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**Institutions, the Cost of Capital, and  
Long-Run Economic Growth:  
Evidence from the 19th Century  
Capital Market**

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# *Institutions, the Cost of Capital, and Long-Run Economic Growth: Evidence from the 19<sup>th</sup> Century Capital Market*

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**Abstract:** Late 19<sup>th</sup> century investors demanded compensation to invest in countries with poor institutional protection of property rights. Using the monthly stock returns of 1,808 firms located in 43 countries but traded in London between 1866 and 1907, we estimate the country-specific cost of capital. We find a negative relationship between institutions that protect property rights and capital costs. Firms located in countries with weak institutions were charged a premium compared to similarly risky firms located in countries with strong institutions, and this penalty appeared to be costly in terms of future growth. Countries that paid a premium for borrowing in London during this period grew more slowly after 1913 and are poorer today. We thus identify the capital market as a channel through which strong institutions promote growth.

**Key words:** International financial integration; cost of capital; institutions; property rights; economic growth; financial development.

**JEL classification:** F36, G15, O16.

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Economists have long debated the extent to which global financial markets promote growth<sup>1</sup>. This may seem surprising given the large number of theoretical arguments that access to well-functioning global capital markets promotes growth in a number of ways.<sup>2</sup> By allocating capital among investment projects until the marginal rates of return are equalized, globally integrated capital markets break the link between a country's level of savings and its ability to invest. A globally integrated capital market therefore renders the initial distribution of wealth across countries irrelevant (Aghion, Caroli, and Garcia-Penalosa 1999). In addition, more liquid capital markets can improve the efficiency of existing investments by creating an environment in which speculators find it profitable to expend resources to gather information (Levine 1997). The process of trading securities embeds this information in asset prices which, in turn, convey information to the entrepreneurs and managers who decide how to allocate capital and effort. Security prices that quickly reflect new information about a firm's prospects also provide a low-cost aid to outside investors who wish to write incentive compatible contracts with otherwise hard-to-monitor agents. Finally, when capital markets allow risk-averse entrepreneurs to trade shares in lumpy investments with imperfectly correlated risks, improved risk sharing can lead to economic growth through increased investment and capital deepening (Atje and Jovanovic 1993; Obstfeld 1994; and Acemoglu and Zilibotti 1997).

A key assumption underlying all of these arguments in favor of finance led growth is that capital flows freely across geographic space because property rights, and the institutions that guarantee them, allow investors to realize the return on their investment. When a country lacks the institutions necessary to convince outside investors that their claims are safe, welfare-enhancing projects may go unfinanced, thereby retarding the pace of economic development.

Using a new monthly data set that contains the hand-collected returns of 1,808 equities traded on the London Stock Exchange between 1866 and 1907, we examine the link between

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<sup>1</sup> Levine (2005) begins his excellent survey of the finance and growth literature by pointing out that in the same year that Merton Miller (1998) asserted that "the idea that financial markets contribute to economic growth is a proposition too obvious for serious discussion" Robert Lucas (1988) dismissed the role of financial markets as an "over-stressed" determinant of economic growth.

<sup>2</sup> Gurley and Shaw (1955), Cameron (1967), and Goldsmith (1969) were early proponents of the view that well-functioning financial markets play in promoting economic growth while Greenwood and Jovanovic (1990) and Bencivenga and Smith (1991) are early examples of neoclassical growth models where financial markets effect steady state growth.

capital costs, property rights and subsequent growth. The 1866-1907 London Stock Exchange offers a unique laboratory to measure country specific determinants of capital costs. At this time, the London Stock Exchange was the dominant location where non-British firms raised finance capital (Michie 1999). Although the equities were traded in London, they represented claims to the residual cash flows of companies located in 43 separate countries from around the globe. Equities from many different nations traded in a single, centralized market permits us to estimate risk-adjusted returns without being forced to conduct the test across markets that may be not be fully integrated (see, e.g., Bekaert et al. 2007). Study of the 1866-1907 London Stock Exchange therefore allows us to measure country specific capital costs without the confounding effects of regulatory, tax and liquidity differences across geographically separated modern exchanges.

Several papers have documented the effect of financial market development on growth after the Second World War (Levine 1997; Levine and Zervos 1998), but, to the best of our knowledge, no one has looked at the same question for the period immediately preceding the First World War. This omission is important because our period of study plays an important role in modern income disparities. Much of the current cross-country difference in wealth can be attributed to divergent growth trajectories that began during our period of study (Pritchett 1997).

The late 19<sup>th</sup> century is likely to be one of the earliest examples of the necessity of well-functioning financial markets. While previous episodes of economic growth relied on technologies that could be financed by mobilizing relatively modest amounts of capital, the size and scope of late 19<sup>th</sup> century industries required more significant amounts of capital. The scale of these projects made access to the international capital market a necessary precondition for undertaking these investments. Private firms from around the world went to London to raise the capital that financed the transportation, industrial, raw material, and infrastructure projects that became the backbone of the second industrial revolution. This paper documents how strong institutions at the country level influenced firms' ability to access low-cost financing during this period and provides insight into a specific channel through which institutions affect the process of economic development<sup>3</sup>.

Our large panel data set of stocks enables us to decompose the cost of capital into two components using standard asset-pricing methods. One component is related to the equity's

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<sup>3</sup> Nunn (2009) makes similar arguments about the importance of historical institutions for understanding modern development.

covariance with non-diversifiable market risks. The other is country-specific and correlated with institutional quality, openness, legal tradition or form of polity. Using these data, we find that firms located in countries with institutions that protected property rights paid a lower cost of capital compared to similarly risky firms that were located in countries with institutions with weaker protections for property rights.

These findings provide empirical support to the view that institutions play an important role in reducing the cost of capital and hence promoting investment. Given that, it is plausible that this is one of the ways that institutions promote economic growth. It is well-established that rich countries tend to have strong institutional guarantees for property rights, and there is evidence that causation flows from institutions to economic growth (Acemoglu, Johnson, and Robinson 2005). Indeed, we also find evidence supporting this proposition as well. Countries with firms that faced a high cost of capital during the second industrial revolution tend to be poorer today than countries that paid a low cost of capital.

The paper is organized as follows. Section 2 presents the relevant theoretical arguments that predict a relationship between expropriation risk and the cost of capital. Section 3 shows the relationship between the cost of capital during the second industrial revolution and subsequent economic growth or current wealth. Section 4 examines how country-specific institutional quality is related to the risk-adjusted cost of capital. Section 5 concludes.

