REPORT ON THE CONCEPT OF "THE IMPACT OF A POLICY ON ECONOMIC EFFICIENCY," THE ECONOMICALLY-EFFICIENT PROTOCOL FOR ANALYZING THE ECONOMIC EFFICIENCY OF A GOVERNMENT POLICY (THE IMPLICATIONS OF THE GENERAL THEORY OF SECOND BEST FOR THAT PROTOCOL), THE POSSIBLE IMPACT OF VARIOUS NATURAL-GAS-PIPELINE REGULATIONS ON THE FOUR CATEGORIES OF RESOURCE MISALLOCATION WITH WHICH THE AUSTRALIAN REGULATORY AUTHORITIES HAVE BEEN CONCERNED, AND VARIOUS STATEMENTS THAT THE AUSTRALIAN REGULATORY AUTHORITIES HAVE MADE ABOUT THESE ISSUES

Richard S. Markovits October 31, 2014

I have expertise on the subjects on which this report focuses. I have a Ph.D. in economics from the London School of Economics (where I specialized in Welfare Economics and Industrial Organization) and a J.D. from Yale Law School. I have taught courses on economic-efficiency analysis in the Yale Economics Department, the Cornell Economics Department, the Stanford Law School, the Law Faculty of the University of Konstanz (Germany), the Law Faculty of the University of Texas, the Economics Faculty of the Technical University (Berlin), the Law and Economics Faculty of Hamburg University, the Law Faculty of Bremen University, the Law Faculty of the Humboldt University (Berlin), and the Law Faculty of Fordham University. I have also lectured on economic-efficiency analysis in the B.C.L. program of Oxford University (during the period in which I was Co-Director of the Centre for Socio-Legal Studies at Wolfson College, Oxford). I have also published one book and a large number of articles on the concept of economic efficiency, Second-Best Theory and the economically-efficient way to predict or post-dict the economic efficiency of a government policy or non-government choice, and the economic efficiency of particular government policies, legal doctrines, or non-government choices. The book is TRUTH OR ECONOMICS: ON THE DEFINITION, PREDICTION, AND RELEVANCE OF ECONOMIC EFFICIENCY (Yale Univ. Press, 2008). The articles include:

[1] A Basic Structure for Micro-Economic Policy Analysis in Our Worse-Than-Second-Best World: A Proposal and Related Critique of the Chicago Approach to the Study of Law and Economics, 1975 WIS. L. REV. 950-1080 (1975);

[2] The Causes and Policy Significance of Pareto Resource Misallocation: A Checklist for Micro-Economic Policy Analysis, 28 STAN. L. REV. 1-44 (1976);

[3] The Allocative Efficiency and Overall Desirability of Oligopolistic Pricing Suits, 28 STAN. L. REV. 45-59 (1976);

[4] The Distributive Impact, Allocative Efficiency, and Overall Desirability of Ideal Housing Codes: Some Theoretical Clarifications, 89 HARV. L. REV. 1815-1846 (1976);

[5] Legal Analysis and the Economic Analysis of Allocative Efficiency, 8 HOFSTRA L. REV. 811-901 (1980);

[6] Legal Analysis and the Economic Analysis of Allocative Efficiency: A Response to Professor Posner's Reply, 11 HOFSTRA L. REV. 667-689 (1983);

[7] Duncan's Do Nots: Cost-Benefit Analysis and the Determination of Legal Entitlements, 36 STAN. L. REV. 1169-1197 (1984);

[8] The Functions, Allocative Efficiency and Legality of Tie-ins: A Comment, 28 J. LAW & ECONOMICS 387-404 (1985);

[9] Cost-Benefit Analysis and the Determination of Legal Entitlements: A Reply to Professor Carlson, 8 CARDOZO L. REV. 75-83 (1986);

[10] Second-Best Theory and the Standard Analysis of Monopoly Rent Seeking: A Generalizable Critique, a "Sociological" Account, and Some Illustrative Stories, 77 IOWA L. REV. 327-69 (1992);

[11] The Case for "Business as Usual" in Law-and-Economics Land: A Critical Comment, 77 IOWA L. REV. 387-95 (1992);

[12] A Constructive Critique of the Traditional Definition and Use of the Concept of "the Effect of a Choice on Allocative (Economic) Efficiency": What Is Right and Why the Kaldor-Hicks Test, the Coase Theorem, and Virtually All Law-and-Economics Welfare Arguments Are Wrong, 1993 ILLINOIS L. REV. 485-533 (1993);

[13] Monopoly and the Allocative Inefficiency of First-Best-Allocatively-Efficient Tort Law: The Whys and Some Therefores, 46 CASE W. RES. L. REV. 313-448 (1996);

[14] Second-Best Theory and Law & Economics: An Introduction, 73 CHI.-KENT L. REV. 3-10 (1998)

[15] The Allocative Efficiency of Shifting from a "Negligence" System to a "Strict Liability" Regime in Our Highly-Pareto-Imperfect Economy: A Partial and Preliminary Third-Best-Allocative-Efficiency Analysis, 73 CHI.-KENT L. REV. 11-134 (1998);

[16] Second-Best Theory and the Obligations of Academics: A Reply to Professor Donohue, 73 CHI.-KENT L. REV. 267-74 (1998);

[17] On the Relevance of Economic-Efficiency Conclusions, 29 FLA. ST. L. REV. 1-54 (2001);

[18] On the Economic Efficiency of Using Law to Increase Research and Development: A Critique of Various Tax, Antitrust, Intellectual Property, and Tort Law Rules and Policy Proposals, 39 HARV. J. ON LEG. 63-120 (2002);

[19] Why Kaplow and Shavell's "Double-Distortion Argument" Articles Are Wrong, 13 GEO. MASON L. REV. 511-619 (2005);

[20] On the Economic Inefficiency of a Liberal-Corrective-Justice-Securing Law of Torts, 2006 ILL. L. REV. 525-69 (2006); and

[21] Background (Fixed-Cost) Avoidance-Choices, Foreground (Variable-Cost) Avoidance-Choices and the Economically Efficient Approach for Courts to Take to Accident Cases: A Marine-Salvage Example and Related Critique of Landes and Posner's Classic Study, 59 BUFFALO L. REV. 57-140 (2011).

I have organized a symposium on Second-Best Theory and Law Economics, 73 CHI.-KENT L. REV. 1-463 (1998) and am currently working on a book that Springer will publish entitled The Welfare Economics of Antitrust Policy and U.S. and E.U. Antitrust Law: A Second-Best-Theory-Based Economic-Efficiency Analysis.

I have read, understood, and complied with THE FEDERAL COURT OF AUSTRALIA Practice Note CM 7 FOR EXPERT WITNESSES IN PROCEEDINGS IN THE FEDERAL COURT OF AUSTRALIA (commencing on 4 June 2013). All the opinions this report articulates are based on my expertise.

Instructions

On 16 December 2013 the ERA published its *Rate of Return Guidelines*[1] as required by the *National Gas Rules*. In those Guidelines, the ERA adopted an approach to the calculation of the cost of debt which relies heavily on allocative efficiency arguments. In particular, the ERA emphasised that it is important to take into consideration general equilibrium effects and the impact pricing in the regulated energy sector might have on the broader economy. This is in particular reference to how it proposes to update the cost of debt estimation through the course of the regulatory period. The focus on allocative efficiency and general equilibrium concerns can be seen in the following quotations from the *Explanatory Statement*[2] associated with the *Guidelines* (the paragraph numbers are from the ERA's document):

> *124. However, the Revenue and Pricing Principles are clear that 'a service provider should be provided with effective incentives in order to promote economic efficiency with respect to reference services... which includes' efficient investment in, and efficient use of, a pipeline. This is squarely aligned with generally accepted principles of economic efficiency. This implies that the allocative efficiency implications extend out into the economy more broadly, consistent with the achievement of the economic concept of 'general equilibrium'; economic efficiency cannot be maximised by only considering a 'partial equilibrium' relating to a subset of the economy. The interactions of upstream and downstream users with the broader economy will influence the economic efficient use of the pipeline, and vice versa.*
> *127. The Authority therefore considers that its task under the NGL is to minimise the risk of monopoly pricing, with a view to maximising economic efficiency from the broad economic perspective (see Chapter 2 for more detail on the Authority's consideration with*

[1] http://www.erawa.com.au/cproot/11953/2/Rate%20of%20Return%20Guidelines.PDF
See also: http://www.erawa.com.au/gas/gas-access/guidelines/rate-of-return-guidelines
[2] http://www.erawa.com.au/cproot/11953/2/Rate%20of%20Return%20Guidelines.PDF

regard to economic efficiency requirements of the NGL and the NGR). The requirement for efficient financing costs is consistent with the broad efficiency considerations that the regulator is required to account for under the NGO and the Revenue and Pricing Principles. The Authority notes in this context that the explicit intent of the NGL and the NGO was to promote economic efficiency in the long term interests of consumers:

> *The national gas objective is to promote efficient investment in, and efficient use of, natural gas services for the long term interests of consumers of natural gas with respect to price, quality, reliability and security of supply of natural gas.*
> *The national gas objective is an economic concept and should be interpreted as such.*
> *The long term interest of consumers of gas requires the economic welfare of consumers, over the long term, to be maximised. If gas markets and access to pipeline services are efficient in an economic sense, the long term economic interests of consumers in respect of price, quality, reliability, safety and security of natural gas services will be maximised. By the promotion of an economic efficiency objective in access to pipeline services, competition will be promoted in upstream and downstream markets.*

This viewpoint is emphasised still further in the discussion on the cost of debt, when the ERA notes later in the *Explanatory Statement* that:

329. Further, the Authority considers that economic efficiency cannot be considered in terms of a single firm or a single group of consumers. Such a partial approach may be efficient in isolation, but still leave net efficiency gains once the full general equilibrium considerations are considered. The Authority is required to achieve efficient outcomes for the long term interests of consumers of natural gas. Those consumers of natural gas are engaged with the broader economy. Hence their long term interests take into account that engagement with the broader economy. This requires efficient pricing of gas transmission and distribution network services, consistent with outcomes that would be observed in effectively competitive markets.

330. In this context, the Authority also rejects GGT's view that neither NGR 87, nor the National Gas Objective set out in section 23 of the NGL contains any requirement for assessment of the approaches based on efficiency criteria. In response, the Authority notes that it was always intended that the NGL and the NGO promote economic efficiency broadly, as this is in the long term interests of consumers…….

332. The Authority considers that the longer term interests of consumers, as set out in the National Gas Objective, are clearly served by promoting economic efficiency, not just in terms of investment and supply of pipeline services, but also for upstream and downstream use of energy and efficiency in the economy more broadly.

In August 2013, DBP has previously made submissions on this issue to the ERA[3]. These reference to the theory of second best, which suggests that, where several sectors of the economy are inefficient, changing the prices of one sector of the economy (in this specific case, changing DBP's prices during the access period to reflect new debt cost information) does not necessarily result in an increase in overall economic efficiency in the kind of general equilibrium sense that the ERA seeks. GGT, the entity which own the other major gas transportation pipeline in Western Australia, the Goldfield Gas Transmission pipeline also filed submissions with the ERA in August 2013 raising similar arguments to DBP in relation to the theory of the second best.[4]

The ERA dismissed these concerns in the publication of its final Guidelines.[5] Among other things, the ERA noted in the *Explanatory Statement* that:

> *125. GGT also suggests that economic efficiency, in terms of Pareto optimality, is an ideal, which does not reflect outcomes in reality. GGT suggests that economic theory has no notion of 'efficiency improvement', invoking the theory of the second best.*
>
> *126. The theory of the second best provides a cautionary tale about the unknown economic welfare effects of policy changes. For example, removing monopoly constraints on gas networks might lead to net welfare losses if costs associated with resulting increases in air pollution outweighed the benefits of the increased consumption of gas. However, it is generally accepted that removing monopoly pricing has net economic benefits, and this provides the rationale for the NGL. The theory of the third best further amplifies that such significant first best policy approaches are likely to be welfare enhancing, despite lack of information about second best optima.*

And further that:

> *344. DBP in its submission on the Draft Guidelines acknowledges that the on-the-day approach is superior in terms of allocative efficiency, but considers that the trailing average approach is superior in terms of productive efficiency. DBP suggests that the work of Lipsey and Lancaster on the theory of the second best indicates that the net benefits of any trade-off between productive and allocative efficiency are not clear, such that neither approach can be considered superior. The Authority considers arguments in relation to the theory of the second best in more detail in*
> *Chapter 3 – Benchmark efficient entity and risk. The Authority notes there that first best policy approaches to correcting market failures that have clear and significant benefits – such as removal of monopoly pricing – are likely to be welfare enhancing, despite lack of information about the exact second best optima.*

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[3] http://www.erawa.com.au/cproot/11520/2/20130801%20D108697%20-%20Public%20Submission%20-%20DBNGP%20(WA)%20Transmission%20Pty%20Limited%20-%20Rate%20of%20Return%20Guidelines%20Review.pdf

[4] http://www.erawa.com.au/cproot/11522/2/20130801%20D108699%20-%20Public%20Submission%20-%20Goldfields%20Gas%20Transmission%20Pty%20Ltd%20-%20Rate%20of%20Return%20Guidelines%20Review.pdf

[5] See pages 23 and 64 at http://www.erawa.com.au/cproot/11952/2/Explanatory%20Statement%20for%20the%20Rate%20of%20Return%20Guidelines.PDF

We are seeking your views on the application of the theory of second best, the way in which the ERA has characterised the ability to effect welfare gains under the theory of third best. In this regard we note that, in a discussion of the model cited in the ERA's paragraph 126 above, one of the authors of the original theory of second best points out a mathematical error which, when corrected, means that the conclusion of the third-best model is to make no change to the status quo, rather than to make a change towards prices reflective of marginal cost (the first-best policy response).[6]

By way of further background, the approach proposed by the ERA on the cost of debt in the Guidelines is set out in the detailed discussion at pages 53 to 81 of the ERA's *Explanatory Statement*. involves setting the cost of debt at the outset of the regulatory period based upon an assessment of what an efficient firm facing the risks associated with DBP's particular gas transportation task might face, and then updating the debt risk premium (above the relevant risk free rate) on the whole cost of debt each year through the access period.[7] The ERA states that the reason for doing this is that firms (not just the firms it regulates, but their customers as well) must face the current marginal cost of any investment as much as possible if investment decisions are to be efficient, and reflecting "stale" debt cost information is likely to lead to inefficient investment. The more detailed discussion is contained in pages 53 to 81 of the ERA's *Explanatory Statement*, which can be assessed, along with the Guidelines themselves, at http://www.erawa.com.au/gas/gas-access/guidelines/rate-of-return-guidelines.

This approach stands in contrast to that favoured by the Australian Energy Regulator (**AER**), which regulates gas pipelines in all Australian States outside Western Australia. The AER has adopted a different approach to the cost of debt, which is more in line with a partial, rather than a general equilibrium approach. Rather than relying on allocative efficiency arguments, it observes that efficient firms stagger their debt, and it thus concludes that regulation ought to reflect what efficient firms do. Accordingly, it proposes a ten-year rolling average for the cost of debt, so the cost of debt is updated each year during an access period for one-tenth of old debt rolling off and one tenth of new debt rolling on. The AER's Guidelines, and more detail on this approach, can be found at http://www.aer.gov.au/node/18859.

DBP seeks your views on the application of the literature concerning , and the theories of, second and third best, including the work that has been undertaken to date by DBP and the ERA, to assist in informing the debate around policy choices associated with how the cost of debt ought to be determined. Based on your literature review, we ask you to address the following issues:

1. The current status of the model the ERA cites is Ng Y-K 1977, "Towards a Theory of Third Best", *Public Finance*32(1), pp. 1-15 which is cited at paragraph 126 of the ERA's Explanatory Statement, set out above. . The discussion of this model by Lipsey can be found at http://www.sfu.ca/econ-research/RePEc/sfu/sfudps/dp12-02.pdf.
2. The nature, extent and significance of any concerns associated with the theory of the second best in the context of economic regulation.

