

# **Tax holidays and foreign investment: what happens when the holiday is over?**

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## **Abstract**

Under tax holidays, foreign firms are taxed at rates that are lower than the usual, in the belief that these temporary benefits may entice these firms to remain in the country. We evaluate the impact of terminating or reducing these tax benefits upon the exit decision by U.S. firms that were established in Puerto Rico. Our results indicate that whenever benefits are reduced or terminated the probability of exit increases in a non-trivial manner.

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We are grateful to PRIDCO for providing the data

## **1. Introduction**

Many countries have specific policies designed to attract foreign direct investment. One of the most common instruments of such policies are tax holidays, that is, periods during which firms are temporarily taxed at rates that are lower than normal (UNCTAD 2000). Tax holidays not being uncommon among OECD countries, are especially popular in developing countries (Goodspeed 2006).

One of the reasons tax holidays are popular in developing countries is the ease of their administration. However, the effectiveness of tax incentives in attracting investment and promoting development has been questioned (Woodward 1974, Root and Ahmed 1978, Lim 1983, Baumol and Wolff 1996, Guimarães, Rolfe and Woodward 1998, Single 1999) and many, starting with Baer (1959), have expressed concerns that projects attracted by tax holidays may leave the country when the incentives end.

Evidence of a relationship between the end of tax holidays and the exit of firms is mostly anecdotal. For example, a report from the United Nations comments on “the example of a manufacturer of computer microprocessors, which enjoyed an eight-year tax holiday in an Asian developing country. At the end of the tax holiday, the manufacturer simply packed up and set up a new operation in a neighboring country, which offered a new tax holiday” (UNCTAD 2000 p. 25). The closest attempt to systematically analyze the impact of tax holidays on the survival of firms was provided by Bond (1981), who examined a set of 152 firms established in Puerto Rico. For a long period Puerto Rico maintained a consistent policy for attracting foreign capital, by which foreign investments benefited from tax exemptions during the first years of operation. Bond collected data on firms that had been established between 1949 and 1972, noting whether they were tax exempt at the beginning of 1975 and whether they

were still in operation at the end of that year. He found that being tax exempt significantly increased the probability of a firm still being in operation in 1975. Bond was not able, however, to relate the moment in which firms exited to the end of the tax exemption. This is because Bond did not have information on when firms left the country nor on whether firms that were not tax exempt in 1975 had never been exempt or if they had been exempt but their exemption period had already ended.

In this paper we use a unique and very detailed data set on firms that were established under the Puerto Rican tax holiday program. The data cover a period of 28 years and include information on the moment the investment took place, the duration of the tax holiday, and the moment the firm left the country. This allows us to shed light on the relationship between the end of the tax holiday and the moment firms leave the country. The overall length of the tax holiday in Puerto Rico varied between 10 to 25 years, depending on the specific location of the investment, longer holidays being available in less developed areas. In addition, and regardless of the location, the level of the tax exemption was progressively reduced every five years. We are able to identify both the starting date and location of each investment in our sample. We are therefore able to identify the schedule of the tax exemption that each firm benefited from. Furthermore, we are able to identify not only whether or not the firm did exit, but also the exiting date for those firms which have exited. This enables us to study whether the close of the tax holiday and the change in the level of the tax exemption exert an impact on the probability of exit.

Our findings indicate that both the end as well as changes in the tax exemption impact negatively on the probability of survival. Although the impact of termination seems to be somewhat greater than that of a mere change, the difference is not significant, either in economic or statistical terms. On average, the probability of exit in

our sample is 7.1% per year. We find that each time the tax exemption changes or terminates the probability of exit increases by around 3 percentage points for a period of three years.

In the next section, we summarize the available economic models of tax holidays. We describe the Puerto Rican tax holiday policy and our data set in sections 3 and 4, respectively. Section 5 presents the estimation and results while, in section 6, we offer concluding remarks.

## **2 . Why do countries offer tax holidays?**

Even though tax holidays are relatively common, there are few economic models that explain why countries use this instrument and choose to favor new investment over investment by existing firms.

Favoring new over existing investment can only be rationalized if there is some asymmetry between new and already operating firms. Different models of tax holidays assume that the asymmetry lies in different areas. Bond and Samuelson (1986) emphasize information asymmetries, while Doyle and van Wijnbergen (1994) emphasize that, unlike firms which are currently operating, potential firms have not yet committed resources to the host country.

