Statistical significance and policy significance
Paper for the Phillips Symposium, July 2008

By Stuart Birks[1]
Director
Centre for Public Policy Evaluation
Massey University
Palmerston North

Phone: 06 350 5799 X2660
Email: k.s.birks@massey.ac.nz

Abstract

Research findings sometimes play a part in the policy making process. This can happen through direct use of analysis, or through their impact on public perceptions and preferences as a result of media coverage. There are opportunities in this process for distortions to occur. This paper looks at one aspect of this, namely the potential for statistical significance to be interpreted as policy significance. The two are not the same. They can diverge for several reasons. Some, such as the difference between correlation and causation, are widely recognised in statistics. Others may merit some attention. Two aspects considered here are first, the policy options suggested by statistical significance, and second, some policy analysis criteria that are not covered by statistical significance alone.

On the first aspect, there are two perspectives on an association between two variables from which policy suggestions may be made. One policy approach would be to alter the value of one variable, the policy instrument, to alter the value of another variable, the target variable. This is the usual perspective. Sometimes it is not possible to change policy instrument. The policy focus then turns to means of changing the relationship between the two variables. This second option, altering the relationship, may be generally available when considering relationships between variables. However, if the first option is feasible, then the second is generally overlooked.

The second aspect to be considered in the paper is that there are some well-recognised policy analysis criteria that are not covered by statistical significance alone. Standard economic approaches to policy making require consideration of alternative options, including assessment of their costs and benefits. There could also be thought given to the extent of control available, and risk and uncertainty. Explicit consideration of policy aspects may result in improved use of statistical findings.

1. Introduction

Given the focus of this conference, it is worth noting that the Phillips curve was a statistically observed phenomenon. From that observation, it was suggested that there existed a trade-off between inflation and unemployment.[2] This policy-related

[1] I wish to acknowledge helpful comments from Paul Callister, Srikanta Chatterjee and Allan Rae.
[2] There is a summary of the literature in Santomero and Seater (1978).

conclusion was later modified with the incorporation of a concept of a "natural rate of unemployment". Policies could be applied to alter the natural rate, thereby altering the specific trade-off between inflation and unemployment. With hindsight, it is possible to identify questions that could have been asked to short-cut this process. There may be institutional factors that reduced the likelihood of those questions being addressed earlier.

There is often a tenuous relationship between research and policy. There are several other steps in the process of policy making, including political and media debate, response to pressure groups, and shaping or reacting to public opinion. Research is not necessarily directly focused on policy, and the approaches taken by researchers do not necessarily directly address policy questions. Nevertheless researchers sometimes describe policy implications arising from their findings, and research findings are sometimes used in policymaking and implementation. The role of research in the policy process is worth exploring.[3] This paper considers one narrow aspect of this wider issue, namely the extent to which a statistically significant research finding can be used as a basis for policy decisions.

There are several forces at work that result in a tendency to favour simplified views of issues.[4] They can be observed at each of the three "levels of discourse" described by Desai, namely theory, data analysis, and policy (Desai, 1981, p. 93). At the theoretical level, there is the value judgment associated with Occam's razor whereby simpler theories are preferred over more complex ones, *ceteris paribus*.[5] At the level of data analysis there are constraints of available data, limitations of techniques and problems with degrees of freedom.[6] At the policy level, a simple message is often required in order to obtain public acceptance. This can arise in part as a result of constraints on transmitting and acquiring information, including the costs of such investments and the limited benefits to individuals of such investments. Its implications can be observed in the importance of interest groups and in the limited range of options presented for consideration.

One aspect of simplification that is apparent at the level of public debate is the way that policy conclusions are frequently drawn from limited statistical evidence. While economists and econometricians are generally cautious about specifying policy implications arising from econometric analyses, at the level of broader debate and media coverage there are fewer reservations. This paper explores some of the limitations and potential opportunities for policy-relevant findings from econometrics. In particular, it considers what can and cannot be deduced as a result of an explanatory variable being found to be statistically significant. In addition, it indicates what aspects to address or questions to raise if econometricians and economists are to extend this work to the point where it may be directly applicable in policy debate.

