Taxes and Growth in a Financially Underdeveloped Country: Evidence from the Chilean Investment Boom*

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Abstract

This paper argues that taxation of retained profits is particularly distortionary in economies with poorly developed financial markets. In such economies, a tax on retained profits reduces the investment of financially constrained firms, investment that has marginal product greater than the after-tax market real interest rate. Contrarily, a tax on distributed profits primarily reduces the investment of financially unconstrained firms. We argue that a $1984-1986$ reduction in the tax rate on retained profits caused a boom in investment and productivity in Chile. We test this theory using both data from Chilean national accounts and panel data on the investment behavior of "constrained" and "unconstrained" firms in Chile from 1982 to 1990.

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1 Introduction

In the late $1970's$ and early $1980's$, the Chilean government undertook a number of policy changes aimed at increasing investment and economic growth. By these measures, the performance of the Chilean economy has been excellent. Chile's GDP per capita has grown at an average rate of 4.5 percent per year during the decade following 1983 (Figure 1a). While not as impressive as the growth miracles of the Asian developing economies during the postwar period, Chile's strong economic performance is unique among the developing economies in the Western hemisphere. Figure 1b shows that at the heart of the impressive growth is a savings and investment boom on the order of ten percent of GDP. In addition, total factor productivity over this same period grew at an average annual rate of 2 percent.

In this paper, we investigate the link between Chile's rapid economic development and its economic policies. Specifically, we demonstrate that one cause of Chile's investment boom was a corporate tax reform that cut the tax rate on retained profits from nearly 50 percent to 10 percent over the period 1984 to 1986. Economic theory implies this reform could have large effects. When firms face credit constraints, taxation of retained profits is more distortionary than taxation of dividends, and slows convergence and growth. Taxation of retained profits reduces the investment of those firms with productive activities that are unable to raise sufficient external funds to undertake these investments at the unconstrained-efficient levels. By taxing retained profits, the government removes internal funds from these firms and reduces investment with marginal product greater than the real interest rate. Thus, in an economy with poorly developed financial markets and with otherwise favorable macroeconomic policies and conditions, such as Chile in the mid $1980's$, taxing retained earnings is particularly harmful.[1] The 1984 tax reform, by reducing the tax rate on retained earnings, increased the internal funds of many credit constrained firms and so lead to increases in aggregate investment and productivity.

The behavior of national saving and investment suggest that the reduction in the taxation of retained profits caused an increase in investment and growth. First, business saving increased after the tax reform, while private saving and public saving remained largely unchanged. Second, the timing of the investment boom also supports our theory. Investment increases by 4.5 percent of

[1] These "favorable macroeconomic policies" represent other important causes of growth that we discuss subsequently.

GDP in the first year of the reform and increases by over 10 percent of GDP over five years, reaching 25 percent of GDP by 1989. The tax reform occurs at the beginning of the investment boom while other reforms such as trade liberalization and the privatization of the public pension system significantly predate the boom.

To test our theory and evaluate its importance, we examine the cross-industry pattern of investment. We find that investment rates rose after the reform primarily in industries that are heavily dependent on external finance. Industries classified by Rajan and Zingales (1998) as dependent on external finance had larger increases in investment in 1985, 1986 and 1987, although not in the first year of the reform, 1984.

Further, we examine the cross-plant pattern of investment using annual, plant-level survey data covering all Chilean manufacturing plants with more than 10 employees. We divide plants into those that are owned by firms that are more and less likely to face financing constraints and compare the investment behavior of plants owned by these different types of firms through the tax reform. We find that the plants owned by firms that exhibit a high correlation of cash flow and investment before the reform increase their investment significantly more in the reform and to some extent following the reform as compared to similar plants that have low correlations of cash flow and investment. We also find some evidence that plants owned by firms that previously had low short-term reserves increased their investment more during and to some extent following the reforms. We find no evidence that plants owned either by firms that pay rent or by firms that are smaller benefitted disproportionately from the reform, but we also note that the small firm versus large firm distinction is less likely to measure the degree of financial constraints facing a firm in Chile, as compared to the United States.

Previous research has typically pointed to other market-oriented reforms undertaken by Chile, particularly the liberalization of the trade regime, the liberalization and deepening of financial markets, bankruptcy reform, and the privatization of public pension system, rather than to corporate tax reform as the underlying cause of Chile's boom.[2] To be clear, our argument is not that these other reforms are irrelevant for growth in general. It is possible that this set of political and economic reforms raised Chile's steady-state level of output per person, although we do not evaluate this claim. We show that the reduction in the tax on retained profits directly increased the accumulation

[2] See, for example, Bergoeing, Kehoe, Kehoe, and Soto (2002), Edwards (1996), Gallego and Loayza (2000), Morandé (1996), and Pavcnik (1999).

of capital. One interpretation is that the tax reform lead to rapid rather than slow convergence towards steady-state. In applying this lesson to financially underdeveloped economies more broadly, it is important to note that taxing retained earnings is highly distortionary only when there are productive investment opportunities.

Our research is related to two previous literatures. First, our analysis is closely related to studies of tax policy and investment using panel data on firms.[3] Second, there is also a large literature on the importance of financial constraints in the United States, both in explaining firm-level investment and on how small shocks can result in large output changes.[4] To the extent that financial constraints on firms are still important in developed economies, our analysis suggests that taxation of retained profits may be quite distortionary even in the United States.

The outline of the paper is as follows. The next section models the effect of taxes on retained profits when some firms are constrained from borrowing as much as they would like to invest at market interest rates. Section 3 describes the 1984 tax reform in Chile and presents evidence about its impact from Chilean national accounts data. Section 4 present aggregate evidence that the corporate tax reform was a significant cause of Chile's rapid growth. Sections 5 details our use of the annual plant-level data from the Chilean manufacturing census that we use in sections 6 and 7 to test the industry and plant-level predictions of our theory respectively. Section 8 discusses alternative explanations for Chile's investment boom, and a final section concludes.

2 Investment and taxes on retained earnings

How does a tax on retained profits alter investment and productivity? In this section, we consider the investment decision of a household that owns a profitable firm and is unable to borrow to finance investment. Firms and households face credit constraints and firms with highly productive investment opportunities are constrained from borrowing to invest at the optimal rate. We consider an economy like Chile's in which there are three taxes levied on capital income: profits tax (τ_p), retained profits

[3] See for example the study of U.S. tax reforms in Cummins, Hassett, and Hubbard (1994).

[4] See Hubbard (1998), Bernanke and Gertler (1995), and Bernanke, Gertler, and Gilchrist (1999) for reviews. Most close to our own work, Calomiris and Hubbard (1995) use a firm's reaction to the retained profits tax of $1936-37$ in the United States to identify liquidity constrained firms and then study their subsequent investment behavior. We reverse this process.

tax (τ_r), and dividend income tax (τ_d). The retained profits and the dividend income tax rate are defined as the tax rate net of the profits tax. We assume that the economy is small and open so that the after-tax real interest rate is fixed at r^f.

Consider two firms that have the same initial capital stock (K_0) and profits (π), but that differ in the productivity of the investment opportunities available to them. Firm H, has a highly productive investment opportunity, and firm L does not. Figure 2 shows the marginal product of capital in the future for each firm, with MPK^H lying above MPK^L. In a world with perfect capital markets, each firm would set the pre-tax marginal product of capital equal to the required pre-tax rate of return to investment, which is equal to the after-tax rate of return adjusted for the tax rates. Thus the first-best levels of capital chosen would be K^{H*} and K^{L*} and gross investment would equal $K^{H*} + K^{L*} - 2(1-\delta) K_0$ where δ is the depreciation rate of old capital.

However, if we assume that these firms, and their owners, do not have access to external funds – debt or equity – to finance further investment, then their investment is limited to their after-tax profits or $(1-\tau_p)(1-\tau_r)\pi$. Both the profits tax and the tax on retained profits directly decrease funds available for investment. This bound on investment limits the future capital stock to

$$\bar{K} = (1-\delta) K_0 + (1-\tau_p)(1-\tau_r)\pi.$$

Thus, as shown, firm H with a highly productive investment opportunity is unable to take full advantage of this opportunity.

Consider now a cut in the rate of tax on retained profits to τ_r'. The new maximum level of the capital stock is

$$\bar{K}' = K_0 + (1-\tau_p)\left(1-\tau_r'\right)\pi > \bar{K}.$$

This tax cut has two important features. First, it impacts firms differently. For the constrained firm (H), every peso decrease in tax revenue leads to a peso increase in its capital stock: $\Delta K = (1-\tau_p)\pi\Delta\tau_r = \Delta revenue$. For the unconstrained firm, the decrease in tax paid does not lead to a corresponding increase in its capital stock. Second, new investment caused by this policy occurs for projects with high productivity that exceeds the marginal product of a peso of outside capital or the opportunity cost of money for the government. It is precisely those firms with the most productive investment opportunities which have the greatest need for funds for capital and so benefit the most from an increase in available internal funds. Thus the policy change leads to an increase in productivity. The increase in output from the increase in capital is $\Delta Y = \frac{MPK^H(\bar{K})+MPK^H(\bar{K}')}{2}\Delta K >= \frac{r^f}{(1-\tau_p)(1-\tau_d)}\Delta K$.

Comparatively, a cut in the dividend tax rate increases the incentive to invest by all firms. But highly profitable firms that are not paying dividends and are cash constrained are unable to raise their investment rates in response to such a tax cut. The marginal product of new investment generated from such a tax cut has the social marginal value of capital since it changes the investment rates of firms that are setting their capital stocks so as to equalize marginal products and interest rates. Similarly, a cut in the profits tax rate increases the incentive to invest by all firms, and allows further investment by cash constrained firms, but does not target the tax cut at highly productive investment opportunities.

This graphical exposition is stylized in three ways worth noting. First, it is unlikely that any firms are truly constrained. Most if not all firms probably have access to funds at some price. But for many firms the costs of monitoring and enforcement may be extremely high, so that these firms face interest rates far above official rates. Such transaction costs associated with making loans act in a similar way to credit constraints.[5] Second, we have not been explicit about product markets. It is necessary that the size of unconstrained firms be limited by economies of scope (so there is diminishing returns in $F(.)$) or by demand, such as through monopolistic competition. Thus the profit opportunities available to one firm are not available to all firms. If they were, the distribution of internal funds and credit constraints would be irrelevant for aggregate investment. Finally, in a multi-period world, a tax on retained profits reduces optimal investment for an unconstrained firm since the firm can postpone the tax burden of dividends by postponing paying out profits. Only for a firm without new investment (in excess of depreciation allowances) is there no tax benefit or government revenue lost and no change in incentives or value. However, the impact remains significantly less than on the investment behavior of a constrained firm because the retained profits tax affects the marginal return to investment from the optimal level rather than a tightening of a

[5] As we argue later, in 1984, the Chilean banking sector was still suffering the after effects of the debt crisis. A number of banks had gone bankrupt and a number had been taken over by the government. Thus, at this time, the sector that monitors loans and enforces debt legal debt contracts was small and probably had low technology leading to high costs of external finance.

binding constraint.[6]

In appendix A, we present a two-period model that formalizes the above arguments, and from this simple model we gauge the magnitude of the increase in capital stock that we expect to result from a cut in the tax in retained profits. The aggregate importance of a tax on retained profits depends on whether a significant number of firms are credit constrained. As a rough benchmark, suppose that half of the firms (weighted by their ex-post capital stock) in Chile are credit constrained and are investing all their internal funds. The share of profits (before taxes) to value added can be approximated by the capital share of national income net of debt payments and depreciation, which we take to be 20 percent for Chile.[7] If the tax on retained profits falls from 50% to 10%, as happened in Chile, then the cash flow available to a firm increases from 10 percent to 18 percent of value-added. If our theory is correct and credit-constrained firms invest the additional cash flow, this tax policy change results in a 4 percentage point increase in the investment share of GDP $(8 \times 1/2)$, which is slightly less than half of the increase in the investment share of GDP in Chile since the mid $1980's$.

In sum, for firms that face liquidity constraints, taxes on retained earnings remove cash from inside credit-constrained firms where it is more valuable. In contrast, dividend taxes only distort the investment decisions of firms at their unconstrained optimal capital stocks.

3 The 1984-1986 tax reform

The Chilean tax system prior to 1984 was based upon the principle that households and firms should be treated similarly in the tax code. This principle was implemented by setting the tax rate applied to retained profits of firms equal to that applied to dividends or distributed earnings. That is, the personal and corporate tax codes were structured so that whether profits were paid to the owner or to the firm was irrelevant for tax revenue collected.

More specifically, in the period prior to 1984, the tax treatment of capital income in Chile can

[6] Although we do not study firm creation, the retained profits tax significantly changes the value of a new firm, and firm creation does increase following the reform.

