Research Program

2002-2203

INTRODUCTION

This document presents the research program adopted by CIRANO's Board of Directors for the year 2002–2003, following the recommendation of the programs committee and consultations with the four thematic committees. The projects are presented by research group: Human Resources, Finance, E-Commerce, Corporate Governance and Experimental Analysis. The Programs Committee is presided by the board of governors of CIRANO and consists of a representative of the universities, the directors of the thematic committees, and the President and Chief Executive Officer and the Senior Vice-President of CIRANO. Its composition is thus as follows: Jacques Gilbert (Raymond Chabot Grant Thornton, Chairman of the Board of Directors); Guy Delisle (Alcan Inc., for the Human Resources Group); Louis Vachon (National Bank of Canada, for the Finance Group); Marcel Messier (Bell Canada, for the E-Commerce Group); Jacques Gilbert (Raymond Chabot Grant Thornton, for the Governance Group); Daniel Coderre (UQAM, representing the university members); Marcel Boyer (Université de Montréal, President and Chief Executive Officer of CIRANO); and Jean-Marc Rousseau (Senior Vice-President of CIRANO).

CIRANO's research program focusses on the concrete and operational implementation of the latest theoretical developments and the newest innovations in CIRANO's areas of research and liaison activities. Indeed, the principal mission of CIRANO is to establish links between leading researchers and organizations in order to enrich our research while translating the research results into a form useful to the partner organizations.

Consequently, it is no surprise that the concerns of many private and public organizations have had a significant impact on our research programming. To see this, one need only examine the projects involving e-commerce, mobilizing and motivating employees, integrated risk management, valuing derivatives, corporate governance, the enhancement of shared infrastructure, the development of knowledge-based economies, etc. Moreover, an inspection of our research program also reveals that the most recent developments in the scientific analysis of organizations drive the work performed at CIRANO and underlie liaison activities and high-level transfers.

SUMMARY

FINANCE

PROJECTS

PROJECTS IN FINANCIAL RISK

The Gordian knot in access to network structures: promoting competition while simultaneously ensuring the development and maintenance of infrastructure [140]
This project is also under: Corporate Governance
Participants : Marcel Boyer (Université de Montréal), Pierre Lasserre (UQAM), Éric Gravel (Groupe d'analyse)

This research project is a new approach to the 2003–2004 project, "Prices for access to network infrastructures: the option cost of inflexibility," and fits within an international current in research in financial mathematics: the use of real options in investment decisions in the broadest sense. Our goal this year is to make a significant contribution to one of the most difficult issues currently confronting regulators, how to promote competition in networks without creating an inefficient duplication of the essential elements of these networks

Financial asset prices and inflation: an analysis of causal links [192]
Participant : Jean-Marie Dufour (Université de Montréal)

While there is a school in the literature that seeks to understand whether central banks should be concerned about developments in asset prices when conducting monetary policy, and another that examines the opposite relationship by measuring the impact of monetary policy on asset prices, no study has examined both sides of this issue simultaneously. We expect to develop a methodology that will allow us to accomplish this. The methodology consists of specifying multivariate time-series models in which causality links between the various variables can be explicitly tested.

Mortgage-backed securities: growth, relevance, and valuation on the Canadian market [204]
Participant : M. Martin Boyer (HEC Montréal)

This study will develop a methodology unique to the Canadian situation for valuing mortgage-backed securities. In particular, we will develop an economic model to measure the risk of pre-payment for NHA MBS, which we will subsequently use in our model for valuing these securities. We will use data from the Canada Mortgage and Housing Corporation to measure the risk of pre-payment on mortgage-backed securities in Canada. Similar studies have been done in the United States but very few seem to be interested in the Canadian case. This will allow us to evaluate the pre-payment risk to which an investor who buys a portfolio of this type of securities is exposed. Subsequently, we will be able to more precisely value mortgage-backed securities in Canada.

Discounting cash flows in uncertainty [234]
Participants : Marcel Boyer (Université de Montréal), Éric Gravel (Groupe d'analyse)

The aim of this project was to clarify discounting cash flows foundations. It studies the case where cash flows define and characterize an investment project which has many risk sources that affect these cash flows differently.

Evaluating collateralized debt obligations (CDO) [206]
Participant : M. Martin Boyer (HEC Montréal)

The market for Collateralized Debt Obligations is the fastest growing of the global markets for asset-backed securities. They have become quite prominent as investments, and are attractive instruments for asset managers. The major risk that has to be taken into account when valuating a CDO is the correlation between the default risks of the collaterals underlying the CDO. This correlation risk can be defined as the probability of default of a security given the default of another security or group of securities that are also part of the collaterals underlying the CDO. The joint default probability is probably the most important component of the risk and yield estimation for a CDO. Their estimation requires, for example, a copulas analysis of the correlations between risks that have to face all the securities included in the CDO. Also, the model risk, difficult to quantify, adds to the complexity of the CDO evaluation. The contribution of this paper will be to compare and to improve already existing models so that an efficient evaluation of CDO can be realised. All of this will be done using CDO market's data.

Financial Risk Management Contribution on a Firm's Investment Decision Coordination [223]
Participants : Marcel Boyer (Université de Montréal), M. Martin Boyer (HEC Montréal), René Garcia (Université de Montréal)

This project will adopt a new perspective that will fully valorize the contribution of a firm's risk management. The authors will dip into the firm economic theory and into industrial economics to postulate a firm's frontier of cash flow transformation possibilities. They will demonstrate that, when the role of real risk management and assets management are conflict-provoking, financial risk management can increase the manager's flexibility. This flexibility will help them to be coordinated and to maximize the firm's value. By doing so, financial risk management contribute directly to the increase of the firm's value.

Investment Decisions of Individuals in Mutual Funds [225]
Participant : Susan E. K. Christoffersen (McGill University)

This project considers how investor behaviour affects fund valuation. Investor inertia obviously adds value to a mutual fund because, with predictable redemptions, a fund is not faced with liquidity uncertainty and stable assets provide a predictable source of income for the manager. This research will identify characteristics about a fund and its investors that will predict when they leave. We will investigate this by first examining investor level portfolio decisions from a proprietary data provider. Second, we will match this monthly inflow and outflow of a large cross-section of funds and find that the circumstances under which an investor comes to a fund provide a good prediction of their redemption decision.

Estimation of a Bonds and Interest Rates Derivatives Portfolio's Value at Risk [226]
Participant : Geneviève Gauthier (HEC Montréal)

Many models use factors to model interest rates term structure. Among them, there are Nelson-Siegel and McCulloch models. This project proposes to estimate these models to obtain a factors time series. This series will be analyzed so that we will be able to choose the appropriate model and to estimate its parameters. The models that will then be used will be autoregressive or moving average models. Once this estimation will be done, it will be possible to forecast the factors of the term structure, the term structure itself and to estimate the value of its portfolio. With the numerous and complex components of this portfolio, this evaluation will surely need a Monte-Carlo simulation as well as lattices. Variance reduction techniques will also be needed to reduce calculation time.

An Equilibrium Model of the Term Structure of Interest Rates [231]
Participants : Richard Luger (Banque du Canada), René Garcia (Université de Montréal)

Models of the term structure of interest rates have been mostly formulated as diffusions in continuous time and in an arbitrage-free framework. In this project, we propose to build an equilibrium-based model. Bonds will be priced in an economy where investors derive utility from consumption and an external reference level of consumption. The new feature of this approach is that the reference level is formed by expectations about aggregate per capita consumption and not by looking at past consumption as in habit models. We will also relate the reference level of consumption to inflation and past consumption growth, in order to capture persistence and measure real activity, and finally to the return on a stock index, in order to link the equity and the bond markets.

Modelling risk with Markovian regime changes [198]
Participant : Éric Jacquier (HEC Montréal)

We propose a project implementing correlation estimation and forecasting methods using changes in the Markov chain regime. Our implementation of Markovian regime changes will increase the robustness of the factor model while preserving the advantages of its parsimony. The methodology proposed in this project springs from developments inspired by our collaboration with partners having a particular interest in its application to portfolio management, especially relating to pension funds.

Looking for the New Economy [220]
Participant : Simon van Norden (HEC Montréal)

While the emergence of new productivity growth trends has played an important role in policy formulation, formal testing of whether the trend growth rate of aggregate productivity has changed significantly is rare, and the best work done to date appears to reach conflicting conclusions. This project examines the existing evidence for a shift in aggregate trend productivity growth and attempts to assess its reliability as a basis for policy making.

Strategic Asset Allocation in the Presence of Hedge Funds [221]
Participants : Jérôme B. Detemple (Boston University), René Garcia (Université de Montréal), Marcel Rindisbacher (University of Toronto)

Pension funds have recently looked at alternative asset classes such as hedge funds, private equity, emerging markets and real estate to improve the sagging performance of their portfolios of traditional asset classes. Two sets of questions arise in this context. To what extent the various strategies pursued by hedge funds provide an increase in returns without increasing the risk of the portfolios of pension funds? How large an exposure should pension funds have in such strategies? A second line of inquiry relates to the type of benchmark pension funds should measure their performance against if they abandon a fixed portfolio benchmark.

Regime Shifts or Factor Models? Implication on optimal portfolios [224]
Participant : Éric Jacquier (HEC Montréal)

The Markov regime switching model specifies the existence of two or more regimes where the parameters of the model are constant. Financial data stylized facts suggest the existence of regimes. Portfolio volatility is greater when the component's yields are negative. This relation is not caused, just as it is commonly suggested, by a leverage effect but by a portfolio effect. Precisely, correlations between assets increase with the volatility. These stylized facts can be incorporated in a concise regime switching model. Another approach also model these stylized facts and it uses factor model with time changing variance factors. Literature on these stylized facts exists but there are no studies that confront these two approaches in a portfolio optimization context. There is the aim of this project.

