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EXCERPT FROM POLITICAL RISK AND IRREVERSIBLE INVESTMENT AND APPLICATION TO QUEBEC

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Excerpt from

Political Risk and Irreversible Investment: Theory and an Application to Quebec

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Abstract

Political risk is widely present in developing but also in developed countries, and stems from a variety of sources. The objective of this paper is twofold. First, we develop a theoretical model to investigate the impact of political risk on irreversible investment. Second, we apply our model to an analysis of the risk of separation of the province of Quebec from the Canadian federation. Our framework allows a simple way of incorporating the effects of political risk on investment decisions which are, at least largely, irreversible and therefore sensitive to risk and uncertainty. We consider the investment decisions of a monopolisitically competitive firm under uncertainty about demand and about the tax-adjusted price of investment goods. We develop a model which incorporates learning and a regime switch with time-varying transition probabilities. If a given regime represents a riskier environment in terms of the state of demand or the state of investment price, then attaching a positive probability to a switch to that regime increases the marginal adjustment cost of investing, reduces the expected marginal value of capital, and reduces irreversible investment. We use annual sectoral data for the Quebec economy for the period 1983-1996 to match the behavior of actual investment with simulated series from our model.

Keywords: Irreversible investment, learning, trends, political risk, regime shifts, Quebec investment, Canada

JEL Codes: E22, D92, O16, O11.

1 Introduction

It is widely accepted that political risk is present in developing countries. What is perhaps less readily recognized is that developed countries are also highly susceptible to political risk stemming from a variety of sources: expropriation, disruptions in market access, unfavourable government regulations, unsustainable exchange rates, debt crises, fiscal crises, policy reversals, risk of political disintegration, etc... Even when economic fundamentals are "right", a subjective perception of unsustainability of the current policy regime may be strongly entrenched, and may have deleterious consequences for investment. Rodrik (1991) emphasizes the importance of political risk (in his case the risk of policy reversal) for irreversible investment decisions, and shows that political uncertainty amounts to levying a tax on investment. Several studies document the importance of political risk in the unsuccessful recovery of private investment following the adoption of IMF stabilization packages in various countries.[1][2] The success of structural adjustment programs typically require a positive response of investment. Yet as Faini and de Melo (1992) note, "uncertainty about the future course of an adjustment package will lead potential investors to adopt a wait and see attitude even if the crucial indicators for a decision, like real wages, are favorable." World Bank studies have shown that following a structural adjustment program, investment typically stagnates and falls, then stabilizes and responds favorably to the reform only after a considerable lag.

Due to the industry-specific nature of most investment goods, investment decisions are, at least largely, irreversible. There is empirical evidence indicating that irreversibility is an important de-

[1] See, for example, Solimano (1992), Serven and Solimano (1992, 1993) and Chhibber, Dailami and Shafik (1992) who study the experience of Latin American, Southeast-Asian and African countries. As another example, in a study of Ghana from 1983 to 1991, Hadjimichael, Nowak, Sharer and Tahari (1996) argue that policies had an impact on private investment mostly through the uncertainty that they generated.

[2] Another related literature examines how economic integration (and political stability) fosters trade. See John McCallum (1995) and John Helliwell (1995).

terminant of investment decisions. Using microeconomic data, Caballero, Engel and Haltiwanger (1995) find evidence in favour of irreversibility. Caballero and Engel (1999) develop a generalized (S, s) model which incorporates irreversibility and a fixed cost. Using macroeconomic data for equipment and structures in the US manufacturing sector for 1947-1992, they find further supporting evidence for the irreversibility effect, and demonstrate that microeoconomic nonlinearities are important at the aggregate level.[3]

There is also empirical evidence that uncertainty has a negative impact on investment. Ferderer (1993) and Huizinga (1993) examine the empirical impact of uncertainty on investment in the US manufacturing sector by making use of proxies such as the standard deviation of past inflation rates. Leahy and Whited (1996) use the variance of the firm's daily stock return for a panel of US manufacturing firms to construct an *ex ante* measure of risk. Their results support the view that uncertainty has negative consequences for investment. In their conclusions they point to "irreversible investment as the most likely explanation for the observed [negative] correlation between investment and uncertainty."

A number of studies have demonstrated a negative relationship between risk and irreversible investment, and uncertainty and irreversible investment. (Here we adopt the Knightian distinction between risk and uncertainty.)[4] In the context of the irreversible investment model, Demers (1985,1991) introduces the learning behaviour of a firm, and shows how output price uncertainty reduces the investment of a Bayesian firm, while Bertola (1989), Caballero (1991), Dixit and Pindyck (1994), Caballero and Pindyck (1996), Pindyck (1988) and Abel and Eberly (1996), working with Brownian motions without learning, show that the impact of output price risk on investment is neg-

[3]See also Caballero (1997), section 3.3.