[7] From 1985 to 1998, the average capital share was 51 percent and the average capital income net of depreciation was 41.2 percent of GDP (Anuario de Cuentas Nacionales, 1999 (Santiago, Chile: Banco Central de Chile), Table 1.57). Given that this number is larger than the capital share for a typical country and that interest payments typically account for a third of capital share, 20 percent is a conservative estimate of the quantity of interest.

be summarized as follows: 1) profits were taxed at a 10 percent rate; 2) retained profits (net of the corporate profits tax) were taxed at either the personal income tax rate of the owners (from 0 to 58 percent) for limited-liability corporations (Sociedad Limitadas) or a 40 percent rate for publicly traded companies (Sociedad Anonimas); 3) dividends (net of the corporate profits tax) were taxed at the personal income tax rate (ranging up to 58 percent);[8] 4) realized capital gains were taxed as dividends if owned by an individual, or corporate profits if owned by a firm.[9] These taxes cumulate to a high effective tax rate on retained profits. Retained profits of publicly traded companies were first taxed at 10 percent (the corporate profits tax) and the residual net of the 10 percent tax was then taxed at 40 percent, for an effective tax rate of 46 percent on retained profits. The tax treatment of retained profits of limited liability corporations was similar, except that the residual net of the 10 percent corporate profits tax was taxed at the marginal income rate of the owner of the firm. This yields an effective tax rate on retained profits of $0.1 + 0.9\tau$ (τ is the marginal income tax rate of the owner of the firm) for limited liability corporations. In 1980, the average marginal income tax rate of individuals who paid taxes on dividends and retained profits was 43 percent, which translates into a typical effective tax rate of almost 50 percent on retained profits.[10]

In January 1984, the Chilean government enacted a significant tax reform. While the reform altered both the personal and corporate tax codes, the largest change was the near-elimination of the tax on retained profits that had paralleled the tax on dividends. The effective tax on retained profits was lowered to 10 percent, effective immediately for limited liability corporations but phased in over three years for publicly traded companies.[11] The tax reform did not alter the tax on corporate profits (10 percent) and left the tax treatment of capital gains largely unchanged.[12] With respect to

[8] This is the tax rate on dividends of limited liability firms, but the dividends tax for shareholders of publicly traded companies (Sociedades Anonimas) is slightly more complicated. There were two taxes on dividends of publicly traded companies. First, dividends were taxed at 40 percent. Second, dividends net of the 40 percent tax was taxed at the personal income tax rate minus 0.4. The tax rate on dividends (net of the corporate profits tax) is therefore $0.6{*}\tau + 0.16$, where τ is the personal income tax rate. If the personal income tax rate is 40 percent, the dividends tax rate is equal to the personal income tax rate (and equal to the dividend tax rate for limited liability corporations).

[9] Capital gains on assets held for less than a year were not taxed prior to 1984.

[10] Calculated from Servicio de Impuestos Internos (1980), pg. 44.

[11] The retained profits tax rate for publicly-traded companies was lowered to 30 percent in 1984, 15 percent in 1985, and 0 thereafter.

[12] The 1984 tax reform removed the tax exemption on capital gains held for less than a year, but otherwise did not change the tax treatment of capital gains.

dividend taxation, the tax reform widened personal income tax brackets and lowered marginal income tax rates slightly. Table 1 describes the personal income tax rates before and after the tax reform. In addition to the cut in income tax rates, the tax reform also provided a credit for corporate taxes paid that reduced the basis for the payment of the dividend tax. That is, the tax on dividends was lowered to $\tau - 0.1$, which results in an effective tax on dividends of $0.01 + 0.9\tau$. Table 2 summarizes the effective tax rate on dividends and retained profits before and after the tax reform.

We note two additional important features of the tax system. First, firms pay estimated taxes on retained earnings monthly. Thus the change in the tax rate on retained profits has an immediate impact on the cash flow of corporations. Second, the corporate tax code was stable from 1986 to 1989, but the tax on retained profits was eliminated entirely for the tax year 1990. Following 1990, the retained profits tax was increased to 15 percent for the remainder of the $1990's$. We focus our analysis of firms on the period $1980 - 1990$.

It is worth asking how the cut in income tax rates is likely to have impacted the Chilean economy. The cuts in personal tax rates have two main effects on incentives. First, to the extent that the cuts in marginal tax rates on labor income were perceived as permanent (as they turned out to be), then the changing tax rates provide no incentive to substitute labor intertemporally. Instead, a wealth effect would reduce labor supply while a substitution effect from leisure to consumption would increase labor supply. Based on observed wage levels and hours of work across countries and over time, if either effect dominates, it is the wealth effect, so that if anything this reform should reduce labor supply. This is hardly an alternative explanation for the observed boom in savings. The one caveat to this argument is that lower tax rates on labor income also increase the incentive to accumulate human capital. It is possible that the investment boom occurred to take advantage of the higher expected future human capital levels. We know of no evidence that supports this hypothesis.

Second, the reduction in the taxation of dividend income increases the incentive to save and accumulate capital. Might this aspect of the reform then have caused some of the observed boom? Empirically, it seems unlikely since, as noted in the introduction, Chile experienced an investment boom at the time of the reform. Saving rose only slowly and Chile borrowed significantly from abroad until 1988 when saving roughly equalled investment. Given the weak observed link between capital income taxation and economic growth and the small changes that Chile actually implemented at this time, the changes in personal tax rates are unlikely to have significant contributed to the Chilean economic boom.

4 Aggregate evidence

The behavior of national saving and investment suggest that the reduction in the taxation of retained profits caused at least part of the rapid growth in Chile. Both saving and investment boomed, from an average rate of 15 percent from 1960 to 1983, to an average rate of 25 percent in the first half of the $1990's$. As figure $3a$ shows, there is a striking change not only in the level but also in the composition of saving at the time of the tax reform. Business saving increased after the tax reform, while private saving and public saving remained largely unchanged. Our theory predicts that saving rises as firms respond to the reduction in the tax on retained profits by retaining more profits, and importantly that households do not decrease active saving to offset this change.[13] With respect to investment, the timing of the investment boom also supports our theory. Investment increases by 4.5 percent of GDP in the first year of the reform and increases by over 10 percent of GDP over five years, reaching 25 percent of GDP by 1989. The tax reform occurs at the beginning of the investment boom while other reforms such as trade liberalization and the privatization of the public pension system significantly predate the boom. It should be noted that Chile did experience an investment boom from 1976 to 1981 financed by large current account deficits. But this lending boom and following collapse are common to many countries in Latin America over this time period.[14] As shown Figure $3b$, only the later investment boom is particular to Chile, since the rest of Latin America stagnated during the $1980's$ following the debt crisis.[15]

What other evidence can we bring to bear? We first examine the change in the debt to asset ratio for firms during this period, for which aggregate data exist only for publicly traded companies. Since publicly traded companies by definition have some access to capital, they are less likely than the typical firm to be credit constrained. In response to the change in the incentives due to the reduction

[13] This is consistent with cash constrained firms being owned by liquidity constrained households. If liquidity constraints and cash constraints were not important, a reduction in the retained profits tax rate might merely result in a shift in the composition of savings from household to corporate savings, with no effect on aggregate savings.

[14] The consensus view of these booms are that they were unsustainable lending booms driven by some combination of poorly-regulated financial liberalization and a surge in capital inflows driven by external factors. See for example Diaz-Alejandro (1984).

[15] Argentina, Brazil, Columbia, Mexico, and Venezuela are "the rest of Latin America."

in the tax on retained earnings, an unconstrained firm should increase its retention of profits relative to payment of dividends.[16] A constrained firm should increase its after-tax retained earnings and increase its investment. As Figure 4*a* shows, following the reforms, publicly traded firms reduce their debt but only after a significant lag.[17]

Figure 4*b* shows the impact of the tax reform and investment boom on real tax revenues collected on capital income, both from the personal income tax and the corporate profits tax.[18] The tax revenues from the category that includes retained profits declines from 250 million 1996 pesos in 1984 to less than 100 million 1996 pesos in 1987. At the same time, the revenues collected from the corporate income tax, the ten percent tax on all firm profits, rises starting in 1984 as firms invest and grow. From 1989 on, excepting the year 1990 when the retained profits tax was set to zero for a year, the increase in taxes collected through the general profits tax has more than replaced the lost revenues on retained profits. Figure 4*b* suggests that Chile was able to reduce the tax on retained earnings and increase tax revenues.

Having presented the basic aggregate facts, we next describe the data on firms and plants that we use to construct industry-level data and to categorize plants by constrained status and test whether constrained plants indeed invested more following the reform.

5 The Chilean Manufacturing Census

The main data for our analysis are from the Chilean Manufacturing Census (Encuesta Nacional Industrial Anual) conducted annually by the Chilean government statistical office (Instituto Nacional de Estadistica). The survey covers all manufacturing plants in Chile with more than ten employees and has been run annually since 1979. In addition to working with the raw data files, we also use some data from an extract from this survey compiled by the World Bank under the direction of James Tybout. Finally, the Chilean statistical agency shared a file containing information on which

[16] There is also a slight reduction in the tax rate on dividends. The optimal response of an unconstrained firm is to increase its capital stock in response to slightly lower tax rate on dividends and pay more dividends. Thus the impact of dividend taxation is to reduce debt to capital ratios. Clearly the tax on retained earnings is the more important change.

[17] Note that, as in the United States, despite the favorable tax treatment of retained versus distributed profits, firms maintain fairly high levels of debt.

[18] Figure 3*b* displays taxes collected during a year rather than the taxes collected on activity during a year.

plants were owned by the same firm. Thus we are able to study the financial situation and behavior of firms to categorize plants as likely or unlikely to be credit constrained.

The advantages of the Chilean Manufacturing Census (CMC) for our purposes are its near universal coverage, annual frequency, and the wealth of information contained about each plant. We combine the information available in the annual surveys from 1979 to 1990 with the World Bank extract which covers only 1979 to 1986. The main unit of our analysis is a plant in a given year. The survey contains information on a wide variety of plant characteristics such as industry (4 digit $ISIC$), factor inputs, energy use, days of production, sales, and so forth. Of particular interest, plants report investment, employment and production on an annual basis. The book value of fixed assets is collected in 1980, 1981. The CMC data for year t are collected in surveys conducted in the beginning of year $t+1$. The data contain the value of flow variables over the entire year t and the value of stock variables as of the end of period t.

The CMC contains information on five types of investment: purchases of new capital, purchases of used capital, production of capital for own use, improvements in own capital by third parties, and sales of capital. Our measure of investment, to which our capital measure corresponds, is the sum of all five types of investment in machinery and equipment and vehicles. That is, we exclude land and buildings. Investment can be negative due to sales of capital and we treat negative reported investment as legitimate. There are a large number of plants that report zero investment from purchases, production, improvements, and sales for all varieties of capital goods. Our primary dataset sets investment to missing only when the World Bank extract considers it missing. This treats the vast majority of zero investment reports as legitimate zeros and treats all such reports after 1986, the last year of the World Bank extract, as legitimate. To check that this assumption is not driving our results, we also create a dataset that sets investment (and thus subsequent capital stocks) to missing if there is zero reported investment in all categories and types for two consecutive years. We make this choice so that our baseline results use data that is consistent with that used by previous researchers, and use the alternative to check that the results are not driven by this particular assumption. In general they are not, and we note any places where our results are not robust to this alternative treatment of the data.

Our definition of capital corresponds to that for investment, and includes machinery, equipment and vehicles, and excludes buildings. We take our main measures of capital stock from the World

Bank extract, which constructs the book value of capital stock in 1980 and 1981 using an inflation adjustment and a depreciation adjustment. To check that our results do not depend on these adjustments, we also construct a separate data extract based on the reported book value of capital as reported in the raw survey data. As with the alternative treatment of investment, our findings are generally robust to this alternative, and we note results for which inference depends on our baseline assumption.

The capital stock for a plant for years besides 1980 and 1981 is calculated by iterating forward using investment and the capital accumulation equation

$$K_{j,t} = (1 - \delta_j)K_{j,t-1} + I_{j,t} \tag{5.1}$$

where j indexes either machinery and equipment or vehicles and the timing follows from the fact that investment during year t adds to the capital reported for end of year $t - 1$ to capital stock at the end of year t. We use the depreciation rates: 10% for machinery and equipment, and 20% for vehicles. These are the same rates used in the World Bank extract. In this procedure, we keep capital stocks positive, and omit depreciation for plants that are missing from the survey for a year, and drop plants missing for more than one year.

We use the machinery price index to deflate both investment and capital stock. We discard plants that die before the experiment that we seek to study, that is any plant that does not exist after 1983. We drop all plants owned or run by the by government. We consider investment to capital ratios greater than three or less than minus one to be mis-coded or mis-reported and so treat them as missing observations. Finally, there is significant attrition of plants. One quarter of plants attrit between 1984 and 1990 in our baseline sample. Details are contained in appendix B, which also provides a further description of the data construction.

