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POLICY-DRIVEN PRODUCTIVITY IN CHILE AND MEXICO IN THE 1980S AND 1990S

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ABSTRACT

Both Chile and Mexico experienced severe economic crises in the early 1980s, but Chile recovered much faster than did Mexico. Using growth accounting and a calibrated dynamic general equilibrium model, we conclude that the crucial determinant of this difference between the two countries was the faster productivity growth in Chile, rather than higher investment or employment. Our hypothesis is that this difference in productivity was driven by earlier policy reforms in Chile, the most crucial of which were in banking and bankruptcy procedures. We propose a theoretical framework in which government policy affects both the allocation of resources and the composition of firms.

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I.   Introduction

Government policy is the primary cause of economic depressions. Exogenous shocks like the deteriorations in the terms of trade and the increases in foreign interest rates that buffeted Chile and Mexico in the early 1980s can cause a decline in economic activity of the usual business cycle magnitude. Government policy, however, can turn such a decline into the severe and prolonged drop in economic activity below trend that constitutes a great depression as defined by Timothy Kehoe and Edward Prescott (2002).

This view of depressions is supported by a collection of papers edited by Kehoe and Prescott and published in the *Review of Economic Dynamics* (January 2002). These papers examine nine depressions using dynamic general equilibrium models. Their striking finding is that the main determinants of depressions are not the drops in the inputs of capital and labor that traditional theories of depressions stress, but rather drops in the efficiency with which these inputs are used, measured as total factor productivity (TFP). Here we sketch a theory of how government policy drives these productivity drops by examining the depressions in Chile and Mexico in the 1980s, which have been extensively studied by Raphael Bergoeing, Patrick Kehoe, Timothy Kehoe, and Raimundo Soto (2002). We think the theory applies more broadly.

Chile and Mexico, like most Latin American countries, experienced severe economic crises in the early 1980s. Their recovery paths differed markedly. In Chile, output per working-age person returned to a 2 percent trend growth path in about a decade and since then has grown faster than trend, as shown in Figure 1. In Mexico, output never fully recovered and two decades later is still 30 percent below trend.

Comparing data from Chile and Mexico allows Bergoeing et al. (2002) to reject two popular explanations for the economic performances of these two countries as explanations for the difference: (1) That Chile's rapid recovery was driven by export growth. During the late 1980s and early 1990s, exports grew much faster in Mexico than in Chile, yet Chile grew while Mexico stagnated. (2) That Mexico's stagnation was due to a large external debt overhang that discouraged new investment. The data show that Chile's ratio of external debt to GDP was much higher than Mexico's, and we argue below that Mexico's stagnation was not caused by the lack of new investment.

Our explanation for the difference in economic performance in Chile and Mexico is based on the different timing of structural reforms in the two countries. Chile undertook reforms in the 1970s and early 1980s in trade policy, fiscal policy, privatization, banking, and bankruptcy laws that set the stage for the successful performance of the late 1980s and 1990s. Mexico postponed these reforms and stagnated.

Our numerical experiments indicate that the only reforms that can explain the difference in economic performance are those that show up primarily as differences in productivity, not reforms that show up as differences in factor inputs. This result rules out fiscal reforms, which primarily affect the incentives to accumulate capital and to work. Moreover, the timing is not right for fiscal reforms as an explanation: Both Chile and Mexico reformed their tax systems in the mid-1980s, so these cannot account for the different paths.

The matter of timing is crucial. We hypothesize that reforms in trade policy and privatization were less important than those in banking and bankruptcy law precisely because Chile had already reaped most of the benefits of these reforms while Mexico was starting to reap them precisely when Mexico was stagnating and Chile was growing. The crucial difference is that Chile was willing to pay the costs of reforming its banking system and of letting inefficient firms go bankrupt while Mexico was not.

II.   Growth Model

Figure 2 plots TFP for Chile and Mexico. (See Bergoeing et al. (2002) for details.) The similarities between these data and those for GDP per working-age person in Figure 1 strongly suggest that TFP differences were primarily responsible for the difference in economic performance in Chile and Mexico. What about changes in factor inputs? Some changes in factor inputs are induced by changes in TFP; others can be caused by frictions in factor markets. To distinguish between these two types of changes factor inputs, we calibrate a growth model of a closed economy in which consumers have perfect foresight over the TFP sequence. Our model includes a fiscal reform meant to capture some features of the reforms implemented in both countries in the 1980s that affected factor inputs. To demonstrate that differences in these reforms did not drive the difference in the recoveries, we impose the same crude tax reform in both countries.