---

[3] For a recent contribution, see Wolf (2007).
[4] See also Birks (2007)
[5] While theoretical simplicity is commonly lauded, sometimes this is merely paying lip-service to the principle. More complex analyses with longer equations, more advanced mathematics and/or larger data bases can be awarded a higher status than simpler, more readily understood expositions.
[6] Concerns about techniques used by economists, especially econometrics, have been raised by various writers, including Swan (2006) and Thurow (1983). Alternative techniques are described in Swan (2006) and Allen (1978).

Section 2 of the paper briefly considers the link between statistical findings and policy recommendations by academic and public sector researchers and through media coverage of research. Section 3 briefly lists some basic considerations, while sections 4 and 5 consider two broad sets of questions that should be asked in order to move from statistically meaningful findings to more comprehensive policy analysis. Some general conclusions are then drawn.

2. Using statistics for policy

One channel for statistical analysis to influence policy is through public presentation of research findings. This may affect general understanding of issues, shaping public opinion and influencing political priorities. This can happen even if the research was not intended for that purpose and if the results are misinterpreted at the public reporting stage. Where attention is created for political purposes, the focus may be on a specific finding, probably associated with a visiting expert deliberately invited to promote a preferred perspective. This is unlikely to result in high-level debate of alternative, possibly contradictory research findings.

2.1 The research phase

McCloskey and Ziliak have identified problems in academic papers in the interpretation of statistical findings as being of significance for policy (McCloskey, 1998; Ziliak & McCloskey, 2004)[7]. One of their central points can be simply illustrated. Consider the gender pay gap. With earnings data for one man and one woman, nothing can be said about the significance of any difference between them as nothing is known about the distribution of male and female earnings. More than one observation for each is required. With a larger sample, assumptions can be made and tests undertaken for a difference in average incomes. At the other extreme, if observations are available for every man and every woman in the population, the average male and female earnings can be calculated precisely. The estimate equals the true population value, the variance of the estimate is therefore zero. A difference as low as 1c is therefore statistically significant. In other words, a finding that a gender pay gap does or does not exist depends on the sample size. However, this has **nothing** to do with significance for policy. Policy decisions should not be determined on the basis of statistical significance alone.

Looking at recent issues of such economic journals as *Applied Economics*[8]*, The Review of Economic Studies, Economic Record* and *Southern Economic Journal*, few articles actually refer to policy implications. This may reflect a difference in focus between academic economists and economists working as policy analysts.[9] Some of the discussion papers from the Reserve Bank of New Zealand use econometric models of the macroeconomy and relate the results to policy decisions.[10] The Department of

---

[7] Note also a new publication on this topic (Ziliak & McCloskey, 2008).
[8] Based on their abstracts, econometrics was central to 10 of 11 articles in *Applied Economics* 39(21), December 2007. Of these, three drew some possible implications for decisions/policy.
[9] As a separate exercise, it may be interesting to see to what extent academic research impacts on policy decisions, and, if considered, whether the findings are correctly interpreted. Example 4 below is a case in point.
[10] http://www.rbnz.govt.nz/research/discusspapers/. Approximately 7 of the 15 papers in 2007 would fit into this category. The greater emphasis on policy implications from econometric analysis may be due

Labour research publications tend to rely heavily on more discursive forms of analysis with graphical representation of data.[11] The Ministry of Economic Development has papers outlining econometric analyses on microeconomic issues using disaggregated data.[12] The policy conclusions tend to be tentative, however. For example:

> "One of the motivations for undertaking this study was to contribute to ongoing policy debates on the scope of geographically targeted policies to raise average productivity. Our findings provide tentative support for such policies, but emphasise that the effects are neither economically large in aggregate, nor uniform in their impact across different firms and industries." (Maré & Timmins, 2007, p. 53)

Given the range of industries and firms and the number of geographically related factors that can affect productivity, this study's findings are not entirely surprising. A strong statistical association would only arise if there is a fixed underlying structure that applies to highly heterogeneous units. This is unlikely to be the case. The same point could be made for many other studies using similar methodology.