Growth Options Implication on Systematic Risk Forecasting [228]
Participant : Éric Jacquier (HEC Montréal)

Betas are fundamental parameters in portfolio composition. Hedge funds must be able to forecast these betas if they want to neutralize the systematic risk of their portfolio. Some pension funds have to respect certain levels of systematic risk. Volatility time variation's models, such as GARCH or SVOL, are very popular when it comes to forecasting individual asset variance. Things are different when systematic risk forecasting is concerned. Transposition of models such as GARCH and the addition of financial leverage do not improve the naïve methods and do not diminish the estimation error. This project will demonstrate the importance of growth options characteristic variables in forecasting the betas. The operational leverage effects are in fact much more important than financial leverage effects.

Investments Evaluation in the Public Sector: Uncertainty, Flexibility, Real Options and Discounting [229]
This project is also under: Corporate Governance
Participants : Marcel Boyer (Université de Montréal), Pierre Lasserre (UQAM), Peter Christoffersen (McGill University), M. Martin Boyer (HEC Montréal)

During the last thirty years, the breakthroughs realized in financial instruments valuation (options, futures) have greatly influenced evaluation techniques and investment decision-making. Despite the fact that these techniques are quite popular in the private sector, the possible applications in the public sector are still limited to scientific analysis. We believe that these analytics tools must be developed and be implemented as soon as possible to improve decision-making in public organisations which, just like private ones, evolve in a more and more volatile environment. Diverse cases could be considered. This far-reaching project will use the authors' knowledge in real options theory and is the follow-up to the discounting cash flow in uncertainty project.

Rethinking Speed Limit Policies: Optimal Monetary Policy and Measurement Issues [232]
Participants : Florian Pelgrin (Banque du Canada), Simon van Norden (HEC Montréal)

Policy rules using output gaps have long been characterized as infeasible because the output gap is not directly observed. Data revision also implies similar problems for income growth targets. This project uses real-time data sets for Canada and the US to compare the relative importance of revisions and estimation uncertainty for a) Taylor-style output gap rules, b) Walsh-style speed limit rules and c) Jensen-style nominal income growth targets.

PROJECTS IN STATISTICAL AND ECONOMETRIC METHODS APPLIED TO FINANCE

Les extrêmes et la dépendance extrême dans le NASDAQ et le S&P 500 [45]
Participant : John Galbraith (McGill University)

This project follows up on the work conducted in the framework of the 2003–2004 project "Estimating tail indices with indirect inference." In this project, we have examined the tail index of the two major U.S. large-cap indices (the DJIA and the S&P 500). Using state-of-the-art statistical inference methods, we found significant changes in the tail indices that were compatible with modifications to market regulation introduced to control computerized trading. In this new study, we intend to present a tail index analysis of the NASDAQ market covering a similar historical period, beginning with the introduction of the NASDAQ composite index in 1984.

Style analysis for speculative funds [52]
Participants : Nicholas Papageorgiou (HEC Montréal), Julien Foreix (CIRANO)

This project was developed in the context of speculative fund management. A preliminary analysis of the yields of speculative funds reveals that the usual methods of style analysis are not effective for these funds, owing to their limited liquidity and the extensive use of derivatives, which yield nonlinear returns. The goal of this project will thus be to develop a new nonlinear methodology to allow extraction of the principle categories of risk to which these funds are exposed from their yields.

The content horizon for forecasts of some key macroeconomic variables [194]
Participant : John Galbraith (McGill University)

Macroeconomic variables are usually forecast over several horizons, generally between one month and several years. The informational content of forecasts diminishes as the horizon increases and, past a certain point (the content horizon), they no longer contain any information beyond the mean value of the series. Earlier studies have analyzed the content horizon of GDP and inflation. In this project we plan to extend this analysis to a broader range of series of macroeconomic variables, using Canadian and U.S. data: the interest rate, growth in stock prices, the unemployment rate, exchange rate movements, and measures of housing starts.

Price discovery for ten-year Government of Canada Bonds [195]
Participant : Bryan Campbell (Concordia University)

This study will examine the existence of a lead-lag relationship between futures contracts on Government of Canada bonds (CGB) and the underlying ten-year bond. High-frequency data (intraday)—or minute by minute quotes and operations—will be used to study the possibility of lead-lag and/or feedback relationships. If we are able to establish such a relationship, we will then examine its nature. The sample will cover the past two years. The literature on the price discovery process includes a variety of different methods for identifying this type of relationship, and the study will contrast these competing methods.

Multivariate and Robust Heteroscedasticity [227]
Participant : Jeroen Rombouts (HEC Montréal)

Multivariate financial time series are often assumed to be conditionally normally distributed mainly because this distribution is easy to work with. Unfortunately, it has been shown that for many financial purposes the normal distribution does not perform satisfactorily. This project develops a mixture model for multivariate high frequency financial time series that allows for different time varying dependencies. This is done by specifying a multivariate GARCH model for each component in the mixture. Applications to stock indices and individual stock data are provided in the context of optimal portfolio selection and risk management.

A subsampling approach for event-driven studies [203]
Participant : Sílvia Gonçalves (Université de Montréal)

The purpose of event-driven studies is to examine the impact of financial events (such as share issues, mergers, or regulatory changes) on corporate yields. More precisely, the goal is to test whether such events have a statistically significant impact. Our main objective in this project is to develop a subsampling-based approach that is independent of assumptions on distributions and remains valid under very general hypotheses on interdependence of the errors, notably including serial and cross-sectional correlation. As an application of our methodology, we intend to analyse the impact of regulation using data on share prices.

Nonlinear combinations of forecasts [205]
Participant : Bryan Campbell (Concordia University)

As Stock and Watson suggested, macroeconomic forecasts generated by diffusion indices have proven as reliable as those yielded by traditional time series models. When these forecasts are linearly combined with those from international forecasting agencies, we observe a slight improvement in performance. A more detailed examination of the contributions of these forecasts suggests that a fixed linear combination may not be adequate. The goal of this project will be to study nonlinear methods to combine nonparametric forecasts from diffusion indices with, for example, annual forecasts from the OECD. In this study, special attention will be paid to using data available at the time of the forecast for generating and evaluating it.

Macroeconomic and Financial Panel Data Analysis [222]
Participant : Benoit Perron (Université de Montréal)

The interest for modeling macroeconomic and financial panel data has increased substantially during the last ten years. This interest has forced researchers to analyse stationnarity properties of panel data. More recently, procedures using factor models have been proposed to allow dependence between data series. The submitted project will discuss many issues:

Estimation and tests of common component This analysis will extract common components of panel data series, by main components for example. We suggest applying this analysis on yield or market price series to determine the common movement's sources.

Identification of stationary series Unit root and cointegration tests of panel data are usually used as a preliminary analysis (pre-testing). In the case where a test reject the unit root hypothesis for all the series of the panel data, it's impossible to conclude that all the series in the panel data are individually stationary. We suggest developing tools that would identify series that are most likely to be stationary so that an efficient empirical treatment of these data would be possible.

Estimation of factors on realized variance/covariance A lot of interest has been recently given on volatility and realized covariance measures obtain by summing the squares and crossed products of high-frequency yields. However, very little work has been done on situations where a lot of assets are involved. We suggest modeling, by factor models, covariance matrixes that will be estimated with high-frequency yields.

Dynamic and Approximate Programming for hedge funds portfolios statistical management [233]
Participant : Yoshua Bengio (Université de Montréal)

We have recently developed statistical learning algorithm for hedge funds portfolio management. An important question still needs to be studied to allow this study to go farther so that it considers interactions between decisions taken during period t and those taken in the future, interactions due to non linearities such as transaction costs, slippage and other market effects. To do that, we would like to take advantage of the recent progress in the statistical learning by reinforcement community, progress that can be seen as approximate methods to do dynamic programming in high dimension environment (where the exact solution is computationally impossible to obtain).Theses researches will be evaluated in the context of futures portfolio management where the underlying assets of these futures contracts are not very correlated with the equity market.

PROJECTS IN COMPUTER MODULES

Applied Research Modules for Practitioners [120]
Participants : Bryan Campbell (Concordia University), Jean-Paul Truong (CIRANO), Julien Foreix (CIRANO), Olivier Marquis (CIRANO), Evelyne Giard (CIRANO)

Our modules are user-friendly software packages that allow the practical demonstration and application of recent research on the Excel platform. We have developed these modules in collaboration with CIRANO partners to answer specific needs for the practical application of innovative techniques. These modules represent a unique transfer tool as they allow the direct implementation of the most recent research results.

Our approach is to code or translate our programs into C++. The code is then precompiled and configured as an add-on in Excel. Users therefore only need to have Excel installed on their computer to have operational access to the modules. Visual Basic is used to create a user-friendly interface and serves as the link between Excel and the C++ code. The precompiled code offers the performance advantages of C++ inside the universal user-friendly Excel platform. We develop techniques that could lead to specialized modules in a variety of fields, including:

Derivatives

This module applies and compares different valuating techniques of options in a user-friendly and interactive way. Mainly, it evaluates equity or indices European and American options. Mallliavin calculus allows the module to derive the general Greeks simulation techniques so as to obtain faster and more performing estimations. These methods are more effective than the classical finite differences methods. Precisely, we are interested in: 1) Pricing of derivatives: analytical methods, Monte Carlo simulations, trees, finite differences and other specialized methods 2) Fast and efficient estimation of the Greeks with Malliavin calculus for more a precise estimation in a variety of contexts.

Risk Management

Value-at-risk has become, despite all the weaknesses linked to its calculation, one of the key concepts in finance. These days, it is the dominant method to characterize risk exposure. Many researches conducted at CIRANO deal with value-at-risk. Topics such as backtesting, estimation risk quantification or decentralization effects on value-at-risk estimations have

been studied. All these elements are subject to possible integration into a risk management module. CIRANO's modules are also considered for the development of yield-risk models in asymmetry. Financial returns volatility presents well-known empirical characteristics. Important shocks on asset prices are most of the time followed by other important shocks (volatility conglomerate). Also, negative shocks have a more important effect on volatility than positive shocks. So, returns-risk models are developed to take into account this volatility's persistence and asymmetry. Precisely, we are interested in: 1) Value at risk: backtesting, quantification of estimation risk, decentralized use of VaR 2) Asymmetry, returns-risk models, volatility persistence and asymmetry.

