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Market outcomes and dynamic patent buyouts[☆]Alberto Galasso^{a,b}, Matthew Mitchell^a, Gabor Virag^{a,*}^a Rotman School of Management, University of Toronto, Toronto, ON, Canada^b NBER, United States

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ABSTRACT

Patents are a useful but imperfect reward for innovation. In sectors like pharmaceuticals, where monopoly distortions seem particularly severe, there is growing international political pressure to identify new reward mechanisms which complement the patent system and reduce prices. Innovation prizes and other non-patent rewards are becoming more prevalent in government's innovation policy, and are also widely implemented by private philanthropists. In this paper we describe situations in which a patent buyout is effective, using information from market outcomes as a guide to the payment amount. We allow for the fact that sales may be manipulable by the innovator in search of the buyout payment, and show that in a wide variety of cases the optimal policy still involves some form of patent buyout. The buyout uses two key pieces of information: market outcomes observed during the patent's life, and the competitive outcome after the patent is bought out. We show that such dynamic market information can be effective at determining both marginal and total willingness to

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pay of consumers in many important cases, and therefore can generate the right innovation incentives.

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1. Introduction

Innovation is the main engine of economic growth, and the consensus among economists, beginning with [Arrow \(1962\)](#), is that the positive externalities from R&D imply under-investment relative to the socially optimal level. For example, a recent study by [Bloom et al. \(2013\)](#) estimates that the gross social rate of return to R&D substantially exceeds the private return, with the socially optimal R&D level more than twice as high as the currently observed R&D expenditure. A central policy question, therefore, is how one can best devise mechanisms that encourage innovation.

The patent system is one the main instruments used by governments to increase R&D incentives. Recently, increased attention has been paid to alternative reward mechanisms, which complement the patent system and can preserve innovation incentives, especially for breakthrough technologies that generate a large improvement in social welfare. McKinsey estimates that the total funds available from innovation prizes have more than tripled over the last decade to surpass \$375 million with a large number of philanthropists entering the business of rewarding innovators ([McKinsey, 2009](#)). For example, Qualcomm and Nokia have offered multimillion-dollar prizes for the development of affordable devices that can recognize and measure personal health information. Similarly, the Gates Foundation has offered an innovation award to those who help immunize children in the poorest regions in the world, and the X PRIZE Foundation offered a \$10 million Ansari Prize for a private space vehicle that can launch a reusable manned spacecraft into space twice within 2 weeks ([Murray et al., 2012](#)). At the same time, government interest in innovation prizes has also increased substantially. In the United States, President Obama's Strategy for American Innovation strongly encouraged the use of innovation prizes, and the America Competes Reauthorization Act of 2010 provided all federal agencies with the power to offer innovation prizes ([Williams, 2012](#)).

Despite this growing trend, little theoretical work on the design of innovation prizes has been conducted. This paper contributes to the recent literature focused on designing prizes that infer demand from various market signals and uses that information to design a reward at least partially based on a cash prize. We study the problem of a philanthropic or government agency interested in rewarding a breakthrough innovation with limited information on the research cost and the social welfare generated by the new technology. Following the mechanism design literature, we refer to such an agency as the "social planner." We show that, in a wide variety of environments, social welfare can be improved by prizes in the form of a buyout of patent rights over time. The buyout system replaces some of the rents obtained through monopoly rights with a prize.

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