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REPORT TO FONTERRA: DISCUSSION OF THE ASSET BETA FOR USE IN MILK PRICING

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Author's Credentials

This report has been prepared by Associate Professor Graham Partington and Professor Stephen Satchell. We are senior finance academics who have published several books and many research papers in finance. We have extensive consulting experience, particularly with respect to the cost of capital and valuation. Our *curricula vitae* are available on request.

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Executive Summary

We were asked to conduct a review of documents on the Commerce Commission's web site in relation to determination of the asset beta for the notional processor. The main questions raised in this review and our conclusions are summarised below.

1. Does the notional processor have a low asset beta and is it is likely to be significantly lower than for other dairy processors? The unambiguous answer to this question is yes. There are several reasons for this conclusion, but a key reason is that the main driver of a firm's asset beta is the firm's revenue beta scaled up by operating leverage. In the case of the notional processor the revenue beta is low. The notional processors unique pricing arrangements for milk mean that the effect of operating leverage will be low and also lower than for other processors. Consequently, the notional processor will have a particularly low asset beta.

2. Does the Commerce Commission's comparator set of firms provide an appropriate estimate of the asset beta for the notional processor? The answer to this question is no. First it is clear that the sample is heterogenous and sample members have different characteristics than the notional processer. Adding a large number of unsuitable companies to increase the sample size for estimating beta does not improve matters, but actually makes them worse. Second it is wrong to average betas calculated against different market indices, since they mean different things. Third we point to the problems in de-levering equity betas and the variation in asset betas that can result. We also note that there were no details given about the de-levering process used for the comparator set.

Using the concept of fuzzy sets we suggest that betas for comparators could be weighted according to the comparator's similarity to the notional processor. To overcome the problems in averaging betas computed against different indices we suggest computing betas against a common index, such as a world market index. We have significant reservations about de-levering, but if it is to be done then there should be clarity about every step in the process.

3. Should Fonterra be included in the comparator set? Unequivocally, Fonterra should be included. It provides the closest match for the notional processor and, given the fundamental principle of no arbitrage, there is no reason to suppose that Fonterra's prices will result in uninformative betas.

4. What are the key risks faced by the notional processor? We used a different method of analysis than Lally (2016) but came to the same conclusion: Variation in non-milk variable costs relative to the efficient cost together with errors in the allowed rate of return are key risks for the notional processor. Risks due to asset stranding and growth options are likely to be relatively unimportant. Considering each of the foregoing risks, they are likely to have a very substantial idiosyncratic component and hence the systematic component (i.e. their contribution to the asset beta) is likely to be small.

5. Does the notional processor have a similar asset beta to the ELBs? The issue here is whether it is regulation or the nature of the business that is the main determinant of the asset beta. We find considerable merit in Lally's (2016) argument in favour an asset beta for the notional processor equal to an ELB. We also find that the revenue betas for both ELBs and the notional processor will be low, but that the ELBs are likely to have a bigger effect from operating leverage. Thus, it is possible that the notional processor could have an asset beta lower than the ELBs, but we put this no higher than a possibility.

The context of the report

Fonterra has requested advice with respect to the asset beta to be used in determining the allowed return for calculation of the milk price. The brief for the work was as follows:

Background

1. Fonterra's market share of >80% of raw milk supplied in NZ means there is not a competitive market for raw milk in most parts of NZ. Consequently, Fonterra has established and operates a building block type framework to calculate the price it pays its farmers for milk. The framework is maintained and operated by an externally resourced team that is independent of Fonterra management, led by Peter Goss from EY. It is also subject to oversight by the NZ Commerce Commission ("NZCC") under a disclosure regime governed by the Dairy Industry Restructuring Act 2001.
2. Fonterra's building blocks approach solves for the milk price that would leave Fonterra with the ability to earn a WACC return on a commodity processing asset base given a set of (exogenously determined) commodity prices and efficient manufacturing costs.
3. The milk price construct means that the relevant asset beta is the beta for a core portion of Fonterra's commodity processing business (which processes around 60% of the milk collected by Fonterra), and not for Fonterra as a whole.
4. A subject of ongoing disagreement between Fonterra and the NZCC is the asset beta used in the milk price WACC calculation. To date, Fonterra has been advised by Alastair Marsden of the University of Auckland, while Cambridge Economics have most recently advised the NZCC. On Dr Marsden's advice Fonterra currently assumes an asset beta of 0.38 whereas CEPA have effectively recommended circa 0.45 – 0.50.
5. The key determinant of the difference in views is, in Fonterra's view, the methodological framework applied by each party:

Consistent with its approach to other regulated entities, the Commission considers it appropriate to place primary reliance on calculated asset betas for businesses operating in the same (broad) sector as Fonterra, and if necessary to adjust the average comparator beta up or down for differences between the Fonterra commodity processing business and the 'average' comparator. While the Commission and its advisors accept there are significant qualitative differences between the two, they have largely argued these do not give rise to differences in exposure to systematic risk and therefore do not imply adjustments are required.

Fonterra's position is that the Fonterra commodity processing business is much more similar to regulated utilities, and that these are therefore the appropriate reference point.

Services

The current requirement is for a relatively high level review of key submissions and reports prepared by:

(a) Fonterra and its advisors; and

(b) the Commerce Commission and its advisors,

and based on that review, advise on the relative merits of the each party's positions, including an assessment of the merits of the arguments identified by each party with respect to the other party's framework.

Fonterra will provide the Consultant with the material Fonterra considers relevant to the review.

Material to be reviewed

The review should be restricted to material available on the Commerce Commission website, with the following being relevant.

Commerce Commission:

- https://comcom.govt.nz/__data/assets/pdf_file/0040/59989/Commerce-Commission-Emerging-views-on-asset-beta-20-July-2017.PDF
- https://comcom.govt.nz/__data/assets/pdf_file/0028/90676/Commerce-Commission-Emerging-views-on-asset-beta-14-June-2018.pdf
- https://comcom.govt.nz/__data/assets/pdf_file/0027/96606/Final-report-Review-of-Fonterras-2017-18-base-milk-price-calculation-14-September-2018.pdf

Fonterra:

- https://comcom.govt.nz/__data/assets/pdf_file/0009/60003/Fonterra-Asset-beta-and-further-reference-to-off-GDT-sales-in-Fonterras-milk-price-23-May-2017.PDF
- https://comcom.govt.nz/__data/assets/pdf_file/0031/90688/Fonterra-Submission-on-emerging-views-paper-on-asset-beta-5-July-2018.PDF
- https://comcom.govt.nz/__data/assets/pdf_file/0024/96225/Fonterra-Submission-on-review-of-Fonterra-base-milk-calculation-draft-report-31-August-2018.pdf

Alastair Marsden:

Initial December 2014 report.