## **2. Institutional Quality, Economic Growth, and the Cross-Section of Asset Returns**

In this section, we first discuss some of the theoretical arguments that institutions are a fundamental cause of economic growth. We then examine what theory predicts about the relationship between institutional quality and asset returns. Finally, we discuss the restrictions imposed by this theory on the behavior of observable returns.

### **2.1 Institutions and Economic Growth**

Before we examine how the quality of economic institutions is related to the ability of firms to raise equity capital, it is important to be clear about how we define the term “institutional quality”. By institutional quality, we mean the formal and informal constraints on political, economic, and social interaction that establish an incentive structure that reduces uncertainty and

promotes economic efficiency (North 1991). To the extent that the constraints imposed by strong institutions ensure the protection of property rights and reduce the risk of expropriation, variation in institutional quality should be reflected in asset prices.

Recent research has focused on the importance of institutions as fundamental drivers of economic growth. We focus on three main strands – Acemoglu, Johnson and Robinson (2001, 2002, 2005), Sokoloff and Engerman (2000), and La Porta et al. (1997, 1998). Acemoglu, Johnson, and Robinson (2001) trace institutional quality to the colonization strategies that Europeans adopted during early European settlement. They hypothesize that in countries with less deadly disease environments, Europeans settled and established strong institutions that protected property rights. By contrast, in regions where settler mortality rates were high, Europeans established extractive institutions that focused on transferring resources from the colony to the home country.

Like Acemoglu, Johnson, and Robinson (2001), Sokoloff and Engerman (2000) share the view that geographic characteristics were important exogenous determinants of the effect of colonial rule on long-run economic growth. Rather than focusing on the effect of the disease environment, however, Sokoloff and Engerman focus on the importance of initial differences in the endowments of land and geography that were most suited to cultivating internationally traded crops (i.e., “cash crops”). In countries where crops were more easily cultivated using plantations and slave labor, institutions emerged to protect the position of elite landowners at the expense of the rest of the population.

In a different vein, La Porta et al. (1997, 1998) emphasize the importance of the colonizer’s legal tradition. They argue that key differences between systems based on British common law and Roman civil law had direct effects on financial development because British common law provided a higher quality of contract enforcement and greater security of property rights than Roman civil law. According to this argument, the tradition adopted by each country has a direct effect on the efficiency with which financial contracts are credibly executed in that country.

Although the mechanisms differ among these three explanations, a common implication is that initial conditions shaped property right institutions. In turn, these initial conditions affected economic growth and development. One obvious channel connecting property rights to development is the ability of countries to attract investment capital. In countries with poor

institutional protection of property, investors face the prospect of having their claims expropriated by a predatory state or an insider unconstrained by local law or custom. The fear of expropriation undermines efficient monitoring by outside investors and inhibits risk sharing, thereby increasing the cost of capital. Given the rapidly declining transportation costs, increasing returns to scale, and the imperfect global competition that characterized many late 19<sup>th</sup> century industries, initial advantages in capital costs could very well have manifested themselves as divergent paths of economic development.

## **2.2 Expropriation Risk and the Cost of Capital**

The prediction that initial differences in the cost of capital has implications for economic growth rates raises the question of how, precisely, differences in institutions affect the cost of equity capital. There are three principal ways in which expropriation risk can affect the cost of equity capital: (1) it decreases the expected cash flow to outside investors; (2) it reduces international risk sharing; and (3) it exacerbates the agency problems related to the separation of ownership and control that are especially acute in international financial transactions.

### **2.2.1 Expected Cash Flows and the Cost of Capital**

The logic behind the cash flow channel is straightforward. If two entrepreneurs have access to identical technology but one is located in a country where the probability of expropriation is higher, the entrepreneur in the country with better property rights can offer outside investors a greater expected post-expropriation cash flow. In the presence of transportation costs both investments may be undertaken, but if trade frictions are sufficiently low and scale economies in production sufficiently large, only the firm located in the country with strong property rights will be able to compete.

Although the cash flow channel is of first-order importance, it is difficult to measure with historical data. As long as investors form unbiased expectations of the likelihood of expropriation, the market assigns the correct price given the post-expropriation cash flow, and the econometrician observes prices that are consistent with observed cash flows. Of course, the actual cost of expropriation is the forgone investment that otherwise would have been undertaken but this counterfactual expropriation free cash flow is unobserved to difficult to estimate. However, cross-country variation in expropriation risk should create differences in the degree of

risk sharing and agency costs across countries. These differences will manifest themselves in the discount rates of observable post-expropriation cash flows and can be estimated with standard asset-pricing models.

### **2.2.2 Imperfect Risk sharing and the Cost of Capital**

The risk of expropriation also creates a capital market friction that discourages cross-border risk sharing, which should raise the cost of capital and retard economic growth. Several models provide examples of how expropriation risk reduces international risk sharing in equilibrium (see, e.g., Eaton and Gersovitz 1984; Stulz 2005; Alfaro, Kalemli-Ozcan and Volosovych 2008; and Kose, Litov, and Yeung 2008).

Economic theory predicts that a reduction in international risk sharing opportunities can affect the ability of countries to invest and lower the rate of economic growth. For example, in Acemoglu and Zilibotti's (1997) model the degree of risk sharing determines the length of time that a country spends in "primitive accumulation" before embarking on a period of sustained economic growth. In that model, economies are endowed with a large number of indivisible projects with high expected returns that are imperfectly correlated with each other. Because the payoffs of the investment projects are imperfectly correlated, much of the economy-wide risk can be diversified away by entrepreneurs trading claims to each other's projects. However, there are also many safe investments with low-expected returns. Since entrepreneurs are risk averse and most of them have little capital, there is a strong incentive to invest in the low-risk, low-return projects. Consequently, economies will go through a long period of slow economic growth until the accumulation of capital is sufficiently large that the entrepreneurs have an incentive to switch to the high-expected return projects.

In Acemoglu and Zilibotti's model, growth outcomes are random in that some countries will be "lucky" and have a large number of early risky investments payoff. This luck results in higher wealth and more investment in high-return projects. Other countries are "unlucky" and have a large number of early risk projects fail. The unlucky countries choose to accumulate capital more slowly than the lucky countries. Some countries are therefore "unbound by chance" and grow quickly while others are poor for an extended period of time.