[4]That is, risk is defined as "objective uncertainty" or randomness in the actual environment of agents whereas "uncertainty" refers to "subjective uncertainty" which includes the subjective beliefs of economic agents, their state of mind and expectations, their "animal spirits."

ative.[5] Altug, Demers and Demers (1999) examine both an uncertain and a risky tax-adjusted price of investment, and establish a negative relationship with irreversible investment in both cases. They show that for some parameters the negative impact of uncertainty on investment is greater than that of risk, thus highlighting the importance of the learning behaviour of firms in understanding the determinants of investment.[6]

While there is a considerable literature on the negative impact of risk and uncertainty on investment, there has been little work in quantifying the effect of political risk on investment decisions.

The objective of this paper is twofold. First, we develop a theoretical model to investigate the impact of political risk on irreversible investment. Second, we apply our model to an analysis of the risk of separation of the province of Quebec from the Canadian federation on Quebec's investment performance.

The case study of Quebec provides for a unique "natural experiment" of the impact of political risk in a developed economy. The issue has existed for more than thirty years, the debate has been carried out in a climate almost free of violence, and the data is of high quality. Two episodes of political risk are clearly identifiable. The first is that of the 1970s, characterized by the election in 1976 of a sovereigntist party, the Parti Québécois (PQ), for the first time in history and culminating in a referendum on sovereignty in 1980. The PQ lost the latter by a relatively large margin, thus

[5]See Caballero (1997) and Dixit and Pindyck (1994) for surveys. See also Abel and Eberly (1994) who develop a model with asymmetric costs of adjustment.

[6]All of the studies mentioned above (and almost all papers in the literature so far) identify a short-run effect, also termed a user cost of capital effect or hurdle rate effect, of risk or uncertainty in the presence of irreversibility. Recently, Abel and Eberly (1999) have analyzed the long-run effect, They examine the impact of output price risk on the expected long-run capital stock. In addition to the hurdle rate effect they also identify a hangover effect. Our work focuses on the short-run or hurdle rate effect in the presence of learning and regime shifts.

putting the sovereigntist issue on the backburner for the rest of the decade. The second episode of political uncertainty is that of the 1990s, marked by the federal government's failed attempts at constitutional reconciliation of Quebec with the rest of Canada, which led to a rise in the popularity of the sovereigntist option in Quebec, the subsequent election of the PQ in 1994, and another referendum on sovereignty very narrowly lost by the PQ in 1995.

In this paper, we seek to determine the quantitative impact of the risk of separation on Quebec investment for the second episode of political risk, namely the 1990s.

We consider the profit-maximization problem of a risk neutral monopolistically competitive firm with irreversible investment and learning about the unknown the state of demand and unknown costs of investment. Taxation is introduced in the manner of Hall and Jorgenson (1967), Abel (1982), and Hayashi (1982).

In our model, the firm is uncertain about the permanent component of the state of demand as well as of the tax-adjusted price of investment. It uses noisy observations on prices and tax rates, as well as observations on other informative variables, to make inferences about the permanent values using a Bayesian updating rule. As a way of modelling the presence of political risk, we also allow for regime switches between a "good" regime and a "bad" regime, where the former is characterized by more "favorable" distributions for the state of demand or the costs of investing. While the firm knows which regime it is currently residing in, each period it must assess the transition probabilities on the basis of a vector of economic and political variables. We identify regime 0 (the "good" regime) as the continuation of the Canadian federation and regime 1 as the separation of Quebec.

Following the approach in Demers (1991), we show that uncertainty about the future state of demand or the costs of investment unambiguously lowers investment. Uncertainty and irreversibility lead to a marginal adjustment cost which arises endogenously with the learning process of the firm.

The prospect of obtaining better future information increases the marginal adjustment cost and depresses current investment. Our framework allows a simple way of incorporating the effects of political risk. If a given regime represents a riskier environment in terms of the state of demand or the state of investment price, attaching a positive probability to a switch to that regime increases the marginal adjustment cost of investing, reduces the expected marginal value of capital, and reduces irreversible investment.

We use poll data as well as election and referendum results to estimate the probability of switching to the "bad regime," i.e., the probability of the separation of Quebec from the Canadian federation. Using annual sectoral data for the Quebec economy, we match the actual investment-capital stock ratios during the second episode of political risk with their simulated counterparts from our model to assess the quantitative impact of the risk of separation and the impact of uncertainty and learning on investment behavior. The simulation procedure is based on the approach in Altug, Demers, and Demers (1999). It combines numerical dynamic programming with a Monte Carlo simulation procedure to simulate the future expected valuation functions. This is similar to Keane and Wolpin (1994), who assume (as we do) that the exogenous state variables are drawn from continuous distributions. However, the simulation procedure used in this paper extends the approach in Keane and Wolpin (1994) to an environment with Bayesian learning and regime shifts. It also allows for trends in the underlying exogenous variables.

The remainder of this paper is organized as follows. Section 2 presents the case of Quebec. This section provides a historical discussion of the problem of political risk in Quebec and relates it to Quebec's investment performance. Section 3 describes the the theoretical framework and solves the firm's dynamic programming problem in the presence of trends, learning and regime shifts. Section 4 describes the solution and simulation procedure used in the paper. It also describes how to simulate the model with continuous random variables and under learning. Section 5 parameterizes

the theoretical model, and presents the numerical results. Some concluding remarks are in Section 6.

