

Economic Growth Amidst Political Instability: Evidence from Revolutionary Mexico¹

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This paper examines the puzzle of how economic growth can continue in the midst of political instability. Our interest in this topic is motivated by a paradox: the theoretical literature written by political scientists predicts that political instability should have a strongly negative impact on growth, while the empirical literature written by economists cannot detect the predicted causal relationship.

The origins of this paradox can be traced to the political science literature on the commitment problem. Briefly stated, the commitment problem is as follows: Any government strong enough to define and arbitrate property rights is also strong enough to abrogate them for its own benefit. Unless a government can find a way to credibly commit not to act in its own short run interests (by seizing property or taxing away the rents from property), asset holders will not invest. If asset holders do not invest, then there will be no economic growth. If there is no economic growth, the government will be unable to finance its needs because there will insufficient tax revenue. Political scientists have, in recent years, come to a general consensus in which “limited governments” (governments that are bound by self-enforcing institutions to respect their

¹ This paper summarizes a book-length work *The Political Economy of Instability: Political Institutions and Economic Performance in Revolutionary Mexico*. The book-length work presents data from the banking, manufacturing, petroleum, mining, and agricultural sectors of the economy. It also presents a formal model of credible commitments without limited government. For reasons of space, this paper only presents data on the manufacturing sector and summarizes the intuition behind the model.

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own laws) provide the solution to the commitment problem.³ By creating self-enforcing institutions that constrain the government, private investors will not be restricted by fear of predation by the state.⁴

It logically follows that political instability must be bad for economic growth because in an unstable polity it is impossible, by definition, to create the required self-enforcing institutions. In fact, under conditions of political instability governments (and factions aspiring to be governments) cannot credibly commit to refrain from predation. They must punish their opponents, reward their allies, and generate revenues to maintain themselves in power. This generates incentives to levy high and arbitrary taxes, confiscate and redistribute property, and dramatically alter economic policies. Indeed, any government that tried to enforce the universal protection of property rights would not survive for very long in an unstable polity: some faction with less scruples would predate on property rights and use those resources to overthrow the government.

Economists therefore searched for an empirical relationship between political instability and economic growth. They expected to find that growth was inversely correlated with instability. They also expected to find that causality runs from political instability to no growth, rather than from no growth to political instability. The results they obtained, however, did not match their expectations. First, the studies that searched for a correlation between instability and slow growth did not all reach the same conclusion: Some studies detected a correlation between political instability and slow economic growth. Other studies, that used different data sets, regression specifications, and instrumental variables failed to replicate those results.⁵ Second,

³ Limited governments and democracy are not the same thing. Any government that cannot act arbitrarily because of the nature of its internal institutions—that is to say, whenever the rule of law exists—is a limited government. The United States, for example, was a limited government from 1789 onwards, but universal white male suffrage did not become widespread until the 1820s, and universal suffrage did not become effective until 1965.

⁴ See North (1981), pp. 146-57; Levi (1988); Weingast (1997a); North and Weingast (1989); North (1990); Weingast (1997b); Miller (1992); Barro and Gordon (1983); Shepsle (1991); and, Root (1989).

⁵ Seminal work in this field includes: Londregan and Poole (1990); Londregan and Poole (1992); Alesina et al. (1996); Barro (1991); and, Barro (1997).

subsequent work employing sensitivity analysis found that whatever correlations had been detected were extremely fragile.⁶ Third, work that used time series econometric techniques to test Granger causality failed to find a causal relationship between political instability and economic growth.⁷ Related work on the impact of instability on investment did find a causal relationship, but that relationship was *positive*: an increase in the level of instability caused an increase in investment.⁸

How can it be that political instability does not necessarily translate into economic stagnation? Under what conditions is instability bad for growth, and under what conditions does instability have little effect on growth? This paper offers two contributions toward an answer to these questions. First, we retrieve and analyze data about an actual country that was politically unstable for a prolonged period of time (Mexico from 1910 to 1929). Second, we propose a solution to the commitment problem that, while economically inefficient compared to limited government, is robust to political instability.

Our empirical research focuses on Mexico from 1910 to 1929.⁹ We focus on Mexico because it is an archetypal example of an unstable polity in which institutions changed in ways that should have had negative consequences for growth. The political system moved from a prolonged period of stability (1876-1910) to a prolonged period of instability (1910-1929), characterized by a revolution, a counter-revolution, a counter-counter-revolution, three civil wars, multiple military rebellions, and three presidential assassinations. The long-standing dictatorship of Porfirio Díaz fell to an armed insurgency in 1911. The reformists that deposed Díaz tried to institute limited government, but were themselves overthrown by Díaz's generals in 1913. That

⁶ Levine and Renelt (1992); See Brunetti (1997).

⁷ Campos and Nugent (2000a), p. 10; Londregan and Poole (1990), p. 174.

⁸ Campos and Nugent (2000b).

⁹ Our project builds on Womack's seminal article on the Mexican economy during the Revolution of 1910-20. See Womack (1978).

counter-revolutionary government was, in turn, overthrown by a broad coalition of reformists and radicals in 1914. The constituent groups that made up that coalition, however, soon fell to fighting among themselves. They therefore fought a long and extremely violent civil war from 1914 to 1917. Even after a new constitution was written in 1917, Mexico continued to be unstable. The first president under the Constitution of 1917, Venustiano Carranza, was overthrown and assassinated by his own generals in 1920. His successor, Alvaro Obregón, was himself assassinated the day after he was reelected to a second term. On three occasions during the 1920's the army, at times allied with politically-ambitious cabinet members, tried to overthrow the government (1923, 1927, and 1929). The 1923 rebellion, in fact, came very close to success and involved a six-month civil war between various factions of the army and armed workers and peasants. In addition, from 1926 to 1929 there was a church-state civil war, led by Catholics who opposed the anti-clerical elements of the Constitution of 1917 allied to landowners who feared agrarian reform. At both the state and federal levels, violence or the threat of violence played a central role in determining who would rule. It was not until 1929, when the last serious violent threat to the government was defeated and a political party (the Partido Nacional Revolucionario--PNR) was formed in order to provide a non-violent forum for Mexico's generals to choose the federal executive, that political stability was restored.

Regulatory policies in Mexico changed in ways that should have worked to discourage private investment. The Constitution of 1917 declared the government the residual claimant on all land and subsoil rights. The government also effectively nationalized the banking system, the urban tramway system, and most of the inter-city railroad network. It came close to expropriating the oil industry several times. (It finally did so in 1938.) The government also threatened to nationalize Mexico's largest manufacturing industry. Finally, the Constitution of 1917 completely reformed Mexico's labor regime. It gave workers the right to organize and strike, limited the workday to eight hours, authorized a minimum wage, and mandated profit sharing

between owners and workers. Ensuing reforms created government-administered national labor contracts that set pay-rates by industry across the country.

In short, Revolutionary Mexico provides a natural experiment with which to test the impact of instability. We develop data sets from firm and industry level data, and then use these data sets to test three hypotheses: (1) investment and output should have shrunk in absolute terms after 1910; (2) instability should have slowed the rate of growth of the Mexican economy relative to the ten year period before Mexico collapsed into instability; (3) rates of investment and output growth might have continued at a high rate relative to the period prior to 1910, but they were slow relative to what Mexico could have accomplished in the absence of an unstable polity.

We assess hypotheses one and two on the basis of time series analysis of economic data from Mexico. That is, our counterfactual case is Mexico itself before 1910. Assessing hypothesis 3 is more difficult, because it requires the comparison of Mexico to a country that was like Mexico in every respect but that did not undergo a long period of instability. There is, of course, no such real world counterfactual case. Nevertheless, there were countries in which the development of particular industries or lines of economic activity resembled that of Mexico. To the degree that this is feasible, we address hypothesis 3 through the comparative analysis of these other cases.

Our results do not support hypotheses (1) and (2). Economic activity was briefly disrupted from 1914 to 1917, but most of the sectors analyzed recovered rapidly to their pre-1910 levels of output. In fact, all the sectors we have analyzed regained or exceeded their pre-1910 rates of growth. The results concerning hypothesis (3) are more ambiguous, because of the difficulty in choosing the correct counterfactual cases. The evidence analyzed does, however, cast considerable doubt on the veracity of this hypothesis.

The rest of this paper is organized as follows: Section II presents data on the Mexican manufacturing sector during the period immediately before and during political instability (1900-29). Section III then explains the rather surprising results we obtain by presenting, in brief form, a theory of how credible commitments can be made

without limited government, and how those commitments can be durable even in the face of political instability. Section IV then uses this theory to explain why political instability had only a short term effect on Mexico's manufacturing sector. Section V concludes.

Section II: Analysis of Data

Firm Survival

We begin with the study of firm survival for two reasons. First, this study prevents a survivor bias in the data that we will later use to examine investment, structure, new entry, and productivity. Second, it provides evidence as to which agents were better positioned to mitigate the effects of instability.

The data we have retrieved on manufacturing indicate that the vast majority of firms survived political violence intact. We also find strong evidence that the rate at which firms failed was not particularly affected by the revolutionary period and that those firms that did go out of business tended to be very small enterprises.

In the steel, cement, paper, glass, wool textile, beer, soap and glycerin, tobacco products, and dynamite and explosives industries, monopolies or oligopolies dominated their product lines in the decades prior to 1910 (a subject we shall return to later in this paper). With the exception of one of the three cement firms that dominated the Mexican market (Cementos Cruz Azul) and the single firm which dominated dynamite and explosive production (the Compañía Nacional Mexicana de Dinamita y Explosivos), all of these firms survived the Revolution. Moreover, the two firms that failed were not destroyed by military action. They were taken over by other firms.¹⁰

The cotton textile industry, where we have detailed data on firm sizes and failure rates, allows us to examine the issue of firm survival systematically.¹¹ The results indicate that most firms survived the fighting intact and those that failed were small

¹⁰ Haber (1989), pp. 91-92, 143, 188.

¹¹ Complete data sources for our analysis of the textile industry can be found in Razo and Haber (1998).

enterprises. Prior to the Revolution, typically six to eight percent of firms failed in each five year period. During the period 1910-1915, however, 16.5 percent of firms closed their doors permanently. These were very small firms, collectively accounting for only seven percent of total industry output. In the period 1915-1920, the percentage of firms failing fell to 5.7 percent, which was lower than the rate that prevailed before the Revolution. These firms accounted for only 2.7 percent of output (see table one). As striking as the low rate at which firms failed during the Revolution is the fact that these firms were replaced by new entrants of roughly comparable size, an issue we shall return to shortly.

Are there any systematic patterns to the data on the cotton textile industry that explain which firms survived and which did not? We estimate probit and logit regressions to predict the probability of survival from 1910 to 1920 as a function of several firm characteristics. We test for the effects of size (measured by market share), location (by geographic region), age of firm, total factor productivity, and the capital-labor ratio. To determine whether these regression results have historical verisimilitude, we analyze the characteristics of those firms that actually failed during the Revolution.

Our probit regression results, reported in panel 1 of table two, indicate that size was the overwhelming factor in determining firm survival. All other variables are not statistically significant. Our samples are unbalanced (4 to 5 survivors for every firm that exited the market) so we used an alternate logit model to cross-check our probit results. The logit regressions in panel 2 of Table Two show similar results: Size remains the major determinant of survival during the revolutionary years.

Our regression results for 1910-1920 are corroborated by examining the characteristics of textile firms that did not survive the revolutionary years. The median size of firms that went out of business during this period corresponded to a market share of only 0.3%. There were, in fact, only two firms that failed with market shares greater than one percent.

There are several hypotheses that potentially explain why larger firms had a greater probability of surviving political violence than their smaller competitors. One

possible explanation is that very small firms were more likely to go out of business because they were technically inefficient (they were of a size below the minimum efficiency scale). The civil war of 1914-17 merely hastened their demise. There are two problems with this interpretation. First, we would expect that firm survival would always be correlated with firm size. We therefore estimated similar regressions for the period 1900-1910. The results are shown in Table Three. The coefficient on firm size has the right sign, but it is not statistically significant. Second, one would expect that survivorship would be correlated with technical efficiency. As specifications 2, 3, 5, 6, 8, 9, 11, and 12 make clear, however, differences in total factor productivity are extremely poor predictors of firm survival.

A more likely explanation for the correlation of firm size with firm survival during the decade 1910-20 is that larger firms had the financial resources to weather the civil war of 1914-1917. Owners of smaller firms likely had less liquid wealth to buttress their enterprises during hard times (their more modest wealth explains, in fact, the small size of their firms), and thus were less likely to be able to purchase stocks of raw materials to get them through prolonged periods when inputs were unavailable, less likely to be able to go for long periods when they could not earn revenues from production, and less likely to be able to pay ransoms or forced loans to passing armies.

This interpretation is buttressed by the documentary evidence we have from company histories and the correspondence of factory owners with Mexico's Department of Labor, both of which indicate that revolutionary armies rarely destroyed the mills they occupied. It was in the interests of armies to run the mills themselves and appropriate the sales revenues (minus the wages paid to the workforce) in order to finance their military operations. Once the stock of raw materials had been exhausted, armies typically returned factories to their owners, often for a ransom.¹² In fact, the archival evidence makes little reference to cases of factory destruction.¹³

¹² Haber (1989), pp. 132-134.

¹³ Mexico's factory owners regularly communicated their problems to the government. See AGN, Ramo del Departamento de Trabajo: Box 45, file 3, 1-5; Box 52, file 12, 1-3; Box 90, file 17, p.

Investor Confidence And Expectations

It is one thing to determine, ex post, what effects the Revolution had on firm survival. It is quite another to determine how factory owners at the time viewed the situation. How did the Revolution and the ensuing period of political instability affect the expectations of investors?

Financial theory states that the price of assets is a reflection of the expectations of investors about the future ability of those assets to produce profits.¹⁴ Reduced expectations about the ability of assets to earn positive returns will therefore result in a decline in the market value of those assets. Thus, one way to get at the question of investor confidence is to study the price of common stock in Mexico's publicly-traded manufacturing companies. We have therefore retrieved year-end stock prices from the Mexico City financial press for publicly-traded manufacturing firms and produced a real (inflation adjusted) stock price index.¹⁵ We estimate the index using both real pesos and real dollars in order to make certain that our results are not driven by the price index. We present the data in table 4.

Regardless of the price index employed, the data indicates that all 11 firms in our index saw dramatic declines in their share prices from 1910 to 1918. Calculated in real pesos, the value of share prices fell 80% from 1910 to 1918. Calculated in real dollars the index fell 77%.

1; Box 91: file 21, 1-2; Box 96, file 5, 49-53; Box 96, file 9, p. 45; Box 107, file 22, p. 2; Box 107, file 22, p. 2; Box 110, file 28, p. 1; Box 173, file 23, p. 1.

¹⁴ For a discussion of the value of the firm (indirectly maximized for consumers by firms) and investment costs see Hayashi (1982).

¹⁵ Our data set includes the four largest cotton textile producers (CIDOSA, CIVSA, CIASA, and CISAASA, which jointly accounted for roughly one-third of national output), the country's steel monopoly (Fundidora Monterrey), the single largest wool textile manufacturer (the Compañía Industrial de San Ildefonso), two of the country's three most important beer brewers (the Cervecería Moctezuma and the Compañía Cervecería de Toluca y México), the country's only large-scale producer of soap and glycerin products (the Compañía Industrial Jabonera de la Laguna), the largest producer of paper products (the Compañía Industrial de San Rafael y Anexas, which monopolized the lucrative newsprint market), and two of the three firms that dominated the production of tobacco products (El Buen Tono and La Cigarrera Mexicana). Data was gathered from *El Economista Mexicano* and *La Semana Mercantil*

Attributing this decline to the impact of political instability is a more complicated affair. Indeed, there are reasons to believe that much of the measured decline would have occurred even in the absence of a revolution and ensuing political instability. First, investors were already becoming uncertain well before Díaz was overthrown. The pattern for all the companies in the sample was a gradual rise in stock prices until 1906, and then a sharp decline. On average, firms lost 23% (measured in real dollars) or 35% (measured in real pesos) of their value from 1906 to 1910.

