



FARE Share

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Sharing valuable insights

What's Inside?

This issue of *FARE Share* highlights happenings in the department and celebrates our achievements. Congratulations to everyone involved!

Inside, we examine municipal water system expansion with a case study of the City of Guelph. We also explore how production decisions are made in times of price uncertainty.

On the back page, we learn estimates and expectations for Canada's new marijuana industry.

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The FARE Share Newsletter features research and analysis from faculty and students in the Institute for the Advanced Study of Food and Agricultural Policy in the Department of Food, Agricultural and Resource Economics (FARE).

Exciting Times in FARE

By: *John Cranfield, Professor and Chair, FARE*

The last twelve months have been exciting times. We've grown as a department and our research excellence has been recognized. In terms of growth, we are delighted to welcome two new faculty members to FARE!

Yu Na Lee (Ph.D. University of Minnesota) joined FARE as an assistant professor in agricultural business. Yu Na's research focuses on how risk and uncertainty affect the decisions and welfare of producers, consumers and households, with a focus on food prices. Her background exploring producer response to price risk will further complement the department's capacity in agricultural development economics.

Kwaku (Sylvanus) Afesorgbor (Ph.D. Aarhus University) joined FARE as an assistant professor in agri-food trade and trade policy. Kwaku's research cuts across international and development economics, specifically in the areas of international political economy, globalization and development, and applied econometrics. His past research has addressed the impact of different economic interventions such as economic integration, international trade, economic sanctions, foreign aid and income inequality.

I am also excited that we have a new position to fill in 2018 in the area of Food Industry Economics and Management.



FARE was well represented at the 2017 Canadian Agricultural Economics Society (CAES) annual meeting held in June in Montréal. Ten faculty, at least a dozen graduate students, and three undergraduate students attended the meetings. Faculty and graduate students made over 20 presentations, including a number of presentations in the graduate student paper competition, and a lively and engaging Fellows Address by Alfons Weersink on the changing landscape of Canada's farm sector. Undergraduate students from the department participated in the inaugural David Sparling Undergraduate Case Competition.

FARE continues to make significant contributions to the leadership of our discipline:

- **Alan Ker** served as CAES president this past year, and led the Society's efforts to organize this year's meetings, including a number of new initiatives that expanded our Society's scope to engage undergraduate and graduate students. I want to thank Alan for his efforts as CAES president – it is an important role, and he has done an excellent job in bringing new ideas and activities that enliven the Society and meetings.

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Optimal Water System Expansion in Guelph

By: David Worden, Research Assistant, FARE, and Brady Deaton, Professor, FARE and McCain Family Chair in Food Security

Municipal water providers supply water to more than 25 million people in Canada. They are regulated under provincial authority and policy dictates that the size of water system infrastructure must meet all levels of demand in a community. In other words, when you turn on the tap in your kitchen or bathroom, regulation dictates that safe potable water will come out even if everyone in the community turns their taps on at the same time.

Timing is everything. As forecasts of water demand are far from perfect, there is a very real challenge for water system designers who must try to determine how much infrastructure they should build to meet the future demand of the community. They face further challenges because they are legally liable should there be a water safety incident related to demand exceeding supply, not to mention the political fallout if the taps run dry.

Given uncertainty about future water demand and substantial risks should there be a shortage, water planners have a strong incentive to overbuild the water system. This is costly because water capacity will sit idle but the costs of it still need to be recovered from the community. In our case study of the City of Guelph, we find strong evidence of plans to overbuild the water system and estimate significant cost savings from less aggressive system expansion strategies.

The City plans to carry out roughly \$38.4 million worth of expansions over the next 20 years in anticipation of increased development and population pressures. The City forecasts demand will steadily increase over time and plans its water infrastructure expansion projects to increase the level of water capacity over time as well. However, using historic data for water demand we argue that the demand forecast is too high and we estimate that a large amount of planned capacity will sit idle.

By constructing a distribution of daily demand for each year over the planning horizon, we estimate the probability that demand will exceed the current level of installed capacity or, put simply,

the probability that the taps will run dry. When the probability of demand exceeding capacity exceeds one in 1,000, our alternate strategies suggest an expansion. This low likelihood is important because significant problems can arise if the taps do run dry as mentioned previously.

Our constructed distribution allows us to both put forward alternate expansion strategies and estimates of the level of capacity that will sit idle for any given strategy. We find cost savings ranging from \$24.5 to \$35.7 million (up to 93% of planned costs) and that the City strategy leaves over 26,000 cubic metres of capacity idle on average due to aggressive expansion.

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Importantly, the alternate strategies that we put forward can yield significant cost savings for the City of Guelph, but there is little incentive for them to deviate from their proposed expansion plan. Why? Because the provincial regulations that water planners face provide a solid regulatory floor at which capacity cannot go below. In contrast, there is no regulatory ceiling on the level of capacity that can be built. Therefore, as a risk mitigation strategy, municipal water planners are likely to overbuild their water systems as much as they can as each expansion moves them further away from the harsh regulatory floor that is in place. Our research suggests that rather than engineering and constructing extensive infrastructure over the next 20 years, policy makers ought to install a regulatory ceiling first.