- https://comcom.govt.nz/__data/assets/pdf_file/0009/60003/Fonterra-Asset-beta-and-further-reference-to-off-GDT-sales-in-Fonterras-milk-price-23-May-2017.PDF
- https://comcom.govt.nz/__data/assets/pdf_file/0030/90687/Fonterra-Submission-appendix-UOA-report-5-July-2018.PDF

Martin Lally:

- 2016 Paper commissioned by the Commerce Commission.

Cambridge Economics:

- Initial report: https://comcom.govt.nz/__data/assets/pdf_file/0017/90620/CEPA-Asset-Beta-report-28-March-2018.pdf
- Comments on submissions: https://comcom.govt.nz/__data/assets/pdf_file/0027/90675/CEPA-and-Freshagenda-Dairy-notional-producers-asset-beta-response-to-submissions-4-June-2018.pdf

The following paper by the Commerce Commission was subsequently added to the documents to be considered.

https://comcom.govt.nz/__data/assets/pdf_file/0035/59984/Our-approach-to-reviewing-Fonterras-Milk-Price-Manual-and-base-milk-price-calculation-15-August-2017.PDF

1. Introduction

As requested by Fonterra, we have tried to produce a high-level report that does not attempt to address the specifics of individual companies or their particular suitability to be in the comparator set. Nor do we look at the details of the legislation/regulation addressed by experts in the various papers. We try to focus instead upon the bigger regulatory and economic issues surrounding the systematic risk associated with the notional processor. Nevertheless, it turns out that the nature of the issues require consideration a certain amount of detail. Our views are informed by our experience in advising on issues to do with regulated firms in Australia, where the details may differ but the principles are similar.

Our report is structured as follows. We begin by making some general comments about the calculation of the asset beta, including discussion of several points that have arisen from the documents reviewed. In order to clarify the likely systematic risk for the notional processor, we next present a brief conceptual analysis of the nature of systematic risk and analyse a simple valuation model.

The conceptual analysis explains why the combination of a low revenue beta and little effect from operating leverage for the notional processor would result in a low asset beta. We would expect this asset beta to be lower than for other milk processors. The valuation model allows a more detailed analysis of risk and we relate this analysis to issues raised in the documents reviewed. This analysis also leads to the conclusion that the notional processor is expected to have a low beta. We then present specific points in the context of individual documents in the set that we were asked to review. This covers all the documents, except for those prepared by Fonterra, but most of the issues raised by Fonterra are already covered in our report.

2.Calculation of beta general comments

a. In the simplest terms, a lower beta for the notional processor (NP) means that Fonterra pays more for the milk it processes. This not only rewards the farmers who are

members of Fonterra but can also help increase market share since it will attract new members to the Fonterra cooperative and discourage current members from leaving. It appears to be the case that NZ dairy farmers have, subject to some limits, the right to join Fonterra[1].

b. In the calculation of beta, we place most faith in looking at the returns of the company shares and the market and calculating an equity beta There is a general acceptance in the documents reviewed of de-levering the equity beta to get an asset beta. However, we have considerable reservations about the de-levering process. Several alternative de-levering formulas are available and quite different asset betas can be obtained depending on the formula employed. Except in the case of Marsden, who states that Hamada's formula is used, we could not find a clear statement about which de-levering formula was used or whether the effect of taxes was considered. In de-levering, there are also issues in relation to the measurement of leverage and assumptions about the magnitude of the debt beta that can be problematic. For example, differences in unlevered betas will arise depending on whether total or net debt is used in the leverage calculation.

c. Using comparator sets to estimate beta suffers from the problem that there are frequently very few suitable candidates to put into the set. Adding a large number of unsuitable companies to increase sample size does not improve matters, but actually makes them much worse, see point **h** below, for further comment.

d. One feature likely to influence the magnitude of beta is the corporate structure of Fonterra. It is a co-operative largely owned by its suppliers. As such, it can be interpreted as a vertically integrated firm. This will have implications for the magnitude of

[1] From the Fonterra website: Open Entry and Exit; DIRA was introduced to ensure that New Zealand dairy markets remain contestable and efficient. It promotes contestability by ensuring that New Zealand dairy farmers can enter and exit Fonterra. Under DIRA Fonterra has a statutory obligation to: be an open co-operative that accepts (subject to limited exceptions) all milk supply offered by any dairy farmer in New Zealand who is willing to hold shares in Fonterra in proportion to their milk supply; ensure the terms of supply that apply to new farmer shareholders only differ to those applying to existing farmer shareholders to reflect different circumstances; allow farmer shareholders to supply up to 20% of their weekly production throughout the season to another processor; allow farmer shareholders to leave the Co-operative and, on leaving, purchase their milk vats (subject to specified conditions).

systematic risk. According to Helfat and Teece (1987), who studied vertically integrated firms, this feature reduces systematic risk. They claim that

> *"The results, both with and without control, suggest that vertical integration , at least when executed via vertical mergers, may be associated with a reduction in systematic risk."*

Other results they present suggest that vertically integrated firms may have cost advantages in raising equity capital, (which has implications for assessing whether vertical integration might create "barriers" to entry). They conclude that vertical integration as a strategy can reduce an investment's exposure to systematic risk in ways which a portfolio manager holding securities cannot. If the notional processor is considered to be a cooperative (as stated to be the case in the key assumptions of the CEPA March 2018 report, Figure 2.1), then we should be looking for firms that have a similar corporate structure so that their betas will inform us about the beta of the notional processor and Fonterra.

e. We are aware that much of the discussion is based around regulatory requirements and these are fixed, at least in the short run. We would note, however, that our role as external consultants, especially from outside New Zealand, puts us into a position where we need to be able to assess whether the regulatory rules are beneficial or appropriate in assessing the risk of Fonterra. For these reasons, we do not restrict our discussion and criticism to lie within the regulatory framework but rather more generally.

f. At the heart of most of the disagreement is the composition of the comparator set. This is critical since it can be manipulated by choices of inclusion or exclusion to give whatever answer for beta you would like. We would advocate a different approach; following on the detailed and valuable research done by CEPA (4 June 2018) in listing the characteristics of individual companies who are potential comparators. One could devise a scorecard giving a score corresponding to the likelihood of comparator set membership. For example, we would give a high score to a company operating in the dairy industry, preferably operating in New Zealand, that sells all of its output overseas

and has substantial regulatory protection against revenue risk.[2] Such procedures are routinely used in credit-rating commercial loans, where set membership can be interpreted in terms of future default risk.

