and 2014, respectively. Including these two stocks at the time of our estimates (June 2016) would result in a considerably smaller number of observations than other stocks (169 for ENV and 75 for HDF as compared with 260 for others). Therefore, our "last five years" beta estimates is only averaged across the four currently listed firms as in Table 11.

8. Table 2 below shows the measured betas for the six portfolios as outlined in section 4.1 for the two sampling periods. Portfolios 1 to 4 have all have firms in them for which there is no additional data and, therefore, the change in beta estimates is muted (given that some firms have the same beta simply because there is no additional data). Portfolio 5 is the only portfolio comprised solely of firms with additional data (SKI, APA, ENV, DUE, AST). Portfolio 6 is added by CEG and is the same as Portfolio 5 but excludes Envestra which only has one year of additional data. Compared with Table 3-31 from the AusNet Services draft decision (July 2016), and focusing on portfolio 5, Table 14 suggests that average portfolio beta has increased by around 0.13 or more as a result of updating Henry's analysis.

Table 2: Summary of extension results for re-levered OLS weekly portfolio beta estimates

	P1	P2	P3	P4	P5	P6
Equal weighted						
Longest available period	0.52	0.56	0.52	0.53	0.52	0.54
Increase vs Henry	0.06	0.04	0.02	0.05	0.13	N/A
Longest available period (excl. tech boom and GFC)	0.56	0.56	0.58	0.61	0.61	0.64
Increase vs Henry	0.07	0.04	0.03	0.08	0.16	N/A
Value weighted						
Longest available period	0.61	0.76	0.44	0.46	0.54	0.55
Increase vs Henry	0.11	0.06	0.00	0.04	0.15	N/A
Longest available period (excl. tech boom and GFC)	0.66	0.76	0.53	0.56	0.65	0.66
Increase vs Henry	0.12	0.06	0.01	0.06	0.17	N/A

Bloomberg data, CEG analysis

2 Introduction

9. I have been asked by Johnson Winter & Slattery to provide a report on the replication and extension of the beta analysis from Henry[4] (2014) to the most recent period (June 2015).

10. The remainder of this report has the following structure:

   ▪ Section 3 replicates and extend Henry's analysis on individual firm betas;

   ▪ Section 4 replicates and extend Henry's portfolio analysis; and

   ▪ Section 5 discusses the most recent 5 and 1 year estimates of the equity beta

11. I acknowledge that I have read, understood and complied with the Federal Court of Australia's Practice Note CM 7, "Expert Witnesses in Proceedings in the Federal Court of Australia". I have made all inquiries that I believe are desirable and appropriate to answer the questions put to me. No matters of significance that I regard as relevant have to my knowledge been withheld.

12. I have been assisted in the preparation of this report by Yanjun Liu in CEG's Sydney office. However, the opinions set out in this report are my own.

Thomas Nicholas Hird

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[4]   Olan T. Henry, *Estimating β: An update*, April 2014

3   Individual stock beta

3.1   Sampling period

13. Table 3 below summarises our extended sampling period for Henry's (weekly) beta analysis. It can be seen that for the four stocks that are still listed (APA, DUE, SKI and AST), our analysis has included an additional 155 weekly observations while for ENV there was only 63 new data points as it was delisted in October 2014.

Table 3: Extended sampling period of Henry's analysis

Bloomberg ticker	Henry start date	Henry end date	Henry # of observations	CEG extended end date	CEG # of observations	Difference in # of observations
AAN AU Equity	20/10/2000	17/08/2007	356	-	356	0
AGL AU Equity	29/05/1992	6/10/2006	749	-	749	0
APA AU Equity	16/06/2000	28/06/2013	680	20/06/2016	835	155
DUE AU Equity	13/08/2004	28/06/2013	463	20/06/2016	618	155
ENV AU Equity	29/08/1997	28/06/2013	826	20/06/2016	889	63
GAS AU Equity	21/12/2001	10/11/2006	255	-	255	0
HDF AU Equity	17/12/2004	23/11/2012	414	-	414	0
SKI AU Equity	2/03/2007	28/06/2013	330	20/06/2016	485	155
AST AU Equity	16/12/2005	28/06/2013	393	20/06/2016	548	155

Bloomberg data, CEG analysis

14. It should be noted that the following stock ticker changes have occurred: AGL AU Equity was renamed from AGK AU Equity for AGL energy limited; and AST AU Equity is renamed from SPN AU Equity for SP Ausnet.

3.2   CEG replication of Henry's Table 2 and A1

15. Henry's Table 2 shows the de-levered/re-levered beta and Table A1 in his appendix shows the corresponding raw estimates of equity beta. In replicating these tables, we sourced historical closing price, market capitalisation and net debt for each of the nine firms in the sample. We then calculate various beta measures using the open source statistic software R.

