REGIONAL INCENTIVES FOR INVESTMENT IN MEXICO: THE ACCELERATED DEPRECIATION REFORMS*

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INTRODUCTION

THE SENSITIVITY OF INVESTMENT TO TAX changes has been a constant topic in the empirical and theoretical economics literature. Even one decade ago, the consensus was that investment does not react to changes in tax rates and depreciation rules; the estimated models implied implausibly large adjustment costs. However, a recent wave of empirical work has explained some of the reasons behind investment insensitivity and generated a new consensus estimate of the elasticity of investment with respect to the user cost of capital (a measure that includes the effect of taxation) between -0.5 and -1.0, implying that taxes, interest rates, and depreciation rules do affect investment decisions.[1]

The insensitivity of investment to tax changes has been explained, for example, by monopolistic competition in the capital goods market, which may cause prices and not quantities (investment) to react to subsidies (Goolsbee, 1998). Moreover, Dixit and Pindyck (1994) argue that there is a bias towards finding small effects because irreversibility might create ranges where investment does not react to changes in the user cost.[2] Finally, Desai and Goolsbee (2004) argue that depreciation rules are already too close to full expensing, and thus the recent U.S. bonus depreciation produced only small percentage changes in the user cost, which in turn implied small effects on investment.

Other explanations for investment insensitivity rely on econometric issues particular to each model. For example, Goolsbee (2000) and Chirinko, Fazzari, and Meyer (1999) find that measurement error in the user cost of capital causes a bias towards finding that taxes do not affect investment. Cummins, Hassett, and Hubbard (1994) also show that measurement error in Tobin's Q can cause this same bias.

The available empirical evidence on this topic for developing economies is scarce, mainly due to data limitations but also due to the complex way in which income from capital is taxed in many of these countries. This paper tries to partially fill this gap in the literature. Using a confidential panel database of Mexican manufacturing establishments, I estimate the sensitivity of investment to tax changes with a difference-in-differences approach.

Previous to 1999, Mexican tax depreciation rules included the option to expense the present discounted value of all future depreciation allowances using a favorable discount rate. Notably, only investments undertaken outside the three main metropolitan areas applied for this preferential tax treatment. In 1999 this system was eliminated to overcome a shortfall in government revenue caused by lower international oil prices. This policy change is arguably exogenous to firm investment decisions, providing a potentially valid justification for a difference-in-differences estimation.

LITERATURE ON INVESTMENT RESPONSE TO TAXES IN MEXICO

Evidence of the effect of taxes on investment in Mexico is scarce. Most of the analysis of investment that has been done at the aggregate or even at the micro level has not considered the effects of taxes. This omission is striking given the large changes that incentives for investment have experienced since 1950. Moreover, the notable exemptions briefly reviewed in this section present very contrasting results.

Feltenstein and Shah (1995) present a computable general equilibrium model to study the impact of taxes on investment in Mexico. Their calibrations show that taxes do affect investment. In a time-series framework, Shah and Slemrod (1995) analyze the effects of taxation on the aggregate flow of Foreign Direct Investment (FDI) to Mexico during 1960-1990. Their results suggest that FDI is very sensitive to taxes. Also using a time-series framework, Perez-Lopez (2004) develops a

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forecast model for Mexican investment where he proxies the tax component of the user cost by the ratio of income taxes (both personal and corporate) to GDP. The coefficient of this term goes in the wrong direction although is not significantly different from zero.

Finally, at the micro level, Schwartzman (1985) finds no support for the view that taxes affect investment in Mexico. He studies how real exchange rate fluctuations contributed to the large volatility of investment of 20 Mexican firms during 1975-1985 (through its effect on Q). His results support that taxes play a very secondary role in affecting investment.

ACCELERATED DEPRECIATION ALLOWANCES IN MEXICO

Overview of the Optional Accelerated Depreciation System

The Mexican government taxes corporate income at a flat rate (34 percent in 1994).[3] Depreciation allowances are based on a straight-line method of deductions for fixed asset purchases. The specific percentage deduction for each asset is specified in the Income Tax Law. For machinery and equipment, this percentage also depends on the industry in which it is used.

In 1994, depreciation rules also included the option to immediately expense the present discounted value of all future depreciation allowances, using a fixed (and favorable) real discount rate of 5 percent. Importantly, this Optional Accelerated Depreciation (OAD, or so called "Depreciacion Inmediata"), was only applicable outside the three main metropolitan areas of the country (i.e., Mexico City, Guadalajara, and Monterrey). For example, in the case of a building, with annual depreciation deductions of 5 percent (20 years of straight-line depreciation), the law allowed plants to immediately expense 62 percent of the acquisition cost, considerably higher than the 35 percent present discounted value of annual depreciation allowances using the market real riskless rate.