2 Political risk: the case of Quebec

2.1 A brief historical perspective

In this section we provide a brief historical account of the political conflict opposing Quebec and the rest of Canada, and identify two major episodes of political risk that have had an important impact on the Quebec economy, and particularly, on Quebec investment.

Canada is a federal state composed of ten provinces. Of the nine provinces other than Quebec, eight have an overwhelming majority of English-speaking residents. Quebec, on the other hand, has a majority of residents whose mother tongue is French and a sizable minority of residents whose mother tongue is English.

Since the inception of the Canadian federation in 1867, the goal of every Premier of Quebec has been to obtain greater autonomy within the federation, but without necessarily pursuing independence. However, in 1968, a major political party, the Parti Québécois (PQ), dedicated to the pursuit of the independence of Quebec, was formed. Initially the aim of the PQ was to seek independence for Quebec by a vote of the Quebec legislature. Defeated in the 1970 and 1973 elections, it finally succeeded in taking power in 1976 (with 40% of the popular vote) on a promise to hold a referendum on Quebec sovereignty. This marks the beginning of a first episode of political risk in Quebec. When the PQ finally held its referendum in 1980, it was defeated, with 60% of the voters being opposed to giving a mandate to the Quebec government to negotiate "sovereignty-association"[7] with the rest of Canada. The defeat of the PQ in the referendum led to a period

[7]The referendum question did not ask directly for support on independence, but rather asked for support on

of political calm in the 1980's. As also evidenced by poll results (see Table 1), during the 1980s, Quebecers seemed to have lost interest in sovereignty. The PQ was re-elected in 1981, but only after shelving its sovereignty plans. Subsequently, it was defeated in December 1985 by its federalist opponent.

The second episode of political uncertainty began in 1990 when the federal government's attempt at addressing Quebec's constitutional demands failed to be ratified by two of the ten provincial legislatures. The failure of this accord (referred to as the "Meech Lake Accord") which aimed at constitutional reconciliation of Quebec with the rest of Canada, was viewed in Quebec as a rejection by the rest of Canada, and led to an unprecedented rise in the popularity of the sovereigntist option in this province, as also evidenced by poll results (see Table 1). A period of high uncertainty followed, with the election of the PQ in 1994 (its first come-back after its 1985 defeat), and another referendum on sovereignty held in 1995, but lost by the PQ by 0.8% of the vote.[8] The 1995 referendum was defeated, but by a margin so narrow that, contrary to the aftermath of the 1980 referendum when the issue was put to rest, the period of political uncertainty that started in 1990 still continues to this day.

"sovereignty" together with a form of association with the rest of Canada. What is notable is that the form of the association in question and the degree of autonomy that was sought were not clearly defined. The question was intentionally ambiguous to garner the maximum of support, but the PQ lost the referendum nevertheless.

[8]As in the 1980 referendum, again the referendum question did not ask directly for support on independence, but asked this time for support on a "partnership proposal" with the rest of Canada taking the European Union (EU) as an example of the proposed partnership. As in the case of the 1980 referendum, again there was no tangible evidence that the rest of Canada would agree to any form of partnership or association other than the currently existing federal form. See Demers and Demers (1995) for a discussion as to why the EU model is not a viable option for the case of Quebec-Canada. The referendum question also stipulated that if a partnership could not be negotiated, independence would be declared unilaterally.

2.2 Does independence constitute political risk?

Should it separate from the rest of Canada, would an independent Quebec take its place among Western nations in a seemless transition, without any disruptions in economic activity and without costs, or does the threat of separation constitute political risk? Evidence from a poll carried out one month prior to the 1995 referendum for Quebec's Business Council (QBC),[9] indicates that an overwhelming majority of business executives in Quebec perceive separation as very costly for the Quebec economy. Thus, according to the QBC poll results, 90% of Quebec executives believed that Quebec would incur substantial costs following a yes vote to sovereignty; 83% believed that Quebec's economy would be severely negatively affected in the five year period following a yes vote; 65% believed that Quebec's economy would suffer from a long-term negative impact; 93% believed that negotiations with the rest of Canada would be long and arduous; 84% believed that a long period of political and economic instability would follow. Finally, 81% believed that immigrants and investors would be deterred from coming to Quebec. These poll results clearly indicate that separation from the Canadian federation is perceived to carry with it both long and short term costs for the Quebec economy.

An analysis of the events that are likely to accompany a move towards independence also confirms that sovereignty could be very costly for Quebec. In the aftermath of a Yes vote to sovereignty, Quebec could well face a financial crisis similar to or even worse than Mexico's 1994 crisis, as is argued in Demers and Demers (1995, Chapter 10). First, like Mexico, Quebec would suffer from some weak fundamentals. For example, Quebec would suffer from a large current account deficit as did Mexico. In addition, unlike Mexico, it would also have a large debt problem amounting to over 120% of GDP in contrast to Mexico's 40%. Second, it would have to renegotiate

[9] A poll conducted in September 1995 for *le Conseil du Patronat du Québec*, by the firm CROP specialised in public opinion research.

simultaneously its membership in the Canadian economic union and in the North American Free Trade Area (NAFTA), its use of the Canadian dollar, the division of the federal debt, etc...[10] Third, Quebec might even have to face the risk of partition of its territory due to opposing claims by native groups and some federalist groups in Quebec wishing to remain within Canada. Fourth, financial capital being highly mobile in Quebec[11], Quebecers would not hesitate to transfer their assets out of Quebec, especially in the face of uncertainty as to whether Quebec would keep using the Canadian dollar or not.[12] Their actions would precipitate a financial crisis.

