Asset Valuation in Workably Competitive Markets

A Report to the New Zealand Commerce Commission

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George has been heavily involved in UK energy policy development over the past twenty years, first as advisor to National Grid and British Gas, then as economic adviser to the energy regulator, and finally, until April 2009, as a Board Member of the Gas and Electricity Markets Authority (GEMA). He has also advised on energy regulation issues internationally, including in Central and Eastern Europe in the early years following the collapse of communism (starting in February 1990 as part of a World Bank team in Warsaw), Japan and Australia.

George has also advised the UK Civil Aviation Authority for many years, and, before that, did work for the British Airports Authority. In 2006, and again in 2010, he has been a member of the Aviation Appeal Panel in the Republic of Ireland, which is constituted to hear appeals against determinations of allowable airport landing charges by the Irish regulator.

In addition to his work in the regulated sectors, which includes work in communications, transport and water services as well as energy and airports, George has a strong interest in competition law and policy, and at various times has acted as an advisor to enforcement authorities and to companies, at both national and at EU levels. He has given evidence in a number of key competition cases to the Competition Commission, the Office of Fair Trading, Southwark Crown Court (*British Airways Executives)*, the High Court (e.g. in *Crehan* and *Arkin*) and the Competition Appeals Tribunal in the UK (e.g. in *Genzyme* and *Personal Protection Insurance*), and to the European Commission and the European Court of First Instance (e.g. in *Hilti* and *Intel*).

Martin Cave (PhD Economics, University of Oxford) was Professor and Director of the Centre for Management under Regulation at Warwick Business School until 31 March 2010. Prior to taking up that position in 2001, he was Professor of economics and Vice-principal at Brunel University.

Martin is a regulatory economist and author or editor of several books and articles on the regulation of network industries. This includes co-authorship of Accounting for Regulation in UK Utilities, ICAEW (1994) and Understanding Regulation, Oxford University Press (1999 and 2011), and co-editorship of Handbook of Telecommunications, Elsevier (vol 1, 2002 and vol 2, 2006), and the Oxford Handbook on Regulation (2010).

In addition, he has advised regulatory agencies and governments on a range of policy and regulatory matters, especially in relation to the communications sector. This includes undertaking independent reviews for the UK government in the areas of spectrum policy, the regulation of social housing, and competition and innovation in the water sector, and work in the

UK on electricity, posts, telecommunications and water. In addition, he chaired an expert panel convened by the Secretary of State for Transport on the regulation of airports, and advised the UK airports regulator, the CAA, on price controls for airports in the South East. In addition, Martin has worked for governments in Canada, France, New Zealand and elsewhere, and for regulators in Armenia, France, Germany, Greece, Jordan, Portugal, Singapore, Thailand and elsewhere.

Michael Pollitt (PhD Economics, University of Oxford) is a University Reader in Business Economics at the Judge Business School, University of Cambridge. He is an Assistant Director of the ESRC Electricity Policy Research Group (EPRG). From 2001-2005 Michael was co-leader of the Cambridge-MIT Electricity Project and served as founding Executive Director of the EPRG in 2005 and 2006. Michael is an economist with particular interests in the efficiency and regulation of network utilities. He has published 8 books and 40 refereed journal articles on efficiency analysis, energy policy and business ethics. He is the leader of the Energy and Environment Research Group at the Judge Business School and the first coach of the Energy and Environment concentration on the Judge's MBA.

Since 2007 Michael has been external economic advisor to Ofgem, where he has recently been working on the RPI-X@20 review of network regulation project, Project Discovery, the fifth Distribution Price Control Review and the Transmission Access Review, among other projects. He has written three policy papers for Ofgem, each of which has been published in peer reviewed journals. He has also advised national energy regulators in The Netherlands, France, Germany and Austria as well as the UK Competition Commission and the UK rail regulator. He works closely with the World Bank and recently he has been appointed to the regulatory review panel for the UK water regulator.

John Small (PhD Economics, University of Canterbury) and was an academic economist for eleven years, primarily at the University of Auckland but also with visiting positions at Monash University, the University of Florida and the London Business School.

John has worked as a consulting economist for twenty years with a focus on competition and regulatory issues. His work has covered all major utility industries and many other sectors including banking and payment systems, agriculture, food processing, retail and waste. John is a founding director of economics firm Covec, and was previously a director of Australian-based economics firm NECG. His clients have included regulatory agencies in New Zealand, Australia, and the broader Asia-Pacific region.

Within New Zealand, John has undertaken a range of previous competition and regulatory assignments for the Commerce Commission. On several occasions he has also advised firms being prosecuted by the Commission. John was appointed lay member of the High Court of New Zealand in 2003 and his warrant was renewed in 2009.

Terms of Reference

The New Zealand Commerce Commission has requested that we provide an independent expert opinion on the following matters.

Topic one: Asset values in workably competitive markets, including the relationship of observed asset prices to replacement cost

a. the factors that affect asset values in workably competitive markets where sunk assets are relatively small in magnitude;

b. the factors that affect asset values in workably competitive markets sharing some similar economic characteristics with the markets regulated under Part 4, in (i) the short-term, and (ii) the long-term;

c. the relationship between depreciated replacement costs and actual asset values in workably competitive markets (with supporting empirical evidence), including discussion of Tobin's 'average q' in a general context and in that of markets with long-lived specialised infrastructure investments;

d. the relationship between market determined asset values, market determined rates of return and prices – i.e., can any general statements be made about the way that observed current rates of return and/or cash flows and/or prices change relative to changes in asset values (i.e., timing and direction)?

e. the variability in the speeds at which asset values in workably competitive markets adjust towards static equilibrium conditions from disequilibrium positions, including the expected outcomes of such adjustment mechanisms; and

f. the implications that the preceding discussion has when attempting to promote outcomes that are consistent with those produced in competitive markets in markets characterised by long-lived specialised infrastructural assets where competition is limited.

Topic two: The relationship between the costs facing potential entrants and asset values in workably competitive markets

a. review of the theoretical arguments advanced in favour of using the HNE test as an appropriate method for assessing whether or not suppliers that face little or no competition are pricing above a workably competitive level (particularly as the test is formulated in the NERA analysis for the MSP[1]);

[1] NERA, September 2002, The Hypothetical New Entrant Test in the Context of Assessing the Moomba to Sydney Pipeline Prices, A Report for the ACCC.

b. your view on the relevance of the HNE test in the context of markets in which long-lived incremental sunk investments are common;

c. your view on the sectors in which the costs facing a hypothetical new entrant may be more or less relevant to the value of suppliers' assets, including the economic characteristics of these sectors;

d. your view on the main strengths and weaknesses of the ways in which the costs facing the hypothetical new entrant can generally be assessed (e.g., the assumptions used for optimisation and depreciation if an ODRC or ODV approach is to be used); and

e. your view on alternative considerations that are relevant to the competitive market counterfactual for markets characterised by long-lived specialised infrastructural assets where competition is limited (e.g., long-term contracts), and the implications of such considerations.

Topic three: Land values in workably competitive markets characterised by long-lived specialised infrastructure investments.

a. the expected relationship between opportunity cost and asset values in workably competitive markets with no sunk costs, and the implications of this for the valuation of land;

b. the relevance of the opportunity cost concept to asset values when services are supplied using both sunk and non-specialised assets; and

c. the economic distinction between MVEU and MVAU approaches as ways of estimating the value of land in workably competitive markets.

d. the treatment of transformation costs when valuing land in workably competitive markets;

e. the relationship between market determined land values, market determined rentals and yields (including the relationship between these over time).

We confirm that this report contains our objective, unbiased opinions on the matters listed above. We also confirm that we have been referred to the Code of Conduct for Expert Witnesses (Code), as contained in Schedule 4 of the High Court Rules for New Zealand, and that this report has been prepared in accordance with that Code.

Topic one: Asset values in workably competitive markets, including the relationship of observed asset prices to replacement cost

By way of introduction, we note that the concept of workable competition was introduced into economics in recognition of the fact that, whilst the examined relationships among competition, economic efficiency and consumer welfare – relationships that are a central interest of welfare economics – typically depended upon an abstract and idealised concept of competition, it was, from a practical point of view, more relevant to consider the implications and effects of forms of competition rather closer to those actually observed in most markets. Workable competition, or as is often called in competition law, effective competition, signifies that the relevant competitive process, whatever its precise structure, is, or is capable of, producing outcomes in terms of economic efficiency and consumer welfare that, at a minimum, are considered satisfactory or acceptable.

When first introduced, by J.M. Clark,[2] workable competition was proposed as a more realistic alternative to the abstract and idealised concept of perfect competition. However, the comparison also holds in relation to other, similar types of economic model, of which perhaps the most relevant over recent years has been the theory of perfect contestability. Like for perfect competition, the conditions necessary for perfect contestability are very rarely, if ever, observed in practice (and there are substantial question marks against the 'robustness' of the resulting theoretical implications, since small changes in assumptions can lead to radical shifts in the implications of the analysis).

Since the economic organisation of an industry or market tends, over time, to adapt to its own relevant circumstances (the economic environment), market structures, economic institutions and business practices can vary significantly from one industry/market to another. Each may be competitive, but competitive in ways that might vary from those of another industry/market. It is not to be expected, therefore, that a workable or effective competition standard will be narrowly prescriptive as to the types and forms of economic organisation and business conduct that might be considered consistent with such competition. Indeed, there has been considerable debate in the literature over the indicia of workable competition.[3]

On the other hand, the concept is far from permissive of all forms of economic organisation and business conduct. For example, early developers of workable competition approaches tended to clearly describe (and seek to justify) explicit criteria to guide decisions over whether competition was and was not workable. Notwithstanding that there was, and remains, disagreement over the

[2] J.M. Clark, 1940, Toward a Concept of Workable Competition, American Economic Review, v30, pp. 241-256.
[3] See for example, S. Sosnick, 'A Critique of Concepts of Workable Competition', Quarterly Journal of. Economics 1958, v72, pp.380-423.

set of relevant indicators, most competition laws around the world rely (at least implicitly) on some notion of workable or effective competition.

Given these initial points, we note the following:

- The concept of competition itself is well-defined, and is the same in both ordinary language and in technical economics. Competition is rivalry; which, of course, can take many forms. It is useful, therefore, to distinguish between the intensity of competition and the forms that competition takes (sporting analogies are useful here: rivalries between teams are of varying intensities, and the forms ('rules') of competition differ, for example, between rugby, soccer and cricket).

- The intensities and forms of competition create different incentive structures and tend toward differentiated performance outcomes. In competition policy, economic organisation and business conduct are generally judged in terms of these tendencies. Thus, rivalry that creates strong incentives for firms to seek out ways of better serving their customers – whether by undercutting a price that is high in relation to cost, or by reducing costs, or by introducing new products, and so on – would be the kind of rivalry that would most usually be described as workable competition.

- Although regulation that stands as a substitute or surrogate for competition can never replicate the properties of a competitive process – for the simple reason that the central dynamic, rivalry, is missing – it is at least possible to ask whether regulatory processes are creating incentives that encourage companies toward the positive outcomes that are implied by the notion of workable/effective competition.

- There are particular problems in linking the concept of workable competition to policy approaches for naturally monopolistic economic sectors, not least because Clark's original paper, and the literature to which it gave rise, was typically concerned with market situations in which, although the supply structure was not of the atomistic form characteristic of perfect competition, there were nevertheless *several* competing suppliers.

- Notwithstanding this difficulty, there are parts of economic literature that come close to reconciling elements of competition with natural monopoly conditions in ways that, in the spirit of the workable competition literature, do not unduly abstract from real contexts. The best known of these approaches is based upon the analysis of franchise bidding, sometimes known as competition <u>for</u> the market, in contrast to competition <u>in</u> the market.[4]

[4] Demestz, H. (1968), 'Why Regulate Utilities?, Journal of Law and Economics, Vol 11, pp 55-65.,

- Both theory and evidence indicate that franchise bidding competition can be undermined by features of the relevant context such as the existence of sunk costs,[5] and hence it cannot necessarily be assumed that such arrangements will invariably be compatible with workable or effective competition. As always, the devil is in the detail. For example, if a franchise is opened up for competition at periodic intervals, much will depend upon the arrangements for the transfer of any existing, specific/sunk assets to a new, winning bidder. Hence, although franchise bidding provides a conceptual framework in which natural monopoly and competition can potentially be reconciled in rather general terms, there is no very simple read across from this way of viewing the problem to implications for regulation in circumstances where franchise bidding is not actually being used.

- Given these problems, we simply note that one conceptually coherent way of linking insights from franchise bidding competition to regulatory practice is to focus on potential competition for franchises or long-term contracts to build and provide services of new assets, whether those assets represent additional capacity to supply or are replacements for old assets that have come to the end of their economic lives. This avoids 'asset handover' problems, since questions about the implications of the notion of workable/effective competition are restricted to new-builds. On this basis, an incumbent supplier can be conceptualised as a holder of a portfolio of long term contracts for the supply of services from assets of different vintages, and attention can be focused on whether or not the forms of contract that are, in effect, determined by regulation are broadly consistent with what might be expected in circumstances of 'competition at the margin'.

- We stress, however, that, in saying that this is a coherent, and indeed a potentially attractive, way of thinking about things in the context of the New Zealand legislation, we do not mean to imply that it is the only possible approach. We have not been asked to discuss *all* the potential ways of making the concept of workable competition meaningful in the context of regulation of natural monopolies, and such a task would be infeasible anyway, given the wide variety of economic circumstances may be relevant.

[5] See J. Vickers and G. Yarrow, *Privatization: An Economic Analysis*, MIT Press 1988, for a discussion of some of the issues.

a. the factors that affect asset values in workably competitive markets where sunk assets are relatively small in magnitude;

The significance of sunk assets being relatively small in magnitude is that capital allocation decisions can be expected to play a continuous and substantial role in influencing economic outcomes, even over relatively short periods of time. For example, if, say, $100 million of assets is dedicated to a particular activity, of which $90 million is recoverable (not sunk), managers will properly need to ask whether economic conditions justify re-allocating part or all of the recoverable $90m to some other purpose/activity. Clearly, the capital allocation choice will depend upon the business prospects in the different activities to which the assets may be applied. The implications for asset values will depend on several other attributes of the relevant industry and/or markets.