16. The replication results are shown in Table 4 below. Consistent with Henry's notation, **w** stands for the re-levering factor[5] and gearing is calculated based on the average market capitalisation and net debt during the sampling period.

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[5]   W = (1-gearing)/(1-0.6)

Table 4: CEG replication of weekly individual beta estimates (Henry's longest sampling period using weekly data)

stock	equity beta	asset beta	w	gearing	re-levered equity beta_CEG (replication)	re-levered equity beta_Henry (actual)
AAN	0.570	0.380	1.567	0.373	0.893	0.880
AGL	0.383	0.265	1.738	0.305	0.666	0.681
APA	0.542	0.256	1.117	0.553	0.606	0.594
DUE	0.482	0.135	0.621	0.752	0.299	0.283
ENV	0.431	0.123	0.689	0.724	0.297	0.304
GAS	0.347	0.124	0.895	0.642	0.311	0.314
HDF	0.742	0.447	1.491	0.404	1.106	1.031
SKI	0.379	0.226	1.364	0.455	0.517	0.329
AST	0.294	0.120	0.995	0.602	0.292	0.287
Average	**0.460**	**0.230**	**1.160**	**0.530**	**0.554**	**0.522**

Bloomberg data, CEG analysis

17. The last two columns in Table 4 compares our replication and Henry's actual figure side-by-side for each individual stock. We note that our estimates are different to Henry's, most notably for SKI, although the average figure is similar.

18. To examine robustness of our estimates (and the discrepancy with Henry's estimates), we have compared our estimates with the "Raw beta" from Bloomberg's "Historical Beta" field[6] and found that our estimates are consistent with the figures from Bloomberg based on Henry's sample and benchmark index (ASX 300 accum); while Henry's raw beta from his Table A1 is slightly different.

19. We note that most of the difference in re-levered equity is due to differences in gearing estimates. For example, for SKI our gearing figure is 45.5% while Henry's is 66%. Similarly, our gearing estimate for HDF is materially lower (40% vs 48%). We have very similar gearing estimates for the other firms.

20. However, given our result is consistent with Bloomberg's figures and the difference in average is minimal, we have used our replication as the reference to compare with the results from the extended sample in the following sections.

3.3 CEG extension of Henry's Table 2 (as of June 2016)

21. Table 5 below shows our extension to Henry's Table 2. The red column corresponds to our replication of Henry's figure in Table 4 while the blue column shows the

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[6] Screenshots included in Appendix A.

estimated (re-levered) equity beta based on the extended sample; the last column calculates the difference.

Table 5: CEG extension of weekly individual beta estimates (Henry's longest sampling period extended until June 2016 using weekly data)

stock	equity beta	asset beta	w	gearing	re-levered equity beta_CEG (**replication**)	re-levered equity beta_CEG (**extension**)	change
AAN	0.570	0.380	1.567	0.373	0.893	0.893	0.000
AGL	0.383	0.265	1.738	0.305	0.666	0.666	0.000
APA	0.566	0.268	1.241	0.504	0.606	0.703	0.097
DUE	0.458	0.129	0.737	0.705	0.299	0.337	0.038
ENV	0.433	0.124	0.737	0.705	0.297	0.319	0.023
GAS	0.347	0.124	0.895	0.642	0.311	0.311	0.000
HDF	0.742	0.447	1.491	0.404	1.106	1.106	0.000
SKI	0.421	0.250	1.545	0.382	0.517	0.650	0.133
AST	0.364	0.149	1.035	0.586	0.292	0.377	0.085
Average	**0.480**	**0.240**	**1.220**	**0.510**	**0.554**	**0.596**	**0.042 – 0.088***

Bloomberg data, CEG analysis. * The bottom end of this range shows the change measured as the average across all betas – including for those that have no additional data and, therefore, have no change. The top end of this range is the change only for the four firms currently listed (i.e., the firms for which there is 3 years additional data which do not include ENV for which there is only an additional 13 months of data).

22. Our result suggests that the average re-levered equity beta has increased by around 0.04 simply by adding data since the end of Henry's sampling period in mid 2013 (or an increase of around 0.09 if we focus only on the firms for which 3 years of additional data is available).

4 Portfolio beta

4.1 Portfolio construction

23. Following the instructions from the AER, Henry (2014) constructed five portfolios each with different constituent stocks and sampling period[7]. In additional to these five portfolios, our portfolio analysis includes a sixth portfolio consists of the remaining four listed stocks (APA, DUE, SKI and AST) as ENV was delisted in 2014.