Bond and Samuelson (1986) suggest that the tax holidays offered by countries to attract foreign investment serve as a signal that the country possesses superior local factors. The argument is that the quality of the local factors that will be used by firms differs among locations and, while countries know this quality, firms do not. A country with low quality factors would have little to gain from offering a tax holiday. It would incur the cost of the incentive without reaping much benefit, as firms would leave the country once they realize that the local factors are of low quality. On the contrary,

countries with high quality local factors would see that firms stay in the country even after the tax holiday expires as high quality local factors enable them to operate efficiently. Consequently, these countries have the opportunity to reap benefits that more than compensate the cost of the tax incentive, while low quality countries do not. Since the offering of tax breaks benefits only high quality countries, Bond and Samuelson (1986) conclude that these countries may issue such breaks as a way to signal the superior quality of their local factors.

Doyle and van Wijnbergen (1994) advance a different argument. They argue that the reason countries use temporary tax incentives is to exploit the fact that firms are locked-in once they invest in a country. After making location-specific sunk investment in a given country, firms see their bargaining power reduced relative to that country. The attractiveness of alternative locations decreases and host countries exploit the increase in their bargaining position by raising taxes. A critical ingredient of models of this family is the inability of the country to make a long-term commitment to keep taxes low.

If capital is immobile to some extent and if there are benefits from locating in a neighborhood where other firms already operate, providing benefits that allow a critical mass of firms to locate in one country may lead other firms to subsequently locate there even if the benefits are then lower than they were previously. Konrad and Kovenock (2009) suggest that because of this it may make sense for developing countries to use tax holidays more intensively than developed countries.

These highly simplified models provide us with some important insights about the rationale for the existence of tax holidays. They predict that firms will not leave the country after the end of the tax holiday more than they do during the holiday. In Bond and Samuelson (1986) firms are left indifferent between staying in the host country and

opting for the outside alternative, which consists of returning to the home country. Similarly, the perfect-equilibrium in Doyle and van Wijnbergen's (1994) game is such that the multinational firm has a null expected profit and no incentive to leave the host country. Whether or not this is the case, it remains a question to be answered empirically.

### 3 . The foreign investment policy in Puerto Rico

Since the 1950's Puerto Rico has sought to attract FDI, particularly U.S. based investment, with an active policy primarily based on tax incentives. This policy was designed to target multinationals willing to set up new manufacturing plants as well as export oriented service industries. Moreover, with the implementation in 1976 of the legislation known as Section 936, U.S. companies were allowed to take a tax credit against U.S. income taxes equal to the U.S. tax on income derived from Puerto Rico. This policy encouraged a substantial amount of U.S. investment in the island. Section 936 was revoked by the U.S. congress in 1996, but a grandfathering clause extended its benefits until 2005 to firms which had invested during its incidence.

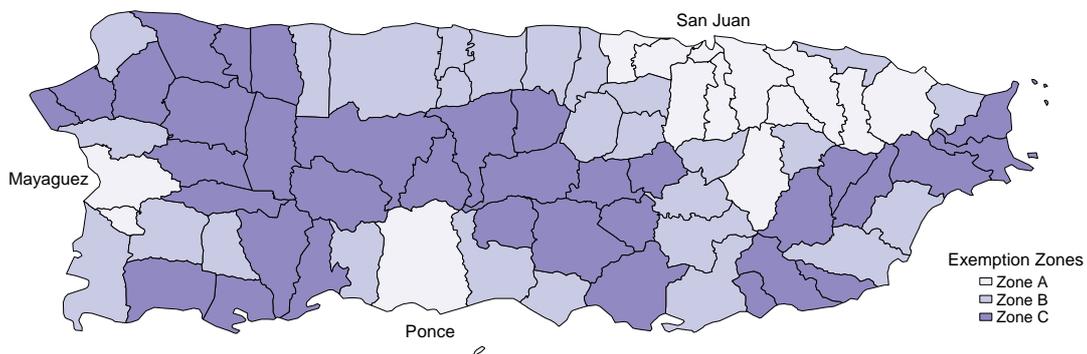


Figure 1 - Tax Exemption Zones in Puerto Rico

The investment incentives offered by the Puerto Rican government remained roughly constant over a long period of time. According to several Tax Incentive Acts enacted since 1979, Puerto Rico was segmented into three areas, each having different levels of economic development. These regions (shown in Figure 1, as of January 1979) show sharp differences in the levels of economic development (Table 1). Per capita income is much higher in Zone A than in the other two areas and the literacy rate, an indirect indicator of the quality of the labor force, is also highest in Zone A. Zone A also scores much better than the others with respect to unemployment. During the 1980s Puerto Rico had an exceptionally high unemployment rate, which stayed above 20% throughout the first half of the decade, but unemployment was much lower in Zone A. Conversely, Zone C performs consistently worse than the others in all of these three indicators.