2.2 The media phase

Tentative conclusions are less commonly observed at Desai's third level, that of the media and policy discourse. Politicians are expected to appear clear and decisive, despite all the actual uncertainties surrounding policy issues. The public want information that has a clear point to make, or, for personal interest, that relates to a need to change behaviour, presented without many complicating qualifications. Journalists may also lack the specialist knowledge required to handle complex issues, and they are constrained by the nature of their media to be concise and entertaining. Consequently, recommendations may be based on limited evidence and analysis, perhaps merely on a statistical association or ascribed to some designated "expert"[13]. To give five examples[14]:

Example 1: obesity and cancer

> An article on the Stuff media web site suggested that obesity and inactivity were "strongly linked to cancer" (NZPA and Reuters, 2007, 1 November). The following advice was given:

---

to the Reserve Bank having defined objectives and a limited number of policy instruments. It therefore has less need to consider a wide range of alternatives or associated costs and benefits.

[11] http://www.dol.govt.nz/publications-browse.asp?BrowseBy=Date&Year=2007, None of the 11 listed publications relied on econometric methods.

[12] http://www.med.govt.nz/templates/StandardSummary____22733.aspx. 3 of 5 papers for 2007 had significant econometric components and drew tentative policy-relevant conclusions.

[13] One of Dunn's "modes of argumentation" in his classification of ways in which policy debate is conducted is "reasoning from authority" based on the achieved or ascribed status of the person presenting the information. (Dunn, 2004, p. 395)

[14] See also (Perry, 2008, 18 January) and (Medical update, 2002). It may not be coincidental that so many examples are health related. The media considers reader interest and this often requires a personal angle (Hamilton, 2004). It is important because the recommendations in the articles may shape perceptions, behaviour and policy.

1. *"Be as lean as possible within the normal range of body weight," the 400-page report said.*
2. *"Be physically active as part of everyday life," was the second of 10 recommendations made by the expert panel.*
3. *The recommendations also included eating mostly plant foods, such as fruits, vegetables and grains, avoiding calorie-dense foods such as sugary drinks, and limiting red meat, alcohol and salt.*

Example 2: alcohol and brain damage

A *Dominion Post* article suggested that binge drinking 'damages brains' (Hill, 2007, 5 November). Arbias (Acquired Brain Injury Service) chief executive Sonia Burton suggested that "[e]ven so-called "social drinking" could cause permanent brain damage". On the basis of this association, she called for an education programme and screening by health professionals that "should be as routine as a cholesterol check".

Example 3: Job cancer risks

A *Dominion Post* report of a study identified occupations with higher likelihoods of death from various cancers (Palmer, 2007, 30 November). It was not made clear what conclusions readers are expected to draw, but the actual risks and the differences in risk were not presented. It might be imagined that people could become more wary of the named higher-risk occupations.

Example 4: Single parenthood and childhood risk

This is an example in a policy context where lack of statistical significance was used to draw policy conclusions. In paragraph 616 and footnote 299 of the Law Commission's *Preliminary Paper 47: Family Court Dispute Resolution* (Law Commission, 2002) there is reference to Fergusson (1998).[15] The paper is quoted in the footnote, *"Collectively, the findings suggest that single parenthood, in the absence of social or family disadvantage, is not a factor that makes a major contribution to childhood risk."*

This statement refers to a statistical finding on the significance of a variable. It is used to suggest that single parenthood may not be a concern as associated childhood problems are not observed when in a study that controls for certain factors. The interpretation of this finding is a more complex matter, and must reflect the interconnectedness of many determining factors, such that the factors that are controlled for may be closely associated with single parenthood. It is therefore not realistic to simply treat single-parenthood as being independent of these determinants. This is made clear in the published study. Hence Fergusson states:

"The implications of these conclusions are clearly that social programmes and policies that are likely to be most effective in addressing the needs of at-risk families and their children are likely to involve multi-compartmental approaches

[15] This example is discussed further in (Birks, 2002).

that have sufficient breadth and flexibility to address the wide range of social, economic, family, individual and related factors that contribute to the development of childhood problems." (Fergusson, 1998, p. 172)

This example illustrates the use of lack of statistical significance to suggest that a factor is not important. It is also a case where a journal article presents its results with great care, but at the policy level it is selectively quoted to provide apparent support for a specific position. In fact, the impact of the factor may well be felt through other, related variables. This can happen due to more complex causal relationships, or because some variables are acting as a proxies for others.