24. Table 6 below summarises the constituent stocks and sampling periods for our portfolio analysis. It can been seen P2-P4 are not affected by the extension as their portfolio end date is set to be before 2013.

Table 6: Portfolio construction and sampling period

Portfolio	Constituent stocks	Henry start date	Henry end date	Henry # of observations	CEG end date	CEG # of observations
P1	APA, ENV	16/06/2000	28/06/2013	680	20/06/2016	789
P2	AAN, AGL, APA, ENV, GAS	21/12/2001	06/10/2006	250	06/10/2006	250
P3	APA, DUE, ENV, HDF, AST	16/12/2005	23/11/2012	362	23/11/2012	362
P4	APA, DUE, ENV, HDF, SKI, AST	02/03/2007	23/11/2012	299	23/11/2012	299
P5	APA, DUE, ENV, SKI, AST	02/03/2007	28/06/2013	330	20/06/2016	467[8]
P6	APA, DUE, SKI, AST	02/03/2007	28/06/2013	330	20/06/2016	485

Bloomberg data, CEG analysis

4.2 CEG replication and extension of Henry's Table 14 and A4

25. Henry's Table 14 and A4 document the beta estimates for five *equal*-weighted portfolio consists of different stocks and sampling periods. This section attempts to replicate his results.

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[7]   Olan T. Henry, *Estimating β: An update*, April 2014, P. 35

[8]   ENV was delisted in 2014 so the # of observations is different for ENV and the remaining four stocks in P5.

26.　As noted before, our beta estimates are slightly different from Henry's results. Table 7 below shows our replication result side-by-side with Henry's estimates for the equal-weighted portfolios. Note that Henry has only five portfolios while we have six. The different in average (re-levered) equity beta is around 0.03.

Table 7: CEG replication of weekly equal-weighted portfolio beta

Portfolio	equity beta	asset beta	w	gearing	re-levered equity beta_CEG (replication)	re-levered equity beta_Henry (actual)
p1	0.505	0.187	0.911	0.636	0.460	0.458
p2	0.441	0.240	1.264	0.495	0.557	0.520
p3	0.531	0.219	0.977	0.609	0.519	0.504
p4	0.514	0.218	1.026	0.589	0.528	0.476
p5	0.461	0.175	0.969	0.613	0.446	0.387
p6	0.445	0.179	1.020	0.592	0.454	-
Average[9]	**0.490**	**0.208**	**1.029**	**0.588**	**0.502**	**0.469**

Bloomberg data, CEG analysis

27.　Consistent with the approach adopted in the previous section, we use our replication as the reference to compare with the results from the extended sample in the following sections.

28.　Table 8 below shows our extension of Henry's Table 16. The red column is our replication of Henry's figure while the blue column corresponds to the estimated (re-levered) equity beta based on the extended sample.

Table 8: CEG extension of weekly equal-weighted portfolio beta

Portfolio	equity beta	asset beta	w	gearing	re-levered equity beta_CEG (replication)	re-levered equity beta_CEG (extension)	change
p1	0.518	0.211	0.998	0.601	0.460	0.517	0.057
p2	0.441	0.240	1.264	0.495	0.557	0.557	0.000
p3	0.531	0.219	0.977	0.609	0.519	0.519	0.000
p4	0.514	0.218	1.026	0.589	0.528	0.528	0.000
p5	0.482	0.209	1.087	0.565	0.446	0.524	0.078
p6	0.471	0.217	1.148	0.541	0.454	0.541	0.087
Average	**0.493**	**0.219**	**1.083**	**0.567**	**0.494**	**0.531**	**0.037-0.074***

*Bloomberg data, CEG analysis. Bloomberg data, CEG analysis. * The bottom end of this range shows the change measured as the average across all betas – including for those that have no additional data and,*

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[9]　Portfolio 6 is excluded in the average as this portfolio is not included in Henry's (2014) analysis.

therefore, have no change. The top end of this range is the change only for the three portfolios for which there is additional data).

29.   Consistent with the result from Table 5, Table 8 shows that the average beta has increased by around 0.04 since the end of Henry's sample period (or an increase of around 0.07 if we focus only on the portfolios for which additional data is available)..

4.3   CEG replication and extension of Henry's Table 16 and A6

30.   Henry's Table 16 and A6 present the beta estimates for five *value*-weighted portfolios consisting of different stocks and sampling periods. To replicate his result we must calculate the weight for each constituent stock in the portfolios based on their average market capitalisation in the sampling period.

31.   Figure 1 below shows the calculated weights for each of the stocks in their corresponding portfolios based on the "Hist_mkt_cap" field from Bloomberg. We note that these weighting are close, albeit not identical, to the weights used by Henry[10] (2014).