Hedge funds

Hedge funds present non-linear relations with other asset classes and with other factors such as the S&P500 and its volatility. With style analysis, these relations can be classified and used to construct a general cartography of hedge funds. One of CIRANO's modules enables the cartography of these funds based on their relations with the factors. These factors can be an economic variable or an implicit variable (main component). This module then generates optionality in comparison with one of the factor to describe theses non linear relations. Forecasts based on the factors autoregressive models and on the coefficients of the style analysis regression may also be realized. The module also allows the calculation and the graphical representation of the fund's Omega. We consider creating in the module a hedge funds portfolio optimisation tool based on the Omega measure that will be more appropriate than the usual return/risk ratio.

Precisely, we are interested in: 1) Non-Linear methods, style analysis, principal component analysis 2) Regression on implicit and explicit factors, forecasting 3) Omega measure for funds performance analysis

Portfolio management

This mean-variance analysis module enables the choice of different mean and covariance estimation methods such as historical estimation, exponential smoothing, and GARCH modelling. Future possible developments of this module are mean – value at risk analysis, confidence intervals of the efficient frontier and portfolio performance analysis. The development of other modules on portfolio management is also considered. A Monte-Carlo simulation that incorporates hedge terms to calculate the shares of an optimal portfolio in a dynamic context is of great interest. It is also possible to use a Bayesian approach that allows managers to have a tool to incorporate their expectations in the portfolio optimization calculation. Like this, calculation methods are more robust to changes in the estimated values and enable the verification of the results sensibility to diverse models and expectations combinations.

Precisely, we are interested in: 1) Portfolio analysis with exposure constraints, more efficient estimation of the means, time-varying variance-covariance matrices and Bayesian integration of practitioners' expectations 2) Optimal dynamic portfolio shares selection through Monte Carlo simulations.

Volatility

In finance, we often use the option prices observed on the market to inverse the Black-Scholes formula and to deduce the implied volatility of the underlying asset. Implied volatility is then used to obtain forecast on volatility and on option prices for the days to come. This procedure can be generalized in a user-friendly way into a module to first deduce the volatility and the implicit prices at the same time and then to jointly found the forecasts on these two variables. In the variance-covariance matrices modeling, where these matrices are of great dimensions and variable through time, the important number of parameters needed make the classical models, such as the multivariate GARCH model, difficult to use. The DCC method (Dynamic Conditional Correlation), used in one of our module, will allow the resolution of this problem by adjusting univariate models to different variables and by using the standardised residuals to model correlation in an autoregressive way.

Precisely, we are interested in: 1) Joint evaluation of an option's volatility and implicit price 2) Forecasting models, time varying variance-covariance matrices modeling with GARCH DCC methods

Real Options

This module enables, with the help of real options, the use of tools developed in the financial options context to evaluate investment projects. These methods are more efficient than the classical analysis of the net present value (NPV) because they allow the evaluation of the intrinsic flexibility of the projects. The possibilities to stop a project on certain dates, to wait or to change its dimension are options that have values which can be quantified and incorporated in the evaluation process.

Precisely, we are interested in: Project evaluation, financial options, project's intrinsic flexibility.

Operational Risk

Since its definitive integration into the Basel Accord in June 2004, operational risk has become a part of the risks that have to be considered in the banking regulation process and so, it has caused a great deal of interest into the banking industry. The operational risk management module is currently the only one using an Internet interface. This choice is dictated by the necessity to use a server to control the behaviour of many users that are simultaneously in different geographic places. Thanks to questionnaires filled by the different users, the module is able to determine the best frequency and severity lost distributions of a certain type of risk into a specified business sector. Monte-Carlo simulations and the use of copulas enable the application of the advanced "Lost Distribution Approach" method and then to calculate the capital requirements and to aggregate them to bank's level.

Precisely, we are interested in: 1) Internet interface, multi-users questionnaires, Lost Distribution Approach, Lost, lost severity and frequency 2) Monte-Carlo, copulas, capital requirements aggregation

Collateralized Debt Obligations (CDO)

Two CDO evaluation models are implemented into a CIRANO's applied research module. The first one, and the simplest one, is the Monte-Carlo simulation. This well-known method gives a robust overview of the product that has to be evaluated. Given a significant calculation time and using default probabilities of the collaterals and their correlation as parameters, the module give a good price approximation. A Gaussian copula structure is used for the correlation and Weibull functions are for the default probability smoothing. The other implemented model contains closed forms with Gaussian copulas. Faster than the Monte-Carlo simulation, it extracts the prices using the default probabilities and the correlation between the collaterals and the market index. The two models calculate the spreads and the lost associated with the different tranches of a CDO. Sensibility data (deltas) are also part of the output and it is possible to reverse engineer certain parameters to gauge some examples. The development of another type of model allowing calibration with market indices and the refinement of the general hypothesis (correlation and defaults structure) is currently in process.

Precisely, we are interested in: 1) Monte-Carlo simulation, Gaussian copulas, tranche prices 2) Closed forms, sensibility, calculation time, reverse engineering.

RISK

PROJECTS

PROJECTS IN BUSINESS AND INTEGRATRED RISK MANAGEMENT

Management of network risks [178]
Participants : Nathalie de Marcellis-Warin (École Polytechnique), Bernard Sinclair-Desgagné (HEC Montréal)

In the context of a study on the domino effect in network risks and interdependency relationships with firms' partners, a literature review of risks connected to inter-corporate networks (with an application to managing risks associated with the supply chain) is currently in progress in collaboration with a research team at the Sorbonne.

Evaluating the risk of installing software packages [50]
This project is also under: Information technologies
Participants : Benoit A. Aubert (HEC Montréal), Suzanne Rivard (HEC Montréal), Michel Patry (HEC Montréal)

Software packages are increasingly used in organizations. While the potential benefits associated with these solutions are considerable, the risks are proportionate. Several initiatives have had to be abandoned, and others entailed severe consequences for the organizations having tried them. This project aims to develop and test a computerized tool to measure and monitor these risks within an organization.

The inherent risk associated with implementing IT is well known and has been widely documented. As substantial as the potential benefits associated with this type of project are, the negative impacts of failure can be just as far-reaching. Horror stories on this subject abound and testify to the high cost of these experiences, the outcomes of which are often hard to foresee even when a solid team is in place. Even though companies are increasingly turning to off-the-shelf software packages, such as Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM), rather than developing proprietary systems, the element of risk remains. Indeed, while it appears intuitively obvious that installing previously tested software is less risky in many organizations than developing customized solutions, the breadth of application of these programs, as well as the fact that they are linked into other systems, means that important challenges remain to firms. While introducing software remains risky and subject to problems, the potential benefits are nonetheless proportionate (cost reduction, shortened cycles, increased productivity, higher quality of customer service, improved resource management, better decision making, more accurate performance monitoring, etc.). This is why risk management plays an important role in these endeavours.

The goal of the research conducted at CIRANO is to test the use of tools to measure implementation risk for integrated computer programs and to better understand how to manage these risks. Several tools have been developed and are currently being used by large organizations. Monitoring large projects in these vast organizations permits a better evaluation of the tools and the associated issues in risk management.

Developing risk measurement, integration, and management tools [66]
Participants : Benoit A. Aubert (HEC Montréal), Henri Barki (HEC Montréal), Jean-Grégoire Bernard (HEC Montréal), Marcel Boyer (Université de Montréal), M. Martin Boyer (HEC Montréal), Gaétan Carrier (Université de Montréal), Peter Christoffersen (McGill University), Nathalie de Marcellis-Warin (École Polytechnique), René Garcia (Université de Montréal), Pierre Lasserre (UQAM), Michel Patry (HEC Montréal), Éric Renault (University of North Carolina), Suzanne Rivard (HEC Montréal), Benoît Robert (École Polytechnique de Montréal), Bernard Sinclair-Desgagné (HEC Montréal)

Valorisation Recherche Québec's (VRQ) Integrated Risk Management project groups researchers from various disciplines, such as finance, economics, medicine, engineering, IT, etc.

The principal goal of this project is to supply managers will a set of integrated management- and decision-support tools for administering risk. This project is divided into four groups, one of which is working on financial risk, a second environmental and technological risk, a third human health risks and, finally, a fourth contract and project risk. The tools to be developed will have a flexible architecture and integrate several methodological instruments and computer programs within a procedure designed to frame the decision maker's progression.

This project will facilitate (1) further development of risk measurement and management tools, (2) advancement of the theoretical aspects of their integration, and (3) the construction of a framework to render these theoretical elements operational. The methods and computer programs developed will thus allow organizations to better evaluate risks, and to do

so in a more integrated fashion. In addition, since our work also examines risk-management processes, these methods and programs will also play an advisory role, suggesting risk management modes appropriate to each situation.

PROJECTS IN TECHNOLOGICAL RISK

Evaluating risks associated with transporting and storing dangerous materials [236]
Participants : Nathalie de Marcellis-Warin (École Polytechnique), Ingrid Peignier (CIRANO), Martin Trépanier (École Polytechnique de Montréal), Bernard Sinclair-Desgagné (HEC Montréal)

Industrial activity necessitates producing and using dangerous materials, as well as transporting them between fixed facilities. Consequently, these materials represent risks within industrial sites, but also between those sites, owing to their transportation. The storage and transportation of dangerous materials are separately the subject of risk evaluation on the basis of methodologies that are specific to each and for which measures to manage these risks are chosen. Some decisions to store in fixed facilities are liable to introduce risks related to transportation.

The goal of the GLOBAL research project, established in France by INERIS (Institut national de l'environnement industriel et des risques) is to develop a risk-assessment methodology that will allow a comprehensive evaluation of risks associated with storing and transporting dangerous materials. This methodology should allow the steps taken to be assessed by accounting for effects induced over time. A further goal of this project is to simplify the overall control of risks, in terms of making it more efficient and less costly, by evaluating the costs of transporting dangerous materials and proposing logistical strategies for reducing risk throughout the supply chain. Finally, we would like to develop a sustainable framework for TDM and the entire industry by generating recommendations for future developments in regulations.