The 1999 and 2002 Reforms

The dependence of federal government revenue on oil exports, combined with lower international oil prices at the end of 1998 made it necessary to take some actions to increase revenue. The elimination of special regimes for the value added tax did not get support in Congress, and thus the government collected more revenue by increasing the corporate tax rate to 35 percent and eliminating the OAD system.[4]

Finally, at the end of 2001 the federal government promoted the implementation of a fundamental tax reform. Even if the final text of the reform was far from a fundamental reform, changes to corporate taxation were important. The corporate tax rate was gradually decreased from 35 percent in 2002 to 32 percent in 2005, while the OAD system was reinstalled.

DATABASE

The data for this paper comes from the Annual Industrial Survey (Encuesta Industrial Anual), conducted by the Mexican Statistics Agency (Instituto Nacional de Estadistica, Geografia e Informatica) and housed at its headquarters in Aguascalientes, Mexico. The survey consists of 7,171 manufacturing establishments from 1994 to 2002.[5]

The variables used in the empirical analysis include plant location (municipality), and information regarding its assets (values of existing assets, purchases of new assets, sales of assets, as well as economic depreciation and write-offs). This information is broken down into five categories of assets: machinery and equipment, constructions and facilities, land, transportation equipment and other assets. Since asset values and depreciation are reported at historic costs or gross book value, I merge this information with asset values at market prices from the 1994 Industrial Census, for a subsample of 4,997 plants.

To estimate each plant capital stock, I use the perpetual inventory method, taking as the initial capital stock the market value of assets from the 1994 Industrial Census.[6] Investment rates (I/K) were defined as the sum of gross capital expenditures (the sum of all assets purchased either in the domestic market or imported from abroad) minus asset retirements (the value of sales of assets, reported at market value), divided by the previous year stock of capital.

EMPIRICAL ANALYSIS

Given the potential exogenous nature of the 1999 and 2002 reforms, I follow a difference-in-differences approach to estimate the effect of taxes on investment. This reduced form estima-

tion, although simple, allows me to abstract from some of the econometric problems mentioned in the Introduction, like measurement error, endogeneity, etc.

In the main specification, I regress investment rates on a dummy equal to one in the years in which the Optional Accelerated Depreciation system was in effect (1994-1998 and 2002), a dummy equal to one if the plant was located outside the three main metropolitan areas (i.e., where the OAD system applies), and the interaction between the two:

$$I_{it}/K_{it-1} = \alpha_i + \beta_1 OAD^{period}_{it} + \beta_2 OAD^{region}_{it} + \beta_3 (OAD^{period}_{it} \times OAD^{region}_{it}) + \varepsilon_{it},$$

where, I: investment, K: capital, OAD^{period}: equals one in 1994-1998 and 2002, OAD^{region}: equals one for plants outside the main metropolitan areas, α: plant fixed effects, and ε: the disturbance term. In all cases, the subindex i defines each plant, while the subindex t defines each year.

The first column in Table 1 shows the results of this regression using only information for investment in machinery and equipment, which is arguably more homogeneous across plants. First, note that the coefficient on the OAD^{period} variable is positive and statistically significant, denoting that, as expected, investment rates were higher in the period in which the bonus depreciation was in place. Second, the coefficient on the OAD^{region} variable is not significantly different from zero, implying it is not possible to reject the null hypothesis that investment rates are equal inside and outside the main metropolitan areas of the country.

The most important result, however, is that of the interaction term. The coefficient of this term is, as predicted, positive and significant, implying that the reforms affected manufacturing investment, even controlling for general trends in investment. In particular, this implies that plants in the OAD region (outside metropolitan areas) reduced more of their investments in the years in which the investment subsidy was eliminated compared to plants that did not qualify for this special tax treatment.

As a robustness check, the second column of Table 1 specifically excludes the Tequila Crisis (1994-1995) period. Note that the coefficients on the interaction term and on the OAD^{period} dummy are both robust to this change. Notably, the coefficient on the OAD^{region} variable becomes statistically significant, implying that plants inside the metropolitan areas have higher investment rates than those in the OAD region.

Table 1
Difference-in-differences regressions

	Mach. & Equip.		*All capital*	
	(1)	*(2)*	*(3)*	*(4)*
LHS: I/K	*94-02*	*96-02*	*94-02*	*96-02*
OAD^{period}	0.026***	0.021***	0.026***	0.027***
	(0.006)	(0.006)	(0.005)	(0.005)
OAD^{region}	-0.036	-0.084**	-0.076**	-0.100**
	(0.037)	(0.042)	(0.033)	(0.039)
$OAD^{period} \times OAD^{region}$	0.015*	0.014*	0.018**	0.017**
	(0.008)	(0.009)	(0.007)	(0.007)
Constant	0.158***	0.182***	0.201***	0.214***
	(0.019)	(0.021)	(0.018)	(0.021)
Observations	33,678	26,194	93,555	72,765
R-squared	0.161	0.202	0.082	0.1
Plant FE	Y	Y	Y	Y
Year FE	N	N	N	N

I is investment, *K* is the capital stock. Robust standard errors in parentheses. All variables winsorized at 1 percent and 99 percent of the empirical distribution. *,**,*** significant at 10 percent, 5 percent and 1 percent, respectively. OAD stands for the region outside the main metropolitan areas, where the Optional Accelerated Depreciation applied in 1994-1998 and 2002.