The type of set resulting from the foregoing procedure is called a fuzzy set (https://en.wikipedia.org/wiki/Fuzzy_set). This sounds esoteric and hopelessly academic but the application here is entirely practical. The weights for set membership could be used to weight the companies' betas in estimating the beta for the notional processor. There would still be scope for disagreement as to the magnitude of the weights that should be used but basing them on firm characteristics seems an intuitive way of approaching the problem. The current procedure of Fonterra assigning 100% weight to EDB's, for example, whilst the Commerce Commission assigns a zero weight seems a crude approach to arriving at the right answer.

g. The NZ Commerce Commission place much reliance on the Betas of the comparator set. They note that there is a one standard deviation between the Beta advocated by Fonterra (0.38) and the mean of the comparator set (circa 0.52). However, the number for beta that they advocate (i.e. .05 reduction from the mean) corresponds probabilistically to a .25 move in units of the standard deviation, corresponding to a 10% probability shift. Given the statistical evidence alone, this seems a surprisingly small adjustment. Of course, this could be tempered by many other separate pieces of evidence.

h. The documents reviewed have a general acceptance of the methodology of averaging betas across different countries. There is no obvious justification for this, it is just wrong. There are several problems in this averaging, but a particular problem is that the betas have different meanings since they are estimated against different market portfolios. This problem can be addressed by computing betas against a common index. For example, an index representing a pooling of the equity markets in the sample, or simply using a world market index. The resulting betas would typically be lower when

[2] We are not aware of such a comparator, but the example does illustrate the key characteristics that are sought. Progressively lower weights should be applied the further from these characteristics that the comparator lies.

computed in this fashion. The current approach of filling up the comparator set with inappropriate information simply muddies the waters.

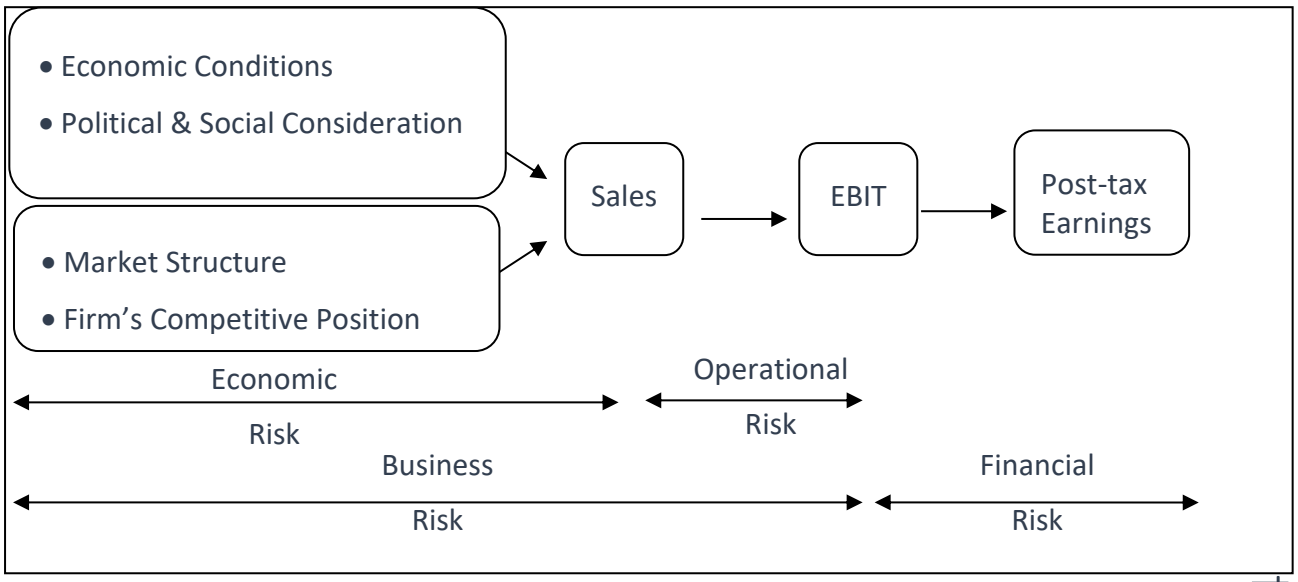
i. The Commerce Commission has expressed a preference for reliance on empirical evidence rather than theoretical analysis. This presumes that the empirical evidence is relevant, reliable and accurate. This is a particular problem in New Zealand as there may well be a shortage of empirical evidence based on domestic data. The temptation is to look to overseas empirical evidence, but this has significant problems and may be worse than relying on theory. In any event, when it comes to estimating asset betas, the empirical evidence relies on the application of a substantial amount of theory.

3. Theoretical considerations

A conceptual analysis of systematic risk

We begin with a simple conceptual analysis. Mackenzie and Partington (2012) provide the following figure (adapted from Hawawini and Viallet (1999)) as a schematic to help explain what underlies systematic (beta) risk. Systematic risk reflects the correlation of returns on an asset with return in the market for capital assts. The latter is usually proxied by the equity market. In this case the NZ equity market.

Figure 1: Dimensions of Risk



In the framework of Figure 1 economic risk relates to sales revenue. The systematic component of economic risk is measured by the revenue beta and the revenue beta is

usually the major driver of the asset beta, but not in the case of the notional processor. The output is sold overseas and overseas demand for milk products is not likely to be highly correlated with the NZ equity market. So, the revenue beta is expected to be low. It is also the case that the method of determining the cost of milk to the notional processor provides substantial protection against the risk of revenue fluctuations.

