

Estimating Cross-Industry Cross-Country Models Using Benchmark Industry Characteristics

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by

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Abstract

International industry data permits testing whether the industry-specific impact of cross-country differences in institutions or policies is consistent with economic theory. Empirical implementation requires specifying the industry characteristics that determine impact strength. Most of the literature has been using US proxies of the relevant industry characteristics. We show that using industry characteristics in a benchmark country as a proxy of the relevant industry characteristics can result in an attenuation bias or an amplification bias. We also describe circumstances allowing for an alternative approach that yields consistent estimates. As an application, we reexamine the influential conjecture that financial development facilitates the reallocation of capital from declining to expanding industries.

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1 Introduction

Applied economists have started using industry data to examine the economic effects of cross-country differences in financial development, institutional quality, and other potential determinants of aggregate economic activity. Their motivation is that theory predicts the impact of, say, financial underdevelopment or malfunctioning institutions to be stronger in some industries than others. The two principal advantages of the cross-industry cross-country approach are its focus on theoretical mechanisms and that it is straightforward to control for country-level determinants of economic activity (Rajan and Zingales, 1998). So far, the approach has been applied to a variety of issues in finance (e.g. Rajan and Zingales, 1998; Braun and Larrain, 2005; Cetorelli and Strahan, 2006; Aghion *et al.*, 2007; Fisman and Love, 2007; Beck *et al.*, 2008; Manova, 2008); to examine how property rights institutions affect economic development (e.g. Claessens and Laeven, 2003; Levchenko, 2007; Nunn, 2007); to study the link between human capital and comparative advantage (e.g. Romalis, 2004; Ciccone and Papaioannou, 2009); to investigate the effect of labor market institutions on comparative advantage and productivity (e.g. Cingano *et al.*, 2010; Cuñat and Melitz, 2010); and to examine the economic consequences of firm size, entry regulation, transaction costs, fiscal policy, risk sharing, and foreign aid (e.g. Pagano and Schivardi, 2003; Klapper *et al.*, 2006; Acemoglu *et al.*, 2009; Aghion *et al.* 2010; Michelacci and Schivardi, 2010; Rajan and Subramanian, 2010).

Implementation of the cross-industry cross-country approach requires specifying which industries should be affected most by financial underdevelopment, malfunctioning institutions, labor market rigidities, high entry costs, etc. For example, Fisman and Love (2007) argue that financial underdevelopment lowers growth most in industries with the potential to expand, while Nunn (2007) reasons that better property rights protection favors industries that require relationship-specific intermediate inputs. Obtaining the relevant industry characteristics is difficult because of limited international industry data and also because, in principle, the cross-industry cross-country approach requires measures of these characteristics if the economy was undistorted. In practice, following Rajan and Zingales (1998), most of the literature has been using US industry characteristics as a proxy because there are rich industry data and distortions tend to be low compared to other developed economies.

Although applied widely, the properties of the cross-industry cross-country estimator have not been studied yet. We show that using industry characteristics in a benchmark country as a proxy for the relevant industry characteristics introduces a bias shaped by two countervailing forces. Using a proxy introduces measurement error which, unsurprisingly, can

result in attenuation bias (a bias towards zero). But the measurement error introduced by benchmarking industry characteristics can also result in amplification bias, because industry characteristics in the benchmark country may be a better proxy for industry characteristics in similar countries. As an example, consider Fisman and Love's (2007) conclusion that financial underdevelopment slows down resource reallocation to industries with high growth potential. This conclusion is based on their empirical finding that US-based measures of industry growth potential are more closely related to actual industry growth in financially developed countries than in financially underdeveloped countries. Our econometric analysis highlights that this finding does not imply an effect of financial development on growth. Instead it could be the result of US-based measures of growth potential being a better proxy for growth potential in financially developed countries.

After characterizing the bias of the cross-industry cross-country estimator, we describe circumstances allowing for an alternative approach that yields consistent estimates. As an application, we examine the conjecture that financial development facilitates the reallocation of capital from declining industries to industries with good investment opportunities (e.g. Bagehot, 1873; Schumpeter, 1911; Rajan and Zingales, 1998; Fisman and Love, 2007; for a review see Levine, 2005). We embed the capital reallocation hypothesis in a multi-industry world equilibrium model with country-specific and global demand and supply shifts and develop its testable implications. Our empirical work indicates a significant link between financial development and capital reallocation towards industries with better investment opportunities.

The remainder of the paper is structured as follows. Section 2 contains our econometric analysis of cross-industry cross-country models. Section 2.1 sets up the general econometric framework. Section 2.2 derives the benchmarking bias of the standard cross-industry cross-country estimator. Section 2.3 describes an alternative estimator. Section 3 discusses an application of our empirical framework and estimation approach. Section 3.1 presents a theoretical model of financial development and inter-industry resource reallocation. Section 3.2 explains how the link can be tested empirically. Section 4 contains our empirical results. Section 5 summarizes.

