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Measuring the Impact of Financial Taxation on Capital

Juan A. Correa* Miguel Lorca[†] Francisco Parro[‡]

Abstract

Using panel data from Chilean manufacturing plants, we present an empirical model to measure the impact of a financial transaction tax on capital stock. Our results show a statistically significant negative effect of the tax on the stock of capital. We also find that the impact on plants is heterogeneous, depending on the intensity of different types of capital held by firms. Indeed, plants with a higher percentage of infrastructure assets, such as land and buildings, are affected relatively less by the tax.

Keywords: financial transaction tax, stock of capital, manufacturing industry

JEL Classification: H20; L60

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1 Introduction

Most of the literature regarding the relationship between taxes and the demand for capital has focused on the analysis of the effect of corporate taxes on the stock of capital of firms (see Hsieh and Parker (2007), and Djankov et al. (2010), among others). However, there is little empirical research about the effect of financial transaction taxes on the stock of capital. Moreover, the research on this topic has mainly focused on the methodological implementation of a financial transaction tax, as discussed by Auerbach and Gordon (2002).

In this paper, we propose an empirical strategy to measure the effect of a financial transaction tax on the stock of capital. Taking advantage of an extensive panel database of 10,946 Chilean manufacturing plants, we find that a financial transaction tax has a statistically significant negative impact on the capital stock. We also find that this effect is not homogeneous among firms that have different types of capital. Our results show that firms with a higher percentage of infrastructure assets, such as land and buildings, are affected relatively less by a financial transaction tax.

As argued by Grubert and Mackie (2000), financial services embody the cost of smoothing consumption over time and, thus, are not consumption goods. Therefore, a financial transaction tax is not neutral since it gives rise to a distortion in consumption behavior, overtaxing future consumption.¹ Furthermore, Jack (2000) states that the fact that financial services are not consumption goods is not sufficient for being exempt. He asserts that only in the case that the financial service value added “is proportional to the nominal value of the underlying financial transfer”, the financial service should not be taxed.

However, another line of thought in the literature states that financial services must be taxed as much as other goods and services, in order not to distort relative prices.

¹A similar argument can be found in Quiggin (1993).

Hoffman et al. (1987) state that the value of intermediate inputs, reflected in the spread between borrowing and lending rates, is a measure of value added and must be taxed to minimize distortions and yield a broader tax base.² Given this strand of the literature, taxing financial services has been broadly recommended.

In the international context, taxing financial services is mainly implemented via two practices: (i) a value-added tax on financial transactions or (ii) a specific tax on some financial services. In Chile, a specific tax is levied on financial services. This tax takes different rates depending on the type of financial service provided. Following Arellano and Corbo (2013), a specific financial transaction tax can be considered as an extension of a value-added tax on financial services. However, it is simpler to implement since it does not contain the main methodological problems of applying a value-added tax on financial transactions. This is the reason why Chile and other countries have opted to implement a specific financial transaction tax instead of a value-added tax.

A financial transaction tax may decrease the capital investment return, since the tax increases the cost of investment funded with debt. Moreover, the tax distorts the optimal allocation of capital stock and therefore decreases the potential growth of an economy.

One of the empirical challenges of attempting to estimate the effect of a financial transaction tax on the stock of capital is identifying the effective tax rate. Since the tax rate varies depending on the type of financial service, firms face different tax rates depending on the financial service they use. Our data permit us to identify the amount of financial transaction tax paid by every manufacturing firm, and then we can construct the effective financial transaction tax rate faced by every firm. However, since firms choose the amount of debt they assume, we face an endogenous problem when estimating the impact of the tax using the effective financial transaction tax rate. In order to address this problem, we use instrumental variables two stage least squares. We implement this methodology using a rich panel data from Chilean manufacturing firms. We find a

²Further exposition of this argument can be found in Whalley (1991) and Merrill and Adrion (1995).

statistically significant negative effect of the tax on the stock of capital.