Operational risk is related to the cost structure of the business in particular the extent of operating leverage (extent of fixed costs). The usual analysis of operating leverage assumes a fixed contribution margin (price minus variable costs) and the result is that more operating leverage increases returns as revenues rise and reduces returns as revenues fall. Consequently, higher operating leverage generally increases the asset beta. However, in the case of the notional processor the method of setting the milk price varies the contribution margin in such a way as to offset variation in revenue. Consequently, operating leverage should have little effect on the asset beta.
The financial risk in Figure 1 is only relevant to the equity beta, not the asset beta. The conclusion of this simple conceptual analysis is that the asset beta of the notional processor will be low. This is because the usual major determinant of the asst beta, the revenue beta scaled up by operating leverage, is expected to be small.

Valuing the notional processor

In order to provide a more detailed illustration of the sources of risk, we consider a simple theoretical example. The simple example is intended to capture key features relevant to the risk and the asset beta of the notional processor. It is not intended as a detailed characterisation of the regulatory regime.

Assume investors make an investment sufficient to fund the establishment of a milk processor. The value of that processor is given by the present value (PV*)* of the cash flow from the business. Abstracting from taxes, the value of the assets of the milk processer can be written as:

$$PV_{asset=}\, PV_{revenue} - PV_{milk\ cost} - PV_{non\text{-}milk\,variable\ costs} - PV_{fixed\ cost} \quad (1)$$

Where all variables represent cash flows.

Assume an efficient notional milk processor, where non-milk variable costs are efficient and where, for a given period, the price of milk is set after the revenue is known such that:

$$Revenue - milk\ cost - \ efficient\ non\text{-}milk\ variable\ costs - fixed\ cost = R_{allowed} \times Assets \quad (2)$$

The value of the efficient notional processor is therefore given by:

$$PV_{revenue} - PV_{milk\ cost} - PV_{other\ efficient\ variable\ costs} - PV_{fixed\ cost} = \sum_{t=1}^{n} \frac{R_{t,allowed} \times Assets_t}{(1+R_{assets})} \quad (3)$$

Where $R_{allowed}$ is the rate of return allowed, R_{assets} is the rate of return the market currently requires on the assets, *t* indexes the time period and *n* is the expected life of the assets.

The calculation of the milk price takes place after the revenue is known and this hedges risk from revenue variations. Given the return allowed and the assets, the milk price determination transfers revenue risk to suppliers. Given that the efficient non-milk variable costs are a cost allowance based on a prior efficiency study of the industry/Fonterra, then they are prespecified. By definition fixed costs are fixed within the relevant range of output.

Risks of the notional processor

We begin by considering risk in a single period world, which is consistent with the use of the standard CAPM. We consider both total risk and systematic risk, but only systematic risk is reflected in the asset beta. If the notional processor is defined to be an efficient processor, then it has exactly the prespecified efficient non-milk variable costs. In which case there is no risk in any of the elements of the cash flow. They are either predetermined, fixed, or hedged. Since there is no risk in the cash flow, the asset beta would be zero and the market's required return would be the risk free rate.

Let us now relax the assumption that the notional processor has efficient non-milk variable costs. In this case the processor has the opportunity to earn a return above the allowed return by being super-efficient or earn a return less than the allowed return by being inefficient. This introduces some uncertainty into returns. However, the effect is likely to be small. This is because the non-milk variable costs are a minor part of the cost structure. We understand them to be less than 20% of total variable costs. With respect to the asset beta, it is only the systematic component of the differences in non-milk variable costs relative to efficient non-milk variable costs that are relevant. The magnitude of any systematic effect in variable costs is an open question. However, we would expect that much of the variation in non-milk variable costs would arise from idiosyncratic operational issues, rather than being driven by a strong correlation with the NZ equity market.

Given the foregoing, in the context of the standard single period CAPM, the asset beta of the notional firm would be very low, or possibly negative based on Lally's decomposition of the asset beta. Reality, however, is that the we have a multiperiod world and the single period CAPM is commonly applied to multiperiod problems.

In a multi-period world, the method of computing the milk price still substantially hedges revenue risk to investors and if other costs match those allowed in computing the milk price than investors receive the regulated return. However, since other costs may not match the costs allowed there is risk with respect to costs. Both efficient and actual non-milk variable costs could change over time. However as noted above these are a minor component of the cash flows. Fixed costs could also change, particularly if the scale of the investment changes and we have more to say about scale changes below.

An alternative perspective on risk in a multiperiod framework can be obtained by examining the variables on the right hand side of equation 3. This shows that, given efficient variable costs, the cash flow to investors depend upon the allowed return and the assets. As long as the allowed rate of return is equal the market's required rate of return then the allowed rate of return is not a source of risk. However, if there are errors in determining the allowed rate of return this increases the total risk faced by investors.

This is only a systematic risk to the extent that errors by the regulator correlate with the equity market index.

Assets might increase due to expansions in the scale of the notional processor's operations. However, since this will be compensated by the allowed return on the additional assets, there is no increase in risk per dollar invested. On the other hand, the value of assets earning the allowed return may be reduced due to the closure of existing plants. In this case, investors cease to be compensated for their investment in the stranded assets Thus asset stranding is a risk to the returns of investors in the notional processor. This risk of asset stranding was a subject that featured in the documents that we reviewed.

Asset stranding

Asset stranding could occur if there was insufficient demand for the milk products in the RCP product mix, but this seems to be a limited risk since the output is assumed to be sold on the world market at market clearing prices and demand risk is transferred to the suppliers of milk via the milk price. However, if world prices fell so low that the milk price received by farmers was below the cost of production then farmers might cease milk production. Thus, asset stranding might occur due to a lack of milk supply. It is also possible to imagine catastrophic events[3] that could lead to local, or possibly more widespread, restrictions in supply. However, such events would be likely to have a temporary impact. In which case there would be temporary plant closures, but the plants would not be permanently stranded.