Second, and perhaps most fundamentally, it is important to note that stock prices in Argentina *and in the United States* also display dramatic declines in the 1910s—even though those countries did not undergo revolutions. That is, stock prices were depressed for reasons other than Mexican instability. In Argentina, the index of real stock prices of large capitalization firms, estimated by Nakamura and Zaragoza, shows a decline in real share values of more than 60 percent between 1910 and 1917.¹⁶ The Standard and Poors index of large capitalization stocks in the United States also fell by roughly half from 1910 to 1918.

Third, stock prices in the United States and Argentina during the 1920's moved with stock prices in Mexico—at least until the late 1920's. In Mexico, the data indicate that stock prices began to recover in the late 1910's (the index jumping from 20 in 1918 to 30 in 1919). Our stock price index then continued to rise in a gradual fashion, peaking in 1923 at 47. This indicates that if investors were uncertain about the future, their uncertainty was largely confined to the period when there was no underlying political system (the period 1914-17). We would also suggest that the lack of a response to the De la Huerta rebellion of 1923-24 is equally striking. Investors seemed not to have been concerned at all, even though forty percent of the army sided against the government. The data from Argentina follow a similar pattern. From their trough in 1920 (68% below their 1910 level) stock prices gradually recovered in the 1920s. Like Mexican stocks, however, Argentine stocks did not approach their pre-1910 level during

from 1896 to 1914. Data from 1914 to 1935 was gathered from the *Boletín Financiero y Minero*. In cases where no shares were traded, the average of the bid and ask prices was taken.

the 1920s. At its peak, the Argentine stock index stood at 64 in 1929. Much the same is true of the United States, where stock prices slowly recovered from their trough in 1921 (when they stood at 38 percent of their 1910 levels), only surpassing their 1910 level in 1928. In short, if one takes Argentina and the United States as the appropriate counterfactuals, then the evidence indicates that the expectations of Mexican investors were only somewhat affected by political instability.

Recovery Of Production

One implication of the result that few firms were destroyed or forced into bankruptcy during the decade 1910-20 is that production should have quickly regained its pre-instability levels once normalcy returned to the transportation and monetary systems in the late 1910's. Two bodies of evidence support this hypothesis. First, we have retrieved evidence on output in the steel, cement, cigarette, beer, and cotton textile industries. The data for all five industries indicate that by there were dramatic declines in production during the civil war of 1914-17. (See Tables 5, 6, 7, 8, and 9). By the early 1920s, however, production in these industries had surpassed Porfirian levels and continued to grow throughout the 1920's. Data we have retrieved on the dynamite industry, where we have production figures beginning only in 1918, indicate that output grew at a spectacular rate in this industry as well throughout the 1920's: output doubled every two years from 1918 to 1929 (see table 10). As was the case with other industries (beer, textiles, cigarettes, paper, cement) this industry satisfied all of national demand by the early 1920's.

Data on electric power consumption in Mexico City for commercial purposes (the data exclude power generated for the water and tramway systems and for public lighting) indicate that the recovery of production extended to small-scale firms whose output we are not able to measure directly. (Since the vast majority of Mexican manufacturing at this point operated with electric machinery, commercial power consumption is a good proxy for industrial activity). Table 11 shows data from the

¹⁶ Nakamura and Zaragoza (1998), p. 261.

Mexican Light and Power Company indicating a steady at rise in commercial power usage from 1907 through the early years of the Revolution (peaking in 1912). Power usage declined dramatically from 1912 to 1915 (falling by roughly 40 percent over three years), and then recovered rapidly. By 1917 commercial power consumption in Mexico City was 17% higher than in 1910, and continued climbing throughout the 1920s. By 1927, commercial power consumption in Mexico City was three times what it had been on the eve of the Revolution. Indeed, the rapid run-up in electric power usage suggests capital deepening. In short, small scale manufacturing appears to have recovered as well as large scale manufacturing.

New Investment

One implication of our analyses of investor confidence, firm survival, and industrial production is that we should expect to see new investment in plant and equipment after 1918. We have been able to retrieve data on new capacity or investment in the cement, steel, cigarette, and cotton textile industries. We have also retrieved detailed data on exports of industrial machinery from the U.S. and U.K. to Mexico, which is an excellent measure of the flow of new investment because virtually all of Mexico's capital goods had to be imported.

Productive capacity in the cement industry continued to expand both during and after the Revolution, growing from 66,000 metric tons per year in 1906 to 151,000 in 1910, 177,000 in 1912, 222,000 in 1920, and 246,000 in 1928. This rate of growth in capacity is especially impressive in light of the fact that capacity utilization was almost always less than 60%, implying that the owners of firms were confident enough about the future to invest well ahead of demand (see table 6).¹⁷ Data on the nation's

¹⁷ The fact that firms invested ahead of demand is explained by the fact that cement production tends, most everywhere in the world, to be characterized by local monopolies. The high bulk-to-price ratio of cement means that it is economical to ship it only over short distances. In order to expand, therefore, firms must erect new production facilities in new areas of the country. Firms also tend to erect more productive capacity than they need in these new markets in order to keep out potential rivals. See Johnson and Parkman (1983).

integrated steel producing monopolist, Fundidora Monterrey, tell a similar story. During the years of civil war, Fundidora Monterrey closed its doors and spent no funds on plant and equipment. As soon as normalcy returned, however, the firm invested in a dramatic fashion: the value of its physical plant grew 41% from 1919 to 1921, even in the face of a rate of capacity utilization of less than 40% (See table 5).

One might argue that the recovery of the steel and cement industries should not be surprising. The physical destruction of the years of revolutionary violence might have stimulated demand for construction goods in the 1920's. These two industries might therefore not be representative of the manufacturing sector as a whole. This hypothesis is not sustained, however, by the analysis of data on the country's most important consumer goods industry: cotton textiles. As table 8 indicates, by 1921 the industry, measured in spindlage, declined by 25 percent from 1913 to 1917.¹⁸ Much of this loss was clearly produced by firms temporarily closing their doors during the worst phases of the fighting. Indeed, the only way to explain a 28 percent jump in capacity from 1917 to 1919 is that firms that had closed their doors during the years of civil war reopened them as soon as military conflict ended. The recovery went well beyond the reopening of old capacity, however. New plant and equipment was being purchased as well. In fact, in 1921 the cotton textile industry was ten percent larger than it had been in 1910 (and roughly equal to its 1913 level), and in the four years from 1921 to 1925 the industry grew an additional 9%, making it 20% larger than it had been in 1910. *This increase in industry capacity cannot be explained as the result of population growth. The Mexican population was five percent smaller in 1921 than it had been in 1910.*¹⁹ The rate of growth of industry capacity then slowed in the late 1920's. This should not be surprising in light of the fact that by this point domestic production had virtually eliminated imports from

¹⁸ Spindles constitute the most important capital input for the production of cotton textile goods, and thus the literature tends to use spindlage as the measure of capital or capacity. See for example, Kane (1988).

¹⁹ Mexican population data are from INEGI (1994), p. 44.

the market. The industry could now only grow as fast as incomes or population growth would allow.

Data we have retrieved on the cigarette industry tell much the same story (See Table 9). The total nominal capital invested in the industry was 19.5 million pesos in 1923. By 1928, total capital invested had grown 37 percent, to 26.6 million pesos. These estimates almost certainly understate the amounts spent by firms on new plant and equipment. The number of firms in the industry declined from 169 in 1923 to 127 in 1928, continuing a trend toward increasing concentration that began in the 1890's. The capital equipment of the failing firms was almost certainly being taken out of production, meaning that net new investment by surviving firms was significantly higher than the 37 percent we have measured.²⁰

The patterns displayed by the cotton textile, cigarette, steel, and cement industries are corroborated by data on U.S. and British exports of industrial machinery to Mexico. In Table 12 we present estimates of the real value of exports of industrial machinery from these two countries to Mexico. We break down industrial machines into three broad categories: steam engines, boilers, and their parts; textile machinery; and manufacturing machinery other than textiles. All of the series indicate the same pattern: new investment, as measured by the export of industrial machinery to Mexico, did not decline during the early years of political instability. The data for 1911, 1912, and 1913 indicate that investment rates were not, on average, much different than they had been during the period 1900-1910. During the years when there was no underlying political system (1914-17), however, new investment, as measured by the importation of industrial machinery, collapsed almost completely. By 1915, new investment was in aggregate one-sixth of what it had been just three years before. Imports of industrial machines climbed rapidly, however, just as soon as the civil war of 1914-17 wound down. By 1920, every category of industrial machinery exported from the United

²⁰ Ideally, we would deflate these nominal capital values to produce a series on real capital invested in the industry. This would require, however, that we know the vintage of the capital employed in 1923, that we know the depreciation rates applied by firms to their capital equipment, and that we know the breakdown of capital spending by type of asset. Unfortunately, this data is not available.

States and Great Britain to Mexico had surpassed its Porfirian levels. In fact, during the 1920's industrial machinery exports to Mexico were anywhere from twice (in the case of textile machines) to six times (manufacturing machines other than textiles) what they had been during the decade before the Revolution.

One might argue that it should not come as a surprise that industrialists reopened their mills after the civil war ended. The capacity that existed prior to the Revolution represented sunk costs. As long as industrialists could cover their variable costs, it paid to put capacity back into production. One might also argue that incremental investments by industrialists should not come as a surprise either: if investments in small increases in productive capacity could, at the margin, allow for the efficient use of already existing capacity, then it would be in the interest of industrialists to undertake those investments, even if the general business environment was uncertain.

There are two problems with this argument. First, the data on exports of industrial machinery to Mexico indicate that firms were doing much more than undertaking incremental increases in productive capacity: the flow of new machinery to Mexico after 1920 exceeded the levels attained before 1910. Second, this argument cannot account for the fact that new firms entered the market for manufactures both during the Revolution and afterwards, even in the face of the failure of older, more established firms. As Table 1 indicates, in the cotton textile industry, for example, from 1910 to 1915 ten new firms entered the industry (eight of these during the turbulent years 1913, 1914, and 1915), adding 4.7 percent to the industry's capacity. From 1915 to 1920 more firms actually entered the industry than exited: five firms closed their doors, but 14 new firms entered (accounting for 4.4 percent of output). From 1920 to 1925 seven new firms entered the industry (accounting for 2.2 percent of output), and from 1925 to 1929 25 new firms entered the industry (accounting for 5 percent of output). In fact, these rates of entry during and after the Revolution are indistinguishable from the rates of entry that prevailed in the five years before the Revolution broke out.

We do not have the kinds of systematic data on entry and exit for other industries that we have for cotton textiles. The partial data we have, however, indicates entry in a number of industries by new, large, capital intensive firms in the early 1920's. In the tobacco industry, for example, the British-American Tobacco Company established two subsidiary manufacturing plants in Mexico which dwarfed their Mexican competitors and quickly drove them out of business. The International Match Company opened a subsidiary in Mexico as well. In the dynamite industry, the Dupont de Nemours Company acquired the works of the Compañía Industrial Nacional Mexicana de Dinamita y Explosivos. In the cement industry, Cementos Monterrey was founded, soon fusing with Cementos Hidalgo to form the mammoth Cementos Mexicanos, and in the beer industry, the huge Cervecería Modelo was established in Mexico City, quickly establishing itself as one of the largest brewers in the country. Ford Motors entered the market as well, opening an assembly plant in Mexico City in 1925.²¹

Rates Of Return

One might argue that new investment might be explained by extraordinarily high profits during the 1920's. It might have been the case, for example, that the macroeconomic environment was extremely favorable to industry. Thus, entrepreneurs might have invested in a politically risky environment because of very high physical productivity of new investments, which would have translated into very high profits.

The evidence on rates of return does not, however, sustain this interpretation. There are two appropriate ways to measure rates of return for the purposes of understanding whether new investment was driven by supernormal profits. Both attempt to proxy the productivity of capital. The first is to look at accounting rates of return—revenues minus costs, divided by the value of physical and cash assets valued at their book rates minus depreciation. Table 13 presents estimates of the accounting rates of return for four firms: the Fundidora Monterrey steel monopoly; the Compañía Industrial de Orizaba (CIDOSA, the nation's largest cotton textile manufacturer); the Compañía Industrial Veracruzana (CIVSA, the nation's second largest cotton textile

²¹ Haber (1989), pp. 143-144; Sterrett and Davis (1928), p. 208.

manufacturer); and El Buen Tono (until the mid-1920's, the nation's largest cigarette producer). For three of the four firms (Buen Tono, CIDOSA, and CIVSA), their rates of return during the 1920's were no higher than they had been during the Porfiriato. In fact, they were on average lower. In the case of Fundidora Monterrey, rates of return were, on average, higher than they had been during the Porfiriato. Fundidora Monterrey had, however, been a net money loser during the Porfiriato and its average rate of return of 4.9 percent from 1920 to 1929 can hardly be described as supernormal.

The other way to measure rates of return is to look at real dividend payments per share (adjusted for inflation and for stock splits). One advantage of this approach is that it provides us with a larger sample of firms. In Table 14 we present the average real dividends received by a hypothetical investor who held an equal number of shares in 11 of the large capitalization manufacturing companies whose stock prices we analyzed previously. The evidence is consistent with the analysis of accounting rates of return. Real dividends during the ten years 1901-1910 averaged nine pesos per share. During the ten years 1920-29, real dividends averaged less than half that level: four pesos per share.

One might argue that dividend payments do not capture the profitability of firms. Highly profitable firms that are plowing back their profits into new plant and equipment might, in fact, pay no dividends at all. The problem with this line of argument, however, is that firms undertaking this kind of aggressive reinvestment strategy would see a rapid run up in the price of their stock, as the new expenditures on plant and equipment would be capitalized in the market value of the firm. The evidence presented earlier on stock prices does not support this argument. Stock prices rose from their depressed 1918 values, but they moved slowly after 1921 and never even came close to regaining their Porfirian levels. In short, it would be difficult to sustain the argument that new investment after the Revolution was driven by an unusually strong macroeconomic environment.

Industry Concentration

A study of industry concentration is relevant for three reasons. First, it allows us to assess to what extent the Mexican Revolution really was able to expand opportunities to other groups beyond the privileged elites of the Porfiriato. Second, we are interested in identifying political determinants of market structure. Third, and most importantly, as we look at aggregate impacts of instability on particular industries, it is important to know whether industry structure changed during the period under analysis in order to validate comparisons among different periods. Our analysis of firm turnover and new investment, for example, might not capture the fact that purchases of new capacity or purchases of competitor's capacity might have taken place among a few large firms. In this case instability might have had a significant negative impact on most of the industry except for those large firms.

Testing these specific mechanisms is difficult in most industries because they were already monopolies or oligopolies prior to 1910. The paper, glass, steel, dynamite, and soap industries were monopolies or near-monopolies, while the beer, cement, and cigarette industries were each dominated by two or three producers.²² What is clear, however, is that these monopolies or oligopolies persisted after the Revolution.²³

The cotton textile industry, however, provides an opportunity to assess the independent impact of the Revolution and ensuing instability on industry structure because there were more than 100 producers. In addition, it would not be possible to explain changes in concentration in this industry as a function of production technology. Textile manufacturing is perhaps the archetypal case of an industry characterized by

²² Haber (1989), chapter four.

