

Economic Commentaries (EC)



Introduction

Daniel V. Gordon

Welcome to the Fall (06) issue of **EC**. The front cover of **EC** pictures our University in celebration of 40 years as an independent research and teaching institution. From humble beginnings as an extension campus of the University of Alberta to today one of Canada's top research and teaching universities, we have come a long way. Getting incentives correct is the fundamental driving force that will lift this university to world class status. **EC** encourages the university administrators to rise to the challenge and put in place incentives that are consistent with this objective.

In this issue, four reports are presented. The lead article is a profile of the Institute for Sustainable Energy, Environment and Economy (*ISEEE*) by Dr. Robert Mansell, Managing Director and Special Advisor to the President on Energy and Environment and Mark Lowey, Communications Director. Dr. Mansell is a Professor in the Department of Economics. A relatively new research institute, *ISEEE* has a mandate to promote and encourage research in sustainable energy use. What is unique about *ISEEE* is that the mandate extends not only to the University of Calgary but also includes the University of Alberta, University of Lethbridge, the energy business community in Calgary and international links. What is clear from the report, *ISEEE* intends to tackle and solve the big problems in sustainable energy use.

The second report is a comment by Dr. Ana Ferrer. At the time of writing, Dr. Ferrer was an adjunct professor in the department of economics and **EC** is very pleased to announce that Dr. Ferrer has recently accepted a position as Assistant Professor in the department of economics. Dr. Ferrer makes a strong addition to the labour and applied econometric group in the economics department. In her report, Dr. Ferrer comments on some recent research concerning family friendly practices in business. Her research investigates an interesting puzzle; if as reported in the literature there is a high incidence of work-family conflict why do we not observe high rates of use of family related benefits?

This is followed by a comment by Dr. John Rowse, Professor, department of economics, on the use of hyperbolic discounting in long-term dynamic economic models. Dr. Rowse acknowledges that hyperbolic discounting is time inconsistent but empirical studies show that individuals actually discount hyperbolically.

In his research, Dr. Rowse investigates three related questions; 'if hyperbolic discounting is appropriate but the wrong hyperbolic discount rate path is used, what errors are made in the resulting analyses? Alternatively, if conventional discounting is utilized when hyperbolic discounting ought to be used, what are the consequences? Finally ... if conventional discounting is correct but hyperbolic discounting is utilized, what are the consequences?'

Our final report is a comment by Dr. Michael McKee, Professor and The Arthur J.E. Child Foundation Chair in Defence Economics, on tax compliance by individuals. Economists argue for increased enforcement effort to improve the rate of compliance. In his research, Dr. McKee asks how tax payers are to learn of this increased enforcement effort. Dr. McKee sets up a laboratory experiment to empirically determine 'as to whether formal announcements or informal communication contribute more to the indirect responses of taxpayers to higher enforcement.'

Finally, we profile three recent graduates of the Graduate programme in economics at the University of Calgary: Ms. Yuanying Huang (BA, MA), Dr. David Krause (BA, MA, PhD), and Ms. Orsolya Perger (BSc, MSc, BA, MA).

Table of Contents

Introduction.....	2
Table of Contents	2
ISEEE – An Integrative Model for Leadership in Sustainable Energy, Environment and Economy	3
Striving for balance: The use of family friendly practices	5
On Hyperbolic Discounting in Exhaustible Resource Models	7
Behavioural Issues in Tax Compliance – Investigating Individual Decisions in the Laboratory	10
Graduate Student Profiles.....	12

ISEEE – An Integrative Model for Leadership in Sustainable Energy, Environment and Economy

Robert Mansell and Mark Lowey



The Institute for Sustainable Energy, Environment and Economy (ISEEE) at the University of Calgary is entering its third year, and is making good progress on its mission.

ISEEE is a unique, dynamic and integrative model, created in October 2003 through the University's academic plan which makes "Leading Innovation in Energy and Environment" a strategic priority. ISEEE is a vehicle to deliver on the U of C's commitment to be internationally recognized for excellence in energy-and-environment research, education and innovation.