The above discussion together with the QBC poll results, point to the fact that shifting to a regime in which Quebec becomes an independent state is clearly perceived as a shift to a riskier regime and one where economic conditions are expected to be worse than the current regime.

2.3 Perception of political risk: poll results and bond spreads

What do Quebecers (and finacial markets at large) think about the likelihood of separation of Quebec from the Canadian federation? In this section we try to assess the popular perception of the likelihood of shifting to a "bad" regime. Firms investing in Quebec pay close attention to indicators of this perception as a means of measuring the probability of independence. While there is no direct observation of this perception, we look at some indicators such as opinion polls, election

[10] In contrast, Mexico benefited from the confidence-building element of joining the NAFTA. However, in counterpart, Mexico suffered from the instability due to a political transition as a new untested president was elected to succeed President Salinas in an election marred by political assasination.

[11] As indeed it was in Mexico. Better informed of the economic and political situation than foreign investors, domestic Mexican investors precipitated the financial crisis by moving their peso-denominated assets into US dollars, and shifting them out of the country.

[12] While the PQ has asserted that it would wish to keep the Canadian dollar as the monetary unit in an independent Quebec, the need to devalue in face of a financial crisis would make it a difficult and undesirable promise to keep. For a detailed discussion, see Demers and Demers (1995), Chapter 10.

and referendum results, as well as data on bond spreads.

Opinion polls report the voting "intentions" of Quebecers in a referendum on independence. As we discuss below, (and as is well perceived by Quebecers) some of these intentions do not actually materialize into actual "Yes" votes in a referendum, and hence overestimate the actual support for sovereignty. It is common knowledge in Quebec that poll results may systematically overstate the Yes vote for several reasons not the least of which is peer pressure. (See Kuran (1990) for arguments indicating that people lie about their voting intentions due to peer pressure.) In addition, the poll results for the Yes vote also capture the response of some nationalist (but not sovereigntist) Quebecers who untruthfully indicate an intention to vote for sovereignty, as a means of signalling their desire for greater autonomy.

As for election results, they are indicative in that they measure the support garnered by the party in favour of independence. However, since there are only two political parties, (one which happens to be federalist and the other sovereigntist), public favour may shift from one party to another for reasons (such as public policy issues) other than their views on sovereignty. (This is also true of that segment of the population which may be termed as "soft" nationalists, who favour greater autonomy and are not completely averse to sovereignty.) Hence, election results also overestimate the actual support for sovereignty.

In Table 1, we establish what we will refer to as the "raw" poll data (given in the second column of Table 1)[13] For years during which there was an election or a referendum, we give preference to these results over poll results. For years during which no survey of opinion poll was conducted, we use an approximate figure in view of the political events of the time (see Appendix A for a thorough discussion). Table 1 clearly reveals that there were two major periods of political risk (1976-80 and 1990-95) separated by a period of stability.

[13]We thank Pierre Drouilly for kindly providing us with the poll data.

For reasons mentioned above, the raw poll data given in Table 1 may overestimate the perceived probability of Quebec sovereignty. To derive a more accurate measure of the perception of the likelihood of shifting to the "bad" regime, the predicted values from a 5-year moving average applied to the Yes votes in the raw poll data may be used. A potential problem is that even the smoothed poll results (given in Table 1 and displayed in Figures 2 and 3 in the next subsection) indicate that support for separation has been over 50% for a number of years in our sample. Given this fact, one could ask why has separation not occurred if the support is as high as even the smoothed poll results indicate? One explanation is that the poll data even if smoothed still contain noise, and do not perfectly measure the fundamental support for separation for the same reasons as those that affect the raw poll data. Hence, they again overestimate the perceived probability of transiting to a "bad regime."[14]

As an additional indicator of expectations, we also consider data on bond spreads between Quebec and Ontario bonds. This information is in Figure 1, which shows the difference between the spreads on 10-year bonds for Quebec and Ontario relative to Canada and the spread between 10-year Canada and US bonds. In the top panel of Figure 1, the data are monthly data from March 1990 to October 1999 while in the bottom panel of Figure 1, the data are monthly between February 1980 and December 1999. The time plot in the top panel of Figure 1 shows that the probability of separation (as reflected by bond markets) increased in 1990 and early 1991 following the rejection of Meech Lake; then declined for the remainder of 1991, and for 1992 and 1993 as investors became convinced that fundamental support for separation was lower than 50 percent and that the (federalist) Premier of Quebec would work to diffuse tensions. The difference between

[14]Another possibility is to define the "bad" regime as "unfavourable business conditions" due to the increased risk of separation. The problem with this definition is that recessions also create a bad business environment, and that the two episodes of political risk coincide or overlap with the 1980-82 and the 1990-91 recessions in Canada.

the bond spreads rose again in 1994 and 1995 with the provincial election and the referendum but eventually fell after the referendum. The spread is large but not very high in 1995, reflecting the fact that markets were worried but ultimately did not believe that separation would really happen. (Note, however, that the monthly data hides substantial daily fluctuations especially in the last weeks prior to the referendum.)