[6] The model the ERA cites is Ng Y-K 1977, "Towards a Theory of Third Best", *Public Finance*32(1), pp. 1-15. The discussion of this model by Lipsey can be found at http://www.sfu.ca/econ-research/RePEc/sfu/sfudps/dp12-02.pdf

3. The impact of the theory of third best on the objections raised at various times to the theory of second best.
4. Subject to your observations on the matters raised at 1 to 3 above, if there are issues associated with the theory of second best which have not been superseded by the theory of third best, and regulators cannot automatically assume that the general-equilibrium welfare gains the ERA seeks can be met solely by implementing first-best policy responses, what kinds of information would a regulator need to make a case that a particular policy response such as the ERA's proposal on the cost of debt might be welfare-enhancing? What kinds of analysis might one expect to see underpinning such a case?

1. The "Concept of the Impact of a Policy on Economic Efficiency"

Economists sometimes claim that they are using a non-monetized definition of the concept of "the impact of a government policy (or non-government act or natural event) on economic efficiency." According to this definition, (1) a policy is said to have increased economic efficiency if and only if it made at least one person better-off and no-one worse-off (effectuated a move to a so-called Pareto-superior position), and (2) a policy is said to have decreased economic efficiency if and only if it made at least one person worse-off and no-one better-off (effectuated a move to a so-called Pareto-inferior position). This usage is connected to the non-monetized concept of a Pareto-optimal allocation of resources. An allocation of resources is said to be Pareto optimal if no conceivable alternative allocation that could ever have been effectuated would have left one or more persons better-off without leaving anyone worse-off.

In practice, however, economists do not use a non-monetized definition of "the impact of a policy on economic efficiency." The reason for this is that no or virtually no government policy will move the economy to either a Pareto-superior or a Pareto-inferior position. More precisely, economists in practice reject the non-monetized Pareto-superior/Pareto-inferior definition because the reality that all or virtually all government policies will make some individuals better-off and some, worse-off implies that, on that Pareto-superior/Pareto-inferior definition, the economic efficiency of all or virtually all government policies would be indeterminate and economists want their conclusions about the economic efficiency of a policy to be useful.

In practice, economists use a monetized definition of the impact of a government policy on economic efficiency according to which the impact of a government policy on economic efficiency equals the difference between the equivalent-monetary[1] (henceforth, equivalent-dollar) gains the choice confers on its beneficiaries (the winners) and the equivalent-dollar losses it imposes on its victims (the losers). In this formulation, a winner's equivalent-dollar gain equals the number of dollars that would have to be transferred to him to leave him as well-off as the choice would leave him if

(1) he did not agree to the transfer,

(2) he either was intrinsically indifferent to the substitution of the transfer for the government policy or non-government decision in question or was unaware of the linkage between the transfer and the relevant choice's rejection,

(3) his distributive attitude toward such transfers, non-parochial distributive preferences, or normative distributive commitments gave him no reason to prefer the transfer to the choice or *vice versa*, and

(4) the transfer would not benefit or harm him indirectly by changing the conduct of others by altering their incomes and/or wealths.

Similarly, in this formulation, a loser's equivalent-dollar loss equals the number of dollars that would have to be withdrawn from him to leave him as poorly-off as the choice would leave him under the loser-counterparts of the four assumptions just delineated. In essence, this definition of the impact of a policy or choice on economic efficiency incorporates elaborated versions of what economists denominate the "equivalent-variation" as opposed to the "compensating-variation" operationalizations of, respectively, a policy's winners' equivalent-dollar gains and a policy's losers' equivalent-dollar losses: (1) it measures the winners' equivalent-dollar gains by the number of dollars that would have to be transferred to them (on appropriate assumptions) to make them as well-off as the policy would make them as opposed to by the number of dollars whose withdrawal from them on appropriate assumptions would leave them as well-off with the policy in place as they would have been had the withdrawal not been made and the policy not been adopted and implemented, and (2) it measures the losers' equivalent-dollar losses by the number of dollars whose withdrawal from them would (on appropriate assumptions) leave them as poorly-off as the policy would leave them as opposed to by the number of dollars whose transfer to them would (on appropriate assumptions) leave them as well-off with the policy being implemented as they would have been had they not received the transfer and the policy never been adopted or implemented. Basically, the equivalent-variation measures a policy's winners' equivalent-dollar gains and policy's losers' equivalent-dollar losses are correct because they are consistent with the reality that the winners have won and the losers have lost. I will explain below why the equivalent-variation measures in question are likely to differ from their compensating-variation counterparts.

I acknowledge that economists have advocated a number of other operationalizations of the concept of "the impact of a policy on economic efficiency"[2]—most importantly, the operationalizations implicit in the Kaldor-Hicks test for an increase in economic efficiency,[3] the operationalization implicit in the so-called Scitovsky test for an increase in economic efficiency,[4] and the explicit "potentially-Pareto-superior" definition of an increase in economic efficiency."[5] According to the Kaldor-Hicks test, a policy increases economic efficiency if and only if its winners could profit by paying its losers enough to agree to it to leave each loser indifferent to accepting the (hypothetical) "bribe" in question. According to the so-called Scitovsky test, a policy increases economic efficiency if and only if it passes the Kaldor-Hicks test and its reversal would not pass the Kaldor-Hicks test. According to the "potentially-Pareto-superior" test for a policy's increasing economic efficiency, a policy increases economic efficiency if and only if one can identify an allocative-transaction-costless money-transfer program that could be financed without generating any economic inefficiency for non-allocative-transaction-cost reasons that in combination with

the policy would create a Pareto-superior policy-package. For reasons I will discuss below, all these alternative definitions mismeasure the economic efficiency of a policy.

I will focus here on three deficiencies of these alternative operationalizations of "the impact of a policy on economic efficiency." First, the Kaldor-Hicks test and the first part of the Scitovsky test (which is the Kaldor-Hicks test) are incorrect because they use the compensating-variation rather than the equivalent-variation measures respectively of a policy's winners' equivalent-dollar gains and a policy's losers' equivalent-dollar losses. Their adoption of the compensating-variation measure is wrong because (1) successive monetary units have diminishing marginal value and on this account (A) the number of dollars whose withdrawal from a winner will inflict a given value-loss (say, utility-loss) on the winner will be lower than the number of dollars whose transfer to the winner will confer the same amount of value (the same utility-gain) on him and (B) the number of dollars whose withdrawal from a loser will inflict a given value-loss (say, utility-loss) on the loser will be lower than the number of dollars whose transfer to the loser will confer an equal value-gain (say, utility-gain) on the loser—*i.e.*, because on this account the Kaldor-Hicks test will tend to underestimate each winner's equivalent-dollar gain and overestimate each loser's equivalent-dollar loss and (2) the equivalent-dollar gain that some policies confer on their winners and the equivalent-dollar loss that some policies confer on their losers depend on these parties' wealths at the time at which the policy is implemented and the Kaldor-Hicks test and the first part of the Scitovsky test proceed on counterfactual assumptions about the wealth positions of the policy's winners and losers at the time the policy will be implemented—*viz.*, assume that the policy's winners' wealths will (counterfactually) be reduced by the (hypothetical) bribe they would have to pay to its losers to leave them as well-off with the policy in place as they would have been had it not been adopted and implemented and that the policy's losers' wealths will (counterfactually) be increased prior to the policy's adoption by the hypothesized bribe in question. To understand the point made after "(2)" in the preceding sentence, assume, for example, that the demand that those beneficiaries of an antitrust policy that would reduce the price of a good who benefit from the policy because they are consumers of the good in question have for that good increases (decreases) with their wealths at the time of the policy's implementation. Because the Kaldor-Hicks test and the first part of the Scitovsky test measure the equivalent-dollar gains a policy will confer on its winners on the counterfactual assumption that their wealths will be reduced (by the bribe they are asked to assume they will be paying the policy's losers) prior to the policy's adoption and implementation, these tests' estimates of the equivalent-dollar gains the policy will confer on these winners will on this account be too low in positive-wealth-elasticity-of-demand cases (because it will be measured on the assumption that these winners will be buying fewer units of the product in question than they in fact will be buying) and too high in negative-wealth-elasticity-of-demand cases (because it will be measured on the assumption that these winners will be

buying more units of the product in question than they in fact will be buying). The Kaldor-Hicks test and the first part of the Scitovsky test will also on this account mis-estimate the equivalent-dollar loss a policy that imposes an effluent tax on a producer will impose on consumers of the good the taxed producer produces if their demand for this product is wealth-elastic because these tests will measure those losses on the counterfactual assumption that the losers' wealths will be increased prior to the policy's implementation by the bribe they will hypothetically be paid to secure their acquiescence to the policy's adoption and implementation.

Second, the Kaldor-Hicks test and the Scitovsky test are also incorrect because they measure the winners' equivalent-dollar gains and the losers' equivalent-dollar losses on the assumption that the parties in question have agreed to the policy's adoption and implementation in a voluntary market transaction. This assumption is at least sometimes distorting because (1) it is always inaccurate—no bribes are ever offered or paid—and (2) in some cases, engaging in voluntary market transactions will be intrinsically costly or beneficial—*e.g.*, agreeing to a policy that compromises your or your spouse's, child's, or friend's health or agreeing to a policy that compensates someone you consider to be a wrongdoer for not engaging in wrongdoing may be intrinsically costly to the agreer or agreeing to sell one of your kidneys to obtain money to finance your child's education may have an intrinsic positive value for the agreer.

Third, the Kaldor-Hicks test, the Scitovsky test, and the potentially-Pareto-superior definition all ignore the fact that, in a world that contains or might contain one or more Parto imperfections (imperfections in seller competition, imperfections in buyer competition, real externalities, taxes on the margin of income, non-sovereignty [relevant imperfections in information], non-maximization, and/or [critically-distorting] buyer surplus), the wealth-transfers the bribes that the Kaldor-Hicks and Scitovsky tests posit could confer an equivalent-dollar gain or impose an equivalent-dollar loss on the briber by altering the choices made by the bribe's recipients by altering their wealth positions and the wealth-transfers that the potentially-Pareto-superior definition assumes (hypothetically) will be combined with the policy whose economic efficiency is at issue could increase or decrease economic efficiency even if they did not generate any allocative transaction costs or require the government to finance them in ways that generate economic inefficiency for other reasons by changing the wealths and hence the choices of their hypothetical recipients. For example, a bribe or government-transfer to a poor person might increase economic efficiency by causing the recipient to purchase cars whose use is less externality-prone (less polluting, less breakdown-prone, less accident-prone) and/or by reducing the amount of economic inefficiency the relevant society generates by underinvesting in the human capital of the children of the poor.

This third mistake will cause the Kaldor-Hicks-test and first-part-of-the-Scitovsky-test estimate of the economic efficiency of a government policy or non-government choice to be inaccurate because it

will lead the policy's/choice's winners to base their calculations of the highest bribe they would be willing to pay *inter alia* on their estimate of the equivalent-dollar impact that the hypothesized, counterfactual bribe would have on them by altering the choices of those bribed by altering their wealths and because it will lead the policy's choice's losers to base their calculations of the lowest bribe that would make them whole *inter alia* on their estimate of the equivalent-dollar impact on them that the hypothetical, counterfactual bribe in question would have by altering the bribe-payors' choices by altering the bribe-payors' wealths. The third mistake will cause the potentially-Pareto-superior definition of the impact of a government policy or non-government choice to be inaccurate because it raises the possibilities that (1) a policy that could be combined with an allocative-transaction-costless government-transfer program whose implementation would not generate any economic-efficiency losses in any other way to form a Pareto-superior policy-package might be economically inefficient—in particular, would be economically inefficient if the government-transfer program in question increased economic efficiency by more than the policy package did so (by more than the policy whose economic efficiency is at issue decreased it)—and (2) a policy that could not be combined with an allocatively-transaction-costless government-transfer policy whose implementation would not cause economic inefficiency in any other way to form a Pareto-superior policy-package might still be economically efficient if all otherwise-suitable government-transfer programs would decrease economic efficiency by altering the wealths and therefore choices of the payors and payees by more than the policy under review increased economic efficiency.

I have just claimed that there is a correct way to operationalize the concept of "the impact of a policy on economic efficiency." Admittedly, some economists and Law & Economics scholars reject this claim—insist that there is no non-arbitrary way to resolve the so-called "offer/asking" problem[6] (in the terms of this report, to choose between [properly specified] variants of the equivalent-variation and compensating-variation measures respectively of a policy's winners' equivalent-dollar gains and a policy's losers' equivalent-dollar losses). I disagree. Concomitantly, I disagree with the Goldfield Gas Transmission submission's claim that economic theory can generate no correct definition of an "efficiency improvement."[7] I also disagree with the GGT's suggestion that this conclusion is warranted by The General Theory of Second Best[8]: as I will indicate below, that theory bears on the protocols one should and should not use to predict or post-dict the impact of a policy on economic efficiency, not on whether the concept of "the impact of a policy on economic efficiency" can be defined non-arbitrarily (is essentially contestable). Although the following statement in the GGT may not imply anything to the contrary, the GGT's correct claim that Pareto optimality is "an ideal that does not reflect outcomes in reality"[9] also has no bearing on whether the concept of "the impact of a policy on economic efficiency" can be defined non-arbitrarily.

I want to close the report's first part by pointing out some loose language or misconceptions in the national gas objective (NGO) as stated in the National Gas Law (NGL) and interpreted by the Economic Regulation Authority (Western Australia) that relate to the concept of "the impact of a government policy on economic efficiency." According to the 2009 National Gas Law, "[t]he objective of the… [National Gas] Law is to promote efficient investment in, and efficient operation and use of natural gas services for the long term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas."[10] Unfortunately, the Economic Regulation Authority (Western Australia) also seems to subscribe to the related incorrect position that the NGL and NGO goal of promoting economic efficiency will be achieved by any policy that maximizes the long-run (equivalent-dollar) interests of consumers of natural gas. Thus, the Authority states:

> The national gas objective is an economic concept and should be interpreted as such. The long term interest of consumers of gas requires the economic welfare of consumers, over the long term to be maximized. If gas markets and access to pipelines are efficient in an economic sense, the long term economic interest of consumers in respect of price, quality, reliability, safety and security of natural gas services will be maximized.[11]

The economic efficiency of a natural-gas-pipeline policy reflects its equivalent-dollar impacts not only (1) on consumers of natural gas but also (2) on owners of natural-gas pipelines, (3) on workers in the natural-gas-pipeline industry (in their role as workers as opposed to their role as consumers of natural gas), (4) on consumers of other existing products from whose production resources are (are not) withdrawn when natural-gas-pipeline policy increases (decreases) the amount of resources allocated to the creation and use of natural-gas pipelines, the prospective (actual) consumers of the other products that were not created (were created) because the resources that could have been used (were used) to create them were (were not) allocated to the creation and use of natural-gas pipelines, the consumers of the other products whose relevant variable and marginal costs of production and (derivatively) prices would have been reduced by the production-process discoveries that would have been made by the production-process-research projects that were not executed because the resources that would otherwise have been used to execute them were allocated instead to the construction and use of natural-gas pipelines or the consumers of the other products whose relevant variable and marginal costs and hence prices were reduced by the use of the production-process discoveries that were made by the production–process-research projects that were executed because a policy reduced the amount of resources allocated to the construction and use of natural-gas pipelines, (5) the investors who would have profited from the alternative resource-uses sacrificed by any policy-generated increase in the amount of resources allocated to natural-gas-pipeline construction and use and the investors who did profit from the resource-uses that resulted from any policy-induced reduction in the amount of resources allocated to the construction and use of natural-gas

pipelines, (6) the workers whose labor would have been employed to execute any resource-uses sacrificed to any policy-induced increases in the amount of resources devoted to the construction and use of natural-gas pipelines or the workers whose labor was employed to execute the resource-uses that resulted from policies that reduced the amount of resources allocated to natural-gas-pipeline construction and use, and so on and so forth. The NGO and its elaboration by the Authority seem to imply that the economic efficiency of natural-gas policy either reflects solely its net equivalent-dollar impact on natural-gas consumers or turns out for some unstated reason to be monotonically related to (to increase with) its net equivalent-dollar impact on natural-gas consumers. The first possible (definitional) implication is simply wrong as a definitional matter, and the second claim is almost always wrong as an empirical matter. The conclusion that the incorrect implications on which I am focusing reflect sloppy language as opposed to real misunderstanding is favored by the fact that the Authority's Explanatory Statement recognizes that the variant of economic-efficiency analysis that should be employed is "general equilibrium" analysis, which takes account of the fact that a policy's relevant impact "extend[s] out into the economy more broadly."[12]

2. The Economically-Efficient Protocol to Use to Predict or Post-Dict the Economic Efficiency of a Government Policy: The Central Implication of The General Theory of Second Best, the Approach to Economic-Efficiency Prediction or Post-Diction That I Think Is Third-Best Economically Efficient, and the Debate Between Prof. Richard Lipsey and Prof. Y.-K. Ng About the Economic Efficiency of Policymakers' Making the Decisions That Would Be Favored by First-Best-Economic-Efficiency Analyses If They Are Operating Under the Conditions of Radical Ignorance Professor Ng Presupposes

A. The Central Implication of The General Theory of Second Best

Part 1 of this report argued that, defined in the way that is most useful and best corresponds to the concept's actual use by economists and other members of the "policy audience," the impact of a policy on economic efficiency equals the difference between the equivalent-dollar gains it confers on its beneficiaries and the equivalent-dollar losses it imposes on its victims. Nevertheless, economists have never tried to assess any choice's impact on economic efficiency by identifying all or a random sample of the choice's winners and losers and estimating these parties' respective equivalent-dollar gains and losses. In part, this fact reflects the unreliability of the answers that a policy's winners and losers would give to questions about the policy's equivalent-dollar impact on them—*i.e.*, reflects the incentives that the beneficiaries/victims of any choice have respectively to exaggerate the magnitude of the equivalent-dollar gains/losses it would confer/impose on them to the extent that their doing so increases the probability that the government choice whose economic efficiency is being examined will be made/rejected or any non-government choice whose economic efficiency is being examined will be allowed/prohibited. And in

part, it reflects the prohibitive cost and difficulty of estimating the gains and losses that individual winners and losers experience through any method that does not rely on their testimony. The impracticability of this approach to assessing a policy's economic efficiency has led economists to base their economic-efficiency assessments on Welfare Economics propositions that relate the impact of a choice on economic efficiency to its impact on the Pareto imperfections in the economy—*i.e.*, to the various types of "imperfections" whose individual exemplars could cause economic inefficiency in an otherwise-Pareto-perfect economy. Although this general approach is almost certainly most-economically-efficient, the particular Welfare Economics proposition on which economists have relied and overwhelmingly continue to rely is wrong.