ISEEE's mission is: "Investing in collaborative, multidisciplinary, and mission-focused research, education and innovation to advance secure, competitive energy supplies for a sustainable, clean environment and a strong economy." The Institute's programs are aligned with Alberta's energy and environment research strategy, and with Canada's innovation and energy strategies.

ISEEE is guided by a Leadership Board that, in addition to Dr. Harvey Weingarten (U of C President and Vice-Provost) and Dr. Robert Mansell (ISEEE's Managing Director), includes:

- Charlie Fischer (President and CEO, Nexen Inc.);

- Gwyn Morgan (Vice-Chairman, EnCana Corp.);
- Jim Gray (Chair, Canada West Foundation and founder of Canadian Hunter Exploration Inc.);
- Neil McCrank (Chair, Alberta Energy and Utilities Board);
- Elizabeth Dowdeswell (Chair of the Council of Canadian Academies and former director of the United Nations Environment Programme);
- Dr. Robert Church, (Chair Emeritus, Alberta Science and Research Authority); and
- Dr. Granger Morgan (University and Lord Chair Professor in Engineering and Public Policy, Carnegie Mellon University).

Strength in Partnership and Collaboration

In advancing its key research initiatives and educational programs, ISEEE works closely with partners at the U of C, as well as with partners and collaborations in the broader community. Key U of C partner faculties and units include: Schulich School of Engineering; Faculty of Science; Haskayne School of Business; Faculty of Law; Faculty of Environmental Design; Faculty of Social Sciences; Research Services; and various institutes on campus.

Examples of ISEEE's partners and collaborations in the broader community include: the University of Alberta and University of Lethbridge (through an MOU that allocates leadership roles in specific areas within the energy, environment and economy field among U of C, U of A and U of L); Alberta Ingenuity; the Alberta Energy Institute; Carnegie Mellon University; and Lawrence Berkeley National Laboratory at the University of California, Berkeley.

In addition, ISEEE works with regulatory agencies, all levels of government and with the private sector to advance research in priority areas and to provide independent, objective assessment and advice on regulatory and policy issues.

ISEEE's Strategic Approach

ISEEE chose, after consulting with academics, other research organizations, governments and industry to focus on advancing strategic initiatives that offer Alberta and Canada the greatest potential benefits for

ensuring secure, competitive energy supplies, a healthy environment and a strong economy.

These four priority development areas are:

Advanced Recovery and Upgrading – This initiative is focused on technologies and associated regulatory and policy changes to advance:

- cleaner and more efficient *in situ* production and upgrading of oil sands (about 90 percent of Alberta's vast oil sand resource of 175 billion barrels of established reserves is too deep to mine and can only be recovered through *in situ* technologies);
- enhanced recovery of conventional oil and gas (on average, more than 70 per cent of our conventional oil and about 40 per cent of our conventional gas resources are currently beyond reach); and
- economic and environmentally responsible recovery of Alberta and Canada's vast unconventional gas resources (coalbed methane, 'tight' gas, shale gas and methane hydrates).

An example in the Advanced Recovery and Upgrading area is the first major ISEEE initiative, the Alberta Ingenuity Centre for In Situ Energy (<http://www.aicise.ca/>). This Centre is an initiative of the Alberta Ingenuity Centres Program and ISEEE, in conjunction with the U of C's Schulich School of Engineering and the Faculty of Science. Shell International E&P/Shell Canada Limited is the Centre's first Founding Industry Member.

The Centre is led by Co-Directors Dr. Pedro Pereira (Alberta Ingenuity Scholar) and Dr. Steve Larter (Canada Research Chair in Petroleum Geology and Alberta Ingenuity Scholar). The economic potential associated with the 'next-generation' underground recovery and upgrading technologies being developed by AICISE is enormous. Just a one-percentage-point gain in recovery of bitumen, combined with the higher value of the upgraded product, translates into a gain of \$26 billion in GDP, \$10 billion in labour income, and \$2.9 billion in government revenues.