Although Acemoglu and Zilibotti do not model international capital markets and expropriation risk explicitly, the economic mechanism that they identify applies equally well to a

setting in which there are projects located in many different countries. If the international capital market allowed entrepreneurs to hold claims to each other's projects, total risk could be reduced and the time in the primitive accumulation stage shortened. If capital were free to flow across countries, the consequences of being initially "unlucky" would be largely irrelevant as wealthy agents located in "lucky" countries would have strong incentive to fund high return projects in poor countries. On the other hand, countries in which poor property rights inhibit the trading of claims to each other's projects would be cut off from the investments of "lucky" countries and spend more time in the primitive accumulation phase. Reduced risk sharing is thus another channel through which expropriation risk can retard economic growth.

### **2.2.3 The Agency Problem and the Cost of Capital**

Expropriation risk can also exacerbate agency problems and raise the cost of external funds. Stulz (2005) presents a model that directly addresses the relationship between the risk of expropriation and country-specific risk premia. The existence of expropriation risk creates a capital market friction that prevents investors from perfectly diversifying risk and results in country-specific premia that are increasing in the risk of expropriation.

In Stulz's model, both the entrepreneur and the outside investors risk expropriation by the state. Due to costly monitoring and a separation of ownership and control, outside investors face the additional risk of expropriation by insiders who control the firm. Stulz refers to this as the "twin agency problem". The traditional efficient contracting response to the separation of ownership from control requires insiders to hold a greater investment than would otherwise be optimal and outsiders to favor firms that allocate capital to internal investments that are cheaper to monitor. The risk of expropriation by the state exacerbates the insider agency problem because techniques that are likely to be most effective at warding off state expropriation (such as opaque accounting, investing in hard-to-measure corporate resources, or hiring politically connected insiders) are exactly the mechanisms that make it difficult for outside investors to monitor and restrain corporate insiders.

Controlling shareholders who are also managers have less incentive to divert company resources than non-shareholding managers but have greater incentive to undertake actions that protect the firm from state expropriation. Consequently, equilibrium ownership concentration increases with the risk of expropriation by the state. Insiders with political connections or the

ability to avoid state expropriation are either skilled at diverting resources without detection or politically powerful, and must therefore hold an even larger fraction of their wealth in the equity of their firm before outside investors will co-invest. The risk sharing benefits of financial globalization are inversely related to the degree of insider holding and the risk of state expropriation.

The twin-agency problem impedes economic growth and development in a number of ways. In the absence of frictions, moving from financial autarky to full financial integration should increase firm values and raise marginal Q as the firm's cash flow is repriced to reflect its covariance with global consumption risk. Several papers provide empirical evidence that the reductions in late 20<sup>th</sup> century barriers to trading equity capital reduced the required return on equity in emerging markets (Bekaert, Harvey, and Lundblad 2005; Henry 2000). The undersea cable and absence of capital controls combined to make the late 19<sup>th</sup> century London Stock Exchange the first truly global capital market. To the extent that agency costs force insiders to overinvest in their firm, the risk sharing gains from this early era of financial integration will be muted.

Stulz's theory is also consistent with other models in which agency problems distort the international allocation of capital, increase capital costs, and depress future economic growth in poor countries with weak institutions (e.g., Gertler and Rogoff 1990; Boyd and Smith 1997; Albuquerque and Wang 2008; and Antràs and Caballero 2009). These models share the common prediction that there is less risk sharing in countries with poor institutional protection of property. Furthermore, this prediction is consistent with empirical findings by Harvey (1995) and La Porta et al. (1997, 1998) that modern cross-country differences in expropriation risk exposure are related to differences in insider concentration.

### **2.3 Testable Implications**

By trading claims to investment projects, entrepreneurs can use frictionless integrated capital markets to eliminate non-diversifiable risks until all investors are exposed to the same common risks. Therefore, in an internationally integrated capital market the required rate of return on an asset is determined by the covariance of the asset's return with non-diversifiable consumption risk. Expropriation risk reduces the ability of investors to share risks and drives a wedge between

the return an asset would require in an integrated market and the return we will observe in a market segmented by market frictions.

The insight that expropriation risk exacerbates market segmentation and agency costs generates a testable restriction on the observable cross section of asset returns. Equities that represent claims to cash flows subject to expropriation should have higher expected returns than would be the case in a frictionless integrated market.

However, differences in returns may not only reflect compensation for differences in property rights, but also cross-country differences in non-diversifiable business-cycle risk or random sampling error. For this reason, we require a model that permits us to decompose an asset's observable return into the component that is related to its exposure to non-diversifiable business-cycle risk and the component orthogonal to non-diversifiable risk. We refer to the orthogonal component as the "risk-adjusted cost of capital".

### 2.3.1 Data

To estimate the risk-adjusted cost of capital, we use a unique hand collected data set of all of the British and foreign equities traded on the London Stock Exchange between 1866 and 1907. The data set consists of 1,808 individual equities, of which 969 are British and 839 are foreign. The price data were collected from the Friday official lists published in the *Money Market Review*, while the London dividend histories and shares outstanding were collected from the *Investor's Monthly Manual* and *The Economist*. Prices were sampled every 28 days between January 1866 and December 1907. In total we observe 295,440 28-day holding period returns corrected for dividends, stock splits and special payments. Additional details on how the database was constructed can be found in Chabot and Kurz (2010).