The perception of political risk can also be observed by analyzing the movements in the Canada-US bond spreads. The bottom panel of Figure 1 shows that there are several episodes of very high spreads between long-term Canadian and US bonds. Focusing on the 1990-91 episode in particular, while the high bond spreads are partly ascribable to the the Bank of Canada's concern about preventing the Canada-US exchange rate from slipping, and partly (from 1991 on) to the radical inflation reduction strategy adopted by the Bank of Canada[15], an additional effect that came into play in 1990 is the Meech Lake Accord. One can see that the spread was fairly high during the entire Meech Lake episode (June 1990), that is, both before the rejection and after. The high spreads in 1995 can be directly ascribed to the effects of political risk. Specifically, the bottom panel of Figure 1 shows that the spread between long-term Canadian and US bonds peaked in June 1995 as the pre-referendum discussions began, fell somewhat in August as it seemed that the forces of the "no" were getting ahead, then rose again to 1.82 in October just before the referendum. It subsequently declined after the defeat of the "yes"at the end of October.

The data on Quebec-Ontario bond spreads also confirm our intuition that even smoothed poll results overstate the perceived probability of separation. While the spread increased in 1990 and early 1991 following the rejection of the Meech Lake Accord, it declined for the remainder of 1991,

[15]Inflation was targeted to be reduced to 2 percent in four years 2 (and in fact, the recession helping, the target was achieved even sooner). This strategy, (together with the efforts to maintain the Canada-US exchange rate) required very restrictive monetary policy which drove interest rates up.

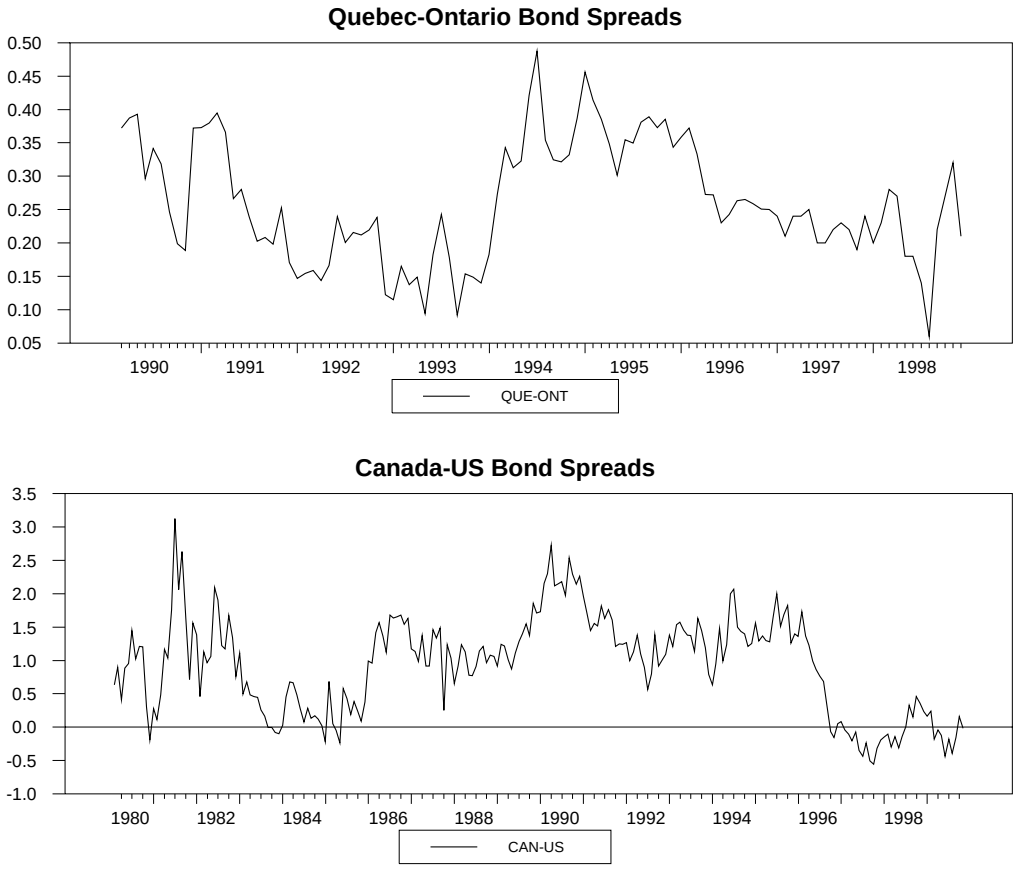

Figure 1: Bond Spreads

and for 1992 and 1993 as investors became convinced that the fundamental support for separation was lower than 50 percent, contrary to the smoothed poll results, which indicate that support for sovereignty was very high in this period.