Sustainable Development Technologies (SDT) – The SDT Initiative is the U of C/ISEEE component in the Canada School of Sustainable Energy, which also includes the U of A and U of L, each with separate and

complementary components. This unprecedented collaboration is aimed at leveraging the three universities' combined research talents and resources as the first crucial step in a much-needed Canada-wide effort to achieve long-term solutions to our energy and environmental challenges.

ISEEE's SDT Initiative is geared to research and development of affordable and practical sustainable energy technologies. These include: solid oxide fuel cells (clean energy using hydrocarbon fuels); lower-cost hydrogen production (for upgrading bitumen and generating value-added petrochemical products); and biomass-fuelled co-generation.

A very important component of the SDT Initiative is energy and environmental systems, policy, modelling and assessment, to identify innovations and improvements that increase energy production and efficiency and reduce environmental impacts. This work will create value-added products and markets, and facilitate the necessary technology transfer, 'smart' regulation, private sector investment and infrastructure development. This component, along with part of the carbon management initiative, falls within the Energy and Environment Systems Research Group. This group includes, for example, Dr. David Keith (Canada Research Chair in Energy and Environment), Dr. Michal Moore, Dr. Danielle Marceau, Dr. Sjak Smulders (Svare Chair in Energy Systems Analysis), Dr. Sheldon Roth, and Dr. Lorraine Whale.

CO₂ Management – This initiative focuses on the capture, storage and use of carbon dioxide, and on CO₂ transportation and safety. In addition to his leadership role in this initiative at U of C, Dr. David Keith is chair of one of the UN Intergovernmental Panel on Climate Change's (IPCC) three crosscutting groups and lead author of the IPCC's recently published *Special Report on Carbon Dioxide Capture and Storage*. CO₂ capture and storage is seen by both the Alberta and federal governments as a key technology to reduce greenhouse gas emissions.

Water Management – This priority development area includes the Alberta Ingenuity Centre for Water Research, a partnership of U of A, U of C and U of L. Dr. Ed McCauley (Canada Research Chair in Population Ecology at the U of C) is one of the Centre's three co-chairs.

The Water Management initiative also includes research and innovation to improve the management of water used or produced in conjunction with oil and gas operations, and the development of novel approaches and methods to treat and manage wastewater.

Substantial Progress Being Made

After completing an analysis of existing strengths, gaps and opportunities at the University of Calgary, ISEEE developed an integrated five-year plan to strengthen and build capacity. The five-year funding required to implement the plan was \$521 million. Of this, \$131 million was committed as of Aug. 31, 2006. Committed plus pending funding (including \$283 million for the new ISEEE building) now amounts to \$408 million.

ISEEE, working with partner academic units, created a successful business case and application to the Alberta government for funding to add almost 1,000 full-time student spaces in the high-priority energy-and-environment program, with about 650 of those spaces at the undergraduate level and 350 at the graduate level. This base budget funding (amounting to about \$50 million over the first five years) will enable the hiring of up to 80 new faculty members.

ISEEE and partner faculties also have submitted applications to the Canada Foundation for Innovation (with decisions expected this November) for a total of about \$50 million in infrastructure funding. In addition, substantial new funding has been obtained from industry and other sources for many new research and education initiatives.

ISEEE has also participated in the organization of and recruitment for many new Chairs at the U of C over the past year. Chairs in areas related to energy-environment-economy have increased from 19 to almost 40 today, with another eight Chairs in the planning phase.

As well, the Institute, working with others on campus, completed applications, functional programming and initial design for the new \$283-million ISEEE building, a 58,000-square-metre showcase of function, style and sustainability. The new facility and associated renovation of existing space will provide office, research, teaching and common space for 1,000 more students, up to 100 new faculty and other key groups that significantly

contribute to ISEEE's programs. Funding has been received from the provincial government to support the detailed design phase now underway.

As part of its community outreach and education programs for the broader public, ISEEE last year launched the inaugural ISEEE Distinguished Speaker Series and the ISEEE Research Seminar Series – both free and open to students and faculty at the University and to the public. The Institute also organized numerous workshops, participated at many major conferences in the community, and made about 100 presentations to visiting delegations from Alberta and other parts of Canada and from other countries.