²³ Data on the competitive structure of the soap industry can be found in *Boletín Financiero y Minero* 26 September 1923. It indicates a four firm ratio of .72 and a Herfindahl Index of .36 (which is to say that the industry had the same competitive structure as an industry with three equally sized firms. Data on the structure of the paper industry, where the four firm ratio was 1.0, can be found in Secretaría de Hacienda (1936), p. 191. Data on the steel, glass, and cement industries can be found in Haber (1989), chapter four.

constant returns to scale, capital divisibilities, and the absence of technological barriers to entry.

We have been able to measure changes in the structure of Mexico's cotton textile industry from 1840 to 1932 by estimating the two standard measures of industry concentration: the Four Firm Ratio and the Herfindahl Index.²⁴ Our analysis, presented in table 15 indicates that the Mexican cotton textile industry was characterized by very high levels of concentration. Circa 1919, Mexico's four largest firms controlled 37.5 percent of the market, which was more than twice the level controlled by Brazil's four largest textile manufacturers and more than five times the level controlled by the four largest textile producers in the United States. Our analysis also indicates, however, that these high levels of concentration pre-dated the Revolution by two decades, and thus could not have been a function of the Revolution (unless one wants to take a strongly post-modern view of historical causality). To the extent that one can find a trend after 1900, it is in the direction of a very modest decline in concentration. The average four-firm ratio was virtually the same during the decade 1911-1920 as it had been in the decade 1901-10 (.332 versus .326). During the decade 1921-1930 concentration was actually lower than it had been in the decade 1901-10 (.299).

Ownership Continuity

Not only did political instability fail to dramatically affect the competitive structure of industry, it also did little to change the structure of ownership. The evidence indicates that the Revolution did not undo the oligarchy that owned Mexico's manufacturing industry during the Porfiriato.

²⁴ The four-firm ratio is calculated as the percentage of the market controlled by the four largest producers. The Herfindahl Index is calculated as the sum of the squares of the market shares of all firms in the industry. Because it uses data from all firms and because it weights firms by size, the Herfindahl Index is generally regarded as a superior index of concentration.

Four bodies of evidence independently point to this result. First, an analysis of the boards of directors of large capitalization industrial companies indicates that there was a striking degree of continuity in the composition of the major stockholders in these companies. We have been able to retrieve lists of board members for eight large manufacturing firms for circa 1910 and 1921. In some cases, we have also been able to retrieve their lists for the 1930s as well. These seven firms include the Fundidora Monterrey steel monopoly, the El Buen Tono and La Tabacalera Mexicana cigarette companies (which jointly controlled 60% of Mexican cigarette production), the Compañía Industrial Jabonera de la Laguna soap and glycerin company, the CIDOSA, CIVSA, and CIASA textile conglomerates, and the San Rafael y Anexas paper monopoly.

Consider, for example, the case of La Tabacalera Mexicana, a major tobacco products manufacturer. La Tabacalera Mexicana had been formed out of the amalgamation of the various tobacco manufactories of the Basagoiti and Zaldo families. The 1911 board of directors therefore included Antonio Basagoiti (as company president), Dionisio Ramon Zaldo, A.R. Zaldo, and Basagoiti's right hand man, Adolfo Prieto. Luis Barroso Arias (a partner of Prieto), Eugenio Alvarez, and William Mitchell served on the board as well. In 1921, Basagoiti was still serving as company president and board member. Dionisio Ramon Zaldo and Adolfo Prieto were also both still on the board. The board now included family relations (likely nephews) of Basagoiti: Juan Castano Basagoiti and Ramon Castano Basagoiti. In fact, as late as 1938, members of the Basagoiti-Zaldo clans still dominated the board, with Dionisio Ramon Zaldo still appearing and what appears to be the son of Antonio Basagoiti, J. Antonio Basagoiti Ruiz.²⁵

Another striking case is provided by the CIDOSA textile conglomerate. CIDOSA was founded and run by a group of French expatriate dry goods merchants and financiers in the 1890's. In 1911 its board of directors included Henri (Enrique)

²⁵ *The Mexican Yearbook*, 1912, p. 126; *Boletín Financiero y Minero*, 29 October 1938; *Boletín Financiero y Minero* 16 April 1930; *Boletín Financiero y Minero*, 17 April 1922.

Tron (as president) as well as three other French merchant-financiers: Eugenio Roux, David Adrian, and Mauricio Honnorat. In 1920, the company was still being run by French expatriates. In fact, the president of the board in 1920, Justino Tron, was almost certainly a relative of the 1911 president, Henri Tron, who now headed the Paris Consultative Committee of the firm. Mauricio Honnorat was no longer on the board, but Leon Honnorat was, along with his long-term business partner Leon Signoret. In fact, as late as 1937 the board had not dramatically changed: French surnames predominated, including Tron, Honnorat, and Signoret.²⁶ These results are consistent with those for the other six other firms in our sample.²⁷

These results are also consistent with the observations of contemporary observers. When Joseph Sterrett and Joseph Davis wrote their 1927 report on Mexico's economic situation for the International Committee of Bankers, they noted: "The industries were in almost all cases started by foreigners and are still largely controlled by the same groups; but the companies are generally Mexican corporations, and in some cases the present active leaders, descendants of the earlier operators, are Mexican citizens who still, as a rule, retain close connection with their country of national origin."²⁸

These bodies of evidence also square with the detailed histories of elite families studied by social historians. Research by Alex Saragoza on the Garza-Sada clan of Monterrey, by Mark Wasserman on the Terrazas-Creel clan of Chihuahua, by Mario

²⁶ *Boletín Financiero y Minero* 28 April 1937; *Boletín Financiero y Minero* 30 January 1920; *Mexican Yearbook* 1912, p. 123. 1/30/1920.

²⁷ For data on the six other companies in our sample see as follows. For Fundidora Monterrey, Annual Reports, 1910 and 1921. For CIASA: *Boletín Financiero y Minero* 7 April 1919, *Mexican Yearbook*, 1911, p. 280; for CIVSA, *Boletín Financiero y Minero* 3 May 1937; *Boletín Financiero y Minero* 11 June 1924; *Mexican Yearbook*, 1911, p. 289; *Mexican Yearbook*, 1912, p. 123; for El Buen Tono, *Boletín Financiero y Minero*, 28 May 1919; *Boletín Financiero y Minero*, 28 May, 1919; *Boletín Financiero y Minero*, 21 April 21, 1924; *Boletín Financiero y Minero*, 26 October 1926; *Boletín Financiero y Minero*, 30 April, 1938; *Mexican Yearbook*, 1911, p. 281; for San Rafael, *Boletín Financiero y Minero*, 27 April 1921; *Mexican Yearbook* 1912, p. 126; *Boletín Financiero y Minero*, 13 April 1928.

²⁸ Sterrett and Davis (1928), p. 207.

Cerutti on the business enterprises of John F. Brittingham, by Leticia Gamboa Ojeda on the textile magnates of Puebla, and by María del Collado Herrera on the Braniff family all point to the same conclusion: these family business empires weathered the revolution and the political instability of the 1920's intact.²⁹

The conclusion that there were not dramatic changes in the composition of the industrial elite of Mexico as a result of political instability is further borne out by an analysis of the structure of ownership of the cotton textile industry, where we have detailed data on both publicly traded and privately-held firms.³⁰ There was, in fact, remarkable stability among the industry leaders. Of the ten largest firms in the industry in 1920, eight had been industry leaders in 1910. All ten firms had been founded before 1910, half of them before 1900. We get similar results if we extend our analysis to the top twenty firms. Of the twenty largest textile firms in 1929, 15 had been founded during the Porfiriato. This is a lower bound estimate. All of the other five were joint stock companies that had obtained limited liability status in the 1920's, although the mills they owned were of Porfirian origin. It is likely the case that some of these firms were in fact sole proprietorships or partnerships that decided to obtain limited liability, corporate status.³¹ In short, with few exceptions, the very same companies that dominated the industry in 1910 dominated it in 1920.

Systematic analysis of data on the cotton textile industry indicates that even among mid-sized firms there was very little turnover of assets. In table 16 we present estimates of the rate at which firms changed hands in five year intervals from 1895 to 1929. During the years 1910-1915, 27 percent of firms changed owners, and during the period 1915-1920, 16 percent of firms changed owners. These rates of ownership turnover were little different than the rates that prevailed under political instability.

²⁹ Saragoza (1988); Wasserman (1993); Marichal and Cerutti (1997); Cerutti and Flores (1997); Gamboa Ojeda (1985); Collado Herrera (1987).

³⁰ By company we refer either to a corporation or a person with distinct ownership rights over a given mill (or group of mills). This may be a corporation, partnership, or sole proprietorship.

³¹ Doing so would have made it easier for them to obtain credit, as the shares in the firm could then be pledged as collateral.

From 1895 to 1900, 29 percent of firms changed hands, from 1900 to 1905 27 percent, and from 1905 to 1910 18 percent. Moreover, the changes in ownership during the period 1910-20 occurred primarily among very small firms. The percent of industry output affected by changes in ownership was only 4.2 percent from 1910 to 1915 and 7.0 percent from 1915 to 1920. This was less than half of the average industry output affected by ownership change before 1910. The rate of ownership change in the 1920's was also not dramatically different from that prevailing before 1910. Regardless of whether we estimate ownership turnover by the percentage of firms in the industry or the percentage of output they controlled, the period 1920-1930 is virtually indistinguishable from the period 1895-1910. In short, the data do not indicate that the Revolution and ensuing instability brought about a greater degree of turnover of assets.

What does appear to have been different, however, was the *size* of firms that changed hands during the decade 1910-20. There was a sizable decline (on the order of 50 percent) in the average size of firms that were sold during this period. This result is consistent the finding that small firms had less chance of surviving the civil war of 1914-17 intact. Since small firms had lower probabilities of survival, the relative price of small firms should have fallen. This would explain the greater propensity of small firms to change hands with greater frequency than larger firms.

Productivity

One might imagine that the dramatic changes in institutions that came out of the Constitution of 1917 should have had adverse consequences for industrial productivity. The changes in institutions that governed labor markets (the rise of unions, the increases in wages, the shortening of the workday, the increase in worker militancy on the shop floor) all should have worked to raise the unit costs of labor. Similarly, the disappearance of a major portion of the banking sector, the decline in lending by the surviving banks for productive activities, and the increase in risk premia associated with new investments in the 1920's should have worked to increase the unit cost of capital.³²

³² The impact of the civil war of 1914-17 on the banking system is taken up in our book-length work, chapter four.

The net result might have been a decline in both labor productivity (output per worker) and total factor productivity (TFP, output per unit of capital and labor).

The detailed data we have retrieved on the cotton textile industry allow us to test this hypothesis directly. We estimate labor productivity and TFP using the following standard methods. We selected two different measures of aggregate industry output: the real (inflation adjusted) value of production, and the volume of production (measured in meters of cloth).³³ Following Kane, we employ spindlage as a proxy for capital.³⁴ Following the work of Atack and Sokoloff on the United States and Bernard and Jones on international productivity comparisons, we employ the number of workers as a proxy for the labor input.³⁵ Estimating labor productivity is more straightforward: it is simply the real value of output or the physical volume of output divided by the number of worker equivalents (workers adjusted for differences in the length of the workday before and after 1917).

Estimating TFP involved several more steps. Ideally, we would have had censuses enumerated at the firm level covering both the pre and post-revolutionary years allowing us to employ panel-data techniques to estimate time trends for TFP growth across different sub-periods. Unfortunately, after 1913 the censuses no longer enumerate at the firm level. We therefore had to proceed in two stages. First, we used the 1850-1913 firm-level censuses to estimate a Cobb-Douglas production function of the form

$Y = A \cdot K^\gamma \cdot L^{1-\gamma}$ with constant returns to scale, where K and L represent the capital and labor inputs and A is a function that captures improvements in technology over time. In order to use linear estimation procedures, we took natural logarithms of a normalized

³³ Both proxies of output have different advantages and disadvantages. Real output is sensitive to the textile price index we have developed. The volume of production gets around the price index problem, but it understates productivity growth because it cannot capture changes in the quality of cloth over time. We therefore employ both measures in order to provide a cross-check on our results.

³⁴ Kane (1988).

³⁵ See Atack (1985); Sokoloff (1984), 351-382; and Bernard and Jones (1996).

production function of the form $y = k^\alpha$ where $y = Y/L$ and $k = K/L$ and added explanatory variables to arrive at the following model.

$$(1) \ln y = \alpha + \beta_1 \cdot \ln k + \beta_2 \cdot \ln L + \beta_3 \cdot \text{Time Trend}$$

We then estimated TFP directly from output and input data for all years for which we have cross sectional census data using the weights for capital and labor estimated from the 1850-1913 production function. For any given time t , where we had data on output, spindles, and workers, we estimated TFP employing the following formula:

$$(2) TFP_t = \frac{\sum_i Output_{t,i}}{\left(\sum_i Spindles_{t,i}\right)^a \cdot \left(\sum_i Workers_{t,i}\right)^b}$$

where a and b are the (normalized) shares of capital and labor as estimated in the panel regression procedure described above and the subscript i identifies the inputs and output of reporting unit i .³⁶

Labor productivity was adversely affected during the period when manufacturers could not obtain the necessary inputs and could not ship their output to market (the years 1914-17). Labor productivity then grew, however, at a rapid pace. (see Table 17). When we proxy output by its real value, output per worker in 1918 was roughly one-third of what it had been in 1913. It then climbed rapidly, nearly regaining its 1913 value by 1921, and then continued growing in a somewhat volatile fashion for the rest of the decade. If we proxy output by meters of cloth produced, labor productivity fell far less dramatically, the index moving from 111 in 1913 to 83 in 1918. The data also indicate a rapid recovery: by 1919 output per worker was at an all time high. On

³⁶ The coefficients on capital and labor from the panel regressions were normalized so that $\alpha + \beta = 1$, because our model did not identify any economies of scale. For estimates of TFP that measure output as the real value of production, this resulted in coefficients of .62 for capital and .38 for labor. For estimates of TFP that measure output in physical units this resulted in coefficients of 0.48 for capital and 0.52 for labor.

average, during the 1920's output per worker was 17 percent higher than it had been during the period 1901-1910.

Our estimates of TFP tell a slightly different story (see Table 18). TFP fell anywhere from 40% to 74% (depending on whether we proxy output by physical units or real value, respectively) from 1913 to 1918. Like labor productivity, however, TFP then recovered quickly, regardless of how output is proxied. When measured by its real value, TFP continued growing through the 1920's. When measured in physical units of cloth produced, however, the results indicate little TFP growth in the 1920's. This may indicate that firms were switching their output to smaller runs of high value cloth. This would be consistent with the fact that effective rates of protection for the fine weave cloth were roughly twice that of coarse weave cloth.

These TFP results are not surprising in light of the one-third reduction in the length of the workday. In fact, although TFP is the one area where we can find some measurable change, the mechanism that induced that change was not a drop in new spending on plant and equipment caused by uncertainty among investors about the security of their property rights. Rather, it was the consequence of a change in the formal rules and regulations governing the length of the workday. It would in fact be shocking to find no impact of a 33 percent reduction in working hours on productivity. Manufacturers mitigated the change in working hours somewhat by increasing the capital-labor ratio, which was 38 percent higher in the decade 1920-29 than in the decade 1901-10.

II. THEORY

How can we explain these empirical results? They are clearly not consistent with the consensus solution to the commitment problem—limited government—and the way that instability should make credible commitments impossible.

The answer is that the commitment problem does not entail a binary choice between predation with no growth or limited government with growth. Mexico did not, in fact, have a limited government before it became unstable. Instead, it solved the commitment problem through a different mechanism, one which we call Vertical

Political Integration (VPI). That commitment mechanism was economically inefficient (compared to limited government), but it was Pareto improving compared to the other politically feasible alternatives that Mexico faced. It also had an advantage over limited government in that it was robust to political instability.