It is also possible to imagine changes in competition, technology and land use that could lead to permanent plant closure, but we have seen no evidence that such asset stranding has a high probability and therefore is a high risk event. Neither is it obvious that the risk of asset stranding has a substantial systematic component. For example, since the output is assumed to be sold on international markets, it is a fall in world market demand for milk products that would be required to drive the milk price to a

[3] For example, earthquakes, or an outbreak of foot and mouth disease.

level leading to restrictions in supply. It seems unlikely that the world market demand for milk products has a substantial correlation with the NZ equity market returns.[4] We suspect that many sources of asset stranding risk would be diversifiable.

Marsden's (2016) illustrative numerical analysis, which was endorsed by Lally (2016), shows that the risk of asset stranding has only a small impact on the required return/asset beta. Empirical evidence supporting the inputs to the Marsden analysis is desirable. However, we tend to agree that the risk of asset stranding is likely to only make a small contribution to the magnitude of the asset beta.

Growth options

Growth options are typically riskier than assets in place, so if there are growth options for the notional producer it is likely that they would increase the asset beta. The asset beta of a firm is a value weighted average of the beta of the assets in place and the beta of growth options. Thus, it is relevant to consider both the nature of growth options and their likely weight.

Both CEPA and the Commerce Commission point to the risk created by growth options, but it seems to us that their arguments for growth options are a bit thin. For example, the Commerce Commission points to growth options arising from changes in products longer term, beyond the limits imposed by DIRA. This makes the point that the regulatory regime limits growth options. Relaxation of regulation could create growth options, but it would a consequence of a redefinition of the notional processor and the option would only arise if the legislative framework is changed. While this is possible, we doubt that investors are currently attaching much value to options of this sort.

For investments that have zero NPV in all states of the world, growth options have no value and thus having no value weight they have no effect on the asset beta. If we assume a competitive industry equilibrium, which is presumably the objective of the Commerce Commission, then investments have an NPV of zero. In which case growth

[4]Both Marsden (2016) and CEPA find that there is no statistically significant relation between the price of milk that Fonterra sells on the global market (which presumably reflects demand) and the NZX50.

options are not relevant to the asset beta. However, growth options could have value if a processor's competitive advantage perturbs the competitive equilibrium, for example by introduction of a new technology lowering variable costs. Alternatively, if the regulated return was overestimated so that investments had a positive NPV, this would also create growth options.

In a competitive industry, growth options arising from a competitive advantage are likely to be relatively short lived as competition erodes the competitive advantage. However, sustained overestimation of the allowed return can give rise to long lived growth options as in the case of "goldplating" of electricity distribution and transmission networks.

In the light of the foregoing analysis and our consideration of Lally's analysis summarised below, we conclude that the notional processor is a low risk business, both in terms of total risk and systematic risk. Our analysis suggests that a significant source of risk is the possibility of errors by the regulator in estimating the allowed return. However, this will only increase the asset beta if the regulators errors correlate positively with market returns. Lally's analysis, which we discuss below suggests this may be the case. Lally's analysis also suggests that the risk in relation to variable costs has a negative effect on beta and we consider that his analysis is plausible. On balance, we conclude that the asset beta is low.

Our theoretical considerations do not tell us exactly how low the asset beta should be, but we would expect the asset beta to be somewhat above the debt beta for the notional processor and somewhat below the asset beta of Fonterra. The setting of the milk price is likely to eliminate a significant part of the risk that Fonterra would otherwise face, but it seems to be agreed that there are risks that Fonterra faces that are not faced by the notional processor. For example, Fonterra is likely to have significant growth options in its overseas operations.

4. Lally: Assessment of the asset beta for Fonterra's notional business, 19 May 2016

Sources of systematic risk

Above, we have taken a somewhat different approach to the analysis of risk than that followed by Lally (2016), but the conclusions of the analyses are very similar. In particular, we both find that variation in non-milk variable costs relative to the efficient cost together with errors in the allowed rate of return are key risks for the notional processor. The effect of the former on the asset beta is likely to be relatively small, while the magnitude of the latter effect would depend on the quality of work by the Commerce Commission and the extent to which any errors correlate with market returns.

Decomposition of the asset beta

Lally (2016) models the systematic effect of cost variation and errors in the allowed return by decomposing the asset beta. We have checked this decomposition and consider that it supplies useful insights. Lally argues that errors in estimating betas are not likely to be correlated with market returns, but that errors in estimating the market risk premium are likely to be so correlated. This has the effect of increasing the asset beta. In our opinion this aspect of Lally's analysis is plausible, subject to the qualification that follows. Lally's argument relies on increases (decreases) in equity market value being driven by decreases (increases) in the market risk premium. Increases (decreases) in equity market value can also be driven by increases (decreases) in expected cash flows with no change in the market risk premium. In which case the effect on asset betas of errors in the allowed return would be weaker.

With respect to non-milk variable costs, Lally's (2016) decomposition of the asset beta shows that it is the covariation of the return on the market with the difference between efficient costs and actual non-milk variable costs that affects the asset beta. Lally argues this covariation is likely to be negative. His argument is that increasing market returns are likely to be caused by growth in GDP and this growth creates cost pressures in the economy. Thus, when market returns are high, the non-milk variable costs are likely to

exceed their efficient level, thus reducing returns to the notional processor and vice versa when the market return is low. Since the covariation is negative, the effect is to reduce the asset beta. We consider this to be a more likely than Marsden's (2014) argument that macroeconomic shocks push up costs while depressing market returns,[5] resulting in a positive effect on asset betas.

While Lally's decomposition analysis provides a useful theoretical framework, practical implementation would not be feasible due to infrequent observation of the required data. Furthermore, there would be reliance on accounting rather than market data, with the former tending to be inaccurate, infrequent and open to manipulation, relative to the latter.

Asset beta and ELBs

Lally points out that Marsden's (2014) argument that the notional business has similar risk to regulated Electricity Line Businesses (ELB) does not consider the different regulatory regimes applying to ELBs and the notional processor. After analysis of this issue Lally concludes that it is appropriate for the asset beta of the notional processor to be equated to the asset beta of ELBs and that the asset beta is therefore 0.34. Lally's work is carefully done and in our opinion it has merit. Lally further states (footnote 3) that he "…does not consider that betas can be estimated to any higher degree of precision than 0.1 and therefore would round down to 0.30…" We agree that values of beta to the second decimal place are difficult to justify in terms of the precision of beta estimates. Thus, a beta value of 0.3 or 0.4 would be appropriate depending on whether one favours Lally's 0.34 or Marsden's/Fonterra's 0.38 as the starting point for rounding beta to one decimal place.