The vast majority of economists base their approach to economic-efficiency assessment on the assumption that the fact that the economy will contain no economic inefficiency if it contains no Pareto imperfections implies that any policy that reduces (increases) the number or magnitude of the Pareto imperfections in an economy will tend on that account to reduce (increase) the amount of economic inefficiency in that economy, regardless of whether it eliminates all Pareto imperfections in the economy. In making this assumption, these scholars ignore either or both the fact that the Pareto imperfection that the policy under review is targeting is not the only Pareto imperfection in the economy and/or what I take to be the central implication of The General Theory of Second Best. According to The General Theory of Second Best,[13] given a set of conditions whose universal fulfillment guarantees the achievement of an optimum, if one or more of those conditions either cannot be fulfilled or will not be fulfilled, then (unless one can make a complicated argument to the contrary that focuses on the way in which departures from the relevant optimal conditions interact to generate suboptimal outcomes, the pre-policy magnitudes of the departures from the optimal conditions in question [henceforth, of the imperfections in the system], and the impact that the policy in question will have on the magnitudes of these imperfections), there will be no reason to believe that any policy that will reduce the number or magnitude of the imperfections in the system without eliminating all such imperfections *will even tend on that account* to bring one closer to the optimum (to generate an improvement). Roughly speaking, this conclusion reflects the fact that, unless one can make an argument to the contrary that applies to the particular policy and context under consideration, the imperfections that the policy will eliminate will be as likely to counteract as to exacerbate the effects of the imperfections that will remain in the system after the policy is implemented. When the relevant goal is maximum economic efficiency, the relevant optimal conditions are the Pareto-optimal conditions listed in Part 1 of this report, and the central implication of The General Theory of Second Best is that, since any economy will contain a huge number of each type of Pareto imperfection after any policy whose economic efficiency is at issue is implemented, unless one can make an

appropriate theoretically-sophisticated, empirically-informed, context-specific argument to the contrary, one should assume that the fact that a policy will reduce (increase) the number or magnitude of the Pareto imperfections in the economy has no bearing on its economic efficiency.

A non-economic example may be helpful. Assume that these is an ideal way to drive a car around a corner (I will not specify the associated maximin or objective function—whatever it is that would ideally be maximized)—*viz.*, to drive the car 15 miles per hour and turn the steering wheel in the appropriate direction 40 degrees per second. If the car is being driven 15 miles per hour, the optimal rate at which to turn the steering wheel will be 40 degrees per second because, if one turns the steering wheel 40 degrees per second, both (all) of the optimal conditions will be fulfilled and the optimum will be achieved. However, what if the accelerator is jammed, the car is moving 85 miles per hour, and nothing can be done about that fact? Will it be (second-best) optimal to turn the steering wheel 40 degrees per second? Almost certainly not. Although it might turn out that fulfilling the second optimal condition (turning the steering wheel 40 degrees per second) is second-best optimal, any such reality will be fortuitous in the sense that it will not follow from the fact that turning the steering wheel 40 degrees per second is an optimal condition. To figure out the best way to turn the steering wheel when the car is traveling 85 miles per hour, one would have to examine how departures from the two optimal conditions interact to cause suboptimal outcomes both in general and in the particular relevant context—for example, the presence of a steel-reinforced concrete wall 50 yards from the road may play an important role in the relevant analysis even if it would play no role in determining the optimal way to drive the car around the corner in question. The pertinent points are: (1) once one of two optimal conditions is not fulfilled, there is no general reason to believe that fulfilling or more closely approximating the second optimal condition will improve the outcome, and (2) in order to determine whether to fulfill or more closely approximate the second of two optimal conditions when the first is not fulfilled (or, more generally, what to do about a second of two outcome-determinants when the magnitude of the first outcome-determinant is not first-best), one must combine an appropriate theoretical analysis with context-specific empirical findings.

B. Some Relevant Vocabulary

(1) First-Best, Second-Best, and Third-Best Economic-Efficiency Analysis

These expressions are defined in different ways by the various welfare economists who use them. In my vocabulary, "first-best-economic-efficiency analysis" refers to economic-efficiency analyses that ignore both or either The General Theory of Second Best and/or the fact that, even if the Pareto-imperfection-reducing policy whose economic efficiency is being examined is adopted and implemented, the economy will remain highly-Pareto-imperfect. More positively, first-best-economic-efficiency

analyses are analyses that (implicitly) assume (1) that the only relevant Pareto imperfection in the economy is the imperfection whose incidence the conduct/policy under investigation would affect and correlatively (2) that any choice that decreases/increases the magnitude of that Pareto imperfection will tend on that account to decease/increase economic efficiency. I use the expression "second-best-economic-efficiency analysis" to refer to the type of economic-efficiency analysis that would be not only perfectly accurate but also economically efficient if perfect theoretical analyses could be costlessly executed and perfect data could be costlessly collected. Second-best-economic-efficiency analyses take perfect account of all the categories of resource misallocation (see below) whose magnitudes any relevant choice might affect, develop perfect formulas relating the extent of each such category of resource misallocation to the various Pareto imperfections and other relevant factors that interact to cause it, and collect and perfectly analyze the implications of perfect data on (1) the magnitude that these imperfections and other factors would have if the non-government or government choice under scrutiny were rejected and (2) the impact that the policy or choice in question would have on these parameters. I denominate the third category of economic-efficiency analysis I want to distinguish "third-best-economic-efficiency analysis." Third-best-economic-efficiency analyses are the type of economic-efficiency analyses that are economically efficient, given that Pareto imperfections are pervasive, choices affect the magnitudes of many categories of resource misallocation, and data and analysis are costly and inaccurate. Third-best-economic-efficiency analysis differs from second-best-economic-efficiency analysis in that it incorporates only those theoretical and empirical research-projects whose predicted allocative benefits exceed their predicted allocative cost.

It is important to distinguish five questions or related sets of questions that can be raised about third-best-economic-efficiency analysis. The first question is definitional: What is the standard (and useful) way to define the concept of third-best-economic-efficiency analysis? The definition I articulated in the preceding paragraph is the standard definition, though many economists who use this expression do not define it explicitly: third-best-economic-efficiency analyses are analyses of the economic efficiency of a policy or non-government choice that respond economically efficiently to three realities—(1) the economy to which the analysis relates contains a wide variety of categories of resource misallocation, seven types of Pareto imperfections, and many Pareto imperfections of each type, (2) the magnitudes of each category of economic inefficiency any economy contains depends on the way in which the individual Pareto imperfections that would cause each in an otherwise-Pareto-perfect economy interact to cause that category of economic inefficiency, and (3) theoretical and empirical research are allocatively costly and may not yield perfectly-accurate conclusions.

The second question is: How much information do economic-efficiency analysts have *ab initio* about the identity and relevant interaction of the determinants of the magnitudes of the various categories of economic inefficiency that a relevant economy contains, about the pre-policy magnitudes of those determinants, and about the impacts of the policy on the magnitudes of those determinants?

The third question is actually a set of two questions: Can economic-efficiency analysts increase their knowledge about the identity, relevance, pre-policy magnitudes, and post-policy magnitudes of the determinants of the amount of economic inefficiency an economy contains, and, if so, what would be the allocative cost of their doing so to different extents? The relevant allocative costs include (1) the direct allocative cost of doing the research in question—the allocative value that the researchers and any other resources the research uses up would have generated in their alternative uses, (2) the allocative cost of financing the research—any mechanical allocative transaction cost that the government would generate when raising the relevant revenue and any economic inefficiency that would be generated by the associated tax-increases, increases in the prices of goods the government sells, or reductions in other government expenditures, and (3) the economic-inefficiency loss that would be generated by any policy-delays it would be economically efficient to effectuate (because the delays would increase the extent to which one could take advantage of the results of the research).

The fourth question is: How large would the weighted-average-expected or certainty-equivalent economic-efficiency benefits be of doing specific additional theoretical or empirical research? The answer to that question depends on the extent to which the research would be expected to increase the accuracy of the available theoretical conclusions or parameter-estimates, the probability that the relevant increased accuracy would alter the economic-efficiency analyst's conclusion about the identity of the policy that would be most economically efficient, and the probable magnitude of the increase in economic efficiency that would result from the substitution of the more-economically-efficient policy for the less-economically-efficient policy.

The fifth question is: Given the realities that create the need for third-best-economic-efficiency analyses, the economic-efficiency analyst's original knowledge of the world, and the allocative cost and benefits of additional theoretical and empirical research, what is the third-best-economically-efficient way for an economic-efficiency analyst to perform his or her job?

Many economists who acknowledge the correctness of The General Theory of Second Best assert that economic-efficiency analysts do not have and cannot obtain economic efficiently the information that could enable them to justify the economic efficiency of adopting any policy and claim that this (asserted) reality makes it third-best economically efficient to adopt all policies that decrease the Pareto-

imperfectness of the economy. I disagree with these economists' dismal assessments both of the knowledge that economic efficiency analysts possess *ab initio* and of their ability to execute relevant, economically-efficient theoretical and empirical research. But even if these dismal assessments were correct, they would not justify the conclusion that it will be third-best economically efficient for economic-efficiency analysts to endorse as economically efficient the policies that first-best-economic-efficiency analyses would conclude would be economically efficient: even if Second-Best-Theory cannot perform the positive function of providing the basis for economically-efficient third-best-economic-efficiency analyses that yield justifiable conclusions that coincide only rarely and fortuitously with those that first-best-economic-efficiency analyses generate, Second-Best Theory will perform the negative function of establishing that—unless an approximate theoretically-sophisticated, empirically-informed, context-specific argument to the contrary can be made—policies that implement the conclusions generated by first-best-economic-efficiency analyses are not likely on balance to increase economic efficiency. If the dismal views of the economists on whom I am focusing are correct, economists should admit that they have nothing justifiable to say about the economic efficiency of any policy (unless they can make the type of non-first-best [third-best] argument to which I have referred for a particular conclusion), and policies should be based entirely on their distributive attractiveness and/or on the normative acceptability of the processes through which they are made.

As Subpart 2D of this report will indicate, Professor Ng has made a more specific argument for the conclusion that, under the more-specific, pessimistic conditions he specifies, the most-economically-efficient course of conduct for an economic-efficiency analyst to follow would be to recommend the policies that first-best-economic-efficiency analysis would conclude would be economically efficient. Subpart 2D also explains that, as Professor Lipsey argues, (1) the assumptions that Professor Ng is making about the initial knowledge-position of economic-efficiency analysts—*viz.*, that the analyst does not know the direction or degree of divergence between the value that would be economically efficient for a controllable parameter to have in the actual situation (in which the magnitude of another relevant, uncontrollable parameter is not first-best) and its first-best value and that it will never be economically efficient for the analyst to improve his or her knowledge of the world—are unrealistic and (2) Professor Ng's conclusion that it will be third-best economically efficient for the analyst to recommend the policies that first-best analyses would conclude would be economically efficient would not follow from his assumption about the radical, irreversible ignorance of the analyst even on the other assumptions Professor Ng makes. However, for current purposes, the important point is that Professor Ng's assumptions relate to the second, third, and fourth questions in my list of five questions and his conclusion relates to the fifth question in my list of five questions—*i.e.*, do not relate to the first,

definitional question: How is the concept of third-best-economic-efficiency analysis actually and most-usefully defined?

(2) Categories of Resource-Use, Categories of Resource Allocation, and Categories of Resource Misallocation (of Economic Inefficiency)

Resources can be used (1) to increase the unit output of an existing product (can be devoted to a unit-output-increasing [UO] use), (2) to create a quality-or-variety increasing (QV) investment—*i.e.*, an investment that creates a superior or additional product variant, a superior or additional distributive outlet, or additional capacity or inventory (that enable the investor to increase the average speed with which it can supply a relevant quantity of its product or service throughout a fluctuating-demand cycle), (3) to execute a production-process-research (PPR) project—*i.e.*, a project that is designed to discover a cheaper way of producing a relevant quantity of an existing product, or (4) to apply known technology to reduce the cost of producing a relevant quantity of an existing product (to modernize an old plant or construct a new plant using existing technology).

I use the phrase "resource allocation" to refer to the withdrawal of resources from one or more specified categories of use and their devotion to a specified individual category of use. Although most actual resource allocations involve the withdrawal of resources from two or more categories of use and their devotion to a single category of use, I often find it analytically and expositionally useful to break down actual resource allocations that involve withdrawals of resources from two or more categories of use into their component parts—*e.g.*, to break down a resource allocation to QV-investment creation from unit-output production, alternative-QV-investment creation, and production-process-research execution into its UO-to-QV, QV-to-QV, and PPR-to-QV components.