Example 5: TV watching and attention problems

A research paper published in *Pediatrics* found a link between children's television watching and attention problems some years later (Landhuis, Poulton, Welch, & Hancox, 2007). On this basis, despite voicing reservations, the researchers recommended restricting children to no more than two hours watching per day. This example is discussed in more detail in section 5.1 below.

As a general point to draw from these examples, the information that is presented in reports of research contributes to the shaping of opinions and views on alternative issues and policies. At the very least, the media do not always apply due caution in presenting these results. This is in part a consequence of inadequate specialist training and expertise.

The distortions may be widespread. Quite apart from statistical estimation and functional form problems, the information deduced from these findings may be flawed. This raises a fundamental question, what can be said about policy from statistical findings?[16] In addition, given the answer to this first question, what additional questions should be asked to more effectively address the requirements for good policy decisions?

3. Consideration of the problems

The following discussion will be based on a simple regression equation as it provides a useful structure for explanation. Consider a basic single equation multiple regression model where Y is a target variable of policy interest and X_1 can be affected by policy:

$$Y = b_0 + b_1X_1 + b_2X_2 + \ldots + b_nX_n + u$$

Statistical analysis can give results such as a finding based on whether or not X_1 is statistically significant as a determinant of Y.[17] With a superficial assessment, it might be concluded that:

[16] For a discussion of the use of econometrics in law, including reservations and qualifications, see Harkrider (2005).

[17] There is scope to debate the criteria for determining whether results are "statistically significant". The standard practice is to follow accepted conventions, such as using 1, 5 and 10% levels of significance, and using a nul hypothesis that the coefficient has a value of zero. These conventions are

- If it is not significant, there is no relationship, so the variable can be ignored.
- If it is significant, there is a relationship, so there can be a policy recommendation to change X_1.

In other words, there is heavy emphasis on the statistical significance of the estimate of b_1. What does the emphasis on statistical significance really mean, and is it appropriate for policy analysis?

3.1 Some basic points

In a nutshell, it would be wrong to place too much emphasis on statistical significance. It cannot be interpreted as answering all the questions required for deciding on policy intervention. Even if the relationship is one between a policy variable and a target variable, many aspects remain to be considered. For policy, it is important to know the magnitudes of impact, the precision of impact, the costs and possible side-effects of intervention, and, ideally, alternative policy options should also be considered. Here are some introductory considerations.

3.1.1 Standard causality issues

These are well known and require no elaboration. Standard questions would include:

a. Is the relationship causal?
b. What is the direction of causality?
c. What is the timing of the impact?

3.1.2 Policy impact – if X is changed, how much change is there in Y?

Harkrider gives a good legal example of this point when he distinguishes between "practical significance" and statistical significance:

> "Practical significance means that the magnitude of the effect being studied is not de minimis – it is sufficiently important substantively for the court to be concerned. For example, econometric evidence in the context of a publishing merger may reveal that titles published by new entrants are .0001 percent less profitable than titles published by existing entrants. That result may be statistically significant, but not substantively important." (Harkrider, 2005, p. 15)

Similarly for policy, it could be asked whether the relationship between the variables and the options for change in X_1 result in realistic and effective policy options.

3.1.3 Variability of response

Often relatively little attention is given to the overall R-squared for an equation. Sometimes a relationship may be only poorly specified by the equation. A statistically significant explanatory variable may then be a small factor in the overall determination of the value of the dependent variable.

---

based on assumptions that could be questioned. This paper takes statistical findings as given, looking at the subsequent stage of interpretation of results for policy purposes.

Also, even though the significance of a coefficient is commonly discussed (as with the t-test results), this may not be carried over to consider the possible variability of response to a policy of changing X_1. The estimated coefficient may be significantly different from zero, but the true value may still be quite different from the estimated value, and the effect of a change in X_1 on Y may also be variable across individual cases.

3.1.4 X as a proxy?

Statistical models only "explain" in terms of finding statistical associations between strings of numbers. The results depend on the numbers alone, with no regard to the specific variables underlying the numbers. Two distinct variables with identical data series would give identical statistical results. The identified variable may be acting as a proxy for one or more other variables which are, individually or collectively, correlated with it. The interpretation of statistical results as referring to specific variables depends heavily on this issue of proxies, especially in situations where related variables are "controlled for".