Degree of capital mobility[6] *and the origins of economic shocks*

Another way of thinking of the significance of low sunk costs is in terms of the mobility of physical capital between different uses. Where assets are mobile, and assuming competition, one effect is to dampen the effects of shocks to business conditions in a particular market on asset valuations in that market. Suppose, for example, that demand falls and excess capacity emerges, leading to lower prices and profits. With mobile physical capital, assets will be re-deployed to other markets (assumed not to be suffering from the demand shock) relatively quickly. This will limit the decline in prices and profits, and lead to faster recovery than would be the case with less mobile assets. That is, the downward effect of the shock would be damped, and the recovery accelerated by capital exit. By the same token, the fluctuation in forward looking asset values, based on present values of future cash flows from the assets in their initial use, would likewise be damped, and recovery in asset values would likely be quicker.

On the other hand, capital mobility implies that shocks that emanate from other sectors of the economy might be more easily transmitted into the market of interest. This might create fluctuations or cycles in asset values in circumstances where they would not exist if the market was isolated by virtue of sunk capital costs.

The impact of capital mobility (low levels of sunk costs) on fluctuations in asset values therefore tends to depend to some extent on the source of shocks to business conditions. The general tendency, however, is to harmonise fluctuations across economic sectors, via the connections

[6] Here and in what follows the term 'capital mobility' is used to refer to the potential for redeployment of physical capital, or physical assets, from one productive activity to another, usually in a different industry or market. This is to be distinguished from the mobility of financial capital, which is not a matter with which we are directly concerned in this report, although it is, of course, a relevant factor when considering sources of finance for infrastructure sectors of the economy.

that occur as a result of capital mobility, and to lead to convergence of the values of similar assets, deployed in different parts of the economy.

We will return to such convergence processes a little later, after first identifying some of the factors that might serve as hindrances to them, and hence that might serve to cause larger and more persistent inter-market variations in asset values.

Market power

One potential hindrance to capital mobility is market power: for example, in the event of an increase in demand in a market, barriers to entry may limit the adjustment processes, whilst incumbent firms may hold back on capacity expansion in order to increase prices and profits. The effects of such restrictions include higher prices, profits, and (forward looking) asset valuations, and persistence over time of these effects.

In a workably competitive market, these effects can, definitionally, be expected to be limited in magnitude: because the effects of substantial and persistent market power tend to be adverse, such rivalry/competition as exists under these conditions would no longer attract the description workable/effective. However, some degree of market power is compatible with workable/ effective competition, and indeed can play a positive role in establishing dynamic incentives for innovation. To the extent that it exists, therefore, such market power may contribute to inter-market variations in asset values.

Long-term contracting

Where capital mobility is high and adaptation to changing market conditions is relatively quick, it can be expected that economic transactions will tend to be characterised by a prevalence of spot or short-term contracting. In these circumstances, asset values might also be expected to tend to adjust relatively quickly to prevailing economic conditions.

If, notwithstanding this general tendency to short contract durations, a particular market is characterised by a greater reliance on contracts of longer durations, capital mobility and asset value convergence may be impeded to some extent. One example of this outcome is where incumbents with market power use longer-term contracts as a way of making entry into the market more difficult. Again, however, there are limits on the magnitude of the possible effect, since the greater the impact of the strategy the more likely it will be that competition can reasonably be described as being not effective, or non-workable.

The most important issue in relation to contracting options in markets where sunk costs are low concerns the nature of the contracting process for the acquisition of new capital assets, which is substantially influenced by the economics of the relevant capital goods industries. Even for

assets which, once constructed, are not specific to particular uses and markets, such as ships and aircraft, longer term contractual relationships may be a characteristic of the supply of newly built assets. We will discuss some of the issues arising from this in the sub-section on *replacement costs* below.

Relative efficiencies of firms within a market

A classic result of one of the basic oligopoly models in economics (the Cournot-Nash model) is that the aggregate profits in a market tend to be an increasing function of the disparities in the relative efficiencies operating within the market. Since market prices tend toward the costs of the marginal efficient competitor, suppliers with higher efficiency and lower costs will tend to make higher profits. In consequence, the (forward looking) valuations of their assets will tend to be higher.

Thus, even if asset values at the margin tend to converge, systematic differences in average (forward looking) asset values may develop between markets, and may persist for considerable time periods. For example, markets with relatively stable demand and cost conditions, where customer requirements, technologies and techniques are well known and broadly understood, may exhibit relatively little differential efficiency among suppliers, whereas markets subject to much greater technological change, with its attendant uncertainties and asymmetries of information, may be characterised by quite wide, inter-firm variations in efficiency. For so long as these characteristics persist, the *average* values of assets in the dynamic market may exceed the average value of *similar* assets in the more static market, even when capital mobility is providing strong tendencies toward convergence at the margin.

Indivisibilities

Indivisibilities, or lumpiness in assets, can be a factor inhibiting convergence of asset values, even when capital mobility is very high. A good example is container shipping, where, for current purposes, a market can be defined as a particular route or trade. Subject to potential constraints arising from the size of port facilities or the capacity of some passages (e.g. the Panama Canal), ships can often easily be redeployed from one market to another. However, although it is in principle possible to build container ships of more or less any size, there may be cost advantages in building to a relatively large, standardised size. In that case, the lumpiness of the asset may become significant in relation to the size of some smaller volume routes or trades, and capital adjustment processes may take the form of discontinuous 'jumps'. Thus, although the value of vessels deployed in a particular market may be higher than the value of similar vessels deployed in other markets, entry of new capacity may not take place because, after the entry of a 'lump' of capacity, competition may push prices to low levels, such that the *post entry* value of vessels is *lower* than the value of ships in other markets.

More generally, this issue can occur in markets where minimum efficient scale (MES) is significant in relation to market size. Suppose, for example, that MES is 20% of market size. This might be judged to permit a sufficient degree of rivalry among firms capable of achieving efficient scale (five in number) to conclude that competition is workable or effective. If, however, the market expands by 5% and prices increase, new entry of capital may not occur because it would imply inefficiency of operations and higher costs (which, notwithstanding higher prices, make entry unprofitable). Asset values may therefore rise to above the value of similar/equivalent assets in other markets, without triggering any redeployment of physical capital.

The literature on workable competition indicia is generally supportive of the idea that there should be as many suppliers in the market as is consistent with these relationships between MES and market size. Similarly, the fact that a sustainable industry structure might leave incumbents with market power is well understood in the contestability literature.[7]

Demand growth/decline

Starting from a position in which demand and capacity are in balance, trend changes in demand will, other things equal, determine whether capital is flowing into or out of the market. If demand growth is particularly high or demand is in strong decline, the capital reallocations may involve movements of assets to or from the relevant market from or to other parts of the economy. For rates of demand growth that are more in line with economy-wide trends, the adjustments of capacity to (changing) demand are more likely to take place via replacement decisions.

In each case, the precise mechanics of adjustment can be expected to depend upon the significance of sunk capital costs relative to total capital costs. The lower the level of sunk costs, the greater the role likely to be played by inter-market transfers of existing assets when demand growth is substantially higher or substantially lower than the economy-wide average.

Similar points can be made about adjustments to shorter-term imbalances between demand and capacity in a market. These circumstances, however, illustrate the importance of expectations in influencing capital flows, and hence in influencing the adjustment processes when assets come to be more or less valuable than in other markets or sectors.

Consider, for example, the impact of a temporary and unanticipated fall demand in a market in circumstances where demand in other parts of the economy is holding up. The economic value of assets that are largely sunk will fall under such circumstances, but the decline will depend

[7] W. J. Baumol, J,C. Panzar, and R.D. Willig (1982). Contestable Markets and the Theory of Industry Structure. Harcourt, Brace, Jovanovich.

upon expectations of future recovery of demand. The impact on asset values will clearly be smaller if recovery is expected to occur quickly.

Since, by assumption, we are considering a situation in which sunk costs are relatively small in magnitude, the overall impact on asset valuation of a temporary fall in demand, arising from these immobile assets, will be limited; but there is another aspect of the story to consider. Asset markets may be subject to frictions arising from factors such as asymmetric information and adjustment costs (i.e. costs of decommissioning capital from one use and commissioning it in another), which introduce cost irreversibilities into what otherwise would be highly mobile assets. By analogy with consumer goods markets, it is sufficient for current purposes to think of these simply as switching costs.

Switching costs contribute to greater inter-market variations in (economic) asset valuations, particularly in the face of shorter-term and uncertain fluctuations in demand/capacity balances. The underlying business assessments may indicate that, although an asset might be worth more in an alternative use when evaluating returns at current prices, it is not worth selling the asset because:

- There is an expectation that demand will recover, and that the notional economic losses sustained by keeping the asset in its present use will be less than the switching costs, and/or

- Uncertainty about the future, coupled with switching costs, gives the asset an 'option value' in its current use which tilts the balance against selling.

Fluctuations in the economic value of assets deployed in a particular market may, on these accounts, be rather larger than might be suggested by a simple calculation of what fraction of overall capital costs are recoverable.

Replacement costs

One immediate distinction that is relevant to the consideration of the implications of replacement costs for economic asset valuations is the distinction between:

- The costs of replacing any given asset with its modern equivalent, and

- The costs of replacing any given asset with an equivalent asset that is redeployed from another market.

In air transport, for example, assuming that each origin and destination pair of airports or cities/regions defines a market, this distinction would correspond to the difference, say, between

an airline procuring a new aircraft (to replace an old one of similar capacity) to serve the Auckland/San Francisco route/market and redeploying a plane from the Auckland/Hong Kong route/market.

We choose this example because it is one of the best illustrations of markets where market-level sunk costs are low, and because it leads into a distinction between sunkness of assets at a broad, 'industry' level, and sunkness at the level of the market. When Boeing or Airbus build a new plane, the costs of manufacture of the asset are sunk in the immediate sense that there is no way in which they can be recovered by converting the aircraft into some other type of economic commodity with value. A plane is a plane, and is specific to its purpose, flying passengers and freight. It is not, however, specific to a particular (geographic) market for flying passengers and freight, and hence the capital costs of the plane are not economically sunk when analysing valuation issues at the market level.

Similar examples that we could have used include various shipping and road transport markets, and in each case there is a distinction between:

- Already constructed assets that are economically mobile as between sectors (e.g. the existing stock of aircraft), and

- Yet to be constructed aircraft, such as those currently on offer from the Boeing and Airbus portfolios.

Maintaining the assumption of low sunk costs (at the market level), at any one point in time there will tend to be strong convergence between the forward looking returns from deployment of an asset in a particular market (its economic valuation) and its value in other markets. Since the latter can be interpreted as a 'replacement' cost – any asset can be replaced by redeploying an equivalent asset from another market – it can be said that there should be strong convergence between asset values in a particular use/market and replacement costs in this sense. In air transport markets, for example, major airlines are constantly redeploying aircraft in their fleets to optimise returns.

The relationship between economic valuations of assets in current uses and replacement cost valuations based upon the construction/manufacturing costs of modern equivalent assets is rather more tenuous. Market prices of existing vessels can, for example, deviate substantially and for extended periods from new-build vessel prices, even in periods when new vessels are being bought and sold. One reason for this – and the same is true in air transport – are construction and ordering lags: it may be that it is necessary to order new builds years in advance of expected commissioning dates. Hence, even though, when deciding whether to purchase new capital assets, a buyer may compare the acquisition cost with the anticipated net present value of the stream of returns attributable to the asset, that stream of returns will relate to a period starting a

number of years into the future. In contrast, the NPVs of currently existing assets will be evaluated on the basis of returns with a much more immediate starting point, and will therefore cover a period not encompassed by the new-build decision. Since, particularly when discount rates are relatively high, the first few years of returns are likely to have a considerable influence on the NPV, there is scope for significant differences to emerge between the two valuations.

We note that the current 'market values' of mobile (as between markets) or non-sunk assets could be either significantly above or significantly below current modern equivalent asset (MEA) replacement costs. If returns are buoyant across all markets in which the assets could be used, current asset valuations could be much higher than MEAVs; if market conditions are depressed they could be much lower.

Of course, it is always possible to construct economic scenarios, models or accounting systems in which these deviations would not occur. For example, if new capital assets were, in effect, auctioned in spot markets, and if MEAVs were based on those spot prices, there would be strong convergence between economic valuations and MEAVs; but new capital assets of types most comparable to assets used in regulated industries, are not typically sold in this way, and MEAVs are not estimated on the basis of resulting spot prices. Such approaches would therefore be largely unhelpful in dealing with economic realities.

In summary then, the above discussion indicates why there tends to be a general pro-cyclical pattern in economic asset values, even when assets are not specific to a particular market (i.e. are not sunk at the market level), and hence why there is a similar pattern in the ratio of (market) asset values to estimates of relevant replacement costs based largely or partly on MEAs (Tobin's q).

We note also at this point that:

- markets characterised by the existence of sunk assets that are relatively small in magnitude tend to be characterised by an absence of intangible assets (brand values, patent portfolios, etc.), for the obvious reason that such assets tend to have substantially lower (though not necessarily zero) values in alternative markets; and

- it is often markets in which intangibles are important that have the highest ratios of market value to accounting estimates of replacement costs.

b. the factors that affect asset values in workably competitive markets sharing some similar economic characteristics with the markets regulated under Part 4, in (i) the short-term, and (ii) the long-term;

The assets with which the Commission is concerned tend to be specific to particular markets, or segments of markets. Put another way, the assets are not economically mobile as between markets: wires, pipes and runways cannot easily be redeployed to other uses and other markets (they can obviously serve different customers who operate in different downstream markets, but that is a different point entirely).

A similar set of factors can be expected to be relevant in affecting asset values as in the case of markets where inter-market asset mobility is much higher. What are likely to differ are the quantitative magnitudes of the effects. We therefore simply list out the factors again, with a very short comment on each, before going on to consider the major reasons for the changed, quantitative implications.