Figure 1: CEG replication of weights in value-weighted portfolios
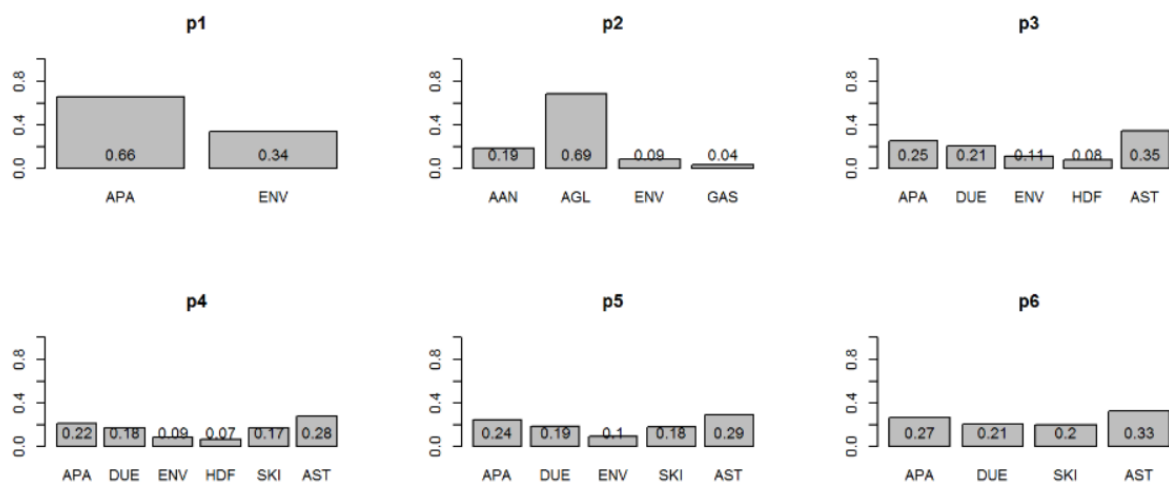
Bloomberg data, CEG analysis

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[10]   Olan T. Henry, *Estimating β: An update*, April 2014, Annex A.

32. Table 9 below shows our replication result side-by-side with Henry's estimates for the value-weighted portfolios. We note that the difference between our replication and Henry's actual figure is 0.03, on average.

Table 9: CEG replication of weekly value-weighted portfolio beta

Portfolio	equity beta	asset beta	w	gearing	re-levered equity beta_CEG (replication)	re-levered equity beta_Henry (actual)
p1	0.517	0.205	0.977	0.609	0.505	0.498
p2	0.459	0.307	1.653	0.339	0.758	0.703
p3	0.469	0.181	0.939	0.625	0.441	0.436
p4	0.463	0.187	0.999	0.600	0.463	0.420
p5	0.446	0.175	0.994	0.602	0.443	0.390
p6	0.438	0.177	1.019	0.593	0.446	
Average[11]	**0.471**	**0.211**	**1.112**	**0.555**	**0.522**	**0.489**

Bloomberg data, CEG analysis

33. Following Henry's approach, we have calculated the portfolio weights to be applied in the extended sampling periods. This is shown in Figure 2 below. Compared with Figure 1, Figure 2 shows that the average market capitalisation for APA has increased relative to other stocks. As a consequence, its weight in portfolio p1, p5 and p6 has been lifted.

Figure 2: CEG extension of weights in value-weighted portfolios

Bloomberg data, CEG analysis

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[11] Portfolio 6 is excluded in the average as this portfolio is not included in Henry's (2014) analysis.

34. Table 10 below shows our extension to Henry's Table 16. The red column corresponds our replication of Henry's figure while the blue column shows the estimated (re-levered) equity beta based on the extended sample.
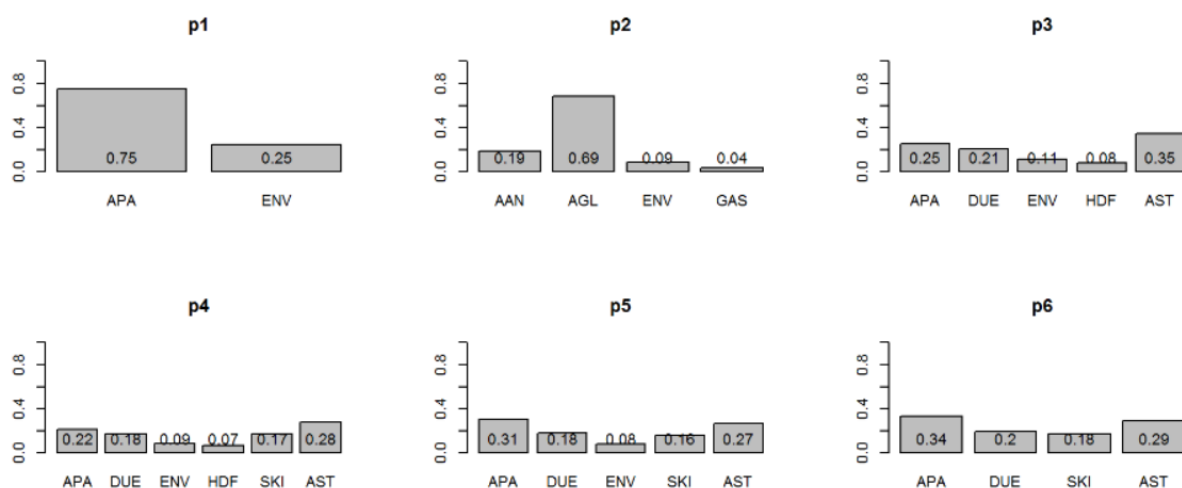
Table 10: CEG extension of weekly value-weighted portfolio beta