4. Main point 1: change X_1 or change b_1?

This is a fundamental point, yet it is often overlooked. Even when the policy options under consideration are restricted to the relationship between X_1 and Y, the outcome depends on both the value of X_1 and the relationship between X_1 and Y. Researchers tend to pick one of these, most commonly a change in X. For example, more education is statistically associated with higher earnings, and so a recommendation aimed at increased earnings could be to provide more education (a change in X). For some variables, such an option is not available. Consider a statistical relationship between gender and earnings. As a general rule, a person's gender cannot be changed, so a policy recommendation might be for a change in the relationship between gender and earnings through regulation or market intervention such as affirmative action on pay and/or employment. These amount to policy changes to alter b_1 rather than X_1. For many policy questions, both X_1 and b_1 may be variable, so both options should be available for consideration.

A common economics textbook illustration of this point can be seen with the treatment of externalities. Consider a market for a product with external costs of production. The standard treatment involves the addition of a "social cost" curve which comprises marginal private cost plus marginal external cost. A tax can be imposed to move the supply curve in recognition of this external cost (Doyle, 2005, p. 148; Stiglitz, 1993, p. 180). Some texts describe such an equilibrium point as the social optimum or the efficient point (Gwartney, Stroup, & Sobel, 2000, p. 128; Mankiw, 2007, p. 206; McTaggart, Findlay, & Parkin, 2003, p. 353; Sloman & Norris, 2008, p. 162). The assumption for this latter claim to be true is that there is a fixed relationship between the marginal cost of the externality and the output of the good (or b_1 is fixed). An alternative, if the option is available, would be to target the externality directly. This would acknowledge the possibility of varying the external cost at any given level of output, which is analogous to a variation of b_1 (Mankiw, 2007, p. 217; McTaggart et al., 2003, p. 352; Stiglitz, 1993, p. 589).

The approach of targeting the externality directly can be taken further. In the supply and demand diagram, the externality is measured not in terms of the volume, but in terms of the value of the externality associated with an additional unit of output. Policies that target the externality directly and varying the volume of the externality assume a fixed value (cost) per unit of externality. Instead, it may be possible to alter this value. Coase (1960) gives the example where people who are affected by an externality could move away so as to avoid the effects, thereby reducing the costs of the externality. In other words, a reduction in an external cost can be achieved through altering output, altering the production process, or altering the behaviour of those affected by the externality. In general, there may be many options available to alter the relationship between a variable, X_1 and another variable, Y.

5. Main point 2 – there are standard policy questions not covered by the econometrics

The examples in part 2.2 above indicate that policy conclusions may be drawn or behaviour changes suggested on the basis of statistically significant of relationships between variables. This can lead to poor decisions, as there are additional aspects that must be considered for a proper assessment. To illustrate, Example 5 from section 2.2 above is discussed here in more detail.

5.1 An example – TV watching and attention problems

In September 2007 there was media coverage of a study on childhood television viewing and attention problems. It serves as a useful illustration of the potential problems that can arise if policy recommendations are made on statistical association alone.

The research paper, published in *Pediatrics*, is, "Does Childhood Television Viewing Lead to Attention Problems in Adolescence? Results From a Prospective Longitudinal Study" (Landhuis et al., 2007). One report in *The Press* (Hann, 2007) included the sort of information contained in a media release by the researchers (Hancox, 2007), together with further information from one of the researchers and a personal angle from a Christchurch mother. The main finding of the study was that "children who watched at least two hours of television a day were more likely to have short attention spans, and have difficulty concentrating on tasks".

Hann quoted Hancox, "Although teachers and parents have been concerned that television may be shortening the attention span of children, this is the first time that watching television has been linked to attention problems in adolescence". To put this in other words, people had suspected a causal relationship, but until now there had not even been any observed statistical relationship. Readers might be excused for thinking that a causal relationship had been found, although that is not what was said. The published study says, "As with any observational study, we were unable to prove that childhood television causes attention problems in adolescence". It also presents possible alternative explanations for the observed relationship, but reasonably suggests that there may be some causal link, and that some limiting of viewing may be prudent for heavy viewers. The study includes a recommendation, "It, therefore, seems prudent to observe the recommendation of the American Academy of

