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“The Timing of Irreversible Investment: Evidence
from the Texas Oilpatch”

Nearly all capital investments are irreversible to some degree; that is, some portion of the initial capital outlay cannot be recovered in the event that the investment is abandoned or dismantled. For example, should an automobile manufacturer decide to close an automobile factory, it may be able to recover some costs via sales of the building and equipment to other firms, but it will not be able to fully recover the factory's entire capital cost. That is, its factory investment is only partially reversible in the sense that a portion of the installed capital cannot be redeployed to an alternative use. In the oil industry, the focus of this proposed research, the drilling of an oil well is nearly a completely irreversible investment: the vast majority of the drilling cost is consumed in payments for rig services and steel well casing that cannot be recovered at all if the well is abandoned.

A large theoretical literature has developed to explain how firms should time irreversible investments in an uncertain economic environment. This work, perhaps best summarized in Dixit and Pindyck's 1994 text, views irreversible investment as a real option in that, at any given point in time, a firm may choose either to exercise its investment option immediately or to delay investment until the expected costs and benefits improve. As pointed out early in the development of this literature by Arrow (1968), and by Arrow and Fisher (1974) in the context of natural resources, delay may be optimal even if investing immediately has a positive net present value in expectation, because the economic environment may evolve in such a way that realized value will be negative. McDonald and Siegel (1986) formalized these concepts to mathematically show that, given some assumptions on the stochastic processes at work, the incentives to delay become stronger as expected volatility increases.

Empirical tests of real options theory, however, have lagged, particularly with regards to the important prediction that firms will be more likely to delay investment when expected volatility is high. The primary barrier to research on this topic has been a lack of data-- both investment activity and the expected returns to investment are usually difficult to observe separately, let alone simultaneously.

This research aims to overcome this problem by taking advantage of a dataset, obtained from the Texas Railroad Commission (TRRC), of oil and gas drilling activity in Texas during 1993-2003. Every well drilled in this dataset represents a discrete decision by a firm to make an irreversible investment in an asset expected to yield some value of hydrocarbons. We propose to combine these drilling data with crude futures prices, crude options prices, and drilling cost data to investigate whether firms delay their investments in response to increases in the expected volatility of the future price of crude oil.