Associated with each possible category of resource allocation is a category of resource misallocation or economic inefficiency. Thus, I find it economically efficient to distinguish the following major categories of resource misallocation:

(1) "UO-to-UO misallocation"—the amount by which economic efficiency could have been increased if, controlling for the loss of allocative value associated with the withdrawal of the resources devoted to UO production from the other categories of use to which they would otherwise have been devoted (the sum of the allocative values each such resource would have generated in the other category of use to which it would otherwise have been devoted), the goods in production had been produced in different proportions (assuming that the alternative allocation in question could have been secured without generating any additional allocative transaction costs or any financing-of-government-operations-related economic-efficiency costs);

(2) "QV-to-QV misallocation"—the amount by which economic efficiency could have been increased if, controlling for the loss of allocative value associated with the withdrawal of the resources devoted to QV-investment creation from the other categories of use to which they would otherwise have been devoted, a different set of QV investments had been created (assuming that the alternative allocation in question could have been secured without generating any additional allocative transaction costs or any financing-of-government-operations-related economic-efficiency costs);

(3) "PPR-to-PPR" misallocation—the amount by which economic efficiency could have been increased if, controlling for the loss of allocative value associated with the withdrawal of the resources devoted to PPR execution from the other categories of use to which they would otherwise have been devoted, a different set of PPR projects had been executed (assuming that the alternative allocation in question could have been secured without generating any additional allocative transaction costs or any financing-of-government-operations-related economic-efficiency costs);

(4) "UO-to-QV or QV-to-UO" misallocation—the amount by which economic efficiency could have been increased if, controlling for the loss of allocative value associated with the withdrawal of resources from the other categories of resource-use to which they would otherwise have been devoted, resources had been allocated in different proportions between UO-increasing and QV-creating resource-uses (assuming that the alternative allocation in question could have been secured without generating any allocative transaction costs or any financing-of-government-operations-related economic-efficiency costs);

(5) "UO-to-PPR or PPR-to-UO" misallocation an economy contains—the amount by which economic efficiency could have been increased if, controlling for the loss of allocative value associated with the withdrawal of resources from the other categories of resource-uses to which they would otherwise have been devoted, resources had been allocated in different proportions between UO-increasing and PPR-executing uses (assuming that the alternative allocation of resources in question could have been secured without generating any allocative transaction costs or any financing-of-government-operations-related economic-efficiency costs);

(6) "PPR-to-QV or QV-to-PPR" misallocation—the amount by which economic efficiency could have been increased if, controlling for the loss of allocative value associated with the withdrawal of resources from the other categories of resource-use to which they would otherwise have been devoted, resources had been allocated in different proportions between PPR-executing and QV-creating uses (assuming that the alternative allocation of resources in question could have been secured without generating any allocative transaction costs or any financing-of-government-operations-related economic-efficiency costs);

(7) choice-among-known-production-processes misallocation—the amount by which economic efficiency would have been increased had producers chosen to produce their outputs with different, known production processes;

(8) consumption-optimum misallocation—the amount by which economic efficiency would have been increased had the goods and services that the economy produced been allocated differently among their different possible final consumers (economic inefficiency that may be generated because particular units of output were allocated to the wrong final consumer and/or because the overall distribution of income and wealth the actual allocation produced was economically inefficient); and

(9) the allocative transaction costs the government generates directly when designing, passing, and implementing its policies; the allocative transaction costs that government policies cause non-government actors to generate to escape detection of violations of prohibitions, to defend themselves against related prosecutions or civil suits, to apply for any government-transfers, or to insure themselves against related losses (*minus* the allocative transaction costs the policy's addressees would have generated by engaging in conduct the policy deters); and the allocative transaction costs and non-allocative-transaction-cost-related misallocation the government generates to finance the "private" costs it incurred to design, pass, and implement its policies.

I also find it economically efficient to distinguish or focus on subcategories of the first three categories of economic inefficiency just listed—*e.g.*, UO-to-UO misallocation between the production of closely-rivalrous products and UO-to-UO misallocation between products that are distantly competitive, UO-to-UO misallocation between the "production" of leisure and the production of other goods, UO-to-UO misallocation between future and current production and/or consumption, QV-to-QV misallocation between the creation of products that would and would not be closely rivalrous, and PPR-to-PPR misallocation between the execution of PPR projects that would and would not be closely rivalrous.

(3) The Concepts of an "Economics-Marginal Allocation of Resources" and a "Mathematics-Marginal Allocation of Resources," of "the Distortion and Percentage Distortion in the Profits Yielded by a Specified Resource Allocation," and of the Distribution of Aggregate-Percentage-Profit-Distortion Figures for a Specified Category of Resource Allocation in an Economy

In my standard-economies usage, a specified allocation of resources in a specified area of product-space is economics-marginal if it is the least-profitable but not-unprofitable allocation of resources in the specified category in the specified area of product-space. Economics-marginal allocations of resources may or may not be mathematics-marginal—*i.e.*, strictly speaking, infinitesimally small (in practice, in economics, small enough to be treated as if they are infinitesimally small). If an economics-marginal allocation of resources is mathematics-marginal and the resource allocator is a sovereign maximizer, the (supernormal) profits it yields will be zero. Economic analyses conventionally

assume that economics-marginal allocations of resources to the production of any product are mathematics-marginal while economics-marginal allocations of resources to QV-investment creation or PPR execution are not mathematics-marginal (are lumpy).

In my usage, a private-cost, private benefit, or profit figure is "distorted" if it diverges from its allocative counterpart. More specifically, in my vocabulary, a private figure is said to be "inflated" if it is higher than its allocative counterpart and "deflated" if it is lower than its allocative counterpart. Thus, the marginal cost of producing a marginal unit of some product is "deflated" if it is lower than the allocative cost of producing that unit (the allocative value that the resources used to produce that marginal unit of output would have generated in their alternative uses), and the profits yielded by a specified resource allocation are inflated if they are higher than the economic efficiency of the resource allocation in question.

It is easy to explain why the impact of a policy on the aggregate distortion in the profits yielded by an economics-marginal resource allocation is relevant to the policy's economic efficiency when the relevant resource allocation is mathematics-marginal as well as economics-marginal and the relevant resource allocator is a sovereign maximizer: since in such cases the profits yielded by the economics-marginal resource allocation are zero, a finding that those profits are inflated by $α implies that the economics-marginal resource allocation in question reduced economic efficiency by $α, and a finding that those profits are deflated by $α implies that the economics-marginal resource allocation in question increased economic efficiency by $α (an implication that is troubling because it implies that additional mathematics-marginal resource allocations of the specified type in the specified area of product-space that had not been made would also have been economically efficient). In both cases, the total amount of misallocation will exceed $α (will equal the total misallocation generated by all the mathematics-marginal resource allocations in the relevant category that were economically inefficient or the total gain in economic efficiency that would have been generated by the additional mathematics-marginal resource allocations in the relevant category that did not take place though they would have been economically efficient).

The analytic protocol that I think is the third-best-economically-efficient approach to analyzing the economic efficiency of a government policy or non-government choice builds on these relationships. To describe it, I have to define two additional concepts. The first is the aggregate percentage distortion generated in the profits yielded by any specified economics-marginal resource allocation—100% *times* the ratio of the distortion generated jointly by all the Pareto imperfections the economy in question contains in the profits yielded by a specified economics-marginal resource allocation in a specified area of product-space to the allocative cost (the opportunity cost in old-fashioned economics terminology) of the resource-use to which the allocation devotes resources (the allocative value that would have been

generated by the resource-use[s] the specified allocation sacrifices). The second is the concept of the distribution of aggregate-percentage-profit-distortion figures for the economics-marginal resource allocations in a specified category in the economy's specified areas of product-space (or in an economically-efficient random sample of those areas of product-space). The economic-efficiency-analysis protocol that I think is third-best economically efficient derives predictions or post-dictions of the impact of the policy on the amount of UO-to-UO misallocation between products that are distantly competitive that the economy contains, the amount of QV-to-QV misallocation between areas of product-space that are distantly competitive that an economy contains, and the amount of PPR-to-PPR misallocation between PPR projects that are distantly competitive that the economy contains substantially from (1) guesstimates or estimates of the mean, mean deviation, and mean squared deviation of the distribution of positive aggregate-percentage-profit-distortion figures for the economy's economics-marginal resource allocations in the associated category and (2) guesstimates or estimates of the impact of the policy on these attributes of the referenced distribution. The economic-efficiency-analysis protocol that I think is third-best economically efficient derives predictions or post-dictions of the effect of a policy on the amount of UO-to-QV (or QV-to-UO), UO-to-PPR (or PPR-to-UO), and PPR-to-QV (or QV-to-PPR) misallocation the economy contains substantially from (1) guesstimates or estimates of the mean, mean deviation, and mean squared deviation of the pre-policy distributions of the respective absolute-aggregate-percentage-profit-distortion distributions for one member of each of the above three pairs of allocations and (2) guesstimates or estimates of the impact of the policy on these distribution-parameters.[14] Although this explanation clearly requires considerable elaboration, the reason that this protocol is third-best economically efficient even when applied to economics-marginal resource allocations that are not mathematics-marginal (that are highly likely to yield positive supernormal profits) is that there is no reason to believe that there will be a positive correlation between (1) the aggregate percentage distortion in the profits yielded by economics-marginal resource allocations that are not mathematics-marginal and (2) the supernormal profit-rates those allocations generate.[15]

C. The Protocol That I Think Is the Third-Best-Economically-Efficient Approach for Predicting or Post-Dicting the Economic Efficiency of a Government Policy: A Partial Summary

Considerations of space and reader patience deter me from developing here a full account of the protocol that I think constitutes the third-best-economically-efficient approach to predicting or post-dicting the economic efficiency of a government policy or from justifying this protocol. However, I do think it would be useful for me to provide enough information about this protocol to ground Part 3's analyses of the impacts that natural-gas-pipeline regulations can have on various categories of economic efficiency. The protocol I think is third-best economically efficient uses different approaches to analyze

the impact of a policy on (1) the amounts the relevant economy contains of UO-to-UO misallocation between products that are not highly competitive, of QV-to-QV misallocation between areas of product-space that are not highly competitive, of PPR-to-PPR misallocation between PPR projects that are not highly competitive, of UO-to-QV or QV-to-UO misallocation, of UO-to-PPR or PPR-to-UO misallocation, and of QV-to-PPR or PPR-to-QV misallocation and (2) the amounts the relevant economy contains of the other types of misallocation listed in subpart 2B(2) of the report. I think that a more complicated version of the following protocol delineates the third-best-economically-efficient approach to analyzing the impact of a government policy on the 6 categories of economic inefficiency listed after "(1)" in the preceding sentence:

(1) divide up the economy's total product-space into non-overlapping sub-areas;

(2) define the various categories of resource allocation that can take place in an economy and the related categories of economic inefficiency an economy can contain;

(3) develop (different) formulas for the aggregate percentage distortions in the profits yielded by the economy's economics-marginal allocations of resources in each of the above categories that is generated by the Pareto imperfections in the economy;

(4) guesstimate or estimate the pre-policy magnitudes of the parameters in these formulas and hence the pre-policy magnitudes of the aggregate percentage distortions in the profits yielded by the economics-marginal allocations of resources in each category;

(5) guesstimate or estimate the impact of the policy on the magnitudes of the parameters in the formulas in question and hence the policy's impact on the aggregate percentage distortions in the profits yielded by the economics-marginal allocations of resources in each category;

(6) derive initial estimates of the impacts of the policy on the above categories of resource misallocation from the preceding estimates—*viz.*, by deriving from these estimates estimates of the pre-policy aggregate-percentage-distortion figures for the profits yielded by the economics-marginal resource allocations in the relevant categories and the impact of the policy on these percentage-profit-distortion figures and, derivatively, from estimates of (A) the pre-policy magnitudes of the means, mean deviations, and mean squared deviations of the distributions of positive aggregate percentage-profit distortions for an economically-efficiently-large random sample of the economy's UO-to-UO allocations between distantly-competitive products, QV-to-QV allocations between distantly-competitive QV investments, and PPR-to-PPR allocations between distantly-competitive PPR projects and the same attributes of the pre-policy distributions of absolute percentage-profit-distortion figures for an economically-efficiently-large random sample of the economy's economics-marginal UO-to-QV (or QV-to-UO) allocations,

UO-to-PPR (or PPR-to-UO) allocations, and QV-to-PPR (or PPR-to-QV) allocations and (B) the impact of the policy on these distribution-attributes;

(7) analyze the allocative cost and benefits of doing further empirical research into the pre-policy magnitudes of the relevant parameters and the impact of the policy on these parameters and continue to do such research until further investigation would be economically inefficient; and

(8) derive conclusions about the impact of the policy in question on the above-specified categories of resource misallocation from the analysis' final estimates of the pre-policy and post-policy magnitudes of the relevant distributions' relevant attributes.

My current view is that it would not be third-best economically efficient to use analogs of the preceding protocol (more precisely, of the more-fully-specified, more-complicated variant of that protocol that I think does constitute the third-best-economically-efficient approach to predicting the impact of a policy on the 6 categories of economic inefficiency I am recommending it be used to predict) to analyze a policy's impact on the other categories of resource misallocation listed in subpart 2B(2) of this report. Thus, I think it will prove to be third-best economically efficient to estimate a policy's impact on the quantity of UO-to-UO misallocation between products that are highly competitive that the relevant economy contains by estimating its impact on the amount of predatory pricing practiced in the economy (since such pricing will tend to allocate sales and resources to privately and presumptively-allocatively worse-placed suppliers that are predators rather than to privately and presumptively-allocatively better-placed suppliers that are targets of predation) and on the amount of price-fixing practiced in the economy (since price-fixing leads to UO-to-UO-misallocation-causing undercutting by competitive inferiors, retaliation against undercutters by retaliators that are privately-worse-placed to supply the recipient of the retaliatory price, and defensive retaliation against retaliating price-fixers). Similarly, I think it will be third-best economically efficient to analyze a policy's impact on the amount of misallocation an economy contains because its producers use less-economically-efficient, known production processes rather than more-economically-efficient, known production processes by investigating the impact of the policy on (1) the frequency with which the use of the known production processes available to producers will generate different amounts of externalities, (2) the frequency with which producers make predatory choices to use higher-average-total-cost production processes whose marginal costs are lower, (3) the frequency with which firms are precluded from reducing their production costs by combining assets that are complementary for scale or non-scale reasons by policies that prohibit them from engaging in mergers, making acquisitions, creating joint ventures, or even growing internally, and (4) the frequency with which firms subject to fair-rate-of-return regulation choose to use known, more-capital-intensive production processes that are more privately and allocatively costly than known, less-capital-intensive alternatives

that are less privately and allocatively expensive to increase their rate-bases and hence the prices that the regulatory authority allows them to charge for their products (the prices that will yield them the allowed rate-of-return on their rate-base).[16] And I suspect that it will prove to be third-best economically efficient to analyze the impact of a policy on consumption-optimum misallocation by determining its impact on (1) the incidence of price discrimination (a practice that creates the possibility that one or more units of the relevant good will be allocated to a lower-valuing buyer who or that is being charged a lower price rather than to a higher-valuing buyer who or that is being charged a higher price) and (2) the number of people in the society who are poor, the depth of the poverty of those who are poor, and the extent of income/wealth inequality in the society in question. The incidence and depth of poverty in a society affects its economic efficiency by affecting (1) the extent to which, from the perspective of economic efficiency, too few resources are invested in the human capital of the children of the poor and poor adults, (2) the amount of misallocation that the consumption decisions of poor consumers generate because it is in their individual (or individual family's) interest for them to purchase cheap products whose consumption generates more external costs than their consumption of more expensive products would (purchase ugly, air-polluting, noise-polluting, breakdown-prone, accident-causing cars or rent ugly, fire-spreading, and disease-spreading housing units), (3) the amount of misallocation that the individuals who are poor generate by making economically-inefficient consumption decisions that are not in their parochial interest (because they do their maths wrong or discount the future at too high a rate), (4) the amount of misallocation that individuals who are poor generate by committing economically-inefficient criminal acts (because they are alienated and therefore place a lower weight on the impact of their behavior on others and because their poverty makes crime preferable to a life without the possible material benefits of crime), (5) the amount of misallocation that poverty generates by reducing the political participation of the people who are poor and thereby causing the government to make economically-inefficient decisions that favor the non-poor, and (6) (I am perhaps being optimistic) the net cost that the poverty of some members of the society in question imposes on other members of that society who have "external preferences"—who place positive or negative dollar values on the welfare positions of others.