Documenting and estimating losses and costs associated with cyber-incidents [179]
Participants : Nathalie de Marcellis-Warin (École Polytechnique), Ingrid Peignier (CIRANO)

More and more companies are the victims of cyber-attacks, but they find it very difficult to evaluate the real losses associated with these incidents. The estimated financial losses are often limited to direct costs: material losses, unavailability of a machine, foregone revenue associated with a specific business process (e.g. an online retail site). Much more difficult to evaluate is the inconvenience to the user, customer dissatisfaction, links between the attack and a fall in the share price, and loss of face, all of which can represent high indirect costs. Thus, firms do not always proceed to a rigorous evaluation of the consequence of cyber-incidents, either because they do not know how to comprehensively identify the cost factors, or because they cannot quantify them. This project seeks to classify the costs associated with cyber-incidents and identify and analyse the valuation methods in use and existing data sources. We shall demonstrate the importance of being aware of the real costs, so as to not overestimate or, conversely, underestimate them, e.g. by neglecting the impact of damage to the corporate image. The final goal is to assist the overall evaluation of the incidence of the costs of cyber-incidents using a standardized analytical grid for them.

Managing technological risks and innovation – the case of nanotechnologies [180]
Participants : Bernard Sinclair-Desgagné (HEC Montréal), Nathalie de Marcellis-Warin (École Polytechnique), Catherine Beaudry (École Polytechnique), Ingrid Peignier (CIRANO), Dina Feigenbaum (CIRANO), Albert Nsamirizi (École Polytechnique de Montréal)

Government bodies have various instruments at their disposal that impact on technological development and innovation. In an era in which more and more use is made of innovation to increase competitiveness and foster economic development, it is important to apply each of these instruments wisely, accounting for potential interactions between them. However, a cursory glance at the administration of medical and environmental standards, for example, reveals that they are poorly coordinated with typical programs to stimulate innovation. Thus, the purpose of this project is precisely to lay the groundwork for a process that integrates the management of technological risks with public policies to stimulate innovation. The point of the exercise will be to articulate concretely the issues surrounding the inevitable arbitrage between incentives to innovate, the spearhead of growth, and a management of technological risk that meets society's needs. In order to come up with questions that are specific and relevant, we will frame our thoughts by concentrating on investigating nanotechnologies. These are currently experiencing extremely rapid growth—naturally linked to promising applications—but also frequently raise concerns regarding their impacts on human health and the environment. Owing to the newness and speed of these developments, it appears to us that there is no better "laboratory" to test and refine our questions, concepts, and methods.

Applied research on the U.S. "Local Emergency Planning Committees" [181]
Participants : Bernard Sinclair-Desgagné (HEC Montréal), Nathalie de Marcellis-Warin (École Polytechnique), Ingrid Peignier (CIRANO)

To better understand the "information-based regulation" approach and to assist the department in its decisions and actions in the field of communicating risks and consensus building, CIRANO intends to examine the operation, the roles, and the

mandates of the LEPCs. The problem is that LEPCs are only known by the legislation, but what are they in reality? Are they effective? How are they appointed? What is the profile of their members? What territory do they cover? How are they financed? What information do they receive from firms? What information do they release to the public (normalized or alternative scenario)? How do they disseminate information? For all of these reasons, CIRANO decided to conduct a survey of the 4000 LEPCs in the United States and compile information describing the reality of their activities, their funding needs and methods, their impact on the effectiveness of information-based regulation (How much confidence do they elicit?), and their role in assisting firms (especially SMEs).

PROJECTS IN ENVIRONMENTAL RISK

Life-Cycle analysis [182]
Participants : Bernard Sinclair-Desgagné (HEC Montréal), Dina Feigenbaum (CIRANO)

Until recently, policies in the area of the environment were largely independent and sectorial. The Integrated Product Policy (IPP) approach is all-encompassing and holistic, as the name suggests. It combines the basic principles of sustainable development with product-oriented policies, targeting the ongoing improvement of goods' and services' environmental performance in a life-cycle framework. Life-cycle analysis (LCA) is an instrument for comparing products, procedures, or services that fulfil the same function, by evaluating their impact over their entire life-cycles: "from the cradle to the grave." LCA is a tool that can be very useful for project management, decision support, and ultimately for risk management. It provides the opportunity to identify risk factors, to analyse the risk associated with technological danger, and to compare the technological risk of two different processes. LCA is one of the primary instruments of Integrated Product Policy (IPP). It allows the nature and scope of the commitment required from stakeholders—producers, distributors, consumers, and public and private buyers—to be grasped. More generally, any strategy for bolstering and coordinating environmental policy affecting goods requires new forms of governance. Specifically, the purpose of our study will be to examine the relevance of IPP in the North American context and to develop the tools necessary for its introduction.

PROJECTS IN HEALTH RISK

A tool to assist the analysis of incidents/accidents in healthcare delivery [237]
This project is also under: Public Policies
Participant : Nathalie de Marcellis-Warin (École Polytechnique)

In Québec, Bill 103 on the safe delivery of healthcare and social services was adopted in December 2002. It requires that health professionals declare all incidents and accidents occurring during the provision of care and also that healthcare facilities establish a registry of incidents and accidents. Within this legislative context, CIRANO received the mandate from the Ministère de la santé et des services sociaux to develop a tool to help facilities in the network analyze accidents. An analytical model used in the nuclear industry was adapted to the healthcare system. This model, called *Recuperare-Santé*, emphasizes managing situations and recuperation. It helps to reconstruct the chronology of events leading up to and following the incident/accident, to understand the causes, and to evaluate performance during the recuperation phase by identifying the time elapsed between the occurrence of the failure/error and detection/identification/intervention. The analytical tool developed from this model yields a structured methodology for conducting in-depth analysis within the establishments (questions to ask during interviews, advice, and a form for entering the results of the analysis). Work is continuing on improvements to the model, especially in terms of evaluating performance during the recuperation phase. Many theoretical questions regarding teamwork and team structure emerge in this context.

Chronicling undesired occurrences during anaesthesia [239]
Participants : Michel Sfez (Société française de gestionnaires de risques en établissements de santé), Nathalie de Marcellis-Warin (École Polytechnique)

Chronicling undesired occurrences during anaesthesia has been the subject of many publications. All of the methods used are, at least partially, based on voluntary reporting by members of the team of anaesthesiologists. Since December 2002, it has been obligatory to declare all incidents/accidents occurring in healthcare facilities in Québec. This declaration must be made using the form dedicated to that purpose (form AH-223, currently being revised). This form is not specific to anaesthesia.

The most extensive study, conducted in Australia, allowed identification of factors that contribute to the occurrence of accidents and pointed in directions for effectively preventing them. However, this type of running digest is most suitable to an epidemiological approach and of limited use to any given team. When the registry deals with elementary events, such as the one recommended in France by the Société française d'anesthésie et de réanimation, two important supplementary limitations come into play. It is currently impossible to isolate risk factors other than those related to the patient, or even the competencies of the front-line actor. Indeed, the canvassing grid yields no information concerning the organizational elements established for conducting anaesthesia. Furthermore, neither of these two approaches provides information on

measures for recovering from accidents or, by extension, on the effectiveness of barriers that exist within the system to mitigate the consequences of identified undesirable events.

The proposed project will seek to elaborate a methodology for chronicling serious undesirable occurrences in anaesthesiology in cooperation with a team of French researchers. The method shall be based on the most relevant elements from among the techniques developed in France and Québec (notably the Recuperare-Santé method). We hope for the following results: a more exhaustive chronicling of events, early identification of serious events along with a greater relevance of the flagged elements to the recovery process, and improved barriers for containing the consequences of these events.

PUBLIC POLICIES

PROJECTS

PROJECTS IN ECONOMIC DEVELOPMENT

Factor productivity: sources, dynamic effects, and the impact of macroeconomic policy in Québec [134]
Participants : Louis Phaneuf (UQAM), Samuel Danthine (UQAM)

The primary goal of this project is to identify the sources underlying variations in factor productivity in Québec, the transmission paths over which these shocks impact on productivity, and the incidence of current and new fiscal policies on variables associated with the labour market, especially average labour productivity. Since factor productivity is among the principal determinants of economic and employment growth, important questions arise. What causes productivity to accelerate or slump? What are the dynamic effects of technological developments on labour productivity, employment, and economic growth? What is the impact of economic policy, and of fiscal policy in particular, on productivity? More specifically, the project will address the following issues from a macroeconomic perspective: 1) Constructing a database. 2) A comparative analyse of the determinants of factor productivity in Québec and North America. The first order of business will be identifying and quantifying the underlying sources of variations in factor productivity using a vector-autoregressive (VAR) approach. Subsequently, the dynamic effects of these variations on growth and on macroeconomic variables linked to the job market—especially labour productivity and employment—will be estimated. 3) Modelling endogenous mechanisms of dynamic propagation in a dynamic general equilibrium framework, yielding an understanding of the outline of the dynamic responses previously estimated. 4) Simulating the impact of various economic policies, existing and new, within the framework of dynamic general equilibrium models, and evaluating the role played by different labour market regulations and institutions.

Profitability of incentives to foreign private investment in Québec [137]
Participants : Nicolas Marceau (UQAM), Alain Guay (UQAM)

The acceleration of global economic integration—i.e. the greater mobility of goods, factors of production, and information—appears to have imposed new constraints on governments, which must be incorporated into policy analysis. Indeed, it is possible that greater economic integration will exacerbate competition between governments in their choice of economic policy, and that this competition will act as a constraint and be detrimental.

In parallel to globalization, we observe decentralization movements in several countries, in which the power to tax, spend, and regulate is shifting from national to "regional" governments (provinces, states, départements, etc.). These reforms may eventually increase the efficiency of governments, ensuring a better alignment of government policy with the desires of the citizenry. However, just like the acceleration of economic integration, decentralization may also have the effect of exacerbating tax competition, which is harmful is some ways.

Thus, the statement that Québec is in competition with its neighbours when attempting to attract foreign private investment should not surprise. What is surprising is that we have few or no indicators of the profitability of Québec's investments in this area. In this project we seek to remedy this state of affairs.