We also assess the degree of heterogeneity in the impact of a financial transaction tax on firms. A related literature has found an inverse relationship between the impact of taxes on capital and the size of firms. Cerda and Larraín (2010) state that small firms face credit constraints. Therefore, since taxes tend to decrease the amount of firms' own capital that they use to invest in their projects, firms with credit constraints would face an increase in the cost of capital when facing the tax. Cerda and Larraín (2010) indeed show empirical evidence that corporate taxes affect the capital stock of small firms relatively more than that of large firms.

However, even in a framework where credit constraints are not relevant, the impact heterogeneity of a tax on capital might come from firms' own characteristics instead of firm size. A relevant heterogeneous characteristic is the composition of the stock of capital. While some production processes lean more on infrastructure, such as land and buildings, others are based mainly on other types of capital, such as machinery and equipment. Therefore, the impact of a tax might be conditioned by the substitution capacity that a firm faces when replacing capital with other input.

We study the interaction of the effective financial transaction tax with the capital composition of firms to estimate the heterogeneity of the impact of a financial transaction tax on capital stock. Our results support the statement that the impact of the tax is different for firms with different compositions of capital. Specifically, firms with a higher percentage of infrastructure assets decrease their acquisition of capital relatively less when a financial transaction tax is implemented.

Our results contribute with new evidence to the scarce empirical literature on the effects of financial transaction taxes. Moreover, our results suggest that the effects of financial transaction taxes can be heterogeneous across firms even in a world without credit constraints. The substitution capacity that a firm faces when replacing capital with other input determines the magnitude of the elasticity of demand for capital and, thus,

the effect of taxation. In line with this idea, we find that the effect is not homogeneous among firms when they hold different types of capital: firms with a higher percentage of infrastructure assets, such as land and buildings, are affected relatively less by a financial transaction tax.

The rest of the paper is organized as follows. Section 2 gives more detail about the Chilean financial transaction tax scheme. Section 3 describes the database used and the construction of the variables employed in our estimations. Section 4 presents our empirical strategy, including the description of the methodology used to address the endogeneity problem. Section 5 shows and discusses the results of our estimations. Section 6 concludes.

2 Financial Transaction Tax

As shown in Matheson (2011), financial transaction tax schemes are not uncommon. Apart from Chile, other countries impose this type of tax, such as Brazil, Italy and Turkey.

The Chilean financial transaction tax is a levy placed on negotiable instruments. The rate of the tax is 1% of the value of checks, and 0.033% of the value of bank drafts, bills of exchange or other documents. Disregarding checks, the tax rate is charged every month, with a maximum level of 0.4% of the value of the instrument. Therefore, for instruments with a maturity of more than 12 months, the rate remains at 0.4%.

As stated by Isla and Muñoz (2009), this tax has been in operation since 1980 and had been modified on 53 occasions until 2009. In the last modification reported by Isla and Muñoz (2009), the tax rate was reduced to 0%.

Table 1 shows the tax rate levied on bank drafts and bills of exchange, and the maximum financial transaction tax rate for the period 1996-2013. As we can see, the tax rate on bank drafts and bills of exchange has varied between 0% and 0.134%, while the maximum level of the tax rate has ranged from 0% to 1.608%.

3 Data and Variables

We use a panel of Chilean manufacturing plants, covering the period from 1995 to 2007. Even though there are more recent data available, we use data until 2007 since the instruments used in the estimations are only available until 2007. As it will be explained further, we use the value-added tax expenditure and other tax expenditures to construct our instruments. However, the panel provides information of these items only until 2007. The database is retrieved from the Annual Chilean Survey of Manufacturers (ENIA), which is a census of manufacturing plants with 10 or more employees, conducted by the Chilean Institute of Statistics at the end of each year. Relevant articles such as Tybout et al. (1991), Liu (1993), Levinsohn (1999), Pavcnik (2002), and Levinsohn and Petrin (2003) have used these data in other types of studies.