In the model, the stand-in consumer chooses sequences of consumption C_t, capital K_t, and hours worked L_t to maximize

(1) $$\sum_{t=1980}^{\infty} \beta^t \left[\gamma \log C_t + (1-\gamma) \log(N_t - L_t) \right]$$

subject to a budget constraint in each period $C_t + K_{t+1} - K_t = w_t L_t + (1-\tau_t)(r_t - \delta)K_t + T_t$ and an initial condition on capital K_{1980}. Here N_t is hours available; w_t and r_t are factor prices; τ_t is the income tax rate on capital income; and T_t is a lump-sum transfer that in equilibrium is equal to tax revenue $\tau_t(r_t - \delta)K_t$. The feasibility constraint is $C_t + K_{t+1} - (1-\delta)K_t = A_t K_t^\alpha L_t^{1-\alpha}$.

Figures 3 and 4 report the results of numerical experiments of a model calibrated to 1960–1980 data. We compare the data with equilibria in which consumers have perfect foresight between 1980 and 1988, are surprised by a tax reform in 1988 that in Chile lowers τ_t from 0.51 to 0.12 and in Mexico lowers τ_t from 0.43 to 0.12, and have perfect foresight from then on. The tax parameters have been calibrated from the data using the first-order conditions from the consumer's problem, but there is direct evidence that the sorts of tax reform that we have imposed are sensible. In Chile, for example, the tax rate on firms' income was lowered from 0.46 to 0.10 in 1984; it was increased to 0.15 in 1991.

The results of our numerical experiments are striking: Differences in TFP — including induced effects on factor inputs — drive all of the differences in the economic experiences of Chile and Mexico. Tax reforms make Chile's recovery stronger and Mexico's depression less severe than they would have been otherwise, but do not drive the difference. There is no significant role left to be played by frictions in factor markets that do not show up in TFP.

III. Explaining TFP Declines

If TFP movements drove both the initial downturns in Chile and Mexico and the difference in their recoveries, what drove the TFP movements? External shocks initiated the TFP drops. These drops were magnified by existing government policies that made the financial sectors in both economies fragile. In Chile, rapid policy reform led to a recovery of TFP. In Mexico, the policy reaction to the initial shocks increased distortions, resulting in a prolonged decline in TFP.

Economic theory suggests two obvious mechanisms for the initial TFP drops: (1) Higher real interest rates make some previously profitable investment projects unprofitable and make the capital involved unproductive. Our measure of TFP assumes full utilization of capital and, hence, attributes this drop in utilization to TFP. (2) A deterioration in the terms of trade requires a country to export more to obtain the same quantity of imports, so that more domestic resources are needed to produce the same final output. Hence, in a closed economy model, negative terms of trade shocks manifest themselves as declines in TFP.

While these mechanisms can account for part of the initial TFP drops in both countries, they cannot account for either the severity of these drops or the difference in the recovery paths. In our view, mistakes in government policies made the financial systems in both countries fragile and, hence, exacerbated the effects of the initial external shocks. But what drove the striking difference in the patterns of recovery of TFP seen in Figure 2? Our view is that higher productivity growth in Chile was driven by the timing of banking and bankruptcy reforms.

IV.   Policy-Driven Productivity

Our hypothesis is that, before reforms, government policy distorted the allocations of resources both within and across sectors in Chile and Mexico, pushing the economies inside their aggregate production possibility frontiers. As reforms were implemented, first in Chile and later in Mexico, each economy moved closer to its production possibility frontier. Here we propose a theory of how distortions in the financial system and poorly designed bankruptcy laws can have negative effects on productivity. We describe first the static effects of distortions on allocations of resources and then the dynamic effects on the entry and exit decisions of firms.

Static Effects of Policy

A government's favored treatment of certain sectors can lead to a static misallocation of resources. Suppose that the government favors some firms or sectors with low-interest-rate loans. With the return on deposits held fixed, lower interest rates for some sectors must be paid either by higher rates in unfavored sectors or by transfers to the financial system from the government.