D. The Debate Between Professors Lipsey and Ng About the Economic Efficiency of the Economic-Efficiency Conclusions That First-Best Analyses Would Generate in Situations of "Informational Poverty" in Which the Policymaker Does Not Know How a Pareto Imperfection in One Market That Cannot Be Directly Altered Will Affect the Magnitude and Direction of the Divergence Between the Price and Marginal Cost of a Product in Another Market Whose Price Can Be Controlled by the Policymaker That Would Be Second-Best Economically Efficient[17]

In Professor Lipsey's concretization, Professor Ng is addressing a situation in which (1) an economy contains one Pareto imperfection (say a supra-competitive price or tax) in one market, (2) the curve that "relates the value of the objective function [in Lipsey's example, the economic efficiency of an economy] to the direction and degree of divergence from the first-best rule of the variable under consideration [in Lipsey's example, the direction and degree of divergence from marginal cost of the price of a product in another market whose price the policymaker can control]…is concave…[so that] [a]s we diverge more and more from the first-best rule [in Lipsey's example, as we set the controllable price further and further above or below the relevant product's marginal cost], the marginal damage [the sub-optimality of the actual outcome]—[in Lipsey's example, the amount of economic inefficiency the relevant economy contains] increases," and (3) the policymaker does not know the direction and degree of divergence from the first-best rule [in Lipsey's example, the direction and degree of the divergence of the controllable price from the marginal cost of producing the product whose price is controllable] that would be second-best economically efficient, the third-best response of the policymaker is to set the controllable variable at its first-best level [in Lipsey's example, to equate the controllable price in the second market with the marginal cost of the product in question]."[18] Professor Lipsey demonstrates that (1) even on Professor Ng's concavity assumption, Professor Ng's argument "*is an argument for maintaining the policy* status quo*, not for imposing first-best rules in third-best worlds*"[19] (italics in the original), (2) even on Professor Ng's concavity assumption, his conclusion "can be seriously harmful,"[20] (3) under the conditions in which second-best issues usually arise, Professor Ng's concavity assumption is unlikely to be realistic,[21] and (4) the type of non-context-specific guides to policy that Professor Ng and others have tried to discover are unlikely to be economically efficient "in the world of many sources [Pareto imperfections] in which we live…"[22] I agree with Professor Lipsey.

It should be obvious that Professor Ng focuses on a situation that is very different from the one I analyze: he assumes (1) that there is one Pareto imperfection that the policymaker cannot control directly and one that the policymaker can control whereas I assume that there are a huge number of Pareto imperfections that the policymaker cannot control directly and one that the policymaker can control and (2) that the policymaker is radically and irreversibly ignorant whereas I assume that the policymaker is initially somewhat better informed and can increase the information at his disposal economically efficiently to some extent. Perhaps because of Professor Ng's assumption of radical, irreversible ignorance, Professor Ng also does not distinguish the categories of economic inefficiency that I believe are third-best economically efficient to distinguish or analyze the different ways in which the various types of Pareto imperfections an economy may contain will interact to cause each such category of economic inefficiency.

3. A Preliminary and Partial Analysis of Whether and How an Economy's Natural-Gas-Pipeline Regulations and Independent Pareto Imperfections Can Cause the Four Categories of Economic Inefficiency on Which the Australian Natural-Gas-Pipeline Regulatory Authorities Have Focused

The Australian natural-gas-pipeline regulatory authorities have focused on four categories of economic inefficiency that pipeline-owner decisions might generate:

(1) UO-to-UO misallocation generated by pricing decisions that affect the quantity of pipeline services supplied;

(2) production-optimum misallocation generated by decisions to operate existing pipelines in ways that are economically-inefficiently-allocatively-costly or to construct pipelines that provide relevant quantities of given services at unnecessarily-high average allocative total cost;

(3) QV-investment misallocation generated by decisions to make investments in pipelines that increase the quality of the pipeline services provided (say, by increasing pipeline capacity and hence the average speed with which pipeline-services are supplied throughout a fluctuating-demand cycle or by reducing natural-gas-pipeline-spillage-generated allocative costs); and perhaps

(4) financing decisions that increase the allocative cost of financing pipeline construction and operation (I am not certain that this is an actual concern of the authorities) or that cause the pipelines to make misallocative existing-pipeline-operation decisions or misallocative pipeline-construction decisions by raising the net (net of capital costs) rate-of-return the regulated pipelines are allowed to earn.

Part 3 of this report analyzes the pipeline-regulation-generated imperfections and independent Pareto imperfections that might cause each of these types of misallocation. Part 3 does not consider the economically-efficient way for natural-gas-pipeline-service-price regulators to analyze the economically-efficient relationship between peak-load and off-peak prices.

I should state at the outset that I have been hired to write this report because I am an expert in Welfare Economics in general (the branch of economics that focuses on the definition of "the impact of a choice or event on economic efficiency," the appropriate way to predict or post-dict that impact, and the relevance of that impact to the moral and legal evaluation of any choice) and Second-Best Theory in particular, not because I have any expertise in the natural-gas or natural-gas-pipeline industries. This subpart includes references to the products against which I suspect natural-gas-pipeline services compete, the various types of expenditures that I suspect the operation of extant natural-gas pipelines may involve, and the various types of "non-operating" investments that natural-gas-pipeline owners might make, but I have no real expertise in such matters.

A. UO-to-UO Misallocation

Although Australian natural-gas-pipeline regulators have never articulated the assumptions they think should be made about the types of uses from which the resources allocated to the use of a natural-gas pipeline are withdrawn, I will proceed on the assumption about this matter that is conventionally made when analyzing whether, from the perspective of economic efficiency, the output of any product *X* is economically efficient—*viz.*, that the resources used to produce units of *X* would otherwise have been used to produce units of another product *Y* already in production (that the resource allocation in question is UO-to-UO between products *Y* and *X*). I suspect that, for most buyers of natural-gas-pipeline services, the alternative to purchasing those services is to change to a different type of energy-source—a shift that would clearly require substantial alterations in their facilities that could not be executed in the short-run. I recognize that a few buyers of natural-gas-pipeline services may be able to obtain natural gas at commercially-viable prices by hiring the services of (tanker) ships that can transport natural gas that has been cooled and liquefied, but my impression is that it is not commercially viable to obtain natural gas by using trucks or railroads to transport cooled, liquefied natural gas. Hence, in the typical case, the *Y* from whose unit-output production resources would be withdrawn when additional units of natural-gas-pipeline services (*X*) are supplied will overwhelmingly be the production and transport of other sources of energy (in Western Australia, primarily coal but increasingly solar-power and wind-power).

The Australian authorities recognize that (1) in an otherwise-Pareto-perfect economy, the output of a seller that faces imperfect price competition will be lower than the economically-efficient output of the product in question[23] and (2) the tendency of the imperfection in seller price-competition that a seller faces to cause it to produce too few units of its product from the perspective of economic efficiency will be counteracted by any external costs its production of the relevant units of its product would have generated.[24] I will now (1) explain these two correct conclusions in distortion-analysis terms, (2) explain when a price-regulation that requires a producer to set a specified supra-marginal-cost price or establishes a maximum-per-unit price that a seller may charge that exceeds the seller's marginal costs but is lower than the per-unit price that would yield the producer more profits than any other per-unit price would yield will and will not distort the private benefits (marginal revenue) the regulated producer obtains by selling its marginal unit of output, and (3) explain why not only the imperfections in seller price-competition faced by the producer of a product *X* and the externalities generated by the production of product *X* but also any imperfections in the seller price-competition faced by the producer of the product *Y* from whose production the resources used to produce the marginal unit of *X* are withdrawn, the externalities that would have been generated by the production of the sacrificed units of *Y*, and individual exemplars of many of the other types of Pareto imperfections an economy may contain will cause UO-to-

UO misallocation between *Y* and *X* in an otherwise-Pareto-perfect economy, and (4) explain how all the exemplars of three types of Pareto imperfections one of whose exemplars would generate UO-to-UO misallocation between the production of *Y* and *X* in an otherwise-Pareto-perfect economy interact to generate UO-to-UO misallocation between *Y* and *X*.

To start, because (1) the imperfection in seller price-competition facing a seller that faces a downward-sloping demand curve and cannot (costlessly or profitably) charge the demand price for its marginal unit of output while continuing to charge the higher prices it would otherwise have charged for its intra-marginal units (more simply and relatedly, a seller that does not charge a discriminately-low price for its marginal unit of output) causes the marginal revenues that the seller in question will obtain by selling successive units of its product to be lower than the prices that the buyers of those successive units could have paid for them and remained equally well-off and (2) in an otherwise-Pareto-perfect economy, the price that the buyer of any unit of any product could pay for it and remain equally well-off equals the allocative value of that unit, any imperfection in seller price-competition will deflate the private benefits that a seller that faces a downward-sloping demand curve and would not practice relevant price discrimination will earn by producing and selling a marginal unit of output, and therefore, in an otherwise-Pareto-perfect economy will cause the seller to produce too few units of its product from the perspective of economic efficiency by reducing the profits it can realize by producing successive units of its product below the economic efficiency of its doing so and thereby rendering unprofitable the production of units of the product in question whose production would be economically efficient (on the conventional assumptions that the production of the marginal unit of every product yields zero profits and that the profits yielded by the production of successive units of any product drop by infinitesimally-small amounts).

In the other direction, the non-internalization of any external costs generated by the production of successive units of output of any product *X* will inflate the profits yielded by their production by deflating the (private) marginal cost of their production (*i.e.*, by causing those [private] marginal costs to be lower than the allocative costs of the production of the units in question—the allocative value that the resources devoted to the production of those units would have generated in their alternative uses) and hence inflating the profits the producer of *X* can make by producing the units in question. On the conventional assumptions that the profits yielded by the marginal unit of each product in the economy is zero and that the profits yielded by the successive units of any product rise by infinitesimally-small amounts, the profit-inflation that the non-internalization of the external costs that the production of *X* will generate will cause *X*'s producer to produce an economically-inefficiently-high output of *X* by rendering profitable the production of units whose production is economically inefficient.

I turn next to the possible distorting impact of regulations that dictate the price that a regulatee must charge for some product or establish a maximum price the regulatee may charge for a product when the dictated or allowed-maximum price exceeds the marginal cost of the product in question but is lower than the per-unit price that would yield the regulatee more profits than any other per-unit price could yield. If the regulation-set or regulated-maximum per-unit price is lower than the price at which the demand curve for the product in question cuts the marginal cost curve for that product from above, (1) the price regulation will increase the regulated producer's unit output above the output it would produce if it would practice single per-unit pricing if unregulated (because, although the regulation would lower the per-unit price the seller would charge, it would increase the marginal revenue the seller would obtain by selling the unit of output that would be the seller's marginal unit of output if the price were unregulated (given that, under regulation, MR would be constant and equal to the dictated or maximum per-unit price up until the output at which the demand curve cut the marginal cost curve from above), and (2) the deflation in the private benefits the producer can obtain by producing its marginal unit of output will be lower than the deflation in the private benefits it would have obtained as an unregulated firm by producing the marginal unit of the output it would have produced as an unregulated firm. If the regulation-dictated or regulated-maximum price equals the higher price at which the demand curve for the product in question cuts the relevant marginal cost curve from above, the regulation will increase the output of the regulatee even more and will eliminate any distortion in the private benefits the regulatee obtains by producing its (changing) marginal unit of output since, in this case, the required or allowed-maximum price (which still equals the marginal revenue the regulated firm will obtain by selling its marginal unit of output) will also equal the demand price for the marginal unit produced (which equals that unit's allocative value on otherwise-Pareto-perfect assumptions).

I now want to explain how, in an otherwise-Pareto-perfect economy, other individual exemplars of imperfections in seller price-competition, other individual exemplars of production externalities, and individual exemplars of some other types of Pareto imperfections would distort the private cost or private benefits of producing a marginal unit of product *X* with resources withdrawn from the production of product *Y* and thereby cause UO-to-UO misallocation between the production of *X* and *Y* in an otherwise-Pareto-perfect economy. If the producer of *Y* is an imperfect competitor that faces a downward-sloping demand curve and does not charge a discriminatively-low price for its marginal unit of output, the imperfection in seller price-competition facing the producer of *Y* will deflate the marginal cost of the marginal unit of *X* by reducing the marginal revenue that the producer of *Y* would have obtained by selling the units of *Y* sacrificed to the production of the marginal unit of *X* below the price that the prospective buyers of those sacrificed units of *Y* could have paid for them and remained equally well-off

(which equal the allocative value of those sacrificed units of *Y* on otherwise-Pareto-perfect assumptions), thereby deflating the private value to the producer of *Y* of the resources the producer of *Y* would have employed to produce the sacrificed units of *Y*, thereby deflating the private cost that the producer of the marginal unit of *X* had to incur to bid those resources away from the prospective producer of the sacrificed units of *Y* and, in an otherwise-Pareto-perfect economy, making it profitable for the producer of *X* to produce one or more units of *X* whose production is economically inefficient. If the consumption of the marginal unit of *X* generated external costs/benefits, the non-internalization of those costs/benefits would inflate/deflate the profits of producing the marginal unit of *X* by inflating/deflating the private benefits (the marginal revenue) of selling the marginal unit of *X*. If the consumption of the sacrificed units of *Y* would have generated external costs/benefits, the non-internalization of those costs/benefits would inflate/deflate the private benefits that the prospective producer of the sacrificed units of *Y* would have earned by producing them, thereby inflating/deflating the private cost to the producer of the marginal unit of *X* of the resources it bid away from *Y* to produce the marginal unit of *X*, thereby deflating/inflating the profits that the producer of the marginal unit of *X* realized by producing that unit. If the sale of the marginal unit of *X* is taxed, the sales or value-added tax in question will deflate the private benefits yielded by the production of the marginal unit of *X* by reducing the price its producer obtains for it and hence the marginal revenue its producer obtains by selling it below the price its buyer pays for it (its allocative value on otherwise-Pareto-perfect assumptions). If the sale of the sacrificed units of *Y* would have been taxed, those prospective taxes would inflate the profits yielded by the production of the marginal unit of *X* by deflating the marginal cost of producing that unit by deflating the private benefits that the prospective producer of the sacrificed units of *Y* would have obtained by selling these units by reducing the price the prospective producer of those units of *Y* would have obtained for them and hence the marginal revenue that the prospective producer of the sacrificed units of *Y* would have obtained by selling them below their allocative value (the prices that their buyers would have paid for them and could have paid for them and remained equally well-off). I could go on, but I hope that the preceding analyses suffice to establish that—in an otherwise-Pareto-perfect economy—an individual exemplar of any type of Pareto imperfection that would distort the private cost or private benefit of producing either *X* or *Y* would cause UO-to-UO misallocation between the production of *Y* and *X*.

I will close this subpart by discussing briefly the way in which the various imperfections whose individual exemplars would cause UO-to-UO misallocation between the production of *Y* and *X* in an otherwise-Pareto-perfect economy will interact to distort the profits yielded by the economics-marginal allocation of resources from the production of units of product *Y* to the production of product *X*. If no consumer of *Y* or *X* ever makes an error when deciding whether to purchase either good and no producer

of *Y* or *X* ever makes an error when deciding the quantity of either good to produce, the amount of misallocation generated by economically-inefficient allocations of resources between the production of products *Y* and *X* will increase with the aggregate distortion in the profits yielded by the economics-marginal allocation of resources between the production of the two products—*i.e.*, with the difference between the profits the allocation in question yielded the producer of *X* and the economic efficiency of the production of the marginal unit of *X*. To simplify the analysis, I will also assume that the consumption of neither *X* nor *Y* generates any externalities, that no consumer of *Y* or *X* is a monopsonist, that no producer of *Y* or *X* is a monopsonistic buyer of any of the inputs used to produce *Y* or *X*, that no taxes are ever levied on the sale of any of the inputs used to produce *Y* or *X*, that no taxes are/would have been levied on the earned income of any worker who sacrificed/would have sacrificed leisure to produce a marginal/just-extra-marginal unit of *X*/*Y*, and that no supplier of any input that was used to produce a marginal unit of *X* or that would have been used to produce a sacrificed just-extra-marginal unit of *Y* is an imperfect competitor. These assumptions are relevant because the Pareto imperfections they indicate I will ignore would or could also distort the profits yielded by an economics-marginal allocation of resources from the production of just-extra-marginal units of *Y* to the production of a marginal unit of *X*. In the analysis that follows, (1) the subscripts ΔUO_X and ΔUO_Y will stand respectively for the marginal unit of *X* and the sacrificed just-extra-marginal unit(s) of *Y*, (2) P_X and P_Y will stand for the prices that, respectively, the buyers of *X* and *Y* must pay for the products (which will exceed the prices that the producers of *X* and *Y* receive for their products if the relevant buyers must pay a [sales, value-added, consumption, *etc*.] tax to purchase the unit in question), (3) PB and LB stand respectively for private benefits and allocative benefits, (4) PC and LC stand respectively for private cost and allocative cost, (5) MLV_X and MLV_Y stand respectively for the allocative value of the marginal units of *X* and the just-extra-marginal (sacrificed) unit or units of *Y*—the net equivalent-dollar gain generated by the consumption of the unit(s) in question if the alternative to its (their) consumption were its (their) allocatively-costless destruction), (6) $MRT_{Y/X}$ stands for the marginal rate at which the economy can transform *Y* into *X*, (7) MC_X and MC_Y stand respectively for the (private) marginal costs of producing *X* and *Y*, (8) MC_X^* and MC_Y^* stand respectively for the adjusted marginal cost of producing *X* and Y, adjusted so that MC_X^*/ MC_Y^* equals the $MRT_{Y/X}$ (see below), and (9) $(M/X/T)D(P\pi_{\Delta UOX/\Delta UOY})$ stands for the distortion (D) in the profits yielded by an allocation of resources from the production of just-extra-marginal units of *Y* to the production of a marginal unit of *X* that would be generated in an otherwise-Pareto-perfect economy by all the imperfections in seller price-competition the economy contains ("M" stands for monopoly), all the externalities of production generated in the economy contains (in this case, the non-subscript "X" stands for externalities of production), and all taxes on the margin of income (in this case, "T" stands for sales, value-added, or

other types of taxes that are levied on the purchase of the marginal unit of *X* and would have been levied on the purchase of the just-extra-marginal units of *Y*).