**Table 1 –Key Economic Indicators by Zones**

	Unemployment Rate	Per Capita Income	Literacy Rate
Zone A	14.9%	\$2,454.2	92.5%
Zone B	25.1%	\$1,659.9	87.6%
Zone C	30.8%	\$1,438.1	86.3%

Source: Data for the unemployment rate is for 1985 and come from the U.S. Bureau of Labor Statistics while the data for per capita income and literacy rates are from the 1980 U.S. Census of Population and Housing. Reported values are population-weighted means.

Because the Puerto Rican “Tax Incentive Acts” intended not only to attract foreign capital, but also to pursue an active policy aimed at reducing the economic regional disparities, the benefits differed for firms locating in the different areas. Firms in the more industrialized area around San Juan (*Zone A*) benefited from a period of 10 years of reduced taxes. The tax holiday was extended to 15 years, although at a lower level, for those firms that located further away from the core zone of San Juan but in areas considered to have an intermediate level of development (*Zone B*). The low

development areas in the southwestern and interior part of the island benefited from a period of tax exemption of 20 years (*Zone C*)<sup>1</sup>. Table 2 shows the phasing out of the tax holidays according to the zones.

**Table 2 – Percentage of Investment Income Exempt by Zones**

Years of Exemption	Zone A	Zone B	Zone C
1 - 5	90%	90%	90%
6 - 10	75%	75%	75%
11 - 15	0%	65%	65%
16 - 20	0%	0%	55%

Although the policy remained constant throughout the period of analysis, the specific municipalities included in each area have changed over time, even though not very much. The zones were defined by Governor Decrees, and once established under a given regime, firms were entitled to maintain the level of benefits that applied at the moment of establishment, even if the benefits corresponding to the specific zone where the firm was established were reduced. Firms in areas where the benefits were extended were sometimes able to renegotiate the extension of the benefits beyond the original deadline. For more details on the Puerto Rican location incentive program see Schwartz, Pelzman, and Keren (2008) and Pelzman (2002).

#### **4. Data**

The data we used in our analysis originate from PRIDCO – the industrial development office of Puerto Rico – and include information on each investment taking place under the Puerto Rican tax holiday acts between 1979 and 2007.

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<sup>1</sup> A fourth zone not considered in our analysis includes the offshore islands of Vieques and Culebra where the tax holiday extended for 25 years.

The data include information on the country of origin, the dates of establishment and closure (censored for firms that were still operating as of September 2007), the magnitude of the prospective investment, the predicted employment and prospective sales, industry affiliation, and municipality where the investment took place. Location is a crucial variable for our analysis as, under the Puerto Rico industrial development policy, location is the basis for determining the duration of the tax holiday that each investing firm benefits from.

Our sample consists of 651 U.S. based firms established between 1979 and 1997. We restricted the data to American firms to reduce heterogeneity and required that firms were established no later than 1997. With this procedure we guarantee that most firms were established while Section 936 was in force, while at the same time we are able to observe firms for a minimum of 10 years.

**Table 3 – Distribution of Investment Projects by Exemption Zone**

	Projects		Employment		Payroll		Investment	
	Number	(%)	Number	(%)	Number	(%)	Number	(%)
Zone A	180	27.6	12,712	13.1	247	12.1	384	11.7
Zone B	337	51.8	51,767	53.3	1,143	55.7	1,830	55.7
Zone C	134	20.6	32,628	33.6	660	32.2	1,069	32.6
Total	651		97,107		2,050		3,282	

Note: All figures are prospective at the time of the investment. Payroll and investment are expressed in 2005 million dollars.

While investments can be found in practically all municipalities, the majority are located relatively close to the major metropolitan areas around San Juan, Ponce and Mayaguez. Most of the investments in our sample (52%) are located in Zone B, with Zone A receiving 28% and Zone C 21%. Even though Zone C received the lowest number of investments projects, these projects are larger than average in terms of employment, payroll and investments (Zone C received close to 1/3 of all these variables despite having only 1/5 of the total number of projects). In contrast, the

number of projects in Zone A is more than a quarter of the total number of projects, but these account for about one eighth of employment, payroll, and investments.