To see this in a simple model, suppress labor and let the production functions be $A_i K_i^\alpha$, $i = 1,\ 2$. Sector 1 receives a proportional subsidy τ_1 on the interest rate that it pays on loans, and

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sector 2 pays a tax τ_2. We can think of these subsidies and taxes as being accomplished through preferential lending by banks. Any net revenues required by banks are financed by the government using lump-sum taxes or transfers. The first-order conditions for profit maximization imply that the relative allocations of capital are given by

(2)
$$\frac{K_1}{K_2} = \left(\frac{A_1}{A_2}\right)^{\frac{1}{1-\alpha}} \left(\frac{1+\tau_2}{1-\tau_1}\right)^{\frac{1}{1-\alpha}}.$$

In contrast to the efficient allocation, the distorted equilibrium has a higher fraction of the capital stock allocated to the subsidized sector than is warranted by relative productivities and, hence, lower aggregate output. If these distortions decrease the incentives to make loans, as they did in Mexico, then they also lead to a lower aggregate capital stock and have an additional negative effect on output.

Despite the static nature of the inefficiency, this mechanism has the potential for explaining some of the difference in TFP performance: Financial reform was the major reform that Chile had done poorly in the 1970s and had to redo in the early 1980s. In Mexico, however, until at least the early 1990s, the banking system remained nationalized, gave subsidized loans to some firms, and rationed loans to others.

Dynamic Effects of Policy

One way distortions in the financial system and poorly designed bankruptcy rules can lead to lower aggregate productivity is by discouraging poorly performing firms from exiting from production. By keeping firms operating that otherwise would have exited, these distortions and bankruptcy rules can prevent new potentially productive firms from entering.

The models developed by Andrew Atkeson and Patrick Kehoe (1995) and Tianshu Chu (2001) can be used to address such issues. In these models, new firms enter with the newest technology, stochastically learn over time, and then exit when their prospects for further productivity improvements are poor. In these models, any policy that interferes with the natural birth, growth, and death of firms based on current and prospective productivities can push the economy further and further inside the production possibility frontier. Simulations by Chu (2001) indicate that these dynamic distortions can have enormous effects over time.

To get some idea of how this sort of model works, consider Atkeson and Kehoe's (1995) model in which production is done in a continuum of plants. Each plant has its own level of productivity A and is operated by a manager. A plant with productivity A has the production function $y = A^{1-v}(k^\alpha l^{1-\alpha})^v$. The manager's span of control parameter, $v < 1$, determines the degree of diminishing returns at the plant level. A manager who decides to operate a plant chooses capital k and labor l to maximize static returns

$$(3) \qquad d_t(A) = \max_{k,l} A^{1-v}(k^\alpha l^{1-\alpha})^v - r_t k - w_t l - w_t^m,$$

where w_t^m is the manager's opportunity cost of not working or starting another plant. Let the solutions be denoted $k_t(A)$ and $l_t(A_t)$. For a given distribution $\lambda_t(A)$ of productivities across plants, aggregate output is given by $Y_t = \overline{A}_t^{1-v} K_t^\alpha L_t^{1-\alpha}$, where $\overline{A}_t = \int_A A \lambda_t(dA)$ is aggregate productivity and $K_t = \int_A k_t(A) \lambda_t(dA)$ and $L_t = \int_A l_t(A) \lambda_t(dA)$ are aggregate capital and labor. That is, aggregate productivity is the mean productivity of the plants that are operating.

Over time, the productivity of each plant evolves stochastically: A plant with productivity A at t has random productivity $A\varepsilon$ at $t+1$, where ε is drawn from a probability distribution $\pi(\varepsilon)$. The crucial decision for the manager of whether or not to operate a plant is dynamic and is described by the Bellman equation

$$(4) \qquad V_t(A) = \max[0,\ V_t^o(A)], \text{ where } V_t^o(A) = d_t(A) + \frac{1}{1+R_t} \int_\varepsilon V_{t+1}(A\varepsilon)\pi(d\varepsilon).$$

Here R_t is the market rate of interest between t and $t+1$, $V_t^o(A)$ is the value if the plant is operated in the current period, and $V_t(A)$ is the maximum of the returns from either closing the plant or operating it. New plants can enter according to a similar process. The outcome of all the managerial decisions to operate or not is a new distribution $\lambda_{t+1}(A)$ over productivities in $t+1$.