The information is reported at the plant level and consolidated at the firm level. The panel includes 10,946 plants across 20 industries at the ISIC 2-digit level. We note that most of the sample is concentrated in the industry ISIC 15 (manufacture of food products and beverages). However, most industries have a large number of plants. We use information about sales, fixed assets, investment and tax expenditure. All amounts are given in thousands of current Chilean pesos.

The ENIA 1995-2007 panel provides the previous year's value and the current year's investment in five types of fixed assets: (i) land, (ii) buildings, (iii) machinery and equipment, (iv) furniture and fixtures, and (v) vehicles. We first adjust the nominal value of each type of asset using the capital deflator provided by the Central Bank of Chile. After obtaining the real value for each type of asset, we use the perpetual inventory method to compute the capital stock for each type of asset as

$$k_{it} = (1 - \delta_k)k_{it-1} + I_{it},$$

where k_{it} is the type of fixed asset for plant i at time t , δ_k denotes the depreciation rate of fixed asset k ,³ and I is the investment in fixed asset k .⁴ We denote the aggregate stock of capital of firm i in period t as K_{it} .

As we explain in the previous section, the legal financial tax rate varies with different maturities and types of financial instruments. As discussed by Cerda and Saravia (2009), another problem with using the legal tax rate is that firms may use different mechanisms to evade the legal tax rate and pay a lower effective tax rate. Therefore, we calculate an effective financial transaction tax rate T , constructed as

$$T_{it} = \frac{TE_{it}}{K_{it}}, \quad (1)$$

where TE_{it} corresponds to the financial tax expenditure of firm i during period t .

To avoid endogeneity problems,⁵ we also retrieve some variables to be used as instruments. The first instrument is the effective value-added tax VA , constructed as

$$VA_{it} = \frac{VAE_{it}}{M_{it}},$$

where VAE_{it} is the value-added tax expenditure of firm i during period t and M_{it} corresponds to the expenditure on materials and raw materials of firm i during period t . The second instrument is the natural logarithm of other tax expenditures, denoted as OT_{it} , which mainly includes the sum of the values of the expenditures on nonrecoverable value-added taxes and readjustments of income taxes.

Table 2 shows descriptive statistics of the database variables used in our estimations.

³We use a depreciation rate of 2.5%, 13%, 13%, and 25% for buildings, machinery and equipment, furniture and fixtures, and vehicles, respectively, as documented by Oulton and Srinivasan (2003).

⁴Investment is defined as the purchase of new and used assets plus asset improvements minus the sales of used assets.

⁵Further explanations of endogeneity problems are provided in the next section.

4 Empirical Strategy

In order to estimate the effect of the financial transaction tax on the stock of capital, we propose the following empirical model:

$$\ln K_{it} = \alpha_0 + \alpha_1 T_{it} + u_{it}, \quad (2)$$

where $\ln K_{it}$ denotes the log of the capital stock of firm i during period t , T_{it} is the effective financial transaction tax rate, and u_{it} represents an idiosyncratic error term.

Additionally, as we discussed in the introduction, our second goal in this paper is to estimate the different impacts of the financial transaction tax for different types of capital. To do so, we propose the following empirical model:

$$\ln K_{it} = \beta_0 + \beta_1 T_{it} + \beta_2 Ic_{it} + e_{it}, \quad (3)$$

where Ic_{it} is the interaction term $T_{it} \times K_{it}^j$ and K_{it}^j is the percentage of capital type j in the total capital stock of firm i during period t . In order to define the type of capital, we construct three specifications. In Specification 1, we use the overall stock of capital. In Specification 2, we define K_{it}^2 as the percentage of land and buildings in the total capital stock. In Specification 3, we define K_{it}^3 as the percentage of machinery and equipment, furniture and fixtures, and vehicles, in the total capital stock.