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- While **Brady Deaton** is stepping down as editor of the *Canadian Journal of Agricultural Economics*, he has stepped into the CAES president cycle (e.g., president-elect, president, past-president). The editor role is a critical function of the *Journal* and Society, and one that does not often garner thanks, so a BIG thank you to Brady! We look forward to your term as CAES president.
- **Getu Hailu** has stepped into the role of an editor of the *Canadian Journal of Agricultural Economics*, a role in which I am sure he will shine!

Since 2008, faculty members from FARE have served as president of CAES three times (including me, Alan Ker and Brady Deaton), and three faculty members have served as editor of the *Canadian*

Journal of Agricultural Economics (Glenn Fox, Brady Deaton and Getu Hailu). Their efforts are highly commendable and reflect our dedication to ensuring we have a lively and high-quality Society and *Journal*.

Our department also received recognition for its research excellence at the meetings:

- Ph.D. alumna **Rebecca Elskamp** won the CAES Outstanding Ph.D. Thesis Award for her thesis “Essays in Economic Behaviour in Multi-Unit Auctions.” (Advisor: Alan Ker)
- Ph.D. alumnus **Peter Slade** received honourable mention in the CAES Outstanding Ph.D. Thesis Award for his thesis “Essays in Economic Behaviour and Interaction.” (Advisor: John Cranfield)



Decision Making Under Price Uncertainty

Research By: Yu Na Lee, Assistant Professor, FARE

How do producers make production decisions under price uncertainty? In his 1971 article, Sandmo famously predicted that when faced with an uncertain output price, a risk-averse firm manager would hedge by producing less than he would have when faced with a certain output price. In this set of experiments with Marc Bellemare, associate professor at the University of Minnesota, and David Just, professor at Cornell University, we take Sandmo's prediction to the lab. We study both the effects of price risk (i.e., uncertain prices whose distribution is known) and price ambiguity (i.e., uncertain prices whose distribution is not known) in two different settings: (1) in the lab with undergraduate students in the U.S. (Cornell University and the University of Minnesota), and (2) in the lab-in-the-field with farmers in rural Peru.

Our experimental protocol closely mimics Sandmo's theoretical model. In the price risk experiments with students in the U.S., each participant assumes a role of a wheat producer and is given charts that describe the relationship between their choices of output level (between 0 to 20, in 1,000 bushels) and profit under five different price scenarios: \$5, \$6, \$7, \$8, and \$9 per bushel. To determine the selling price in each round, we first randomly draw either certainty or uncertainty. Given certainty, price is always predetermined at \$7. Given uncertainty, we randomly draw one among four pictures of price distributions that are mean preserving spreads of one another. Participants are asked to decide, *ex ante* of the realization of the price, how many units to produce by seeing a distribution of the price. Once all participants have recorded their choices of output level, we randomly draw a ball from the bag with the corresponding price distribution to determine the *ex post* market price. We repeat this procedure ten times for practice and twenty times for actual rounds. Each participant is then compensated based on the profit she had made in a randomly selected actual round. The same participants also played the Holt-Laury list experiment, which we conducted to elicit participants' risk attitudes.

For experiments in rural Peru with farmers, the experimental protocol was translated from English to Spanish, making minimal necessary changes. The crop was changed from wheat to potato, which is produced more commonly in Peru. The lab-in-the-field experiments in Peru were contracted out to Innovations for Poverty Action (IPA) in Lima.

From the price risk treatment, we find that price risk *per se* causes our participants to significantly raise their output by an entire unit of production. We also find that marginal increases in the variance of the price distribution causes decreases in output. These results are consistent across the two subgroups of participants (U.S. students and Peruvian farmers) and constitute an outright rejection of the predictions of Sandmo that is rooted in the expected utility theory. We then explored whether alternative decision-making models could explain our participants' behaviour. We find that participants are risk-loving over expected losses and they tend to react much more strongly to small-probability events than to greater-probability events, which suggest that they exhibit behaviour consistent with the prospect theory.

In the price ambiguity treatment, pooled results indicate that participants increase production levels under price ambiguity, but we find that this result is driven by two factors: information on past price realizations and individual risk attitudes. First, priors formed during practice sessions seem to completely alter participants' expectations and, in turn, their production choices during the real rounds. Also, participants in our lab-in-the-field experiments in Peru exhibited risk-loving tendency and produced significantly higher levels of output under price ambiguity. Lastly, we find that participants behave consistently with prospect theory, and they mistakenly expect that any deviation in the price at a given round will be canceled by another deviation in the following round—the tendency known as gambler's fallacy.