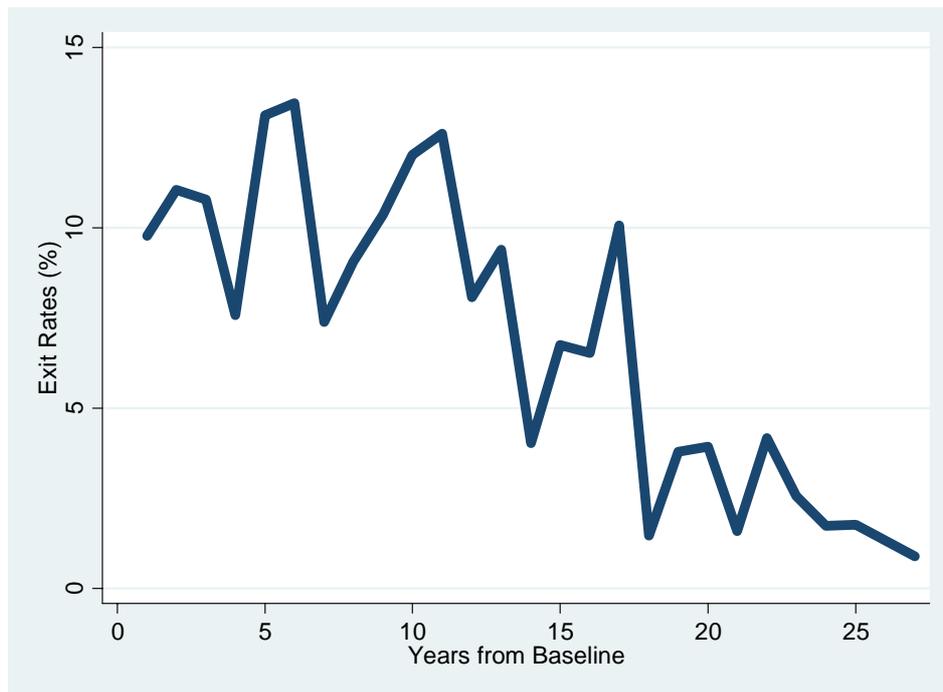
**Table 4 – Distribution of Investment Projects by Industry**

Industry	Projects		Employment		Payroll		Investment	
	Number	%	Number	%	\$	%	\$	%
36-Electronic & Other Electr Equip	101	15.5	18,514	19.1	394	19.2	412	12.5
40-Export Service Industries	101	15.5	2,410	2.5	63	3.1	54	1.6
38-Instruments & Related Prod	70	10.8	13,592	14	396	19.3	619	18.8
23-Apparel & Other Textile Prod	68	10.4	17,401	17.9	241	11.8	67	2
28-Chemicals & Allied Prod	68	10.4	8,865	9.1	278	13.5	1,139	34.7
35-Industrial Machinery & Equip	43	6.6	10,608	10.9	230	11.2	382	11.6
30-Rubber & Misc Plastic Prod	42	6.5	4,337	4.5	80	3.9	111	3.4
34-Fabricated Metal Prod	27	4.1	1,565	1.6	30	1.5	155	4.7
20-Food & Kindred Prod	22	3.4	3,939	4.1	72	3.5	75	2.3
39-Misc Mfg Industries	22	3.4	2,106	2.2	34	1.6	51	1.6
27-Printing & Publishing	21	3.2	1,368	1.4	32	1.6	39	1.2
26-Paper & Allied Prod	16	2.5	800	0.8	17	0.8	34	1.1
31-Leather & Leather Prod	15	2.3	6,671	6.9	104	5.1	29	0.9
22-Textile Mill Prod	8	1.2	1,873	1.9	28	1.4	19	0.6
32-Stone, Clay & Glass Prod	7	1.1	885	0.9	18	0.9	11	0.3
25-Furniture & Fixtures	6	0.9	585	0.6	9	0.4	3	0.1
37-Transportation Equipment	6	0.9	1,100	1.1	15	0.7	13	0.4
29-Petroleum Ref & Related Ind	4	0.6	315	0.3	7	0.3	53	1.6
33-Primary Metal Industries	4	0.6	173	0.2	3	0.1	17	0.5

Note: All figures are prospective at the time of the investment. Payroll and investment are expressed in 2005 million dollars.