How do such systems work? A crucial insight is provided by the industrial organization literature on contracting among private firms. Klein et al. (1978) have argued that when there are strong incentives for firms to engage in post-contractual opportunism, it is more efficient for them to integrate into a single firm.³⁷ This is particularly likely to occur under conditions of bilateral monopoly with asset specificity. In other words, firms integrate when either party to the contract can hold the other up and has strong incentives to do so even after a contract has been signed.³⁸

We argue that the same incentives facing firms in conditions of bilateral monopoly with asset specificity prevail between governments and asset holders. Just like a firm worried about hold-up from suppliers, or suppliers worried about a potential monopsony, the political and economic actors' incentives are to vertically integrate. Governments need asset holders to invest in order to create sources of tax revenue. Asset holders need government to not predate on their property rights, and to protect them from predation by others.

The result is a form of government that we call Vertical Political Integration (VPI). Under VPI there is an implicit contract between a government and *some subset* of asset holders to create and divide rents. The government offers selective protection of property rights and other favorable policies to the "integrated" asset holders. These policies allow this subgroup of asset holders to earn returns above the competitive level. These asset holders then invest their wealth in productive assets. Some of the returns to this investment are then diverted to the government.

³⁷ See Klein et al. (1978).

³⁸ A classic case is the sugar industry. See Dye (1998).

What makes the government's commitment to integrated asset holders credible? In an economic setting, firms integrate with the underlying assumption that the legal system will adjudicate most of the problems that may arise with integration. The government will serve as the third party enforcer of the contract that merges the two firms.³⁹ In VPI, however, the government itself is a party to the arrangement that it is supposed to arbitrate. This raises a thorny problem: What keeps the government from unilaterally changing the rules once asset holders have invested their wealth in productive assets? More extremely, what keeps the government from simply confiscating those productive assets?

Without limited government there is no self-enforcing solution to the contract. Governments will be constrained, of course, by the fact that asset holders have human capital that is difficult to replicate. The government will also be constrained by the fact that if it predates today, it will forego tax revenues in the future. If an industry is growing rapidly, the government will realize that the stream of future taxes will exceed whatever short-term benefits it might obtain by immediate predation. Neither of these factors, however, can create a sustainable equilibrium that permits economic growth. Asset holders will know that the government will be unconstrained once it has learned how to run the industry and once the rate of growth of new investment has slowed. This knowledge will produce a self-fulfilling prophecy: Asset holders will choose not to invest because they know that there is a high likelihood that they will be expropriated once the industry has matured.

This means that the VPI contract must be enforced by a third party that can punish the government and that has a strong incentive to do so. The third party's payoffs must directly depend on the ability of asset holders to obtain favorable treatment from the government. This provides the incentives for the third party to monitor, and be ready to punish, the government to ensure that it does not renege on its

³⁹ For example, when a company buys a subsidiary, it assumes that headquarters can order the managers of the subsidiary to follow new policies, and that those managers cannot siphon off rents for themselves. Should the subsidiary's manager renege, they can be legally dismissed.

commitments.⁴⁰ As a result, by integrating a third party to enforce the contract between government and asset holders, VPI allows the government to make a credible promise to respect the property rights of the integrated asset holders, thereby giving them an incentive to invest. Economic activity, then, can be sustained even without limited government.

Who could the third party be? In rare cases, the third party could be a foreign state. This tends only to occur when one party to the contract is a citizen of that foreign state (usually a very wealthy and influential citizen) or is the foreign state itself. In most cases, however, some domestic group must have the ability to serve as the third party enforcer. This domestic third party must receive a stream of rents from asset holders and be able to punish the government if those rents are interrupted. In general, it may be any group that provides *crucial* political support for the government. What is key is that the integrated asset holders must align the third party's interests with their own for VPI to work. (The basic intuition of VPI is laid out as a stage game in Figure 1.)

Although VPI can sustain growth, it has three negative consequences for economic efficiency and welfare, which make it second-best to limited government. First, the requirement that rents be generated and distributed through the political system means that there will be a serious misallocation of resources in the economy. Industries will exist that would not exist otherwise, monopolies and oligopolies will exist in industries that should be characterized by more perfect competition, and opportunities will be denied to entrepreneurs with the required skills and assets, but without political access or protection. Second, since VPI must generate rents to distribute to members of the coalition, these rents must come from somewhere: usually everyone and anyone outside the coalition.⁴¹ Thus VPI has negative distributional

⁴⁰ The most intuitive way to think about this punishment—and its most common shape—is a violent revolt, but it may take other forms, such as general strikes, street demonstrations, or other forms of political protest. The key is that the punishment be severe enough to deter the government from defecting or otherwise predate on the asset holders.

⁴¹ We assume that not all groups in society can solve the coordination problems involved in organizing a rebellion, and therefore rents can be extracted from them with impunity.

consequences. Third, VPI coalitions will only be stable when the government itself earns rents above and beyond the cost of providing public services. If the government is not earning such rents it will have no incentive not to predate. Thus, VPI systems are inefficient providers of public goods.

VPI also has negative political consequences. The very nature of VPI—a series of implicit contracts between select economic agents and the government—means that the particular features of those contracts cannot be debated and revised through a transparent and open process. The government must be able to make deals in smoke filled rooms without the necessity of public review and approval. This is especially crucial because VPI governments are inefficient providers of public services. In a democratic system, the electorate would remove the government and replace it with a government that was more efficient. In addition, electoral democracy and its accoutrements make it easy for the losers from rent seeking to mobilize and defend their interests. In short, VPI is not consistent with high levels of political democracy.

What happens to VPI if the polity becomes unstable?⁴² Under some circumstances, political instability may actually make commitments more credible. If there is political instability, by definition there will also be political competition that could potentially overthrow the government. This political competition may serve to keep the government in check. That is, if the government predate, asset holders could switch their support to other factions that could overthrow the government. In this particular case, the holdup problem between governments and asset holders is no longer bilaterally symmetric: the government needs the revenues from the asset holders more than the asset holders need the government. What is key are two factors: whether the government can credibly threaten to expropriate and run the industry in the short run; and whether the revenues provided by the asset holders are so crucial to the government that even their brief interruption could cause the government to fall. If the government cannot credibly threaten to run the industry (as expressed in the model, if the value of q

⁴² By instability we mean that the mechanism by which governments change hands is unconstitutional, unpredictable, recurring, and violent.

is low) and if the asset holders provide crucial revenues, then the government will be constrained.

Even if political competition does not constrain the government, existing third party enforcement might. If any government that *may come to power* requires the political support of the existing third party enforcer to stay in power, then asset holders will behave *as if* the polity were stable. That is to say, even though there may be multiple competing governments, the identity of which government is in power is not relevant. Presidents, prime ministers, and cabinets may be shuffled willy nilly. In fact, they may even be shuffled at gunpoint. As long as third party enforcement is not affected, however, political instability will not affect the behavior of asset holders. From their point of view, there will have been no change in the institutions that govern their property rights and the revenues from those property rights.

Is there a threshold of instability at which VPI no longer functions? VPI breaks down when third party enforcement is no longer credible. This can happen if any of three conditions holds. The first is if the government knows with absolute certainty that it will fall in the near future. It will have no incentives not to steal as much as it can while it still can. The second is if asset holders or third party enforcers can no longer coordinate their actions. The third party can no longer be counted on to punish the government if it predares on the asset holders. The third condition under which extreme violence may disrupt VPI is if a government comes to power that does not need the support of the previous third party enforcer. Obviously, threats of punishment by this group will no longer constrain the government. This most intuitively occurs when the third party enforcers are dead on the battlefield. Less extremely, the new government may be invulnerable to the previous third party enforcer used to threaten the government. For example, third party enforcement by a dictator's family or close cronies may no longer be effective once the dictator loses power. In terms of the model, the value of p will have fallen to zero.

Is there any way to restart economic growth once a VPI system has ceased to function? One possibility is that one faction will engage in widespread predation and use

the resulting resources to slaughter all potential sources of opposition and seize uncontested power. It is not clear, however, how such a government could make credible commitments to protect property rights: all possible third party enforcers have been eliminated. Such a despotic government would produce political stability, but economic growth would be extremely unlikely.

The other exit is that the VPI system can be reconstituted. So long as there is a shared belief system about how a VPI system works, it is not a secret to any of the consequential actors in society about how to constitute a viable coalition to govern the country and mobilize resources. In short, because everyone understands the rules of the game, asset holders, political factions, and social groups that are politically crucial will all seek out one another. A new coalition will emerge, but the basic structure of the political and economic system will survive intact. The result will be the resumption of economic activity in fairly short order. Thus, VPI can be robust to even the strongest forms of political instability. This is, in fact, exactly what happened in Revolutionary Mexico.

IV. Mexico as a VPI System

When Porfirio Díaz seized power in 1876 the commitment problem was not a distant theoretical abstraction. The governments that had preceded Díaz had all predated on property rights in order to reward their allies, punish their enemies, and obtain sources of short-run revenue.⁴³ Even the “liberals” who formed the Republican movement and espoused the virtues of private property predated on their political enemies.⁴⁴ The result was that there were no credible commitments in nineteenth century Mexico, and because there were no credible commitments there was neither

⁴³ Much of this predation took place in the context of state-level political battles, which produced, over time, an increase in the number of Mexican states. To cite one example, the present day states of Yucatán, Quintana Roo, and Campeche were originally a single state. In 1857, the western portion of the state violently seceded, forming the present-day state of Campeche. Opponents of the secession were expropriated by the victors. See Wells (1985), pp. 68-69.

⁴⁴ Plana (1996), p. 33, 73-74;

political stability nor economic growth. Indeed, nineteenth century Mexico is canonical case of a “coup trap:” a self-replicating cycle of violence, predation, and zero growth. The estimates made by Coatsworth indicate a per capita GNP (in 1950 U.S. dollars) of \$73 in 1800 and \$62 in 1877.⁴⁵

Limited government was not an option that was available to Porfirio Díaz. The political reality of late nineteenth century Mexico was similar to that of contemporary Russia: “a crumbling, peripheralized federalism.” In the Mexican case, the form this took was the prevalence of regional warlords or political bosses who operated with a great deal of autonomy from the central government.⁴⁶ Any attempt to create a political system in Mexico in which decision-makers would be constrained by the rule of law would have met with violent opposition by the regional warlords/state governors who ran the provinces as virtually independent fiefdoms and who commanded state militias that often outnumbered the federal army.

Díaz therefore had to settle for a second-best solution to the commitment problem.⁴⁷ That solution was a political-economic system in which the government made a credible commitment to some *subset of asset holders* that it would enforce *their* property rights. In order to compensate them for the risk of investing in an economy in which there was not limited government, Díaz granted special entitlements and privileges to this subset of asset holders that allowed them to earn economic returns above those that would prevail in a competitive economy. In short, he created a VPI system.

One particularly crucial piece of Díaz’ VPI polity was the contract his government made with the country’s bankers. Space constraints prevent us from going

⁴⁵ Coatsworth, John. H. 1978. “Obstacles to Economic Growth in Nineteenth Century Mexico.” American Historical Review 83(1): pp. 80-100.

⁴⁶ The similarities between the contemporary Russian Federation and Porfirian Mexico have been made by Robinson. See:Robinson (forthcoming).

⁴⁷ Because the first best solution (limited government) was not a practical possibility, the second-best solution was actually the Pareto improving solution. For a discussion of why second-best solutions are Pareto improving when the first-best solution is infeasible, see Shleifer and Treisman (2000).

into detail, but the basic arrangement Díaz hammered out was as follows: you lend me the funds I need to establish a viable government, and I will grant you a number of extremely lucrative privileges. The resulting banking system had the following features. Two banks (Banamex and the Banco de Londres y México) were granted a duopoly in the Mexico City market. In addition, only Banamex and the Banco de Londres y México had the right to branch across state lines. They were also permitted to hold lower ratios of reserves to banknotes than the state-level banks: 33 percent as opposed to 50 percent. Banamex was also granted an exclusive privilege of providing financial services to the government: collecting tax receipts, making payments, holding federal deposits, and underwriting all foreign and domestic federal debt issues. In short, Banamex was granted special privileges allowing it to earn rents above the competitive level, and some of these privileges were shared with the Banco de Londres y México.

State level banks were also protected from competition. The law was written in such a way that, as a practical matter, only one bank could be established in each state, although existing banks were grandfathered in. The law specified that bank charters (and additions to capital) had to be approved by the Secretary of the Treasury and the Federal Congress. In order to make this commitment credible beyond the tenure of any particular Treasury Secretary, the law also created three other barriers to entry. First, the law created very high minimum capital requirements, U.S. \$125,000 (later raised to U.S. \$250,000). Second, the law established a two percent annual tax on paid-in capital. The first banks granted a charter in each state, however, were granted an exemption from the tax. This gave the first banks into each market an insuperable advantage. Third, state banks were not allowed to branch outside of their concession territories. This prevented banks chartered in one state from challenging the monopoly of a bank in an adjoining state. In short, the only threat to the monopoly of a state bank could come from a branch of Banamex or the Banco de Londres y México.

This arrangement provided rents to all of the players in the game. First, stockholders in Banamex and the Banco de Londres y México benefited because their

firms shared a duopoly in the most lucrative market in the entire country (the Federal District). Second, stockholders in the state banks benefited because they were granted local monopolies. At most, they would face two other competitors, but only if both Banamex and the Banco de Londres y México decided to open local branches in their state. Third, Secretary of the Treasury Limantour benefited because his brother was a stockholder in the Banco de Londres y México. Fourth, the state governors benefited because they were given the de facto right to choose which group of financiers in their states would receive a bank charter. In return, this group of financiers almost always rewarded the state governor with a seat on the board of directors, which entitled him to director's fees in addition to the possibility that he would receive shares of stock for free. Finally, the federal government benefited, because it gained a line of credit that was essential in starting the virtuous cycle of state financing, economic growth, and rising tax revenues. There was only one problem: Mexico's banks acted like inefficient monopolists, which had a negative effect on the rest of the economy.⁴⁸

Mexico's manufacturers received entitlements similar to those that prevailed in banking. The most important of these was trade protection. In fact, Mexico's manufacturers not only required high tariffs on their final outputs, they required low or zero tariffs on their inputs. Without a cascading tariff structure that provided firms with high effective rates of protection, Mexico's manufacturers would not have stood a chance against foreign competition.⁴⁹ For many of Mexico's new and rapidly growing industries tariff rates were extraordinarily high: 76 percent for bottled beer, 72 percent for common cloth, 88 percent for fine cloth, 198 percent for printing paper, 225 percent for candles, and 234 percent for soap, to cite a few examples. In addition, the government created a "cascading" tariff structure: duties on final manufactured goods were high while duties on the inputs to produce those final goods were low or zero.⁵⁰

⁴⁸ Maurer (1997); Maurer (1999); Maurer and Haber (forthcoming).

⁴⁹ The reasons are detailed in Haber (1989), chapter 3.

⁵⁰ Beatty (1996), chapter 3.

Trade protection in steel illustrates the case clearly. In 1909 the tariff on steel products produced by Fundidora Monterrey (the nation's sole integrated steel producer) was 43.7%. The tariff on products that the firm did not produce was roughly half that: 22.9%. The tariff on the imported inputs that Fundidora Monterrey consumed was 3.4%.⁵¹ This was true in the textile industry as well. The tariff on imported cloth tended to be twice that of the tariff on imported raw cotton. The result was an effective rate of protection that varied from 39 to 78 percent (the variance driven by movements in the real exchange rate, which affected the peso price of imports).⁵²

A system of high tariffs, of course, generated rents that encouraged market entry. One might think that any rents that manufacturers earned would have been quickly dissipated by domestic competition. This did not happen for three reasons. First, Mexico's peculiar banking laws created financial barriers to entry. Second, a similarly peculiar set of patent laws created technological barriers to entry. Third, the government created tax-based barriers to entry by erecting high excise taxes, to which it then selectively granted exemptions. In short, at the exact same time that the U.S. government was trying to reduce industrial concentration by the writing of anti-trust laws, the Mexican government was trying to foster industrial investment by crafting patent and tax laws that discouraged competition.