Portfolio	equity beta	asset beta	w	gearing	re-levered equity beta_CEG (replication)	re-levered equity beta_CEG (extension)	change
p1	0.542	0.246	1.120	0.552	0.505	0.607	0.102
p2	0.459	0.307	1.653	0.339	0.758	0.758	0.000
p3	0.469	0.181	0.939	0.625	0.441	0.441	0.000
p4	0.463	0.187	0.999	0.600	0.463	0.463	0.000
p5	0.487	0.219	1.118	0.553	0.443	0.544	0.101
p6	0.484	0.223	1.142	0.543	0.446	0.552	0.107
Average	**0.484**	**0.227**	**1.162**	**0.535**	**0.509**	**0.561**	**0.052 - 0.103***

Bloomberg data, CEG analysis. * The bottom end of this range shows the change measured as the average across all betas – including for those that have no additional data and, therefore, have no change. The top end of this range is the change only for the three portfolios for which there is additional data).

35. Consistent with results from Table 5 and Table 8, Table 10 shows that the de-levered/re-levered equity beta has increase by 0.05 on average (or an increase of around 0.10 if we focus only on the portfolios for which additional data is available).

5 Most recent beta

5.1 Last five years beta (Henry's Table 4 and A3)

36. Henry's Table 4 and A3 shows his estimates of the weekly beta for the "last five year". To draw a comparison, we have also estimated the re-levered equity beta for the most recent 261 weeks. Results are shown in Table 11 below[12].

Table 11: CEG extension of weekly individual beta estimates for the most recent 5 years

Portfolio	equity beta	asset beta	w	gearing	re-levered equity beta_Henry (actual)	re-levered equity beta_CEG (extension)	change
APA	0.547	0.298	1.361	0.456	0.540	0.745	0.205
DUE	0.274	0.096	0.877	0.649	0.244	0.240	-0.004
SKI	0.478	0.345	1.800	0.280	0.299	0.861	0.563
AST	0.691	0.297	1.073	0.571	0.273	0.741	0.469
Average	**0.498**	**0.259**	**1.278**	**0.489**	**0.339**	**0.647**	**0.308**

Bloomberg data, CEG analysis

37. Apart from DUE which experienced a minimal decline, the 5-year weekly beta for the remaining three stocks have all increased considerably, almost doubling on average. We note that the rise in beta is much more apparent when examining the last 5 years because the "longest possible sample" analysis due to the relatively small weight additional data receives in the longer historical estimates.

5.2 Last one year beta

38. As noted in our DBP report[13], a 5 year equity beta gives less weight to the most recent data and so will typically rise/fall more slowly after the point at which beta in the market rises/falls. To illustrate, Table 12 below shows our estimates of the weekly beta for the most recent 52 weeks. It can be seen that the increase in beta (comparing 1 year estimates to Henry's five year estimates) is around 0.13 (Table 12 vs Table 11).

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12   ENV and HDF are not included because they were delisted thus had considerably less amount of observations.

13   CEG, Estimating beta to be used in the Sharpe-Lintner CAPM, February 2016, Para. 115

Table 12: CEG extension of weekly individual beta estimates for the most recent 52 weeks

Portfolio	equity beta	asset beta	w	gearing	re-levered equity beta_CEG (extension)	Change (with respect to Henry's five year beta)
APA	0.669	0.343	1.282	0.487	0.858	0.318
DUE	0.308	0.135	1.097	0.561	0.337	0.093
SKI	0.625	0.462	1.847	0.261	1.154	0.855
AST	0.699	0.300	1.074	0.570	0.750	0.478
Average	**0.575**	**0.310**	**1.325**	**0.470**	**0.775**	**0.436**

Bloomberg data, CEG analysis

6 Summary of replication and extension results

39. We have also replicated and extended Henry's table 3, 7, 15, 17, A2, A5 and A7 associated the sampling period excluding the technology boom (prior to 2002) and the GFC period (29/08/2008 to 06/11/2009). The detailed results are can be found in Appendix B.