The sectoral distribution of these investments is presented in Table 4. All major manufacturing sectors (with the exception of tobacco products) received investment projects, with no obvious concentration in a single area. *Electronic and Other Electric Equipment* along with *Export Service Industries* received most of the projects (15.5% of the total number of projects each), but the other available metrics such as employment, payroll and amount invested portray a different picture. In terms of employment, *Electronic and Other Electric Equipment* (19.1%) remains the largest industry followed by the labor intensive *Apparel & Other Textile Products* (17.9%) while *Export Service Industries* drops to a low share of 2.5%. A similar picture emerges when we look at the variable payroll but this time the leading industry is the better paying *Instruments &*

*Related Products* sector. Finally, the distribution based on amount invested gives yet a different picture. With more than one third of the total, *Chemical and Allied Products* stands out as the most important industry; a closer look at the data reveals that these investments are mostly in the pharmaceutical industry. This brief analysis suggests that all these different factors, particularly the magnitude of the investment, are important factors that need to be taken into account when analyzing the exit of firms.



**Figure 2 - Exit Rates of U.S. Multinationals in Puerto Rico**

Of the whole set of firms in our sample, 539 had exited by 2007. Figure 2 shows the evolution of the exit rates for the U.S. multinationals. A quick inspection of the graph shows that overall exit rates tend to decrease over time with small peaks following immediately after the 5th, 10<sup>th</sup>, and 15th year. The graph seems to lend support to the idea that U.S. multinationals tend to cluster their exit times around the time when tax holidays decrease or expire.

## 5. Estimation and results

Given the nature of our data we opted to estimate a discrete-time transition model using a (stacked) logit binary choice model. The appeal of such procedure resides in its simplicity, which allows one to use the desirable properties of a duration model within the context of the well known logit framework (see Cameron and Trivedi, 1995).

Implementation of the stacked logit regression is done by letting each observation in our data correspond to one firm in one given year, provided of course, that the firm was active at the beginning of that year. As we are interested in evaluating the impact of tax exemption upon the exit of firms, our dependent variable is a dummy variable indicating whether or not the firm exited in each period. The right hand side variables include controls for age, characteristics of the firms, and indicators of whether the level of the tax exemption had changed (or the tax exemption was terminated in that period).

While the policy has precisely defined lengths for the tax exemption, in reality things can be somewhat more blurred, as firms may apply for extensions. Reasons for extensions include the firm having losses or undergoing an expansion during the period of exemption. Matters are further complicated by the fact that after the end of the initial exemption firms still may negotiate an extension of the exemption for another 10 years, albeit at a lower rate. These negotiations and their outcomes are not made public. All of these possible extensions create noise in the data, and make it difficult to identify the effect of the end of the extension upon survival. Still, as we know that the effect of measurement error is to bias the estimates downwards, if we are able to find an effect in our data, the presumption is that the actual effect will be larger than estimated.

In order to account for the possibility that the end of the exemption comes later than originally defined or that there may be some lag between the end of the exemption and the moment of exit, we defined different control dummies. The first takes the value

1 if the level of the tax exemption changes in that year and 0 otherwise. A second dummy takes the value 1 if the exemption changed in the previous year and 0 otherwise. Two other dummies take the value 1 if the exemption changed in two and three years before, respectively. Because it is plausible that the end of the exemption has a greater impact than its mere reduction, we created a similar but separate set of four dummies that take the value 1 if the exemption ends in that year or in one of the three preceding years. In Table 5 we report the average marginal effects for the stacked logit regression. Firm level cluster-robust standard errors are also reported thereby providing a more conservative approach for statistical inference.

**Table 5 – Determinants of Exit of U.S. Multinationals**

	(1)	(2)	(3)
Age	-0.0019*** (0.0006)	-0.0006 (0.0007)	-0.0011 (0.0008)
ln Emp		0.0199** (0.0086)	0.0194** (0.0086)
ln Inv		-0.0163*** (0.0031)	-0.0162*** (0.0031)
ln Pay		-0.0179* (0.0098)	-.0178* (0.0098)
<i>Exemption decrease</i>			
T			0.0308** (0.0136)
t + 1			0.0423*** (0.0150)
t + 2			-0.0066 (0.0138)
t + 3			0.0064 (0.0152)
<i>End of exemption</i>			
t			0.0307 (0.0283)
t + 1			-0.0053 (0.0271)
t + 2			0.0824** (0.0383)
t + 3			-0.0226 (0.0289)
Log-likelihood	-1,819.6	-1,771.4	-1,760.3
Akaike Information	3,643.3	3,552.8	3,546.5

Note: Coefficients in the table are marginal effects evaluated at the sample means. The number of stars indicate significance levels as follows: \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

Columns (1) and (2) show the impact of the control variables (a constant is always included in the regressions, although not reported in the tables). The first column

shows that the exit rate falls over time, which sits well with the findings of Zaheer (1995) and Mata and Portugal (2002), who found that foreign firms display lower exit rates as they grow older. However, this effect becomes non-significant when the three control variables in column 2 are included (a quadratic age specification and a logarithmic specification for age were also attempted, but age was never found to be significant).