The paper industry provides an example of how financial market imperfections created barriers to entry in manufacturing. A single firm, the San Rafael paper company, dominated the market because its principal investors could mobilize capital through the financial markets and the banking system, while its actual and potential competitors could not. Its basic business strategy was to buy out any operation whose principals had the private knowledge required to run a competing paper mill. Thus, within a decade of its founding, it had purchased five of its seven competitors. The only competition San Rafael faced came from two small factories that had been founded,

⁵¹ Gomez (1997), p. 216.

⁵² Gómez (1999b), p. 604.

ironically, by German technicians that San Rafael brought to Mexico to supervise its own operations. These competitors, however, lacked access to the banks or the financial markets, and therefore remained very small in scale. They competed with San Rafael on the basis of their ability to produce high quality paper products that could compete with imported goods. San Rafael, on the other hand, monopolized the market in low value products, particularly newsprint.⁵³

One of the reasons that privileged access to capital could serve as a barrier to entry in paper manufacturing was because there are large economies of scale in paper making and because the number of individuals with the private knowledge necessary to run a paper mill in Mexico was extremely small.⁵⁴ How significant were financial barriers to entry in industries that were characterized by modest scale economies, in which the knowledge of the specific technologies of production were easy to acquire?

The cotton textile industry provides us with a perfect test case. In textile manufacturing the capital equipment was easily divisible, the minimum efficient scale of production was small, and the technology was easy to acquire and operate. Unlike industries that make use of heat or chemical reactions (such as beer brewing, steel making, cement making, or paper milling) textile production does not require the careful coordination of inputs and outputs across different departments. Private production knowledge is therefore less crucial. The textile industry therefore provides an excellent test case of the relationship between the development of the financial markets and banks that provide capital to an industry, and the development of the industry itself.⁵⁵ What effects did privileged access to capital have in textile

⁵³ Haber (1989), pp. 96-99.

⁵⁴ The manufacture of paper products requires a knowledge of chemistry and a knowledge of the specific features and capacities of paper-making equipment. There are, in fact, very large economies of scale in paper manufacturing, but capturing these requires that owners or managers are able to combine skilled labor, raw materials, and high through-put machinery in an effective manner.

⁵⁵ This does not mean that scale economies were insignificant in cotton textile production. Indeed, had economies of scale been negligible, access to capital could not have served as a barrier to entry. It does mean, however, that scale economies were exhausted in textiles at relatively small firm sizes compared to such industries as steel, cement, and chemicals.

manufacturing? The evidence is unambiguous: privileged access to capital served as an effective barrier to entry. An industry that should have been characterized by near-perfect competition was instead highly concentrated. Moreover, an industry that should have been characterized by declining concentration over time was instead characterized by increasing levels of concentration.

In addition to the barriers to entry created by Mexico's peculiar banking laws, the government actively worked to create barriers to entry through the patent system. In the 1890's the Díaz government completely reformed the patent laws. One of the unusual features of the resulting law was that foreigners who had already developed and patented a technology or process elsewhere could receive a patent for that invention in Mexico as well.⁵⁶ This all seems benign until you consider the impact of the law: it meant that a Mexican manufacturing firm could purchase the sole rights to use a particular invention in Mexico, thereby creating a monopoly through the control of the requisite technology.⁵⁷ Two industries provide us with relevant examples. In cigarette manufacturing, for example, one firm, El Buen Tono, dominated the market because it was the only firm that had the right to use the Bonsack cigarette rolling machine.⁵⁸ Glass-bottle making provides another relevant example. In this case, one firm, Vidriera Monterrey, purchased the sole rights to use the Owen's automatic glass-blowing machine. It therefore monopolized the manufacture of glass bottles. Since the owners of the glass firm were also the owners of one of the country's largest beer breweries (the Cerveceria Cuauhtémoc) this gave rise to concentration in the beer industry.

⁵⁶ For a complete discussion of Mexico's patent laws see Beatty (1997).

⁵⁷ Had the foreign inventor not been able to re-patent the technology in Mexico, he could not have guaranteed that the Mexican purchaser would have had the sole rights to use it. Other Mexican firms could have copied the invention without paying royalties. The result would have been that technologies developed in the United States would have diffused more quickly to Mexico because they could have been appropriated without cost.

⁵⁸ For the history of this firm and the Bonsack machine, see Haber (1989), pp. 99-100; Beatty (1997).

Competing breweries had to either blow glass bottles by hand, or import them from the United States.⁵⁹

Finally, the federal government actively worked to create legal barriers to entry via the manipulation of the tax code. The *Compañía Nacional Mexicana de Dinamita y Explosivos* (the Mexican National Dynamite and Explosives Company) provides the clearest example of how the tax code could be used to create a monopoly. In fact, the tax concession that the firm received from the Díaz government in 1901 was a masterpiece of rent-producing legislation. First, the company got the government to establish both an import tax and an excise tax on dynamite. Then it got the government to grant it an exemption from both of these taxes. The excise tax was set at 210 pesos per ton, the import tax at 30 pesos. The average price of imported dynamite was 301 pesos per ton, exclusive of taxes and transport costs. The combined taxes, then, of 240 pesos would have levied an 80 percent tariff on imports, clearly giving the company a high degree of protection. Assuming that a hypothetical domestic competitor could have produced dynamite at the cost of imports, the 210 peso excise tax would have added 70 percent to the final price of its products. The government further agreed that if it should ever lower either of these taxes, it would pay the company the equivalent amount per ton of explosives produced, in order to compensate it for the drop in the rate of protection. Finally, in a seeming concession by the company, *Dinamita y Explosivos* “agreed” that if dynamite prices rose beyond the “normal price” it would import the amount necessary in order to restore equilibrium to the market. The imported dynamite would enter the country “as if it were the product of the firm’s own operations,” that is, without payment of either the import or the excise tax. What this effectively meant was that what the company could not produce it was allowed to import duty free. The concessionaires had, in effect, gotten the government to award them a monopoly on dynamite production and distribution. The purpose of this

⁵⁹ Haber (1989), pp. 89-91.

monopoly, as Mexico's miners pointed out, was to transfer rents from Mexico's miners to the stockholders of the explosives company.⁶⁰

Who provided third party enforcement of this coalition between the Díaz government and Mexico's manufacturers? The answer depended on how much enforcement was needed. In industries whose operation required very high levels of private production knowledge, such as steel or paper making, very little enforcement was needed at all. The government could credibly threaten to expropriate the industry, because it could not run it itself or because any third group in whom it would vest the property rights would produce no more in the way of tax revenues than the original owners (in terms of the stage game, the value of q was low).

In industries that required less private production knowledge, enforcement tended to be provided by crucial political actors who had the ability to punish Díaz. Either of two groups served this role: state governors or Díaz' own coterie. The El Bueno Tono Cigarette Company, whose market dominance was the product of its control of a foreign patent (that any other manufacturer could have employed) is a classic case in point. The firm's board of directors included Roberto Nuñez (the under-secretary of the treasury), Julio Limantour (brother of the secretary of the treasury), Pablo Macedo (the president of congress), Manuel González Cosío (Secretary of War), and Porfirio Díaz jr. (the dictator's son).⁶¹ The board of the Compañía Nacional Mexicana de Dinamita y Explosivos tells a similar story. Running the firm required very little private production knowledge: most of what it did was import dynamite from the United States and then resell it at inflated prices. In fact, it was years before the firm

⁶⁰ One contemporary estimate indicates that the monopoly raised miners' total costs of production by three percent. This is considerable in light of the fact that total state and federal taxes totalled 4.3 percent of the total costs of production, and in light of the fact that a three percent increase in total costs would have been an even larger percent of profits (the percentage depending on the profit margins of the particular mining company). See *Engineering and Mining Journal*, March 9, 1905, p. 475. Also see: Haber (1989), pp. 91-93; *Engineering and Mining Journal*, December 17, 1903, p. 918; *Engineering and Mining Journal*, March 23, 1905, p. 575; *Engineering and Mining Journal*, December 9, 1905, pp. 1074, 1077-78.

⁶¹ Haber (1989), p. 100; *The Mexican Yearbook, 1909-10*, p. 420; *Mexican Yearbook 1908*, p. 531.

produced a single stick of dynamite. Thus, its board of directors included a set of Porfirian insiders, including, Enrique Creel (the governor of Chihuahua), as well as Julio Limantour, Roberto Nuñez, and Porfirio Díaz jr.⁶²

In the case of firms that maintained market dominance because of their privileged access to capital, third party enforcement was implicitly provided by the fact that Mexico's peculiar financial laws were enforced by the state governors, who earned rents as board members of the banks. Examples can be found across the country. In fact, virtually every local bank in Mexico distributed stock to the governor in which the bank operated. The role of the state governors was not just restricted to banking. In the state of Puebla, for example, the textile industrialists went into business with Governor Martínez. First, they placed him on the board of the Banco Oriental. Second, they formed a partnership with him to run several large agricultural estates. Martínez then appointed members of this group to his cabinet or the mayoralty of Puebla City.⁶³ In Chihuahua, to cite another example, the Terrazas-Creel clan ran the state as practically a family business enterprise. Luis Terrazas served as governor from 1860-73, 1879-84, and 1903-04, and his son-in-law Enrique Creel followed in the governorship from 1904 to 1910. Their holdings ran across banking, ranching, agriculture, manufacturing, food processing, mining and smelting, dry goods retailing, railroads, and public utilities. By 1910 they were the single largest employer in the state. They also controlled 70% of the flour market and 50% of meatpacking operations.⁶⁴ Needless to say, if the Díaz government threatened to undermine the property rights of Chihuahua's elite, it would also undermine the property rights of Terrazas-Creel. In fact, Creel was actually called on to play the role of enforcer of the property rights arrangements between the state's landowners and the Díaz government—with great success.⁶⁵

⁶² Haber (1989), pp. 92-93; *Mexican Yearbook 1909-10*, p. 421; *Mexican Yearbook 1912*, p. 418; *Engineering and Mining Journal*, December 17, 1903, p. 918.

⁶³ Gamboa Ojeda (1985), pp. 192-194.

⁶⁴ Wasserman (1979), chapter 3.

⁶⁵ Katz (1998), p. 37.

The Mexican Revolution did not produce the complete destruction of the Porfirian VPI system. The years 1911, 1912, and 1913, in fact, simply substituted governments for one another, with no basic changes in the rules of the game. In fact, the identities of the asset holders and third party enforcers did not change at all. Economic activity, therefore continued at a brisk pace throughout those years.

It was only once Huerta was forced from power and the victors turned to fighting amongst themselves that the Porfirian VPI game ended. Some of the Porfirian third party enforcers, particularly former state governors, were now battling other factions for control of the state, or were, more commonly, were in exile in Paris. Without third parties to enforce contracts, all kinds of improbable and unsustainable coalitions were formed—the most notorious of these being a coalition of conservative landowners and anarchist workers under Carranza. There was, in fact, no underlying political system anymore. This meant that in those sectors of the economy which did not require high amounts of private production knowledge or in which third party enforcement was provided by foreign states (particularly the United States), governments and factions could predate with impunity. Forced loans were exacted. Currency was wildly printed. Property was confiscated and used to generate income for armed movements. The net result was the massive drop in investment and output we see in virtually every data series on manufacturing from 1914 to 1917.

This did not mean, however, the complete destruction of Mexico's VPI governance structure. As our empirical work has shown, Porfirian Mexico's economic elite and the enterprises owned by that elite virtually all survived the Revolution intact. Moreover, every government that came to power after 1910 had to confront the commitment problem: and every single one of them came up with the same solution as Díaz. They needed tax revenues—and they needed them badly, if they were to maintain themselves in power. They therefore did exactly what Díaz had done: make a commitment to protect the property rights of some subset of asset holders, and provide those asset holders with rates of return above the competitive level. Those asset holders would then share some of the resulting revenues in the form of taxes with the

government. The logic of the situation dictated that the asset holders that governments integrated with were the exact same ones that had been around since the Porfiriato. Indeed, Mexico's bankers and manufacturers, who had been part of the Díaz coalition, were both part of every post-revolutionary coalition until the 1980's.

Space constraints prevent us from discussing each and every process of special committees and executive decrees that were used to provide special entitlements to Mexico's asset holders in the early 1920's. In the case of manufacturers, the single most important issue was tariff protection. The industrialists had openly rejected an attempt by Carranza to bring them into his coalition in 1914. In 1917, in order to bring to an end conflict over the tariff, Carranza organized a congress of industrialists under federal government sponsorship. While this congress failed to create a stable coalition with the nation's manufacturers, it did succeed in giving rise to a national manufacturer's association that would later play a key role in 1923 when Obregon successfully integrated the manufacturers into his coalition. The government created a tariff commission which manufacturers and merchants used to frame tariff policy. The recommendations of the tariff commission were enacted without congressional debate or approval. As we shall shortly see, they were able to drive tariffs up well beyond even their Porfirian levels.

One thing had changed since the Porfiriato, however. Mexico's workers and peasants had fought a revolution and had emerged from the fighting as important political constituencies. No government that came to power after 1914 could afford not to have *one of them* as part of the governing coalition. This meant that whichever group was chosen was going to be entitled to rents, and those rents would have to come from the integrated asset holders. It also meant, however, that this group was going to wind up, ironically, serving as the third party enforcer of the coalition between the industrialists and the government.

The reason for this had nothing to do with abstract principals of coalition formation. It had to do with the concrete facts of political and military survival in post-1917 Mexico. Every government from 1917 to 1929 faced two fundamental problems:

there was political competition generated by groups external to their government (particularly the Cristeros); and the government's own politically ambitious generals would take any opportunity to seize power. Carranza had, of course, been overthrown by his own generals in 1920. The victors of that rebellion (Obregón, Calles, and de la Huerta) were soon challenged by multiple military uprisings in 1920, 1921, and 1922. More importantly, they soon fell to fighting among themselves, with de la Huerta leading a military campaign in 1923-24 against Obregón and Calles.

The De la Huerta rebellion drove home to Obregón and Calles just how fragile their government was. Obregón now faced three options—one of which was infeasible and one of which was unpalatable. The first option was to do nothing. This meant facing the inevitable violent attempts to seize the presidential palace. Obregón's expected payoff from following this strategy was highly non-positive—a bullet in the back of the head. The second option was to destroy all potential sources of opposition within the country. This was unfeasible. Obregón simply lacked the financial and military resources to break the power of the state governors or bring the “generals” and their armed retinues to heel.

Only one option remained: finding a source of political support that would provide Obregón and Calles with the ability to survive future rebellions by his generals or ambitious regional strongmen. There existed two plausible candidates to play this role: the peasantry and organized labor.

Forming a national coalition with the peasants was not politically feasible. Gaining peasant support meant giving the peasants land. Such a strategy would almost certainly have brought Obregón into direct conflict with the generals who were still loyal to him. These generals received protection rents from landlords, or had become landlords themselves. In fact, President Obregón was himself a general-turned-landlord.