### 2.3.2 Factor Model Specification

We adjust for business-cycle risk with both the one factor Capital Asset Pricing Model (CAPM) and a 3-factor Fama-French (FF) model:

$$(R_{it} - R_{ft}) = \alpha_i + \beta_{i,SM} (R_{SM} - R_{ft}) + \beta_{i,SMB} (R_{SMB} - R_{ft}) + \beta_{i,VAL} (R_{VAL} - R_{ft}) + \varepsilon_{it} \quad (1)$$

where  $R_{it}$  is the time  $t$  gross holding-period return of stock  $i$ ;  $R_{SM}$  is the time  $t$  return of the value-weighted portfolio of all stocks;  $R_{SMB}$  is the time  $t$  return of a zero cost size-sorted portfolio formed by buying a value-weighted portfolio of stocks ranked at time  $t-1$  in the bottom 30% of market value and shorting a value-weighted portfolio of stocks ranked at time  $t-1$  in the top 30% of market value; and  $R_{VAL}$  is the time  $t$  return of a zero cost value-sorted portfolio formed by buying a value-weighted portfolio of stocks ranked at time  $t-1$  in the top 30% of dividend yield among all stocks that paid dividends in the past year and shorting a value-weighted portfolio of all stocks that did not pay dividends in the past year. We use the London banker's bill rate as a proxy for the risk-free rate.

is the difference between  $i$ -th stock's return and the return that the model would predict given the stock's exposure to the common risk factors. If the model is specified correctly and investors treated firms from each country in the same way, we would expect the estimated alpha to equal zero. If investors demanded a premium for investing in countries with poor institutions, however, then the cross-section of estimated alphas would be negatively correlated with the strength of institutions. A test of the importance of institutions based on cross-country differences in estimated  $\alpha_i$  is therefore a joint test of the hypothesis that country-specific institutional measures matter and a test of the asset pricing model specification. It is thus important to know whether the CAPM and 3-factor Fama-French specification does a good job of explaining differences in asset returns.

Table 1 reports the average return of all non-British stocks in our sample and the average mispricing from the CAPM and 3-factor Fama-French specifications. The average return of all non-British stocks is 4.82% per annum. Once we control for risk using the CAPM specification, the average annual mispricing is only 88 basis points. The average CAPM mispricing is small but statistically and economically significant. When we expand the risk factors to include the Fama-French 3-factor specification the average mispricing shrinks to only 18 basis points per annum. On average, the Fama-French specification does an excellent job of accounting for the differences in asset returns during this period. We can therefore be confident that this factor-pricing model is well-specified.

### 2.3.3 Testing Whether Institutional Quality is Priced

If the risk of expropriation creates a capital market friction which effectively segments capital market, entrepreneurs who have the misfortune of living in countries with poor protection against expropriation can only attract outside capital by agreeing to retain a large portion of the equity in their ventures. As a result, risks will not be perfectly shared and the required rate of return of an asset will depend on both the asset's covariance with the non-diversifiable factor risks and its covariance with the local country consumption (Errunza and Losq 1985; and Jorion and Schwartz 1986). The component of the asset's return related to local risk generates an additional country-specific risk premium in addition to the premium associated with exposure to the non-diversifiable factor risks. This relationship can be expressed in the following equation:

$$E[R_i - R_f] = \sum \beta_k \gamma_k + \beta_L \delta \quad (2)$$

where  $\beta_k$  and  $\beta_L$  are regression coefficients from a multiple regression of excess returns on  $K$  non-diversifiable global factor risk portfolios and a local risk proxied by an index comprised of local country stocks;  $\gamma_k$  is the equilibrium risk premium per unit of beta; and  $\delta$  is the equilibrium risk premium required per unit of  $\beta_L$ .<sup>4</sup> If the local market index is positively correlated with the global index, then  $\delta$  will be positive.<sup>5</sup> Although the theoretical rationale for the segmentation differs, similar asset-pricing equations are derived in Albuquerque and Wang (2008) and Lee (2011). Equation (2) provides a testable restriction on the cross-section of observable asset returns. We estimate the following multifactor pricing model:

$$(R_{it} - R_{ft}) = \alpha_i + \beta_{i,SM} (R_{SM} - R_{ft}) + \beta_{i,SMB} (R_{SMB} - R_{ft}) + \beta_{i,VAL} (R_{VAL} - R_{ft}) + \varepsilon_{it} \quad (3)$$

$$\alpha_i = (\alpha + \sum_j \delta_j X_{ij})$$

where the mispricing of the  $i$ th asset is modeled as a function of the vector  $X_{ij}$  that measure the underlying institutional quality of the country in which the asset is located. If the quality of institutions affects asset prices, then the mispricing of asset  $i$  should be positively correlated with institutional measures of expropriation risk and negatively correlated with measures of

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<sup>4</sup> This is equation (16) in Errunza and Losq (1985) and equation (3) in Jorion and Schwartz (1986).

<sup>5</sup> See footnote 17 in Jorion and Schwartz (1986).

international risk sharing. To test this hypothesis, we estimate equation (3) using various measures of institutional quality and risk sharing as covariates in the vector  $X$ .

If we find an observable trait (such as institutional quality) is priced, then investors could have earned positive alpha by forming portfolios based on this trait. The existence of a positive alpha does not necessarily imply informational inefficiency or investor irrationality, however. In the models of expropriation risk discussed above, the additional return for investing in countries with weak property right is an equilibrium compensation for expropriation risk. Investors rationally choose to hold low alpha investments with cash flows that are secure against expropriation risk and high alpha investments with cash flows that are at risk of expropriation.

### **2.3.4 Controlling for Industry Fixed Effects**

If we find that a characteristic such as expropriation risk “explains” differences in asset returns, it is important to guard against the possibility that the characteristic is correlated with another risk factor that demands a risk premium in equilibrium. A concrete concern is that the composition of industries across countries is correlated with institutional quality. Geography-based explanations of property rights such as Acemoglu, Johnson, and Robinson (2001, 2002, 2005) and Sokoloff and Engerman (2000) predict that industry and property rights will be correlated. In addition, there is evidence that many industries share common characteristics and hence can be priced by an industry-specific risk factor. For example, the alpha documented in many studies can be explained by the industry-level human capital (Eiling 2011). Institutions are measured at the country level and many empirical papers that estimate modern country-specific costs of capital have found priced industry effects to be a confounding factor.

To address these concerns, we estimate equation (3) with industry dummies. The results are presented in Table 2. Although the null hypothesis that industry dummy coefficients are collectively zero cannot be rejected, a number of industry dummies are individually significant. For this reason, in all of the regressions that follow industry dummies are included, and the estimated effect of institutions on capital costs can be interpreted as a within-industry measure.

## **3. Institutions, the Cost of Capital, and Economic Growth**

We measure the effect of institutions on the cost of capital by estimating equation (3) with various proxies for institutional quality in the vector of covariates  $\mathbf{X}$ . The previously cited models share the following testable predictions:

1. Measures of the quality of institutional protection of property rights should be negatively correlated with risk-adjusted returns.
2. To the extent that poor institutional protection of property rights raises capital costs and depresses growth, countries with *high* growth should have *low* risk-adjusted returns.