- *Degree of capital mobility and the origins of economic shocks*

  With lower physical capital mobility, a market will be more insulated from the rest of the economy. Shocks emanating from within the sector will therefore be less damped, whereas there will be greater protection from external shocks.

- *Market power*

  Lower capital mobility tends itself to be a factor contributing to higher market power, via its effects on entry and exit barriers. For workable/effective competition to exist, therefore, rather greater reliance will need to be placed on rivalry between established firms.

- *Long-term contracting*

  Deployment of specific and durable capital to a particular purpose/market is often associated with arrangements that involve parties in longer term commitments. This is perhaps the difference with the most far reaching economic consequences, and it will be discussed below.

- *Relative efficiencies*

  Linked to the implications of sunk costs for barriers to entry and exit, significant differentials in the efficiencies of firms operating in a market may persist for longer (it may take longer for them to be competed away).

- *Indivisibilities*

As above.

- *Demand growth/decline*

As above, although the stabilising effects of capital mobility will be largely absent, so both the impact and duration of the effects can be expected to increase.

- *Replacement costs*

There will be no 'second hand' markets to which reference can be made in determining the cost of replacing an asset with an equivalent asset already constructed and deployed in a different market. Replacement cost valuations will therefore almost inevitably have to be based on MEA (newbuild) costs, which, for reasons given, can be expected to exhibit more remote and more tenuous relationships with economic valuations.

Commitments and choice

Given substantial, market-level sunk costs, it is to be expected that, other things equal, there will tend to be much larger deviations of asset valuations from replacement costs in particular periods (i.e. in the short-term), and that any such differences that emerge will tend to persist for longer (in comparison with markets where asset mobility is a more significant factor). The particular patterns of deviations will depend upon the specifics of the relevant market context. For example, if replacement costs are relatively stable whilst demand is volatile, asset valuations might fluctuate/cycle around replacement costs over time. On the other hand, if replacement costs are rising steadily in real terms, and other economic conditions are not particularly volatile, we might find that although asset valuations are increasing over time, they persistently lag behind the upward movements in replacement costs (i.e. Tobin's q remains more or less permanently below 1).

Consider, for example, a situation in which the costs of operating old plant are rising on account of an increasing frequency of periods of non-operation (due to wear and tear). In an initial (static) equilibrium, such plant may come to the margin of replacement when its operating costs reach the full cost of modern plant, with which it is to be replaced. Now suppose that replacement costs increase. It will be profitable to keep plant at the margin operating longer, until such time as the operating costs have risen to the new, higher replacement cost level. During this period, whose duration will depend in part on the size of the hike in replacement costs and the rate at which operating costs of old plant increase with age, market prices will, in competitive conditions, be rising and (given the static assumptions) demand will be falling.

Although equilibrium will be eventually restored, at a higher price, there will be a lagged adjustment, and, if replacement costs keep increasing, what will be observed is continuing adjustment, including of existing asset valuations, toward equilibrium (where asset values will be aligned with economically depreciated replacement costs). During adjustment, increasing prices will raise the values of existing assets, if output is sold at spot prices (see below on the implications of long-term contracts), but the process will be gradual. If the hike in replacement costs is fully anticipated (from a time before the construction of any current assets), the process will be reflected in expected depreciation rates, determined *ex ante*, which will be lower earlier on and higher later than under fully static conditions. If the replacement cost hike is unanticipated, owners of existing assets will enjoy windfall gains.

Of particular significance in the hypothesised circumstances (of significant sunk costs) is the larger role that may be played by longer-term contracting, whether of an explicit or implicit (e.g. reputational) variety. This occurs because a prospective combination of asset sunkness/durability and (*ex post*) market power (specifically *ex post* buyer power) can give rise to opportunism and hold up problems when longer-term contracts between buyers and sellers are absent.

Implicit longer term contracting can occur when the economic relationship between the buyer and its customers is of an ongoing nature. Short-term profit maximisation in such circumstances may be disadvantageous for the seller because the buyer prefers stability, either in the price or the quality or the supply reliability of the product. Where there is competition, with some suppliers offering greater stability than others as a matter of corporate policy, customers may positively prefer to deal with the former, even at higher prices.

By way of illustration, consider a supplier with a regular customer base who is suddenly faced with extra demand from new customers. In the short-term, it might be possible for the supplier to serve all demand, both new and old, but only by incurring extra costs. This suggests that prices should be raised. It may nevertheless be unprofitable to operate in this way if, by so doing, the reputation of the company would suffer among established customers, who, in a workably competitive market, might choose to switch business to rivals considered to be more 'reliable' or 'less opportunistic' in their pricing. The better strategy might be to forgo some short-term profits by continuing to supply at the old prices until such time as costs can be brought down again by adjustments of capacity.

Explicit long-term contracts, struck *ex ante*, may occur in a variety of different economic circumstances, of which simple bilateral monopoly is the most basic. Among the other possibilities are circumstances where franchise bidding or tendering competition is feasible, since, although there may be competition for the contract *ex ante*, *ex post* there may be market power on either or both sides of the transaction, depending upon the levels of sunk investments made by the contracting parties in the relevant supply relationship. Such contracts are common

in public procurement, but are by no means restricted to the public sector. Gas procurement contracts struck by competing gas suppliers in liberalised energy markets are an obvious case in point.

It is not necessarily the case, of course, that the existence of sunk assets implies the existence of buyer power problems, and much depends upon the organisation of the relevant markets. A power station that is constructed to serve a particular customer or group of customers who do not have access to a wide-coverage transmission grid may be vulnerable to *ex post* market power problems, whereas an exactly equivalent asset, connected to such a grid, may be able to sell to a large number of potential buyers.

Remembering that the purpose of the current exercise is to assist in the development of regulation, it is sensible to recognise both that the existence of workable competition is consistent with a range of different market circumstances and that it is those circumstances that are closer to the conditions prevailing in regulated or price-monitored activities that are likely to provide the more immediately relevant benchmarks. Since, in regulated industries, the regulator has an influence on selling prices that is akin to the potential influence of a buyer with market power – a similarity that is reflected in the economics literature on regulation, which focuses considerable attention on the 'policy credibility' or opportunism problem – we think it appropriate to direct attention to workably competitive markets that are subject to potential hold-up problems.

In doing so, it is relevant to point out that the existence of potential (*ex post*) buyer power is not a feature of the market that necessarily means that competition will not be workable or effective. Indeed, longer term *ex ante* contracting can be seen as the market 'solution' to the potential market power problem. That is, terms and conditions of supply are settled early, when each party to the bargain has more numerous, economically feasible, substitutable alternatives than later, when one or both of the parties are 'locked in' in some way or another. Competition can be effective/workable precisely because things are settled at a time when effective alternatives exist for both buyers and sellers.

The contracts we are referring to here can be of a number of forms. One important distinction is between contracts for the capital good itself (as when a ship owner/operator makes commitments to a shipbuilder in relation to the construction of a new, specialised vessel that has limited uses) or for the output from the asset (as when a power station operator contracts ahead for sale of output from a power station that is about to be constructed). It is the latter that are most relevant when considering how a regulatory authority might influence the prices or charges of utilities, although, as has already been seen in the discussion of markets with low levels of sunk costs, the former also has an important, but different, influence on asset valuations. Regulators, presumably reflecting societal preferences, often tender for contracts which involve payment schedules that relate prices to CPI. A good reason for this is that both parties can credibly

enforce such contracts in a way that cannot be guaranteed otherwise. Indeed utility sectors in developing countries have found themselves forced to renege on other types of contracts (e.g in Argentina where US-dollar indexed contracts were unsustainable post-currency crisis in 2002).

In relation to a longer-term sales contract, once struck the terms of the contract will influence the future stream of returns of the supplier, and hence the value of the relevant assets. That is, economic asset valuations will typically be affected by historical events since, although such valuations continue to be forward looking, the future income streams on which they are based will themselves depend on historical events, specifically aspects of the terms and conditions that reflected economic conditions and expectations at the time the contract was struck, and which may be significantly out of line with current conditions.

There are many economic contexts in which contractual arrangements that get seriously out of line with current market conditions might be expected to be renegotiated, and it might be argued, on the basis of this point, that, even in the presence of longer term contracts, it is short-term economic conditions that are of dominant importance in influencing asset values. There are, however, two limitations to this argument:

- If significant short- to medium-term deviations between contract and short-term (spot) prices (where these prices actually exist) were not contemplated, the long-term contract would have little point. These are not circumstances that are particularly interesting for the current exercise since, as indicated, we are focused on situations consistent with the existence of an underlying/background hold-up problem.

- In the circumstances of interest, the causes of pressure to renegotiate – which are most usually linked with the potential competitive distress that a long-term contract, which is out of line with current market conditions, might cause to one of the parties - are likely to be absent. Thus, a supplier is not likely to be distressed by contract prices that, although low in relation to prices being determined today, are sufficient to provide a reasonable rate of return on capital; whilst a buyer might be able to accommodate higher (than current) contract prices if the relevant contract is one of a portfolio of contracts, struck at different times, some of which are 'in the money' and others of which are 'out of the money' (that is, the buyer has well hedged positions), or if the buyer has substantial market power in downstream markets (which are not the markets to which the workable competition benchmark/standard is being applied).

Investment and real options

In addition to, and separate from, longer-term contracting/commitment issues, we note that market-level sunk costs can be expected to interact with uncertainty to produce a divergence between entry and exit prices. Potential entrants have the flexibility to choose whether and when

to commit (sink) capital. When prices and revenues are uncertain, it can be advantageous to delay entry until demand conditions provide greater confidence that sunk capital costs will be recovered (e.g. until there are higher prices). Similarly, under these conditions firms will be reluctant to incur any sunk costs associated with exit and potential re-entry until prices are low enough to convince investors that there is no further value in delaying exit.[8]

Thus, in the short-term, market prices can vary within a range (corresponding to the entry/exit price range) without inducing new entry or exit. Call this the 'dead zone'. Somewhere in the middle of the dead zone will be a price level corresponding to a long-run static equilibrium, where economic conditions are unchanging and where economic asset values are equal to MEA costs. The fact that the entry and exit prices lie either side of this price level implies that economic asset valuations can rise above or fall below MEA costs, and remain there durably, without triggering new entry.

Real option values do not arise in the theory of perfect competition, for the simple reason that the theory abstracts from uncertainty. Similarly, they don't exist in conditions of perfect contestability, for the simple reason that, in this case, theory abstracts from the existence of sunk assets. Notions of workable or effective competition do, in contrast, embrace the existence of uncertainty and asset sunkness, precisely because they are intended to be more realistic, and uncertainty and sunkness are almost invariable characteristics of economic reality.

MEA costs exert their influence chiefly via the new entry price, which they affect directly. However, if prices are in the dead zone, and if we are concerned with more dynamic conditions in which, among other things, replacement costs are changing over time, it cannot simply be *today's* replacement costs that matter. Since entry of capital will not be triggered until the entry price is reached, and since, from any given starting point, it might be reckoned that it will take some time to reach that price, it will be replacement costs at the relevant future time that are most directly related to the asset valuation level at which new entry is triggered. In summary, when considering the timing of investment, the expected future evolution of MEA costs is directly relevant, as is the expected future evolution of demand. Each of these factors will affect assessments of the future evolutions of market prices, which in turn will feed directly into the NPV calculations that determine the value of current assets.

[8] The real options theory of investment was first comprehensively outlined by A.K. Dixit and R.S. Pindyck (1994) *Investment Under Uncertainty*, Princeton University Press. The empirical relevance of the theory has been demonstrated in several papers, though this is often represented through indicators other than the trigger price, such as the timing of investment. The existence of a land preservation option delayed development by six years on average in a detailed study of USA data, see C.A. Towe, C.J. Nickerson and N. Bockstael, 2008, An Empirical Examination of the Timing of Land Conversions in the Presence of Farmland Preservation Programs, American Journal of Agricultural economics, v90, pp. 613-26. Another recent paper used real estate data and showed that real option effects still exist in workably competitive markets, but that the size of their impact is negatively related to competitive intensity, see E.S. Schwartz and W.N. Torous, 2007, Commercial Office Space: Testing the Implications of Real Options Models with Competitive Interactions, Real Estate Economics, v35, pp.1-20.

A similar point can be developed in relation to the replacement of existing assets: it will be replacement costs around the time that replacement becomes a marginal decision that will be relevant in driving the economic outcomes.

There will, of course, necessarily be some uncertainty as to what these future replacement costs will be, and as to where any long-term equilibrium might therefore lie (an uncertainty about the future which is entirely consistent with the notion of workable competition, a concept that is not associated with the proposition that there exists a single, precisely calculable long-run equilibrium).

An important question that arises from these points is: should regulators seek to incorporate real options values into their assessments? If the regulatory system is intended to expose returns on investments to fluctuations in current market current conditions, the answer is yes, unless the future is relatively certain and sunk costs are low (a condition that is unlikely to be fulfilled).[9] In practice, however, most regulatory systems do not do this. Rather, they are based upon long-term contracting approaches, which 'fix' the asset value at the moment that it enters the RAB, and do not adjust it thereafter. In such circumstances, option value issues disappear, and the issues of uncertainty and sunkness are addressed via the assessment of new investments *ex ante*, for example via 'prudence reviews' or requirements that investments be efficiently incurred.

This approach can, of course, lead to excessive investment, including via investment that is incurred ahead of the time that it is (efficiently) required, because it makes no explicit provision for the 'option value' of waiting. In principle, regulators should be fully awake to the tendency toward such over-investment – like buyers in workably competitive markets – but regulatory incentives to err on the side of caution mean that, in practice, many projects may approved that are 'too early' (this appears to be a common phenomenon across different national jurisdictions). Nevertheless, regulators can at least avoid any bias that might be created, when setting the allowable rate of return, by inappropriately awarding suppliers 'option values' that are, in effect, eliminated by regulatory arrangements that are akin longer-term contracting which reduces exposure of the supplier to variations in market conditions.