All the indicators that we have considered in this section exhibit "nonstationarity". That is, there are breaks in the trend of the data depending on whether the economy is going through a period of political stability or one of political risk. Furthermore, as evidenced by the smoothed poll data, there is a difference in the trend even between the first episode of political risk and the second. To avoid problems of non-stationarity, we will only focus on the second episode of political risk, namely the 1990-96 period. In spite of the shortcomings mentioned above, and taking these caveats into account, we will also use the smoothed poll data as our measure of the perception of political risk in Quebec.

2.4 Investment and political risk: analyzing the data

We now relate our measure of political risk, namely, a five-year moving average of poll data (as described in the previous section), to investment behavior in Quebec. We also take the neighboring province of Ontario as a point of comparison and consider the relative investment performance in Quebec and Ontario. [16]

We use alternative measures of investment to examine investment performance by sector, by type of investment (public or private), and by type of the investment good (machinery and equipment or structures). Sectoral data on investment and capital stocks include both public and private investment expenditures.[17] To isolate the private response of investment to separation risk, we con-

[16] Taking Ontario's investment performance as a benchmark may be criticized on the grounds that political uncertainty relating to the Quebec issue has had an impact on the entire Canadian economy. However, its impact on Quebec has undoubtedly been far stronger. Hence the comparison is still relevant.

[17] The data that are used to calculate the investment series are described in detail in Appendix B.

sider investment expenditures in manufacturing industries (which includes nondurable and durable manufacturing industries). According to a study conducted by the firm Dun and Bradstreet, separatism has been responsible for the departure of more than 500 head offices from Montreal since 1976, and for the equally important departure of many strategic activities within corporate headquarters (though the extent of the latter is more difficult to quantify). To capture the effects of political risk on such headquarter or other coordinating activities, we also consider investment behavior in the broadly defined business sector (which includes manufacturing industries plus construction, transportation and storage, wholesale trade, retail trade, finance and insurance, real estate, business service industries, accomodation, food, and beverage services, and other service industries).

Figures 2 and 3 present time plots of the difference of the investment-capital stock ratios in Quebec and Ontario versus the results of the smoothed opinion polls (described in Section 2.3) for the period 1963-1998. The three panels in Figure 2 plot the difference of the investment-capital stock ratios for investment in machinery and equipment versus the poll results for each of the following sectors: the manufacturing sector, the more broadly defined business sector, and for total industries (including agriculture, natural resource industries, communications, and government and other public sector industries). Figure 3 provides the same information for investment in structures. One finding that emerges from Figure 2 is that while the investment-capital stock ratios in Quebec and Ontario are almost identical in 1963, a significant divergence has occurred by 1998, with the investment-capital stock ratios for investment in machinery and equipment across all three sectors in Quebec showing large declines relative to Ontario's after 1990. These declines coincide with the rise of political risk after the failure of the Meech Lake Accord in 1990 and the subsequent increase in support for separatism. As Figure 2 shows, the large decline in the investment-capital stock ratios after 1990 are accompanied by the equally large increases in the opinion polls favoring