In this simple version of the model, the probability distribution $\pi(\varepsilon)$ that generates shocks to plant-specific productivity does not change with plant age. In the data, the labor employed and output produced by a cohort of plants tend to start low when plants are young, grow for the next 20 years or so, and then gradually decline. To capture this sort of pattern, Atkeson and Kehoe (1995) add a frontier level of new technology that grows over time, and they allow the mean

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value of shocks to productivity to first increase and then decrease. In their model, new plants enter with the newest technology, but little specific knowledge on how to use it. Over time, these plants build up their specific knowledge and grow as they draw shocks to productivity from a distribution with an increasing mean. After 20 years or so, the mean of the shocks ε starts to fall, as the learning process slows. Plants then decline in size and eventually exit.

Now consider the effects of a distortion which the government encourages banks to lend at a subsidized rate $R_{1t} = \hat{R}_t(1 - \tau_{1t})$ to firms (identified with plants in the model) in sector 1 and to lend to other firms at a relatively high rate $R_{2t} = \hat{R}_t(1 + \tau_{2t})$. The favored firms discount the future less than the unfavored ones. In addition to the static effect of misallocating capital, this distortion results in different solutions to the managers' dynamic programming problems in sectors 1 and 2. In particular, favored firms will choose to continue to operate in situations where unfavored firms would choose to exit. Even if a favored firm experiences a low productivity A, it will be more prone than an unfavored firm to borrow to cover its losses and to continue operating, hoping for a favorable shock ε to increase its productivity in the future.

Consider next poorly designed bankruptcy procedures that make it difficult for firms to exit or subsidize the losses of firms to keep them operating. These procedures cause firms to keep operating for longer than they would have otherwise and impede the entry of new firms.

Together, distortions in the financial system and poorly designed bankruptcy procedures change the mix of firms that operate, leading to inefficiently many low-productivity firms continuing. This leads to a lower value of aggregate productivity $\bar{A}$.

How would the removal of these distortions affect the path of productivity over time? Some effects would be immediate. Upon removal, some previously favored firms that would have continued will exit, and some unfavored firms that would have exited will continue to operate. The subtler, and potentially more important, effects take more time to show up in aggregates. The removal of distortions would encourage new firms to enter. These firms would have the newest technologies, but would build up their organization-specific productivity only slowly. Consequently, removing these distortions would show up with a lag in the aggregate productivity statistics.

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Kehoe, Timothy J. and Prescott, Edward C. "Great Depressions of the 20th Century." *Review of Economic Dynamics*, January 2002, 5(1), pp. 1–18.

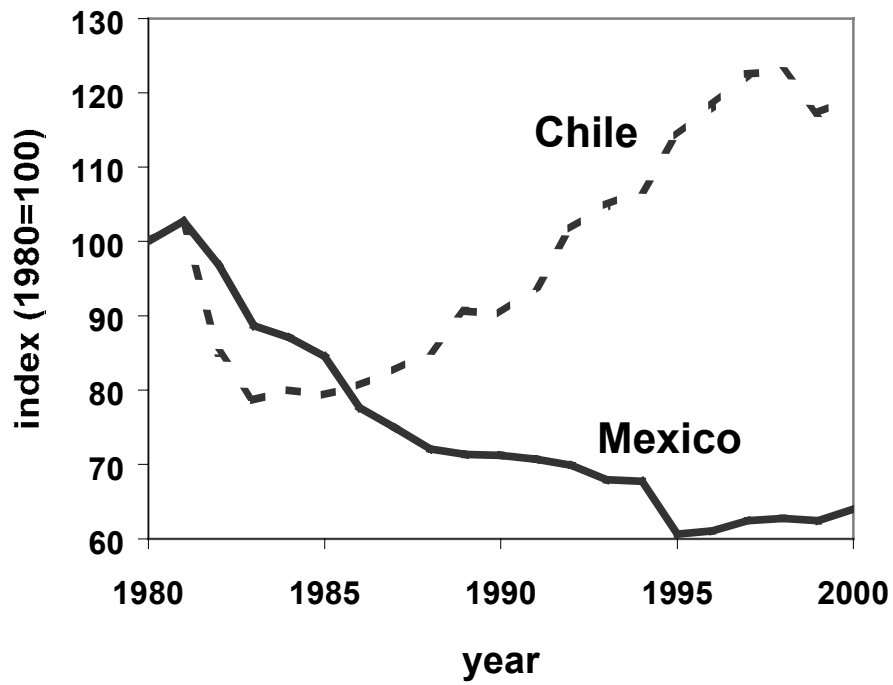**Figure 1. Real GDP per working-age (15-64) person in Chile and Mexico, detrended by 2% per year.**