### 3.1 Institutions and Historical Risk-Adjusted Returns

To test these hypotheses, we require a measure of property rights protection. Acemoglu, Johnson, and Robinson (2001) trace institutional quality to the colonization strategies that Europeans adopted during the late 18<sup>th</sup> and early 19<sup>th</sup> centuries and hypothesize that Europeans established strong institutions that protected property rights in countries with less deadly disease environments during colonial rule. They document a strong correlation between the cross-country variation in modern protection against expropriation risk and current wealth. We have no 19<sup>th</sup> century equivalent to the measure of expropriation risk, but Acemoglu, Johnson, and Robinson's argument that historical conditions determine modern property rights imply that institutions are largely immutable over long periods and that modern day protection against expropriation risk is a good proxy for historic protection as well.

In Table 3 we show that historical alphas are correlated with modern measures of protection against expropriation risk. The cross-country variation in alpha shows the predicted negative relationship modern protection against expropriation risk. The coefficients reported in Table 3 imply that the difference in protection against expropriation risk between a country like the United States ( $XROP = 9.98$ ) and Nicaragua ( $XPROP = 5.29$ ) would correspond to about a 2.44% per annum difference in Fama-French model's required rate of return.

At the same time, it is important to exercise caution when interpreting the regression results in Table 3. Causation may flow from the historical risk premium to modern property rights. The set of institutions that guarantee property rights entail significant costs. If high capital

costs in the late 19<sup>th</sup> century prevented countries from investing in the industries of the second industrial revolution, they may not be able to afford modern protections against expropriation.

To identify the relationship between property rights and capital costs, we need exogenous variation in institutions that does not affect modern wealth except through institutions. As we discussed in section 2, Acemoglu, Johnson, and Robinson (2001) propose 18<sup>th</sup> and 19<sup>th</sup> century settler mortality as an instrument for modern institutions. Unlike current measures of protection against expropriation risk, late 19<sup>th</sup> century stock prices cannot cause settler mortality, and settler mortality should have no effect on current wealth except through its effect on institutions. For these reasons we use settler mortality as an instrument for institutional quality.

We construct a high and low settler mortality dummy variable equal to one if the country in question is in the top third or bottom third of Acemoglu, Johnson, and Robinsons settler mortality measure. Settler mortality is significantly correlated with the risk-adjusted cost of capital. Firms located in high settler mortality countries faced 10% per annum cost disadvantage compared with firms located in other countries. An investor who formed a portfolio by purchasing equity in firms located in high settler mortality countries and sold short equity in firms located in low mortality countries could expect to receive about an 11% per annum premium relative to an equally risky portfolio with no exposure to the risk associated with settler mortality. Finally we project modern protection against expropriation risk on settler mortality to construct an exogenous measure of property right protection. The positive correlation between estimated alpha and the expropriation risk projected on settler mortality is precisely what one would expect if the quality of institutions both influenced modern institutions *and* the rate that investors charged firms seeking finance in London during the late 19<sup>th</sup> century.

The use of settler mortality in cross-sectional growth regressions has not gone unchallenged. For example, Sachs (2003) has criticized the use of settler mortality in cross-sectional GDP regressions. He argues that settler mortality is correlated with geographic and climate variables and that these variables have a direct effect on productivity and output. While this problem is a concern for growth regressions, it is not clear that climate-driven differences in productivity or the marginal product of capital would influence stock returns and the risk premium. As long as these differences are known at the time that the investor purchases the shares, they should be reflected in stock prices.

In Table 4 we add geography and climate to our vector of covariates  $X$  variables to examine this possibility. We control for climate and geography by including absolute latitude and mean temperature. These variables have explanatory power in cross-country growth and wealth regressions, but they have no effect on the risk premium. Latitude and temperature had no effect on asset returns when included separately, and they have confounding effects when included simultaneously in the same regression. The negative relationship between alpha and settler mortality remains robust to the inclusion of latitude and temperature covariates.

As a whole, this evidence suggests that historical capital costs are correlated with mortality and that this correlation is independent of climate and geography. British investors did not demand a risk premium to invest in locations with a poor climate. These results suggest that 19<sup>th</sup> century capital costs were correlated with the quality of institutions, as instrumented by settler mortality, but were uncorrelated with geography and climate.

The British disproportionately colonized northern low-mortality climates, however, and we may conflate the settler mortality instrument with the salutary effect of British institutions on the cost of capital. Ferguson and Schularick (2006) argue that colonial status mattered for government borrowing costs during the late 19<sup>th</sup> century. British colonies are also more likely to have the British legal traditions that La Porta et al. (1997) and Levine (1998) argue influence both capital costs and economic development today.

In Table 5 we show that neither British colonial status nor British legal origin affected the firm-specific capital costs. The Table 5 specification with a British colony dummy compares the risk-adjusted cost of capital between firms located in British colonies and those located elsewhere. While firms located in high mortality countries paid a premium of 11% per annum, firms located in British colonies enjoyed a statistically and economically insignificant 29 basis point annual funding advantage.

Many British colonies retained their legal traditions imposed by earlier Spanish and French settlers. Therefore, a regression on a dummy that measures whether a country was a British colony is not necessarily the same as controlling for legal origin. Table 5 also reports regressions on La Porta et.al. (1997) rule of law index and legal tradition dummies. With the exception of Scandinavian legal tradition, there is no significant relationship between legal tradition and the Fama-French risk-adjusted cost of capital. A variable measuring the modern rule of law, on the other hand, is weakly significant in the Fama-French specification but the sign

is inconsistent with what theory predicts. This anomaly vanishes when we replace the modern rule of law variable with its predicted value based on projections onto settler mortality or legal origin dummies.

Thus far we have sought to explain risk-adjusted returns using a modern (instrumented) measure of property right protections. What about information known to investors in the 19<sup>th</sup> century? In Table 6 we estimate (3) using political measures potentially known to historical investors. We regress time  $t$  returns on Polity IV database measures of time  $t-1$  variables that capture political participation and stability. Regardless of our choice of variable, historical risk-adjusted returns were unaffected by political system or stability.

A Victorian and Edwardian investor who selected investments based on the level of executive constraint, democracy, suffrage or political autarky in the firm's country would have done no better or worse than investors who ignored these variables.

