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The investment tax credit and irreversible investment

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ABSTRACT

We examine the impact of random changes in investment tax credit (ITC) policy on the irreversible investment decisions of a monopolistically competitive firm facing demand uncertainty. We examine the impact of increases in risk and changes in persistence in the ITC policy on investment behavior. Our results indicate that a temporary ITC (lower policy persistence) generally increases the variability of investment both in the short and the long-run. It lowers investment in the short-run and raises it in the long-run. Thus, perhaps surprisingly, a temporary ITC does not always lead to higher investment but always leads to more volatile investment. Policy-makers may thus face a long-run trade-off between the level and the volatility of investment. We also find that increases in risk defined in terms of mean-preserving spreads may lead to lower investment.

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1. Introduction

Governments frequently modify tax laws, be it with the intent of stabilizing the economy through countercyclical actions, of stimulating the level of investment and long-run growth, of changing the composition of investment or of reducing its volatility. In a recent paper, Romer and Romer (2007b) argue that tax changes have a much stronger impact on real GDP than found in previous studies. They show that a 1% increase in taxes (as a percentage of GDP) reduces real GDP by 2–3% in US postwar data, and they trace the source of this effect to the strong (negative) impact of the tax change on investment. Thus, investment seems to be the component of GDP that is the most sensitive to tax changes. The investment tax credit (ITC) has been a popular fiscal tool to influence the level of investment for reasons of macro-stabilization or to stimulate specific sectors. While there has not been any ITC at the federal level since 1986, more recently there has been some support for the notion of reintroducing an ITC as a cost-effective way of stimulating investment. In addition, there are a very large number of sector-specific ITC measures that are provided at the state level.

Few papers have investigated the impact of tax policy uncertainty on investment decisions.[1] Yet, this topic is of theoretical, empirical and policy importance for developed, semi-industrialized and transition economies alike. For example, since tax

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[1] Among these we may note Lucas (1976), Abel (1982), Bizer and Judd (1989), Aizenman and Marion (1993), and more recently, Hassett and Metcalf (1999), to which we refer below. For a current review of tax policy, see Hassett and Hubbard (2002).

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policy often responds to economic conditions, firms may assign a positive probability that an investment tax credit (ITC) could be put in place should aggregate investment decline or should long-run growth issues become a public concern. Alternatively firms may anticipate a reduction or elimination of the ITC should there be an overheating of the economy.[2] Such considerations would affect both the timing and the amount of investment undertaken by firms. Uncertainty about the ITC could be expected to have an even more pronounced impact when investment is irreversible.

In this paper, we examine the impact of changes in the ITC in a framework where investment decisions are irreversible, and where firms must decide on whether to invest, and if so, how much. Hence, uncertainty may affect both the timing of investment (the extensive margin) and the quantity of investment (the intensive margin). In our framework, a change in the current value of the ITC affects investment directly through the current cost of investing and also by its informational content as it signals higher or lower values of future ITCs. Due to irreversibility, the anticipation of future tax changes affects investment by altering the expected marginal value of capital and the endogenous risk premium or option value of waiting.

We focus on the impact of changes in the persistence and volatility of the ITC. Hassett and Metcalf (1999) observe that the ITC seems to be better characterized by a stationary Poisson process in US post-war data. They assume in their study that the ITC follows a 2-state Poisson process, and analyse the impact of a mean-preserving spread (MPS) in this setting. We too assume that the ITC follows a Poisson process. However, US postwar data show that ITC changes may be more accurately characterized as a three-state process. Romer and Romer (2007a) provide a very extensive documentation of all tax changes in post-war US data.[3] For the period between 1946 and 1996, we note from their study that an ITC was first introduced in 1962 as a permanent measure, and was generally in effect from 1962 until the tax reform of 1986. During this period, the ITC went through several changes some of which were announced as being temporary and others permanent. It was temporarily suspended in 1966 for approximately one year, reinstated in 1967 (with a higher ceiling), repealed in 1969, reinstated (and temporarily increased) in 1971, reduced permanently in 1982 and finally repealed in the 1986 tax reform. There was no ITC between 1946 and 1962 and between 1986 and 1996. Thus, focusing on the period between 1946 and 1996, we may characterize the ITC as an on–off Poisson process with three states: a low state (ITC off), a high state (ITC on and high) and a medium state (ITC on but lower).[4] Hence, we consider a three-state (high/medium/low) Poisson process[5] to investigate the impact of both greater persistence and volatility.