40. Table 13 below summarises the result from our extension to Henry's individual stock beta analysis. This table is directly compared with Table 3-30 from the AusNet Services draft decision (July 2016). This evidence suggests that beta has increased around 0.10 or more since the end of Henry's sampling period.

Table 13: Summary of extension results for re-levered OLS weekly individual beta estimates

	Longest available period	Longest available period (excl. tech boom and GFC)	Last five years
Henry original results	0.52	0.56	0.46
CEG extension results	0.60	0.66	0.65
Change	**0.08**	**0.10**	**0.19**

Bloomberg data, CEG analysis

41. It should be noted that Henry's average "last five years" beta estimates includes six firms (APA, DUE, DNV, HDF, SKI and AST), among which ENV and HDF were delisted in 2013 and 2014, respectively. Including these two stocks at the time of our estimates (June 2016) would result in a considerably less number of observations than other stocks (169 for ENV and 75 for HDF as compared with 260 for others). Therefore, our "last five years" beta estimates is only averaged across the four currently listed firms as in Table 11.

42. Table 14 below shows the measured betas for the six portfolios as outlined in section 5 for the two sampling periods. Portfolio 5 is the only portfolio comprised of firms with additional data (portfolio 6 is added by CEG and is the same as Portfolio 5 but excludes Envestra). Compared with Table 3-31 from the AusNet Services draft decision (July 2016), and focusing on portfolio 5, Table 14 suggests that average portfolio betas has since then increased by around 0.13 or more (focusing on portfolio 5).

Table 14: Summary of extension results for re-levered OLS weekly portfolio beta estimates

	P1	P2	P3	P4	P5	P6[14]
Equal weighted						
Longest available period	0.52	0.56	0.52	0.53	0.52	0.54
Increase vs Henry	0.06	0.04	0.02	0.05	0.13	N/A
Longest available period (excl. tech boom and GFC)	0.56	0.56	0.58	0.61	0.61	0.64
Increase vs Henry	0.07	0.04	0.03	0.08	0.16	N/A
Value weighted						
Longest available period	0.61	0.76	0.44	0.46	0.54	0.55
Increase vs Henry	0.11	0.06	0.00	0.04	0.15	N/A
Longest available period (excl. tech boom and GFC)	0.66	0.76	0.53	0.56	0.65	0.66
Increase vs Henry	0.12	0.06	0.01	0.06	0.17	N/A

Bloomberg data, CEG analysis

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[14] Comparisons are made against replication of Henry (2014), because this portfolio is not included in Henry's (2004) analysis.

Appendix A   Bloomberg historical beta screenshots

43.   Figure 3 shows a number of screenshots from the Bloomberg "Historical beta" field for AAN, APA, DUE, ENU, GAS, HDF, SKI and AST. The "Raw Beta" in the right sidebar column can be compared directly with "equity beta" column in Table 4 of this report. This demonstrates that our estimates of the equity beta is consistent with Bloomberg's measure while being slightly different to the figures in Henry (2014).