Organized labor was the only viable candidate to fill the role. In fact, some elements of organized labor had already provided Obregón with paramilitary support during the de la Huerta rebellion. Indeed, Obregón was not the first Mexican politician

to use militant workers to hold political power. Carranza armed anarchist labor unions in 1915 and used them against his enemies. Once the Red Battalions military significance faded the following year, Carranza quickly moved against them—declaring martial law and arresting their anarchist leaders.⁶⁶

Obregón had been marginally less two-faced in his dealings with organized labor before 1923. In 1918, General Obregón struck an agreement with the leader of the Confederación Regional Obrera Mexicana (CROM) and its affiliated political party, the Partido Laborista Mexicano (PLM), that they would mobilize support for his 1920 election. In exchange, Obregón promised to write legislation that would enable the labor articles of the Constitution of 1917 and found a labor ministry that would be controlled by the CROM.⁶⁷

As things turned out, the CROM's support of Obregón in 1920 proved irrelevant. Carranza stole the election for his crony, Ignacio Bonillas, and Obregón took the presidency by armed force. The CROM's support was moot. The CROM's leader, Luis Morones, became head of federally-owned military factories—with all the concomitant opportunities for graft—but Obregón reneged on his promise to pass a federal labor law. In fact, Obregón leaned on federal judges to grant injunctions against state labor laws. He also got the Supreme Court to rule in 1922 that the decisions of the state-level arbitration boards (the Juntas de Conciliación y Arbitraje) were not binding because the federal government *had not created any enabling legislation for Article 123*.⁶⁸

The De la Huerta Rebellion increased the CROM's leverage over Obregón and Calles. After 1924, the CROM was no longer a marginal player in supporting Obregón's coalition—it now played a key role. Without institutionalized support from an organization like the CROM, Obregón and Calles knew that the next rebellion against them would have a high probability of success.

⁶⁶ Middlebrook (1995), pp. 18-19.

⁶⁷ Middlebrook (1995), p. 77.

⁶⁸ Collado Herrera (1996), pp. 266, 314-315, 323, 325-326.

The government therefore became an active supporter of organized labor's demands. In January 1924, right in the middle of the De la Huerta Rebellion, Obregón convinced the Supreme Court to reverse its previous rulings regarding the power of the state-level arbitration boards. The court now upheld the CROM's favored interpretation of Article 123 of the Constitution: the decisions of the Juntas de Conciliación y Arbitraje would be binding on all parties. The government also threw its active support behind CROM labor actions. A contemporary observer provides us with the following account. "When a strike is declared the strikers plant labor's red and black flag in the doorway of the shop or factory. The flag acts not as merely an announcement but as an effective padlock. None may come or go, striker or non-striker. Federal troops enforce this labor fiat. That these forces are to preserve order and prevent sabotage or other damages to the owner's property incidental to the strike is the allegation. Their truer purpose is to support the strike."⁶⁹

In exchange, the CROM-PLM helped the Obregón-Calles faction steal elections. Stealing elections was important because Mexico was nominally a democracy. Openly abrogating the constitution would provide a lightning rod for political opposition. It could also allow factions in the U.S. government to legitimize armed intervention. Particularly crucial to stealing elections was the fact that Mexico did not have secret ballots. Ballots generally differed for each candidate or party: voters asked for a ballot of some candidate or party, and they then made an X inside the color mark that denominated that party. The polls were supervised by government authorities, but also by representatives of each candidate or party competing.⁷⁰ In short, the CROM-PLM could be used to ensure that citizens voted the way that the government wanted them to. The CROM did more, however, than simply monitor how citizens voted. It also played a role in the endless cases of electoral fraud and intimidation that characterized Mexican elections. In fact, when Calles came to power

⁶⁹ Gruening (1928), pp. 357-58.

⁷⁰ Gruening (1928), p. 395.

in he contemplated withholding recognition from any candidate on whose behalf electoral fraud had been committed. As one contemporary observer noted, however, there was a fundamental problem with this noble idea: Calles would have had to disqualify nearly all of the candidates in nearly all of the states.⁷¹

In exchange for its political support, the CROM leadership and the CROM rank and file received substantial benefits. In particular, the leader of the CROM, Luis Morones, was made Secretary of Industry, Commerce and Labor from 1924 to 1928. That is to say, the leader of the labor party, the head of the largest labor federation, and the Secretary of Labor were one in the same person. These political connections, in turn, strengthened the CROM's organizational strength. The federal government deducted CROM dues directly from federal employee's salaries. The CROM's control over appointments appointments to state-level Juntas de Conciliación y Arbitraje, coupled with the influence of its elected officials, meant that it could force employers to recognize CROM-affiliated unions and undermine rival, non-CROM unions. The fact that the Secretary of Industry Commerce and Labor could rule a strike illegal (which, in turned allowed employers to fire the workforce and hire replacements) gave Morones a very powerful tool against rival labor unions or federations.⁷²

What essentially developed was a VPI coalition in which the organized labor played the role of third party enforcer. How this worked is perhaps best illustrated by the 1925-27 cotton textile agreement. As in any VPI coalition, each party to the implicit contract "hired" the other two parties for their unique abilities. The federal government received excise taxes from the textile manufacturers (equal to five percent of the value of output). Manufacturers received high tariffs and subsidized cotton from the federal government. The deal was enforced by the CROM, which received high wages and job security for CROM workers in exchange for which the CROM provided

⁷¹ Gruening (1928), p. 490.

⁷² Middlebrook (1995), pp. 79-80.

Obregón and Calles with political support. CROM leaders, for their part, received positions in the federal government.

The outcomes of the VPI coalition could easily be predicted from theory. Textile tariffs climbed in the mid-1920's, back up to their Porfirian levels. Gómez' estimates of nominal and effective rates of protection indicate that the specific tariff on coarse, unbleached cloth was raised in 1923, 1927, and 1930. This produced nominal tariff rates of 24 percent in 1923, 32 percent in 1927, and 183 percent in 1930. The effective rate of protection moved just as dramatically. Gómez' lower-bound estimates indicate effective rates of 38 percent in 1923, 46 percent in 1927, and 345 percent in 1930. Tariffs on fine weave goods rose even faster. The nominal tariff was 31 percent in 1923. It rose to 41 percent in 1927, and to 206 percent in 1930. The effective rate of protection was 53 percent in 1923, 65 percent in 1927, and 397 percent in 1930.⁷³

In addition to protective tariffs, Mexico's textile manufacturers also received subsidized cotton. This subsidy was accomplished by a prohibition on exports of raw cotton until domestic demand had been satisfied. Since Mexico was a net cotton exporter, this implied that the cotton textile factories could buy cotton at less than the world market price. Manufacturers could simply hold up cotton exports until producers sold them what they wanted at the price they were willing to pay. In fact, many manufacturers used this to transfer rents from cotton growers to themselves by buying more cotton than they needed at the domestic, politically-determined price, and then reselling it at the international, market-determined price. To further depress the domestic price of cotton, the government imposed a 15-centavo export tax per kilogram of cotton.⁷⁴

The CROM received a high price for enforcing this level of protection. First, CROM workers received substantial wage increases. Our estimates of real wages in the

⁷³ Gómez (1999), pp. 604, 608.

⁷⁴ Vargas-Lobsinger 1999: 77.

cotton textile industry indicate a rise in wages of 35 percent from 1923 to 1929.⁷⁵ These estimates do not capture the already sizable increase in compensation prior to 1923.

Aurora Gomez' study of the CIVSA textile conglomerate indicates that the combination of price deflation in the late 1920's coupled with increases in nominal wage rates drove up the purchasing power of wages by 131 percent from 1920 to 1929.⁷⁶

Second, CROM workers received job security. Union agreements gave unions, not employers, the right to hire and fire. In addition, the CROM effectively blocked the introduction of labor saving technologies. In the early 1920's this was accomplished through the kind of thuggery that the CROM used in winning elections. In the textile industry, for example, the CROM intimidated firms and workers from running automatic machinery.⁷⁷ These kind of "informal" arrangements blocking technological change were institutionalized in the 1925-27 cotton textile agreements. The agreements produced wage lists that specified the maximum number of machines that could be assigned to each worker and the specific, uniform wage rates per unit of output. This meant that industrialists had no incentive to introduce labor saving machinery: the wage rate and the number of machines per worker could not vary.⁷⁸

We do not yet know the full details of the VPI arrangements in other industries. The evidence strongly indicates, however, that rent-sharing agreements were not peculiar to cotton textiles. First, we know that tariffs rose across the board. Cosío Villegas' estimates of the coefficient of protection indicates that in 1920 protection stood at only 14 percent, roughly half of its 1910 level. By 1923 the coefficient of protection had nearly doubled, to 24 percent. It then continued to rise, reaching 27 percent in

⁷⁵ Secretaria de Hacienda, Departamento de Impuestos Especiales (1924-1929); Dirección General de Estadística (1926). Wages deflated using the Gómez-Galvarriato and Musacchio Price Index (See Gómez-Galvarriato and Musacchio (1998)).

⁷⁶ Gómez (forthcoming).

⁷⁷ Gómez (1999), p. 584-85.

⁷⁸ Gómez (1999), p. 585-88.

1927 and 31 percent in 1928.⁷⁹ Second, the evidence that we have about wages in another major industry, steel, indicates that real wages were rising there at the same rate as in cotton textiles. Our estimates of real wages for the Fundidora Monterrey steel monopoly indicate that wages rose by 35 percent from 1923 to 1929.⁸⁰ Third, we know that the number of CROM workers was rising dramatically during the 1920's. Fourth, we also know that the number of strikes was moving in exactly the opposite direction. In 1922 there were 197 strikes in Mexico, involving 71,736 workers, with a loss of 692,339 man-days of labor. By 1924, this fell to 138 strikes, involving 33,985 strikers, and a loss of 395,491 man-days of labor. By 1926, the CROM had effectively ended strikes. There were only 24 strikes, involved 2,977 workers, with a loss of only 41,222 man-days of labor.⁸¹ Finally, there is evidence from the sugar milling industry that manufacturers were actively soliciting the CROM to form a coalition that would provide the manufacturers with protection from any government attempt to lower tariffs. The incentives were much the same as in textiles: Mexico's sugar millers could not have survived against Cuban imports in the 1920's without high tariffs, and high tariffs could only be maintained if the government could be punished by the CROM. Thus, the sugar millers of Veracruz actively sought the help of the CROM. The manager of the

⁷⁹ Cosío Villegas (1989), p. 58.

⁸⁰ Calculated from department by department wage data in Fundidora Monterrey, Informe Annual, 1923-1930.

⁸¹ Gruening (1928), p. 377.

San Cristóbal mill, in fact, went so far as to invite a representative of the CROM to attend the company's board meetings.⁸²

In short, Mexico's manufacturers may not have liked the CROM and they certainly did not enjoy their inability to hire, fire, or set salaries independently. They did, however, obtain something in return.: enforcement of the coalition with the government. Indeed, after the CROM went into decline (because of a falling out with Calles over the founding of the PNR), it was replaced by a new labor federation, one which was later made a formal part of the official party under Cárdenas. The upshot in manufacturing was two-fold. First, during the period 1917-1923, manufacturers invested because they perceived that governments were too weak to abrogate their property rights. The threat of political competition meant that governments wanted to keep asset holders from defecting to rival coalitions. Second, once a viable third party enforcer emerged in the early 1920's, industrialists came to perceive that even strong governments could not abrogate their property rights because doing so would cut off the stream of rents to that enforcer, who would, in turn, punish the government. In short, no government, regardless of its stated ideology, dared threaten their property rights or the revenues those property rights generated. Manufacturers thus invested as if the polity were stable.

Conclusions:

This paper has made a substantive argument, based on new theory and evidence, that political instability does not necessarily have a negative impact on

⁸² As in textiles, informal arrangements soon became formalized. In 1926, the *Comisión Mixta de Obreros, Campesinos y Empresarios Azucareros* met in Jalapa, Veracruz, to discuss the industry's problems. A few months later the *Comisión Nacional Azucarera* met in Mexico City, providing a national forum for discussions between the sugar growers, the unions, and government. Aurrecoechea and Paz Paredes (1993): 107.

economic performance. Our analysis begins with a widely accepted premise about the political foundations of growth: governments need to make credible commitments to the universal protection of private property rights. This premise the possibility that credible commitments could be made through other mechanisms. We thus propose an alternate theory of governance structures based on vertical political integration, which allows for the possibility of creating credible commitments even under political instability. Our analysis is more general than the existing focus on limited governments. In particular, it suggests that the current focus on the existence of either limited governments (which can sustain growth) versus predatory governments (which hamper growth) is limited because it ignores the fact that commitment is a matter of degree. Rather than a binary choice, establishing credible commitments is a problem of selecting a particular governance structure from a continuum of different types of commitment that a political system can sustain. In fact, limited and predatory governments are but two extreme cases of a broad range of governance structures.

To be sure, commitment mechanisms other than limited government are clearly a second-best solution and have associated inefficiencies and negative results. On the other hand, there some advantages of vertical integration with respect to a limited government solution. First, vertical integration is feasible under a larger set of conditions. Both empirical evidence and theoretical considerations show us that limited governments are hard to come by even under stable conditions. The conditions are even more stringent under political instability because governments need to establish credible commitments under severe uncertainty about how instability will be resolved. Whereas it is impossible for limited governments to emerge from political instability, it is feasible (and indeed expected) for governance structures to establish credible commitments through vertical integration. It should be noted that credible commitments need not be, and are often not, offered to all members of society. In terms of growth, a governance structure that provides protection to elite economic groups is sufficient to sustain economic growth.

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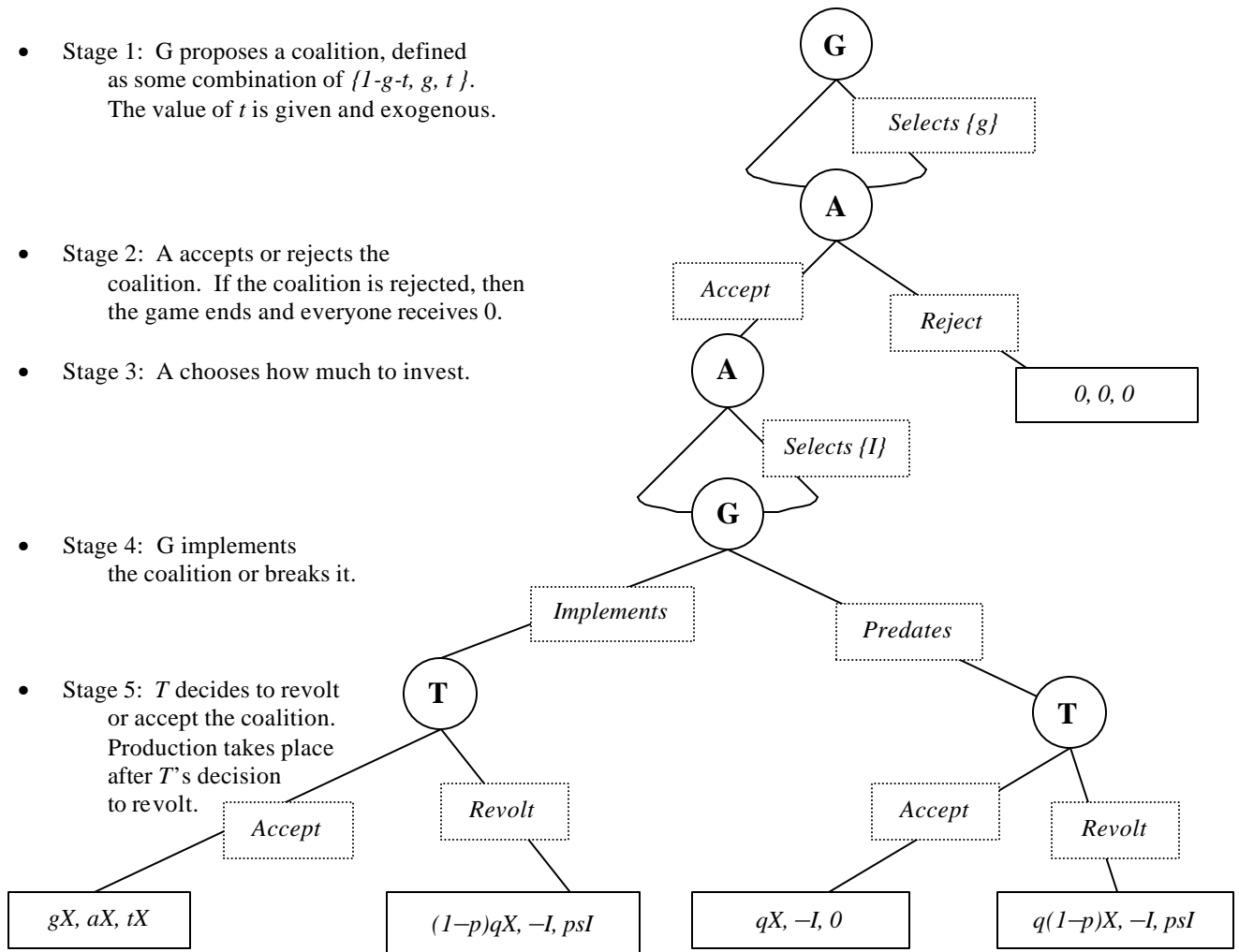
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- Stage 1: G proposes a coalition, defined as some combination of $\{1-g-t, g, t\}$. The value of t is given and exogenous.
- Stage 2: A accepts or rejects the coalition. If the coalition is rejected, then the game ends and everyone receives 0.
- Stage 3: A chooses how much to invest.