Productivity of Québec's public sector [73]
Participants : Claude Montmarquette (Université de Montréal), François Vaillancourt (Université de Montréal)

Expenditures by publicly-owned bodies represent nearly 45 per cent of Québec's GDP. In light of the magnitude of this ratio, it is clear that the efficiency with which the public sector executes its tasks must necessarily have an impact on the overall productivity of the Québec economy. For example, whether a dollar spent on education yields more, or less, training, will affect the quality of Québec's workforce and its eventual productivity. Similarly, if spending on transfers to individuals, or collecting government revenues, imply a high overhead in manpower and organization, this situation will translate into a corresponding lower ability to spend. Measuring governments' productivity, in terms of output per dollar spent, is difficult: How can government output be defined? The government sector is to a large extent a service sector, and thus confronts the same obstacle in evaluating productivity as private sector service firms, without counting the difficulties in evaluating the productivity of a sector that is mostly non-market. The measurement problem, however real, does not exempt us from dealing with this issue. Governments are very preoccupied by productivity in the private sector, so how can they justify ignoring their own productivity when they represent 45 per cent of GDP?

PROJECTS IN PUBLIC FINANCE AND TAX POLICY

Tax rate, context and information level [148]
Participants : David Masclet (Université de Rennes I), Claude Montmarquette (Université de Montréal)

The goal of this experiment is to introduce a reference group dimension into the experimental protocol, which is liable to influence labour supply in the context of different choices of tax regime. Indeed, subjects are generally prone to evaluate their situation by comparison to that of other subjects, i.e. their reference group. Thus, we may wish to know what impact agents' knowledge about other participants has on their own level of effort. We distinguish between two sorts of information that subjects may have concerning the other participants. The participants may know to what rate the others are subjected, which may be different from their own rate, and they may also know the level of effort supplied by the others for a given rate.

Does an agent's knowledge of other participants' activity level provide an incentive to account for the latter's efforts when choosing his or her own level of effort? Furthermore, will subjects be sensitive to the fact that others are subject to a different rate, for example that they pay more, or less, in taxes? Indeed, when subjects are informed of the rate imposed on the other participants and that it differs from their own, feelings of injustice may result, leading them to modify their labour supply. The theory of equity is based on the assumption that all rational agents invest of themselves in an activity until the benefits derived from it are proportional to the investment. Individuals will appreciate the benefits they derive from their activity in relationship to how much effort they put in, relative to those of others. Any imbalance gives rise to a feeling of unfairness. Dissatisfaction, born of a perceived relative injustice, must then translate into a behavioural change. Thus, when subjects observe that they are taxed more highly than others for the same level of productive activity, they may be motivated to reduce their labour supply.

Tax-advantaged funds in Quebec [254]
Participants : Jean-Marc Suret (Université Laval), Cécile Carpentier (Université Laval)

Our purpose here is to update and disseminate our work on labour-sponsored funds in Québec. We will be addressing the impact these funds have on the financing of privately held corporations in Québec, analyzing their cost to the government, and measuring the yields to these funds (FSTQ, Fondaction, CRCD).

A proposal has been submitted to the MFQ and we are awaiting their response.

Labour-sponsored funds in Canada [255]
Participants : Jean-Marc Suret (Université Laval), Cécile Carpentier (Université Laval)

This is an extension of our Québec-based examination of labour-sponsored funds to all of Canada. We will (1) evaluate the impact of these funds on the financing of small Canadian firms, in particular those active in the technology sector, (2) devise an appropriate measure of the risk of return to the main Canadian funds—from the perspective of the investors—before and after taxes, (3) conduct a cost-benefit analysis of this type of tax-advantaged fund, and (4) propose modifications to this program.

This work will fall under a study of Canadian programs providing tax breaks for financing, but will also contribute to a new evaluation of these programs in Québec. This was one of the main recommendations of the commission of inquiry into the cost overruns of the modernization of the Papiers Gaspésia inc. mill, which was tabled in early May.

Tax policy and economic development [256]
Participants : Jean-Marc Suret (Université Laval), Cécile Carpentier (Université Laval)

What tax policies best further the funding of privately-owned corporations, especially those in the technology sector? In the past, governments (especially in Québec) have used a very aggressive tax policy to attempt to stimulate the financing of private companies. Despite numerous proofs of their inefficiency, these policies seem to persist. Nonetheless, there are studies that demonstrate that tax credits are an ineffectual and costly means of intervention. An international study also found a negative correlation between the extent of these policies for promoting private investment and the development of venture capital markets. Conversely, strategies designed to ease the tax burden on divestment stimulate investments in private companies. It also appears that regulatory provisions play a key role. However, international studies cannot be directly applied to the elaboration of policies specific to the Québec context: The province does not have full control over its fiscal and regulatory system.

The question we will seek to answer with our research is: In the specific context of Québec, what strategies will best allow growing private firms to have access to capital? These strategies incorporate dimensions of personal and corporate taxation and regulation.

PROJECTS IN SOCIAL POLICY

The demand for subsidized daycare [258]
Participant : Guy Lacroix (Université Laval)

The establishment of subsidized daycare in Québec has been the subject of very few empirical studies. However, many such studies have been conducted in Europe, where one finds subsidized daycare plans that also face quantity rationing (see below). The goal of this project is to estimate excess demand for spaces in subsidized daycare in Québec using state-of-the-art econometric techniques. We propose a joint estimation of labour supply and the delivery of daycare services (with or without subsidies) using a partial observability model originally developed by Abowd and Farber (1982) to examine rationing of unionized jobs. This model was recently expanded to account for more diverse stochastic structures, and successfully applied to many situations (Wrohlich, 2005; Chevalier, 2004). However, the scope of these studies is limited to modelling demand for subsidized daycare services—they ignore the decision of whether or not to work.

Student loans and income contingent repayment (ICR) [259]
Participant : Claude Montmarquette (Université de Montréal)

The education minister recently suggested that the repayment of student loans could be made proportional to income. This should make it possible to increase the amounts allocated and facilitate reimbursement according to each individual's ability to pay. As early as 2000, a fact-finding committee on income contingent repayment of student loans, headed by Claude Montmarquette, achieved a consensus on this issue. In its report, "Le remboursement des prêts pour études: essentiel à la pérennité du Programme de prêts et bourses," the committee, which consisted of representatives from financial institutions, students, universities and cégeps, and the ministère, unanimously recommended that consideration be given to setting up an income contingent repayment (ICR) system (report submitted to François Legault, minister of Education, Government of Québec, 2000).

In the framework of such a plan, former students would partially repay their debts (after a certain waiting period) only if their income exceeds a given threshold. The amount of the repayment would be computed using a given repayment rate applied to the difference between gross income and the chosen income threshold.

This type of system would feature several benefits, especially in reducing the risk to students of pursuing studies that do not pay off financially and in creating a closer link between the market for education and the labour market. However, for this plan to work it must be implemented with a great deal of care and attention to detail. Several issues need to be examined, especially: At what level should the threshold be set? Should it vary by family structure and region? What of the repayment rate? Should there be a deadline after which the remaining debt is forgiven? How should the additional funding made available to universities and other educational institutions be explicitly tied to reimbursing the loans to their students? What impact might the choice of threshold income have on the labour supply?

This provides the context in which a CIRANO team under the leadership of Claude Montmarquette is conducting a study aimed at establishing an ICR system in Québec. In the first instance, the purpose of the study will be to develop the rationale for ICR. It will then provide the ministère with an action plan for implementing the system. These labours will require simulations with the various parameters and an experimental study to establish their optimal values.

An income security plan for Québec [247]
Participant : Jean-Yves Duclos (Université Laval)

The economy of Québec is lagging considerably behind those of its principal competitors, especially Ontario and the United States. Moreover, if nothing is done, this discrepancy will grow, owing in no small part to demographic trends that are particularly detrimental to Québec. This fact is disturbing and of concern to all Quebeckers, whatever their age, social position, or political convictions. It is thus essential that Québec's assets be more effectively harnessed to increasing its collective wealth. This must, necessarily, involve rationalizing several government programs and promoting greater efficiency in its use of public resources. All reforms create casualties, even when they are guided by the public good, and the greatest concern must be for low-income Quebeckers. Fortunately, a reform of the welfare state in Québec could allow a more simple and transparent income security system to be established to take over the government's redistribution functions and protect the worst-off from the impact of measures aimed at promoting efficiency and growth. Such a regime would also feature substantial benefits in terms of political transparency, democratic life, and vertical and horizontal equity. This conception of reform is based on the notion of income security (IS). An IS plan would consist of a direct transfer to each citizen and would replace a more or less long list of social programs.

Research in four complementary areas may prove useful for shedding light on the current debate and evaluating the advisability of an IS.

1. It could identify, examine, and document the elements of personal income taxation and income support programs that might be replaced by an IS plan.

2. It could evaluate the budgetary and redistributive effects, from a purely accounting perspective, of the reallocation of resources that would result from a single transfer replacing many others.
3. It could also predict the impact this type of change would have on agents' behaviour (work, savings, consumption).
4. Finally, it could include a comparative study of the impacts of establishing an IS regime with those from reforming other modes of government intervention (such as the allocation and pricing of hydro-electricity and the financing of higher education).

PROJECTS IN HEALTH

The impact of mixed compensation on specialists' practices in Quebec [89]
Participant : Bernard Fortin (Université Laval)

Planning the supply of healthcare services available to Quebecers is no easy task. To accomplish this, the government of Québec has taken a two-pronged approach. The first, which we can call coercive, does not shy away from imposing restrictions, often severe, on healthcare workers? practices. The emergency-medicine legislation, Bill 114, is an example of this type of management imposed on medical resources. Use of the coercive approach can have significant effects on the supply of healthcare. However, it also imposes costs, which are sometimes high, on the workers constrained by the regulations, and contributes to labour conflicts.