[9] Saying that options values should, in principle, be taken into account does not, of course, imply anything about what such values might look like in a specific context. Thus, although the idea that has received most attention is the value of waiting before making commitments to irreversible investments, so that the option is retained to bring later information to bear on the investment decision, it should not be forgotten that waiting/delay can also lead to a loss of opportunities/options. This is most obvious at the level of the individual firm in a competitive market, where waiting may, for example, mean that a rival wins a race to innovate.

c. the relationship between depreciated replacement costs and actual asset values in workably competitive markets (with supporting empirical evidence), including discussion of Tobin's 'average *q*' in a general context and in that of markets with long-lived specialised infrastructure investments;

Aspects of this issue have been covered in the above sections, and Annex 1 comprises a discussion of the empirical evidence authored by John Small. Tobin's q is based on estimates of the replacement cost of an existing set of assets. The review shows that observed market values vary quite widely from equality with replacement cost, that some of this variation is systematically correlated with contextual factors, and that average q can be less than one for many years in a row.

Since the economic environment can vary substantially from one market/industry to another, it is not feasible for us to discuss even a modest fraction of the possible contexts in which competition might be considered workable. One example of a market with long-lived specialised infrastructure assets, which we give now and a little later, and which may assist in providing a more concrete form for some of the reasoning, is power generation.

A feature of this industry is that several different technologies are employed, having marginal costs that vary from approximately zero (for hydro stations during periods of abundant water supply) to quite high levels associated with running gas and even kerosene powered turbines.

In the short-run, we might expect to see prices in a competitive spot market reflecting the short-run costs of plant that is marginal in a given period (and the plant that is marginal will vary from period to period, depending on the level of demand for example). In effect, the different types and vintages of plants, each with differing short-run marginal costs, will combine to form a 'short-run supply curve'.[10] In the long-run, it is to be expected that, *others things being equal* (always a crucial provision when quite a lot may be going on), there will be some tendency for prices to move toward the long-run marginal costs of the plant type that will be marginal at the relevant time of year and level of demand. These long-run costs marginal costs will be determined by the costs of new plant, and hence to replacement costs at the margin.

The main point here is that, because thermal plant of one variety or another is very frequently 'at the margin', even in power systems that, like New Zealand's, rely heavily on hydro generation, the economic value of an existing hydro plant need not be related in any direct and close way to the cost of replacing the plant, *even over long periods.* Its value, in a spot market context, depends chiefly on expected wholesale power prices, which depend upon short-run marginal

[10] Although such curves are only strictly defined where suppliers are price-takers, and although the concept of workable competition clearly embraces situations in which suppliers are not price-takers, the approximation should be acceptable for illustrative purposes.

costs of *thermal* sets, which, over time, are subject to the influence of, but are themselves not closely determined by, *thermal*-set long-run marginal costs.[11]

d. the relationship between market determined asset values, market determined rates of return and prices – i.e., can any general statements be made about the way that observed current rates of return and/or cash flows and/or prices change relative to changes in asset values (i.e., timing and direction)?

There is an important, initial distinction to be made between these relationships considered as linkages between (a) marginal and (b) average values of the relevant variables (and between marginal q and average q).

Under workable competition, once the assets are in place, their values are determined by underlying supply and demand factors, with the valuation of 'sunk' investments occurring in the ways that all economic rents tend to be determined in competitive conditions, via expectations of current and future cash flows – e.g. a fall in demand will lead to lower prices, margins and cash flows, and hence to lower asset values.

The levels of asset values coming out of the immediate competitive dynamics are not necessarily in lock-step with current earnings, because expectations about the future are also relevant to current valuations. For example, assets values may increase, and current yields on those asset values may decline, as a result of more bullish expectations of future demand.

Simply because expectations of the future have become more bullish does not mean that suppliers could induce consumers to accept higher prices in circumstances where short-run supply and conditions remain unchanged. If suppliers could do that, it is arguable that the relevant conditions are not workably competitive, since a key characteristic of workable competition is that it provides consumers with the means to protect themselves against such pricing conduct.

As discussed above average 'q' can vary significantly without being associated with short-term tendencies for entry or exit of capital (the entry/exit price distinction drawn above).

Before sunk assets are in place, the costs of building and commissioning assets will play a large role in determining investment decisions. New capital will only enter if marginal $q > 1$. The influence here flows *from* replacement cost values *to* prices and margins. After investment is in place, the influence of replacement costs declines and asset values tend to *reflect* the earnings

[11] This analysis is not undermined by widespread trading via electricity contracts designed to avoid exposure to the spot market, since those contracts are in any case priced with reference to expected spot market prices.

that can be achieved in the hypothesised, competitive circumstances (and the existence of workable competition implies there will be no guarantees of cost recovery, except where this is specifically negotiated *ex ante*). Even marginal 'q' may quickly turn out to be significantly higher or lower than one.

e. **the variability in the speeds at which asset values in workably competitive markets adjust towards static equilibrium conditions from disequilibrium positions, including the expected outcomes of such adjustment mechanisms;**

We take it that this question refers to the adjustment process that would take place in circumstances where all changes in background economic parameters cease, and where the adjustment takes place only via the entry and exit of capital. This seems to be a natural context in which to consider adjustment speeds, although it can be noted that, at any point in time, actual market adjustments may be pointing toward a quite different outcome, based upon a particular set of expectations about the future movements of the relevant market parmeters.

Subject to this clarification, it might be expected that, depending upon the influence of longer term (explicit or implicit) contracting:

- adjustment speeds will tend to be slower when sunk costs are high and assets are durable (see earlier);

- the greater the role played by longer term contracting the slower will tend to be the rate of adjustment, although the precise adjustment dynamics will depend upon the characteristics of the relevant contracts, including any indexation provisions;

- if economic conditions are truly static/unchanging, asset values will eventually converge to depreciated replacement costs. Note, however, an implication of an earlier point: if everything is static except that replacement costs are rising, it is feasible that $q < 1$ could persist indefinitely.

f. the implications that the preceding discussion has when attempting to promote outcomes that are consistent with those produced in competitive markets in markets characterised by long-lived specialised infrastructural assets where competition is limited.

To repeat an earlier point, regulation itself is often analysed in terms of the regulator acting as a 'buyer' for end consumers, and further acting as a buyer with market power. As noted above, it is possible to envisage workably competitive markets in which, because of asset specificity, buyers have *ex post* market power, but in which *ex ante* contract competition is sufficient

simultaneously (a) to protect consumer interests against seller market power, and (b) provide FCM for suppliers in relation to the specific risk of *ex post* buyer opportunism (and hence maintain investment incentives). This seems to us to be the nearest 'workably competitive' situation to the regulatory position, the residual difference being broadly that between a workably competitive oligopoly/oligopsony and simple bilateral monopoly (one seller, one buyer/regulator).

In the traditional RAB-based approaches to regulation found in jurisdictions such as the US and UK, and starting from any given asset valuation, the RAB adjustment process mimics the Tobin marginal/incremental q process. That is, application of the 'efficiently incurred' test will tend to imply that capex entering the RAB will have a marginal q close to one.

The RAB itself, upon which *average* allowable prices are based, can therefore be interpreted as the depreciated, cumulative value of all past, incremental capex, valued at the replacement cost pertaining at the time of the investment. The calculations here (i.e. US/UK style arrangements) are chiefly done on a simple historic cost basis or an indexed historic cost basis.

This corresponds to the asset valuation adjustment process in a workably competitive market in which long-term supply contracts are struck in conjunction with each new tranche of investment. *Asset values in such circumstances tend to be heavily influenced by historic costs (i.e. the replacement cost of each tranche of new investment, as estimated at the time the investment is made),* although again the degree of influence is affected by the nature of any indexing provisions.

Within this same context (a workably competitive market in which longer-term contracting is prevalent), the asset value at the start of any period would itself tend to reflect the *past* bargains between consumers and suppliers, crystallised in the contracts (explicit or implicit).

A good illustration of these points are gas supply contracts struck in markets lacking liquid spot gas markets (e.g. the US and UK in earlier periods, much of continental Europe today). Gas utilities typically held/hold a portfolio of contracts for supply, struck at different times, and requiring per kWh payments that were influenced by the economic conditions at the times at which contracts were struck, and hence which could differ substantially from contract to contract. On the other side of the market, gas producers' revenue streams were likewise influenced by similar factors.[12] [13]

[12] Similarly, we understand that the development of the Maui gas field in New Zealand was facilitated by long-term contracts at effective prices that were well below the replacement cost of gas by the time new gas was required.

[13] If gas suppliers are price takers in downstream markets, they will take and sell gas up to the point where the downstream price, net of relevant supply costs, is equal to the cost of wholesale gas on the marginal contract. Workable competition encompasses non-price-taking conduct, and hence this condition generalises to an equation between downstream marginal revenue and marginal cost. The cost of wholesale gas on the marginal contract is not, however, generally equal to the replacement cost of supplies (the cost of gas on a new contract, struck today). It

We note that, although downstream gas markets may have been monopolised, upstream markets were not. Thus, in continental Europe, gas utilities in different jurisdictions might compete for new long term supply contracts obtainable from a number of different sources. We note also that the different 'prices' for gas determined by different contracts struck at different dates did not imply that different groups of downstream consumers were necessarily charged different prices. Rather, gas supplies from different sources are typically 'pooled' by utilities and, to the extent that quantities taken under different contract can be varied, the effect is simply to present the buyer with a rising short-run supply curve (supplies at lower contract prices being called or 'nominated' first.)

If, for some reason, no such (past) long-term bargains are considered to have standing – i.e. the market is entirely cleared of past commitments in a kind of jubilee process – then initial outcomes would be determined by the immediate demand and cost conditions of the day (i.e. it would be a short-run equilibrium outcome). This follows from the fact that workable/effective competition is usually taken to imply that consumers have the means to protect themselves against the exploitation of significant market power, which pricing substantially above short-run equilibrium prices would be.

Note that, given the existence of sunk costs, a workably competitive market without long-term contracts would, assuming it was viable (see above), likely lead to more volatile asset values because the valuations would be subject to the vagaries of all the various factors discussed earlier in this note. From the supplier's point of view, it is typically the case that a key purpose of a long-term contract is to mitigate risks to asset valuations that might arise from buyer opportunism; and, as discussed, the supplier might (but also might not) seek to shed some other sources of risk.

For example, institutions providing finance for the purchase of specialised shipping vessels (refrigerated vessels or LNG tankers) may make it a condition of that finance that the ship-owner has secured long term charter arrangements for the vessel (a form of long-term contract) – or alternatively finance may be provided at lower cost where such charter arrangements have been obtained, reflecting the fact that some market risks have been passed across to the charterer. Note also that, in this market, the depth of trading in specialised vessels may be insufficient to establish a market index (e.g. of ship hire rates for vessels of the relevant type and size) such that

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may be lower, because demand is relatively depressed for example, or higher, because the development of new supplies may be subject to considerable lags. The short-run supply curve to a company with a portfolio of contracts will also be affected by the nature of the relevant bargains. For example, one form of contract is 'take-or-pay', meaning that the buyer will pay the supplier for the gas whether or not it takes gas up to a designated contract level of supply, which transfers demand risk from seller to buyer. Where take-or-pay contracts are used and spot markets are absent, the marginal cost of wholesale gas to the buyer effectively falls to zero, up to the designated contract level, and a prevalence of such contracts in a market can lead to very low downstream prices, well below levels indicated by the longer-term replacement costs of gas.

long term contracts could be linked to it. This does not, however, mean that the relevant markets are not workably or effectively competitive: they are, in fact, characterised by significant numbers of both buyers and sellers.

In summary

Like long-term contracting, RAB-based regulation, as conventionally applied, has the effect of protecting investors against risks that are similar to some of the risks that can confront firms in workably competitive markets characterised by durable, sunk assets (buyer/regulatory opportunism, high downside exposures on sunk investments). There is, therefore, a distinct similarity (of this type of regulation) with a key feature of a workably competitive market in which long-term contracts are a major form of supply relationship. Indeed, regulation itself is often analysed as a type of (highly) incomplete contract between investors and consumers. In particular, we note that the notion of financial capital maintenance, particularly in relation to the risks of *ex post* opportunism, is likely to feature prominently in both situations (regulation, workable competition under the hypothesised circumstances).

Topic two: The relationship between the costs facing potential entrants and asset values in workably competitive markets

a. review of the theoretical arguments advanced in favour of using the HNE test as an appropriate method for assessing whether or not suppliers that face little or no competition are pricing above a workably competitive level (particularly as the test is formulated in the NERA analysis for the MSP);

The theoretical arguments in favour of using the HNE test, at least when applied in relation to the assets of an incumbent utility in their entirety (i.e. and therefore not for incremental projects only) derive chiefly from contestability theory, and, in a strict sense, their (theoretical) validity is contingent on the assumptions of contestability theory, which include the assumption that fixed costs are zero.

For that reason, among others, one would need to think very carefully about what the HNE test is helping us understand. It is unlikely that it is intended simply to inform us of how things would be if things were very different from the way things actually are: there must be some claim that the assumed, hypothetical conditions carry valuable economic information that is relevant in other, realistic economic conditions. However, particularly given the known 'non-robustness' characteristics of some of the propositions of perfect contestability theory, it is unclear what the basis for this claim actually is. Clearly the idea of allowing incumbent monopolies to earn returns based on the cost of hypothetical new entrants depends also on what precisely we mean

by this latter concept. A refranchising to operate the existing assets subject to a fair value asset transfer could be construed as hypothetical new entrant benchmark, although that then raises the question of how 'fair value' is to be determined. A start-from-scratch entrant cost might often be overgenerous.

To illustrate this last point, an incumbent might have been granted easements in the past in order to facilitate and promote the development of a utility system. A HNE test may ask how much it would cost to obtain such easements today, which could be a much higher number. However, to incorporate such value into the asset base and, as a result, to raise prices could be considered perverse in circumstances in which the relevant concessions were granted for the ultimate benefit of the community as whole, as consumers, not for the ultimate benefit of shareholders. By incorporating the value of past concessions into the asset base, and hence allowing that value to be 'remunerated' by higher cash flows consequent on higher allowable prices, a HNE approach could lead to an unintended re-distribution of income from consumers to shareholders.