### **3.2 Historical Alpha and Economic Growth**

As a whole, this evidence indicates that London investors discriminated against firms located in countries with poor protection of property rights. Countries with weak institutions paid a higher risk-adjusted cost of capital – and this difference likely mattered for subsequent wealth. In Table 7, we document that countries that grew slowly after 1913 and tend to be poor today faced a relatively high alpha during the second industrial revolution.

At first glance, this is counterintuitive. If we told modern economists that they could go back to 1870 London to buy stocks, we conjecture that most would choose stocks located in the countries that, with the benefit of hindsight, are known to have succeeded. But an investor who had purchased a portfolio of U.S., Canadian, Australian or German stocks would have dramatically underperformed the market.

The reason for this counterintuitive finding becomes more clear upon reflection. In most applications of multifactor asset pricing models we are used to thinking of alpha as the “surprise” component of returns and testing whether these surprises were actually predictable. If firms had large positive alphas during the second industrial revolution because they consistently generated cash flows that were a positive surprise to their investors we would observe a positive alpha, but we would expect the countries that host such “lucky” firms to grow quickly as well. On the other hand, if these firms offered their investors positive alpha as equilibrium compensation for poor

institutional protection of their property rights, we would expect the countries these firms were located in to grow slowly for the reasons discussed in Section 2.

Therefore, if the models proposed in Section 2 are correct we should observe a negative correlation between modern wealth and 19<sup>th</sup> century capital costs. In fact, an investor who purchased stocks located in countries with the bottom 30% of 1913-2011 growth would have outperformed the market by 1.9% per annum. One would only expect to find such a negative relationship if high risk-adjusted returns were compensation for a market friction that had a negative influence on capital accumulation and future growth.

#### **4. Conclusion**

This paper documents the relationship between institutions that protect property rights, the cost of capital during the second industrial revolution, and subsequent wealth. We established two striking relationships. First, there is a negative correlation between the strength of institutions that protect property rights and the risk-adjusted cost of capital in the late 19<sup>th</sup> and early 20<sup>th</sup> century. When firms located in countries with weak institutions raised capital in London, they were charged a premium compared to similarly risky firms located in countries with strong institutions. Second, there is a similarly strong negative correlation between post 1913 GDP growth or current per capita GDP and historical risk-adjusted capital costs. Firms located in countries that grew slowly after our sample period faced a significantly higher cost of capital during the second industrial revolution.

Taken together, these facts suggest that the extent to which institutions guarantee property rights influenced the cost of capital during the late 19<sup>th</sup> century and that this influence had consequences for long-run economic growth. Institutions seem to matter for economic growth by providing a secure environment for investment. Financial markets thus act as an important conduit through which institutions shaped long-run economic growth.

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**Table 1: Regression Results for Alternative Asset Pricing Models**

$$R_{it} - R_{ft} = \alpha + \sum_k \beta_{ik} F_{kt} + \varepsilon_{it}$$

| Model                       | No Factors | CAPM     | Fama-French |
|-----------------------------|------------|----------|-------------|
| Constant                    | 4.82 ***   | 0.88 *** | 0.18        |
| t-stat                      | 12.64      | 2.32     | 0.53        |
| adj.-R                      | N/A        | 0.051    | 0.092       |
| Stock-Month<br>Observations | 140,251    | 140,251  | 140,251     |

Notes: The “No Factors” regression contains only a constant, the “CAPM” regression includes the world market portfolio, and “Fama-French” the world market portfolio, the SMB and VAL portfolios.  
T-stats are computed with robust clustered standard errors  
\*\*\* (\*\*) (\*) indicates that the estimate is significant at the 1% (5%) (10%) level.

**Table 2: Industry FE Regression Results**

$$R_{it} - R_{ft} = (\alpha + \sum_j \theta_j \text{Industry}_j) + \sum_k \beta_{ik} F_{kt} + \varepsilon_{it}$$

| Model:                      | No Factors      |        | CAPM            |        | Fama-French     |        |
|-----------------------------|-----------------|--------|-----------------|--------|-----------------|--------|
|                             | $\theta_j$ Coef | t-stat | $\theta_j$ Coef | t-stat | $\theta_j$ Coef | t-stat |
| Industry                    | (Annual %)      |        | (Annual %)      |        | (Annual %)      |        |
| Constant (Railroad Omitted) | 4.14 ***        | 6.16   | -1.27 *         | -1.92  | -1.13 **        | -1.97  |
| Bank                        | 1.20            | 0.96   | 3.03 **         | 3.50   | 2.25 **         | 2.81   |
| Breweries                   | -5.63 **        | -2.14  | -3.27           | -1.35  | -5.04 **        | -2.07  |
| Canal                       | 0.22            | 0.03   | 2.65 ***        | 4.00   | 2.48 ***        | 4.32   |
| Docks                       | -3.86           | -0.63  | -0.97           | -0.31  | -1.31           | -0.42  |
| Gas                         | 0.08            | 0.04   | 3.90 ***        | 4.30   | 2.97 ***        | 3.24   |
| Electricity                 | -11.33          | -1.16  | -4.85           | -0.68  | -6.61           | -0.82  |
| Petroleum                   | -2.79           | -0.44  | 2.46            | 0.30   | 4.15            | 0.62   |
| Iron, Coal and Steel        | -5.73           | -1.41  | -1.22           | -0.24  | -2.06           | -0.38  |
| Land and Building           | 8.95            | 0.58   | 13.96 ***       | 21.03  | 12.15 ***       | 21.12  |
| Land, Mortgage Financial    | 1.14            | 0.93   | 3.86 ***        | 3.78   | 2.62 **         | 2.72   |
| SS & Shipbuilding           | 6.20            | 1.41   | 9.36 ***        | 4.19   | 6.55 **         | 3.39   |
| Tea and Coffe               | -3.78 *         | -1.85  | 1.32            | 0.88   | -0.76           | -0.54  |
| Tele                        | 1.82            | 0.92   | 4.11 ***        | 3.99   | 2.63 **         | 2.61   |
| Tramway and Omnibus         | 0.85            | 0.33   | 3.78 **         | 2.85   | 2.40 *          | 1.77   |
| Trusts                      | -1.66           | -0.69  | 1.71            | 1.38   | 0.89            | 0.72   |
| Waterworks                  | 1.33            | 0.39   | 5.89 ***        | 3.78   | 4.84 ***        | 4.04   |
| Other                       | 0.47            | 0.29   | 2.98            | 1.25   | 2.44            | 1.03   |
| Mines                       | 4.61 ***        | 3.43   | 3.64 **         | 2.32   | 2.09            | 1.37   |
| Bond                        | 1.57            | 0.19   | 2.35            | 1.50   | 2.97            | 1.22   |
| R-Squared                   | 0.00023         |        | 0.051           |        | 0.092           |        |
| Stock-Month Observations    | 140,916         |        | 140,796         |        | 140,251         |        |