The second type of management is incentive-based. Working with monetary or contractual arrangements, it encourages the participants to adopt behaviour that contributes to reaching goals that have been set by the government and professional bodies. One example of an incentive policy is the mixed compensation mode introduced in 1999 for specialists, under which the physician is paid a lump sum per half day or day plus a percentage of the billing. This new type of compensation seeks to achieve greater equity between specialists who perform different tasks. It is also designed to improve the efficiency of physicians? allocation of their working hours: Compensation modes have often been accused of encouraging a proliferation of the number of billable acts while discouraging some productive activities that remain unpaid under that particular system.

This project seeks to evaluate the impact of the introduction of this reform on the professional practices of the affected specialists. An empirical analysis will be conducted-examining the impact on the number of hours worked annually by these specialists, how they are divided between the different activities, and on the volume and types of medical interventions-so as to better evaluate the impact this sort of change to compensation methods has on how physicians allocate their time and, if applicable, to propose the required modifications. Our analysis, which will be based on a model of individual choice applied to the professional activities of specialists, will account for the fact that physicians? participation in mixed compensation is contingent on the unanimous consent of physicians having their primary practice, or a substantial share of their practice, within the department, service, or area of activity. Investment in human capital is at the heart of growth and economic development. It is also perceived as a means of reducing income disparities, to the extent that these differences in earnings are real and based on varying levels of human capital. We observe that there are two broad currents in the treatment of this issue: the ?American way? and the ?French approach.? To Americans, varying levels of human capital trump wage differentials, but the French place less emphasis on compensating the education gap and impose a lower cost on the acquisition of human capital. Québec sits somewhere between the two, but closer to the French. Is it significant whether investments in human capital are less expensive, but also yield less (as with the French), or cost more and yield more (the American approach)? Does the choice of approach impact on the quantity invested? Who among the population invests more in human capital: the most gifted or the least gifted? What are the impacts in terms of public finances of choosing one model over other? Does the Québec position, i.e. a model that more closely resembles the French than the American approach, lead to a ?brain drain??

A tool to assist the analysis of incidents/accidents in healthcare delivery [237]
This project is also under: Risk
Participant : Nathalie de Marcellis-Warin (École Polytechnique)

In Québec, Bill 103 on the safe delivery of healthcare and social services was adopted in December 2002. It requires that health professionals declare all incidents and accidents occurring during the provision of care and also that healthcare facilities establish a registry of incidents and accidents. Within this legislative context, CIRANO received the mandate from the Ministère de la santé et des services sociaux to develop a tool to help facilities in the network analyze accidents. An analytical model used in the nuclear industry was adapted to the healthcare system. This model, called *Recuperare-Santé*, emphasizes managing situations and recuperation. It helps to reconstruct the chronology of events leading up to and following the incident/accident, to understand the causes, and to evaluate performance during the recuperation phase by identifying the time elapsed between the occurrence of the failure/error and detection/identification/intervention. The analytical tool developed from this model yields a structured methodology for conducting in-depth analysis within the establishments (questions to ask during interviews, advice, and a form for entering the results of the analysis). Work is continuing on improvements to the model, especially in terms of evaluating performance during the recuperation phase. Many theoretical questions regarding teamwork and team structure emerge in this context.

Sustainability of funding by means of efficiency in the healthcare system: prevention and accountability [243]
Participants : André Blais (Université de Montréal), Joanne Castonguay (CIRANO), Nathalie de Marcellis-Warin (École Polytechnique), Claude Montmarquette (Université de Montréal), Robert Perreault (ADRLSSSS- Montréal), Denis Roy (ADRLSSSS- Montérégie)

Sustainable funding of our healthcare system can only be achieved by improving its efficiency. Greater efficiency, in turn, requires more accountability in the decision making of organizations, healthcare stakeholders, and patients, as well as a better synchronization of supply and demand. Our goal will be to more fully understand the preferences of patients, stakeholders, organizations, and the general population, allowing us to propose solutions for increasing the system's efficiency. We will develop an interdisciplinary research program on the sources of efficiency created by greater accountability and preventive behaviour, which we will examine from the economic, ethical, political, and social perspectives. The group's labours will focus on two research themes: technological choices and medical errors. Under technological choices we will address the arbitrage between various elements, including prevention, medical equipment, drugs, and treatments. The medical errors theme will examine ways to increase the accountability of organizations and stakeholders and to develop organizational cultures that foster learning. Each issue could be the subject of a continuum of research involving the four disciplines: economic, political, social, and ethical analysis.

PROJECTS IN HUMAN CAPITAL

Private integration services (PIS) and the development of self-sufficiency, skills, and socio-professional integration [190]
This project is also under: Corporate Governance
Participants : Marc R. Blais (UQAM), Ursula Hess (UQAM), Raymonde Beaudoin (Ministère de l'Emploi, de la Solidarité sociale et de la Famille), Nadine Murard

PIS seek to help individuals who have not succeeded in finding or holding down a job using the available measures to integrate into the labour force. There are over 55 PIS in Québec with more than 2000 participants. The procedure consists of a period approximately six months long that provides participants with the opportunity to experience a work environment in a context of technical and psycho-social support aimed at developing their social and professional integration. PIS must satisfy accreditation standards established by the Ministère de l'Emploi, de la Solidarité sociale et de la Famille (MESSF) in order to be recognized and qualify for financing from the Ministère. The MESSF is currently preparing an evaluation of the impacts of this measure.

Our mandate is to provide specialized scientific support for planning and implementing this evaluation. More specifically, we will examine the impact of the leadership styles shown by significant individuals on and off the jobsite on the development of participants' motivation, self-sufficiency, and socio-professional skills. The relationship between these motivational processes and indices of labour-market integration and participants' well-being will be analysed.

This research and knowledge transfer program will be conducted in partnership with the Direction générale-adjointe de la recherche de l'évaluation et de la statistique (DGARES) and the Ministère de l'Emploi, de la Solidarité sociale et de la Famille (MESSF).

Determinants of artists' income: an econometric analysis [246]
Participants : Nathalie Viennot-Briot (CIRANO), Claude Montmarquette (Université de Montréal)

Artists are often heard to lament their precarious socio-economic conditions. In order to arrive at a better understanding of this reality, the Ministère de la culture et des communications is collaborating with the Institut de la statistique du Québec to collect socio-economic data from income tax declarations. In a recent document, "Pour mieux vivre son art," the ministère published a series of descriptive statistics, mostly for the year 2001.

Despite the caveat regarding interpretation of the results, the principal conclusion suggested by the document is that artists need to lead a "double life" to live comfortably. This statement is based on the fact that 60 per cent of them receive wage income and 62 per cent earn money from self-employment, compared to 8.7 per cent for the general population of Québec taxpayers.

The goal of this study will be to conduct advanced statistical analysis on the fiscal database for artists to better understand the determinants of their income and their status as employees and independent workers. During the analysis, we hope to identify directions that fiscal or other policies can take to improve artists' living conditions and their situation relative to the rest of the population. To achieve this, we shall go beyond existing studies, which have confined themselves to describing the plight of artists, and seek to explain their situation. Failing to understand these determinants of their reality and simply concluding that artists are facing difficulties is trite and, more importantly, such an attitude actually raises barriers to proposing solutions that are effective and fair to artists and their fellow citizens.

Analysis of the impacts of the aging of the labour force on wages and productivity in Canada [251]
Participant : Benoit Dostie (HEC Montréal)

This project will seek to establish the existence and size of the gap between the wages and productivity of elderly workers when productivity differentials are estimated using a production function. Information on the magnitude of these differentials will inform decision makers regarding optimal policies in light of the aging of the population. For example, some policies to foster in-house training could mitigate the impact of the aging of the population if the productivity of older workers is falling off rapidly. Also, abolishing mandatory retirement could prove harmful if productivity declines rapidly with age, since it would make it harder for firms to eliminate their least productive workers.

Job-matching and employment-duration models [252]
Participant : Benoit Dostie (HEC Montréal)

Empirical studies of employee turnover play a central role in our understanding of the labour market. Despite this importance, our knowledge of the mechanisms that cause an employer to dismiss an employee, or an employee to leave a job, remains cursory. However, the recent appearance of new databases containing linked information on employers and employees will allow some light to be shed on this mechanism for a first time. Indeed, only use of a linked database will allow firms' human resources practices to be distinguished from independent choices made by individuals on the labour market in terms of their impact on turnover. In fact, even recent extensions made to job-matching models rely on explicit modelling of the turnover of labour within the firm. Thus, it is more important than ever to have a thorough understanding of this phenomenon if we are to adequately model the labour market.

The number of hours worked from a historical perspective [253]
Participant : Michael Huberman (Université de Montréal)

This project seeks to understand differences between the New and Old Worlds in the number of hours worked. For some time, researchers have been observing that Europeans work considerably less than Americans, Canadians, and Australians. Some explanations for this divergence have been advanced: higher taxes in Europe, wage inequalities combined with the relative weakness of unions in the New World. Underlying all these approaches is the belief that this divergence is a modern phenomenon that began during the 1980s. However, in a recent publication the researcher demonstrated that the New World was already working harder a century ago. The goal of this project is to construct new series of hours of work (monthly and annual) and to explain the divergence by accounting for initial conditions, such as geography and legal systems. This project is financed by the SSHRC.

Choice of academic discipline in Canadian universities [240]
Participants : Brahim Boudarbat (Universtité de Montréal), Claude Montmarquette (Université de Montréal)

The goal of this study is to analyze the process by which an academic discipline is chosen within Canadian universities. Particular emphasis will be placed on the role played by labour market data and its evolution. In other words, the study will seek to understand how labour supply by discipline adjusts to the constantly changing labour market. Market signals will be captured with three variables: discounted earnings for each field of study, the unemployment rate associated with each field, and the probability of finding a job corresponding to the field of study. Retention of this latter variable constitutes a major contribution relative to the existing literature, which frequently uses only income as a labour-market signal.

In the empirical study we shall use data from the national survey of graduates (NGS - National Graduates Survey) from Canadian public post-secondary institutions. The NGS canvasses selected graduating classes (usually every five years) two and five years after completion of the program of study.