- Stage 4: G implements the coalition or breaks it.
- Stage 5: T decides to revolt or accept the coalition. Production takes place after T's decision to revolt.

$p \in [0, 1], t \in [0, 1], q \in [0, 1]$, and $g + a + t \leq 1$.
 $A = 1 - g - t$.
 Payoffs are listed in the order (G,A,T).
 X = output, I = investment, and X is a function of I ,
 $X = x(I)$.

A coalition will not be broken if $(1-p)X \leq gX$.

Table 1
Exit and Entry in the Mexican Cotton Textile Industry, 1895-1929

Years	NUMBER OF FIRMS		EXIT			ENTRY		
	In First Year	End of Period ^a	Number of firms that exit the market permanently	Percentage of firms that exit the industry ^b	Combined Market Share	New Firms entering the market within the period	Percentage of new firms that enter the market ^c	Combined Market Share
1895-1900	109	132	7	6.4%	1.3%	28	21.2%	25.7%
1900-1905	132	130	11	8.3%	5.1%	13	10.0%	9.9%
1905-1910	130	121	9	6.9%	2.7%	11	9.1%	4.2%
1910-1915	121	87	20	16.5%	7.0%	10	11.5%	4.7%
1915-1920	87	131	5	5.7%	2.7%	14	10.7%	4.4%
1920-1925	131	118	15	11.5%	2.0%	7	5.9%	2.2%
1925-1929	118	142	15	12.7%	6.7%	25	17.6%	5.0%

^a This total includes as well those firms that exit the industry temporarily and those that have re-entered the industry after a temporary exit.

^b As a percentage of total number of firms in the beginning year of the period.

^c As a percentage of total number of firms by the end of the period.

Table 2
 Probit and Logit Survival Regressions, 1910-1920
 T Statistics in Parentheses

Dependent Variable: Survival (1 if firm survives entire period; 0 if firm disappears from the industry)

	1910-1920					
	Probit			Logit		
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6
Intercept	-0.451 (-1.108)	-0.640 (-0.767)	-0.349 (-0.550)	-0.875 (-1.260)	-1.163 (-0.824)	-0.905 (-0.770)
Size--measured as share of industry output	213.923 (2.890)	168.614 (2.117)	156.368 (2.046)	393.578 (2.800)	312.066 (2.135)	297.495 (2.086)
Region--Dummy for Firms in States of DF, MX, Puebla, Veracruz, and Tlaxcala	0.445 (1.247)	0.704 (1.632)	0.869 (1.860)	0.743 (1.165)	1.253 (1.590)	1.592 (1.840)
Joint Stock--dummy for public, limited liability firms	0.578 (1.292)	0.749 (1.257)	0.808 (1.363)	1.082 (1.264)	1.547 (1.287)	1.755 (1.412)
Vintage-Dummy for age of firm	-0.543 (-1.101)	-0.931 (-1.595)	-1.213 (-1.553)	-0.939 (-1.104)	-1.641 (-1.625)	-2.103 (-1.592)
TFP (production proxied by real value of output)a		0.004 (0.958)			0.006 (0.899)	
TFP (production proxied by meters of output)a			0.000 (0.496)			0.001 (0.682)
Capital-Labor Ratio		-0.004 (-0.272)	-0.006 (-0.730)		-0.007 (-0.307)	-0.012 (-0.787)
N	108	90	87	108	90	87
Adjusted R2	0.29	0.30	0.29	0.30	0.31	0.31

Source: See footnote 71.

Table 3
 Probit and Logit Survival Regressions, 1900-1910
 T Statistics in Parentheses

Dependent Variable: Survival (1 if firm survives entire period; 0 if firm disappears from the industry)

	1900-1910					
	Probit			Logit		
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6
Intercept	1.023 (3.349)	3.499 (2.799)	1.651 (1.569)	1.717 (3.023)	7.371 (2.630)	3.139 (1.437)
Size--measured as share of industry output	31.113 (0.719)	31.548 (1.155)	12.185 (0.371)	59.675 (0.692)	67.914 (1.192)	28.135 (0.377)
Region--Dummy for Firms in States of DF, MX, Puebla, Veracruz, and Tlaxcala	0.082 (0.250)	-0.046 (-0.083)	-0.196 (-0.335)	0.132 (0.204)	-0.110 (-0.093)	-0.353 (-0.293)
Joint Stock--dummy for public, limited liability firms	0.402 (1.039)	-0.653 (-1.138)	-0.383 (-0.757)	0.820 (1.001)	-1.252 (-1.061)	-0.828 (-0.768)
Vintage-Dummy for age of firm						
TFP (production proxied by real value of output) ^a		-0.013 (-1.881)			-0.029 (-1.976)	
TFP (production proxied by meters of output) ^a			0.000 (0.088)			0.000 (-0.009)
Capital-Labor Ratio ^a		-0.018 (-0.627)	0.002 (0.053)		-0.051 (-0.873)	0.000 (-0.002)
N	125	76	72	125	76	72
Adjusted R2	0.02	0.14	0.01	0.02	0.18	0.01

^a For 1900-1910 observations, TFP and K/L data were taken from the 1896 census. For 1910-1920 observations, TFP and K/L data were taken from the 1912 census. In both cases, we assumed that the input mix and productivity of firms remained constant in the short-run.

Source: See footnote 71.

Table 4
 Stock Price Indexes
 Mexican Manufacturing Compared to Brazil, Argentina, and the United States
 1910=100

Year	Mexico		Argentina	United States	
	Industrial1	Industrial2	Large Scale Firms4	S&P 500a	
1900			44		74
1901	126	99	46		94
1902	96	74	42		97
1903	98	76	55		80
1904	99	90	62		78
1905	141	121	74		100
1906	155	130	66		107
1907	145	120	74		84
1908	120	104	88		86
1909	104	92	89		108
1910	100	100	100		100
1911	92	99	99		99
1912	80	85	91		98
1913	72	74	78		86
1914	61	46	68		81
1915			51		82
1916		34	45		87
1917			39		66
1918	20	33	43		50
1919	30	39	38		51
1920	26	37	32		40
1921	27	43	39		38
1922	38	47	46		50
1923	47	48	44		50
1924	43	47	43		53
1925	39	50	43		64
1926	35	44	51		71
1927	34	38	56		88
1928	32	33	63		117
1929	30	30	64		152
1930	25	30	59		126
1931	22	24			
1932	19	16			
1933	27	21			
1934	33	24			
1935	35	24			
1936	37	26			
1937	31	25			
1938	23	17			

1. Large scale, publicly traded manufacturing firms. Prices in Real Pesos.
2. Large scale, publicly traded manufacturing firms. Prices in real dollars.
3. Publicly traded cotton textile manufacturing firms.
4. Large capitalization firms, weighted by market capitalization.
 - a. Standard and Poor's 500, Large Capitalization firms. Weighted by market capitalization.

Sources: Argentine and U.S. Data from Leonard Nakamura and Carlos Zaragoza, "Economic Growth in Argentina in the Period 1900-1930: Some Evidence from Stock Returns," in Coatsworth and Taylor, pp. 247-67. Mexican data estimated from El Economista Mexicano, 1900-1914; Boletín Financiero y Minero, 1914-1938.

Table 5
Capacity, Output, and Value of Physical Plant in Fundidora Monterrey
(Mexico's Steel Monopolist)

Year	Capacity*	Output**	Capacity Utilization (Percent)	Value of Physical Plant ***
1903	110	22	20%	8,388
1904	110	36	33%	9,236
1905	110	4	4%	9,833
1906	110	25	23%	10,032
1907	110	16	15%	9,526
1908	110	17	15%	9,082
1909	110	59	54%	9,317
1910	110	45	41%	9,365
1911	110	71	65%	9,087
1912	110	33	30%	9,337
1913	110	12	11%	9,226
1914	110	0	0%	8,989
1915	110	0	0%	8,509
1916	110	0	0%	8,161
1917	110	12	11%	7,819
1918	110	21	19%	7,830
1919	110	21	19%	7,374
1920	110	15	14%	9,133
1921	110	42	38%	10,421
1922	110	24	22%	10,217
1923	110	44	40%	10,238
1924	110	19	17%	10,340
1925	110	49	45%	9,872
1926	110	62	56%	9,700
1927	110	41	37%	9,436
1928	110	51	46%	9,173
1929	110	60	55%	8,679
1930	110	58	53%	8,649
1931	110	53	48%	8,124
1932	110	20	18%	7,625
1933	110	54	49%	7,528
1934	110	66	60%	6,530
1935	110	64	58%	6,882
1936	110	88	80%	7,450
1937	110	59	54%	8,868

* Capacity of the blast furnace, in thousands of metric tons.

** Output of the blast furnace, in thousands of metric tons.

*** Book value of the physical plant (land, equipment, buildings), net of depreciation in thousands of pesos. Physical plant depreciated at flat rate of five percent per annum.

Source: Calculated from Fundidora Monterrey, *Informe Annual*, 1900-1938.

Table 6
 Capacity and Output in Mexico's Cement Industry, 1906-1938
 (In Thousands of Metric Tons)

Year	Capacity	Output	Capacity Utilization
1906	66	20	30%
1907	66	30	45%
1908	66	40	61%
1909	86	50	58%
1910	151	60	40%
1911	152	50	33%
1912	177	40	23%
1913	177	30	17%
1914	177	25	14%
1915	177	10	6%
1916	177	20	11%
1917	177	30	17%
1918	177	40	23%
1919	177	40	23%
1920	222	45	20%
1921	222	50	23%
1922	222	70	32%
1923	222	90	41%
1924	222	107	48%
1925	222	110	50%
1926	222	151	68%
1927	222	158	71%
1928	246	204	83%
1929	291	158	54%
1930	291	227	78%
1931	375	157	42%
1932	405	138	34%
1933	405	173	43%
1934	405	241	60%
1935	405	252	62%
1936	405	286	71%
1937	405	345	85%
1938	513	374	73%

Source: Haber, *Industry and Underdevelopment* (fn. 29), 41, 127, 165, 177.

Table 7
 Mexican Beer Production,
 National and Cervecería Cuauhtemoc
 (In Thousands of Liters)

Year	Cervecería Cuauhtemoc	National Output	Cuauhtemoc Market Share
1900	4,866	----	----
1901	4,685	----	----
1902	5,581	----	----
1903	5,925	----	----
1904	6,865	----	----
1905	8,884	----	----
1906	13,344	----	----
1907	14,005	----	----
1908	11,183	----	----
1909	11,582	----	----
1910	13,275	----	----
1911	14,172	----	----
1912	16,519	----	----
1913	11,732	----	----
1914-15*	3,359	----	----
1916	2,758	----	----
1917	4,640	----	----
1918	4,977	----	----
1919	7,735	----	----
1920	14,929	----	----
1921	16,689	----	----
1922	13,156	----	----
1923	12,335	----	----
1924	11,564	52,003	22%
1925	15,736	53,673	29%
1926	21,521	67,925	32%
1927	23,201	71,613	32%
1928	22,229	67,911	33%
1929	23,174	71,973	32%
1930	21,760	72,065	30%
1931	18,894	54,711	35%
1932	14,367	42,470	34%
1933	19,082	52,991	36%
1934	24,305	67,368	36%
1935	29,291	82,513	35%
1936	36,355	98,893	37%
1937	44,225	120,805	37%
1938	43,483	129,802	33%
1939	49,052	160,452	31%
1940	54,709	179,198	31%

* Combined Year

Source: Unpublished data from Cervecería Cuauhtemoc Sales Department;
 Dirección General de Estadística, *Anuario Estadístico de la República Mexicana* (Mexico City, 1942), 958.

Table 8
Mexican Cotton Textile Industry, 1883-1933

YEAR	ESTIMATED NOMINAL VALUE OUTPUT ^a	ESTIMATED REAL VALUE OUTPUT ^a	ESTIMATED METERS OF OUTPUT ^a	ESTIMATED SPINDLES	ESTIMATED WORKER EQUIVALENTS ^b
1883	11,484	8,538	76,331		
1888 ^d	264	216	60,842	249,561	15,083
1889	10,909	8,942	83,827		
1891	12,066	9,891	93,527	277,784	14,051
1893	19,064	15,628	122,550	370,570	21,963
1895	23,554	21,222	170,929	411,090	18,208
1896	23,658	23,658	206,412	430,868	19,771
1899	29,753	29,753	231,686	491,443	23,731
1900	35,459	35,459	261,397	588,474	27,767
1901	33,877	33,877	262,044	591,506	26,709
1902	28,780	28,780	235,956	595,728	24,964
1903	36,907	36,907	262,170	632,601	26,149
1904	42,511	42,511	280,710	635,940	27,456
1905	51,214	51,214	310,692	678,058	30,162
1906	51,171	51,171	349,712	688,217	31,673
1907	51,686	51,686	428,284	613,548	33,132
1908	54,934	54,934	368,370	732,876	35,816
1909	43,370	43,370	314,228	726,278	32,229
1910	50,651	50,651	315,322	702,874	31,963
1911	51,348	51,348	341,441	725,297	32,147
1912	63,802	72,834	319,668	762,149	32,209
1913	54,002	33,978	298,897	752,804	32,641
1917 ^e	25,125	12,266		573,092	22,187
1918	48,567	15,111	180,453	689,173	23,067
1919	80,781	23,333	305,509	735,308	21,877
1920	120,492	27,840	298,829	753,837	24,691
1921	93,342	66,826	338,346	770,945	25,485
1922	85,023	53,040	330,601	803,230	26,451
1923	97,563	44,214	303,090	802,363	26,419
1924	96,435	44,155	285,594	812,165	25,155
1925	102,527	56,839	380,041	840,890	33,262
1926	88,766	60,562	327,487	832,193	27,476
1927	73,179	51,156	308,940	821,211	27,492
1928	89,630	52,529	300,425	823,862	25,348
1929	105,055	67,861	389,147	839,100	27,598
1930	84,876	58,426	305,512	803,873	27,729
1931	78,580	70,154	269,085	838,223	25,788
1932	88,694	52,333	301,537	851,163	25,223
1933	110,612	47,569	381,783	862,303	27,308

^a Output reported in thousands.

^b Number of workers adjusted for changes in the length of the workday: 12 hours from 1850 to 1913, 10 hours from 1914 to 1917, 8 hours from 1918 to 1933.

^c Value of output calculated from prices and quantities. This is a lower-bounded estimate since not all quantities were matched with a respective price.

^d For these years, the majority of firms reported output in meters.

^e Spindles and workers data for 1917 was taken from *Estadísticas Históricas* (fn. 27), 616.