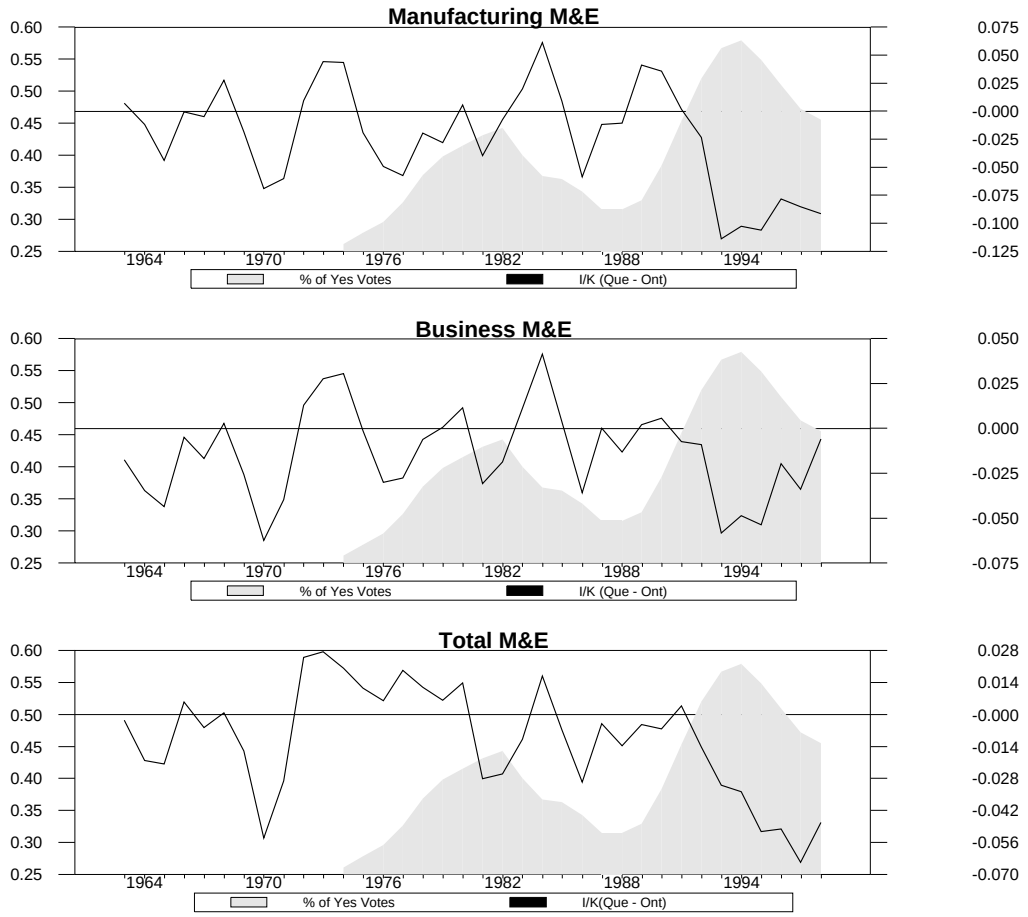

Figure 2: Poll Results versus Investment-Capital Stock Ratios – M&E

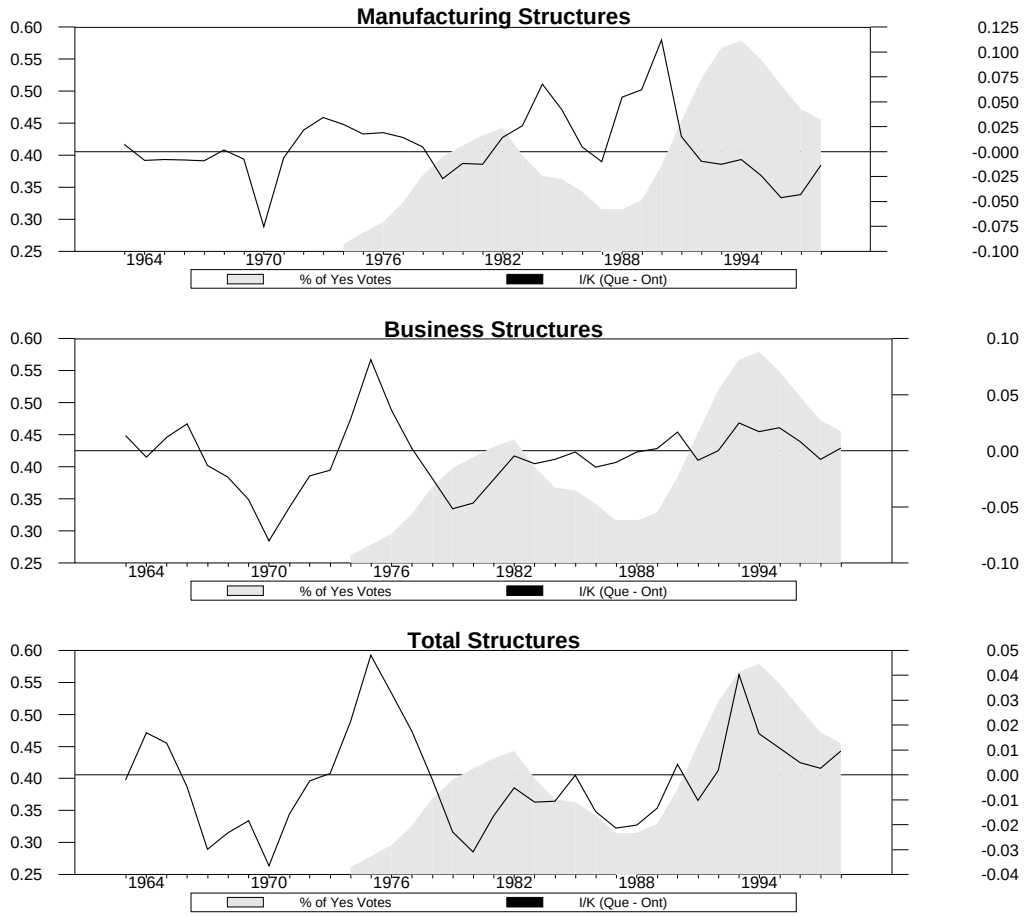

Figure 3: Poll Results versus Investment-Capital Stock Ratios – Structures

separation. As Figure 3 shows, similar declines in the investment-capital stock ratios are also observed for structures investment in Quebec after 1990. By contrast, investment as a fraction of the capital stock was higher in Quebec relative to Ontario for both machinery and equipment and structures in 1988.[18]