In looking at ISEEE's mission, core initiatives and programs, it goes without saying that in order to accomplish our goal of making the U of C the clear 'go-to place' for research, education and innovation in energy, environment and economy leadership areas, strong participation by economists is essential. We very much appreciate the contributions of those in the Department of Economics who are helping us achieve this goal.

ISEEE has come a long way in less than three years toward accomplishing its mission. But we've only just begun. Many more opportunities and developments are still to come.

Striving for balance: The use of family friendly practices

Ana Ferrer

Economists view societies as forever reaching for balance. We conceive economic systems as moving towards "steady states" and visualize markets in general equilibrium. We are aware, however, that these are dynamic entities that evolve, reacting to impulses that affect any dimension of social behaviour and interaction. These impulses will typically generate opportunities for growth and development but will also generate conflict within the established "status quo". Solutions to these struggles move societies towards new equilibria. One of our tasks as scientists is to draw

attention to situations where such tension exists and where solutions to reach a new balance are needed.



One of such state of affairs is the increase in two earner households over the past 40 years. The massive incorporation of women to the labour force has fundamentally altered the structure of the labour market, placing an increasing burden on dual earners families and single parents to balance work and family demands. According to recent estimates from the Labour Force Survey, in 2002 72% of all couples were dual earners (up from 33% in 1965), as were over 60% of all Canadian households with dependents. Moreover, 63% of all single parents work. Consequences of the work-family conflict range from mental health disorders, physical health problems, family strain, and employee absenteeism, high turnover rates and low productivity. Working parents' mental and physical health as well as their employer's perceived and actual support in the work-family conflict, affect productivity, job commitment, and children's welfare. Therefore, issues of work-family conflict and their influence on workers and firm outcomes, as well as their potential resolution, should not lack for a wide audience among employers, employees and politicians.

Research in the area is divided between studies that focus on employer benefits of implementing family friendly practices and studies focussing on the effects of policies for workers. Both lines of research concentrate on the availability of benefits to workers, with virtually no studies considering the use of benefits by workers. This is somewhat surprising. A passing look at use of benefits statistics reveals some puzzling results. Given the magnitude of the work-family conflict described in the

literature, one would expect to observe high rates of use conditional on availability, particularly among certain groups, like female workers or single parents. Yet, overall usage of employer provided benefits is relatively low, suggesting first, that availability does not imply use and second, that these policies are not overly effective in alleviating work-family conflicts. It would appear as if benefits were available to workers who do not use them. This could be either because they find them unnecessary or unsuitable to their needs. For example, flexible work hours may be of little use to families with pre-school children, as many working parents will want to use full-time child care and full-time care is mostly available during regular work hours. It may be most useful to parents with informal care arrangements who work part-time and may need to schedule their work around caregiver availability. Working from home may have limited usefulness to parents as a substitute for regular care, but be useful to parents of school age children, as it reduces commuting time. Further, while childcare or eldercare may be quite useful, it will only be useful to workers with young children and eldercare responsibilities. Low wage workers may prefer less expensive, informal care options to expensive workplace arrangements. More generally, it could be the case that the benefit, or a combination of benefits, is available to both parents and only one of them uses it. Note that the lack of need for benefits can explain low usage, but so can the lack of availability of benefits. If workers who need or would like benefits and would use them have no access to them, it would explain the low numbers of users.

What appears obvious is that if we want to ascertain the extent to which these benefits contribute to lessen work-family conflict, we are interested in use, rather than availability, of benefits. In our work, "The Incidence of Family Friendly Benefits in Canada", we seek to determine the factors that contribute to the use of employer provided family friendly benefits among Canadian workers taking into account that benefit availability strongly depends on technological constraints, like firms size, type of work, etc... . The paper significantly fills the gap in the Canadian empirical literature by providing estimates of incidence of use of benefits using a nationally representative survey of workplaces and employees. In addition, and more importantly, by distinguishing use from availability, we are able to offer some insight on the

constraints that families with dependents may face in taking advantage of these benefits.