Notes:

"No Factors" includes only the industry fixed effect dummies

$\delta$ -Coeff is reported in annual percentage points

t-stats are computed with robust clustered standard errors

\*\*\* (\*\*) (\*) indicates that the estimate is significant at the 1% (5%)

**Table 3:  $\delta$  from following regression**

$$R_{it} - R_{ft} = (\alpha + \delta x_{it} + \sum_j \theta_j \text{Industry}_j) + \sum_k \beta_{ik} F_{kt} + \varepsilon_{it}$$

| Model       | x-Variable(s)                                           | $\delta$ -Coefficient<br>(Annual %) | t-stat | R-Sq | Stock-Month<br>Observations |
|-------------|---------------------------------------------------------|-------------------------------------|--------|------|-----------------------------|
| CAPM        | High Settler Mortality                                  | 10.16 ***                           | 3.29   | 0.06 | 106,772                     |
| Fama French | High Settler Mortality                                  | 10.04 ***                           | 2.88   | 0.10 | 106,454                     |
| CAPM        | Low Settler Mortality                                   | -2.94 ***                           | -3.33  | 0.06 | 106,772                     |
|             | High Settler Mortality                                  | 8.71 ***                            | 2.68   |      |                             |
| FAMA French | Low Settler Mortality                                   | -1.82 **                            | -2.14  | 0.10 | 106,454                     |
|             | High Settler Mortality                                  | 9.15 **                             | 2.54   |      |                             |
| CAPM        | Expropriation Risk                                      | -0.82 ***                           | -3.08  | 0.05 | 127,881                     |
| Fama French | Expropriation Risk                                      | -0.52 **                            | -2.07  | 0.09 | 127,400                     |
| CAPM        | Expropriation Risk<br>projected on Settler<br>Mortality | -1.33 ***                           | -2.87  | 0.06 | 106,772                     |
| Fama French | Expropriation Risk<br>projected on Settler<br>Mortality | -0.85 *                             | -1.91  | 0.08 | 106,454                     |

Notes: Settler mortality and expropriation risk data come from Acemoglu, Johnson, and Robinson 2001. Expropriation risk is protection against expropriation from the Polity III data set High and Low are Dummy variables =1 if in the highest and lowest thirds respectively.

$\delta$ -Coeff is reported in yearly percentage points

t-stats are computed with robust clustered standard errors

\*\*\* (\*\*) (\*) indicates that the estimate is significant at the 1% (5%) (10%)

**Table 4:  $\delta$  from following regression**

$$R_{it} - R_{ft} = (\alpha + \delta x_{it} + \sum_j \theta_j \text{Industry}_j) + \sum_k \beta_{ik} F_{kt} + \varepsilon_{it}$$

| x-Variable(s): | Temp     | Latitude | Settler<br>Mortality | R-Sq  | Stock-Month<br>Observations |
|----------------|----------|----------|----------------------|-------|-----------------------------|
| <b>Model</b>   |          |          |                      |       |                             |
| CAPM           | 0.03     |          |                      | 0.054 | 128,620                     |
| (t-stat)       | 0.65     |          |                      |       |                             |
| Fama French    | 0.001    |          |                      | 0.092 | 128,139                     |
| (t-stat)       | 0.02     |          |                      |       |                             |
| CAPM           |          | 1.08     |                      | 0.054 | 128,605                     |
| (t-stat)       |          | 0.43     |                      |       |                             |
| Fama French    |          | 2.20     |                      | 0.092 | 128,124                     |
| (t-stat)       |          | 0.95     |                      |       |                             |
| CAPM           | 0.37 **  | 16.89 ** |                      | 0.054 | 128,605                     |
| (t-stat)       | 2.47     | 2.33     |                      |       |                             |
| Fama French    | 0.30 **  | 14.91 ** |                      | 0.092 | 128,124                     |
| (t-stat)       | 2.06     | 2.17     |                      |       |                             |
| CAPM           | 1.89 *** | 0.40 *** | 22.16 ***            | 0.057 | 106,757                     |
| (t-stat)       | 3.33     | 2.55     | 2.69                 |       |                             |
| Fama French    | 1.38 **  | 0.33 **  | 19.00 **             | 0.096 | 106,439                     |
| (t-stat)       | 2.51     | 1.96     | 2.39                 |       |                             |

Notes: Temperature, Latitude, and Settler Mortality data are at the country level and come from Acemoglu, Johnson, and Robinson (2001). Temperature measures the average temperature of a country (in degrees centigrade); latitude is the absolute value of the latitude of a country, scaled down to take on values in [0,1] (from LaPorta et al. 1999)

$\delta$ -Coeff is reported in annual percentage points

t-stats are computed with robust clustered standard errors

\*\*\* (\*\*) (\*) indicates that the estimate is significant at the 1% (5%) (10%) level.

**Table 5:  $\delta$  from following regression**

$$R_{it} - R_{ft} = (\alpha + \delta x_{it} + \sum_j \theta_j \text{Industry}_j) + \sum_k \beta_{ik} F_{kt} + \varepsilon_{it}$$