Table 9

The Mexican Cigarette Industry, Output and Investment, 1899-1928

Year	Factories	Production Thousand of Kilos	Production Millions of Packages of Cigarettes	Capital Invested Nominal Pesos	Value of Output Nominal Pesos	Number of Workers
1899	766	4,916	329			
1900	766	5,907	376			
1901	740	5,974	365			
1902	701	6,203	372			
1903	670	7,305	406			
1904	605	7,724	468			
1905	469	8,174	483			
1906	491	8,456	505			
1907	479	8,856	524			
1908	469	8,904	515			
1909	437	8,661	505			
1910	451	8,451	512			
1911	341	8,380	493			
1923	169	10,202	411	19,457,999	26,174,851	4990
1924	207	7,830	380	19,668,424	24,062,005	4766
1925	197	9,020	385	19,948,643	28,536,637	5905
1926	163	9,546	452	22,435,177	29,124,007	5201
1927	143	10,649	542	23,123,888	31,174,424	5051
1928	127		543	26,639,540	30,551,504	4685

Sources: Haber (1989), p. 49; Estadística Nacional, Revista Mensual, Sept. 1928; Estadística Nacional, Revista Mensual, February 1930.

Table 10
Output and Consumption of Dynamite, 1918-1930

Year	Output Thousands of Kilograms	Consumption Thousands of Kilograms	Production as Percent of Consumption
1918	301,644	285,519	106%
1919	776,223	585,711	133%
1920	646,698	741,114	87%
1921	706,709	565,004	125%
1922	571,604	647,242	88%
1923	586,573	633,362	93%
1924	535,747	721,428	74%
1925	1,221,870	1,202,653	102%
1926	1,424,524	1,463,975	97%
1927	3,182,704	3,072,732	104%
1928	4,766,470	4,671,643	102%
1929	5,759,625	5,620,138	102%
<u>1930</u>	4,644,760	4,701,818	99%

Source:

Anuario de Estadística Minera.--1929 y 1930: page 358.

Table 11

Power Generated by the Mexican Light and Power Company for Commercial Purposes, 1907-1927
(In Thousands of Kilowatt Hours)

Year	Thousands Kwatt Hrs	Index 1910=100
1907	45,779	80
1908	44,061	77
1909	47,074	82
1910	57,112	100
1911	59,244	104
1912	67,565	118
1913	62,117	109
1914	56,274	99
1915	39,096	68
1916	42,888	75
1917	67,062	117
1918	72,901	128
1919	82,212	144
1920	91,145	160
1921	88,379	155
1922	103,111	181
1923	113,704	199
1924	125,424	220
1925	144,230	253
1926	166,483	292
1927	178,089	312

Source: Sterrett and Davis, p. 213.

Table 12
 Combined US/UK machinery exports to Mexico, 1900-1935
 (In 1929 US dollars)

Year	Steam Engines, Boilers, and Pipes and Fittings	Industrial Machinery	Textile Machinery	Total Manufacturing
1900	651,490	266,655	468,115	1,386,260
1901	569,966	218,603	183,564	972,134
1902	705,417	138,589	248,021	1,092,026
1903	747,508	373,789	147,243	1,268,541
1904	642,555	393,401	395,789	1,431,745
1905	675,932	625,306	265,632	1,566,870
1906	1,554,324	803,813	354,592	2,712,729
1907	1,546,928	1,002,979	471,916	3,021,822
1908	1,552,717	968,387	472,963	2,994,067
1909	1,745,211	629,118	525,028	2,899,356
1910	2,473,655	667,517	349,919	3,491,091
1911	1,415,846	1,041,324	331,188	2,788,357
1912	1,378,297	719,897	391,488	2,489,682
1913	1,667,428	1,416,650	25,922	3,110,000
1914	1,324,538	294,144	6,274	1,624,956
1915	399,702	112,255	3,405	515,363
1916	849,200	419,905	8,521	1,277,626
1917	2,488,976	859,726	35,552	3,384,254
1918	115,871	1,457,912	85,800	1,659,582
1919	11,025,273	2,727,192	164,364	13,916,829
1920	28,350,017	4,503,392	457,035	33,310,444
1921	1,118,589	3,917,214	138,966	5,174,770
1922	3,544,176	1,666,927	1,112,938	6,324,042
1923	3,598,330	1,454,173	595,872	5,648,376
1924	3,539,853	1,377,192	634,439	5,551,485
1925	3,614,478	1,782,672	916,903	6,314,053
1926	2,375,880	6,187,387	1,111,451	9,674,717
1927	2,080,808	5,538,085	1,066,284	8,685,178
1928	1,782,763	5,139,867	1,123,659	8,046,289
1929	2,992,974	7,934,877	680,932	11,608,782
1930	1,827,263	7,535,382	643,881	10,006,526
1931	1,076,060	662,389	426,688	2,165,137
1932	495,831	383,290	163,623	1,042,744
1933	531,747	541,879	415,211	1,488,836
1934	1,258,459	889,020	532,113	2,679,591
1935	1,351,441	1,084,168	694,107	3,129,716

Sources United States: U.S. Department of Commerce, *The Foreign Commerce and Navigation of the United States, 1902-1930*. Price deflator is the wholesale price index,

United Kingdom: Annual Statements of the Trade of the United Kingdom with *Foreign Countries*, 1900-1935

Table 13

Estimated Rates of Return on Capital Stock, 1902-1929^a

Year	Fundidora Monterrey	Buen Tono	CIDOSA	CIVSA
1902		6		12
1903	2	11		12
1904	0	12		12
1905	-1	14		12
1906	1	15		8
1907	-3	16	13	8
1908	-4	16	7	5
1909	-1	14	8	6
1910	1	14	11	6
1911	3		6	4
1912	1		8	9
1913	-6			6
1914	-7			0
1915	-10			-2
1916	-6			7
1917	21 ^b			14
1918	3	12		8
1919	5	21		12
1920	9		14	11
1921	7			15
1922	4		13	12
1923	11	16		10
1924	-1	12	4	2
1925	5			7
1926	3		-5	-3
1927	1		4	8
1928	2	-10	3	3
1929	8	-12	0	3

a. Calculated as profits (net of depreciation) divided by the value of capital (net of depreciation). For Fundidora Monterrey, El Buen Tono, and CIDOSA capital is measured by capital stock (land, equipment, buildings and cash assets). For CIVSA capital is measured by assets (land, equipment, buildings, cash assets, and other financial assets).

b. The 1917 rate of return of 21 percent was not the product of productive activities but came from the refinancing of the company's bonded debt.

SOURCE: CIDOSA, Fundidora Monterrey, and Buen Tono from Haber, 1989, pp. 110, 128, 160. CIVSA from Aurora Gómez-Galvarriato, "Measuring the Impact of Institutional Change," in Jeffrey L. Bortz and Stephen Haber eds., *Institutional Change and Economic Performance*.

Table 14
Real Dividend Payments Per Shareholder, 1901-1929
(Earnings per share, 1940 pesos)

Real Dividends 1900 Pesos															
Year	Buen Tono	San Ildefonso	CIDOSA	San Antonio Abad	Atlixco	CIVSA	Jabonera La Laguna	San Rafael	Fundidora Monterrey	Toluca y Mexico	Cigarrera Mexicana	Cerveceria Moctezuma	Average		
1901	24	0	13	0	0	15	19	0	0	0	0	0	6		
1902	9	0	8	0	0	10	30	4	0	9	10	5	7		
1903	8	0	19	0	0	10	17	9	0	10	10	2	7		
1904	17	0	19	0	0	11	30	4	0	13	10	15	10		
1905	17	0	19	0	0	10	30	0	0	14	0	9	8		
1906	22	22	19	8	8	10	30	7	0	10	0	10	12		
1907	25	3	21	3	7	11	29	4	0	7	6	12	11		
1908	25	3	18	4	7	11	41	9	0	17	0	8	12		
1909	23	0	15	4	0	10	38	0	0	11	5	6	9		
1910	11	1	13	0	0	8	33	5	0	4	4	12	8		
1911	20	1	13	3	3	8	26	5	0	13	4	9	9		
1912	19	1	13	3	2	8	32	6	4	0	4	8	8		
1913	0	2	7	0	2	8	13	3	0	4	0	5	4		
1914	8	0	11	0	0	3	0	0	0	2	0	4	2		
1915	0	1	10	0	0	0	0	0	0	0	0	0	1		
1916	0	0	0	1	0	0	0	0	0	0	0	0	0		
1917	9	0	5	2	0	0	15	0	0	0	1	0	3		
1918	7	1	4	4	0	2	7	0	0	0	0	3	2		
1919	11	1	16	4	0	7	26	0	0	0	2	18	7		
1920	12	1	12	2	0	6	23	2	1	0	1	7	6		
1921	15	2	18	4	2	7	5	3	1	2	2	12	6		
1922	19	2	14	0	1	13	0	2	0	0	3	14	6		
1923	22	2	18	0	1	7	19	3	0	0	4	9	7		
1924	21	2	7	0	3	10	24	4	0	0	6	9	7		
1925	18	1	6	0	2	3		2	0	0	4	8	4		
1926	14	0	6	0	0	4		3	0	0	4	5	3		
1927	7	0	0	0	3	0		3	1	0	2	0	1		
1928	0	0	0	0	0	5		3	1	0	2	0	1		
1929	0	1	0	0	0	4		3	2	0	1	0	1		

Year	Buen Tono	San Ildefonso	CIDOSA	San Antonio Abad	Atlixco	CIVSA	Jabonera La Laguna	San Rafael	Fundidora Monterrey	Toluca y Mexico	Cigarrera Mexicana	Cerveceria Moctezuma
1901-10	18	3	16	2	2	11	30	4	0	10	5	9
1918-29	12	1	9	1	1	6	9	2	0	0	3	7
1920-29	13	1	8	1	1	6	7	3	1	0	3	6
1918-25	16	2	12	2	1	7	13	2	0	0	3	10
1920-25	18	2	13	1	2	8	12	3	0	0	4	10

SOURCE: Dividends calculated from El Economista Mexicana, 1901-1914; Boletín Financiero y Minero, 1916-1930.

Table 15
INDICES OF CONCENTRATION IN THE COTTON TEXTILE INDUSTRIES
OF BRAZIL, MEXICO, INDIA, AND THE UNITED STATES, 1840-1934

Year	<u>FOUR FIRM RATIO</u>				<u>HERFINDAHL INDEX</u>		
	<u>BRAZIL</u>	<u>MEXICO</u>	<u>INDIA</u>	<u>U. S. A.</u>	<u>BRAZIL</u>	<u>MEXICO</u>	<u>INDIA</u>
1840		0.579				0.114	
1843		0.346				0.043	
1844		0.344				0.054	
1845		0.292				0.038	
1850		0.270		0.100		0.040	
1854		0.318				0.040	
1857		0.321				0.040	
1860				0.126			
1862		0.273				0.041	
1865		0.278				0.029	
1866	0.729				0.167		
1870				0.107			
1875	0.756				0.238		
1878		0.168				0.021	
1880				0.087			
1882	0.509				0.115		
1883	0.483	0.158			0.099	0.019	
1888		0.174				0.021	
1889		0.180				0.022	
1891		0.188				0.023	
1893		0.200		0.077		0.022	
1895		0.371				0.040	
1896		0.297				0.039	
1898		0.394				0.055	
1900		0.316	0.190	0.070		0.036	0.018
1902		0.381				0.063	
1904		0.328				0.041	
1905	0.215	0.315			0.027	0.041	
1906		0.338				0.048	
1907	0.217				0.027		
1909		0.337				0.047	
1910		0.255		0.075		0.028	
1911		0.328	0.190			0.049	0.018
1912		0.286				0.036	
1913		0.298				0.069	
1914	0.154	0.384			0.015	0.055	
1915	0.157	0.348			0.016	0.043	
1916		0.297				0.042	
1917		0.385				0.059	
1918		0.330				0.047	
1919		0.375				0.059	
1920		0.286	0.206	0.066		0.036	
1924	0.233	0.331			0.028	0.043	
1925	0.237	0.297			0.027	0.038	
1926	0.209				0.023		
1927	0.195				0.022		
1929		0.281				0.034	
1930			0.189	0.095			
1932		0.256				0.029	
1934	0.176				0.017		

^a Concentration by estimated capacity, measured at the firm level. A detailed discussion of the estimation procedures is available from the author.

Sources for Table 5-15:

Brazil: See Table 4.

Mexico: SHCP, *Estudio de la Industrialización*.

Barjau Martinez, "Estadísticas Económicas," Table 13; SHCP, *Estudio de la Industrialización*.

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Semana Mercantil.

Archivo General de la Nación, "Extracto de hilados y tejidos 1912"

Archivo General de la Nación, "Extracto de hilados y tejidos 1913"

El Economista Mexicano.

SHCP, *Boletín*.

India: See Table 4.

U.S.A See Table 4.

Table 16
 Rates of Ownership Change
 Mexican Cotton Textile Industry, 1895-1929

Period	Firms Appearing in both years	Firms that change Ownership	Percentage of industry that changes ownership	Output affected by ownership turnover
1895-1900	94	27	29.0%	22.6%
1900-1905	112	30	27.0%	15.2%
1905-1910	102	18	18.0%	12.5%
1910-1915	66	7	27.0%	4.2%
1915-1920	77	12	16.0%	7.0%
1920-1925	103	22	21.0%	18.9%
1925-1929	100	20	20.0%	12.4%

Table 17 Indices of Labor Productivity, 1850-1933
 Mexican Cotton Textile Industry
 Base Year, 1900=100

Year	Real Value of Output	Meters of Output
1850	12	20
1854	39	20
1857	16	19
1878		66
1888		43
1891	55	71
1893	56	59
1895	91	100
1896	94	111
1899	98	104
1900	100	100
1901	99	104
1902	90	100
1903	111	107
1904	121	109
1905	133	109
1906	127	117
1907	122	137
1908	120	109
1909	105	104
1910	124	105
1911	125	113
1912	177	105
1913	82	97
1918	44	83
1919	84	148
1920	88	129
1921	205	141
1922	157	133
1923	131	122
1924	137	121
1925	134	121
1926	173	127
1927	146	119
1928	162	126
1929	193	150
1930	165	117
1931	213	111
1932	162	127
1933	136	149
1850-1857	22	20
1850-1888		34
1891-1900	82	91
1901-1910	115	110
1911-1920	100	113
1921-1929	160	129
1930-1933	169	126

Table 18: Indices of Aggregate TFP, and Capital-Labor Ratio, 1850-1933
 Mexican Cotton Textile Industry
 Base Year, 1900=100

<u>Year/Period</u>	<u>Real Value of Output</u>	<u>Meters of Output</u>	<u>Capital-Labor Ratio</u>
1850	34	26	57
1854	73	30	55
1857	36	29	58
1878		67	99
1888		68	78
1891	55	70	93
1893	66	66	80
1895	84	94	107
1896	92	110	103
1899	100	105	98
1900	100	100	100
1901	97	102	104
1902	84	95	113
1903	102	100	114
1904	115	104	109
1905	128	106	106
1906	125	116	103
1907	132	147	87
1908	123	111	97
1909	102	101	106
1910	121	103	104
1911	121	109	106
1912	136	97	112
1913	140	105	109
1918	36	70	141
1919	64	119	159
1920	71	108	144
1921	166	119	143
1922	127	112	143
1923	106	103	143
1924	107	99	152
1925	121	112	119
1926	140	107	143
1927	119	101	141
1928	126	103	153
1929	156	126	143
1930	137	101	137
1931	166	90	153
1932	123	102	159
1933	108	123	149
1850-1857	47	29	57
1850-1888		44	69
1891-1900	83	91	97
1901-1910	113	108	104
1911-1920	95	101	128
1921-1929	130	109	142
1930-1933	133	104	150