[5] We acknowledge that this might happen occasionally.

5.CEPA: Dairy notional processors' asset beta, March 2018

There is considerable overlap in the issues related to this CEPA report and CEPA's June 2018 response to submissions. The major report is the March 2018 report and it is to this report that we mainly refer

Should Fonterra be in the comparator set?

It is clear from CEPAs Figure 2.1, which gives the key assumptions about the notional processor, that the notional processor closely resembles Fonterra. Given the scarcity of suitable comparators and the close correspondence between the notional processor and Fonterra, it is unequivocal that Fonterra should be included in the comparator set.

Lally (2016, p.6) goes further and argues that: "The only beta estimates that are potentially useful are for Fonterra itself". If precise and relatively stable estimates of Fonterra's beta were available, we would have considerable sympathy with this view. However, this does not appear to be the case and hence additional, but very carefully selected, comparators are desirable. CEPA's argument for exclusion of Fonterra based on insufficient liquidity is open to question and does not appear to have been applied across the comparator sample.

Analysis of the comparator set.

Description of the comparators is thoroughly done in the CEPA report and the basis of classification provides a good insight into the individual characteristics of each chosen company. However, what it also shows is that the comparator set is highly heterogeneous. It hardly represents a random sample in the sense that we can think of this set as being drawn independently from the same distribution.

It appears to us that it is rather difficult to find firms that have the property of being closely similar to Fonterra, or the notional processor. Therefore, the average beta computed across the comparator set is not likely to be particularly informative regarding the beta of the notional processor, or Fonterra. It is in the lack of firms that clearly form

a set representative of the notional processor that creates many of the problems in resolving disagreement between Fonterra and the Commerce Commission.

Sub-sample classification

In CEPA's Table 3.2 there is a schema that presents the basis for classifying the comparator sample into sub-samples. This classification does not include tradability. Tradability is defined by Tian (2018) as the extent to which a firm sells its products abroad, specifically, the share of its output that is exported. Given the fact that 96% of dairy output is exported from New Zealand, one would be led to think that tradability is an important feature of NZ dairy processors.

Fonterra buys milk from farmers and resells it after processing most of the milk into various products, but it also can sell some milk directly to other domestic processers. In either case, most of the products are exported. A reasonable interpretation of these facts would be that tradability is for the notional company is high. On the evidence of Tiang (2018) tradability affects returns. Tiang shows that the CAPM alpha is negative, both conditionally and unconditionally. There are several explanations for a negative alpha, but one of them is that high tradability firms have lower required returns. Tradability is therefore worthy of further consideration.

Homogeneity of sub-samples

Because they have similar betas CEPA argue that the subsamples presented are homogenous and that differences in the firms, such as ability to transfer price risk do not matter to systematic risk. We do not find this argument very convincing. It might suggest that these firms are similar in their exposure to market risk, relative to their own equity markets. It does not demonstrate that they are suitable candidates for the comparator set.

We also share Marsden's concerns about the limited value of these results due to small sub-sample sizes and restricted ability to pass through price and volume risks.

The issue of risk pass through

The assumption made by Fonterra, discussed on page 5 of both CEPA reports, that it can pass through volume and price risk to the farmer is true period by period. We believe the capacity to pass on risk is substantial, but presumably it is not without limit. There must exist shocks of some magnitude where it is no longer true that all the risk can be transferred. This ability to pass through risk to suppliers is a key feature of the notional producer. However, the extent to which the members of the comparator set are able to pass through volume and price risks seems to us challenging to assess but is likely to be substantially less than in the case of Fonterra. In addition to the regulatory regime, Fonterra's particular structure, where it is owned by its members, gives it more capacity in this regard. However, the fact that its market share has been falling since inception suggests that in the longer term Fonterra cannot necessarily pass on all risk, as members can choose to leave, or new members fail to join.

Liquidity autocorrelation and beta

CEPA claim that Fonterra is illiquid,[6] and we know from other research that illiquid stocks seem to have different betas at different frequencies of observation. This is because the illiquidity generates auto-correlation in the data. The best way to tackle this is to agree an observation frequency, such as monthly, and estimate beta over a horizon close to or equal to the regulatory period, say four years.

6. Marsden: Asset Beta for Notional Processor: Response to the Cambridge Report 9 May 2018

Asset Beta

We agree with most of the arguments presented in Marsden 9th May 2018. The beta for the notional processor should be lower than the beta of the comparator sample for the reasons given by Marsden and other reasons that we have listed elsewhere. As

[6] We note that Marsden (May 2018) disputes the claim of illiquidity (footnote 28), stating that "…trading occurred on all trading days from January 2013 for both shares in Fonterra Co-operative Group Ltd and units in the Fonterra's Shareholders' Fund."

discussed elsewhere, the comparators are a heterogeneous group and it is by no means clear that this is the appropriate comparator set.

We can say that the notional processor is very likely to have a lower beta than the members of the comparator set but given inappropriate comparators the actual percentile for the beta estimate of 0.38 is not that informative. In this context statements by the Commerce Commission such as are made in their 14 September 2014 report, paragraph B122, "…Dr Marsden's analysis implies an approximately 75% likelihood that the true asset beta is above 0.38" have limited meaning.

Marsden attempts to rebut CEPA's point about a low systematic risk for revenue by pointing to the importance of the dairy industry to the economy and arguing that therefore revenue shocks are likely to have some systematic impact. This argument has some merit, but we would not expect the revenue risk to have a substantial systematic component. Indeed, the low revenue beta for the notional processor is a key feature that helps explain why it would have a low asset beta.

Transfer of price and volume risk

We accept Marsden's point in paragraph (7.21). that the comparators do not have the same ability to ability to pass through price and volume risk in the same way as Fonterra and the notional processor. However, we are by no means convinced that Fonterra has no price risk or volume risk. Risk here needs to be considered in terms of a time-horizon. Period by period we consider the risk to be low, but if we take the risk in the long-term, say perhaps over a 10-year horizon, then it is quite clear by the reduction in the proportion of the market that Fonterra has experienced that there are long-term risks. World demand appears buoyant, but an increasing trend to veganism and an increase in feeding babies breast milk rather than formula are examples of trends that could dampen demand. For the notional processor the risk of a declining market longer term creates the risk of a reduced scale of operations. However, this is only a risk to investors if it leads to asset stranding.