2 Empirical Cross-Industry Cross-Country Models

We present an empirical framework that encompasses the cross-industry cross-country literature (e.g. Rajan and Zingales, 1998; Romalis, 2004; Fisman and Love, 2007; Nunn, 2007). This framework allows us to discuss the biases that arise when the industry characteristics

of one country, the benchmark country, are used to proxy industry characteristics in other countries. Our key result is that such benchmarking of industry characteristics may result in attenuation bias or amplification bias. We detail the source of amplification bias and illustrate it in a simple example and with a Monte Carlo simulation. We also explain under what circumstances the benchmarking bias can be avoided.

2.1 Empirical Framework

Suppose the theoretical model yields

$$(1) \quad y_{sn} = \alpha_n + \alpha_s + \beta z_{sn} x_n + v_{sn},$$

where $s = \{1, \dots, S\}$ are industries and $n = \{1, \dots, N\}$ countries.¹ For example, following Rajan and Zingales (1998), y_{sn} could be value-added growth of industries in different countries; z_{sn} the external-finance dependence of these industries; x_n the degree of financial development of countries; α_n and α_s country- and industry-level growth determinants; and v_{sn} unobservable growth determinants at the country-industry level. The parameter of interest in (1) is the coefficient β on the interaction term. If $\beta > 0$, financial development raises growth more in finance-dependent industries. A closely related example is Fisman and Love (2007), who focus on the interaction between financial development and growth opportunities available in each industry. A third example fitting the empirical framework in (1) is Nunn (2007), where y_{sn} refers to country-industry exports; z_{sn} to the extent intermediate inputs used by the industries are relationship specific; and x_n to the quality of contract enforcement. In this example, the interaction term allows for contract enforcement to raise exports more in industries with relationship-specific inputs.

Usually there are no data on z_{sn} for a broad set of countries. This raises the question whether β can be estimated using the industry characteristics of a benchmark country as a proxy. Such benchmarking of industry characteristics can only work if there are some industry characteristics that are common across countries (global). In the context of Rajan and Zingales (1998) and Nunn (2007) these would be technological characteristics that tend to make one industry more finance dependent or more relationship specific than another. In Fisman and Love, the global industry characteristic refers to industry growth opportunities that are available in all countries.

To capture the idea of a global industry characteristic we assume that there is an industry characteristic z_s that is common to an industry no matter where it is located. It seems

¹Alternatively, s could refer to firms and n to regions for example. We use industries and countries because currently most applications are at the country-industry level.

unreasonable to suppose that all industry characteristics are global and we therefore allow for a country-industry specific element ε_{sn} ,

$$(2) \quad z_{sn} = z_s + \varepsilon_{sn},$$

where ε_{sn} has the following main features.² First, ε_{sn} is independent of z_s . Second, $E(\varepsilon_{sn}|n) = E(\varepsilon_{sn}|s) = 0$. Third, to capture that industry characteristics z_{sn} may reflect global industry characteristics more closely in some countries than others, we allow for $\sigma_k^2 = E(\varepsilon_{sn}^2|n = k) \neq E(\varepsilon_{sn}^2|n = l) = \sigma_l^2$ for $k \neq l$. Fourth, to capture that some country pairs may have more similar industry characteristics than others, we allow for $\sigma_{kl} = E(\varepsilon_{sn}\varepsilon_{sm}|n = k, m = l) \neq E(\varepsilon_{sn}\varepsilon_{sm}|n = p, m = q) = \sigma_{pq}$ for $k \neq l \neq p \neq q$. These features can be captured by a model where the random vector $(\varepsilon_{11}, \varepsilon_{21}, \dots, \varepsilon_{S1}, \dots, \varepsilon_{SN})'$ is drawn from the following multivariate normal distribution,

$$(3) \quad \begin{pmatrix} \varepsilon_{11} \\ \varepsilon_{21} \\ \cdot \\ \varepsilon_{S1} \\ \cdot \\ \varepsilon_{SN} \end{pmatrix} \sim N \left(\begin{pmatrix} 0 \\ 0 \\ \cdot \\ 0 \\ \cdot \\ 0 \end{pmatrix}, \begin{bmatrix} \sigma_1^2 I & \sigma_{12} I & \dots & \sigma_{1N} I \\ \sigma_{21} I & \sigma_2^2 I & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \sigma_{N1} I & \sigma_{N2} I & \dots & \sigma_N^2 I \end{bmatrix} \right)$$

where I is an identity matrix of size S .

