A Proposal to Investigate How Government Policy Uncertainty Affects Innovation

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1. Motivation

The recent disputes over fiscal, monetary, and regulatory policy escalate uncertainty in economic environment within which businesses operate. An important question is how this increasing uncertainty affects real activities of firms? While previous studies suggest that uncertainty changes firms' investment and hiring decisions,[1] little is known about its impact on corporate innovation. Given that innovation is a key driver of economic growth, it is crucial to understand the relationship between uncertainty and innovation. We fill this gap by investigating how innovation is affected by government policy uncertainty (GPU) and what is the underlying transmission channel.

2. Theoretical Background and Empirical Hypothesis

The macroeconomic literature suggests an irreversibility channel through which uncertainty alters investments. Facing uncertainty, firms have incentives to delay their investments because of an increasing value of the option to wait and the partial irreversibility of investments (Bernanke (1983), Abel (1994)). Using volatility of stock returns as a measure for overall uncertainty, Bloom et al. (2007) and Bloom (2009) provide supportive evidence for this channel.

Nevertheless, the cost of capital as a major factor in firms' capital budgeting decisions may create an additional channel through which uncertainty affects investments. Recent studies in the finance literature show that uncertainty about government policy increases equity risk premium, since investors demand compensation for undiversifiable political risk (Pastor and Veronesi (2012, 2013)). Given that equity risk premium is a building block of the cost of capital, we expect that uncertainty will change firms' financing cost, which in turn will influence their innovation activities. Accordingly, we hypothesize that policy uncertainty affects innovation through its impact on firms' cost of funding (the financing channel).

3. Data and Measures

One challenge of this study is to find an appropriate measure of government policy uncertainty. Previous studies use variables such as stock return volatility or dispersions in analyst forecasts to capture *overall* uncertainty faced by a firm (Bloom et al. (2007), Bond and Cummins (2004)). However, such measures may not be able to properly quantify uncertainty related to government policy. As an attempt, Julio and Yook (2012) use national election years as an indicator of high political uncertainty. This proxy, however, does not capture variation in policy uncertainty in nonelection years. In this study, we adopt the time-varying uncertainty index recently developed by Baker et al. (2013) to measure policy uncertainty. The index is a weighted average of uncertainty related to taxation, government spending, and inflation, as well as the frequency of

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[1] See, for example, Bernanke (1983), Bloom et al. (2007), Baker et al. (2013).

major newspaper articles discussing economic policy-related uncertainty. This continuous index exhibits substantial variation over time and tends to spike during high policy uncertainty periods, such as debt-ceiling crisis, budgetary disputes, and tight presidential elections.

To investigate whether policy uncertainty affects innovation through the financing channel, we need a measure of individual firms' cost of capital. We estimate the cost of capital as the weighted average cost of capital (WACC). The WACC comprises a firm's cost of equity and after-tax cost of debt with its market leverage ratio as the weight. There are two main approaches to estimate the cost of equity. The earlier studies use *ex post* realized stock returns as a proxy for an *ex ante* expected returns, which is used to measure a firm's cost of equity (Campbell (1987)). Unfortunately, realized returns have been shown to be a noisy measure for expected returns (Elton (1999), Pastor and Stambaugh (1999)). In this study, we will use an *ex ante* proxy developed by the recent accounting and asset pricing research, namely the implied cost of equity. The implied cost of equity is defined as the discount rate (or internal rate of return) that equates a stock's present value of expected future cash flows to its current price. It is a forward-looking measure that utilizes forecasts of a firm's future fundamentals.

The firm-level financial data are from the merged CRSP-Compustat database and the stock price data are from GRSP monthly stock database. We use R&D spending to measure innovative input and use patent-based metrics to measure innovative output. Our patent-based measures include the number of patents applied by a firm in a given year, the citation count adjusted for truncation bias, and the originality and generality of patents.

4. **Empirical Strategy**

We first examine the relationship between government policy uncertainty and firms' innovation activities by estimating a panel data model that controls for the difference in observable and unobservable firm attributes. After establishing the relationship, we explore the financing channel by testing whether a firm's cost of capital is sensitive to changes in policy uncertainty using the estimated weighted average cost of capital for each firm in each year. We will also investigate whether firms' financing decisions respond to fluctuations in policy uncertainty.

A potential concern about the government policy uncertainty index is that the index may be endogenous. The effect of government policy uncertainty on innovation may be confounded by other confounding factors such as overall economic conditions or aggregate-level investment opportunities. We will adopt several approaches to address this concern and will also conduct a battery of robustness checks.

5. **Significance of Research**

This paper is related to the literature on the relationship between uncertainty and real economy. Our study will provide new firm-level evidence on another transmission mechanism through which policy uncertainty affects innovation, namely the financing channel. The findings will help policymakers to evaluate the impact of uncertainty about their policies on innovation and potentially on economic growth. Our study also adds to the literature on finance and innovation by identifying a new economic factor that shapes innovation.

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