As we can see from equation (1), the effective financial transaction tax rate, T , is constructed using the stock of capital as the denominator. Hence, firms with high levels of capital stock also show relatively low levels of T , thus understating the effect of T on the stock of capital. Therefore, since we have the possibility that $E[u|T] \neq 0$ and $E[e|T, Ic] \neq 0$, estimating the regressions (2) and (3) by OLS may deliver biased and inconsistent estimators of α and β .

In order to address this problem, we propose the use of instrumental variables. Since VA and OT are not directly correlated with the stock of capital –instead, both the value-added tax rate and readjustments of income taxes, as well as the financial transaction tax rate, are of course determined by authorities– we use both VA and OT as instrumental variables for regressions (2) and (3). As an example, Chilean authorities modified both the financial and the value added taxes in years 2001, 2002, 2006 and 2007.⁶ Therefore, we regress

$$T_{it} = \gamma_0 + \gamma_1 VA_{it} + \gamma_2 OT_{it} + \nu_{it}. \quad (4)$$

We then recover \hat{T}_{it} to be used as regressor in the second stage. Considering that there might be some particular firms' characteristics, which may remain constant over time, and some particular shocks, which may affect the overall manufacturing sector, we use both firm and year fixed effects. Additional to the use of year effects, we also use the world output index and The Economist commodity price index to control external macroeconomic conditions which may affect capital formation in the manufacturing sector. Therefore, we define the following regressions:

$$\ln K_{it} = \alpha_0 + \alpha_1 \hat{T}_{it} + \rho' X_t + \delta_i + \theta_t + \mu_{it}, \quad (5)$$

$$\ln K_{it} = \beta_0 + \beta_1 \hat{T}_{it} + \beta_2 \hat{I}C_{it} + \xi' X_t + \sigma_i + \tau_t + \epsilon_{it}, \quad (6)$$

where $\hat{I}C_{it}$ is the interaction defined as $\hat{T}_{it} \times K_{it}^j$, X_t is a vector containing the world output index and The Economist commodity price index used as macroeconomic control variables, δ_i and σ_i represent the firms fixed effects, and θ_t and τ_t the year effects. We

⁶The acts 19,716 and 19,768 of 2001 modified the value-added tax and the financial tax respectively, the Act 19,840 of 2002 modified the value-added tax and the financial tax, the acts 20,102 and 20,130 of 2006 modified the value-added tax and the financial tax respectively, and the Act 20,190 of 2007 modified the value-added tax and the financial tax.

also check the exogeneity of our instruments using the Hansen J test and their relevance following the Staiger and Stock (1997) condition.

Another problem that our estimations might face is the presence of outliers. The manufacturing industry firms are very heterogeneous, where a small group may show very high levels of capital stock, while another small group may show very low levels of capital stock. Using the logarithm of the stock of capital may reduce the problems caused by the presence of outliers. However, it may not be sufficient. Therefore, we define outliers as the 2.5% of firms with the lowest levels of capital stock and the 2.5% of firms with the highest levels of capital stock. In order to check the robustness of our results we perform the regressions including and excluding outliers.

5 Results

In order to check how endogeneity may affect our results, we first perform the OLS regressions. The OLS coefficient results of equation (2) are shown in the column Specification 1 of Table 3. We observe that the coefficient is negative and statistically significant. Therefore, there is a negative effect of the financial tax on the stock of capital in the manufacturing industry. The column Specification 2 of Table 3 shows equation (3) results for K_{it}^2 . Since the interaction coefficient is negative, the OLS result shows that the financial transaction tax rate have a more negative impact in firms where the stock of capital has a higher component of infrastructure, such as land and buildings. On the contrary, the results shown by the column Specification 3 of Table 3 tell us that the effect of the financial transaction tax is less negative in firms where the stock of capital is mostly composed by machinery and other assets different from land and buildings.

