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Risk, price regulation, and irreversible investment

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Abstract

We show that regulators' price-setting, rate base, and allowed rate of return decisions are inextricably linked if prices are set so that regulated firms just break even whenever they are forced to invest. Breaking even ex ante is a necessary condition for Ramsey pricing to be sustainable over time. Unless regulators adopt traditional rate of return regulation, the irreversibility of much infrastructure investment significantly alters the results of the approach to price-setting described by Marshall et al. (1981) [Marshall, William J., Yawitz, Jess B., Greenberg, Edward, 1981. Optimal regulation under uncertainty. Journal of Finance 36 (4), 909–921]. In particular, the practice of 'optimizing' inefficient assets out of the regulated firm's rate base, as occurs in total element long-run incremental cost calculations in telecommunications, exposes the firm to demand risk. The firm requires an economically significant premium for bearing this risk, and this premium is a function of both the systematic and unsystematic risk of demand shocks. In addition, we argue that if the firm is to break even under incentive regulation then the level of the rate base will exceed the optimized replacement cost by an amount which we interpret as the value of the excess capacity of the firm's assets. If this component is excluded from the rate base, incentive regulation will not be sustainable.

JEL classification: G31; L5

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1. Introduction

A regulator needs to make three decisions when setting the prices which a regulated utility may charge. It needs to choose the appropriate cost of the firm's assets (the rate base), the rate of return the firm is allowed to earn on this rate base, and the prices the firm is allowed to charge. Marshall et al. (1981) show how the last two decisions are interrelated. However, because they focus on traditional rate of return regulation, they do not discuss the effect of the choice of rate base. Nor do they consider the implications of irreversible investment, which characterizes most industries subject to price regulation.[1] In this paper we show that the choice of rate base can have a crucial impact on the other two decisions, and that the reason for this is the irreversibility of investment. In particular, we demonstrate that the regulator's choice of rate base and the form of regulation impact on the risks which the regulated firm faces, and thus on the rate of return it should be allowed to earn.

The Ramsey-pricing process for regulating a natural monopoly firm is, in a static setting, second-best welfare optimal in that it maximizes welfare subject to a zero profit constraint. We show how to implement the zero profit condition in a dynamic setting where the regulated firm is forced to make irreversible investments in order to meet demand. If welfare is to be maximized and the firm is to be financially viable in the long run, then the firm must just be able to cover the anticipated cost of worthwhile investments on a forward-looking basis.[2] We find, for a variety of forms of regulation, the rate of return that achieves this goal: our approach admits a mixture of markets supplied and products offered by the regulated firm. The way in which the zero profit condition is implemented is determined in large part by the regulator's choice of rate base, and this choice will affect the sharing of risk between consumers and producers, and thereby the overall level of welfare.[3]

There are two widely applied rate bases. Traditional rate of return regulation uses the depreciated historical installation cost of existing assets as the rate base. When combined with forecast operating expenditure, this yields the revenue requirement that, along with forecast demand, is used to set prices.[4] The historical cost rate base continues to be used in some situations, including elements of the electricity transmission system in the US. Historical cost rate of return regulation was widely used until the 1980s when it was gradually replaced with incentive regulation, where prices are set in ways that seek to

[1] Irreversibility is a widespread phenomenon, even in industries where physical capital is not especially industry-specific. For example, between 50% and 80% of the cost of machine tools in Sweden is sunk (Asplund, 2000), and the market value of physical capital in the US aerospace industry is just 28% of its replacement cost on average (Ramey and Shapiro, 2001). Irreversibility is likely to be even greater in most infrastructure networks. Hausman (1999) and Economides (1999) debate the extent of irreversibility in the context of telecommunications.

[2] Hausman and Myers (2002) argue that the provision of inadequate revenue to the regulated owner of the railroad infrastructure in the UK, Railtrack, led to under-investment in maintenance that contributed to accidents on that railway. Unable to raise funds in financial markets to finance investment in track upgrades, Railtrack was placed in liquidation by the UK government in October 2001.

[3] Cowan (2003) examines the effects of regulation in allocating price risk between consumers and shareholders, finding a trade-off between risk allocation and allocative efficiency.

[4] Typically, approved investment plans also affect the revenue requirement under rate of return regulation. For a discussion of the process of rate of return regulation see Spulber (1989, pp. 270–279).