Government's involvement in the provision of family friendly benefits typically consists of the regulation of leave, pregnancy related insurance and the regulation of and subsidies for schooling/care for children. However, employer provided benefits that is, practices introduced voluntarily by the firms to help workers to reconcile the demands of work and family life, introduce an additional degree of flexibility for workers with families, even in countries with significant welfare states. For instance, families may find convenient the possibility of working from home to save commuting time, or to have flexible schedules. These are types of family friendly practices that depend mainly on the firm and can hardly be subject to regulation. Firms have different instruments at hand to help employees to deal with work-family conflict: a) Facilitating (paid/unpaid) leave from work for family reasons b) Facilitating changes in the work schedule and or work location c) Family support policies, which offer practical help with child/elder care assistance.

Our results suggest that workers are striving for balance and that more workers would use family friendly benefits if they were available to them. However, we also find that some benefits, like flexible schedules, are not used by full time workers to solve the family-work conflicts, while others, like family support services, are offered to workers who are in no dire need of them. On the other hand, female workers, particularly educated females, seem to choose to work in firms that offer the possibility of working from home and this choice appears to be motivated by the existence of family demands. In addition, it is female workers choose both to work fewer hours and at home. Having school aged children is a significant determinant of this choice. These findings suggest some scope of action for firms. For instance firms interested in helping female workers with work-life issues may consider offering working from home as an alternative to office work. However, with few exceptions, the results just reveal that, as currently offered, firm provided benefits are of scarce interest to workers in the solution of work-family conflict. This appears to be due to technological constraints that limit availability of benefits (for instance a small retail firm may not be able to offer on-site childcare or the possibility of working from home to their employees). However, an alternative explanation is that workers are not able to use services that are in theory available, as

many family friendly benefits are not explicit firm policies but are left to the discretion of managers.

Our study joins an increasing body of literature that stresses the need to increase the options to workers with families to balance work and family responsibilities, and outlines an important role for the government in the provision of these options. Since the benefits that would appear to be most helpful to workers (family benefits and telework) are difficult to implement for many firms because of technical constraints, governments remain a major player in the provision of solutions to the work-family conflict. In addition, gender differences in the use of benefits indicate that females still carry the main burden of family responsibilities. Therefore, there is also a considerable amount of room for public policy in facilitating equal gender roles in the provision of family care and in easing the work-family conflict. Public policy can assist in the resolution of work family conflict through a variety of programs including funded extended parental leave and convenient and affordable child care arrangements, but could also provide incentives that deter firms from discriminating against employees using family benefits. Hopefully, workers with families will be able to reach a new balance in the provision of labour and of family care.

On Hyperbolic Discounting in Exhaustible Resource Models

John Rowse



How should future costs and benefits be discounted in dynamic economic models? This question has been examined in the economic literature for decades. More recently, a closely related question has been addressed: How should the distant future be discounted in long-term economic models, models which have time horizons of one century or more? Prompting this question has been interest in phenomena with distant future implications, such as loss of biodiversity, minerals depletion and climate change. In turn, such interest has stimulated recent focus on hyperbolic discounting, in which marginal discount rates decline with distance into the future.

Hyperbolic discounting has been justified by evidence that individuals actually discount hyperbolically. However, hyperbolic discounting is known to be time-inconsistent: making decisions now, an economic agent who discounts the future hyperbolically will want to revise those decisions next year, even if next year there is no new information learned beyond what was used to make the original decisions. By contrast, conventional (constant annual) discounting is time consistent in that the decision maker never wants to change the original decisions, regardless of the time period from which they are viewed, provided that no new information is learned as time passes. Time consistency is generally favoured by economists because (i) time inconsistency typically recurs over time (certainly it does with hyperbolic discounting), implying that individuals never learn from the past, and (ii) with time inconsistency it is difficult to give meaning to the most efficient course of action over time.