The three control variables in column 2 are in logs and measure different facets of size: the magnitude of the prospective investment (*ln Inv*), the prospective number of employees (*ln Emp*) and the size of the payroll (*ln Pay*). Earlier investigators have found firm size to be negatively related to exit from foreign countries (e.g., Mata and Portugal 2002, Gorg and Strobl 2003, Bernard and Jensen 2007, Mudambi and Zahra 2007) and we find the same. Investment and payroll attracted negative signs, while employment attracted a positive coefficient. For a given level of investment and payroll, firms with larger employment use less qualified personnel and more labor intensive technologies, and this seems to have a negative effect upon the chances of survival (if only one control variable is included, this attracts a negative coefficient, no matter which variable is included).

The third column includes our eight dummies indicating whether the exemption has changed or ended in the period or in one of the subsequent periods. The results indicate that the effect of changing (but not terminating the exemption) occurs immediately after the level of the exemption changes (an increase of 3 percentage points (p.p.) in the same year and 4 in the following year) while for the end of the exemption the effect seems to be visible two years afterward (an increase of 8 p.p.). These results are robust to several exclusions of the other dummies.

The results indicate that both the changes and the end of the tax holiday affect the survival of firms, although the effect of the end of the tax exemption seems to occur with a somewhat longer delay. The effect of the termination also seems to be greater in magnitude; the magnitude of the estimated effect of termination in the contemporaneous year is 3 p.p. (although this estimate is not significant).

This lag structure is somewhat *ad-hoc* and one may not be comfortable with it. We therefore estimated more parsimonious models imposing equality restrictions on the coefficients of specification reported in column (3) of Table 5. We assumed that the effect begins in the year when the exemption changes (or terminates) and remains constant for a number of years. These simpler specifications will capture the essence of the models in Table 5.

**Table 6 – Determinants of Exit of U.S. Multinationals: Alternative Specifications**

	(1)	(2)	(3)	(4)	(5)
Age	-0.0011 (0.0007)	-0.0012 (0.0007)	-0.0011 (0.0007)	0.0009 (0.0007)	-
In Emp	0.0194** (0.0086)	0.0196** (0.0086)	0.0195** (0.0086)	-0.0010 (0.0125)	-0.0006 (0.0125)
In Inv	-0.0163*** (0.0031)	- 0.0163*** (0.0031)	-0.0163*** (0.0031)	-0.0178*** (0.0043)	-0.0186*** (0.0044)
In Pay	-0.0177* (0.0098)	-0.0178* (0.0098)	-0.0178** (0.0098)	-0.0068 (0.0121)	-0.0063 (0.0121)
Decrease t, t+1	0.0356*** (0.0099)				
Decrease t, t+1, t+2		0.0233*** (0.0087)			
End t, t+1, t+2	0.0350* (0.0186)	0.0350* (0.0188)			
Change t, t+1, t+2			0.0236*** (0.0076)	0.0265*** (0.0080)	0.0223*** (.0079)
Dummies					
Area Exemption (2)	N	N	N	Y	Y
M Code (69)	N	N	N	Y	Y
Industry (19)	N	N	N	Y	Y
Year Start (18)	N	N	N	Y	Y
Current Year (27)	N	N	N	N	Y
Log Likelihood	-1763.00	-1766.37	-1766.53	-1695.31	-1677.39
Akaike Information	3540.0	3546.8	3545.0	3602.6	3616.8

Note: Coefficients in the table are marginal effects evaluated at the sample means. The number of stars indicate significance levels as follows: \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

The results of estimating these models are shown in Table 6. We estimated models with windows of 1, 2, 3, and 4 years. For comparing the different specifications and to select our preferred one, we chose the model with the lowest value for the Akaike information criterion. The first column contains our preferred specification when different effects for the changes and the termination of the exemptions are allowed. Our preferred specification allows for a window of 2 years for the effect of changes and for a window of 3 years for the effect of terminations. The impact of changing the level of exemption is 3.6 p.p. per year during 2 years, while the impact of terminating the exemption is 3.5 p.p. per year for 3 years. In the second column, we impose the same window structure (3 years) for change and termination. The results are consistent. They are identical for termination, while for change we estimate an overall decrease in survival of 2.3 p.p. per year over a period of 3 years.