The yield to investments in human capital: Capitalizing on the value of information on educational choices generated by laboratory experiments [249]
This project is also under: Experimental Economics Laboratory
Participants : Cathleen Johnson (CIRANO), Claude Montmarquette (Université de Montréal)

The information used in this study is from a large-scale experiment conducted by Canada Student Loans and the Applied Research and Analysis Directorate of the former Human Resources Development Canada. Given a context in which we are building the knowledge-based economy, the return to investments in human capital is a burning issue.

Our previous work has demonstrated that individuals (adults and students) who have a positive perception of education are significantly more likely to invest in it. Also, those who have a good understanding of the labour market are more open to education. Finally, individuals aged 25 and less, and having participated in an information session on the labour market, are much more likely to make a greater investment in their education.

This project will revisit the database created during the previous study in order to: First, generate more detailed results and, second, investigate the yield to investments in human capital. Four issues will be examined: (1) We may have introduced selectivity bias in the framework of our experiment on participation in a labour-market information session. Is it possible that, by initially selecting low-income individuals, we underestimated the potential of this type of intervention? (2) What exactly is the impact of information on the labour market, given the other variables (the type of financing received, the type of program followed [full-time or part-time], the individual's skills, etc.)? Is there a subset of the population on whom information would have no effect? (3) How can all of this information be incorporated into an econometric model? Should we resort to a structural model? (4) What conclusions can we draw from this work regarding the issue of the yield to investments in human capital?

The impact of breast cancer on women's labour supply [257]
Participants : Guy Lacroix (Université Laval), Elisabeth Maunsell (Université Laval)

This project will examine the impact of breast cancer on women's labour supply in Québec. The recent literature on this issue has presented results that are somewhat contradictory. Thus, Neumark et al. (2002, 2005) find that the occurrence of breast cancer has a significant negative impact, while Mausell et al. (2004) find the opposite. Most studies having been conducted are descriptive in nature and rely on statistical techniques that ignore important issues related to representativeness (selectivity bias, poor matching of the control and experimental groups, etc.). The goal of the study will be to closely examine spells of labour market participation and non-participation subsequent to the occurrence of breast cancer. This project will consist of several sub-projects which will differ in terms of the methodological approach and the variables under study (labour income, transitions on the labour market, etc.). We have access to very high quality data from the work of Maunsell et al. (2004). These data contain detailed information on over 2000 women under 60 years old, approximately half of whom experienced an episode of breast cancer (identified from the Registre québecois des tumeurs). The other half did not suffer from breast cancer before or during the three-year surveillance period (as reported in the dossiers of the Ministère de la santé du Québec). We have historical information on employment, wages, many socio-demographic variables, etc.

CORPORATE GOVERNANCE

PROJECTS

PROJECTS IN HUMAN RESOURCES

Private integration services (PIS) and the development of self-sufficiency, skills, and socio-professional integration [190]
This project is also under: Public Policies
Participants : Marc R. Blais (UQAM), Ursula Hess (UQAM), Raymonde Beaudoin (Ministère de l'Emploi, de la Solidarité sociale et de la Famille), Nadine Murard

PIS seek to help individuals who have not succeeded in finding or holding down a job using the available measures to integrate into the labour force. There are over 55 PIS in Québec with more than 2000 participants. The procedure consists of a period approximately six months long that provides participants with the opportunity to experience a work environment in a context of technical and psycho-social support aimed at developing their social and professional integration. PIS must satisfy accreditation standards established by the Ministère de l'Emploi, de la Solidarité sociale et de la Famille (MESSF) in order to be recognized and qualify for financing from the Ministère. The MESSF is currently preparing an evaluation of the impacts of this measure.

Our mandate is to provide specialized scientific support for planning and implementing this evaluation. More specifically, we will examine the impact of the leadership styles shown by significant individuals on and off the jobsite on the development of participants' motivation, self-sufficiency, and socio-professional skills. The relationship between these motivational processes and indices of labour-market integration and participants' well-being will be analysed.

This research and knowledge transfer program will be conducted in partnership with the Direction générale-adjointe de la recherche de l'évaluation et de la statistique (DGARES) and the Ministère de l'Emploi, de la Solidarité sociale et de la Famille (MESSF).

PROJECTS IN INFRASTRUCTURES

The Gordian knot in access to network structures: promoting competition while simultaneously ensuring the development and maintenance of infrastructure [140]
This project is also under: Finance
Participants : Marcel Boyer (Université de Montréal), Éric Gravel (Groupe d'analyse), Pierre Lasserre (UQAM)

This research project is a new approach to the 2003–2004 project, "Prices for access to network infrastructures: the option cost of inflexibility," and fits within an international current in research in financial mathematics: the use of real options in investment decisions in the broadest sense. Our goal this year is to make a significant contribution to one of the most difficult issues currently confronting regulators, how to promote competition in networks without creating an inefficient duplication of the essential elements of these networks.

PROJECTS IN GOVERNANCE AND PUBLIC MARKETS

Competitive social democracy [269]
Participant : Marcel Boyer (Université de Montréal)

Competitive social democracy is a model based on citizens' rationality and the quest for efficiency in the production and distribution of public goods and services (PGS). The role of the public sector is to identify the need for public goods and services, in terms of both quality and quantity, to elaborate their design, to perform the necessary arbitrage, and to manage the contracts for supplying them. The role of the private sector (in the broadest sense: corporations, cooperatives, NGOs, NPOs, etc.) is to efficiently produce and distribute all private and public goods and services in a competitive, flexible, and modular environment.

Issues and goals in the field of public-private partnerships [261]
Participants : Benoit A. Aubert (HEC Montréal), Michel Patry (HEC Montréal)

Public-private partnerships involve participation by three stakeholders having different goals and areas of expertise: the government, the firm, and the community of citizen-consumers. There are several types or forms of partnership between the public and private sectors: The range of possibilities can be represented by a continuum, ranging from purely public provision

to complete privatization. There are several obstacles to the establishment of sustainable partnerships. The principal challenge, without a doubt, is designing the contractual agreement. Difficulties pertaining to the definition of the responsibilities of each party, the comparison of internal costs (often poorly defined), and the exact specification of the services to be delivered are considerable. In this field, the projects conducted by CIRANO seek to provide managers with a set of tools and yardsticks that will allow them to administer partnerships.

We are working on three projects:

1. A review of public-private partnerships. Currently, in Québec as well as elsewhere in the world, public-private partnerships (PPPs) are management tools whose popularity is steadily growing among government bodies. Consequently, constant monitoring of the situation is called for to identify solutions. In light of this, several PPP projects are being monitored and documented over the course of the year.
2. Yardsticks and indicators for public-private partnerships. In order to allow government authorities to adequately manage partnership agreements concluded with private firms, yardsticks and performance indicators must be developed and adapted to the specific situation of PPPs. Thus, development of these tools will support the management of the agreements.
3. Risk sharing in public-private partnerships. The signing of a public-private agreement involves considerable risks for both the government organization and the private firm. Consequently, new models for risk sharing are evaluated in order to identify their strengths and weaknesses. These models can then be adapted to various PPP agreements.

Developing a governance framework for public infrastructure projects in Québec [248]
Participants : Joanne Castonguay (CIRANO), Roger Miller (École Polytechnique), Louise Roy (CIRANO)

In Québec, a number of public infrastructures are in a state of advanced deterioration and need to be replaced or renewed—and this must occur in an environment of scarce government funds. Throughout the world, large-scale public construction projects frequently run significantly behind schedule and over budget, and are furthermore the object of intense media scrutiny and speculation associated with this type of problem.

During the late 1990s, Roger Miller led a multidisciplinary research program on the strategic management of large engineering projects that conducted a detailed survey of the management and performance of sixty large international construction projects. The research of professor Miller and his team made it possible to identify risk factors and practices that made the difference between failure and success for these large projects. The most significant conclusion arising from the projects analyzed within this research program was that the institutional governance framework is vital to the success of large projects.

The research team proposes developing an institutional framework, applicable to the governance of large public infrastructure projects in Québec, that is founded on best practices. The framework we intend to submit is based on the following goals:

1. It will inform the stakeholders on the best practices at each stage of the project cycle and on the questions that need to be answered in order to highlight all the issues associated with the project.
2. It will make provision for a process by which the performance of the project management can be evaluated and practices adjusted, when appropriate, as well as for learning.

Five types of tools will allow researchers to accumulate the information required for success of the project: (1) consultation with the principal actors in Québec; (2) an updated review of the literature; (3) a benchmark for institutional governance frameworks in other jurisdictions; (4) an analysis of large projects in Québec; and (5) a socio-political analysis of project governance.

Investments Evaluation in the Public Sector: Uncertainty, Flexibility, Real Options and Discounting [229]
This project is also under: Finance
Participants : Marcel Boyer (Université de Montréal), Pierre Lasserre (UQAM), Peter Christoffersen (McGill University), M. Martin Boyer (HEC Montréal)

During the last thirty years, the breakthroughs realized in financial instruments valuation (options, futures) have greatly influenced evaluation techniques and investment decision-making. Despite the fact that these techniques are quite popular in the private sector, the possible applications in the public sector are still limited to scientific analysis. We believe that these analytics tools must be developed and be implemented as soon as possible to improve decision-making in public organisations which, just like private ones, evolve in a more and more volatile environment. Diverse cases could be considered. This far-reaching project will use the authors' knowledge in real options theory and is the follow-up to the discounting cash flow in uncertainty project.

PROJECTS IN GOVERNANCE AND MARKETS REGULATION

Legal aspects of open-source software [208]
This project is also under: Information technologies
Participant : Pierre-Paul Lemyre (Université de Montréal)

Development of open-source software relies on open licences, and several types of open licences have been proposed. The government of Québec has funded studies on the economic and legal impact of this type of licence. In 2005, a legal analysis was conducted on the various types of open licences and their impact on the operations of government organizations and on companies supplying IT services to the government.

We hope to pursue these studies in collaboration with the federal and Québec governments.