Pediatrics to limit children's television viewing to a maximum of 2 hours per day" (Landhuis et al., 2007, p. 536).[18]

There are several additional questions that could have been asked. On the statistical findings, it was found that childhood television viewing was associated with adolescent attention problems with a standardised regression coefficient of 0.12 and p of 0.0001. When adolescent television viewing was added to the equation, the coefficient fell to 0.06 and p fell to 0.0515, with results for adolescent television viewing being 0.16 and $p < 0.0001$ (Landhuis et al., 2007, p. 534). If television viewing hours when young are correlated with viewing hours when older, care should be taken in concluding that younger viewing causes problems later. It may not be possible to separately identify the effects of earlier viewing as suggested.

Questions could also be asked on the interpretation of the results in terms of recommended actions. Should we be concerned? What are "attention problems"? Are they really problems, and how serious are they? How many children have these problems, and what is the actual difference associated with extra hours of television viewing? What magnitude of benefits might be expected from reducing younger children's viewing? If viewing is reduced, what would the affected children be doing otherwise (do the average results apply to all)? If there are benefits from improved attention, what other ways might there be to bring about this change? Might any of these alternatives be easier or more effective?

5.2 Policy questions

As indicated by the example above, not only are there statistical issues to consider when drawing policy conclusions, but there are also a number of specific policy questions to ask. An "ideal" economic approach to policy decisions (assuming perfect information and zero costs of analysis) involves identifying all the available policy options, determining their effects, valuing them to calculate costs and benefits, and then applying a decision rule to select the best option. A statistically significant relationship in a regression equation tells nothing about alternative options. Nor does it address the question of costs and benefits. All it demonstrates is that it **may** be possible to alter the value of Y by changing the value of X_1. Outstanding questions[19] include:

a. Can you change X?
b. At what cost?
c. How much control is there over this change (how precise are the changes in X)?
d. How variable are the effects on Y?
e. What lags are there?
f. What is the **value** of the resulting change in Y (what is the benefit, does it outweigh the cost)?

[18] Figure 1 of the study (Landhuis et al., 2007, p. 535) indicated fewer attention problems among those watching for 1-2 hours per day compared to those watching less than 1 hour per day, which suggests first that the relationship may be non-linear, and second that increased viewing may be beneficial for low watchers.

[19] While these questions are raised in relation to econometric studies, they apply to all policy options where one (policy) variable is altered so as to bring about a change in another (target) variable.

g. Are there any distributional effects (gainers, losers)?
h. Are there any side-effects?
i. Are there other policy options available?

In summary, it is important to consider the ability to change the target variable, and the costs and benefits of such a change, along with those of alternative policy options to address the same problem. This information is not provided through a t-test.

6. Conclusions

While econometrics may be useful for analysis and identifying relationships between variables, there are additional issues that should be addressed when considering policy. Consequently, care must be exercised when interpreting statistical results in a policy or general decision making context. In particular, this implies an understanding of the assumptions being made as to what can and cannot be changed, and an awareness of costs and benefits and alternative options. While many analysts may present their findings carefully, there is also the danger that others, including the media and the public, will draw false inferences from their results. They could also be misused in a political environment. Consideration of these factors could increase the value of econometric analyses.

References

Allen, T. H. (1978). *New methods in social science research: policy sciences and futures research*. New York: Praeger.

Birks, S. (2002). Submission to the Law Commission on Preliminary Paper 47: Family Court Dispute Resolution. Retrieved 7 January, 2008, from http://econ.massey.ac.nz/cppe/issues/LCPP47sub.htm

Birks, S. (2007). To KISS or not to KISS [Electronic Version]. *Asymmetric Information*, 11-12. Retrieved 3 January 2008 from http://www.nzae.org.nz/news/newsletters/AINo28-March2007.pdf.

Coase, R. H. (1960). The Problem of Social Cost. *Journal of Law and Economics, 3*, 1-44.

Desai, M. (1981). *Testing monetarism*. London: Pinter.

Doyle, E. (2005). *The economic system*. Chichester: Wiley.

Dunn, W. N. (2004). *Public policy analysis: an introduction* (3rd ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

Fergusson, D. M. (1998). The Christchurch Health and Development Study: an overview and some key findings. *Social Policy Journal of New Zealand,* (10), 154-176.