6 Evidence from Chilean industries

We begin by testing whether, at the time of the tax reform, investment increases were concentrated in industries for which external finance is important. Rajan and Zingales (1998) construct measures of the reliance of an industry on external finance by examining the use of external finance by US companies. They show that in countries with poorly developed financial markets, industries that are more reliant on external finance grow more slowly relative to the typical growth for that industry and for that country in aggregate. We take a similar tack to identifying the impact of the cut in the tax on retained profits. If capital markets in Chile were poorly developed in the $1980's$ and if the 1984 tax cut disproportionately benefitted plants that are credit constrained, then investment rates should rise disproportionately in industries that are particularly reliant on external finance.

We estimate the following equation

$$\frac{I_{n,t}}{K_{nt}} = \alpha_n + \gamma_t + E_n \mathbf{D}_t \beta_E + F_n \mathbf{D}_t \beta_D + \varepsilon_{i,t} \tag{6.1}$$

where $I_{n,t}$ and $K_{n,t}$ are the total investment and capital stock respectively for industry n in year t, α_n measures the average investment to capital ratio for industry n, γ_t measures the average investment to capital ratio in year t, E_n is dependence on external finance for industry n as measured by Rajan and Zingales, $\mathbf{D}_t$ is a row-vector of indicator variables for years after the tax reform begins, β_E is the coefficient vector of interest and measures the amount by which $\frac{I_{n,t}}{K_{nt}}$ is higher for industries that are highly dependent on external finance in each year after the reform, F_n is a measure of capital intensity – the average of the 1981 and 1982 log of the ratio of the capital stock in industry n to the to total wages in industry n, and the vector β_D measures the extent to which investment to capital ratios are larger for industries that are more capital intensive in each year after the reform. We thus measure the extent to which industries that are more dependent on external finance have larger increases in investment rates after the reform, relative to their typical investment rates, the average investment rate in that year, and controlling for the fact that if the industry is also capital intensive, it may increase its investment more in response to the tax reform.

Since we estimate this equation on industry-level data from 1982 to 1990, the "typical" growth rate of an industry is measured by its performance in 1982 and 1983. We also measure typical performance by 1982, 1983, 1989 and 1990, by dropping the last two years of interactions between external dependence and the time indicators and between capital intensity and the time indicators. The first two years have the advantage of being prior to the reform, but the disadvantage that even after controlling for year effects, the pattern of growth across industries may be affected by the severity of the 1982 recession. The last two years have the advantage of being years of healthy growth in Chile, but the disadvantage of being post-reform and after a significant growth boom, when capital markets are beginning to develop more generally.

Table 3 shows the results of estimating equation (6.1) using weighted least squares where the weights are the number of plants in an industry and making inference allowing for arbitrary cross-industry correlations in each year.[19] Industries are defined by three-digit ISIC.[20] The first set of results examines the impact of the reform through 1990, the second set treat 1989 and 1990 as additional "control" years. The coefficients of interest, $\beta_{E,t}$, are negative and insignificant in 1984, positive in 1985 and positive and significant in both sets of results in 1986, and 1987. The last column of the Table quantifies the relative impact of the reform across industries that differ in their degree of financial dependence. An industry one standard deviations above the average level of dependence on external finance is predicted to have increased its capital 13 percent according to the first set of results or 6 percent according to the second by the end of 1987 relative to a comparable industry one standard deviation below the average. Industries that are more dependent on external finance grew more rapidly than usual at the time of the reform.[21]

These results suggests that many plants were having difficulty raising external funds in 1983, that plants in industries most dependent on external finance were the most hurt by these constraints, and that in 1985 through 1987, these plants made the largest increases in their investment. But this inference is made from cross-industry analysis. We now turn directly to plant-level evidence in which we compare the investment behavior of plants that are likely and unlikely to be cash constrained and control for the typical industry investment levels to see if this dimension of the data also supports our theory.

[19] Here we use the degree of external dependence as a continuous variable rather than using it to split the sample, as we do subsequently with indicators of possibly constrained status in the plant-level analysis. We choose this functional form to better control for capital intensity. That said, results are substantively similar if we instead split plants into thirds by the Rajan and Zingales measures and also include indicator variables for high, medium or low capital intensity.

[20] The exceptions are food processing and manufacture of fabrivated metal, where large numbers of plants allow finer detail, and six industries with few plants that are grouped into three categories. Complete details are in Appendix B.

[21] Results are similar across samples, and similar if one omits the control for capital intensity, and similar if one compares the three groups: highly dependent, medium dependence and little dependence on external finance. More capital intensive industries tend to have no consistent pattern of investment rates in 1984 or 1985, statistically insignificant higher investment rates in 1986, and lower investment rates in 1987 and 1988.

7 Evidence from Chilean plants

This section presents comparisons of the investment behavior of plants that are likely and unlikely to be having trouble raising external funds for productive investment. We measure the likelihood of being constrained based on the correlation of profits and investment before the reform, the amount of short-term capital held by the firm before the reform, whether a firm pays rent, and the size of the firm. When firms are split by investment-profit correlation, we find a significant effect of the reform as predicted by our theory. There is also some evidence from the sample split by short-term assets. But there is no detectable post-reform investment boom of plants owned by small firms more than large firms of plants owned by rent paying more than non-rent paying firms.

Our key dependent variable is investment during year t divided by capital at the start of the year (the end of the previous year):

$$\left(\frac{I}{K}\right)_{i,t} \equiv \frac{\sum_j I_{j,t}}{\sum_j K_{j,t-1}}$$

Table 4 provides a set of statistics on the number of plants, and the mean, standard deviation, and median of investment to capital ratios by year.

To characterize plants as likely or unlikely to have restricted access to capital, we merge plants owned by the same firm together into observations on firms. Each firm, and its associated plants, are categorized into more and less likely to be liquidity constrained on the basis of observed firm characteristics before 1984. Most plants are themselves firms; approximately 350 plants are associated with multi-plant firms during the years of the reform. The firms are divided into thirds: those for whom internal funds are likely to be important, those for whom the observed characteristics suggest a middle range of financial constraint; and those for whom internal and external funds are likely to have similar importance.

We first measure of the likelihood of a plant being credit constrained by the correlation of cash flow and investment for the entire firm during the period before the reforms.[22] We measure cash

[22] Our identification strategy is the reverse of that of Calomiris and Hubbard (1995). Calmaris and Hubbard (1995) identifies firms as credit constrained or not based on their response to a 1937 surtax imposed on retained earnings. Firms that retain profits despite between 7 and 27 percent additional taxes on such retained profits are called credit constrained. Constrained plants are found to display a higher correlation between investment and cash flow than firms that do not retain profits in the face of this tax. In contrast, we identify credit constraints by sensitivity to cash flow

flow as the reported net profits of a firm. The argument for this measure is standard. Plants that are credit constrained rely more heavily on internal funds to finance operations and so are unable to maintain investment when cash flow drops significantly. Thus, the size of the correlation of cash flow and investment provides a good measure of the degree to which a plant relies on internal funds to finance investment. Our exact measure is the correlation between the ratio of net profits to capital and the ratio of gross investment to capital over the period 1980 to 1982, where we use the 1980 capital stock in place of the unavailable 1979 stock. While we choose this period due to our limited sample, we suspect that this is a good time period for observing which plants are credit constrained since 1982 was a large, temporary downturn. Plants able to maintain some investment or avoid selling off capital in this deep recession are the most likely to have had owners with deep pockets, access to borrowing, or significant internal funds.

We divide our sample of plants into thirds based on our measure of the correlation of profits and investment. We expect the group with the highest correlations to be the most likely to be credit constrained and to benefit the most from the reduction in the tax on retained profits. We call these plants "constrained," the middle third "possibly constrained" and the third of plants with the lowest correlation "unconstrained," however these terms do not imply that we believe this split to be perfect. Given this crude measure there are surely plants that are constrained in the unconstrained sample and vice versa. This should lead any estimates of the impact of the tax reform to be biased towards zero. Following these results we present evidence from several alternative or complementary divisions of plants.

We begin by running the regression:

$$\ln\left(\frac{I}{K}\right)_{i,t} = \alpha_i + \gamma_t + C_i\mathbf{D}_t\boldsymbol{\beta}_C + LC_i\mathbf{D}_t\boldsymbol{\beta}_{LC} + \varepsilon_{i,t} \tag{7.1}$$

where α_i is a plant-specific fixed effect, γ_t is a year-specific fixed effect, C_i is an indicator of whether a plant is deemed constrained, LC_i is an indicator variable for whether a plant is likely constrained, $\mathbf{D}_t$ is a row-vector of indicator variables for years after the tax reform begins, and $\varepsilon_{i,t}$ captures other factors that impact plant's investment choices as well as measurement error in K and I. The column-vectors $\boldsymbol{\beta}_C$ and $\boldsymbol{\beta}_{LC}$ measure the differential investment activity of plants during and after the tax reform relative to their previous investment rates and relative to the contemporaneous investment

prior to the tax change, and then examine whether constrained plants display a greater response to the tax change.

choices of plants deemed unlikely to be constrained. We use all available data on plants from 1982 to 1990 and, as before, vary whether 1989 and 1990 are used as control years by varying whether indicator variables for 1989 and 1990 are included in the the vector $\mathbf{D}_t$.

Table 5 presents the estimates from equation (7.1) in the first and second columns of results. Plants with high correlation of investment and profits through the boom-bust period of $1980-1982$ show rapid and large increases in investment rates following the tax cuts. Constrained plants on average raise their investment rates by three to four percentage points during the three years of the reform. These estimates control for the average investment rate of a given plant and for the average investment rate in each year. We find similar results if we instead use our alternative series for capital and/or investment. The effect of the reform seems to be persistent. There is little evidence that investment rates slow following the reform, although slightly more evidence for our alternative capital and investment series. Turning to the plants with medium correlations of profits and investment, those that we deem possibly constrained, we also find a significant although smaller investment boom among these plants, again after controlling for both time and plant effects.

Our plant-level results so far rely on the assumption that the differences in the correlation of profits and investment across plants are driven by differences in access to capital rather than differences in technologies and product-specific demands. This assumption might fail if our results are largely comparing plants in different industries. That is, one might be concerned there are some industries that use technologies that happen to produce a high correlation between profits and investment and also happened to boom in the post-1983 period. We first address this alternative by controlling for the investment rate of each plant's industry in each year that we study. We then turn to alternative identification strategies.

We first compare the investment behavior of firms that are constrained and unconstrained relative to the average investment in that industry in that year. That is, we drop the firm and time effects in equation (7.1), and instead include a set of 33 three-digit industry level dummies interacted with a complete set of time dummy variables. Denoting this interacted set α_{jt} we estimate

$$\ln\left(\frac{I}{K}\right)_{i,t} = \alpha_{jt} + \gamma_C C_i + \gamma_{LC} LC_i + C_i \mathbf{D}_t \boldsymbol{\beta}_C + LC_i \mathbf{D}_t \boldsymbol{\beta}_{LC} + \varepsilon_{i,t}. \tag{7.2}$$

The coefficients γ_C and γ_{LC} capture the average investment rates of constrained and possibly constrained plants and the coefficient vectors $\boldsymbol{\beta}_C$ and $\boldsymbol{\beta}_{LC}$ measure the higher investment to capital rates for constrained and possibly constrained plants in each year relative to the average in that industry in that year. The last two columns of results in Table 5 show that our conclusions are robust to this alternative specification. The relative investment rates of constrained and possibly-constrained plants rise significantly during the reform. It is also interesting to note that the coefficients on the indicator variables for constrained and possibly constrained firms are both negative. This indicates that constrained firms invest at lower rates than unconstrained firms, as one might expect.

It is still the case however that we treat a plant as constrained if its correlation is in the top third for all plants rather than relative to the typical correlation in its own industry. Thus we next divide plants by investment-profits correlation relative to the average rate in their industry. A plant is deemed constrained if, among the plants in its four digit industry, it is among the top third in net profits-investment correlation prior to the reform. The results of this exercise are substantively identical to the results in Table 5. Plants we deem likely to be constrained experience larger investment booms. The remainder of the results all classify the constrained status of plants relative to the average values in their industry.

Having established that plants with higher correlations of profits and investment benefit more from the reform, we now investigate alternative assumptions for identifying constrained and unconstrained plants. We consider three other measures of the degree to which a plant is short on internal funds: the ratio of short-term reserves to capital, the ratio of rental payments to capital, and the size of the firm. All of the splits are based on numbers in 1980 and 1981, when book values are reported and well prior to the tax experiment we are considering. On balance, the results of these alternative splits do not clearly support or refute our main hypothesis.

Table 6 shows the relative investment to capital ratios of plants deemed constrained by their holdings of short term reserves in 1980 and 1981. Results are quite similar across the construction of the capital stock series, and robust to whether the 1989 and 1990 years are treated as control years, but differ with respect to the construction of the investment series. Thus Table 6 presents results from the two different constructions of the investment series. The first two sets of results are derived from the baseline series and show no significant differential effect of the reform on plants with low short-term asset ratios in 1980 and 1981. The second two sets of results do suggest that plants with low short-term assets to capital ratios grew more quickly following the reform, particularly when we control for the typical growth in each industry in each year.