The economics of open-source software: Contributions to a government policy on open-source software [267]
This project is also under: Information technologies
Participants : Marcel Boyer (Université de Montréal), Jacques Robert (HEC Montréal)

This project seeks to lay the groundwork for a government policy on open-source software. We briefly characterize the extent of the open-source software phenomenon and analyze its pros and cons for the government, in its role as both an engine of economic development and a large user of information and communications technologies. We conclude with a series of recommendations for the government, as "economic and industrial policy maker" and as a "large user," in light of the expansion of open-source software. A preliminary study was completed in 2005 and we hope to continue this work (in collaboration with the federal or Québec governments).

The Measure and Regulation of Competition in Telecommunications Markets [264]
Participant : Marcel Boyer (Université de Montréal)

The two specific objectives of this project are first the development of a methodological framework, which will allow a proper characterization of the level of competition in the telecommunications industry, more specifically in the residential local access market, and second the recommendations of significant changes in the CRTC approach to the regulation of the Canadian Telecommunications industry.

INFORMATION TECHNOLOGIES

PROJECTS

Evaluating the risk of installing software packages [50]
This project is also under: Risk
Participants : Benoit A. Aubert (HEC Montréal), Suzanne Rivard (HEC Montréal), Michel Patry (HEC Montréal)

Software packages are increasingly used in organizations. While the potential benefits associated with these solutions are considerable, the risks are proportionate. Several initiatives have had to be abandoned, and others entailed severe consequences for the organizations having tried them. This project aims to develop and test a computerized tool to measure and monitor these risks within an organization.

The inherent risk associated with implementing IT is well known and has been widely documented. As substantial as the potential benefits associated with this type of project are, the negative impacts of failure can be just as far-reaching. Horror stories on this subject abound and testify to the high cost of these experiences, the outcomes of which are often hard to foresee even when a solid team is in place. Even though companies are increasingly turning to off-the-shelf software packages, such as Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM), rather than developing proprietary systems, the element of risk remains. Indeed, while it appears intuitively obvious that installing previously tested software is less risky in many organizations than developing customized solutions, the breadth of application of these programs, as well as the fact that they are linked into other systems, means that important challenges remain to firms. While introducing software remains risky and subject to problems, the potential benefits are nonetheless proportionate (cost reduction, shortened cycles, increased productivity, higher quality of customer service, improved resource management, better decision making, more accurate performance monitoring, etc.). This is why risk management plays an important role in these endeavours.

The goal of the research conducted at CIRANO is to test the use of tools to measure implementation risk for integrated computer programs and to better understand how to manage these risks. Several tools have been developed and are currently being used by large organizations. Monitoring large projects in these vast organizations permits a better evaluation of the tools and the associated issues in risk management.

Process integration [95]
Participants : Benoit A. Aubert (HEC Montréal), Betty Vandenbosch (Case Western Reserve University)

Information technologies allow a growing number of firms to function in an integrated fashion, both internally and in their dealings with their business partners. One of our goals is to provide a tool to measure the level of integration of a given process. This measure will allow identification of the steps required to increase the level of integration (to the extent that this is profitable for the organization) and to assist in the choice of the appropriate technology. Our contribution will be at the level of ERP systems, which are at the core of the internal management of firms. Initiatives using technologies supporting inter-organizational processes must account for ERP systems and integrate into them. This measure should be applicable both to inter- and intra-organizational processes. Eventually, a decision-aid tool will be developed to precisely measure how integrated a process is by modelling and simulating it electronically. Differing degrees of integration will be defined following an examination of various processes. We will then be able to evaluate the profitability of increasing the level of integration within an organization, which can subsequently be compared with the costs and risks associated with the higher level of integration.

A formal definition of integration has been elaborated, and we are now testing the elements of this definition (accessibility, time, transparency and modularity) in various environments (manufacturing and service sectors, principal and support processes). These cases allow us to verify to what point the proposed definition truly encompasses the concept of integration. In a subsequent step, the notion of the value extracted from a process will be tied in with this project. Several firms are participating in this study.

Legal aspects of open-source software [208]
This project is also under: Corporate Governance
Participant : Pierre-Paul Lemyre (Université de Montréal)

Development of open-source software relies on open licences, and several types of open licences have been proposed. The government of Québec has funded studies on the economic and legal impact of this type of licence. In 2005, a legal analysis was conducted on the various types of open licences and their impact on the operations of government organizations and on companies supplying IT services to the government.

We hope to pursue these studies in collaboration with the federal and Québec governments.

The economics of open-source software: Contributions to a government policy on open-source software [267]
This project is also under: Corporate Governance
Participants : Marcel Boyer (Université de Montréal), Jacques Robert (HEC Montréal)

This project seeks to lay the groundwork for a government policy on open-source software. We briefly characterize the extent of the open-source software phenomenon and analyze its pros and cons for the government, in its role as both an engine of economic development and a large user of information and communications technologies. We conclude with a series of recommendations for the government, as "economic and industrial policy maker" and as a "large user," in light of the expansion of open-source software. A preliminary study was completed in 2005 and we hope to continue this work (in collaboration with the federal or Québec governments).

Deployment of free software in an office workstation environment [207]
Participants : Suzanne Rivard (HEC Montréal), Malika Aboubekr (CIRANO), Robert Gérin-Lajoie (DGTIC, Université de Montréal)

In the framework of RESOLL,1 an initial study financed by the government of Québec will accompany two government pilot projects in which free software is deployed in an office workstation environment: Linux, OpenOffice, Mozilla, scripting environment, and others. Two projects of this magnitude represent numerous technical and managerial challenges. We propose a monitoring and accompaniment process with two primary components: risk management and the establishment of the key elements for success. Documentation from which one or several practical guides can be created will be developed, and these guides will subsequently be generated.

Network of experts in open standards and free and open-source code [211]
Participants : François Coallier (École de technologie supérieure), Michel Dagenais (École Polytechnique de Montréal), Éric Lefebvre (École de technologie supérieure), Robert Gérin-Lajoie (DGTIC, Université de Montréal), Jean Talbot (HEC Montréal), Mike Wylo (HEC Montréal), Daniel Poulin (Université de Montréal)

Open standards and freeware play an important role in the development of information technologies. Supported by vast communities of developers and users, free standards-base software is providing a growing number of high-performance, expansible, and competitive solutions. The goal of this project is to allow governmental organizations and firms to better understand and capitalize on the potential of open standards and freeware. We seek to establish a network of experts and actors from the milieu to conduct studies and pilot projects integrating computer solutions based on open standards and freeware, especially in the areas of electronic government, health, municipal and parapublic services, and business processes for SMEs. In the framework of this project we will propose several studies to governments and organize some symposia.

EXPERIMENTAL ECONOMICS LABORATORY

PROJECTS

For scientific reasons relateed to the validity of the experimentations, the informations on research projets will be available when the experiences will be completed.

PROJECTS IN APPLICATIONS TO PUBLIC POLICY

The yield to investments in human capital: Capitalizing on the value of information on educational choices generated by laboratory experiments [249]
This project is also under: Public Policies
Participants : Cathleen Johnson (CIRANO), Claude Montmarquette (Université de Montréal)

The information used in this study is from a large-scale experiment conducted by Canada Student Loans and the Applied Research and Analysis Directorate of the former Human Resources Development Canada. Given a context in which we are building the knowledge-based economy, the return to investments in human capital is a burning issue.

Our previous work has demonstrated that individuals (adults and students) who have a positive perception of education are significantly more likely to invest in it. Also, those who have a good understanding of the labour market are more open to education. Finally, individuals aged 25 and less, and having participated in an information session on the labour market, are much more likely to make a greater investment in their education.

This project will revisit the database created during the previous study in order to: First, generate more detailed results and, second, investigate the yield to investments in human capital. Four issues will be examined: (1) We may have introduced selectivity bias in the framework of our experiment on participation in a labour-market information session. Is it possible that, by initially selecting low-income individuals, we underestimated the potential of this type of intervention? (2) What exactly is the impact of information on the labour market, given the other variables (the type of financing received, the type of program followed [full-time or part-time], the individual's skills, etc.)? Is there a subset of the population on whom information would have no effect? (3) How can all of this information be incorporated into an econometric model? Should we resort to a structural model? (4) What conclusions can we draw from this work regarding the issue of the yield to investments in human capital?

PROJECTS IN GENERAL BEHAVIOUR AND DECISION-MAKING

Revealed Preferences [216]
Participant : Jim Engle-Warnick (McGill University)

This paper is a systematic study of the decision rules that experimental subjects use in five 2x2 games. I elicit the subjects' preferences, expectations, and decisions to fully econometrically specify their decision making. I find that subjects are able to predict the decisions of opponents, I estimate a system of demand equations, and I find heterogeneity in risk posture. I investigate whether the elicited information helps to predict subjects' decisions in the games. To my best knowledge this paper is the first attempt to fully model decision making of an individual subject in this manner.

Repeated Games [217]
Participant : Jim Engle-Warnick (McGill University)

This research proposal, for the first time, forms an empirical basis for preferences, expectations, and strategies on a subject-by-subject basis, in a direct, systematic, and rigorous way, by eliciting this information from experimental subjects in simple twoplayer games. The games will be selected according to their importance to institution and mechanism design, focusing on behaviours that are thought to be important for economic performance and development. They will include a trust game, a social dilemma (e.g., the prisoner's dilemma), a bargaining game (e.g., an ultimatum bargaining game), and an evolutionary game (e.g., a hawk-dove game). A different group of subjects will then do the most difficult work for us by attempting to identify the strategies that the original subjects may have used when playing the games.

How People Learn To Make Different Decisions: An Experimental Study in Price Dispersion [176]
Participant : Jim Engle-Warnick (McGill University)

We propose a study that will shed light on an important and puzzling market phenomenon of price dispersion, which is the sale of exactly the same item for different prices by different sellers. It occurs, for example, in internet commerce and the

market for petrol, and significantly affects outcomes for consumers. We propose to test our hypothesis that price dispersion is the result of a particular type of learning process, induced on the sellers, by the structure of the market. We will test this hypothesis using a series of economics decision-making experiments, in which human subjects make decisions in a computer laboratory market. We thus propose to advance the use of learning theories that are used to study how people come to make decisions in psychological, social, and economic contexts, and along the way to contribute to the debate regarding the source of an important market phenomenon.