For the empirical framework to be sufficiently general to encompass the cross-industry cross-country literature, we allow v_{sn} in (1) to be related to ε_{sn} in (2),

$$(4) \quad v_{sn} = \kappa \varepsilon_{sn} + \eta_{sn},$$

where η_{sn} is i.i.d. across countries and industries and $E(\eta_{sn}|n) = E(\eta_{sn}|s) = 0$. To see the case for $\kappa \neq 0$ in an example, consider Fisman and Love's (2007) study. They argue that industries with favorable growth opportunities should see faster value-added growth in financially developed countries because well-working financial markets reallocate production factors more rapidly. The corresponding empirical framework would be $y_{sn} = \alpha_n + \alpha_s + \beta z_{sn} x_n + v_{sn}$, where y_{sn} is value-added growth, z_{sn} the growth opportunity of industry s in country n , and x_n the degree of financial development in country n . Assuming $\kappa = 0$ would be equivalent to supposing that growth opportunities affect actual growth only through the interaction with financial development. But industries may be able to adjust production along margins that do not require financial markets, by relying on internal cash-flow or

²Allowing for a country-specific element, i.e. $z_{sn} = z_n + z_s + \varepsilon_{sn}$, would not affect our results as z_n would end up being absorbed by the country fixed effect in (1). We therefore assume $z_n = 0$ for simplicity.

trade credit for example (e.g. Rajan and Zingales, 1998; Fisman and Love, 2003). $\kappa \neq 0$ allows for such alternative margins of adjustment. Another reason to allow for $\kappa \neq 0$ is that industry growth opportunities may arise because of demand shocks, which would affect prices and hence value-added growth even if industries were unable to adjust any factor of production.

An immediate implication of the empirical framework is that it would be straightforward to estimate β if we were to observe the global industry characteristic z_s . Substituting (2) and (4) in (1) yields

$$(5) \quad y_{sn} = \alpha_n + \alpha_s + \beta z_s x_n + \omega_{sn},$$

where $\omega_{sn} = \beta \varepsilon_{sn} x_n + \kappa \varepsilon_{sn} + \eta_{sn}$. Because $E(z_s x_n \omega_{sn}) = 0$, β could be estimated consistently by regressing y_{sn} on country fixed effects, industry fixed effects, and the interaction between country characteristics and global industry characteristics $z_s x_n$ using least squares (the calculation of standard errors would have to take into account that ω_{sn} is non-spherical).

But global industry characteristics are unobservable in practice. The cross-industry cross-country literature proceeds by using a proxy from a benchmark country, usually the US (z_{sUS}). The equation being estimated is

$$(6) \quad y_{sn} = \alpha_n + \alpha_s + \beta z_{sUS} x_n + residual_{sn},$$

with US data being used solely to obtain z_{sUS} . We now address two questions about this estimating equation. What is the benchmarking bias when (6) is estimated using least squares, and under what circumstances can the bias be avoided?

2.2 Benchmarking Bias

It is immediate to see that least-squares estimation of (6) will in general not yield a consistent estimate of β . (1), (2), and (4) imply that the residual in (6) is given by

$$(7) \quad residual_{sn} = \beta(\varepsilon_{sn} - \varepsilon_{sUS})x_n + \kappa \varepsilon_{sn} + \eta_{sn}.$$

Moreover, (2) implies that the interaction term on the right-hand side of (6) is $z_{sUS} x_n = z_s x_n + \varepsilon_{sUS} x_n$. Hence, the regressor of interest in (6) will in general be correlated with the residual.

To determine the least-squares bias, it is useful to write the least-squares estimator ($\hat{\beta}$)

in terms of demeaned data,³

$$(8) \quad \widehat{\beta} = \frac{\frac{1}{N} \frac{1}{S} \sum_{n=1}^N \sum_{s=1}^S (z_{sUS} x_n - z_{sUS} \bar{x} - \overline{z_{US}} x_n + \overline{z_{US} \bar{x}}) (y_{sn} - \bar{y}_n - \bar{y}_s + \bar{y})}{\frac{1}{N} \frac{1}{S} \sum_{s=1}^S \sum_{n=1}^N (z_{sUS} x_n - z_{sUS} \bar{x} - \overline{z_{US}} x_n + \overline{z_{US} \bar{x}})^2},$$

where upper bars denote (unconditional or conditional) means, i.e. $\bar{y} = \frac{1}{N} \frac{1}{S} \sum_n \sum_s y_{sn}$; $\bar{y}_s = \frac{1}{N} \sum_n y_{sn}$; $\bar{y}_n = \frac{1}{S} \sum_s y_{sn}$. Substituting for y_{sn} using (6) and (7), and taking the probability limit of (8) as N and S go to infinity, yields