I will start with the (simple) mathematical derivation and then explain each of its steps linguistically:

(1) $(M/X/T)D(P\pi_{\Delta UOX/\Delta UOY})\equiv(M/X/T)D(PB_{\Delta UOX})-(M/X/T)D(PC_{\Delta UOX/UOY})\equiv$

(2) $(PB_{\Delta UOX}-LB_{\Delta UOX})-(PC_{(\Delta UOX/\Delta UOY)}-LC_{(\Delta UOX/\Delta UOY)})=$

(3) $(MR_X-MLV_X)-(MC_X)-MRT_{Y/X}(MLV_Y)=$

(4) $(MR_X-P_X)-(MC_X-MRT_{Y/X}[MLV_Y])=$

(5) $-P_X + (MC^*_X/\ MC^*_Y)\ P_Y =$

(6) $MC^*_X\ ([P_Y/MC^*_Y]-[P_X/MC^*_X])=$

(7) $MC^*_X\ ([P_Y/MC_Y][MC_Y/MC^*_Y])-[P_X/MC_X][MC_X/MC^*_X]$

Step (1) is simply a definition of any specified category of distortion in the profits yielded by any specified category of resource allocation—*i.e.*, simply states that that distortion is identical to the difference between the indicated distortion in the associated private-benefit and private-cost figures. Step (2) is also an identity—indicates simply that that the indicated distortion in the relevant private benefits is, by definition, the difference between the relevant private and allocative benefits and that the indicated distortion in the relevant private costs is, by definition, the difference between the relevant private and allocative costs. Step (3) manifests (A) the fact that (at least if I assume that the production and sale of the marginal unit of *X* does not increase its producer's profits by enabling it to make other additional sales or by reducing the costs it must incur to produce other products) $PB_{\Delta UOX}=MR_X$, (B) by definition $LB_{\Delta UOX}\equiv MLV_X$, (C) the fact that, by definition, $PC_{\Delta UOX/\Delta UOY}=MC_X$, and (D) the fact that (at least if I ignore the complexity introduced by the possibility that more than one unit of *Y* may have to be sacrificed to produce the marginal unit of *X*—a complexity that would require me to substitute an $AMLV_Y$ figure for MLV_Y where $AMLV_Y$ stands for the average marginal allocative value of the sacrificed units of *Y* and, in steps (5) to (7), to substitute an AP_Y figure for P_Y where AP_Y would stand for the average price that the buyers of the sacrificed units of *Y* could have paid for them and remained equally well-off), the allocative cost of producing a marginal unit of *X* equals the number of units of *Y* that were sacrificed when the marginal unit of *X* was produced *times* the (average) allocative value that each sacrificed unit of *Y* would have had. Step (5) (A) eliminates MR_X and $(-MC_X)$ on the ground that, on the analysis' assumption that the producer of *X* is a sovereign maximizer, $MR_X=MC_X$, (B) substitutes (MC^*_X/MC^*_Y) for $MRT_{Y/X}$ (see below), and (C) substitutes P_Y for MLV_Y (a substitution that reflects the facts that (i) $P_Y=MLV_Y$ if the consumer of *Y* is a sovereign maximizer and is not a monopsonist of *Y* and the consumption of the

marginal unit of *Y* generates no externalities or buyer surplus and (ii) the analysis that is being executed is based on the assumption that these conditions are fulfilled. The substitution of MC_X^*/MC_Y^* for $MRT_{Y/X}$ reflects the fact that—although $MRT_{Y/X}$ will equal MC_X/MC_Y in a Pareto-perfect economy since in such an economy (A) the producer of the marginal unit of *X* will purchase all the inputs it will use to produce that unit of *X*, (B) the producer of the just-extra-marginal units(s) of *Y* that is (are) sacrificed to the production of the marginal unit of *X* would have purchased all the inputs that it would have used to produce the sacrificed unit(s) of *Y*, and (C) the same price will be charged to the producer of *X* and the producer of *Y* for any input they respectively used to produce the marginal unit of *X* and would have used to produce the sacrificed just-extra-marginal units(s) of *Y* (since no sales taxes will be levied on those inputs and no input supplier will have competitive advantages that may render profitable its charging the producers of *X* and *Y* different prices for the same input)—in a world in which the production of *X* and *Y* might generate external costs or benefits, the producers of the relevant units of *X* and *Y* might have to pay different amounts of sales taxes to purchase an input one used to produce the marginal unit of *X* and the other would have used to produce the sacrificed unit(s) of *Y*, and the producer of *X* and *Y* might be charged different prices for the same input (say, by a given input-producer), the MC figures in question will usually have to be adjusted to yield a MC_X^*/MC_Y^* ratio that equals $MRT_{Y/X}$—*i.e.*, MC_X/MC_Y may not equal $MRT_{Y/X}$. For example, if the production of the marginal unit of *X* generated external costs but the production of the sacrificed units of *Y* would not have generated any externalities, $MRT_{Y/X}$ will be higher than MC_X/MC_Y—*i.e.*, the MC_X figure will have to be adjusted up to reflect the fact that some of the allocative costs of producing the marginal unit of *X* were external to its producer. Step (6) simply puts the terms in step (5) in parentheses, divides each term by MC_X^*, and then multiplies the expression inside the parentheses by MC_X^*: to see why this operation does not change the value of the expression in step (5), note that (5−3)=4([5/4]−[3/4]). Step (7) simply substitutes $(P_Y/MC_Y)(MC_Y/MC_Y^*)$ for P/MC_Y^* and $(P_X/MC_X)(MC_X/MC_X^*)$ for P/MC_X^*.

I want to make three observations about the results in steps (6) and (7). First, the possibilities that P_X might exceed MC_X and that P_Y might exceed MC_Y reflect both the possibilities that *X* and/or *Y* might be priced supra-competitively and the possibility that the sale of the marginal unit of *X* and/or the prospective sale of the sacrificed unit(s) of *Y* might be taxed. Second, as already stated, the fact that MC_X and MC_Y must be adjusted to create MC_X^* and MC_Y^* figures whose ratio equals $MRT_{Y/X}$ reflects (on our simplifying assumptions) the possibilities that the production of the marginal unit of *X* and the sacrificed production of the just-extra-marginal units of *Y* might generate externalities and the possibility that taxes might have been levied on the sale of at least some of the inputs that the producer of *X* used to produce the marginal unit of *X* and the prospective producers of the sacrificed unit(s) of *Y* would have used to

produce those units. Third, except fortuitously, the distortion in the profits yielded by the economics-marginal allocation of resources to the production of a marginal unit of *X* from the production of one or more just-extra-marginal units of *Y* that would be generated jointly in an otherwise-Pareto-perfect economy by the imperfections in seller price-competition, externalities of production, and taxes on the margin of income the economy in question contains will not equal the sum of the distortions in those profits that would be generated separately in an otherwise-Pareto-perfect economy respectively by the imperfections in seller price-competition the economy contains, the externalities of production in that economy, and the sales taxes that are levied in the economy in question. This conclusion reflects, for example, the realities that the fact that the goods in question are priced supra-competitively affects the profit-distortion that the extant taxes on the margin of income generate and the fact that the economy's producers charge supra-competitive prices and the sale of its products are taxed—by affecting the unit outputs of its products—affect the externalities generated by the production of their respective marginal units of output and hence the profit distortion that the non-internalization of such externalities of production generates in the real world.[25]

Perhaps it would be useful for me to concretize the preceding discussion by examining its implications for an admittedly-highly-stylized (and therefore inaccurate) account of the natural-gas situation in Western Australia. If *X* is natural gas, *Y* in Western Australia would (overwhelmingly) be coal. I have been told that coal is priced monopolistically (that P_Y/MC_Y is considerably higher than one) and that a high percentage of the cost of producing and consuming coal is external to its producer and consumers (that MC_Y/MC_Y^* where *Y* stands for coal and MC_Y^* is an adjusted MC figure created by adjusting MC upward to reflect *inter alia* the percentage of the allocative marginal costs that external marginal costs constitute) is considerably lower not only than one but also than MC_X/ MC_X^* where *X* stands for natural gas and MC_X^* is created from MC_X in the same way that MC_Y^* is created from MC_Y). Stage (7) of the derivation this subsection contains implies that the P/MC ratio for *X* (natural gas) that would minimize UO-to-UO misallocation between natural gas (*X*) and coal (*Y*) by minimizing the distortion in the profits yielded by the economics-marginal allocation of resources from the production and delivery of just-extra-marginal units of *Y* (coal) to the production and delivery of the marginal unit of *X* (natural gas) depends on P_Y/MC_Y and the relationship between MC_Y/MC_Y^* and MC_X/MC_X^*. Insofar as UO-to-UO misallocation is concerned, the fact that P_Y/MC_Y exceeds one favors the economic efficiency of P_X's exceeding MC_X, and the fact that MC_Y/MC_Y^* is lower than MC_X/MC_X^* favors P_X's being close to MC_X: both these conclusions reflect the fact that the amount of UO-to-UO misallocation between natural gas and coal increase with the difference between $([P_Y/MC_Y][MC_Y/MC_Y^*])$ and $([P_X/MC_X][MC_X/MC_X^*])$—*i.e.*, with the distortion in the profits yielded by the economics-marginal (least-profitable but not-

unprofitable) allocation of resources from the production and delivery of marginal units of coal to the production and delivery of a marginal unit of natural gas. Of course, stage (7) of the relevant derivation really reveals that, to determine the P/MC ratio for natural gas that would minimize UO-to-UO misallocation between natural gas and coal, one would have to estimate P_Y/MC_Y, MC_Y/MC_Y^*, and MC_X/MC_X^*.

B. The Possible Impact of Natural-Gas-Pipeline-Service-Pricing Regulations on the Amount of Misallocation Pipeline-Owners Generate When Operating Their Pipelines

As I have already indicated[26] and Australian natural-gas-pipeline regulatory authorities recognize,[27] natural-gas-pipeline-pricing regulation that duly compensates an efficient regulatee given the risk it faces but, in practice, prohibits the regulated firm's charging as high prices for its regulated services as it would otherwise find profitable to charge for them will tend to make it profitable for the regulatee to make inherently-unprofitable investments that will increase its rate-base and thereby increase the overall operating profits it is allowed to earn on all its regulated investments and concomitantly the profits it is allowed to earn on its other regulated investments (the prices it is allowed to charge for the products and services that its other regulated investments put it in a position to supply). I hasten to emphasize, however, that this Averch-Johnson-Wellisz effect of duly-compensating natural-gas-pipeline-pricing regulation will not lead the regulated public utility to make inherently-unprofitable investments indiscriminately: because the regulated public utility will want to earn the allowed normal or supernormal rate-of-return on the highest amount of investment it could make on which such an overall rate-of-return could be generated, it will want to make unprofitable investments whose rates-of-return are as little subnormal as is possible.

I recognize that Australian regulators have the authority to exclude from the rate-base investments they find not to be *ex ante* economically efficient (as well as investments whose use they conclude would no longer be economically efficient). I also recognize that many Australian regulators do not think that the "overcapitalization" possibility on which this and the next subsection of this report focus is important in Australia. However, I do think that the difficulty of determining whether quality-increasing investments are economically inefficient and whether more-capital-intensive production processes really are cost-increasing make these possibilities more salient than many Australian regulators appear to perceive them to be. The recent growing concern in Australia that electricity networks may be overcapitalized may foretell a shift in the relevant perceptions of Australian regulators. And the difficulty that investigators may have in determining whether Australian electricity networks really are overcapitalized may bring home why such a shift in attitudes may be warranted.

The regulatory-authority concern on which this subpart is focusing, therefore, is that its pricing-regulations might induce the regulated natural gas-pipelines to make inherently-unprofitable and economically-inefficient decisions to incur costs when operating what might be termed its existing facilities. Two questions are relevant in this regard: (1) what kinds of inherently-unprofitable operating-expenditure decisions might the authorities' pricing regulations induce the regulatees to make (via the Averch-Johnson-Wellisz mechanism) and (2) how should one analyze whether—in an otherwise-Pareto-imperfect economy—such regulation-induced inherently-unprofitable operating expenditures would be economically inefficient?

At least three points are relevant to the first inquiry. To start, the Averch-Johnson-Wellisz mechanism will not cause any regulatee to make inherently-unprofitable operating expenditures that would be classified as variable costs because such expenditures will not increase the regulatee's rate-base and hence the supernormal profits it will be allowed to realize on its independent regulated investments. Second, duly-compensating natural-gas-pipeline-pricing regulations may make it profitable via the Averch-Johnson-Wellisz mechanism for regulatees to arrange their affairs to obtain inputs in a way that would result in the expenditures being classified as fixed costs rather than in an otherwise-more-profitable way that would result in the expenditures being classified as variable costs—*e.g.*, to purchase rather than lease automobiles, trucks, and equipment of other kinds or to pay managers or other sorts of employees guaranteed annual salaries rather than hourly wages. Third, although this possibility might be better placed in the next subpart of this report, duly-compensating natural-gas-pipeline-pricing regulations might make it profitable via the Averch-Johnson-Wellisz mechanism for the regulatee to use less-inherently-profitable, more-capital-intensive production processes rather than more-inherently-profitable, less-capital-intensive production processes (to reduce their variable operating costs while increasing their fixed "operating" costs—their investment)—*e.g.*, to substitute (1) a combination of (A) more expensive, less corrodable, less-likely-to-crack, thicker pipelines and (B) fewer expenditures on pipeline-safety instruction to employees, hiring and training emergency (leak or rupture) responders, public education about the possibility of leaks and rewards to members of the public for reporting leaks, inspections of safety valves, "smart pig" robotic inspections of pipelines, hydrostatic testing of pipeline integrity, *etc*. for (2) a combination of (A) less-expensive pipelines and (B) more variable-operating-cost expenditures of the above kinds despite the fact that the former combination was inherently-less-profitable than the latter combination.

The second inquiry focuses on the economic inefficiency of any Averch-Johnson-Wellisz-mechanism-induced operating-cost decision. With two exceptions, I will defer the analysis of this issue to Subpart 3C, which discusses *inter alia* the third-best-economically-efficient way to analyze the

economic efficiency of the inherently-unprofitable non-operating-cost investments that duly-compensating natural-gas-pipeline-pricing regulations may induce regulatees to make via the Averch-Johnson-Wellisz mechanism. The exceptions relate to decisions to substitute purchases for leases of motor vehicles and equipment and to pay managers and workers guaranteed annual salaries rather than hourly wages without a guaranteed number of hours of employment or annual salaries that will be reduced if the prospective recipient is laid off or fired. I suspect that, when it is inherently cheaper to lease rather than buy motor vehicles and equipment, the substitution of the sale-arrangement for the lease-arrangement (1) increases the risk costs that the regulatee bears by more than it reduces the risk costs that the suppliers of the motor vehicles and equipment bear and/or (2) increases the private transaction costs that are generated (or, at least, that the risk-cost disadvantage of the sale-arrangement exceeds any private-transaction-cost disadvantage of the sale-arrangement). Since private risk costs are allocative as well as private, any private-risk-cost disadvantage of the regulation-induced sale-arrangement would be associated with an equally-large allocative-risk-cost disadvantage. Admittedly, if the sale-arrangement had a private-transaction-cost advantage, that private advantage might be associated with a larger allocative-transaction-cost advantage (because, for example, the saved resources were used to increase the unit output of imperfect competitors and/or execute PPR projects) or a smaller allocative-transaction-cost advantage (because the saved resources were used to create QV investments)—indeed, with an allocative-transaction-cost advantage that was sufficiently higher than its private counterpart for the sale-arrangement to be more-economically-efficient even though it was more-privately-costly. However, I suspect that, across all cases, inherently-unprofitable substitutions of sale-arrangements for lease-arrangements will be economically inefficient, and I am far from certain that it would prove to be third-best allocatively efficient to investigate further the actual economic efficiency of such substitutions.