Figure 2. Total factor productivity in Chile and Mexico, detrended by 1.4% per year.
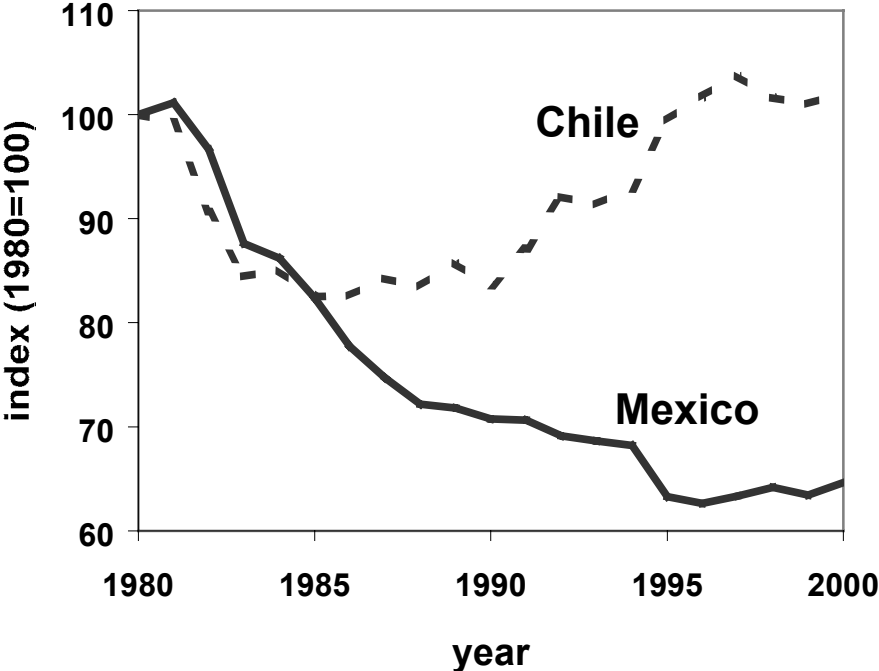
Figure 3. Model experiment: Real GDP per working age (15-64) person in Chile, detrended by 2% per year.
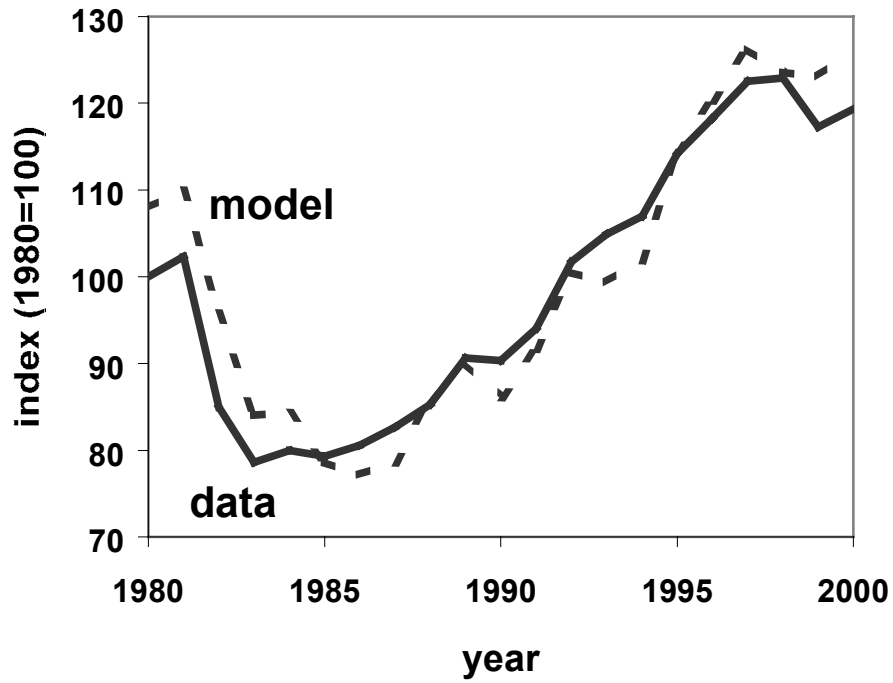
Figure 4. Model experiment: Real GDP per working age (15-64) person in Mexico, detrended by 2% per year.