7. Marsden: Asset Beta for Notional Processor: Response to the Cambridge Report dated 4 June 2018 and the Commerce Commission's Emerging Views on Asset Beta dated 14 June 2018, 5 July 2018

There is substantial overlap between this report and the May 9th report, so some comments under section six also apply here. At the risk of repetition, we shall comment on some of the points in the July report.

Comparators and alternative beta estimates.

There seems no good reason to exclude Fonterra from the comparator sample based on illiquidity given the inadequacy of the other members of the sample in matching the notional processor's risk profile. Whilst recognising the difficulties of populating the comparator sample, we are uneasy about using foreign firms as they have a different market portfolio to measure systematic risk against. The notion that we can average different betas in different markets faces serious theoretical challenges.

Our concern about the use of overseas companies extends to the use of overseas utilities, mainly US based, to estimate the beta for ELBs. Marsden discusses this issue at paragraph 6.16, and the Commerce Commission in their documents has expressed doubt about the appropriateness of US utilities as a comparator for the notional processor. We have several observations to make about this.

We understand that there may be a limited choice of comparators in the NZ market, hence the temptation to use data on overseas utilities to estimate the beta for ELBs. Hopefully this is done with considerable care and thought so that appropriate estimates of beta are obtained. The proper question to ask is not whether US utilities are an appropriate comparator for the notional processor, but whether NZ ELBs are an appropriate comparator, as argued by Lally and Marsden. If they are, then the notional processor should have a similar beta to the ELBs. In this case, the source of the beta estimate for the ELBs in not relevant as long as the estimate is correct. If US utilities do not provide the correct estimate for ELBs then the estimate should be revised.

We share Marsden's scepticism (para 6.23) about brokers' estimates of beta unless they provide sufficient information to replicate the calculation and use correct/plausible methodologies.

Seasonality in Fonterra's share price

The issue of seasonality, in excluding Fonterra, from the comparator sample is discussed at length by Marsden in Section 4. and on the basis of his analysis it does not seem that the evidence in favour of seasonality is at all rigorous. Even if seasonality is present, it is questionable whether it matters to the estimation of beta. Brooks et al (1997), study seasonality and its impact on beta, admittedly using Australian data. This research gives fairly strong evidence that seasonality does not affect the stability of beta. Brooks et. al. state:

> *"A key finding of this paper is that taking account of the January monthly seasonal and other monthly seasonal has no effect on the beta stability characteristics of individual stocks. Hence, based on our analysis, seasonal effects do not provide an explanation of beta instability".*

One has to be careful in interpreting a single empirical result in one country in one time period to understand another empirical result in a different country at a different time However, the result of Brooks et al does seem to us reasonably convincing that seasonality is not such an important issue. Furthermore, the diagrams presented in Marsden's report (4.14 and 4.16) do not suggest very strong seasonality in the data.

8. Commerce Commission: Review of Fonterra's 2017/18 base milk price calculation: Dairy Industry Restructuring Act 2001,14 September 2018.

We note that the Commerce Commission reports are of good quality and the arguments are clearly made. In relation to the Commerce Commission's September 2018 report we focus on the appendix which deals with the beta calculations. The appendix runs from page 21 to the end of the report and constitutes the details of the case made by the Commerce Commission.

Contestability

Before addressing the appendix we start with a definition of economic contestability. This is because contestability is repeatedly mentioned in the Commerce Commission's report. Market contestability refers to the ease with which new firms can enter and leave a market. A perfectly contestable market is one with no entry or exit costs. Barriers to entry and exit reduce the degree of contestability. As we earlier suggested the vertical integration of Fonterra will create some barriers to entry and hence raise the degree of contestability. However, it is quite unclear by how much, and neither is it clear what this implies for the definition of the notional processor.

Comparator set

We refer back to our earlier discussion of the difficulties in constructing the comparator sets and then averaging the betas to get an estimate of the beta for the notional processor. Rather than take an equal-weighted average a much better scheme would be to weight the comparators by their degree of importance, suitably defined. So, in constructing what might be the distribution of betas, we would give a high weight to Fonterra as a constituent; a slightly lesser but still important weight to Synlait and successively smaller weights to the other comparators that have been suggested. Simulating from this distribution would give us a better notion of what the mean or a confidence interval for the mean should be.

In paragraph B31 the Commerce Commission concedes that the notional processor's beta could be below the mid-point for the sample of other processors. However, it then suggests that the evidence, does not provide a basis for the notional processor's beta being significantly below that of other processors. As we have previously argued the comparator set is highly questionable as a basis for making conclusions about the distribution of the notional processor's beta.

Paragraphs B74 to B78 place reliance on the work by CEPA in estimating beta from the comparator set. However, closer inspection of the comparator set listed on page 32 of CEPA (March 2018) reveal that the majority are overseas companies. As we have

discussed elsewhere, there is very little logic to averaging betas across different markets. We also note that CEPA's analysis does not detail how the estimated equity betas were transformed (de-levered) to give asset betas. As a minimum, there should be sufficient information to replicate their results.

Suitability of Fonterra as a comparator

The Commerce Commission argues that Fonterra is not an appropriate comparator based on the fact that 90% of Fonterra shares are owned by farmer suppliers. The full implications of a company being a co-operative trading shares on the open market and having other shares held by its members who are also its suppliers is complex and we can find little guidance in the academic literature. However, there seems to be little justification to support the assertion that Fonterra share prices are uninformative in measuring systematic risk. Indeed, we consider that Fonterra share prices are likely to be particularly informative in this regard. As long as the fundamental principle of no-arbitrage holds there is no reason to believe that Fonterra's shares are priced any differently to other shares in the market.

The point is also made (para B43.2) that relying on a single observation (Fonterra) to estimate beta is unreliable due to measurement error. The implication is that more observations are more reliable. This is not correct. Whether a single observation is more or less reliable than numerous observations depends upon the quality of the other observations. By way of analogy, one reliable and informed examiner will deliver a more accurate estimate of the content of an exam paper than 10 ill-informed examiners. The fallacy here is to assume that the additional companies contain positive information about the risk of notional processor. It is quite possible for the additional firms to take us further away from the correct answer.