One possible explanation for the lack of relative investment boom in this split of the data is that firms that are constrained may hold more liquid assets to avoid bankruptcy than plants that can borrow freely. Thus plants with credit lines maintain low levels of short-term assets without bankruptcy risk and contaminate this variable as an indicator of constrained status. There is also the possibility that the high inflation rate leads to a pattern of reserves that is more dependent on monetary factors than real factors. In sum, we conclude that we find at best modest support for our hypothesis, and no evidence to reject it, when identifying plants as constrained by comparing their level of short term reserves to their industry's average level.

Our second alternative identification strategy is to assume that plants that are financially constrained and have highly productive investment opportunities may be able to rent physical capital to partially loosen the financial constraint. That is, a financially constrained firm is more likely to rent than own the building in which it operates. In Table 7 we investigate whether plants that report paying rental payments benefit more during the years of the reforms. Since most plants report paying no rent, we simply study those that do relative to those that do not. We find no clear evidence that plants that pay more rent invest more following the reform. Our findings are similar whether or not one includes 1989 and 1990 as control years, but differ by capital and investment series, with the results with only one alternative series lying between the reported pairs of results.

The final alternative identification strategy is to assume that small plants are more likely to be constrained. This is standard practice in the literature on credit constrained plants in the United States – small plants are seen as having significantly lower access to credit markets – but in Chile several issues arise. First, the size of a plant is generally determined by its capital stock in the period prior to that being studied. Thus, capital stocks in 1980 and 1981 could be used to create a split. However, since only book capital is available and there is significant mismeasurement of initial capital stock, this would create a bias towards small plants having high investment to capital ratios early in the sample. This bias would create the incorrect illusion that small plants are growing faster than large plants prior to the tax reform and potentially that their growth slows relative to large plants as the tax reform is instituted. We provide a partial solution to this problem by splitting plants by the average number of employees in 1980 and 1981 rather than by initial capital stock.

The second problem with size is that most small manufacturing plants in Chile are family-run businesses that are perhaps limited in size by economies of scope. The most notable example of this is that 14 percent of our sample is plants in ISIC 3117, bakeries. In the United States, "small" firms in investment studies are usually small public firms, and in 1980 and 1981 in Chile less than one percent of plants are even public. Thus we are really comparing small plants to small plants. Finally, currently, but even more so in the early $1980's$, Chile's financial markets are significantly less developed than those in the United States. Many relatively large plants in Chile do not have access to capital in the same way that relatively large companies in the United States do. In short, size is much less of an indicator of access to capital in Chile and more an indicator of industry, for example. We provide a partial solution to these problems by splitting firms relative to the average size in their industry, as discussed previously.

Table 8 presents the results from dividing plants by size. To re-emphasize how different this exercise is from previous studies of U.S. data, in the typical industry in Chile, small plants are defined as averaging 19 employees or less while large plants are defined as averaging 44 employees or more. As Table 8 shows, there is no evidence that the investment rates of small plants rise (or fall) disproportionately at the time of the tax reform.[23]

In sum, plants that have a high correlation between cash flow (net profits) and investment prior to the reform have the largest increases in investment rates post-reform. This finding is quite robust. However, alternative measures of which firms are likely to be constrained are not supportive of the main hypothesis. We believe that the first measure is the best, but report the results of our other analyses.

8 Other Policy Reforms in Chile

Out theory is that in a country such as Chile in 1984 with undeveloped financial markets, investment is constrained by the lack of access to the credit. By increasing the internal funds available to profitable firms, the 1984 corporate tax reform played a large role in unleashing the savings and investment boom that took place in Chile. However, an alternative hypothesis is that most firms were not credit constrained and that the documented patterns of increases in investment and saving are due to other reforms implemented by Chile's military regime over this time period. Under this

[23] Results are similar for the alternative definition of capital and for regressions that include 1989 and 1990 as post-reform years.

alternative hypothesis, the 1984 tax reform shifted the composition of savings towards corporate savings without affecting the aggregate investment rate.

This section describes the major reforms that occurred in Chile over the last 25 years: the semi-privatization of the public pension system, the liberalization and development of financial markets, and the opening to trade and capital flows.[24] Each subsection describes the major policy changes in one area and makes the case that the reforms in question are, based on theory and evidence, unlikely to alter the inferences drawn so far in this paper. To be clear, we do not mean to argue that these reforms did not benefit Chilean economic growth. Rather each of these reforms surely played a role. The corporate tax reform caused an investment boom, leading to faster convergence. These other reforms affected the steady-state levels of output and capital per worker, and convergence to these levels, for most countries and states, is a slow process.

8.1 Privatization of the public pension system

Prior to 1981, Chile had an unfunded, pay-as-you-go, public pension system much like the U.S. Social Security system.[25] The average payroll tax rate varied significantly across firms, but was around 30 percent of wages.[26] In 1981, the Chilean government cut and standardized the payroll tax, and created a new system which mandated contributions to heavily regulated but privately-managed accounts. All new entrants to the labor force had their payments (20% of wages), less administrative fees and a share for disability and health insurance (10% of wages), placed into private accounts which they could invest into one of several regulated mutual funds.[27] Those employed at the time of the reform had the option to switch into the new system or remain in the old. The new system was immediately popular: 70 percent of private employment switched in the first year.[28] Elderly workers

[24] See the chapters in Bosworth, Dornbusch, and Laban (1994) and Perry and Leipziger (1999) for a detailed description of the reforms implemented by the Chilean government.

[25] For more complete descriptions, see Edwards (1996) and Diamond (1993).

[26] Exact estimates differ. See Coronado (1997), Gruber (1995), Edwards and Edwards (2000). The rates were significantly higher early in the 1970's.

[27] The health insurance share of the tax could be used by the payee to purchased health insurace from private providers, subject to strict regulation. Among new entrants, the participation of the self-employed was optional, and this has lead to a significant problem of households gaming some of the redistributive nature of the system by moving in and out of self-employment.

[28] Coronado (1997).

tended to remain with the old system and 20 percent of the self-employed opted to participate.

The new system was fully funded, with the exception that all plans were guaranteed by the government. To pay the unfunded liabilities of the old system, the government issued a large amount of new debt, "recognition bonds," which were bought by households and slowly paid down by the government. The fiscal costs of these unfunded liabilities averaged 4.7 percent of GDP in 1981 – 1988.[29]

How might this reform be responsible for the savings and investment boom? First, note that as long as households do not change their consumption behavior and government spending does not change, such a reform has no effect on aggregate national savings. In such a Ricardian world, measured household savings increases by definition because contributions into private accounts are counted as private savings, and this increase is mirrored by the increased public spending necessary to pay the unfunded liabilities of the old system. There is therefore no net effect on aggregate savings.

But Ricardian equivalence seems like a poor assumption to apply to Chile in the early $1980's$. Chile had poorly developed financial markets and, it seems likely that many households and small businesses were financially constrained. However, the impact of this reform is exactly the same as in a Ricardian world if households cannot access or borrow against their private pension accounts. The consumption and investment of constrained households does not change since the privatization merely replaces a government IOU with a particular account that the government funds by issuing a government IOU. One caveat to this argument is that this reform might alter factor prices, but this does not occur if rates of return are set by the world capital market. That is, the privatization of the pension system does not alter saving and investment if the domestic and/or international capital markets absorb the additional government bonds without altering the domestic real interest rate.

In practice, the privatization seems to have just re-categorized public pension contributions as private instead of public saving. Figure 5 decomposes household savings into contributions to the privatized social security system and into non-social security savings. A significant part of the trend increase in household savings (from -3.8 percent of GDP in $1975-83$ to 1.7 percent of GDP in $1984-94$) is due to contributions into the privatized social security accounts. The increase in measured household savings due to these contributions is mirrored by lower public savings due to the costs of the unfunded liabilities of the old pension system (as shown in Figure 3a).

[29] Ortuzar (1988), quoted in Edwards (1996), Table 5.

Our discussion so far assumes that taxes are nondistortionary. But if private savings incentives were affected by the reform, then the privatization of social security could be partially responsible for the savings boom. For example, if payroll taxes were high and not related to benefits before the reform, then the privatization of social security would increase the incentives to earn by giving households greater benefits for greater taxes paid. An increase in labor supply could lead to an investment boom. Evidence on this point is provided by Gruber (1995), which finds that the incidence of payroll taxes in Chile fell fully on wages, with no effect on employment. According to this evidence, payroll taxes under the old system did not create significant labor market distortions.

Another alternative channel is that the privatized pension funds may have lead to a deepening of financial markets and so increased the incentives of households to save and firm access to financial capital. There is some evidence that non-social security savings increased over the relevant time period (see Figure 5), but the magnitude of the increase – slightly over 3 percent of GDP from $1975-83$ to $1984-94$ – is small relative to the increase in the aggregate savings rate. Financial market development is discussed in the next section. Here we reiterate that even if the reform increased savings, in theory this does not lead to an investment boom in a small open economy like Chile. Many economists are sceptical of this small open economy theoretical argument on empirical grounds: saving rates and investment rates are highly correlated across countries. But if high saving lead to high investment in Chile, we would expect to see Chile exporting at least a small amount of capital. In fact, following the reform and through much of the $1980's$, Chile ran significant current account deficits, importing capital. This fact is strongly suggestive that high saving did not directly cause high investment, and more importantly that the role of the reform of the public pension system in the investment boom is minimal.

One important final piece of evidence comes from the experiences of the set of countries that reformed their public pension systems. Samwick (2000) studies seven pension reforms in Latin America, seven reforms in Africa, two reforms in Asia, and four reforms in developed economies. Samwick (2000) finds no evidence that countries that privatized their social security systems experience an increase in savings rates, with one exception, Chile.[30] It seems unlikely that Chile was the one exception in which the reform of a public pension lead to investment and saving booms.

[30] He concludes, ". . . no country other than Chile that moved to a system of based more on defined contributions during the sample period experienced an increase in the trend saving rates after reform." Samwick (2000), page 272.

8.2 Liberalization and development of financial markets

Over the last 25 years, there has been a significant increase in the role of bank credit and publicly-traded equity in Chile's financial markets.[31] However, most of this deepening of financial markets occurred in the $1970's$ and $1990's$. The increase in financial intermediation of the $1990's$ seems a direct result of growth rather than the other way around.

During the first few years of the military regime, Chile focused its efforts on liberalizing the banking sector. From $1974-81$, the government lifted interest rate controls, eliminated entry barriers to the banking industry, lowered liquidity requirements for banks, eliminated quantitative controls on credit, and privatized state-owned banks. As shown in Figure $6a$, the result was a large expansion in bank credit, which increased from 10 percent of GDP in the early $1970's$ to almost 60 percent of GDP by the early $1980's$. This development halted with the advent of the debt crisis and the recession of 1982. After the banking crisis of 1982, the government took over most of the country's banks, and, undertook the process of liquidating or recapitalizing and privatizing them, a process which took many years. Bank credit declined significantly in 1982 and continued falling during the beginning of the investment boom. Bank credit reached its low of 40 percent of GDP in $1985-86$. A new banking law in 1986 established limits on the leverage positions of the banks, increased reserve requirements, and generally increased the supervisory capacity of the Central Bank over the banking sector. These restrictions kept bank credit roughly constant at 40 percent of GDP until the start of the $1990's$. Thus, bank credit was falling as the investment boom began and did not rise as a share of output until investment and saving rates stopped growing.

Turning to the equity market, the stock market played an even more minor role in Chile's financial system in the $1980's$; the market value of publicly traded equity in Chile was 30 percent of GDP in the $1980's$. As shown in Figure $6b$, it was not until the $1990's$ that the stock market in Chile increased rapidly. The market value of publicly-traded stocks in Chile (relative to GDP) roughly tripled from 35 percent of GDP in 1989 to 94 percent in 1996.[32] Since the growth of bank credit was limited in the $1990's$, the deepening of Chile's capital markets during this decade was disproportionately due

[31] For additional details, see Gallego and Loayza (2000) and Barandarán and Hernández (1999).

[32] This increase is only partially due to an increase in the price of Chilean equity. In fact, the quantity of Chilean equity, computed by dividing the market value of Chilean stock by its price, increased by 70 percent from 1990 to 1996 (Eyzaguirre and Lefort (1999), Table 3-1 and Figure 3-2).

to the growth in the stock market.