While the effect of termination seems to be greater than that of change, the difference is not statistically significant, and column 3 reports the results of estimating a model in which the impacts of change and termination are constrained to be the same. Column 4 repeats the estimation in column 3, but now includes wider sets of dummies to control for region (71), industries (19), and starting year (18). The only visible change is in the coefficients associated with employment and pay, which become smaller (in absolute terms) and non-significant. In contrast, the estimate of the effect of the level of investment retains the same sign, magnitude, and significance. As for the estimated effect of exemptions, it remains significant and of the same magnitude. Finally, in column 5 a set of 27 year dummies is also included in order to control for anything that might vary from year to year, such as GDP growth, interest rates, etc. Including dummies for starting year and current time prevents the independent estimation of the effect of age (estimated to be non-significant in the other columns).

Results remain robust, the estimates of the effect of changing or terminating the tax holiday being estimated to be in the range 2.2-2.7 p.p. per year for a period of 3 years.

The compounded effect of these increases in exit rates results in reductions of 14%-15%, 20%-23%, and 25%-30% in the number of firms that remain active after the tax increases of the 10<sup>th</sup>, 15<sup>th</sup>, and 20<sup>th</sup> year (estimates are based on a baseline exit rate of 7.8% and an increases of 2.23%-2.65% per year during 3 years).

A final possibility is that the impact of changes in tax exemptions differs over time. The impact could be decreasing over time because both the absolute and the relative magnitude of tax changes decrease over time. During the first 5 years firms pay only 10% of the full tax rate. From year 6 to 10, they pay 25%. For the same income, taxes more than double. The second increase in taxes – at the end of year 10 – leaves firms with paying 35% of the full tax, which is an increase of less than one half. And at the end of the fifteenth year, those that experience a third reduction in the exemption have their tax rates increase by less than one third. Similarly, the increase in taxes when the tax holiday terminates is smaller for the regions which have a longer holiday length. Time may also decrease the relative importance of tax changes, since as time goes by many other changes may come about and survival may be more and more dictated by these other causes than by changes in taxes. Finally, if the distribution of firms' efficiency is highly skewed and there is a concentration of marginal firms, these marginal firms would be wiped out the first time costs increase and the sample remaining firms would be less sensitive to changes in costs.

Table 7 reports the results of allowing different effects of changes and termination of exemptions, also allowing each of these impacts to differ according to the moment when it takes place. Estimation is performed assuming a window of 3 years and, therefore, the reported estimation can be seen as a more general case of the

estimation reported in column 4 of Table 6. If anything, the impacts seem to increase a bit over time, especially in the case of tax changes (from 2 to 3.6 and again to 4.4 p.p.). In the case of the termination of tax exemptions the pattern is less clear: it starts at 3.7 and ends at 6.2, but the effect of termination after 15 years is estimated to be only 2 p.p. The differences, however, are not statistically significant and the less restrictive model in Table 7 is not superior to that in column 4 of Table 6 (the likelihood ratio test has a p-value of 78.3).

**Table 7 –Exit of U.S. Multinationals: a more flexible specification**

Age	0.0006 (0.0112)
In Emp	-0.0011 (0.0112)
In Inv	-0.0177*** (0.0039)
In Pay	-0.0067 (0.0106)
Decrease t, t+1, t+2 after 5 years	0.0201** (0.0089)
Decrease t, t+1, t+2 after 10 years	0.0357*** (0.0136)
Decrease t, t+1, t+2 after 15 years	0.0435 (0.0289)
End t, t+1, t+2 after 10 years	0.0365* (0.0195)
End t, t+1, t+2 after 15 years	0.0200 (0.0233)
End t, t+1, t+2 after 20 years	0.0618 (0.0407)
Dummies	
Area Exemption (2)	Y
M Code (69)	Y
Industry (19)	Y
Year Start (18)	Y
Log Likelihood	-1,694.09
Akaike Information	3,624.2

Note: Coefficients in the table are marginal effects evaluated at the sample means. The number of stars indicate significance levels as follows: \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

The effect of terminations seems to be harder to identify and two reasons may lie at the root of this. First, marginal firms may choose to leave after the first reductions,

thus being unaffected by terminations. Second, exemption periods can be extended, which makes the effect of terminations come later and be less precisely estimated. Exemption periods can be extended if firms have losses during the period. The longer the activity span the more likely it is that a firm has gone through one year of losses. Exemptions can be re-negotiated if firms expand their activities. When the end of the exemption period comes, firms may successfully re-negotiate extension of the tax breaks (albeit at higher rates).