It may alternatively be argued that when policy changes, the probability of another change occurring very soon thereafter should be low since it takes at least four quarters to implement a new fiscal policy. By contrast, the probability of a change should be much higher if the policy has been in place for a substantial amount of time. In order to capture this effect, we consider an alternative non-Poisson third order Markovian process for the ITC where the ITC state is duration-dependent: the longer a given ITC state has been in place, the lower the probability of remaining in that state. The impact of persistence and volatility is investigated in this model as well.

We first consider the impact of changes in the persistence of the ITC. In a context of certainty, the impact of higher tax incentives depend on whether they are temporary or permanent. A temporary ITC is typically expected to have a greater impact than a permanent one because it induces an intertemporal reallocation of investment. Under *uncertainty*, we examine the impact of the permanence of an ITC by investigating how changes in the persistence of tax incentives affect investment. We show that more temporary ITCs (lower policy persistence) lead to greater variability of investment. In addition, using numerical simulations, we also show that more temporary ITC's do not always lead to higher investment, but always lead to greater variability. When setting the ITC, policy-makers may face a trade-off between higher versus more stable investment.

We next consider the impact of increases in risk in the ITC. In their analysis of mean-preserving spreads (MPS) in the ITC when firms must optimally choose the time to undertake an irreversible investment project, Hassett and Metcalf (1999) find that an increase in tax risk actually reduces the time to invest. Hence, they conclude that greater randomness in the ITC *increases* investment. We show that Hasset and Metcalf's findings can be attributed in our framework to the impact of a "current cost" effect of a change in tax policy as firms seek to take advantage of higher than average tax incentives. We also show that in the context of the three-state Poisson model, when the firm faces uncertainty not only with respect to the *timing* of the change in the ITC (as in the two-state Poisson model), but also with respect to the *direction* and *magnitude* of the change in the ITC, greater randomness in the ITC in the sense of a mean-preserving spread *lowers* investment.

The remainder of this paper is organized as follows: Sections 2 and 3 present the theoretical framework and the simulation results, respectively, while Section 4 concludes.

2. The theoretical framework

Consider the problem of a monopolistically competitive risk neutral firm that faces uncertainty in its environment arising from shocks to demand and from randomness in tax policy.

[2] Numerous tax provisions affect corporate investment, three of the most noteworthy being the statutory corporate profits tax rate, depreciation allowance schedules, and the investment tax credit (ITC). All three affect the tax wedge, or the percentage of the purchase price of investment that the firm must pay. An examination of US tax policy shows that the tax wedge has been volatile at times partly as a result of changes in the ITC.

[3] See also Altug et al. (2004) for an analysis of the "tax wedge" affecting real investment decisions.

[4] Specifically, the ITC changes can be categorized as: $\underbrace{1946\text{–}1961}_{\text{no ITC}}$ $\underbrace{1962\text{–}1965}_{\text{med ITC}}$ $\underbrace{1966\text{–}1967}_{\text{no ITC}}$ $\underbrace{1967\text{–}1968}_{\text{high ITC}}$ $\underbrace{1969\text{–}1970}_{\text{no ITC}}$ $\underbrace{1971\text{–}1981}_{\text{high ITC}}$ $\underbrace{1982\text{–}1985}_{\text{med ITC}}$ $\underbrace{1986\text{–}1996}_{\text{no ITC}}$.

[5] More accurately, we assume the ITC follows a mixed Poisson process. A change in the ITC occurs in accordance with a Poisson jump process as in Hassett and Metcalf (1999), but conditional on a change occurring, the value of the ITC is itself random and may take on one of two values. In HM, conditional on a change occurring, the value of the ITC is known to the firm.

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