Might these changes in Chile's financial structure have driven the savings and investment boom? They could explain the investment boom if firms that were previously credit constrained were able to obtain financing for their investments as a result of the deepening of Chile's financial markets. However, the aggregate evidence indicates that the investment boom was not financed by external credit but rather by retained earnings. In addition, the timing of the lending boom and the stock market boom in Chile does not support the hypothesis that the investment boom is due to developments in Chile's financial market. The investment boom in Chile took place from 1984 to 1989, but aggregate bank credit did not increase over this time period. Similarly, Chile's equity market did not increase significantly until the $1990's$, after the investment boom. The evidence suggests that the investment boom caused the development of Chile's equity market rather than the reverse.[33]

Finally, we check that our main result is not due to the fact that credit-constrained firms increased borrowing starting in 1984. Recall that we find that the investment of likely constrained firms (measured as firms with a high correlation of investment and cash-flow) increased after 1984 relative to the investment of firms that were likely unconstrained. If this boom were due to an increased access to credit, then we would expect that the ratio of interest payments to capital would rise for our "constrained" firms relative to our "unconstrained" firms. To test this hypothesis, we estimate equations (7.1) and (7.2) with interest payments to capital as the dependent variable. We find little evidence of this effect. Table 9 shows the results that match the results presented in Table 5 and there is no evidence that the likely-constrained plants borrowed more when their investment boomed. Results using the alternative capital stock series or the alternative investment series also find if anything decreases in interest payments for plants deemed likely to be constrained. However, the alternative capital and investment series together suggest, statistically insignificant but economically significant increases in interest payments for these plants. The balance of the evidence is consistent not with a general increase in available debt instruments and increased access to credit for constrained plants, but rather with increased funds available from internal sources allowing plants with profitable

[33] If the investment boom was driven by the development of Chile's financial markets, then a firm's investment should become less sensitive to cash flow, not more sensitive to cash flow. Gallego and Loayza (2000) find some evidence that the investment of publicly traded companies was less sensitive to cash-flow, but *only after the investment boom*, that is in the $1990's$ relative to the $1980's$.

investment opportunities to invest substantially more.

8.3 Trade liberalization

Another major reform pursued by Chile in the late $1970's$ and early $1980's$ was the liberalization of its trade regime.[34] During the $1960's$ and early $1970's$, Chile, like many developing economies, pursued policies of import substitution. By 1973, in addition to multiple official exchange rates and quantitative restrictions on imports, the average tariff rate exceeded 100 percent. Among the economic reforms pursued by the Pinochet government was international economic openness, so that by 1979, the average tariff rate had fallen to 12 percent and many of the regulatory restrictions on importing and exporting had been removed. From 1976 to 1981, Chilean manufacturing production grew by 25 percent, but at the same time, the balance of trade worsened and the real exchange rate appreciated significantly.

While the liberalization would seem like a boon to growth and possibly a direct cause of high rates of investment, policy reversed direction during the debt crisis and the deep 1982 recession. By 1984, when the investment boom began, tariffs had been raised to an average of 36 percent. It seems unlikely that decreased openness would lead to an investment boom. As the economy improved, the tariffs were again lowered, to an average of 15 percent by 1988.

To summarize, low tariffs lag economic growth and do not lead it. The investment boom began in 1984, when tariffs rates peaked. Openness may have been an important foundation for growth, but seems unlikely to have been the precipitating factor for the investment boom and growth of the $1980's$ and $1990's$.

9 Conclusion

In 1984, Chile had a poorly developed financial system, with many banks under public control or poorly capitalized. Average tariff rates were double the rates of five years earlier. The semi-privatization of the public pension system had moved a large amount of implicit government debt into an explicit form. Yet, unlike the other Latin American economies, Chile experienced an investment and growth boom over the next decade.

[34] See Tybout (1996) and Pavcnik (1999).

This paper makes the novel argument that a corporate tax reform is a significant and direct cause of this boom. We use aggregate, industry and plant-level data to show that the reduction in the taxation of retained earnings allowed financially constrained firms to take advantage of highly profitable investment activities. The increase in saving associated with the investment boom was almost entirely an increase in business saving. Investment rates rose the most in industries that are the most reliant on external finance. Plants that exhibit a high correlation of investment and cash flow prior to the tax reform increase their investment rates the most during and to some extent following the reform. Our case is not airtight, as the plant-level data does not confirm our main hypothesis for all other identification strategies, strategies which we view as inferior but not without some merit.

More generally, in countries with poorly developed financial markets, taxation of retained profits can have a significant effect on corporate savings and can therefore be particularly harmful for growth. By taxing retained profits, the government removes internal funds from some firms where the value of these resources exceed the real interest rate. This argument is conditioned on a country having otherwise favorable macroeconomic policies and conditions. In an economy with high levels of corruption or taxation, poor property rights, poor infrastructure, and so forth, the reduction of a tax on retained profits is likely to accomplish little since investment is low not because of poor financial markets but due to few opportunities for profit. Finally, our paper adds to evidence that underdeveloped financial markets are a significant factor retarding economic growth. Corporate saving is an important source of productive investment, and policies that increase the internal funds available to firms may have disproportionately large growth effects.

Appendixes

A A two period model of credit-constraints, taxes, and investment

Consider a two-period model of investment in which firms choose capital to maximize profits. Firms face credit constraints and those with low internal funds are constrained from borrowing to invest at the optimal rate. We demonstrate that taxes on retained earnings are particularly harmful in this environment.

We set the tax structure in our simple model to mimic the structure of Chile's taxation of profits, dividends, and retained earnings, as described in detail in the next section. There are three taxes levied on capital income: profits tax (τ_p), retained profits tax (τ_r), and dividend income tax (τ_d). The retained profits and the dividend income tax rate are defined as the tax rate net of the profits tax; the effective tax rate on retained profits is therefore $\tau_p + \tau_r - \tau_p \cdot \tau_r$ and that on dividends is $\tau_p + \tau_d - \tau_p \cdot \tau_d$.

The economy is small and open so that the interest rate is fixed. We assume that foreign investors require an after tax return of $R^f = 1 + (1 - \tau_d)\, r$ where r is the pre-tax real interest rate in the economy.

The economy is populated by two-period-lived family firms. Firms invest at date 1 and consume at date 2 and maximize the present value of after-tax dividends. There are two types of firms: those who at date 1 have few internal funds, $Y_1 = Y_1^{lc}$ (who will be liquidity constrained); and those who at date 1 have significant internal funds, $Y_1 = Y_1^{nlc} > Y_1^{lc}$ (who will not be liquidity constrained). These internal funds are profits from previous activity, and are subject to taxation as such. These resources can be converted into date 2 income either by paying a dividend, or by using these internal funds to buy capital (I^I) in the "family" firm.

$$(1 - \tau_p)Y_1 = \frac{I^I}{1 - \tau_r} + d_1 \tag{A.1}$$

Internal funds invested are subject to taxation as retained earnings. Both dividends and investment are constrained to be weakly positive.

In addition to investing internal funds, the entrepreneur can borrow to finance investment in the family firm, I^B, which she repays in the second period at the market interest rate r. To capture financial constraints in a simple manner, we assume that the maximum amount the firm can borrow is limited to the amount of collateral creditors can seize in the event of a default and that this amount is the entrepreneurs' internal funds. Thus, investment financed by borrowing, I^B, cannot be greater than after-tax internal funds.

$$I^B \leq (1 - \tau_r)\,(1 - \tau_p)Y_1 \tag{A.2}$$

For a firm investing as much as it can, $I^B = I^I = (1-\tau_r)\,(1-\tau_p)Y_1$.

The family firm produces output net of materials and labor costs in the second period of $Y_2 = F(K) = F(I^B + I^I)$. Firms have access to the same production function regardless of type. Capital depreciates completely.

Finally, we assume that

$$
\begin{aligned}
(1-\tau_r)\left(1+(1-\tau_p)\left(F'\left[2(1-\tau_p)(1-\tau_r)Y_1^{lc}\right]-1\right)\right) &> 1+r \qquad \text{(A1)}\\
F'\left[(1-\tau_r)\,(1-\tau_p)Y_1^{nlc}\right] &< 1+r \qquad \text{(A2)}
\end{aligned}
$$

which imply: (A1) that the entrepreneur with internal funds Y_1^{lc} cannot borrow sufficient to finance the unconstrained optimal amount of investment; and (A2) that the entrepreneur with Y_1^{nlc} can borrow the unconstrained optimal amount without hitting the financing constraint.

Firms maximize the present discounted value of after-tax dividends subject to the budget constraint and collateral constraint.

$$
\begin{aligned}
&Max_{I^{Bor},\ I^{Int},\ d_1}\ (1+(1-\tau_d)\,r)(1-\tau_d)d_1 \qquad \text{(A.3)}\\
&+(1-\tau_d)\left[F(I^B+I^I)-(1+r)\,I^B-\tau_p\left(F(I^B+I^I)-I^I-I^B-rI^B\right)\right]\\
&\text{subject to } (A.1) \text{ and } (A.2).
\end{aligned}
$$

The first expression in equation (A.3) is the after-tax value in the second period of dividends paid in the first period. The second term is the after tax value of dividends paid in the second period. The dividends in the second period are after-tax profits, which are output less debt repayment less the profits tax and firms can write off depreciation and interest payments.

For an entrepreneur with sufficient internal funds, the optimal amount of capital is determined by the first order condition for debt I^B and the marginal product of capital equals the domestic real interest rate:

$$F'\left[I_d^* + I_f^*\right] = 1 + r. \qquad \text{(A.4)}$$

where I_d^* and I_f^* are the optimal choices of I_d and I_f. The marginal product of capital of an unconstrained firm is set higher than the world rate of return due to the tax on dividends. Since interest costs are tax deductible, the choice of capital stock is not affected by profit taxes or taxes on retained earnings.[35] The

[35] Because we have specified only the one constraint in capital markets, unconstrained firms are able to choose their capital structure as dictated by tax incentives. Thus ,they borrow to finance all new investment.

unconstrained firm pays its first-period profits out as dividends if the wealth of the entrepreneur is higher saving the dividends outside the firm $(1-\tau_d)(1+(1-\tau_d)\,r) > (1-\tau_p)(1-\tau_r)\,(1+r)+\tau_p(1-\tau_r)$. This condition is met, for example, when dividends and profits are taxed similarly and retained profits are taxed.

The investment strategy of the entrepreneurs with few internal funds is to borrow and retain earnings so as to invest as much as possible. Equation (A.2) binds, $I_f^* = I_d^* = (1-\tau_p)(1-\tau_r)Y_1^{lc}$, and the marginal product of capital exceeds the market rate

$$(1-\tau_r)\left(1+(1-\tau_p)\left(F'\left[I_d^*+I_f^*\right]-1\right)\right) > 1+r. \tag{A.5}$$

Since the investment of liquidity constrained firms is constrained to be low, these firms have an after-tax marginal product of capital that exceeds the market interest rate.

There are two important implications of equations (A.4) and (A.5). The distortionary effect of dividend and profits taxes on the capital stock differ for liquidity constrained and non-constrained firms. The tax on retained profits does not affect the capital stock of firms that do not face binding liquidity constraints. Since they have access to capital markets, these firms are able to make up for a reduced level of internal funds (due to the retained profits tax) by borrowing more from external capital markets. However, dividend taxes distort the choice of capital stock of unconstrained firms, by raising the market real interest rate.

In contrast, a tax on retained profits does reduce the investment and capital stock for constrained firms. Since the capital stock of liquidity constrained firms is limited by their available cash flow, taxes on retained profits, by reducing the amount of internal funds available to the firm, decrease capital stock of these firms one for one. Dividend taxes affect the after-tax second-period income of liquidity-constrained entrepreneurs, but do not affect the capital stock because liquidity-constrained entrepreneurs are already investing their entire first period endowment income in their firms' capital stock.

We note three points about robustness. First, we model the heterogeneity across entrepreneurs as due to differences in internal funds. But the same implications follow if instead entrepreneurs have similar limited levels of internal funds and differ by the productivity of their projects. Then the entrepreneurs who are constrained are those who desire to invest the most – those with the most productive investment opportunities. Second, we have not been explicit about product markets. It is necessary that the size of unconstrained

In fact, informational, incentive or bankruptcy constraints seem to cause firms to limit their debt finance and in practice profits taxes are likely to distort capital accumulation. We abstract from these posibilities to keep out model simple and because our focus is not on the corporate profits tax. We do not mean to maintain that distortions from this source are not important.

firms be limited by economies of scope (so there is diminishing returns in $F(.)$) or by demand, such as through monopolistic competition. Finally, in a multi-period model, a tax on retained profits reduces optimal investment for an unconstrained firm since the firm can postpone the tax burden of dividends by postponing paying out profits. However, the impact remains significantly less than on the investment behavior of a constrained firm because it affects the marginal return to investment from the optimal level rather than a tightening of a binding constraint.

In sum, for firms that face liquidity constraints, taxes on retained earnings remove cash from inside credit-constrained firms where it is more valuable. In contrast, dividend taxes only distort the investment decisions of firms at their unconstrained optimal capital stocks.

B Additional details on the Chilean manufacturing census

The CMC survey questionnaires do not directly ask for asset information, but according to the instructions of the survey, plants are supposed to provide a copy of their balance sheets (that they are required to keep for tax purposes). These sheets are the source of the asset information, including the book value of capital, contained in the Survey in 1980 and 1981. Book value is also asked annually since 1992. There is a "book value of assets" measure reported in 1986 and 1987. The 1986 and 1987 numbers are implausibly small (i.e. less than 5 percent of investment) and we do not use them.