## **8. Conclusion**

We provide a first direct analysis of the impact of the end of tax holidays upon the timing of exit of firms using a unique data set containing data on the timing of investment and divestment of U.S firms in Puerto Rico. Puerto Rico has consistently provided a tax holiday as an incentive to attract foreign direct investment. Perhaps to reduce the negative impact of eliminating the tax exemption all at once, the territory maintained a policy in which the tax benefit was gradually phased out in five-year steps during a period that could go up to 20 years in the less developed areas. Our results indicate that the likelihood of firm exit increases significantly when the incentives end, but also whenever they are reduced. According to our estimates in the year the incentives are reduced or terminated and in the two subsequent years the likelihood of exit increases between 2.2 p.p. and 2.7 p.p., over and above a baseline exit rate of 7.8%.

While earlier research reports that countries offering longer tax holidays have been able to attract significantly more foreign direct investment than those with shorter holidays (Woodward and Rolfe 1993), it is not clear that these are the most interesting firms from the point of view of the host country. Cantwell and Mudambi 2005 found

that subsidiaries of foreign companies that locate in government assisted areas are less likely than others to develop the skills that lead parent companies to attribute them competence creating mandates and, if they have such mandates, they tend to invest less in R&D than other firms.

Most of the studies addressing the impact of the Puerto Rican tax holiday program in shaping the location of firms within that territory have found it to be modest (Woodward 1974, Guimarães, Rolfe, and Woodward 1998, Grubert and Slemrod 1998, Liard-Muriente 2007). Our results show that tax holidays mattered for attracting investment to Puerto Rico; otherwise firms would not have left when the incentives were reduced. However, they also indicate that firms that are attracted to a country are not “trapped” by incentives and leave the country when incentives come to an end or decrease in magnitude. Our results stand in contrast with those of Mudambi and Zahra 2007 who hypothesized that government support would enhance the survival prospects of foreign firms, but were not able to find empirical support for such hypothesis. Our results indicate that incentives matter for the timing of exit. Even minor reductions in the incentive lead to non-negligible increases in exit, and while the absolute effect of the end of incentives is estimated to be somewhat larger than that of reductions, the magnitudes of the two effects are not statistically different.

While our results are clear, their implications for public policy toward foreign investment are not straightforward. This is because it is unclear how the benefits of foreign investment spread over time. If the benefits concentrate in the few first years of presence in the host country, the case for temporary incentives is stronger than if the benefits are permanent or generated at a later moment in time. One of the reasons why foreign investment is believed to benefit the host country economy is because foreign investment may generate knowledge spillovers to local firms. While foreign firms will

try to prevent knowledge leakage to firms operating in the same industry and with which they compete directly, they may actively promote these spillovers to their local suppliers as a means of improving their own productivity (Javorcik 2004, Blalock and Simon 2009). Knowledge spillovers to upstream firms are likely to be more intense at the beginning of the relationship and decline over time, as suppliers improve on their practices. On the contrary, horizontal spillovers are likely to occur as an unintended consequence of the presence of the foreign firm, namely via labor flows from foreign to local firms (Spencer 2008). Consequently, this type of spillover may even increase when foreign firms leave the country, as larger numbers of trained employees become available on these occasions.

However, and while substantial effort has recently been put into the discovery of the relationship between spillovers generated by the presence of foreign firms and the motivations of such firms (Driffield and Love 2007) and on whether this relationship is monotonic (Buckley, Clegg, and Wang 2007), very little (if anything) is known about the distributions of spillovers over time. Research on this topic is unquestionably difficult (Spencer 2008), but it is certainly much needed.

Our results also have implications for managers of local firms. Again, these are not straightforward, as exit of a foreign firm may have different impacts upon local firms operating in the same or upstream industries. For firms that operate in the same industry, exit of foreign firms is good news: competition weakens and exit can be an opportunity for acquiring physical and human capital that were previously employed by foreign firms. For these firms, knowing that there are periods in which foreign firms are more likely to exit means that these are periods when it is important to be particularly alert to the opportunities that may arise. For upstream firms, exit of the foreign firm is bad news because they lose part of their business. Sometimes, these upstream firms are

required to make significant specific investments for selling to their foreign clients. Managers of such firms must take special care in evaluating these investments, in particular when foreign clients entered the country thanks to temporary incentives and the required investments last longer than the incentives.

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