Figure 3: Bloomberg historical beta screenshots
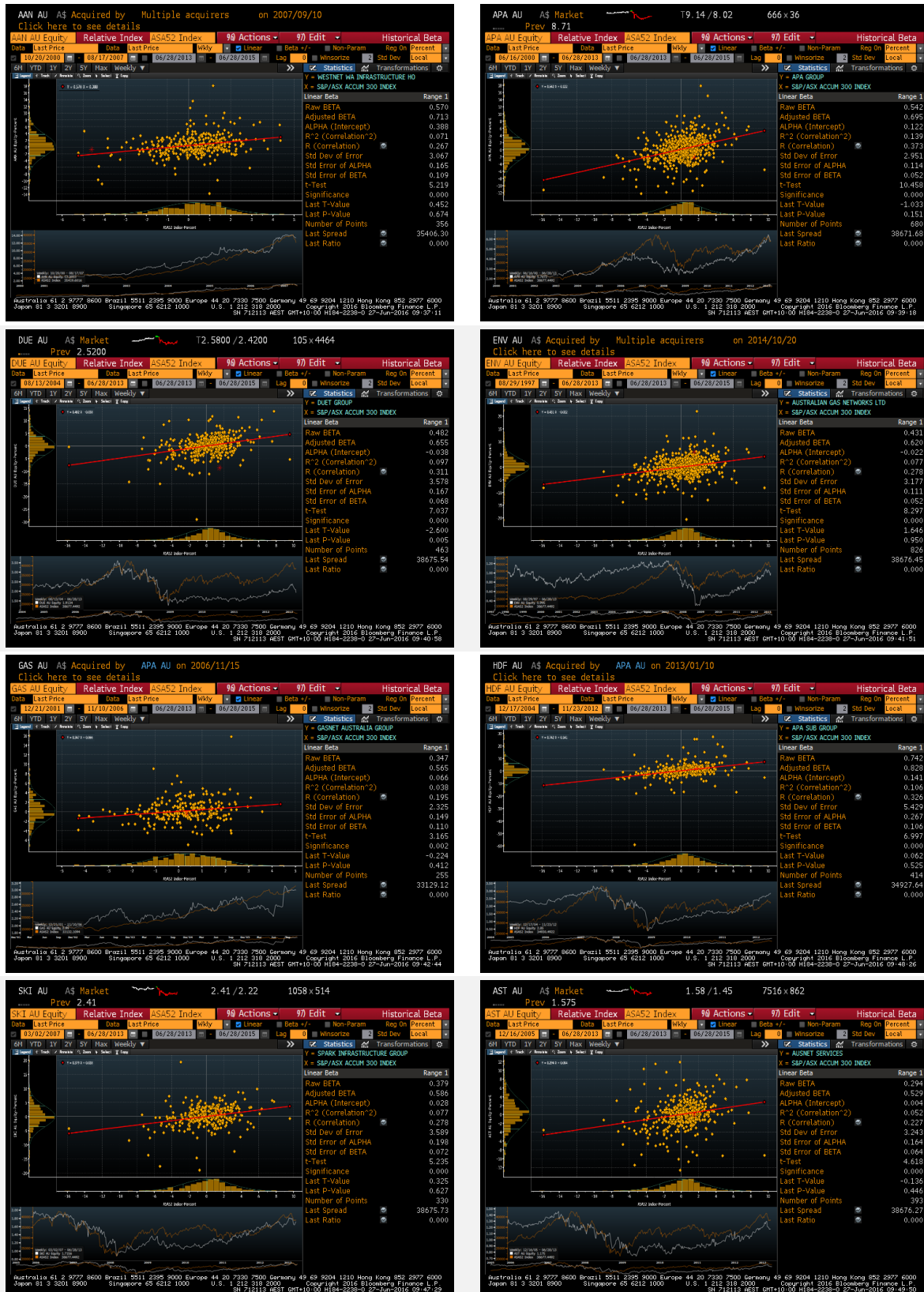
Appendix B CEG replication and extension of Henry's beta analysis for the period after the technology boom but excluding the GFC

B.1 Individual stocks beta

B.1.1 CEG replication of Henry's Table 3 and A2

stock	equity beta	asset beta	w	gearing	re-levered equity beta_CEG (replication)	re-levered equity beta_Henry (actual)
AAN	0.644	0.429	1.567	0.373	1.009	0.996
AGL	0.427	0.295	1.821	0.272	0.777	0.750
APA	0.572	0.277	1.160	0.536	0.663	0.635
DUE	0.504	0.146	0.635	0.746	0.320	0.299
ENV	0.476	0.139	0.756	0.698	0.360	0.366
GAS	0.351	0.125	0.895	0.642	0.314	0.317
HDF	0.684	0.426	1.524	0.390	1.043	0.905
SKI	0.383	0.236	1.422	0.431	0.544	0.340
AST	0.464	0.194	1.024	0.591	0.475	0.468
Average	**0.500**	**0.250**	**1.200**	**0.520**	**0.610**	**0.564**

Bloomberg data, CEG analysis

B.1.2 CEG extension of Henry's Table 3 and A2

stock	equity beta	asset beta	w	gearing	re-levered equity beta_CEG (replication)	re-levered equity beta_CEG (extension)	change
AAN	0.644	0.429	1.567	0.373	1.009	1.009	0.000
AGL	0.427	0.295	1.815	0.274	0.774	0.774	0.000
APA	0.604	0.293	1.273	0.491	0.663	0.768	0.105
DUE	0.462	0.133	0.757	0.697	0.320	0.350	0.030
ENV	0.479	0.140	0.810	0.676	0.360	0.388	0.028
GAS	0.351	0.125	0.895	0.642	0.314	0.314	0.000
HDF	0.684	0.426	1.524	0.390	1.043	1.043	0.000
SKI	0.448	0.276	1.604	0.359	0.544	0.718	0.174
AST	0.528	0.221	1.055	0.578	0.475	0.557	0.082
Average	**0.510**	**0.260**	**1.260**	**0.500**	**0.610**	**0.660**	**0.050**