A 2000 manuscript by the Massachusetts Institute of Technology Press, expounding economic models of climate change, utilizes a specific hyperbolic discount rate path (NB) for determining numerical results.¹ Furthermore, a 2001 *American Economic Review* article argues for hyperbolic discounting and recommends an explicit step-function hyperbolic discounting path (W) for use in economic models.² Such hyperbolic paths ignore time inconsistency, the NB and W paths differ, and each differs from a constant discount rate path. With publications in such prominent places using or recommending hyperbolic discounting, it is plausible to expect that many policy analysts may in the future utilize hyperbolic discounting in their long-term economic models. Actually, if appropriate, hyperbolic discounting is germane to all dynamic economic models, even those

with a short time horizon -- such as one decade or more -- which discount intertemporal benefits and costs.

Future contributions to the hyperbolic discounting literature may assess the advantages and disadvantages of different hyperbolic discount rate paths. Thus far, however, the following questions have not been addressed: if hyperbolic discounting is appropriate but the wrong hyperbolic discount rate path is used, what errors are made in the resulting analyses? Alternatively, if conventional discounting is utilized when hyperbolic discounting ought to be used, what are the consequences? Finally, presuming that the discount rate debate is not yet settled, if conventional discounting is correct but hyperbolic discounting is utilized, what are the consequences?

A recent study addresses these questions.³ The economic model used is the discrete-time version of a stylized control-theoretic continuous-time numerical model of the world oil market.⁴ Conceived primarily as a pedagogical tool for understanding the forces that shape optimal dynamic economic allocations, the original model was used by its author to observe that different dynamic allocation paths could generate social welfare (SW) values (present-valued consumer surplus (CS) plus producer surplus (PS) -- a common metric in partial equilibrium economic models) that were similar, differing little from the SW of the optimal or efficient dynamic allocation path. Many years ago this same model was used to address the consequences of using the wrong (constant) discount rate in an exhaustible resource model.⁵ One finding of the latter study was that, given a particular social discount rate known to be correct, it made little difference in terms of SW which discount rate was used (as long as the difference from the correct rate was not too large) but it did make considerable difference in the division of SW between consumers and producers and the intertemporal distribution of CS and PS. This finding suggested a similar outcome might occur when hyperbolic discounting is utilized, but the outcome was uncertain. Moreover, it was unknown what an optimal dynamic allocation path might be when discounting is hyperbolic. To cope with the latter problem, the model was converted to discrete time to allow the model to determine the optimal dynamic allocation path endogenously.

Principal findings of the research are:

- Conventional discounting can yield a very small relative SW loss when either the W discount rate path or the NB discount rate path is correct.
- Using one hyperbolic discount rate path (for example, W) when a different hyperbolic path (for example, NB) is correct can incur a very small relative welfare loss.
- Utilizing an hyperbolic discount rate path when conventional discounting is correct can also incur a relatively small welfare loss.
- Proportionate and absolute changes to PS and CS typically dominate the proportionate and absolute welfare loss of using the wrong discount rate path.

Several sensitivity analyses support these findings. Similar results are also found when a vastly different complex discrete-time natural gas model for British Columbia is used to examine the NB and W hyperbolic discount rate paths and two other hyperbolic discount rate paths utilized in the literature.⁶ Moreover, earlier research results from using the wrong constant discount rate were argued to generalize because exhaustible resources have many near-optimal depletion paths.⁷ The same logic applies when discounting is hyperbolic.

What are the implications? Although the optimal allocation path is unique, many near-optimal allocation paths exist -- some of them found using hyperbolic discount rate paths -- and these can exhibit very different divisions of surplus between consumers and producers, and may also generate different paths of environmental externalities. Income distribution and externalities matter to society but standard welfare-maximizing partial equilibrium models capture them poorly. Focus on using the "correct" discount rate path may just leave such matters unexamined or unresolved, although such issues may be among the most critical. If society cares about them, models may have to be constructed which measure societal desiderata directly.