Gwartney, J. D., Stroup, R. L., & Sobel, R. S. (2000). *Economics: Private and public choice* (9 ed.). Fort Worth: Dryden.

Hamilton, J. T. (2004). *All the news that's fit to sell: how the market transforms information into news*. Princeton, N.J.: Princeton University Press.

Hancox, R. J. (2007). Childhood TV viewing linked to teenage attention problems, Media release, 4 September, Dunedin School of Medicine, Department of Preventive and Social Medicine [Electronic Version]. Retrieved 25 September from http://dunedinstudy.otago.ac.nz/Publications%20and%20Documents/Summary%20and%20Media%20Sheets/TV%20attention%20FINAL.pdf.

Hann, A. (2007, 5 September). TV linked to teen attention problems. *The Press*.
Harkrider, J. (Ed.). (2005). *Econometrics: Legal, Practical, and Technical Issues*: American Bar Association.
Hill, R. (2007, 5 November). Binge drinking 'damages brains' [Electronic Version]. *The Dominion Post*. Retrieved 17 December 2007 from http://www.stuff.co.nz/4261574a20475.html.
Landhuis, C. E., Poulton, R., Welch, D., & Hancox, R. J. (2007). Does Childhood Television Viewing Lead to Attention Problems in Adolescence? Results From a Prospective Longitudinal Study. *Pediatrics, 120*(3), 532-537.
Law Commission. (2002). *Preliminary Paper 47: Family Court Dispute Resolution*. Retrieved 7 January 2008, from http://www.lawcom.govt.nz/UploadFiles/Publications/Publication_87_207_PP47.pdf.
Mankiw, N. G. (2007). *Essentials of Economics* (4 ed.). Mason: Thomson.
Maré, D. C., & Timmins, J. (2007). *Geographic Concentration and Firm Productivity*. Retrieved 20 December 2007, from http://www.med.govt.nz/upload/51016/07-01.pdf.
McCloskey, D. N. (1998). *The rhetoric of economics* (2nd ed.). Madison, Wis.: University of Wisconsin Press.
McTaggart, D., Findlay, C., & Parkin, M. (2003). *Economics* (4 ed.). Frenchs Forest: Pearson Education.
Medical update. (2002, July). Smoke screen. *Reader's Digest (New Zealand Edition), 161,* 19.
NZPA and Reuters. (2007, 1 November). Obesity, inactivity 'strongly linked to cancer' [Electronic Version]. *Stuff*. Retrieved 17 December from http://www.stuff.co.nz/4257962a20475.html.
Palmer, R. (2007, 30 November). Cancer study uncovers job risks [Electronic Version]. *The Dominion Post*. Retrieved 20 December 2007 from http://www.stuff.co.nz/4297221a19716.html.
Perry, M. (2008, 18 January). Solariums found to raise skin cancer risk in young [Electronic Version]. *New Zealand Herald*. Retrieved 25 January 2008 from http://www.nzherald.co.nz/section/story.cfm?c_id=204&objectid=10487507.
Santomero, A. M., & Seater, J. J. (1978). The Inflation-Unemployment Trade-Off: A Critique of the Literature. *Journal of Economic Literature, 16*(2), 499-544.
Sloman, J., & Norris, K. (2008). *Principles of economics* (2nd ed.). Frenchs Forest, N.S.W.: Pearson Education Australia.
Stiglitz, J. E. (1993). *Economics*. New York: Norton.
Swann, G. M. P. (2006). *Putting econometrics in its place: a new direction in applied economics*. Cheltenham, UK: Edward Elgar.
Thurow, L. C. (1983). *Dangerous currents: the state of economics*. Oxford: Oxford University Press.
Wolf, A. (2007). Misleading statistical studies. *Policy Quarterly, 3*(4), 22-29.
Ziliak, S. T., & McCloskey, D. N. (2004). Size matters: the standard error of regressions in the American Economic Review. *Journal of Socio-Economics, 33*(5), 527-546.
Ziliak, S. T., & McCloskey, D. N. (2008). *The Cult of Statistical Significance: How the Standard Error Costs Us Jobs, Justice, and Lives*. Ann Arbor, MI: University of Michigan Press.