| Model       | x-Variable(s)              | $\delta$ -Coefficient<br>(Annual %) | t-stat | R-Sq | Stock-Month<br>Observations |
|-------------|----------------------------|-------------------------------------|--------|------|-----------------------------|
| CAPM        | French Legal               | 1.65 **                             | 2.12   | 0.05 | 122,361                     |
| Fama French | French Legal               | 0.65                                | 0.88   | 0.09 | 121,880                     |
| CAPM        | French Legal               | 1.88 **                             | 2.39   | 0.06 | 122,361                     |
|             | German Legal               | -1.14                               | -0.72  |      |                             |
|             | Scand Legal                | 10.55 **                            | 2.11   |      |                             |
| Fama French | French Legal               | 0.83                                | 1.11   | 0.09 | 121,880                     |
|             | German Legal               | -1.42                               | -0.85  |      |                             |
|             | Scand Legal                | 9.62 **                             | 2.27   |      |                             |
| CAPM        | Rule of Law                | 0.003                               | 1.34   | 0.05 | 121,966                     |
| Fama French | Rule of Law                | 0.003 *                             | 1.94   | 0.09 | 121,485                     |
| CAPM        | Rule of Law (Settler Mort) | -0.69 ***                           | -2.87  | 0.06 | 106,772                     |
| Fama French | Rule of Law (Settler Mort) | -0.44 *                             | -1.91  | 0.10 | 106,454                     |
| CAPM        | Rule of Law (Legal Orig)   | 0.04 **                             | 2.12   | 0.05 | 121,966                     |
| Fama French | Rule of Law (Legal Orig)   | 0.01                                | 0.78   | 0.09 | 121,485                     |
| CAPM        | British Colony             | -0.91 **                            | -1.48  | 0.05 | 128,620                     |
| Fama French | British Colony             | -0.29                               | -0.49  | 0.09 | 128,139                     |
| CAPM        | Non-Colonial               | 1.89 *                              | 1.64   | 0.05 | 128,620                     |
|             | French Colony              | 9.61                                | 1.64   |      |                             |
|             | Span-Port Colony           | 2.09 **                             | 2.36   |      |                             |
|             | Other Colony               | 3.26 ***                            | 2.77   |      |                             |
| Fama French | Non-Colonial               | 1.32                                | 1.25   | 0.09 | 128,139                     |
|             | French Colony              | 10.54 **                            | 1.98   |      |                             |
|             | Span-Port Colony           | 0.79                                | 0.92   |      |                             |
|             | Other Colony               | 2.14 *                              | 1.89   |      |                             |

Notes: Rule of Law, Colony Dummies, and Legal Dummies are at the country level and are taken from LaPorta, et al (2008)

$\delta$ -Coeff is reported in annual percentage points

t-stats are computed with robust clustered standard errors

\*\*\* (\*\*) (\*) indicates that the estimate is significant at the 1% (5%) (10%)

**Table 6:  $\delta$  from following regression**

$$R_{it} - R_{ft} = (\alpha + \delta x_{it} + \sum_j \theta_j \text{Industry}_j) + \sum_k \beta_{ik} F_{kt} + \varepsilon_{it}$$

| Model       | x-Variable     | $\delta$ -Coefficient<br>(Annual %) | t-stat | R-Sq | Stock-Month<br>Observations |
|-------------|----------------|-------------------------------------|--------|------|-----------------------------|
| CAPM        | Exec Const     | -0.24                               | -1.40  | 0.06 | 95,607                      |
| Fama-French | Exec Const     | -0.09                               | -0.54  | 0.10 | 95,607                      |
| CAPM        | Suffrage       | -0.04                               | -0.31  | 0.03 | 29,985                      |
| Fama-French | Suffrage       | -0.06                               | -0.52  | 0.06 | 29,985                      |
| CAPM        | Autarky        | -1.38 ***                           | -2.01  | 0.06 | 97,357                      |
| Fama-French | Autarky        | -0.53                               | -0.82  | 0.10 | 97,010                      |
| CAPM        | Democracy      | 1.48 *                              | 1.80   | 0.06 | 97,357                      |
| Fama-French | Democracy      | 0.57                                | 0.75   | 0.10 | 97,010                      |
| CAPM        | Stability      | 1.15                                | 0.80   | 0.06 | 97,357                      |
| Fama-French | Stability      | 1.56                                | 1.13   | 0.10 | 97,010                      |
| CAPM        | Var(Autarky)   | -0.15                               | -1.19  | 0.06 | 96,853                      |
| Fama-French | Var(Autarky)   | 8.36                                | 0.96   | 0.10 | 96,438                      |
| CAPM        | Var(Democ)     | -0.16                               | -1.25  | 0.06 | 96,853                      |
| Fama-French | Var(Democ)     | 2.91                                | 0.24   | 0.10 | 96,438                      |
| CAPM        | Var(Stability) | -0.16                               | -1.21  | 0.06 | 96,853                      |
| Fama-French | Var(Stability) | 26.22                               | 1.42   | 0.10 | 96,438                      |

Notes: Autarky, Democracy, and Stability are from Gates et al 2006 (taken from the Polity 4 database)  
Stability=min(dist(stability),dist(autarky))  
 $\delta$ -Coeff is reported in annual Percentage Points  
t-stats are computed with robust clustered standard errors  
\*\*\* (\*\*) (\*) indicates that the estimate is significant at the 1% (5%) (10%) level.

**Table 7:  $\delta$  from following regression**

$$R_{it} - R_{ft} = (\alpha + \delta x_{it} + \sum_j \theta_j \text{Industry}_j) + \sum_k \beta_{ik} F_{kt} + \varepsilon_{it}$$

| Model       | x-Variable            | $\delta$ -Coefficient<br>(Annual %) | t-stat | R-Sq | Stock-Month<br>Observations |
|-------------|-----------------------|-------------------------------------|--------|------|-----------------------------|
| CAPM        | low growth            | 2.50 ***                            | 3.12   | 0.05 | 128,160                     |
| Fama-French | low growth            | 1.89 **                             | 2.40   | 0.09 | 127,679                     |
| CAPM        | lgdp 2011             | -0.87 **                            | -2.38  | 0.05 | 128,135                     |
| Fama-French | lgdp 2011             | -0.75 **                            | -2.12  | 0.09 | 127,654                     |
| CAPM        | lgdp 2011 - lgdp 1913 | -1.25 **                            | -1.96  | 0.05 | 123,589                     |
| Fama-French | lgdp 2011 - lgdp 1913 | -1.10 *                             | -1.80  | 0.09 | 123,108                     |

Notes: 2011 data comes from the World Bank and excludes Iran, New Zealand, and Cuba; they are included in the growth bin regression

GDP 1913 is constructed using Barro et al updating of Maddison. Low growth is equal to 1 if a country was in the bottom third of all countries when ranked by lgdp2011-lgdp1913 and zero otherwise

$\delta$ -Coeff is reported in annual percentage points

t-stats are computed with robust clustered standard errors

\*\*\* (\*\*) (\*) indicates that the estimate is significant at the 1% (5%)

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A series of research studies on regional economic issues relating to the Seventh Federal Reserve District, and on financial and economic topics.

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