I suspect that, when it is inherently unprofitable to substitute annual salaries with guaranteed employment for hourly wages or annual salaries without guaranteed employment, the inherent unprofitability of the shift to a salary-arrangement with guaranteed employment reflects the fact that the small transaction-cost savings it achieves (by obviating keeping track of the employee's hours and calculating the hour-based remuneration the employee is owed) is smaller than the sum of (1) the certainty-equivalent loss that the shift will impose on the company by precluding it from firing or laying off the manager or worker if a downturn in its sales or a shift in the relative sales generated by the different products or services it offers to supply makes it profitable for it to do so and (2) the certainty-equivalent loss that the shift will impose on the company by reducing the incentives of the employee to be productive (though I acknowledge that a shift from hourly wages or unguaranteed annual salaries to guaranteed annual salaries may have the opposite effect by increasing worker loyalty). In any event,

mostly for reasons that have already been discussed in other contexts, in a Pareto-imperfect economy, some of these private costs and benefits will not equal their allocative counterparts:

(1) the private-transaction-cost saving will not equal its allocative counterpart to the extent that the private value of the saved resources to their alternative employers do not equal the allocative product they will generate in their alternative uses;
(2) the private savings the company could have obtained by firing or laying off workers will not equal the economic-efficiency gains the firings or layoffs will generate, which will depend *inter alia* on whether they increase total unemployment in the relevant economy, on the public-financing misallocation that the firings/layoffs will generate if they increase government transfer-payments, on the type of labor the employees in question performed for their original employer (unit-output-increasing, QV-investment-creating, PPR-executing) and the type of labor they performed for their new employer (if they were re-employed), on the percentage distortions in the benefits that the relevant three types of labor generate for the employers for which they are performed, and
(3) the private loss/gain the shift will impose/confer on the company by decreasing/increasing the productivity of the covered employees will equal the associated economic-efficiency losses/gains only fortuitously—will differ (once more) according to the type of labor the covered workers who would not have been let go in any case perform and on the percentage distortions in the benefits their labor confers on the employer in question.

For these reasons, it is extremely unlikely to be third-best allocatively efficient to assume that any regulation-induced inherently-unprofitable shift from hourly wages or unguaranteed annual salaries to guaranteed annual salaries would be economically inefficient, much less that such a shift would decrease economic efficiency by the same amount that it would decrease the regulatee's profits but for the Averch-Johnson-Wellisz effect.

C. The Impact of Natural-Gas-Pipeline-Service-Pricing Regulations on the Amount of Misallocation Pipeline Owners Generate When Making Non-Operating-Cost Regulated Investments

U.S. and Australian public-pricing regulatory authorities have for a long time been concerned that their regulations might induce regulatees to make economically-inefficient investments. Thus, as Wellisz indicated, American regulatory commission tried to control regulatee prices to make them yield a "fair rate of return on *prudent* investment"[28] (emphasis added), and the Australian authorities have been interested in inducing their regulatees to make only "efficient" investments.[29] Once more, two questions must be addressed under the current (sub)heading: (1) what kinds of inherently-unprofitable (non-operating-cost) investments might natural-gas-pipeline companies be induced to make by duly-compensating natural-gas-pipeline-pricing regulations and (2) how should one analyze the economic efficiency of such regulation-induced investments?

The Averch-Johnson-Wellisz mechanism will tend to induce natural-gas-pipeline companies to make at least two categories of inherently-unprofitable non-operating-cost investments. The first such category of investments contains some though obviously not all investments that increase the speed with

which the regulatee can supply relevant quantities of natural gas throughout a fluctuating-demand cycle. Such investments would include (1) investments in entirely-new pipelines (which increase the company's transmission capacity), (2) investments in new "loops" to existing pipelines (added sections to existing pipelines), which also increase the company's transmission capacity, (3) investments in supercharging compression stations, which increase the company's transmission capacity, (4) for some customers, investments in natural-gas-cooling facilities (that enable the regulatee to liquefy the gas) and in ships (tankers) that can transport the liquefied gas, and (5) investments in natural-gas-storage facilities, which increase the average speed with which the company can supply natural gas throughout a fluctuating-demand cycle by enabling it to supply some natural gas out of "inventory" located near natural-gas customers.

The second set of inherently-unprofitable non-operating-cost investments that might be induced by the Averch-Johnson-Wellisz mechanism are investments in pipeline-safety (investments that reduce the weighted-average-expected private and allocative losses generated by leaks and ruptures). Such investments would include (1) investments that replace existing pipelines with safer pipelines that follow the same routes, (2) investments that replace existing pipelines with pipelines that may be no less prone to spills but follow routes that make any given spill that might occur less-allocatively-costly, (3) investments that replace existing pipelines with pipelines that follow routes that make them less vulnerable to earthquakes, floods, third-party excavations, sabotage, and theft (piracy) that might increase the likelihood of spills (*e.g.*, because the thefts involve the installation of additional taps, the damaging of safety-valves, or the use of explosives), and (4) investments in additional or superior safety-valves or in the "smart pig" robotic devices and hydrostatic-testing equipment mentioned in Subpart 3B of this report.

What is the economically-efficient way to analyze the economic efficiency of such regulation-induced, inherently-unprofitable investments? If the relevant economy were otherwise-Pareto-perfect, one would be justified in assuming that those investments would reduce economic efficiency by an amount equal to the amount by which the profits that they would yield absent the Averch-Johnson-Wellisz mechanism would be subnormal. However, given the fact that the economy is not otherwise-Pareto-perfect, that assumption would be incorrect, and it would almost certainly not be third-best economically efficient to make it.

Considerations of space and reader patience deter me from providing even a full outline of the approach to analyzing the economic efficiency of such induced investments that would be likely to be third-best economically efficient. However, I do think it would be cost-effective for me to make three points or sets of points that relate to the ways in which imperfections in seller price-competition will

distort the private cost of creating regulation-induced investments and two points or sets of points about the ways in which imperfections in seller price-competition and possible natural-gas-spillage-generated externalities will distort the private benefits of using, respectively, average-speed-of-supply-enhancing regulation-induced investments and allocative-cost-of-spillage-reducing regulation-induced investments.

I will start by setting out the "distortion in the private cost of creating the regulation-induced-investment points, which apply to both the supply-speed-enhancing and the spillage-damage-reducing investments that pricing regulations can induce. The first point in this category is "structural": the other Pareto imperfections in an economy that contains a natural-gas-pipeline company that faces imperfect seller price-competition and is subject to duly-compensating-natural-gas-pipeline--pricing regulation will distort the private cost of creating any investments that a regulatee makes for Averch-Johnson-Wellisz reasons by distorting the private benefits that the alternative users of the resources employed to create the induced investments would have secured from the resource-uses that were sacrificed. This conclusion follows from (1) the fact that the private cost of the relevant resources to the regulatee will be infinitesimally above their private value to their alternative users, which implies that any distortion in the private benefits the relevant resources would have generated for their alternative users will show up as an equal distortion in their private cost to the regulatee-investor, and (2) the fact that the private value that the resources used to create the induced investments would have generated for their alternative users will be distorted by other Pareto imperfections in the economy.

The second point is that the first point implies that the distortion in the private cost of any regulation-induced investment will depend on (1) the percentages of the resources used to create the induced investment that were withdrawn respectively from alternative UO-increasing uses, alternative QV-investment-creating uses, and alternative PPR-executing uses and (2) the percentage distortion in the private benefits that the resources would have generated in these sacrificed uses—the ratio of the distortion in those private benefits to those private benefits.

The full set of the third set of points would explain how all the exemplars of all the other types of Pareto imperfections in the economy in which the imperfectly-competitive natural-gas-pipeline owner is regulated will (acting jointly) distort the private benefits generated by, respectively, the UO-increasing, QV-investment-creating, and PPR-executing resource-uses sacrificed to the creation of the regulation-induced investment in question. However, I will limit myself to discussing the ways in which imperfections in seller price-competition will distort the private benefits that would have been generated by each of these types of sacrificed resource-uses.

The imperfections in seller price-competition that would have been faced by the unit-output producers from whose production resources were withdrawn to create the induced investments will deflate the private cost of the price-regulation-induced investments because they would have deflated the private benefits the resources in question would have conferred on the unit-output producers whose units of output were sacrificed by reducing the marginal revenues that those unit-output producers would have collected on the sacrificed units of output below the prices that those units' prospective buyers could have paid for them and remained equally well-off and concomitantly by reducing the marginal revenue products of the relevant resources below their marginal allocative products.

Two sets of imperfections in seller price-competition will distort the private benefits that any QV investments that were sacrificed to the creation of the regulation-induced investments would have yielded the prospective QV investors from which resources were withdrawn and hence the private cost the actual QV investor had to incur to create its QV investment. The imperfections in seller price-competition faced by the sellers whose unit outputs would have been reduced by the use of the sacrificed QV investments would inflate the private cost of creating the price-regulation-induced investments by inflating the private benefits the sacrificed QV investment would have yielded its prospective maker by deflating the private benefits that those resources would have generated for those unit-output producers, thereby deflating the private cost of those resources to the prospective maker of the sacrificed QV investment and inflating the operating profits that the prospective maker of the sacrificed QV investment would have realized by using the sacrificed QV investment and hence the private value of the resources used to create the price-regulation-induced investment to the prospective maker of the sacrificed QV investments. The imperfections in seller price-competition that would have faced the prospective QV investors from which some of the resources used to create the price-regulation-induced investment would have been withdrawn will deflate the private cost of those resources to the regulatee by deflating the revenue that the prospective maker of the sacrificed QV investment would have obatined by using that sacrificed QV investment and hence the operating profits the prospective owner of the sacrificed QV investment would have realized by using the sacrificed investment (the value to that party of the resources it would have used to create that sacrificed QV investment) by causing the use of the sacrificed QV investment to generate buyer surplus. However, for reasons I have explained elsewhere,[30] the inflation in the profits of using the sacrificed QV investment that is caused by the imperfections in seller price-competition facing the unit-output producers from which the maker of the sacrificed QV investment would have withdrawn the resources it would have combined with the sacrificed QV investment to produce units of the product or service the sacrificed QV investment would have put it in a position to supply will exceed the deflation in those profits that would have been generated by the buyer surplus that would have been yielded by the

sales of the product or service that the sacrificed QV investment would have put its users in a position to supply: for example, if the P/MC ratio of the products whose outputs would have been reduced by the use of the sacrificed QV investment equals the prospective P/MC ratio of the product that would have been created by the sacrificed QV investment, the demand curves for the old and new products in question are linear and identical, and the sacrificed QV investment's use would have reduced by one unit the outputs of each of the products whose output its use would have reduced, the deflation in the private cost of using the sacrificed QV investment and hence the inflation in the private cost to the regulatee of the resources it withdrew from the creation of the sacrificed QV investment to create the regulation-induced investment that will be generated by the imperfections in seller price-competition that would have faced the producers whose unit outputs would have been reduced by the use of the sacrificed QV investment will be twice the buyer-surplus deflation of the operating profits that would have been generated by the use of the sacrificed QV investment by the imperfection in seller price-competition that would have faced the creator of the sacrificed QV investment.

I will now analyze the way in which imperfections in seller price-competition will distort the private value to their alternative users of the resources that the regulatee withdraws from PPR to make its price-regulation-induced investment. To simplify, I will assume (I think realistically) (1) that the use of the production-process discovery that the sacrificed PPR project would have yielded would have reduced the marginal cost of producing units of the product to whose production process it relates and (2) that all the resources used to produce the pre-discovery output of the good to whose production process the sacrificed PPR project would have related and all the resources that would have been used to produce the additional units of output the discovery would have rendered it profitable for its user to produce would have been withdrawn from alternative unit-output-increasing uses by imperfect competitors. (I should add that I also made the second assumption when analyzing the imperfection-in-seller-price-competition distortion in the operating profits that would have been yielded by any QV investment sacrificed to the making of the regulation-induced investments.) I will also assume that the researcher that would have executed the sacrificed PPR project was also a producer of the good to whose production process the sacrificed PPR project would have related and would have used the discovery exclusively itself. On these assumptions, two sets of imperfections in seller price-competition will distort the profits that a researcher whose PPR project was sacrificed to the creation of price-regulation-induced investments would have realized by using the discovery its research would have yielded and hence the private cost to the regulatee of the resources it withdrew from PPR to make the price-regulation-induced investments it made. The first contains the imperfections in price competition facing the unit-output producers from which the firm that would have executed the sacrificed PPR project withdrew the resources it used to produce its pre-

discovery output and would have withdrawn the resources it would have used to produce the additional units of its product the discovery would have made it profitable for the firm to produce (by lowering its marginal costs). These imperfections in seller price competition will have two relevant effects: (1) they will deflate the profits the discovery would have enabled the discovery/producer to earn by reducing the private cost it had to incur to produce its pre-discovery output by deflating the private cost to that firm of the resources the discovery enables it to save by deflating their private value to their alternative users (the imperfectly-competitive unit-output producers from which they were withdrawn pre-discovery) and (2) they will inflate the profits the discovery would have enabled the discoverer/producer to earn by expanding its unit output by deflating the private cost it had to incur to expand its unit output by deflating the private value of the resources it would have used for this purpose to the imperfectly-competitive unit-output producers from which they would have been withdrawn. The second set of imperfections in seller price-competition that is relevant in this context contains the imperfection in seller price-competition facing the prospective discoverer in its capacity as a producer of the good to whose production process the discovery would have related: this imperfection in seller price-competition will deflate the profits the discoverer/producer would have earned by using its discovery (and hence the private cost to the regulatee of the resources it withdrew from the prospective maker of the sacrificed PPR investment to make the regulation-induced investments) because it will result in additional buyer surplus being generated by the reduction in the price of the good to whose production process the discovery would have related to which the use of the marginal-cost-reducing discovery would have led. However, since, as I have shown elsewhere,[31] on the neutral assumption that the pre-discovery output of the good to whose production process the production-process discovery relates was economically efficient, this buyer-surplus deflation in the profits that the marginal-cost-reducing production-process discovery will enable its user to earn by expanding its output will be higher than the inflation in those profits that would have been caused by the deflation in the private cost of producing the extra units of output generated by the imperfections in seller price-competition facing the unit-output producers from which the resources that would have been used to produce the additional units of output would have been withdrawn, taken together, all the relevant imperfections in seller price-competition (1) will deflate both components of the profits the production-process-researcher/producer would have realized by using its marginal-cost-reducing production-process discovery—the profits that the discovery's use would have generated by reducing the private cost of producing its pre-discovery output and the profits the discovery would have generated by making it profitable for its user to expand its output—and hence (2) will deflate the private cost to the regulatee of the resources it withdraws from PPR to make its price-regulation-induced investments.