Table 4 shows the OLS results for both equation (2) and equation (3), excluding outliers. As we can see in this table, the results are very similar to that of the Table 3. Therefore, the OLS results are not driven by the presence of outliers.

As explained in the previous section, the OLS regressions might deliver biased and inconsistent estimators of α and β , since T is constructed using the stock of capital as the denominator. In order to address this empirical issue we use instrumental variables two stage least squares. We use the effective value-added tax and the natural logarithm of other tax expenditures as instruments. In order to test the instruments' relevance we use the Staiger and Stock (1997) condition of relevance. Additionally, we test the instruments' exogeneity using the J-statistic of the Hansen test. Table 5 presents the results of this tests and the TSLS coefficients' results of equations (5) and (6).

Regarding the instruments' relevance, we observe from Table 5 that the F-statistic of the first stage regression (4) is 59.05, which satisfies the Staiger and Stock (1997) condition of relevance. Additionally, the J-statistic of the Hansen test is 0.0540, failing to reject the null hypothesis that the instruments are exogeneous at any conventional level of significance. Therefore, our instruments achieve both relevance and exogeneity conditions.

Regarding our main results, we observe from column Specification 1 of Table 5 that there is a negative and statistically significant effect of the financial tax on the stock of capital. We can also notice from the value of the coefficient that the OLS result of Table 3 understates the negative effect of the financial tax on the stock of capital. As discussed in the previous section, since the effective financial tax rate is constructed using the stock of capital as the denominator, firms with high levels of stock of capital will present low levels of the financial tax rate and high levels of the logarithm of the stock of capital. Therefore, the OLS estimator understates the negative effect of the tax on the stock of capital.

Additionally, we can observe from column Specification 2 of Table 5 that as long as the percentage in infrastructure assets increases, the financial transaction tax rate will have a relatively less negative impact on the stock of capital. On the contrary, as soon as the percentage in other than land and buildings assets increases, the financial transaction

tax rate will have a relatively higher negative impact on the stock of capital, as it can be seen from column Specification 3 of Table 5. As we can notice, from the OLS results we draw opposite conclusions. Therefore, the endogeneity problem is more serious when performing the OLS regression (3), since it is not only understating the negative effect of the tax on the capital stock but also changing the conclusion about how the interaction coefficient affects the stock of capital. This phenomenon emphasizes the necessity of using instrumental variables.

Finally, Table 6 shows the TSLS coefficient results of equations (5) and (6), excluding outliers. As we can see in this table, all specifications results are very similar to that of the Table 5, without changing our main conclusions.

6 Conclusion

This paper provides empirical evidence on the effect of a financial transaction tax on capital stock of firms. Our findings show that a financial transaction tax has a statistically significant negative effect on the stock of capital.

Additionally, we assess the degree of heterogeneity of the effects across firms. Specifically, we study the interaction of the effective financial transaction tax with the capital composition of firms.

We find that the effect of the financial transaction tax is not homogeneous among firms that have different types of capital. Our results show that firms with a higher percentage of infrastructure assets, such as land and buildings, are affected relatively less by a financial transaction tax.

The importance of our results is twofold. We first present new evidence on the effects of financial transaction taxes. This evidence is valuable since previous empirical studies have mostly focused on the effects of corporate taxes. Second, our results suggest that the effects of financial transaction taxes can be heterogeneous across firms even in the

absence of credit constraints. We find that firms with a higher percentage of infrastructure assets, such as land and buildings, are affected relatively less by a financial transaction tax. The intuitive idea behind this result is that different types of capital have different elasticities of substitution with other inputs and, thus, we expect a different impact of financial transaction taxes on firms which are composed by different types of capital.

These results might be useful to be considered before implementing a financial transaction tax, since, as we show, capital stock accumulation is not neutral to such a tax. Moreover, the capital accumulation of firms that depend relatively more on machines or equipment would be relatively more affected by the implementation of this type of tax.