Using all the information in the survey, the next two columns present the analysis of investment rates not only on machinery and equipment, but in other forms of capital as well. To this end, I construct a 3-dimensional panel, in which the unit of observation is not each plant, but the specific type of assets in each plant (increasing the number of observations almost four times the original). To control for specific characteristics of each type of asset in each plant, I include "plant × type of asset" fixed effects in the estimation.

Column 3 of Table 1 presents the estimation for the full 1994-2002 period. The results show that the precision of the estimation is considerably increased: the statistical significance of all coefficients increases, but the point estimates do not change. This provides evidence that not only investment in machinery and equipment, but in all forms of assets was affected by the tax reform. In particular, plants outside the main metropolitan areas adjusted more of their investment when subsidies were eliminated, compared to plants that did not qualified for the subsidy.

Finally, column 4 presents the analysis for all types of capital excluding the Tequila Crisis. As before, the results are robust to this change in specification. The results are also robust to the inclusion of year fixed effects. I omit these results from the table because it would not be possible to simultaneously estimate the effect of the OAD^{period} dummy variable and year fixed effects.

An important fundamental concern with the previous empirical estimation is the difference between short- and long-run dynamics. House and Shapiro (2006) show that for sufficiently forward looking investment in long lived assets, the elasticity to temporary changes in tax parameters is nearly infinite. If the elimination of bonus depreciation in Mexico in 1999 was seen as temporary, the relationship between short- and long-run dynamics could be an important determinant of the effect found in the previous analysis.

CONCLUSIONS

This paper shows that investment is responsive to tax changes. Exploiting the exogenous nature of the elimination of depreciation allowances in Mexico at the end of the 1990s, I was able to use a difference-in-differences approach to study how manufacturing plants adjusted their capital stock in response to the reduction of subsidies for investment. The results are robust to estimating the model for machinery and equipment investment only or to the estimation of a 3-dimensional panel using as the unit of observation the type of capital in each manufacturing plant in each year.

Across models, the results show that plants that qualified for this subsidy reduce more of their investment rates when the subsidy was eliminated, compared to plants that did not qualify for this special tax treatment. All the results are also robust to the exclusion of the Tequila Crisis period.

The analysis presented in this paper does not, however, exploit the large cross-sectional variation in the cost of capital provided by the aforementioned reforms.[7] In Ramirez Verdugo (2006a, 2006b), I explore in detail these considerations and estimate the elasticity of investment with respect to the user cost. Correcting the estimates for endogeneity and measurement error using instrumental variables, the results show that this elasticity is significantly greater than unity (the neoclassical benchmark), with a preferred estimate around -2.0 (also considerably larger than the consensus for the United States).

Notes

[1] See Chirinko (1993) and Hassett and Hubbard (2002) for reviews of the literature.

[2] Irreversibility refers to the situation where plant managers are reluctant to reduce their capital stock. This might be caused by large penalties to the prices of capital goods in the secondary market. Caballero, Engel, and Haltiwanger (1995) show that the pattern of investment by U.S. manufacturing plants is consistent with the presence of irreversibilities and other non-convexities.

[3] The Mexican corporate tax system is neutral with respect to inflation and is fully integrated with the personal income tax system. Investment tax credits are small and targeted to agriculture, thus, since my analysis focuses on manufacturing establishments, I omit its consideration.

[4] The Optional Accelerated Depreciation system was replaced with a system of differential taxation of retained earnings over distributed earnings. Specifically, retained earnings were now taxed at 30 percent and distributed profits were subject to the full 35 percent tax rate, while the tax liability (5 percent × taxable income) was deferred until distribution.

[5] In this paper I use the most recent panel of the Annual Industrial Survey, which covers 205 6-digit industries, excluding maquiladoras, basic petrochemical plants, refineries and plants with less than 15 employees. See INEGI (2005).

[6] Previous studies that have used the Annual Industrial Survey use the initial reported gross book value of assets as the initial capital stock in the perpetual inventory method. This procedure can yield misleading measures in short panels for two reasons. First, this method approximates the market value of assets by the book value of assets in the initial year, relying on the length of the panel to erode this bias. Second, the reported book value in the survey is not net of depreciation, and thus might include assets already fully depreciated. The use of market value figures from the 1994 Industrial Census allows me to overcome these problems.

[7] This large cross-sectional variation comes from: industry variation driven by economic depreciation rates; pure time-series variation driven by interest rates; time-series and industry level variation driven by changes in the ratio of prices of capital goods and output; and time-series, industry, and regional variation driven by the changes to the system of depreciation allowances.

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