I now want to make one set of two points about the ways in which various imperfections in seller price-competition will distort the private benefits yielded by average-speed-of-supply-enhancing regulation-induced investments and a single point about the way in which any prospective externalities of spillage will distort the private benefits yielded by allocative-cost-of-spillage-decreasing regulation-induced investments. The first set of two points reflects the fact that average-speed-of supply-enhancing regulation-induced investments are QV investments. The first member of this first set of points is that the fact that average-speed-of-supply-enhancing regulation-induced investments are QV investments implies (1) that the preceding analysis of the ways in which different relevant imperfections in seller price-competition would have distorted (A) the private benefits that the use of the QV investments that were sacrificed to the making of any regulation-induced investment would have conferred on the investors that would have made these sacrificed QV investments and (B) the private benefits that the use of any made QV investment would confer on its creator and (2) the conclusions of the preceding analysis that, taken together, in an otherwise-Pareto-perfect economy, the relevant imperfections in seller price-competition would have inflated the private benefits that the prospective makers of the sacrificed QV investments would have realized by using the sacrificed QV investments and the private benefits that the actual creator of any QV investment that was made did realize by using its QV investment both apply to the private benefits that were generated by regulation-induced average-speed-of-supply-enhancing investments. The second point in this first set is that the first member of this set does not imply that the relevant imperfections in seller price-competition will not distort the profits of *creating and using* this category of regulation-induced investments: more specifically, since in an otherwise-Pareto-perfect economy, the imperfection-in-seller-price-competition-generated inflation of the private cost of creating the relevant regulation-induced investments will depend on the proportions of the resources used to create those investments withdrawn from unit-output increasing, QV-investment-creating, and PPR-executing uses and the percentage-distortion in the private cost of withdrawing resources from alternative QV-investment-creating uses will depend *inter alia* on the P/MC ratio of the product that would have been created by the sacrificed QV investment and the weighted-average P/MC ratio of the products whose sales would have been reduced by the use of the sacrificed QV investment (which will in general differ from the weighted-average P/MC ratio for the regulation-induced QV investments and the weighted-average P/MC ratio of the products whose outputs were reduced by the use of the regulation-induced QV investments, which together will determine the percentage inflation in the benefits of using the regulation-induced investments), there is every reason to expect that, in an otherwise-Pareto-perfect economy, the relevant imperfections in seller price-competition would inflate the supernormal profits generated by some regulation-induced QV investments and deflate the supernormal profits generated by other regulation-induced QV investments and that it will prove to be third-best allocatively efficient to take

these profit-distortions into account when estimating the economic efficiency of the inherently-unprofitable QV investments induced by natural-gas-pipeline rate-of-return regulation.

The second set of points I want to make at this juncture is a single obvious point that relates to the way in which the possible non-internalization of any allocative costs that would be generated by natural-gas spills will distort the profits yielded by allocative-cost-of-natural-gas-spill-reducing regulation-induced investments. Clearly, to the extent that these investments will reduce natural-gas-spillage allocative costs, the fact that some of allocative costs of this type that the investments will prevent would not have been internalized to the natural-gas-pipeline owner will deflate the profits the investments in question yield (will create a possibility that inherently-unprofitable investments of these kinds will be economically efficient).

D. The Alleged Tendency That Natural-Gas-Pipeline Rate-of-Return Regulation May Have to Generate Economic Inefficiency by Inducing the Regulatees to Finance Their Investments "Inefficiently"—*i.e.*, at an Unnecessarily-High Private Cost

The Australian natural-gas-pipeline regulators are very concerned about this possibility. I will address two related issues: (1) if duly-compensating natural-gas-pipeline-pricing regulation induced natural-gas-pipeline companies to finance their operations at a higher cost of capital than they could have secured, how would the regulation on this account generate economic inefficiency and (2) why and when would duly-compensating natural-gas-pipeline-pricing regulation make it profitable for a regulatee to pay more for capital (say, debt) than it had to pay (alternatively, to be candid, would it ever in the real world be profitable for a regulatee to pay more than it had to pay to finance its operations)?

If natural-gas-pipeline rate-of-return regulation induced regulatees to obtain capital (say, debt) at a higher rate of interest than was necessary, this effect might decrease economic efficiency both directly and indirectly. It would do so directly to the extent that the higher interest-rate the regulatee paid reflects the fact that it had obtained capital from a supplier whose relevant private and allocative costs of supplying capital were higher than their counterparts would be for an alternative (more-economically-efficient) supplier of capital. The relevant difference could reflect either or both (1) the fact that the risk cost of supplying the relevant capital was higher for the high-price supplier than for the low-price supplier (though the relevant risks would presumably be about the same for both) or (2) the fact that the higher-price supplier of capital generated higher transaction costs to supply the capital than the lower-price supplier of capital would have had to generate to do so. I hasten to point out that any such private-risk-cost difference will be an allocative-risk-cost difference (private risk costs are allocative) and that, although private transaction costs do not in general equal their allocative counterparts (for the same sorts

of reasons that the private cost of producing a unit of output, of creating a QV investment, or of executing a PPR project do not generally equal their allocative counterpart), the fact that the private transaction costs generated by the actual supply of capital were higher than the private transaction costs that would have been generated by an available lower-priced supply of capital almost certainly means that the allocative transaction costs that were generated were higher than necessary. If a natural-gas-pipeline regulatee could increase the supernormal rate-of-return (net of cost of capital) it was allowed to return by paying higher interest-rates on its debt than it had to pay, its financing its operations unnecessarily expensively would also affect the amount of economic inefficiency in the relevant economy indirectly by inducing the regulatee to make additional inherently-unprofitable operating-cost and non-operating-cost investments that may be economically efficient or economically inefficient.

The critical question, then, is whether duly-compensating natural-gas-pipeline-pricing regulations will give the regulatees an incentive to obtain financing at higher-than-necessary cost? If the allowed rate-of-return (gross of capital costs) were adjusted continuously to take full account of the cost of capital the regulatee incurred, the regulation would not give the regulatee any incentive to incur higher-than-necessary costs of capital (say, to pay a higher interest-rate for debt than was necessary) because any increase in the rate-of-return (gross [say] of interest payments) it was allowed to earn would do no more than cancel out the higher interest-rate payments it had to make. The only situation in which the regulatee would have an incentive to pay higher interest-rates than necessary for its debt would be one in which the interest-rate it was paying (say) in year one would determine the gross-of-capital-cost rate-of-return it was permitted to earn not only in year one but in subsequent years as well—in subsequent years in which it could reduce the cost of its debt without causing the regulatory authorities to discover this ploy and in some way penalize the regulatee sufficiently for such gamesmanship to make its "deception" non-profitable. I doubt that these conditions are often fulfilled.

CONCLUSION

This report gives the following answers to the questions it addresses:

(1) (A) "the impact of a policy or choice on economic efficiency" should be defined to equal the difference between the equivalent-dollar gains it confers on its beneficiaries and the equivalent-dollar losses it imposes on its victims;

(B) these gains and losses should be equated with properly-elaborated variants of the equivalent variations (as opposed to the compensating variations) in the winners' and losers' wealths—*i.e.*, respectively, by the number of dollars whose transfer to the winners under appropriate assumptions would leave them as well-off as the policy would leave them and by the number of

dollars whose withdrawal from the losers under appropriate assumptions would leave them as poorly-off as the policy would leave them; and

(C) one cannot assume that the economic efficiency of a natural-gas-pipeline regulatory-policy is monotonically related to its long-run equivalent-dollar-impact on natural-gas consumers;

(2) (A) The General Theory of Second Best states that, given a set of conditions whose universal fulfillment guarantees an optimum, if one or more of those conditions cannot be or will not be fulfilled, unless one can devise a context-specific argument to the contrary (an argument that must reveal the ways in which individual departures from each of the optimal conditions would cause outcomes to be suboptimal if there were no other departures from any optimal condition, the ways in which individual departures from each optimal condition interact to cause suboptimal outcomes, the magnitude and incidence of the pre-policy departures from the optimal conditions, and the impact of the policy on departures from the optimal conditions), there is no general reason to assume that policies that will reduce the number or magnitude of the departures from the optimal conditions will even tend on that account to yield an improvement;

(B) in the context of natural-gas-pipeline regulatory-policy, the relevant goal is increasing economic efficiency as much as possible, the relevant optimal conditions are the Pareto-optimal conditions, the central implication of The General Theory of Second Best is that, unless one can make a context-specific argument to the contrary, one cannot assume that policies that decrease/increase the number or magnitude of the Pareto imperfections in the economy will even tend to increase/decrease economic inefficiency on that account if the policy that would decrease the Pareto-imperfections of the economy would not create a situation in which the economy contained no Pareto imperfections (roughly speaking, because the imperfections that could be removed would be as likely to counteract as to compound the net effects of the imperfections that would remain);

(C) Professor Lipsey is correct in rejecting Professor Ng's claim that under the conditions of radical ignorance Professor Ng is assuming to prevail it will be economically efficient for a policymaker to adopt policies that would be economically efficient if the only Pareto imperfection in the economy were the imperfection the policy under consideration would target, and I would add that Professor Ng's analysis focuses on situations in which economic-efficiency analysts are far more ignorant and far more irreversibly ignorant (at non-prohibitive cost) than I believe natural-gas-pipeline regulators are; and

(D) the economically-efficient response for policymakers to make to The General Theory of Second Best is to follow a protocol that instructs the decisionmaker to distinguish various

categories of economic inefficiency, to analyze the ways in which the various Pareto imperfections whose individual exemplars would cause each category of economic inefficiency in an otherwise-Pareto-perfect economy interact to cause each such category of economic inefficiency in an actual, highly-Pareto-imperfect economy, to derive economic-efficiency conclusions from a combination of the theoretical work just described and guesstimates or estimates of the pre-policy and post-policy magnitudes of the parameters whose relevance the theoretical work establishes, and to take account of not only the economic-efficiency gains that can be generated by additional, relevant theoretical and empirical research but also of the allocative cost of such research; and

(3) (A) duly-compensating natural-gas-pipeline-pricing regulations can affect the amount of economic inefficiency that regulatees generate by supplying too much or too little natural gas from the perspective of economic inefficiency, by making inherently-unprofitable operating-cost investments, by making non-operating-cost investments that increase the average speed with which they can supply relevant quantities of natural gas throughout a fluctuating-demand cycle or reduce natural-gas-spillage-generated allocative costs, and conceivably though implausibly by securing loans at unnecessarily-high private cost; and

(B) it will be economically efficient to take account of The General Theory of Second Best—*i.e.*, of the relationships whose importance this General Theory emphasizes—when analyzing the impact that different natural-gas-pipeline regulations will have on each of these types of economic inefficiency.

All of the above conclusions are based on the specialized knowledge that forms the basis of my expertise. I have made all the inquires that I believe are desirable and appropriate for one to make. No matters of significance that I regard as relevant have, to my knowledge, been ignored.

Richard S. Markovits
John B. Connally Chair in Law
University of Texas School of Law

[1] The text refers to *equivalent*-dollar gains and losses rather than to dollar gains and losses because many of the relevant effects not only are not direct monetary effects but, in some instances, cannot be capitalized by the person that experiences them. Take, for example, the equivalent-dollar gain that the owner of swampland who values it positively (for sentimental reasons) despite the fact that its market value is zero obtains from an environmental policy that cleans up the water in the swamp and/or the air over the swamp. If the policy does not improve the property sufficiently for it to have a positive market value post-policy, this winner will not be able to capitalize his equivalent-dollar gain.

[2] See RICHARD S. MARKOVITS, TRUTH OR ECONOMICS: ON THE DEFINITION, PREDICTION, AND RELEVANCE OF ECONOMIC EFFICIENCY (henceforth, TRUTH OR ECONOMICS) at Chapter 2 (Yale Univ. Press, 2008).

[3] See J.R. Hicks, *The Rehabilitation of Consumer Surplus*, 8 REV. ECON. STUD. 108 (1940).

[4] See Tibor Scitovsky, *A Note on Welfare Propositions in Economics*, 9 REV. ECON. STUD. 77 (1941).

[5] See TRUTH OR ECONOMICS 58-62.

[6] See, *e.g.*, Duncan Kennedy, *Cost Benefit Analysis of Entitlement Programs: A Critique*, 33 STAN L. REV. 387, 401-421 (1981).

[7] See Goldfield Gas Transmissions, Submissions on the Economic Regulation Authority's Rate of Return Guidelines (henceforth, GGT) at 6, www.earwa.com.au (October 7, 2013).

[8] *Id.*

[9] *Id.*

[10] Western Australian Government Gazette 2009, *National Gas Access (WA) Act 2009* at 76, www.slp.wa.gov.au

[11] National Gas (South Australia) Bill 2008, *Second Reading Speech*, at 4, www.ret.gov.au

[12] Western Australian Economic Regulation Authority, Explanatory Statement for the Rate of Return Guidelines, Paragraph 124, http://www.earear.com.au/cprout/1195312/Rate%20of%20Return%Guidelines.PDF (16 December 2013).

[13] For the original formal statement of this General Theory, see R.G. Lipsey and Kelvin Lancaster, The General Theory of Second Best, 24 REV. ECON. STUD. 11 (1956).

[14] For a full account of the protocol I believe is the third-best-economically-efficient approach to predicting or post-dicting the impact of a policy on the 6 categories of resource allocation the footnoted text-paragraph references and my argument for its third-best economic efficiency, see Richard S. Markovits, A Distortion-Analysis Protocol for Economic-Efficiency Analysis: A Third-Best-Economically-Efficient Response to the General Theory of Second Best (henceforth, Distortion Analysis Protocol) (unpublished manuscript—September 14, 2014). For a truncated version of this protocol and a basic explanation of its justifiability, see TRUTH OR ECONOMICS 137-156.

[15] See Distortion Analysis Protocol at 151-237.

[16] This type of conduct is one variant of the Averch-Johnson-Wellisz effect of "fair rate-of-return" public-utility regulation. See Harvey Averch and Leland L. Johnson, *Behavior of the Firm Under Regulatory Constraint*, 52 AMER. ECON. REV. 1052 (1962) and Stanislaw H. Wellisz, *Regulation of Natural Gas Pipeline Companies: An Economic Analysis*, 71 J. POL. ECON. 30 (1963).

[17] Professor Ng's relevant papers apply to the second-best problem more generally. The text's description focuses on Professor Lipsey's concretization of Professor Ng's argument. See Richard G. Lipsey, A Critique of Professor Ng's Third-Best Theory 1-16 (Working Paper, Department of Economics, Simon Fraser University) (February 2012) and Y.-K. Ng, *Towards a Theory of Third-Best*, 32 Public Finance 1 (1977). I should add that Professor Lipsey's critiques of Professor Ng's argument and conclusions do not depend in any way on any assumption that classical economic or antitrust markets can be defined non-arbitrarily. For my arguments for the conclusion that neither classical economic nor antitrust markets can be defined non-arbitrarily, see RICHARD S. MARKOVITS, ECONOMICS AND THE INTERPRETATION AND APPLICATION OF U.S. AND E.U. ANTITRUST LAW, VOL. I: BASIC CONCEPTS AND ECONOMICS-BASED LEGAL ANALYSES OF OLIGOPOLISTIC AND PREDATORY CONDUCT 165-181 (Ch. 6) (Springer 2014) and Richard Markovits, *On the Inevitable Arbitrariness of Market Definitions*, 2002 ANTITRUST BULL. 1877 (2002).

[18] See Lipsey, *op. cit. supra* note 17 at 5, quoting Ng, *op. cit. supra* note 17 at 1-3.

[19] See *id.*

[20] *Id.* at 5-7.

[21] *Id.* at 7-9.

[22] *Id.* at 9-10

[23] See Explanatory Statement for the Rate of Return Guidelines at Paragraphs 126, 127, and 134, http://wwww.erawa.com.au/cproot/11953/2Rate%20of20Returns%20Guidelines, PDF (16 December 2013).

[24] *Id.* at Paragraph 126.

[25] For a demonstration that the distortion in the profits yielded by an economics-marginal allocation of resources to the production of a marginal unit of X from the production of just-extra-marginal units of Y that would be jointly generated in an otherwise-Pareto-perfect economy by imperfections in the seller price-competition faced by final-product producers and the externalities generated by the production of relevant units of final products will equal only fortuitously the sum of the distortion in those profits that such imperfections in seller price-competition

would generate in an otherwise-Pareto-perfect economy and the distortion in those profits that such externalities would generate in such an economy, see TRUTH OR ECONOMICS at 157-162.

[26] See the text accompanying note 16 of this report.

[27] See Western Australia Government Gazette 2009, *National Gas Access (WA) Act* 2009, www.slp.wa.gov.au, p. 76. National Gas (South Australia) Bill 2008, Second Reading Speech, www.ret.gov.au, p. 4.

[28] See Wellisz, *op. cit. supra* note 16 at. 1.

[29] See the sources cited in notes 10 and 11 *supra* at the pages cited.

[30] See TRUTH OR ECONOMICS 178-181.

[31] See *id*. at 212-219.