During the 1963-1998 period, we can identify four episodes: political stability (1962 -75); the first episode of political risk (1976-80); political stability (1981-89); and the second episode of political risk (1990-98). To test whether political risk had a significant effect in reducing the investment-capital stock ratio in Quebec relative to Ontario, we define the random variable $d_j \equiv [I/K_{Que} - I/K_{Ont}]^j$ as the difference between the investment-capital stock ratios for Quebec and Ontario, where $j = 0$ for the episode of political stability and $j = 1$ for the episode of political risk. Also define μ_j the population mean of d_j for $j = 0, 1$. As a simple test of the hypothesis that the divergence in the I/K values for Quebec versus Ontario are significantly related to the existence of political risk, we can test whether $\mu_0 = \mu_1$ versus the alternative that $\mu_0 > \mu_1$. We concentrate on the second episode of political risk because our simulation results pertain to this episode. Note that there was a recession in 1980-82 and another one in 1990-91. Thus by comparing the second episode of political stability 1981-1989 with the second episode of political risk, we can net out the effect of common Canadian factors that arise from the existence of the recessions in 1981 and 1990, respectively.[19]

[18]This is most likely due to a strong anticipatory reaction from Quebec to the 1988 Canada-US Free-Trade Agreement (FTA), which constituted a landmark in increasing its exports to the US market. The impact of the FTA on Ontario was also strong but was somewhat mitigated by industrial adjustments and by rationalization.

[19]There are two caveats to the above analysis. First, Ontario's economy (as all of Canada) has also been affected by political risk related to the Quebec issue, and second, Ontario's economy has been negatively affected by a social-democratic government in power from 1991 to 1995. However, with respect to the first caveat, the negative impact of political risk on Ontario's economy is substantially less than for Quebec. With respect to the second caveat, the

The sample values of the statistic for the test of the null hypothesis that $\mu_0 = \mu_1$ for the episodes of political stability 1981-1989 and political risk 1990-1998 are given by 2.71892, 1.79629, and 2.16126 for investment in machinery and equipment for manufacturing, business, and total industries.[20] Since the t-value for a one-sided test of the null hypothesis that $\mu_0 = \mu_1$ against the alternative hypothesis that $\mu_0 > \mu_1$ is equal to 1.746 at the 5% level of significance, we can reject the null hypothesis that the mean values of the variable $d_j \equiv [I/K_{Que} - I/K_{Ont}]^j$ were equal for $j = 0, 1$ in favor of the alternative that the mean value of $d_1 \equiv [I/K_{Que} - I/K_{Ont}]^1$ was lower than the mean value of $d_0 \equiv [I/K_{Que} - I/K_{Ont}]^0$. This indicates that I/K_{Que} fell significantly relative to I/K_{Ont} in the episode of political risk for investment in machinery and equipment in all three sectors described above. This result provides confirmation that the rise in political risk in 1990 led to a significant shortfall of the investment-capital stock ratio for Quebec relative to Ontario for investment in machinery and equipment, with the strongest effect occurring for the manufacturing sector.

Turning to the behavior of structures investment, the top panel of Figure 3 shows that $[I/K_{Que} - I/K_{Ont}]$ for manufacturing structures became slightly negative after 1990. The sample value of the test statistic that $\mu^0 = \mu^1$ versus the alternative that $\mu^0 > \mu^1$ for investment in structures in the manufacturing sector is 1.55988, which is significant at the 10% level but not at the 5 % level. Thus, there is some evidence for a decline in I/K_{Que} relative to I/K_{Ont} for structures

social democratic government in Ontario was defeated by a pro-business conservative government in 1996. As a result, there was a dramatic turnaround in Ontario's economy as early as 1994 as the defeat of the socio-democrats was widely anticipated.

[20] The sample statistic is calculated as

$$T = \sqrt{n_0 n_1/(n_0+n_1)}\left(\bar{d}_0 - \bar{d}_1\right) / \sqrt{\left(\sum(d_{0t} - \bar{d}_0) + \sum(d_{1t} - \bar{d}_1)\right)/(n_0 + n_1 - 2)},$$

where n_0 and n_1 are the sample sizes for the period of political stability and political risk, respectively.

investment in the manufacturing sector during the episode of political risk. By contrast, when the broadly-defined business sector and total industries are considered, we find the opposite result, that $[I/K_{Que} - I/K_{Ont}]^1$ is larger than $[I/K_{Que} - I/K_{Ont}]^0$ for structures investment. The values of the relevant test statistics are given by -3.12284, and -3.93376, respectively. The second and third panels of Figure 3 show that while the value of $[I/K_{Que} - I/K_{Ont}]$ for investment in structures in the business sector and for total industries fell after 1993 or 1994, it was positive and larger on average during the episode of political risk than its corresponding average value in the episode of political stability. The reason for these results may be that structures investment responds with a time lag to increases in political risk due to a time-to-build feature in investment.[21]

These results show that the episode of political risk in the 1990's is associated with a significant decline in the investment-capital stock ratio for investment in machinery and equipment in Quebec relative to Ontario. This relationship is the strongest for investment in the manufacturing sector. Since the irreversibility constraint is likely to be the most binding for manufacturing industries, these findings provide preliminary support for considering a model of irreversible investment to study the impact of political risk and uncertainty on investment behavior.

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[21] See, for example, Altug (1989).

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