We exclude buildings from our measure of capital and investment because the book value of capital in 1980 and 1981 only lists land and buildings together while investment data until 1987 do not include land at all. That is, in 1980 or 1981 we construct capital stock using reports on book value of fixed assets in machinery and equipment, furniture, and vehicles and then distribute the amount reported in "other fixed assets" across the three categories (machinery, vehicles and real estate) in the proportion that each category is of the sum of the three. From 1992 on, the reported asset types are: land; buildings; machinery and equipment; and vehicles. The CMC contains information on four main categories of capital investment: buildings; machinery and equipment; vehicles; and, after 1986, land.[36]

In the World Bank extract, the reported book value of capital stock has a monetary adjustment factor (in addition to being deflated to be made real) and is also adjusted to account for some depreciation. Since the documentation is unclear as to how these adjustments are derived, we construct two separate data extracts:

[36] In 1987 and 1988 investment in land is reported under "other" investment; after 1988, land is its own investment category. Prior to 1987, investment in land is not included in the survey; notably it is not included in investment in real estate (whereas in this period land is included in capital stock in real estate).

one that is based on the reported book value of capital as reported in the raw survey data for 1980 (1981 if 1980 is missing or zero); the other that is based on the "net," "inflation adjusted" capital stock as reported in the World Bank extract for 1980 (1981 if 1980 is missing or zero). "Net" and "inflation adjusted" are the terms used in the Wold Bank documentation.

We use a machinery price index to deflate both investment and fixed assets in machinery and equipment, and vehicles. Capital stock in "other assets" is distributed across categories in the construction of K by category and and the deflation is done after this distribution. We deflate the reported book values of capital stock by the average deflator for year t and year $t+1$ since the reported book values refer to end of year values and the deflators provide a price index for the entire year. Flow variables such as investment are simply deflated by year t price deflators.

In cumulating past capital stocks and investment to construct capital stocks, the data are cleaned in three ways. First, in some rare cases, we infer that the capital stock becomes negative, and we reset these stocks to zero. Since capital is a denominator such an observation is not used in analysis. Since we drop extreme outliers some cases close in time to this observation with unreasonably low capital stocks are also not used. Second, when a plant disappears from the sample for only one year, we assume that it was merely missed in the survey for a year and carry its capital stock forward over the missing year without adjustment. That is we assume that investment roughly equalled depreciation during the omitted year. Finally, plants absent for more than one year are considered to have become too small to be in the survey or to have gone bankrupt, and any future observations on such a plant are dropped.

A nontrivial number of plants, about 20 percent, switch industry codes at some point during the period over which they are observed. We treat these as legitimate. Firms that are associated with plants that cover multiple industries are associated with the mode industry. Where ties occur they are broken somewhat randomly by choosing the smallest industry code. Most firms operate plants in related industries, and we verified that this allocation rule does not drive any results. Finally, roughly half of plants "attrits" between 1983 and 1990 for the alternative sample that sets investment to missing following two consecutive years of zero reported investment.

Industries are defined by their three-digit ISIC code, except that a) the food production industry (311) is treated as four separate three digit industries since it has so many of the firms in the sample (groups are 3111 and 3112 (meat and dairy); 3113, 3114, and 3115 (canning and oils and fats); 3116, 3118 and 3119 (grains, sugar, and cocoa); 3117 (bakeries); b) 312 (other manufactured foods and animal feed)is grouped with 3140 (tobacco); c) industry 381 (fabricated metal except machines) is also treated more finely – it is simply left at the four digit level; and finally d) due to small numbers, industry 3540 (petroleum and coal) is grouped with 353 (petroleum refineries) and 3620 (glass) is grouped with 361 (pottery and china).

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Tax Bracket (1983-1985)	Marginal Tax Rates 1983	1984	1985	Tax Bracket (1986)	Marginal Tax Rates 1986
0-32,140	0.00	0.00	0.00	$0 - 32,140$	0.00
32,140-80,350	0.08	0.07	0.06	$32,140 - 96,420$	0.05
80,350-128,560	0.13	0.12	0.11	$96,420 - 160,700$	0.10
128,560-176,770	0.18	0.17	0.16	$160,700 - 224,980$	0.15
176,770-224,980	0.28	0.27	0.26	$224,980 - 289,260$	0.25
224,980-273,190	0.38	0.37	0.36	$289,260 - 385,680$	0.35
273,190-321,400	0.48	0.47	0.46	$385,680 - 482,100$	0.45
above 321,400	0.58	0.57	0.56	above $482,100$	0.50

Table 1: Personal Income Tax Rates in Chile pre and post Reform

Notes. The tax brackets are indexed for inflation. The 1986 tax bracket is quoted in January 1984 pesos p/month

	Sociedad Anonimas		Sociedades Limitadas	
	Retained Profits	Distributed Profits	Retained Profits	Distributed Profits
pre-1984	0.460	$0.244 + 0.54\tau$	$0.1 + 0.9\tau$	$0.10 + 0.9\tau$
1984	0.370	$0.118 + 0.63\tau$	0.1	$0.01 + 0.9\tau$
1985	0.235	$0.04375 + 0.765\tau$	0.1	$0.01 + 0.9\tau$
post 1985	0.100	$0.01 + 0.9\tau$	0.1	$0.01 + 0.9\tau$

Table 2: Corporate Tax Rates in Chile pre and post Reform

Notes. τ is the marginal personal income tax rate.

Table 3: Industry Investment Rates as a Function of Dependence on External Finance

	Coefficient	Standard Error	Effect of One Standard Deviation Increase in External Finance Dependency
		Panel A	
Interaction of Dependence on			
External Finance and: 1984	-0.024	(0.015)	-0.010
1985	0.019	(0.015)	0.008
1986	0.035	(0.014)	0.014
1987	0.046	(0.015)	0.019
1988	-0.032	(0.015)	-0.013
		Panel B	
Interaction of Dependence on			
External Finance and: 1984	-0.003	(0.004)	-0.001
1985	0.039	(0.004)	0.016
1986	0.055	(0.004)	0.022
1987	0.067	(0.004)	0.027
1988	-0.011	(0.004)	-0.004
1989	0.056	(0.004)	0.023
1990	0.037	(0.004)	0.015
Number of Observations:	306		

Note: Regressions include industry and year effects captial labor ratio interacted with year effects. Standard errors are calculated allowing for arbitrary heteroskedasticity and cross-industry correlations within each year. Regressions are run on data from 1982 to 1990 and include only plants that survive until at least 1984. Panel A uses 1982, 1983, 1989, and 1990 as control years; Panel B uses only 1982 and 1983. See text for further details.

Table 4: Number of Plants and Investment Capital Ratios by Year and Sample

Panel A: Baseline Sample
Capital stock initialized from World Bank extract
Investment missing following the World Bank extract

Year	Number of Observations	Mean I/K	Standard Deviation I/K	Median I/K
1981	3,283	0.115	0.303	0.000
1982	3,321	0.058	0.209	0.000
1983	3,209	0.059	0.213	0.000
1984	3,209	0.071	0.219	0.000
1985	3,013	0.068	0.212	0.000
1986	2,767	0.079	0.233	0.000
1987	2,635	0.103	0.251	0.009
1988	2,517	0.113	0.266	0.019
1989	2,433	0.139	0.289	0.029
1990	2,375	0.112	0.258	0.017

Panel B: Alternative Initial Capital Stock
Capital stock initialized as the reported book value
Investment missing following the World Bank extract

Year	Number of Observations	Mean I/K	Standard Deviation I/K	Median I/K
1981	3,286	0.111	0.266	0.000
1982	3,354	0.056	0.197	0.000
1983	3,235	0.057	0.199	0.000
1984	3,233	0.065	0.194	0.000
1985	3,028	0.065	0.204	0.000
1986	2,784	0.075	0.223	0.000
1987	2,653	0.102	0.252	0.009
1988	2,533	0.116	0.278	0.020
1989	2,434	0.134	0.275	0.027
1990	2,378	0.112	0.255	0.017

Panel C: Alternative Investment Series
Capital stock initialized from World Bank extract
Investment missing if zero in two consecutive years

Year	Number of Observations	Mean I/K	Standard Deviation I/K	Median I/K
1981	1,907	0.2005734	0.3781525	0.0788183
1982	1,757	0.1066308	0.280374	0.0306863
1983	1,449	0.103754	0.2584918	0.0302968
1984	1,309	0.1307663	0.2723599	0.0499551
1985	1,184	0.1205192	0.2390222	0.0457503
1986	982	0.142286	0.2620428	0.0643813
1987	831	0.1469315	0.2320091	0.0764872
1988	791	0.1503537	0.2451368	0.0902295
1989	762	0.1831413	0.2607033	0.1085611
1990	727	0.1631771	0.2540562	0.0911481

Panel D: Alternative Capital Stock and Investment Series
Capital stock initialized as the reported book value
Investment missing if zero in two consecutive years

Year	Number of Observations	Mean I/K	Standard Deviation I/K	Median I/K
1981	1,907	0.2041381	0.3452066	0.0847551
1982	1,783	0.1036753	0.2554344	0.0305476
1983	1,464	0.0945425	0.2267038	0.0277332
1984	1,321	0.1177184	0.2378064	0.0465582
1985	1,186	0.1001863	0.1807689	0.0409718
1986	986	0.1254738	0.2290787	0.0575351
1987	834	0.1308616	0.2008967	0.0660726
1988	794	0.1383945	0.2204166	0.0792377
1989	763	0.1688204	0.2344262	0.0992237
1990	730	0.1535068	0.2518668	0.0807679

Table 5: Investment to Capital as a Function of Profit-Investment Correlations and Year

	Plant and Year Effects		Plant and Year Effects		Industry x Year Effects		Industry x Year Effects	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
High correlation indicator:					-0.021	(0.006)	-0.039	(0.008)
High corr. plants in: 1984	0.049	(0.012)	0.063	(0.013)	0.044	(0.013)	0.063	(0.014)
1985	0.032	(0.012)	0.046	(0.013)	0.031	(0.013)	0.049	(0.014)
1986	0.024	(0.013)	0.038	(0.014)	0.024	(0.013)	0.042	(0.014)
1987	0.008	(0.013)	0.023	(0.014)	0.008	(0.014)	0.026	(0.015)
1988	0.031	(0.013)	0.046	(0.014)	0.033	(0.014)	0.051	(0.015)
1989			0.039	(0.014)			0.045	(0.015)
1990			0.024	(0.014)			0.036	(0.015)
Medium correlation indicator:					-0.039	(0.006)	-0.058	(0.008)
Medium corr. plants in: 1984	0.024	(0.012)	0.041	(0.013)	0.023	(0.012)	0.042	(0.013)
1985	0.016	(0.012)	0.034	(0.013)	0.017	(0.013)	0.036	(0.013)
1986	0.011	(0.012)	0.029	(0.013)	0.013	(0.013)	0.033	(0.014)
1987	0.023	(0.013)	0.042	(0.014)	0.023	(0.013)	0.042	(0.014)
1988	0.031	(0.013)	0.051	(0.014)	0.034	(0.013)	0.053	(0.014)
1989			0.038	(0.014)			0.038	(0.014)
1990			0.046	(0.014)			0.051	(0.015)
Number of Observations:	24,590		24,590		24,590		24,590	

Note: Correlation categorizations are based on the three observations of investment to capital ratios and net profit to capital ratios in 1980, 1981, and 1982. Regressions are run on data from 1982 to 1990 and include only plants that survive until at least 1984. See text for further details.

Table 6: Investment to Capital as a Function of Short-Term Assets to Capital Ratio

	Baseline Series				Alternative Investment Series			
	Plant and Year Effects		Industry x Year Effects		Plant and Year Effects		Industry x Year Effects	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Low assets indicator:			-0.019	(0.006)			-0.016	(0.010)
Low plants in: 1984	-0.005	(0.011)	-0.002	(0.012)	-0.001	(0.020)	0.031	(0.022)
1985	0.012	(0.011)	0.013	(0.012)	0.020	(0.021)	0.035	(0.023)
1986	0.008	(0.012)	0.010	(0.013)	0.020	(0.023)	0.035	(0.025)
1987	-0.001	(0.012)	0.010	(0.013)	0.003	(0.025)	0.010	(0.027)
1988	0.007	(0.012)	0.017	(0.013)	0.005	(0.026)	0.011	(0.028)
Medium assets indicator:			-0.041	(0.006)			-0.049	(0.009)
Medium plants in: 1984	-0.006	(0.011)	-0.004	(0.012)	-0.016	(0.019)	-0.003	(0.020)
1985	0.013	(0.012)	0.016	(0.012)	0.006	(0.020)	0.019	(0.021)
1986	0.007	(0.012)	0.006	(0.013)	0.003	(0.021)	-0.002	(0.022)
1987	0.021	(0.012)	0.022	(0.013)	0.027	(0.022)	0.020	(0.024)
1988	0.003	(0.012)	0.003	(0.013)	-0.008	(0.023)	-0.022	(0.025)
Number of Observations:	24,666		24,666		9,404		9,404	

Note: All regressions include year and plant indicator variables. Categorizations are based on the ratio of short-term assets to capital in 1980 and 1981 relative to the industry average. Regressions are run on data from 1982 to 1990 and include only plants that survive until at least 1984. See text for further details.