One possible argument is that the HNE can be considered as a 'thought experiment', with a view to assessing the highest level of price consistent with workable competition. An immediate problem is that the test does not actually do this for markets characterised by sunk costs and uncertainty going forward: the new entry price may be *above* that implied by replacement costs. In any event, upper bounds are not necessarily very helpful in and of themselves (infinity is an upper bound).

As formulated by NERA for the Moomba-Sydney pipeline case,[14] the HNE test would set the benchmark service price using:

- replacement costs for an optimised new asset ORC (which are then annualised) divided by
- total market volume.

NERA justifies the use of total market volumes on the basis that the HNE will be of efficient scale. This is a critical point; indeed it is probably the main substantive point in NERA's report, itself a critique of earlier analysis that used a different volume assumption.

In the market relevant to the NERA analysis, a single supplier is the efficient industry structure. However, at least when viewing the HNE analysis as dealing with a situation that could potentially represent a real possibility, the assumption that the HNE will fully capture the incumbent's customers raises a question about what would then happen to the incumbent's pre-existing, long-lived assets. Standard entry theory suggests a competitive response which would

[14] NERA, September 2002, The Hypothetical New Entrant Test in the Context of Assessing the Moomba to Sydney Pipeline Prices, A Report for the ACCC.

drive prices down, potentially to a floor defined by, or at least related to, variable operating costs. That this is assumed not to occur shows that the entry assumptions underlying the HNE test (as formulated by NERA) do not involve actual competitive entry as such, at least under realistic conditions. Rather, the test seems to be fairly rigidly linked to the notion of perfect contestability under conditions of zero sunk costs, and therefore not grounded in factual realities.

In more recent work submitted to the Commerce Commission in the context of the Input Methodology consultations, NERA describes the outcome of the HNE test as leading to ODRC valuations, which in the relevant industries will tend to be materially less than ORC valuations.[15] Given the economic similarities between the Moomba-Sydney pipeline and the Orion electricity distribution network, it is not immediately clear what accounts for the shift in emphasis from ORC to ODRC. One possibility is that the difference might be attributable to the use of a different competitive standard, and specifically to the fact that a workable competition standard is relevant to the Commission's analysis, but it is also possible that it is driven by different economic modelling assumptions or by different purposes (e.g. whether the immediate focus is on the calculation of regulated prices or on regulated asset values).

In the New Zealand context, it may be a greater weakness that NERA's more recent HNE analysis does not consider the impact of entry on market prices in workably competitive markets. NERA's rationale for ODRC valuations is entirely cost-based: an entrant will only pay ODRC because that defines cost indifference between existing and new assets. However in many markets, including what would typically be judged to be workably competitive markets, extra capacity increases the intensity of competition and depresses market prices.[16] This is because of the existence of at least some sunk costs.

One possible way forward is to base depreciation calculations on second hand prices of existing assets, which would fit with an assumption that the HNE puts together its business by buying such assets. This would be a practicable way forward in circumstances in which reasonably liquid markets in second hand assets existed, on a sufficiently comprehensive scale, for the calculations to be done. In such circumstances, the asset valuation of a HNE could be derived from an assessment of what assets are efficiently required to supply the relevant products and services, based upon objective benchmarks (market prices). In the absence of such markets, however, this approach will not be feasible.

[15] See for example, NERA, 15 October 2009, Asset Values in Workably Competitive Markets. A Report Prepared on Behalf of Orion New Zealand Ltd.

[16] This is predicted by the popular Cournot model of competition. For theoretical extension to price competition when sunk assets are important see D.M. Kreps and J.A. Scheinkman 1983 Quantity Precommitment and Bertrand Competition Yield Cournot Outcomes, Bell Journal of Economics, 14, pp. 326-337. For experimental support for Kreps and Scheinkman. see V. Anderhub, 2003, Capacity Choices and Price Competition in Experimental Markets, Experimental Economics, 6, pp. 27-52.

We note that the fact that the HNE test can be formulated in terms of (a) assuming complete displacement by a brand new asset (in the Moomba-Sydney case), and (b) the purchase of existing second-hand assets (in these proceedings), itself illustrates the hazards associated with using the HNE concept to guide regulatory asset valuation. The main point, however, is an empirical one: complete displacement of existing assets is linked to notions of perfect contestability, procurement of second hand assets presumes the existence of sufficiently comprehensive second-hand markets in assets, and neither approach is likely to be close to factual realities, including the realities of workably competitive markets.

There are also time consistency issues to consider. We note that some expert advisors to firms in these proceedings have invoked the workable competition standard to advocate ODRC valuations of the initial asset base, while also supporting a lock-in and roll-forward approach to setting future asset values.[17] To the extent there is disagreement over the way assets will be valued after the initial period, it relates only to indexation. Thus an optimisation process, which is central to the HNE test, is not under active consideration. Even indexation that could potentially keep asset values tracking new-build costs more closely than otherwise was not universally supported by experts at the conference.[18] If as some experts contend, it is the workable competition standard that motivates an HNE test and leads inexorably to ODRC valuations, we find it difficult to see any economic logic in then abandoning this method for all valuations beyond the initial valuation.

b. your view on the relevance of the HNE test in the context of markets in which long-lived incremental sunk investments are common;

For the purpose of this question we will assume that "the" HNE test is the one advocated in these proceedings, which is based on ODRC asset valuation, rather than the one discussed by NERA in the Moomba-Sydney pipeline case, which is based on ORC.

In answer to the question, we would say "not very relevant in general", in the sense that we would not expect to find any very close correlation, in the hypothesised circumstances, between incumbent firms' asset values and the costs of a HNE over the short to medium term. Medium term here can be taken to mean the typical 4/5 year period over which price controls are set in many jurisdictions.

In this context, it might be helpful to consider an example, such as electricity generation in liberalised wholesale energy markets (and see above for the earlier reference to the NZ power

[17] Jeff Balchin (for Powerco), Greg Houston (for Orion) and Euan Morton (for Vector) all argued at the Conference that the competitive market standard pointed towards ODRC valuation for the initial RAB. None appears to have objected to their clients also advocating a lock-in and roll-forward approach to future asset valuations.
[18] See for example, Jeff Balchin's comments on page 245 of the Gas Pipelines Input Methodologies Conference Transcript.

sector). The value of a generating station will depend upon a range of considerations, such as the length of time it might be expected to keep operating, whether the system is over-supplied in the short-to-medium term, whether the generator has contracted ahead for its output, and so on. If we sought to apply the HNE to arrive at a valuation for the relevant asset, a simple replacement cost valuation, based on an assumed accounting depreciation profile (e.g. straight line), would be unlikely to give a good approximation in general. On the other hand, a more complex implementation approach, based on a realistic attempt to get an estimate of economic depreciation, would lead to detailed consideration of all those past and current features of the market context that the HNE seeks to avoid (by focusing only on new entrants' costs).

It is difficult to empirically test the extent of alignment between the economic value of old assets and the values that would be predicted by a particular implementation of the HNE test in these circumstances. To do so, one would need observations from liquid second-hand markets (e.g. a market for power stations of particular types and particular ages), but those are generally unlikely to be available in the relevant contexts (although see comments on land valuation below), and we note that even where such markets do exist they often reflect value discounts that can be attributed to asymmetric information (i.e. there tend to be adverse selection problems[19]) and other 'switching costs' (see above). If no second-hand markets exist, then presumably a 'hypothetical' second hand value has to be estimated. In effect, the task then is, say, to value a second-hand power station with given characteristics operating in a specified market context; which is to bring the issue through a full circle. We do not think that a valuer or investment banker, faced with the task, is likely to say "let's look at the costs of a hypothetical new entrant", since that is either circular (if HNE costs are based on a hypothetical second-hand value) or largely irrelevant (if HNE costs are based on new build minus accounting depreciation).

Rather, the primary focus of valuation exercises will likely be on the anticipated future earnings of the station, which in turn depend principally on station-specific items (running costs, remaining service life), output prices and dispatch volumes. The new-build costs of potential entrants, both now and in the future, are not irrelevant, because they place some limits on future prices. But those limits are generally imprecise,[20] and are therefore unlikely to be predominant in a valuation process.

The fact that HNE tests/valuations are not typically undertaken in workably competitive markets, combined with the wide range of results one can obtain from such tests, depending upon the

[19] The idea that used goods markets result in heavy discounts was introduced by G.A. Akerlof (1970) The Market for Lemons: Quality Uncertainty and the Market Mechanism, Quarterly Journal of Economics, v84, pp.488-500. Recent work has found that adverse selection is a prominent feature of the market for contemporary used business aircraft, but that it is mitigated by leasing which increases the frequency of trade. See T.W. Gilligan (2004) Lemons and Leases in the Used Business Aircraft Market, Journal of Political Economy, v112, pp. 1157-1180.

[20] All of the normal difficulties with estimating ORCs (which in this case includes technology choice, location, fuel costs, WACC and depreciation) are compounded by uncertainty over future cost trends for the marginal technology, the impact of entry on market prices, and the risk appetite of marginal investors.

specific assumptions made when implementing the approach, suggests caution in adopting them for regulatory purposes. There remains a related but distinct question as to whether asset values in markets characterised by long-lived sunk investments do in fact reflect the results one might obtain from an HNE test. Annex 1 surveys the literature on Tobin's q to inform answers to this question.[21]

Tobin's q is defined as the ratio of the market value of assets to replacement cost, although there appear to be uncertainties in the relevant literature, corresponding to the distinction between ORC and ODRC approaches discussed above, as to how to measure replacement costs.

Our conclusions from the review are that while there is a wide range of q values, and some systematic correlation between q and other contextual factors, it is quite common to observe $q<1$. We cannot tell whether the extent to which $q<1$ is linked in any systematic way to divergences between accounting depreciation and economic depreciation.

c. your view on the sectors in which the costs facing a hypothetical new entrant may be more or less relevant to the value of suppliers' assets, including the economic characteristics of these sectors;

In general, on the basis of points made above, in conditions of workable competition, HNE costs will tend to be most closely aligned with asset values when:

- Sunk costs are not an important feature of supply;
- Economic depreciation of assets is relatively rapid;
- Demand growth is relatively high;
- The assets to be valued are incremental or modular in relation to assets as a whole.

The underlying issue is the relative significance of the 'investment' or capital entry/exit decisions in the relatively near term, assessed relative to the total assets dedicated to supply. The influence of potential entrants in relation to such 'incremental' decisions (by an incumbent) can be expected to be direct and significant, provided that barriers to entry are modest.

The relevant incremental investment decisions involve *ex ante* assessments of future returns and of costs of the relevant assets at the relevant time. It is the latter upon which the HNE focuses. If, therefore, 'incremental' capex decisions account for, say, 75% of all physical capital in a

[21] J. Tobin (1969) A General Equilibrium Approach to Monetary Theory, Journal of Money, Credit and Banking, v1, pp.15-29.

particular period – because sunk costs are low (existing assets have opportunity costs such that there is a constant requirement to ask whether they would be better redeployed to other markets), depreciation is high (replacement investment is high), demand growth is fast (implying a significant requirement for expansion), and/or the investment/valuation is modular (e.g. for assets required to supply a new service) – then today's 'replacement costs' can be expected to be an influential factor for a large fraction of the valuation exercise. An alternative characterisation is that the assets are barely assets at all, verging on being able to be treated as current period expenses. Cellular phones and desktop computers might be examples.

d. your view on the main strengths and weaknesses of the ways in which the costs facing the hypothetical new entrant can generally be assessed (e.g., the assumptions used for optimisation and depreciation if an ODRC or ODV approach is to be used);

To the extent that there are strengths associated with implementing these methods (ODRC, ORC), they derive from the use of handbooks that offer guidance on the selection of the necessary assumptions, which offers a measure of predictability, assisting firms subject to regular revaluations to form views about the valuation impact of particular investment projects.

The main disadvantage is that there are numerous assumptions required, which in our view render these methods rather subjective. Key issues that must be decided fall into three broad categories:

- Design of the notional new physical asset;
- Construction assumptions;
- Depreciation assumptions.

Optimisation assumptions are required to arrive at a preferred asset design. These assumptions tend to start with the existing asset and modify it in various ways. Typically this reduces the size and/or capacity of the existing asset because some parts might not be rebuilt if they were destroyed. One might also consider resizing certain components where the physical asset is deemed to have excess capacity. It is not usual to relocate joining points (nodes) in a network, though that would be consistent with the logic of optimisation.[22]

Construction assumptions include decisions over the notional speed of construction. It is normal to assume that the whole asset is rebuilt in one operation, but faster and slower construction speed assumptions lead to different levels of holding cost (and possibly also construction cost).

[22] In telecommunications access regulation, this is known as the distinction between "scorched earth" and "scorched node" optimisation. Most regulators allow the basic layout of the network (the nodes) to remain in place. This is consistent with the view that historic decisions/arrangements regarding easement grants be respected.

Additionally, one needs a view on whether the asset is rebuilt while in service (brownfield) or not (greenfield), the former generally being more expensive.

There have been significant debates over the depreciation profile that should be applied. Straight line depreciation is simple and often used by accountants, but can differ markedly from economic depreciation which reflects the actual change in market value of an asset. Since the market value is being determined by an ODV/ODRC process, economic depreciation is actually an outcome of the valuation process rather than an input to it. Nevertheless it is possible to contrive various proxies for economic depreciation if one looks closely at the remaining service lifetime of the existing asset, the way operating costs for the existing asset change over service life, and the historic and likely future pattern of demand.

The subjectivity of ODRC and ODV estimates is one of the reasons that they have not been favoured in US and UK utility regulation. However, the notion of an "efficient competitor" has appeared in UK and European competition law, particularly in margin squeeze cases involving dominant firms. In consequence of the small number of cases that have been decided, the status of the efficient competitor test is not entirely clear, but there have been very strong economic/ legal arguments, which appear to represent a reasonable consensus, that, among other things, since a dominant firm cannot easily know what the costs of an efficient competitor are (they are too speculative/subjective to guide conduct), the relevant comparator is, in fact, the costs of an "*as efficient* competitor" (AEC), and that the appropriate proxy for these is the dominant firm's own costs. It should go without saying that this, of course, does not assist in dealing with the regulatory issues at all.