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- M.Sc. alumna **Regan Arntz-Gray** won the CAES Outstanding M.Sc. Thesis Award for her thesis "Economic Implications of a Changing Yield Weather Relationship." (Advisor: Alan Ker)

Since 2005, FARE graduate students have won (or been a co-recipient) of the Outstanding M.Sc. award nine times, and the Outstanding Ph.D. award, which is awarded every three years, twice. This is an unparalleled level of recognition amongst agricultural economics departments in Canada and reflects the dedication of students and faculty to making research discoveries of exceptional quality and importance.

More recently, the department had a large presence and played an important role at the CAES Canadian Agricultural Policy Conference in Ottawa on January 24-26. Alan Ker organized

an excellent conference that focused attention on a number of important themes on Canadian agriculture. We had eight faculty members at the conference, with Brady Deaton presenting his research on food insecurity, and Getu Hailu and myself moderating sessions. Over a dozen graduate students and research assistants from the department also attended, with six of them presenting research posters. **Kate Jones**, a second-year M.Sc. student came second in the poster competition. I am very proud of the fact that three second-year M.Sc. students in the department swept the AAFC Agricultural Policy Briefing note competition – **Kate Jones** was first, **Lisa Wong** second, and **Brianne Chan** third. Each received a small cash prize, and Kate will have a paid internship at AAFC.

Price Uncertainty

What do we learn from these results? First, we see that participants behave very differently according to those two treatments. When participants face price uncertainty of a known nature, they tend to take some risk by producing more than in the situation of price certainty. When they face price uncertainty of an unknown nature and have to make decisions under only little information on price, context matters a great deal. Thus, results are very sensitive to even small changes in experimental settings, information from past rounds, and the characteristics of the decision maker. Thus, policy makers should clearly know whether the price uncertainty that they concern is price risk or ambiguity. Indeed, we lack both theoretical and empirical evidence on how production decisions are made under price ambiguity, which is the situation that smallholder farmers in developing countries often face given information asymmetry between market participants, imperfect insurance and credit markets, and challenges in accessing market information.

Our work also suggests that the theory of producer behaviour in the face of output price risk as well as policies used to protect producers from price risk need to be rethought through the lens of behavioural economics. Examining how reference prices are formed by farmers and how they affect production decisions in the spirit of the prospect theory might be a fruitful area of future endeavours.

Canada's New Marijuana Industry

By: *Liam D. Kelly, Ph.D. Candidate and Karl D. Meilke, Professor Emeritus, Professor, FARE*



With the legalization of marijuana (MJ) for recreational purposes just a few months away, we assessed the implications of this major policy change for Ontario using data from Colorado, which legalized recreational MJ in 2014. Based on this comparison and after adjusting for population:

- we estimate that legal MJ sales in Ontario will be approximately C\$2.1 billion within three years of legalization;
- annual tax revenues of C\$400-C\$500 million will be attainable within three years of legalization (assuming an effective tax rate of about 20 percent);
- Ontario sales revenue in a mature MJ market may exceed C\$3 billion;
- these revenue estimates are only attainable if the number of legal MJ outlets is not limited to such an extent as to severely constrain legal demand and are operated efficiently.

The legalization of recreational MJ is likely to face a number of economic challenges. First, in Ontario, the government has decided to sell MJ from government-run Ontario Cannabis Stores. Initially, a very limited number of these stores will be opened compared to jurisdictions in the United States. Sales will be available online via the Canadian e-commerce platform Shopify, although further details have yet to be released. These decisions will likely restrict sales from what the market could absorb given wider distribution. In addition, up-front costs will be high as properties need to be rented, remodeled, stocked and staff trained. Adding to the challenge is the fact that a large number of private sector MJ-oriented stores are already operating in the expectation that they will get a part of the recreational MJ business. Local municipalities will need to constantly monitor and shut down stores operating illegally.

Second, for alcohol and cigarettes, the government is fairly free to set a tax rate and let the market determine the retail price. However, for recreational MJ there is a well-developed black market and if legal prices exceed black market prices, legal sales and tax revenues will fall. So, there is a soft upper bound to the price of recreational MJ, and operational and pricing inefficiencies will negatively influence government profits and tax revenues.

Third, supply chains between MJ growers, processors and the government monopsony purchasing agent will need to be developed. Currently, there is a large degree of optimism in the “marijuana patch” in Southern Ontario and elsewhere. Monitoring and following developments in this new agricultural industry should be a high priority for farm organizations and the Ontario Ministry of Agriculture, Food and Rural Affairs. Some of the euphoria at the farm level needs to be tempered by the fact that MJ plant production is likely to be handled by a few large and well-capitalized farms/firms.

Regardless of the tax regime, market price and regulatory environment, the legalization of MJ will have profound implications for Canada. Already, the price of MJ-based equities are growing exponentially and creating new investment opportunities/pitfalls for Canadians. In addition, several Canadian MJ businesses have been granted licenses to begin exporting MJ to a number of countries that have recently legalized MJ, either for medical or recreational purposes; including the Czech Republic, Germany, New Zealand and Australia. While exporting MJ may be more complicated than corn and wheat, at the end of the day MJ is an agricultural commodity with significant demand both domestically and internationally, and Canada is well positioned to benefit from both.



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