Table 7: Investment to Capital as a Function of Whether a Firm Pays Rent

	Baseline Series				Alternative Capital and Investment Series			
	Plant and Year Effects		Industry x Year Effects		Plant and Year Effects		Industry x Year Effects	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Rent Paying plant indicator:			0.024	(0.005)			0.027	(0.008)
Rent Paying plant in: 1984	-0.007	(0.010)	-0.009	(0.010)	0.010	(0.014)	-0.003	(0.018)
1985	-0.018	(0.010)	-0.020	(0.011)	0.016	(0.015)	0.006	(0.019)
1986	-0.003	(0.010)	-0.005	(0.011)	0.014	(0.016)	0.008	(0.020)
1987	-0.015	(0.011)	-0.023	(0.011)	-0.003	(0.018)	-0.019	(0.022)
1988	-0.017	(0.011)	-0.026	(0.012)	0.011	(0.018)	0.009	(0.023)
Number of Observations:	24,666		24,666		9,618		9,618	

Note: Plants are categorized as rent-payers based on 1980 and 1981 data. Regressions are run on data from 1982 to 1990 and include only plants that survive until at least 1984. See text for further details.

Table 8: Investment to Capital as a Function of Plant Size and Year

	Baseline Series				Alternative Investment Series			
	Plant and Year Effects		Industry x Year Effects		Plant and Year Effects		Industry x Year Effects	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Small plant indicator:			-0.021	(0.006)			0.026	(0.010)
Small Plants in: 1984	0.008	(0.011)	-0.005	(0.013)	0.038	(0.020)	0.019	(0.021)
1985	-0.004	(0.011)	-0.019	(0.013)	0.016	(0.020)	0.008	(0.022)
1986	-0.004	(0.012)	-0.015	(0.013)	-0.042	(0.022)	-0.031	(0.024)
1987	0.038	(0.012)	0.031	(0.014)	-0.019	(0.024)	-0.003	(0.026)
1988	0.020	(0.012)	0.008	(0.014)	-0.006	(0.024)	0.024	(0.026)
Medium plant indicator:			-0.009	(0.005)			-0.007	(0.009)
Medium Plants in: 1984	0.008	(0.011)	0.005	(0.012)	0.024	(0.019)	0.024	(0.020)
1985	0.006	(0.011)	0.006	(0.012)	-0.001	(0.020)	0.008	(0.020)
1986	-0.002	(0.012)	-0.003	(0.012)	0.032	(0.021)	0.031	(0.022)
1987	0.008	(0.012)	0.004	(0.012)	0.016	(0.023)	0.014	(0.024)
1988	0.023	(0.012)	0.022	(0.013)	0.033	(0.023)	0.042	(0.024)
Number of Observations:	25,479		25,479		9,792		9,792	

Note: Size categorizations are based on the percent difference in firm employment in 1980 and 1981 from the industry average. Regressions are run on data from 1982 to 1990 and include only plants that survive until at least 1984. See text for further details. Results using the alternative capital series and including 1989 and 1990 interactions yeild similar results.

Table 9: Interest Payments to Capital as a Function of Profit-Investment Correlations and Year

	Plant and Year Effects		Plant and Year Effects		Industry x Year Effects		Industry x Year Effects	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
High correlation indicator:					0.131	(0.051)	0.196	(0.068)
High corr. plants in: 1984	-0.052	(0.086)	-0.138	(0.093)	-0.024	(0.109)	-0.090	(0.118)
1985	-0.090	(0.088)	-0.180	(0.095)	-0.141	(0.111)	-0.206	(0.120)
1986	-0.140	(0.090)	-0.232	(0.097)	-0.183	(0.114)	-0.249	(0.123)
1987	-0.194	(0.092)	-0.288	(0.099)	-0.125	(0.116)	-0.190	(0.125)
1988	0.002	(0.093)	-0.094	(0.101)	0.035	(0.118)	-0.031	(0.126)
1989			-0.206	(0.102)			-0.141	(0.128)
1990			-0.222	(0.103)			-0.166	(0.129)
Medium correlation indicator:					-0.030	(0.050)	-0.072	(0.066)
Medium corr. plants in: 1984	-0.003	(0.083)	0.035	(0.089)	0.009	(0.106)	0.051	(0.115)
1985	0.030	(0.085)	0.070	(0.091)	0.006	(0.109)	0.048	(0.117)
1986	-0.020	(0.088)	0.022	(0.094)	-0.028	(0.112)	0.014	(0.120)
1987	-0.007	(0.089)	0.036	(0.096)	0.006	(0.115)	0.048	(0.123)
1988	0.048	(0.091)	0.092	(0.098)	0.054	(0.117)	0.096	(0.125)
1989			0.096	(0.099)			0.098	(0.126)
1990			0.116	(0.100)			0.111	(0.127)
Number of Observations:	24,631		24,631		24,631		24,631	

Note: Correlation categorizations are based on the three observations of investment to capital ratios and net profit to capital ratios in 1980, 1981, and 1982. Regressions are run on data from 1982 to 1990 and include only plants that survive until at least 1984. See text for further details.