Annex 2 considers some of the cost estimation issues that have occurred in Australasian utility regulation.

e. your view on alternative considerations that are relevant to the competitive market counterfactual for markets characterised by long-lived specialised infrastructural assets where competition is limited (e.g., long-term contracts), and the implications of such considerations.

We note that:

- Long-term contracting is consistent with workable competition in the relevant circumstances (there are lots of examples, including long-term supply contracts in deregulated wholesale electricity and gas markets, and the chartering of specialised tankers for the ocean transport of LNG/LPG).

- When assets are dedicated, in whole or in part, to meeting the commitments of a long-term contract, asset values will be heavily influenced by contractual terms.

- A supplier engaged in such a business over a long period is likely to have a portfolio of such contracts, struck at different times. Since the valuation of the company as a whole will reflect the aggregate value of all such contracts, the past history matters in a very direct and obvious way.

- Such contractual terms would not affect the costs of an HNE, and they are an obvious source of divergence between incumbent asset values and HNE costs.

- The extent of the divergence is likely to depend on the precise details of the contracts, and in particular on any indexation provisions therein. Where it exists, such indexation may be of a general kind (e.g. relating terms to, say, a measure of general prices, such as the consumer price index or producer price index), or much more specific (e.g. as when a long-term gas supply contract is indexed to spot gas prices).

- Indexation to general price indices tended to become more prevalent in earlier periods of inflationary pressure. However, in the absence of uncertainties (and risks) surrounding inflation rates, capital providers often tend to favour non-indexation. This is because non-indexed long-term contracts will tend to return cash flows that will remunerate capital rather more quickly. They also tend to make it easier to match returns with financial liabilities, since most corporate debt is specified in nominal, not indexed, prices.

- Indexation requires reference prices that are beyond the control of the contracting parties. General indices of prices – such as RPIs, CPIs, PPIs, etc. – have this property, and hence are widely used. More specialised indices – such as oil or coal prices in the energy sector – might also be used: for example, in the absence of liquid spot gas markets, gas supply contracts in Europe and New Zealand are often indexed to world oil prices.

- The more specific the outputs or assets supplied under long-term contracts, however, the less likely it is that there will be an available index that tracks market conditions very closely. For example, indices of capital goods published in national statistics may only be disaggregated to classes of assets that have a variety of alternative uses, since attempting to construct indices for more bespoke assets is likely to be both very difficult/costly and of limited interest to users of those statistics.

- We are not aware, for example, of cases where payments for assets supplied under long-term contracts are indexed to optimised replacement costs in economic contexts that could be described as workably competitive. Specificity of assets tends to mean that ORC estimates are subjective, and that there would therefore be considerable scope for disagreement, *ex post*, about what the contract actually implied for payment obligations.

This 'incompleteness' of the contract could itself be expected to be a source of problems, and hence a deterrent to the striking of such contracts.

- Nevertheless , it is conceptually possible to imagine circumstances in which an effective arbitration process for determining 'optimised replacement costs' existed, and to ask what indexation might possibly look like if that were the case. Speaking generally, it might be expected that, if they were so indexed, contract prices would be increased in circumstances in which such replacement costs increased, since the tendency of such higher (replacement) costs is to have upward effects on prices that are not determined by long-term contracts (albeit that the upward pressures may take some time to materialise). This would be a kind of 'operating capital maintenance' approach. Asset values would then rise when replacement costs increased *because contract prices would be increased.*

- What we would not expect to see, however, is an FCM approach to contract specification *combined* with 'routine' asset revaluations, based on replacement costs, during the life of the contract. The reason is that an FCM approach implies that an upward asset revaluation (made because of indications of increased replacement costs) is to be treated as income to the supplier, and hence that immediate contract prices should be *reduced*. This combination – *reduced* payments to a supplier when the supplier faces increased costs – appears to lack an economic rationale.

- We therefore consider that it would be inconsistent to mix FCM and OCM approaches, and that FCM is the generally preferred approach because it is the more likely to emerge in *ex ante* competition among suppliers for long-term contracts.

- Further than this it is difficult to go. The concept of workable competition is not one lending itself to any very precise specification or meaning, and ultimately, as Professor John Vickers has said in the context of the use of economic concepts in competition law, it is for the Courts to determine the legal meanings of the words. On the other hand, to repeat one of our early points, workable competition is not an infinitely elastic concept, and the concepts of 'workability' and 'effectiveness' imply something about market performance upon which expert economists might reasonably expected to be able to assist the Courts. It is on this basis that we conclude that:

    - an indexed historic cost approach to asset valuation is consistent with commercial practices that could occur under conditions of workable/effective competition in roughly (but never exactly) comparable economic circumstances;

    - this does not mean that other approaches to asset valuation are necessarily inconsistent with workable/effective competition; although

- a combination of an FCM approach with occasional asset revaluations does seem to us to lack any underlying economic logic, since it would lead to short-term *reductions* in prices when replacement costs *increase*, which is not a causal linkage (higher costs, lower prices) that would normally be expected in any variety of competitive market. Even if the reductions in prices were spread over time, the correlation between replacement costs and prices would be the 'wrong way round': in workably competitive markets, we would expect to see an increase in replacement costs reflected in higher prices, albeit often in a lagged way in which the immediate price impacts could be small or non-existent.

Topic three: Land values in workably competitive markets characterised by long-lived specialised infrastructure investments.

a. the expected relationship between opportunity cost and asset values in workably competitive markets with no sunk costs, and the implications of this for the valuation of land;

If there are no sunk costs whatever then the value of an asset in a particular use will, absent inefficiency in resource allocation, be at least equal to its opportunity cost (i.e. its value in its next best use). Otherwise it would be profitable to redeploy the asset to the alternative use.

Land is an asset that typically has multiple potential uses, and hence it is natural to refer to opportunity costs when considering its value. This does not mean, however, that longer term contracts are irrelevant when considering land values. Indeed, long term leasing arrangements are relatively common in a wide range of activities involving land as an input. Rather, the implication is that the long-term contractual arrangements are likely to contain explicit indexing of payments, such that the indexing arrangements reflect, possibly in a fairly rough and ready way, changes in the opportunity cost of land.

b. the relevance of the opportunity cost concept to asset values when services are supplied using both sunk and non-specialised assets;

There is no real issue here if the sunk and non-specialised assets are readily separable. We therefore focus on situations in which land is bundled with some specialised asset, and subsequent unbundling is likely to have significant costs ('remediation' costs).

A first question in this case is whether the chief interest lies in arriving at a value for the 'bundle' of specialised and non-specialised assets, or in obtaining separate valuations for the two

components (i.e. in disaggregated values) for purposes other than arriving at an aggregated valuation.

In the case of airports, for example, for airside regulation the chief interest usually lies in an aggregated valuation, since that is the asset value that will feed into any price determination or price monitoring process. Airports may, however, own large areas of land that are not bundled with specific, airside assets: for example, land that is surplus to requirements, or is used for various other ancillary or related activities, including retailing. There may, therefore, also be interest in the 'unbundled' value of land (gross or net of any remediation costs), in order to establish incentives for land disposals, or (under single till systems) to assess the performance of the ancillary and related activities that influence allowed, regulated revenues.

For airside activities, the procurement of land by a supplier in a workably competitive 'airports' market could be expected to subject to the general principles that apply whenever long-lived, sunk assets are an issue. Before building a runway and other specialised facilities, it is to be expected that the operator would either (a) purchase land or (b) lease land under a long-term contract. In the latter case, we would expect the contract to be either indexed, or via some sort of review process based on available, objective data, such as comparable prices (objectivity being required to prevent *ex post* opportunism by the party with the greatest power to resolve ambiguities in contractual obligations).

c. the economic distinction between MVEU and MVAU approaches as ways of estimating the value of land in workably competitive markets.

Assessing opportunity cost implies looking at the next best use of land, whether than next best use is an equivalent or an alternative use. Thus, at one moment, the opportunity cost of land used for rearing livestock might be given by the next best livestock use. However, if the price of livestock falls on the relevant markets, it might be better to transform the land into a golf course (the alternative use becomes marginal).

MVEU implies that the relevant opportunity cost is based on existing use of assets. In some types of workably competitive market, this may be the most relevant way in which to value the asset. For example, arable land might be straightforward to value in this way because (a) there are simple, objective benchmarks against which its value, as arable land, can (to a good approximation) be determined, and (b) the value of the land in other uses is clearly less.

In other sets of circumstances, such comparators or benchmarks may not be available. For example, suppose a whisky distillery is scheduled for closure and the question is asked: what is the MVEU of the land? Conceptually, it is the most that another distiller would be willing to pay for the site; but that may be very difficult to determine in practice. There is no deep and liquid market in 'sites for whisky distilleries' to which reference could be made.

Perhaps of greater significance is the context in which the question is being asked. The regulatory issues are to do with arriving at valuations for land that will be of assistance in assessing the costs of, and hence the charges made by, an airport owner operating in a particular, designated market. Since land is an asset that (notwithstanding its physical fixity) is *economically* mobile between markets (i.e. it can be used as an input to provide services in any of a number of different markets), the earlier discussions suggest that the most relevant question is: what is the value of land if redeployed to another market?

It is possible that different airports can be in different markets, and so in abstract it is arguable that MVEU remains a relevant concept. However, airports are only judged to lie in different relevant markets when there are substantial, geographic, differentiating factors. Thus, for example, Glasgow and Edinburgh airports are considered to be in a different market from Heathrow, Gatwick and Stansted, but the London airports are generally considered to lie within the same relevant market. And it would make no sense to ask what Heathrow land would be worth if it could serve Edinburgh and Glasgow (which would amount to an equivalent/similar use, but in a different geographic market)

Since the regulatory task is concerned with the valuation of airport land when deployed to a specific market, to us the relevant comparator is MVAU, since, for example, only alternative uses can provide benchmarks for valuing land deployed to, say, 'the market for airport services in the Auckland area.'

Putting this another way, there appears to be no very objective way of estimating how much the land would be worth to a hypothetical, efficient, alternative operator. Indeed, in contexts where airport charges are controlled, the value would be highly dependent on the charge limits determined by regulation, raising problems of circularity -- the whole point of much regulation being, to a large extent at least, to determine prices on the basis of reasonably objective cost estimates.

MVAU considers how much the land would be worth in another use and, since the range of possible uses is much broader, it offers more scope for finding objective benchmarks upon which to base the valuation.

d. the treatment of transformation costs when valuing land in workably competitive markets;

When 'pristine' land is procured for purposes that require the construction of specialised assets there may be costs ('conversion' costs) of preparing the land for the new use. Since conversion costs are economically equivalent to costs of constructing specialised assets like runways,

terminals, etc. (they are simply first stage capex), there seems to be no very strong reason for separating them out from the latter.

In the reverse direction, if land is to be redeployed to another purpose, there may be remediation costs (e.g. an office block to pull down or a runway to be torn up) which will affect the value of land itself in the new use (the higher are such costs, the lower will be the value of the land). We note, however, that this will not always be the case: there may sometimes be alternative uses for the existing assets that would create more value than a remediation process. Indeed it is difficult to think of examples of airports being returned to pristine condition, usually the facilities at least in part have residual value. Berlin's Tempelhof Airport (closed in 2008) has reopened as a park, with the terminal building being used as a venue for events. In an earlier time, London's main airport was at Croydon and, although the airport closed in 1959, the terminal building and control tower are still used, whilst the runway was partly built on and partly remains. In Hong Kong, Kai Tak Airport, which closed in 1998, awaits redevelopment, with the runway likely to be built on. The terminal buildings have, however, been demolished (in 2003-4).

The opportunity cost of land can be estimated gross or net of any relevant remediation costs. *Prima facie*, it seems most natural to take a 'net' approach, since it would be the disposal of the land (i.e. a land-associated event) that would 'cause' the costs to be incurred. On this basis, the opportunity cost of airport land would be assessed on an 'as is' basis; i.e. how much is this land worth if it is sold bundled with those parts of the existing assets than cannot be dismantled/removed at a profit.

Thinking about things *ex ante*, if a landlord leased 'pristine' land to an airport operator, it might be the case that (a) the landlord would insist on the site being restored to a reasonable condition at the end of the lease (a roughly comparable example here would be requirements to make good land after opencast mining operations, which might either be required by the landowner or as a matter of public policy in granting a licence), or (b), in the alternative, the rental payments would be higher, to compensate for any 'end of tenancy' costs to be incurred by the owner. The first option here (a) provides stronger incentives for the airport not to do things that would increase remediation costs. The acquisition of the land would therefore 'cause' a contingent liability in relation to remediation, which would be well defined in terms of a lease of specified length. Where, however, the operator of the airport owns the land, the contingency is subject to the control of the operator, and its value is likely to be rather lower (approaching zero – i.e. alternative use is remote).

In relation to conversion costs of land for airport use, then, those costs that are reflected in the value of land in an alternative use can be treated as land costs, but it remains to consider how the remaining conversion costs (those that are sunk) should be handled. A number of positions appear to be arguable on this:

- It might be that there aren't any such sunk costs – i.e. in NPV terms today's market premium for flatter land with sea wall protection etc. may be greater than the costs incurred in conversion. (Labour would have been much cheaper when conversion took place.)

- If they do exist, the costs may be very small in terms of their contribution to total airport costs, in which case it could be disproportionate to do anything other than to take a simple, acceptable approach.

- If it is unclear whether sunk conversion costs are positive, and particularly if we think they are unlikely to be 'large' it is arguable that the 'costs' should be ignored. This would be equivalent to depreciating them over a period shorter than the period since conversion.

- On the other hand, if a 'significant' value for such costs has been established, there is an obvious case for spreading them over all subsequent users/beneficiaries of the airport, in which case they would not have been fully depreciated by now. Zero depreciation is one option here, which would imply (at a constant cost of capital) an equal allocation to each subsequent time period, but it is only one of the alternatives. Another would be an equal allocation (in real terms) to each and every airport user over the lifetime of the airport. This approach would backload recovery, since airports now tend to be much busier than they used to be. In that case, the asset might be appreciating in value, although it would have a correspondingly lower running yield. Note that the capital appreciation here has nothing to do with replacement costs – it arises from the inter-generational sharing-rule for financing a once and for all fixed/sunk cost that benefits all generations. The equation for calculating the per-passenger allocation would be: net present value of sum of [constant (real) cost allocated to each beneficiary * number of beneficiaries in each year] = NPV of sunk conversion costs. The implications for landing charges would appear, prima facie, to be very small.