Revenue beta

The Commerce Commission (paras B96 to B96.5) recognises that the notional processor may have greater capacity than other processors to transfer price and volume risk to suppliers, but makes the case that dairy price and volume risk is not a significant

systematic risk. This goes to our point about the low revenue beta for the notional processor.

The ability to transfer price and volume risk would substantially offset the effect of operating leverage for the notional processor, as previously discussed. The combination of a low revenue beta and little effect from operating leverage mean that it is to be expected that the notional processor would have a lower asset beta than other processors.

9. Commerce Commission (CC). Review of Fonterra's 2016/17 base milk price calculation Emerging views on asset beta, 20 July 2017.

This is a very well-reasoned document which asks for additional evidence to support Fonterra's claim that the notional producer should have an asset beta of 0.38. Much of the material is covered in temporally subsequent papers but we reproduce a number of paragraphs from the report and comment upon them.

Shifting Risk

The Commerce Commission state (para 20):

> *Consistent with Fonterra's position, our provisional view is that there is no reason why it would not be reasonably possible for an efficient commodity processor in New Zealand to assume substantially the same commodity price risk as the Notional Producer. In particular, if Fonterra is able to shift commodity price risk to its farmer suppliers, there does not appear to be any reason why other processors could not do the same.*

Our response to this is that Fonterra is in a rather special position as a vertically integrated co-operative and as a monopsonist. It is generally agreed that Fonterra can offload much of the commodity price-risk and this feeds into the risk borne by investors and hence the required rate of return. We also note a more qualified view by the Commission in paragraphs 40 and 41 and as discussed in section 8 above.

Beta estimate

In paragraph 38, the Commission state:

> *Looking at the market evidence, we cannot conclude that Fonterra's point estimate is not practically feasible. The sample mean is between 0.48 and 0.52, with a large measurement error (standard deviation of 0.23 to 0.24).*

We do not find the methodology outlined particularly appealing, for reasons that we have previously discussed. However, if we were to pursue it, we note the following. The value of 0.38 is approximately equal to 1 standard deviation shift from the mean. Taken from the perspective of a value of asset Beta for the notional processor being less than the mean, which is uncontested, there is a chance of 1/3 of a firm from that population of comparators having a value less than 0.38 and a chance of 2/3's of a firm from that population of comparators having a value greater than 0.38 but less than the mean. So 0.38 is certainly not an outlier and it is debateable whether it is a "substantial departure from the sample mean" (para 39).

10. Commerce Commission: Review of Fonterra's 2017/18 base milk price calculation Emerging views on asset beta, 14 June 2018

This Commission report has a large overlap with the reports discussed in sections 8 and 9 and so we only cover two points below.

Beta adjustment

At paragraph 53 the Commission states:

> *The main findings from CEPA/Freshagenda were as follows:*
>
> *53.1 First, companies in the sample should have systematic risks more similar to the NP, than those of EDBs. Therefore, relying on the estimates from the dairy comparators should produce a better estimate of the asset beta for the NP than the sample of EDBs used by Fonterra.*
>
> *53.2 Second, analysis of the subsamples produced sub-sample means that are very similar to the full sample mean. However, CEPA*

considered there is an argument for a downwards adjustment to the sample mid-point. They could not estimate this empirically, but considered our past 0.05 adjustment in other sectors provides a reasonable estimate.

We do not agree the companies in the comparator set necessarily have systematic risks more similar to the notional processor than those of ELBs and elsewhere we have pointed to other problems is the asset beta estimate from the comparator set.

The magnitude of the downward adjustment (0.05) is not motivated by the properties of the cross-sectional distribution of betas from the comparator set of companies and seems somewhat arbitrary. As discussed in section 2.g. above, the probability corresponding to this adjustment is approximately 10%. This seems rather small in the circumstances.

Notional processor and EDBs

The Commission's statement at paragraph 55 is that:

In CEPA's view, in a mature economy like New Zealand, the drivers of EDBs' revenues are somewhat different to those of the NP:

Network growth is somewhat decoupled from economic growth, related to factors such as changing patterns of electricity demand and supply, rather than changes in economic growth. The input cost pressures for ELBs are also likely to be different from those of the Notional Processor. Another difference is that the Notional Processor is assumed to export all of its commodity outputs, while the ELBs services are provided domestically.

We accept the point that the EDBs provide domestic services rather than the 100% export of output assumed for the NP. We also agree that EDBs clearly have different costs structures and markets compared to the notional processor. However, the question is whether risks and returns are largely due to the effects of regulation, or the underlying nature of the businesses. If the former the betas are likely to be similar, if the latter the betas may differ significantly.

We note the following characteristics are likely with respect to the asset betas of EDBs. Just as for the notional processor, the revenue beta is likely to be low and this is implicit in the quote above. Because of inelastic demand for electricity and the monopoly supply position of networks revenue risk is low. The effect of operating leverage for EDBs is likely to be higher than for the notional processor. This is because of a higher level of operating leverage.

We also expect growth options are likely to be greater for EDBs. Growth options can arise from increasing costs efficiencies, and our observation is that network operators regularly argue that superior returns have been driven by beating efficiency benchmarks.[7] Other growth options may come from investment. The trend towards electric cars may well increase demand for network services and the nature of regulation of EDBs in NZ, where there is a bias towards overestimating rather than underestimating the required return (to protect supply), means that asset expansion is biased towards a positive NPV. These considerations raise the possibility that the beta for EDBs may be higher than for the notional processor, but we put this no higher than a possibility.

Conclusion

Whether the asset beta for the notional processor is 0.38 is difficult to impossible to establish definitively. However, there is a case that the notional processor has an asset beta approximately equal to the asset beta of ELBs, possibly slightly higher or lower. The comparator set as currently constituted and analysed provides scant evidence on what the magnitude of the asset beta should be. However, what is clear is that risk for the notional processor is low and so is the asset beta.

[7] Developing cost efficiencies is an option for the notional processor, but we wonder how regularly the efficient cost benchmark is currently beaten?

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