Bloomberg data, CEG analysis

B.2 Portfolio beta

B.2.1 CEG replication of Henry's Table 15 and A5

Portfolio	equity beta	asset beta	w	gearing	re-levered equity beta_CEG (replication)	re-levered equity beta_Henry (actual)
p1	0.524	0.205	0.958	0.617	0.502	0.493
p2	0.442	0.240	1.264	0.494	0.559	0.521
p3	0.576	0.243	1.012	0.595	0.583	0.550
p4	0.566	0.247	1.068	0.573	0.605	0.532
p5	0.524	0.208	1.012	0.595	0.530	0.454
p6	0.521	0.216	1.061	0.576	0.553	-
Average[15]	**0.526**	**0.229**	**1.063**	**0.575**	**0.556**	**0.510**

Bloomberg data, CEG analysis

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[15]   Portfolio 6 is excluded in the average as this portfolio is not included in Henry's (2014) analysis.

B.2.2 CEG extension of Henry's Table 15 and A5

Portfolio	equity beta	asset beta	w	gearing	re-levered equity beta_CEG (replication)	re-levered equity beta_CEG (extension)	change
p1	0.541	0.231	1.041	0.584	0.502	0.564	0.062
p2	0.442	0.240	1.264	0.494	0.559	0.559	0.000
p3	0.576	0.243	1.012	0.595	0.583	0.583	0.000
p4	0.566	0.247	1.068	0.573	0.605	0.605	0.000
p5	0.540	0.243	1.126	0.550	0.530	0.608	0.078
p6	0.541	0.255	1.183	0.527	0.553	0.640	0.087
Average	**0.534**	**0.243**	**1.116**	**0.554**	**0.555**	**0.593**	**0.038**

Bloomberg data, CEG analysis

B.2.3 CEG replication of Henry's Table 17 and A7

Portfolio	equity beta	asset beta	w	gearing	re-levered equity beta_CEG (replication)	re-levered equity beta_Henry (actual)
p1	0.539	0.223	1.020	0.592	0.549	0.536
p2	0.458	0.307	1.654	0.339	0.757	0.702
p3	0.548	0.219	0.975	0.610	0.534	0.517
p4	0.543	0.226	1.040	0.584	0.565	0.503
p5	0.530	0.216	1.035	0.586	0.548	0.476
p6	0.529	0.221	1.059	0.576	0.560	-
Average[16]	**0.524**	**0.238**	**1.145**	**0.542**	**0.591**	**0.547**

Bloomberg data, CEG analysis

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[16]   Portfolio 6 is excluded in the average as this portfolio is not included in Henry's (2014) analysis.

B.2.4 CEG extension of Henry's Table 17 and A7

Portfolio	equity beta	asset beta	w	gearing	re-levered equity beta_CEG (replication)	re-levered equity beta_CEG (extension)	change
p1	0.572	0.269	1.157	0.537	0.549	0.662	0.113
p2	0.458	0.307	1.654	0.339	0.757	0.757	0.000
p3	0.548	0.219	0.975	0.610	0.534	0.534	0.000
p4	0.543	0.226	1.040	0.584	0.565	0.565	0.000
p5	0.561	0.260	1.153	0.539	0.548	0.647	0.099
p6	0.564	0.266	1.176	0.530	0.560	0.663	0.103
Average	**0.541**	**0.258**	**1.192**	**0.523**	**0.586**	**0.638**	**0.052**

Bloomberg data, CEG analysis

B.3 Most recent beta

B.3.1 Last five year beta (Henry's Table 7)

Portfolio	equity beta	asset beta	w	gearing	re-levered equity beta_Henry (actual)	re-levered equity beta_CEG (extension)	change
APA	0.817	0.445	1.361	0.817	0.772	1.111	0.340
DUE	0.398	0.140	0.877	0.398	0.318	0.349	0.031
SKI	0.151	0.108	1.800	0.151	0.207	0.271	0.064
AST	0.688	0.295	1.073	0.688	0.361	0.738	0.377
Average	**0.513**	**0.247**	**1.278**	**0.513**	**0.414**	**0.617**	**0.203**

Bloomberg data, CEG analysis

B.3.2 Last one year beta

Portfolio	equity beta	asset beta	w	gearing	re-levered equity beta_CEG (extension)	Change (with respect to Henry's five year beta)
APA	0.814	0.417	1.282	0.487	1.043	0.271
DUE	0.435	0.191	1.097	0.561	0.477	0.159
SKI	0.300	0.221	1.847	0.261	0.554	0.346
AST	0.602	0.259	1.074	0.570	0.646	0.286
Average	**0.537**	**0.272**	**1.325**	**0.470**	**0.680**	**0.266**

Bloomberg data, CEG analysis