- It is possible to go even further. A utilitarian rule, which is a bit more complex still, might require later, richer generations paying a higher per-user charge, which would backload the cost allocation even more.

- All these options look to be within the bounds of normal accounting and business practices. (Just as different durations of government gilt edged stock, including stock of infinite duration, are alternative methods of raising finance for public projects.) It might, therefore, be largely a question of ensuring proportionality between the sophistication of the approach and the materiality of the costs that are being allocated.

- The most important point is that there are no very obvious economic reasons for revaluing to ‘replacement costs’ (what it would cost if done today).

e. the relationship between market determined land values, market determined rentals and yields (including the relationship between these over time).

Market determined land values will depend on the NPV of the activities able to be conducted using that land as an input. In consequence, there is no very mechanistic relationship between those values and shorter term yields/rentals.

For example, if prospects for the future appear to become better, either because of a fall in the general discount rate or because of improved demand conditions, values will increase but yields will fall. However, if the general discount rises at the same time that future demand prospects improve, land values might remain relatively constant (the two factors cancel each other out in NPV terms) whilst yields increase (reflecting generally higher discount rates).

Annex 1

Summary of empirical evidence on the relationship between replacement costs and asset values

The relationship between replacement costs and asset values is summarised by Tobin's *q* statistic, defined as:

$$q = \frac{\text{Market value}}{\text{Replacement cost}}$$

There is an important distinction between *marginal* and *average* q. Investment by an existing firm depends on the marginal q associated with particular projects. Investment will typically not proceed unless the market value of the firm is expected to increase by at least as much as the (replacement) cost of the investment, so marginal q must be at least 1 to bring forth investment.

No such strong prediction exists in respect of the average q applying to a firm at any point in time. Assuming away measurement difficulties (discussed further below), a firm's average q will tend to exceed 1 if it enjoys market power, and be less than 1 when demand is weak or costs are high relative to the conditions prevailing at the time of investment.

Data Issues

For a given entity such as a firm, market value is calculated as the value of the firm's outstanding shares plus the value of its debt.

Replacement cost is the current cost to replace the firm's assets currently in use. Serious attempts have been made to estimate replacement cost of these assets in most of the studies reviewed since that of Lindenberg & Ross (1981). To do this, authors look at flows of investments and depreciation over time and infer from those flows what the stock of replacement costs should be. This requires making some assumptions about rate of technical progress and depreciation; it is not free from controversy and debate, but there is at least a genuine attempt to estimate replacement costs.

The difficulties of estimating replacement cost are mentioned in many of the papers surveyed here. Methodologies vary across the papers surveyed but are usually consistent within each paper.

Relevant Literature

There are many empirical studies that estimate the value of *q*. This may be done for individual firms using firm-level financial data, or at the aggregate level using macroeconomic data such as the US Federal Reserve's Flow of Funds Accounts.[23] Generally the empirical studies attempt to explain the variance of *q* across industries, countries and over time in terms of underlying factors. This literature is briefly summarised here.

Lindenberg & Ross (1981) use *q* to assess the rents earned by U.S. firms, which may be comprised of Ricardian rents[24] (e.g. if there are increasing costs), and/or due to market power. They estimate *q* for 246 individual U.S. firms in 32 industries between 1960 and 1977. The estimated average *q* over this time period varies from 0.45 to 8.5 across firms and from 0.9 to 3.1 across industries.[25] The estimates for industries are shown in Table 1. These results show that *q* values can vary quite widely across industries and across time.

Lindenberg & Ross found that 159 firms had a *q* that was statistically significantly greater than one while the remainder had *q* insignificantly different from one, although Lindenberg & Ross only report a one-sided test of $q = 1$ against $q > 1$.[26] They also regress *q* on estimates of the Lerner index for each firm and the four-firm concentration ratio for each industry, and find a significant positive relationship between *q* and the Lerner index, but no relationship with the concentration ratio. Overall, Lindenberg & Ross conclude that high values of *q* are associated with "relatively unique products, unique factors of production, and so forth, all of which contribute to monopoly and/or quasi-rents", while low values of *q* are associated with "relatively competitive, tightly regulated or dying industries."

[23] See http://www.federalreserve.gov/releases/z1/Current/default.htm.
[24] Ricardian rents are economic profits earned by parties with relatively productive assets when prices are set at a level sufficient to allow relatively less productive firms to survive.
[25] Calculating *q* for a firm from reported financial data is not entirely straightforward, as the replacement cost of the firm's assets is not easily measured. Lindenberg & Ross develop a methodology for estimating *q* based on reported accounting data. Chung & Pruitt (1994) give a simpler approximation that yields *q* estimates very close to those of Lindenberg & Ross. For 40 randomly selected firms between 1978 and 1987, Chung & Pruitt calculate *q* values ranging from 0.3 to 24.8.
[26] At the same overall significance level, a two sided test (of $q = 1$ against $q \neq 1$) would likely have found fewer more firms with large q significantly different 1 but another set of firms with small q also significantly different from 1. We cannot predict either way whether that would imply more or fewer firms with q significantly different from = 1 on balance.

Table 1 Estimated *q* values across U.S. industries and time (Lindenberg & Ross, 1981).

Two-digit SIC Code	Industry	Firms (*N*)	1960	1962	1964	1966	1968	1970	1972	1974	1976	Average	SD
38	Measure, photo equipment	7	3.76	2.72	1.97	3.49	3.30	2.85	3.19	3.02	2.97	3.08	2.16
13	Oil & gas extracting	1	1.60	1.99	1.69	3.10	5.22	3.24	3.94	2.83	2.47	2.94	1.28
28	Chemicals	31	2.32	2.48	2.61	2.42	2.14	2.42	2.46	2.53	2.35	2.42	1.84
36	Electric Machinery	15	1.58	1.78	1.82	1.90	1.71	1.70	1.78	1.72	1.92	1.79	.70
20	Food products	16	1.59	1.75	1.71	1.67	1.74	1.84	1.84	1.67	1.69	1.72	1.05
35	Machinery (nonelectric)	23	1.77	1.68	1.58	1.62	1.64	1.55	1.49	1.67	1.74	1.67	1.14
27	Printing industries	2	3.06	1.58	1.01	1.26	1.04	1.74	2.45	1.47	1.54	1.66	.88
31	Leather products	2	1.33	1.29	1.65	1.21	2.15	2.24	2.41	1.18	1.76	1.66	.93
52	Building materials	1	1.93	1.82	1.54	1.18	1.94	1.77	.86	1.57	1.70	1.60	.53
24	Lumber & wood products	3	1.36	1.21	1.61	1.46	2.15	2.14	1.56	1.54	1.58	1.59	.43
12	Bituminous coal mining	2	.94	1.40	1.57	1.38	1.96	1.62	1.44	1.57	1.48	1.54	.60
53	General merchandise stores	9	1.20	1.31	1.45	1.22	1.36	1.53	1.80	1.33	1.42	1.42	.61
59	Miscellaneous retail	1	1.31	1.12	1.24	1.58	1.54	1.44	1.39	1.32	1.44	1.41	.41
21	Tobacco manufacture	6	1.44	1.37	1.36	1.19	1.35	1.54	1.45	1.45	1.36	1.39	.44
29	Petroleum refining	22	1.33	1.34	1.52	1.44	1.47	1.43	1.48	1.45	1.27	1.39	.49
51	Nondurable wholesale	1	1.25	1.53	1.61	1.19	1.31	1.20	1.08	1.19	1.58	1.35	.40
39	Miscellaneous manufacture	2	2.31	1.30	.89	.91	1.16	1.39	1.82	1.27	1.34	1.33	.46
32	Stone, clay, glass	16	1.69	1.52	1.31	1.30	1.23	1.24	1.00	1.28	1.38	1.29	.70
10	Metal mining	4	1.10	1.18	1.25	1.26	1.57	1.24	.87	1.32	1.25	1.24	.40
30	Rubber & plastics	4	1.10	1.06	1.15	1.12	1.14	1.37	1.69	1.11	1.17	1.23	.67
54	Food stores	3	1.18	1.18	1.39	1.18	1.29	1.38	1.08	1.12	1.36	1.23	.38
99	Unclassified	3	.97	1.23	1.16	1.30	1.48	1.21	1.21	1.17	1.19	1.20	.37
37	Transport equipment	14	1.09	1.35	1.33	1.14	1.14	1.10	1.13	1.17	1.23	1.17	.28
16	Construction (other)	3	1.03	.91	1.06	.93	1.36	1.02	1.57	1.19	1.06	1.15	.64
23	Apparel Products	1	.90	1.27	1.14	1.06	1.27	1.20	.96	1.12	1.14	1.13	.28
26	Paper & allied products	12	1.29	1.18	1.12	1.02	1.06	1.03	.90	1.06	1.15	1.09	.40
48	Communication	3	1.25	1.21	1.25	1.20	.90	.96	.88	1.10	1.13	1.08	.30
34	Fabricated metals	7	.96	.95	.90	1.08	1.19	1.03	1.14	1.03	1.01	1.04	.38
49	Electric, gas, & sanitation services	8	.96	1.21	1.16	1.05	.77	.84	.70	.94	.96	.94	.24
25	Furniture & fixtures	1	.72	.59	.86	.72	1.24	1.27	1.06	.83	1.05	.93	.29
22	Textile products	7	.67	.81	.91	.84	1.13	1.05	.99	.83	.90	.92	.51
33	Primary metal industries	16	.94	.86	.92	.98	.85	.75	.63	.91	.89	.85	.33

Similar conclusions were reached by Salinger (1984) and Smirlock *et al* (1984). The former uses a sample of 252 U.S. manufacturing firms in 1979 and reports an average *q* of 1.2 with standard deviation of 0.9.[27] The latter use a sample of 132 U.S. manufacturing firms between 1961 and 1969 and report an average *q* of 2.3, ranging from 0.8 to 11.2 and with lower and upper quartiles of 1.3 and 2.8 respectively.

Lustgarten & Thomadakis (1987) argued that expectations are important in determining the market value of a firm, and hence the relationship between *q* and structural factors such as concentration and firm specialisation can vary over time and across firms depending on investors' expectations. In particular they found that industry concentration can have a positive or negative impact on *q* at different points in time depending on expectations . Lang & Stulz (1994) found a negative relationship between firm diversification (i.e. the number of market segments in which a firm operates) and *q* for U.S. firms in the 1980s. Across 1,149 U.S. firms in 1984, Lang & Stulz report an average *q* of 1.1 (median 0.8) with a standard deviation of 1.2.[28] The average value of *q* varies from 1.5 for firms operating in one market segment to 0.7 for firms operating in five or more segments.

McGahan (1999) estimates *q* for 4,947 U.S. corporations between 1981 and 1994. Her estimates of average *q* across time and by industry are shown in Table 2. McGahan decomposes the variance of *q* across firms and time into industry effects, firm effects, and time effects. This

[27] This estimate is not statistically significantly different from 1.
[28] This estimate is not statistically significantly different from 1.

decomposition revealed that industry effects were stable and accounted for a little under a third of the variation in *q*. Firm effects accounted for nearly two-thirds of the variation and temporary firm-specific effects were relatively large, meaning that for an individual firm the value of *q* is volatile. Time effects on *q* were small but statistically significant.

Table 2 Tobin's *q* estimates for U.S. corporations 1981 – 1994 (McGahan, 1999).

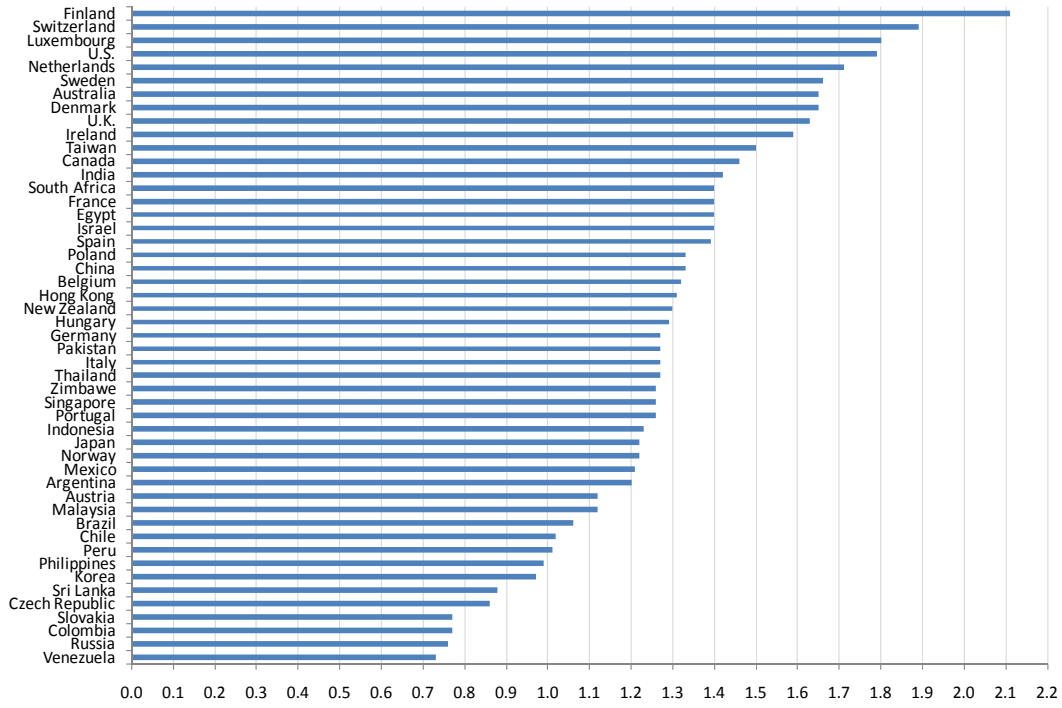
Year	81	82	83	84	85	86	87	88	89	90	91	92	93	94
Avg *q* (all industries)	0.95	1.01	1.16	1.06	1.12	1.19	1.14	1.13	1.13	1.06	1.25	1.31	1.40	1.32

Industry	**Avg *q* (all years)**
Agriculture & mining	1.14
Manufacturing	1.18
Transportation	0.95
Wholesale & retail trade	1.24
Lodging, entertainment & health services	1.57
Personal, business & other services	1.43

Similarly, Acquaah & Chi (2007) find that firm-specific resources such as management capability and employee productivity, as well as industry characteristics, can explain some of the variation of *q* across firms. The level of R&D is another important factor determining the value of *q*, with firms that undertake more R&D generally having higher market valuations (i.e. higher *q*), as demonstrated by many empirical studies including Hirschey (1985), Chauvin & Hirschey (1993), Chan *et al* (2001), Yang & Chen (2003), and others. This is because R&D generally represents an intangible asset that does not enter into replacement costs but does affect market valuations.