Figure 1a

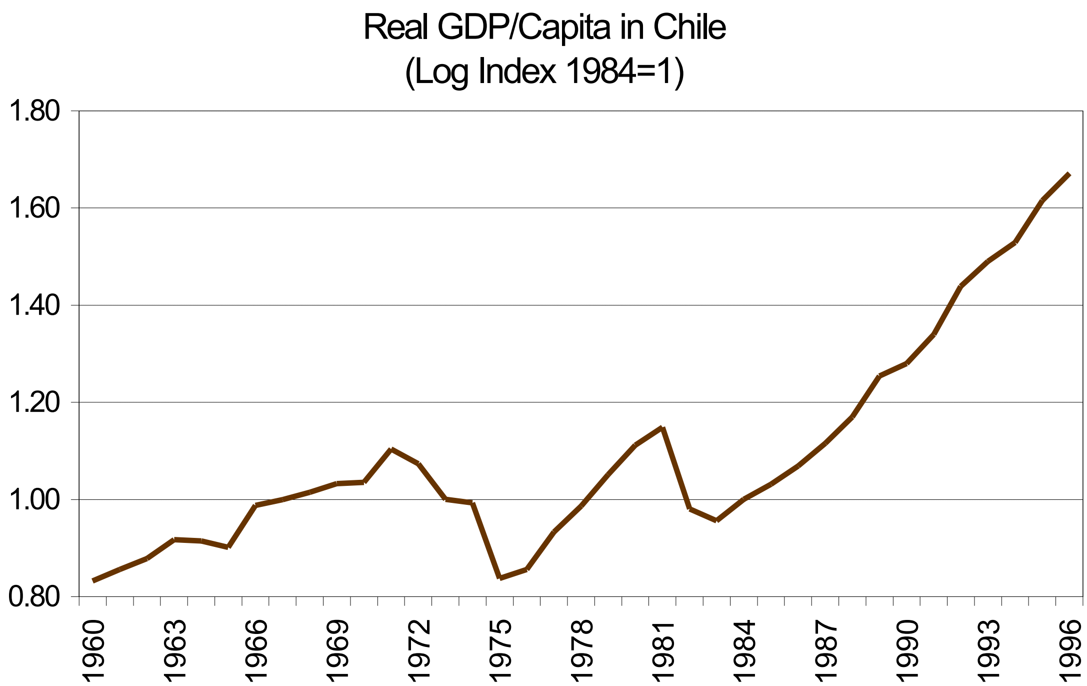

Figure 1b

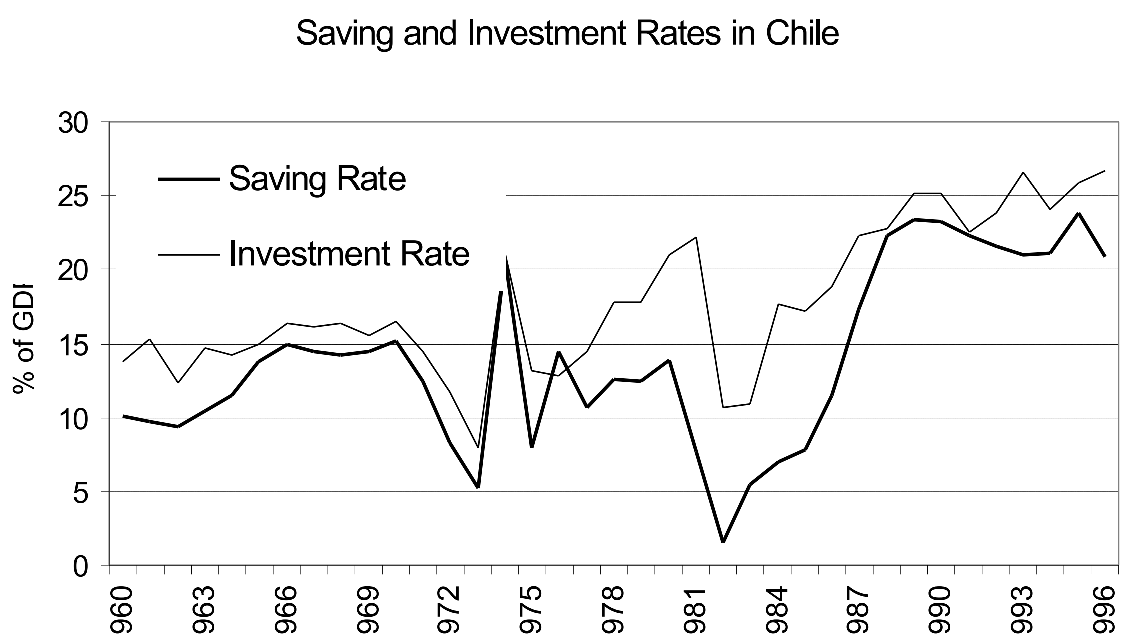

Figure 2: Investment and Credit Constraints

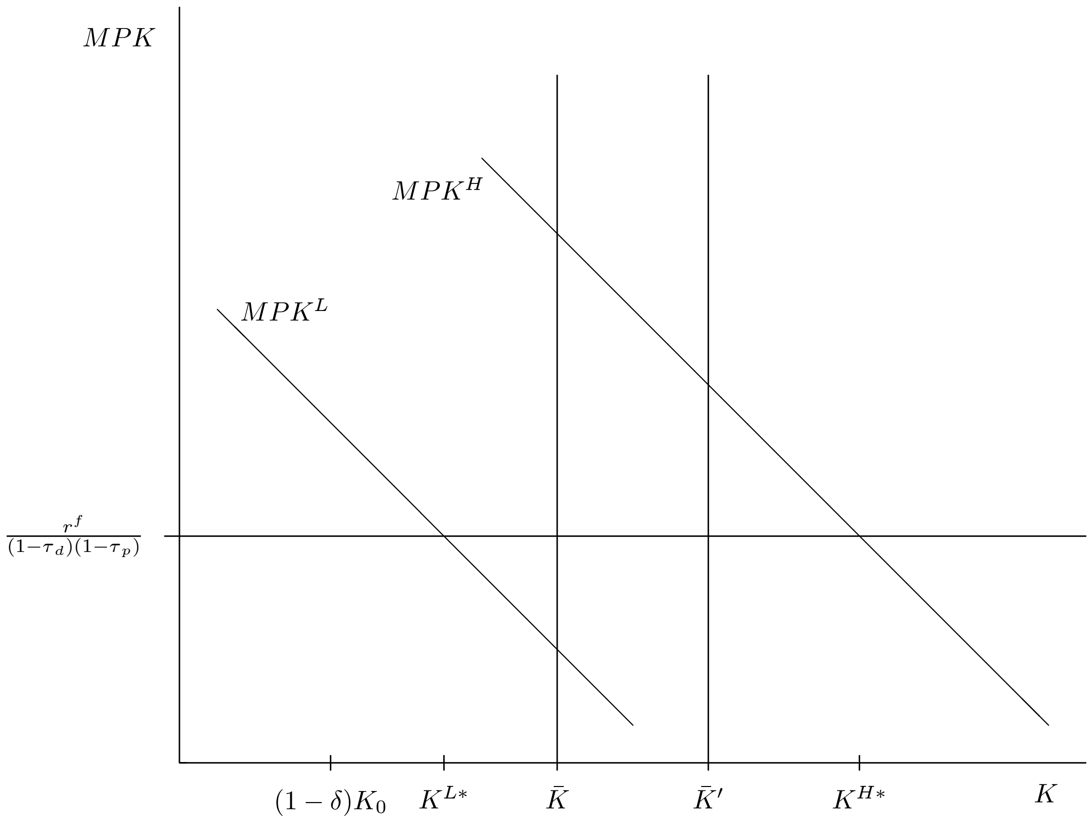

Figure 3a

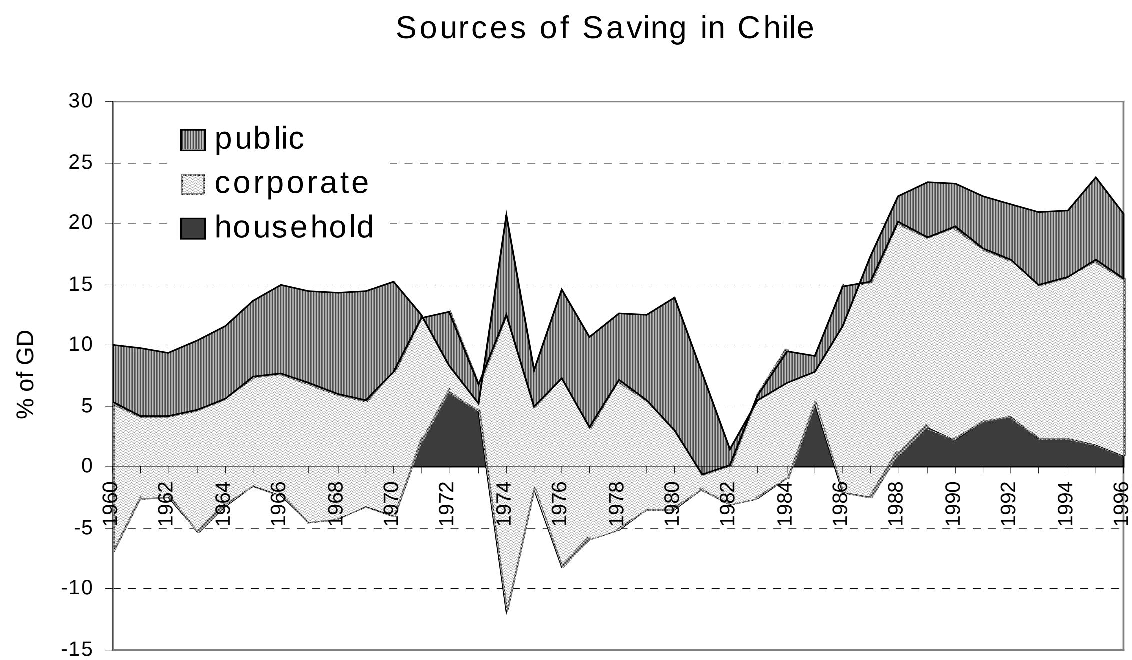

Figure 3b

Figure 4a

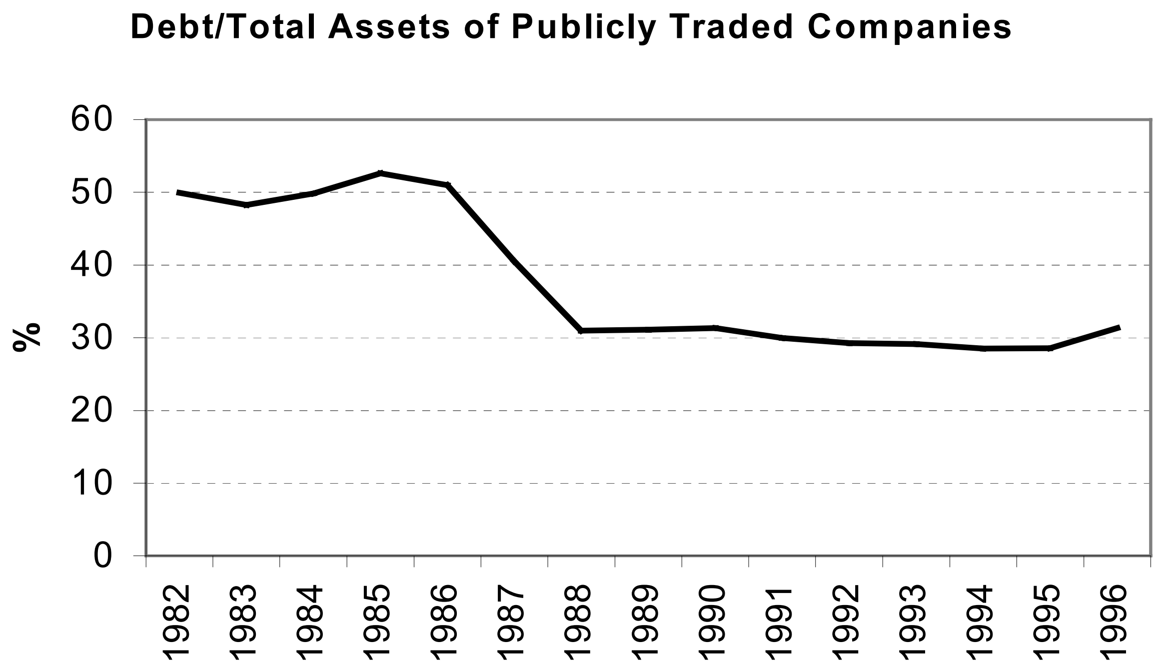

Figure 4b

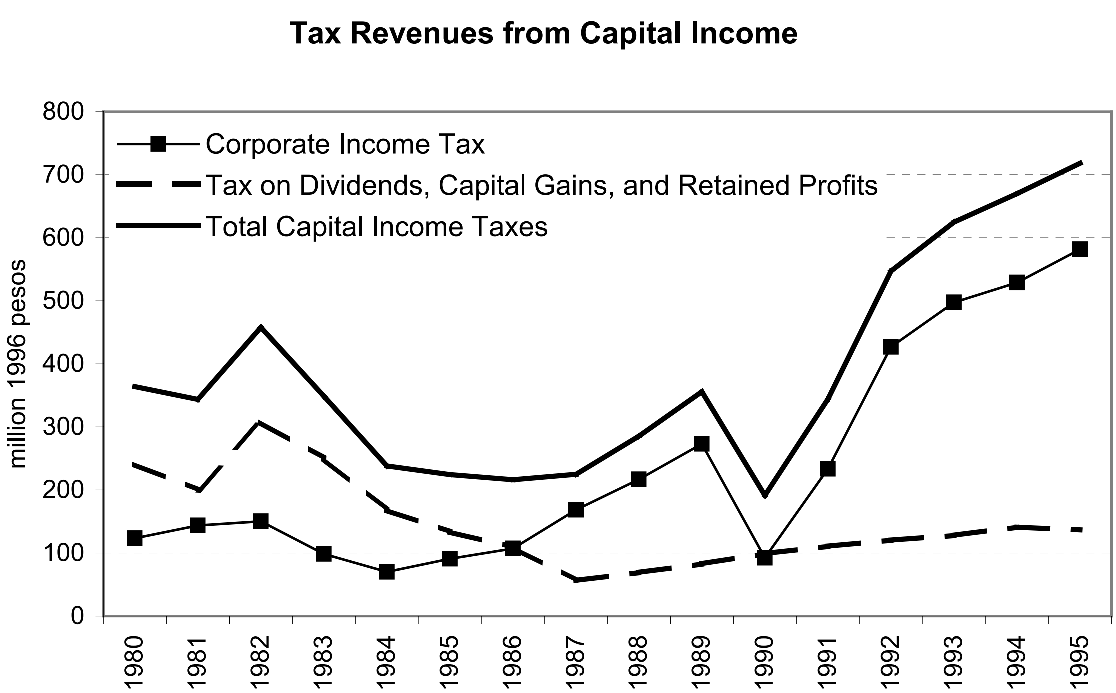

Figure 5

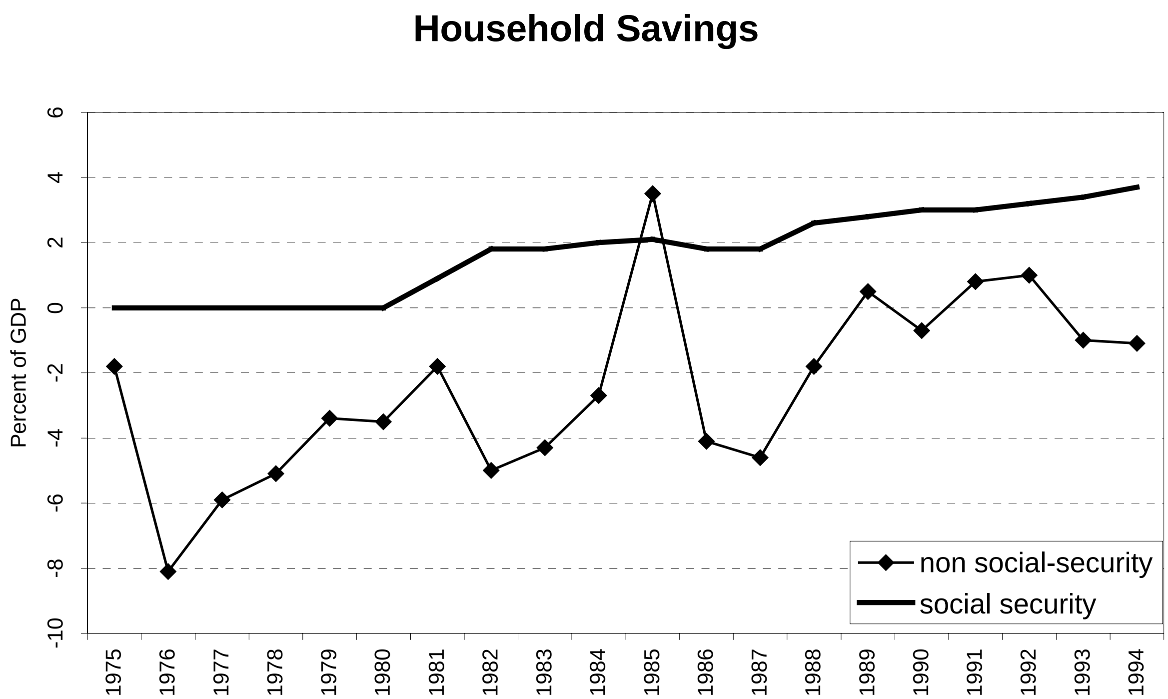
Household Savings
Percent of GDP
6
4
2
0
-2
-4
-6
-8
-10
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
non social-security
social security

Figure 6a

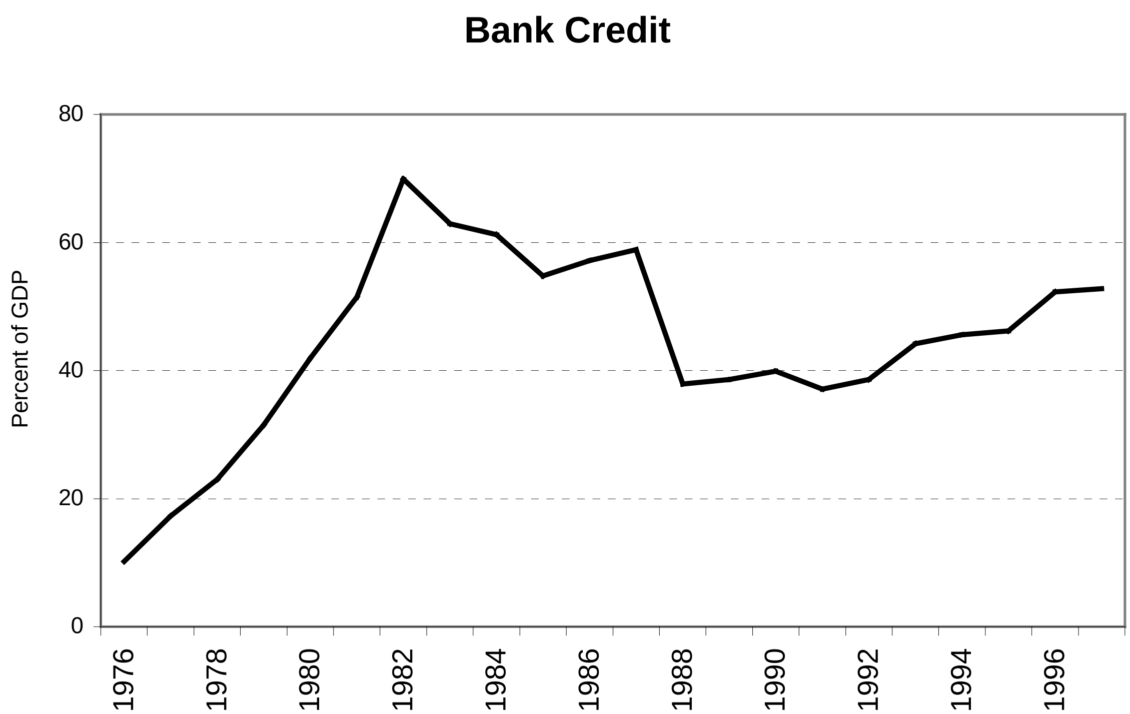

Figure 6b