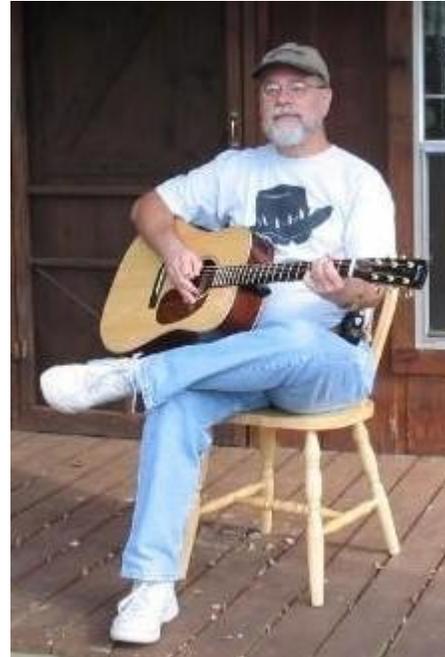
Do the findings apply to non-exhaustible-resource models? Although long term climate change or forestry models based on present value maximization differ considerably from the discrete-time world oil model, it is the discounting of outcomes from future economic activities which squeezes together the objective function values of a range of alternative solution paths,

particularly over a long time frame. Models which utilize long time frames likely exhibit similar behavior regarding alternative conventional and hyperbolic discount rate paths.

Finally, how should model outcomes be interpreted? Many economic models are formulated to simulate the behaviour of competitive markets in order to trace the consequences of tax, subsidy or regulatory measures by government. Yet, although individuals may discount hyperbolically, it is not likely that suppliers of exhaustible resources (or of any economic goods) do so when they take into account the opportunity cost of capital. Anecdotal evidence of oilpatch decision making behavior in Canada suggests that conventional time discounting dominates. Accordingly, difficult questions arise. If outcomes are generated by a model of assumed competitive market behavior using hyperbolic discounting, but real-world suppliers do not discount hyperbolically, how should the model be interpreted? What do the model outcomes represent and what can they be used for? Such questions warrant attention in the debate over how to discount the distant future.

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3. J. Rowse, [2006], *On Hyperbolic Time Discounting in Exhaustible Resource Models: An Application to World Oil Resources*, Natural Resource Modeling 19, 243-277.
4. D. Chapman [1987], *Computation Techniques for Intertemporal Allocation of Natural Resources*, American Journal of Agricultural Economics 69, 134-142.
5. J. Rowse [1990], *Using the Wrong Discount Rate to Allocate an Exhaustible Resource*, American Journal of Agricultural Economics 72, 121-130.
6. J. Rowse, [2006], *On Hyperbolic Discounting in Energy Models: An Application to Natural Gas Allocation in Canada*, University of Calgary,

7. J. Rowse [1988], *Does an Exhaustible Resource Usually Have Many Near-Optimal Depletion Paths?*, *American Journal of Agricultural Economics* 70, 646-653.



Behavioural Issues in Tax Compliance – Investigating Individual Decisions in the Laboratory

Michael McKee

It is a long way to April 30th so I suspect few of you are thinking about income tax filing. I tend to think about this issue a lot. I've been conducting research on individual behaviour in tax compliance decisions for several years, beginning with an investigation of individual responses during and after tax amnesties. Tax evasion is a potentially serious issue. In the US the "tax gap" or the amount lost due to evasion in the personal income tax is estimated at \$200 billion (about two-thirds of the projected budget deficit for the current fiscal year). The numbers in Canada are similar orders.

Since the decision to evade is made at the individual level, it is natural to investigate the behavioural issues at this level. Field data suffer from several problems: the audits do not detect all underreported income, non-filers are not often captured, honest errors are not identified, and final audit adjustments are not included. Most of my work in this area has been conducted using laboratory experiments that implement the essential features on the individual tax filing decision. Individuals earn income, file a tax report, face an audit, and if found to have evaded pay a financial penalty. Working with colleagues at some of my previous universities (primarily James Alm now at Georgia State University and Betty Jackson at the University of Colorado) and funded by a variety of public and private sources (including the U.S. Internal Revenue Service and Peat Marwick) I have investigated the effects of alternate audit regimes, coordination among taxpayers, and the aforementioned tax amnesties.