An interesting extension of this paper would be to formalize the channel whereby a financial transaction tax differently affects capital formation depending on the different types of assets.

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A Tables

Table 1: Chilean Financial Transaction Tax Rate

Year	Tax Rate (%)	Maximum Tax Rate (%)	Year	Tax Rate (%)	Maximum Tax Rate (%)
1996	0.1	1.2	2005	0.134	1.608
1997	0.1	1.2	2006	0.134	1.608
1998	0.1	1.2	2007	0.125	1.5
1999	0.1	1.2	2008*	0.1	1.2
2000	0.1	1.2	2009	0	0
2001	0.1	1.2	2010	0.05	0.6
2002	0.134	1.608	2011	0.05	0.6
2003	0.134	1.608	2012	0.05	0.6
2004	0.134	1.608	2013	0.033	0.4

(*) During the first quarter of 2008, the tax rate was 0.1125% and the maximum tax rate was 1.35%.

Table 2: Descriptive Statistics

Variable	Obs.	Mean	Standard Deviation
$\ln K$	57,257	11.7083	2.4379
T	57,257	0.0047	0.1449
VA	57,257	0.2578	14.2325
OT	57,257	0.0480	1.4856

Table 3: Effect of Financial Tax on Capital Stock (OLS)

	Specification 1	Specification 2	Specification 3
Tax (T)	-0.2191 (0.0184)***	-0.2121 (0.0184)***	-2.4118 (0.4010)***
Interaction (I)	-	-2.1997 (0.4019)***	2.1997 (0.4019)***
Instrumental Variables	No	No	No
Macro Variables	Yes	Yes	Yes
Firm Effects	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes
Observations	57,257	57,257	57,257

Standard errors in parentheses. *** significant at 1% level.

Table 4: Effect of Financial Tax on Capital Stock (OLS excluding Outliers)

	Specification 1	Specification 2	Specification 3
Tax (T)	-0.2178 (0.0184)***	-0.2110 (0.0184)***	-2.3425 (0.4003)***
Interaction (I)	-	-2.1315 (0.4019)***	2.1315 (0.4012)***
Instrumental Variables	No	No	No
Macro Variables	Yes	Yes	Yes
Firm Effects	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes
Observations	55,765	55,765	55,765

Standard errors in parentheses. *** significant at 1% level.

Table 5: Effect of Financial Tax on Capital Stock (TSLS)

	Specification 1	Specification 2	Specification 3
Tax (T)	-3.7638 (0.3718)***	-4.3821 (0.5260)***	-3.1747 (0.5138)***
Interaction (I)	-	1.2074 (0.7268)*	-1.2074 (0.7268)*
Macro Variables	Yes	Yes	Yes
Firm Effects	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes
Observations	57,257	57,257	57,257
Instrumental Variables			
F-statistic	59.05 [0.0000]***		
J-statistic	0.0540 [0.8162]		
Firm Effects	Yes		
Year Effects	Yes		
Observations	57,257		

Standard errors in parentheses. P-values in square brackets. *** significant at 1% level.

** significant at 5% level. * significant at 10% level.

Table 6: Effect of Financial Tax on Capital Stock (TSLS excluding Outliers)

	Specification 1	Specification 2	Specification 3
Tax (T)	-3.7368 (0.3707)***	-4.5070 (0.5243)***	-3.0037 (0.5118)***
Interaction (I)	-	1.5032 (0.7237)**	-1.5032 (0.7237)**
Macro Variables	Yes	Yes	Yes
Firm Effects	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes
Observations	55,765	55,765	55,765
Instrumental Variables			
F-statistic	57.47 [0.0000]***		
J-statistic	0.0596 [0.8072]		
Firm Effects	Yes		
Year Effects	Yes		
Observations	55,765		

Standard errors in parentheses. P-values in square brackets. *** significant at 1% level.

** significant at 5% level. * significant at 10% level.