Chua *et al* (2007) conducted a cross-country comparison of *q*, calculating a country-level *q* for 49 countries from 1999 to 2004. Their estimates of *q* vary greatly, from 0.73 for Venezuela to 2.11 for Finland, as shown in Figure 1. The estimated *q* for New Zealand is 1.30, which is equal to the overall average of their sample. Chua *et al* attempt to explain the cross-country variation as being due to structural factors including the rule of law, degree of corruption, extent of insider trading, GDP growth, economic openness, the tax regime, and so on. Overall, these factors explain slightly less than half of the cross-country variation in *q*, with capital market openness and GDP growth being the most important explanatory variables.

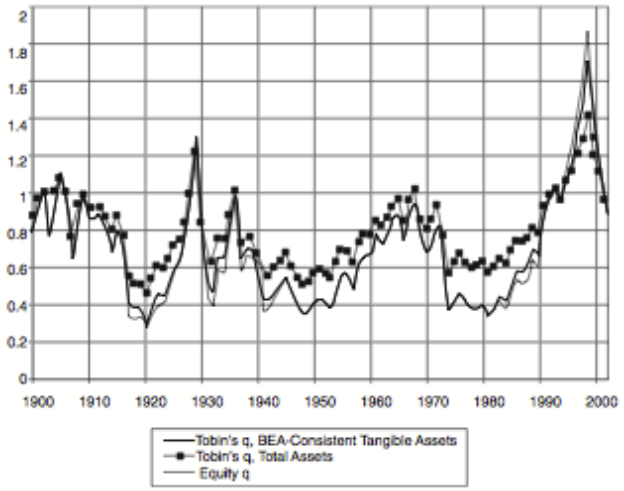
Figure 1 Cross-country estimates of Tobin's *q* for 1999 to 2004 (Chua *et al*, 2007).



Though the overall mean of these estimates is not statistically significantly different from 1, the results reported by Chua *et al* (2007) are for a comparatively short time period.

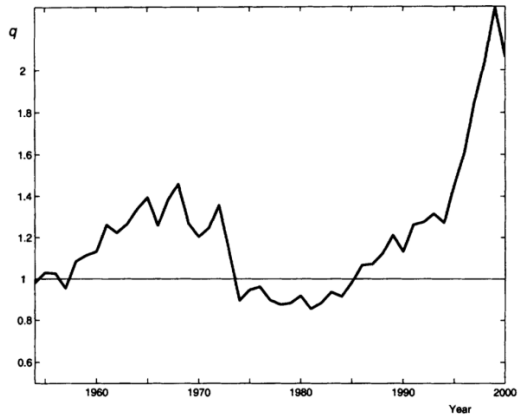
Other studies have estimated country-level *q* for individual countries over longer periods. Wright (2004) gives estimates for the U.S. nonfinancial corporate sector from 1900 to 2002 using the Federal Reserve Flow of Funds data and other sources (see Figure 2) and shows that over most of this period, the overall level of *q* was less than one. Chua *et al*'s result of $q = 1.8$ for the U.S. between 1999 to 2004 is consistent with Wright's result for that time period, but this period appears to be exceptional relative to the preceding 90 years when *q* was less than one most of the time.

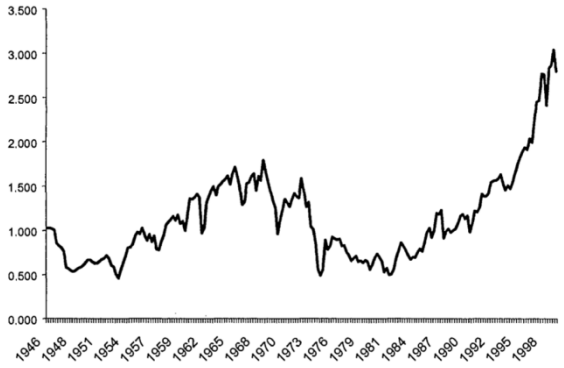
Figure 2 Estimates of *q* for the U.S. nonfinancial corporate sector (Wright, 2004).



Similar persistent values of economy-wide *q* below one for the U.S. are found by Blanchard *et al* (1993), while Hall (2001) and Laitner & Stolyarov (2003) estimate values generally above one. The results from the latter two papers are shown in Figure 3. These differences in results illustrate the fact that estimation of *q* is not straightforward – particularly estimation of the replacement cost of assets in the denominator.

Figure 3 U.S. nonfinancial corporate sector *q* estimates from Laitner & Stoylarov (2003, left) and Hall (2001, right).





Wright claims that his approach is the most accurate. In an unpublished (2006) paper sourced from his website,[29] he claims that the finding of q above one by Laitner and Stolyarov (2003) is "entirely due to errors and omissions in the authors' calculations"..."the primary factor being the omission of significant elements of tangible, rather than intangible assets – most notably land. When the calculation is carried out correcting for these errors the resulting q series turns out to be usually well below unity".

[29] Stephen Wright, April 4, 2006, "Tobin's q and Intangible Assets" downloaded from http://www.ems.bbk.ac.uk/faculty/wright/pdf/TobinsQIntangibleAssets

This claim appears uncontested. Checks on the homepages Laitner and Stolyarov show no dissent. In a personal communication referring to the journal that published Laitner and Stolyarov (2003), Wright says that "the AER accepted the point I made in my comment but wouldn't publish it because they said it was not interesting".

Conclusion

A large number of Tobin's *q* estimates are available in the literature, both at the industry/firm level and at the country level. Many of these studies have shown that some of the variation in *q* can be explained by underlying structural factors, including market structure and country characteristics. In general, the more competitive the market, the lower the value of *q*, although this depends on investors' expectations. At the aggregate level, it appears that *q* has a tendency to return to one or slightly less than one in the long run, although significant deviations below one can persist for decades.

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Annex 2

Replacement Cost Concepts in Australasian Utility Regulation

Regulators wishing to value assets using replacement cost concepts have several options available. Choosing between them requires at least implicit decisions over:

- Whether to reduce replacement cost values to reflect depreciation;
- Whether to optimise the assets being valued; and
- Whether to impose allow demand factors to affect valuations.

This Annex discusses the way replacement cost valuation concepts have been used in regulating utilities in Australia and New Zealand.

TSLRIC

The most "pure" replacement cost concept in current usage is known as total service long-run incremental cost ('TSLRIC') and is used in the telecommunications industry. In that industry, replacement costs have been falling over time. Regulation based on TSLRIC valuations leads to declining allowed revenues over time, a profile justified on the grounds than new entry costs are falling.

When TSLRIC valuations are used, they are notionally applied annually and with optimisation. Depreciation is set using a tilted annuity designed so that the total capital charge (i.e. the WACC-influenced return on capital plus the depreciation charge) falls each year by an amount expected to mirror the change in replacement costs. Setting aside prediction errors and other implementation issues, the result is that the implied regulatory asset base ('RAB') in each year is equal to (un-depreciated) replacement cost in that year.

The Commerce Commission uses TSLRIC concepts to assess the net costs of the Telecommunications Service Obligation. The TSLRIC concept also features as a defined term and a "final pricing principle" for several designated services in Schedule 1 of the Telecommunications Act 2001.

Several authors have strongly criticised the TSLRIC concept on conceptual and practical (implementation) grounds. Hausman (1998)[30] says the resulting prices are too low, do not properly reflect the fact that many costs are sunk and that the "the adoption of TSLRIC as a cost basis to set the prices for unbundled elements has negative economic incentive effects for innovation and for new investment in telecommunications networks". Laffont and Tirole (2000)[31] say that the "broad regulatory consensus in favour of LRIC unfortunately is supported by little economic argument". Ergas (1998)[32] says "as a general matter, there is no meaningful sense in which replacement costs, even of a hypothetical efficient supplier, measure the opportunity cost of using existing assets".

Deprival Values

The optimised deprival value ('ODV') method, as used in Australasian regulation, departs materially from the deprival value concepts discussed in the accounting and valuation literatures during debates over asset valuation in the 1970s and 1980s.[33] In those latter contexts, deprival value is intended to reflect the amount by which an asset owner is better off as a result of owning a particular asset (or equivalently, worse off in the event she was deprived of the asset).[34] If the earning power of the asset is such that a new one could profitably be installed in the event of loss, deprival value is equal to replacement cost. Otherwise, it would not be replaced, and the deprival value is the net present value ('NPV') of the asset's expected earnings profile.

This description of deprival value is not the same as the economic concept of opportunity cost. Opportunity cost refers to the value of the best alternative to the decision actually taken. If an investor did not build a utility network, they could choose from many other options. In fact the only option excluded is the one the investors chose. So, in the words of Bromwich (1977), "deprival value advocates have in mind an hypothetical alternative not actually available to the decision makers".[35]

Deprival value as used in this literature is however intended to be an estimate of replacement cost, in the event that the asset would actually be replaced. In that event, it would be prudent to use modern equivalent assets and to only rebuild those parts of an asset that are needed. So deprival valuation will generally include an optimisation process.

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[30] J. Hausman (1998) "The Effect of Sunk Costs in Telecommunications Regulation" mimeo, Massachusetts Institute of Technology, http://econ-www.mit.edu/files/1027 at p17.
[31] J.-J. Laffont and J. Tirole (2000) "Competition in Telecommunications", MIT Press, Cambridge MA, at p148.
[32] H. Ergas (1998) "TSLRIC, TELRIC and Other Forms of Forward-Looking Cost Models in Telecommunications: A Curmudgeon's Guide", mimeo, University of Auckland, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1430248 at p5.
[33] These debates concerned the proper measurement and reporting of financial performance in the context of general price inflation. A key reference for is W.T. Baxter (1975) "Accounting Values and Inflation", McGraw Hill.
[34] W. Baxter (2003), "The case for Deprival Value", Edinburgh, The Institute of Chartered Accountants of Scotland.
[35] M. Bromwich (1977) "The General Validity of Certain 'Current' Value Asset Valuation Bases", Accounting and Business Research, 7(28) pp 242-249.

Although this sounds like an optimised deprival value ('ODV') the Australasian usage of the term ODV never results in a replacement cost valuation (except if the asset is new). Instead it is the minimum of optimised *depreciated* replacement cost ('ODRC') and the economic value ('EV') of the assets. In general, ODRC < EV so that ODV = ODRC. However if the earning power of the asset is sufficiently low (or zero in which case EV = scrap value), then ODV is lower than ODRC. In any event, un-depreciated replacement cost is never the outcome.

Depreciated Replacement Cost

The ODRC method involves estimating the cost of building an appropriately designed new asset today and then "depreciating" that cost by an amount reflecting the age and condition of the existing asset. It is therefore a mixture containing elements of both replacement and embedded costs.

In the context of electricity transmission regulation, the ACCC has viewed ODRC as being consistent with outcomes in competitive markets, helping to smooth price shocks and guarding against inefficient bypass. In addition, the ACCC described the market decision-making process that it considered gave rise to ODRC valuations.[36]

> *Finally, another justification for DORC setting the upper limit to valuations comes from what a DORC valuation actually is attempting to measure. This is the maximum price that a firm would be prepared to pay for 'second-hand' assets with their remaining service potential, higher operating costs, and (old) technology - given the alternative of installing new assets which embody the latest technology, and which generally have lower operating costs, and which will have a greater remaining service potential. Therefore, if prices reflect a value that is in excess of DORC, then users would be better off if the existing system were scrapped and replaced by new assets.*

Discussion

This description contemplates a trade-off, by an entrant, between building a new asset and buying an existing asset. Such a trade-off is clearly relevant to a potential entrant into a workably competitive market in which the relevant second-hand markets existed (which, from the discussion in the main report, is only likely when market-level sunk costs are small), but the implications for the value of an existing asset is less obvious, at least without further information about the market.

[36] ACCC, Draft Statement of Principles for the Regulation of Transmission Revenues, 27 May 1999, pp. 39-40. This statement is consistent with many other explanations of the rationale for ODRC.

In workably competitive markets with lumpy capacity, the addition of new capacity (as distinct from the transfer of existing capacity to new owners) has a tendency to depress service prices. If there are several potential entrants, each of whom could build new assets, the threat of new capacity could push the value of existing assets below ODRC, as it is usually defined.

In standard economic models of competition, additional new supply will reduce prices noticeably unless there are already many firms competing. Since price reductions associated with entry do not feature in explanations of ODRC, we must conclude that the markets contemplated by proponents of ODRC are highly, rather than merely workably competitive. Something close to perfect competition or perfect contestability appears to be envisaged. It is therefore difficult to reconcile the type of firms found in these models and implied by the ODRC explanation, with the cost structures relevant to the Input Methodologies project.

Additionally, in such intensely competitive markets, the capital cost of an entrant does not affect the observed service prices. Instead, firms compete on the basis of their variable costs, driving market prices down to the variable cost of the least efficient firm required to meet demand. If a potential entrant into such markets faces significant capital costs, entry will simply not occur unless the entrant *also* has variable costs that are materially lower than the prevailing market price, so they can cover total costs without any increase in market prices.