Since evasion is a crime, most economists prescribe an increase in enforcement effort (higher audit probabilities and/or increased penalties) as a solution to the evasion problem. If the tax authority follows this prescription, the open question is how the taxpayers are to learn of this. It is clear that, if taxpayers are to respond to the higher enforcement effort, they must learn that this effort has increased. It can be fairly stated that tax agencies, e.g., the IRS, are largely ignorant of this most important aspect of increasing enforcement effort – how this information should be communicated to taxpayers so as to maximize the effect on tax compliance. Individual taxpayers are simply audited too infrequently to learn much about audit risk from their own experience. While it is possible that the tax authority could simply announce the policy change and expect a response, it is equally possible that the taxpayers will remain ignorant of this change. It is also possible that taxpayers may communicate their audit experiences within their circle of business and social acquaintances. In this way, taxpayers will learn of increased enforcement efforts through the increased frequency of individuals' reporting audits.

It is an empirical question as to whether formal announcements or informal communication contribute more to the indirect responses of taxpayers to higher enforcement. Given the difficulties with utilizing field

data, James Alm, Betty Jackson and I designed a set of laboratory experiments to investigate this question. We recruit individuals to participate in a setting in which they earn income each round, report the income and pay taxes, and then face an audit. We vary the manner by which our taxpayer subjects are informed of the enforcement effort (audit rate). In one treatment, the audit results are revealed “officially” in that our computer software informs the subjects of the number of person audited in the previous period. In a second treatment, the subjects are able to send a text message reporting their audit experience in the current period to the other persons. We label this “unofficial” information. The subjects may choose to send no message or one of a set of messages concerning audit and compliance behavior in the previous round.

Thus, in our laboratory setting we are able to manipulate, as treatments, the information presented to the taxpayers and to offer taxpayers opportunities to communicate the results of audits and compliance. In the base case sessions, the subjects receive no further information about audit results beyond their own audit experience. In a second treatment the same objective audit rates are in effect, and subjects are also told by the experimenter the actual number of audits conducted during a period (and the fines collected in some versions of this treatment). In a third treatment the subjects are offered the opportunity to send a “message” to the other participants about their audit experience; subjects may also choose to send no message; and subjects may choose to send a message that is truthful or not. The experimental design therefore allows us to test hypotheses about the effects of two types of communication of audit policies and results, in order to explore the direct and the indirect effects of audits: “official” information disseminated by the “government” (e.g., the experimenter) and “unofficial”, or informal, communications among “taxpayers” (e.g., the subjects).

Our results indicate that “unofficial” communications have a strong indirect effect on compliance. But the effect is not always desirable for the tax authority. Messages that indicate that a subject was not audited or was able to cheat successfully reduce overall compliance, while messages that a subject was audited or paid his or her taxes increase compliance. Further, “official” announcements of information may not always encourage voluntary compliance.

From the tax authority perspective, our results suggest that the information transmission path is not obvious and that this issue must be addressed along with the more straightforward increase in enforcement effort (higher audit rates and penalties). Without such information transmission, the tax authority is likely to be disappointed in the effectiveness of the increased enforcement.

The avoidance of taxes is the only intellectual pursuit that carries any reward.

John Maynard Keynes

English economist (1883 – 1946)

When there is an income tax, the just man will pay more and the unjust less on the same amount of income.

Plato, *The Republic*

*Greek author & philosopher in Athens
(427 BC – 347 BC)*

Graduate Student Profiles



Yuanying Huang

Master of Economics: University of Calgary, 2005
Undergraduate: Shanghai University of Finance and Economics, China
[visiting student, University of Southampton, UK]

I am working at TransAlta as a market analyst (East Long Term). I am responsible for forecasting electricity price and analyzing power and energy market for Eastern Canada and United States.



David Krause

Doctor of Philosophy, Economics, University of Calgary, 2002
Master of Arts, Economics, University of Calgary, 1995
Bachelors of Arts, Economics, University of Calgary, 1994

David is the current Director – Economic Analysis at Bell Canada Enterprises. As Director, David provides economic advice and analysis in support of all business units, but primarily in support of regulatory proceedings and policy initiatives. Prior to joining BCE Inc., David spent two years as a Senior Economist in the Competition Policy Branch at the Canadian Competition Bureau, and two years as an Assistant Professor at the University of Lethbridge.



Orsolya Perger

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