$$(9) \quad \widehat{\beta}^a = \beta + \frac{\text{plim}_{N \rightarrow \infty, S \rightarrow \infty} \frac{1}{N} \frac{1}{S} \sum_{n=1}^N \sum_{s=1}^S (x_n - \bar{x}) (\beta x_n (\varepsilon_{sn} - \varepsilon_{sUS}) + \kappa \varepsilon_{sn}) \varepsilon_{sUS}}{E(z_{sUS}^2) \lim_{N \rightarrow \infty} \frac{1}{N} \sum_{n=1}^N (x_n - \bar{x})^2},$$

where $\widehat{\beta}^a$ denotes the probability limit of $\widehat{\beta}$. To obtain (9) we made use of $E(\varepsilon_{sn}|n) = E(\varepsilon_{sn}|s) = E(\eta_{sn}|n) = E(\eta_{sn}|s) = 0$. To simplify the expression in the denominator we also assumed $Ez_s = 0$.⁴

The sign of the least-squares bias is determined by the probability limit in (9). If this limit exists, it can be shown that (9) becomes

$$(10) \quad \widehat{\beta}^a = \beta + \frac{\lim_{N \rightarrow \infty} \frac{1}{N} \sum_{n=1}^N (x_n - \bar{x}) (\beta x_n (\sigma_{nUS} - \sigma_{US}^2) + \kappa \sigma_{nUS})}{E(z_{sUS}^2) \lim_{N \rightarrow \infty} \frac{1}{N} \sum_{n=1}^N (x_n - \bar{x})^2},$$

where the σ -terms are defined in (3). To go from (9) to (10), it is useful to define $\mu_{sn} = (x_n - \bar{x}) (\beta x_n (\varepsilon_{sn} - \varepsilon_{sUS}) + \kappa \varepsilon_{sn}) \varepsilon_{sUS}$ and $\mu = \frac{1}{S} \frac{1}{N} \sum_s \sum_n \mu_{sn}$. Furthermore, we also define $\bar{\mu}^N = \frac{1}{N} \sum_n (x_n - \bar{x}) (\beta x_n (\sigma_{nUS} - \sigma_{US}^2) + \kappa \sigma_{nUS})$ and $\bar{\mu} = \lim_{N \rightarrow \infty} \bar{\mu}^N$. We want to show that $\bar{\mu}$ is the probability limit of μ as N and S go to infinity. To do so we need to show that for all $\epsilon > 0$ and $\delta > 0$ there is a N', S' such that for $N \geq N', S \geq S'$ it is true that $\text{Prob}(\bar{\mu} - \epsilon \leq \mu \leq \bar{\mu} + \epsilon) \geq 1 - \delta$. The first step involves application of the law of large numbers. We rewrite μ as $\mu = \frac{1}{S} \sum_s \mu_s^N$ where $\mu_s^N = \frac{1}{N} \sum_n \mu_{sn}$. It can be checked using (3) that μ_s^N , $s = 1, \dots, S$ satisfies that $E(\mu_s^N \mu_j^N) = 0$ for $s \neq j$, that $E(\mu_s^N \mu_s^N)$ is the same for all s , and that $E\mu_s^N = \bar{\mu}^N$. Hence, by the law of large numbers, for every N there is

³In panel econometrics, this is known as the within transformation (e.g. Baltagi, 2008, Chapter 3).

⁴Allowing for $Ez_s \neq 0$ complicates the expression in the denominator without generating any interesting insights as the sign of the bias is determined by the numerator.

an \widehat{S}^N such that for $S \geq \widehat{S}^N$ it is true that $Prob(\bar{\mu}^N - \epsilon/2 \leq \mu \leq \bar{\mu}^N + \epsilon/2) \geq 1 - \delta$. The second step is to show that this implies that there is a N', S' such that for $N \geq N', S \geq S'$ it is true that $Prob(\bar{\mu} - \epsilon \leq \mu \leq \bar{\mu} + \epsilon) \geq 1 - \delta$. First note that because $\bar{\mu} = \lim_{N \rightarrow \infty} \bar{\mu}_N$, there is a \widehat{N} such that for $N \geq \widehat{N}$ we get that $\bar{\mu} - \epsilon/2 \leq \bar{\mu}^N \leq \bar{\mu} + \epsilon/2$. The first part of this inequality implies $\bar{\mu} - \epsilon \leq \bar{\mu}^N - \epsilon/2$ and the second part of the inequality implies $\bar{\mu}^N + \epsilon/2 \leq \bar{\mu} + \epsilon$. Hence, there is a \widehat{N} such that for $N \geq \widehat{N}$, $\bar{\mu} - \epsilon \leq \bar{\mu}^N - \epsilon/2 \leq \bar{\mu}^N + \epsilon/2 \leq \bar{\mu} + \epsilon$ or equivalently $[\bar{\mu}^N - \epsilon/2, \bar{\mu}^N + \epsilon/2] \subseteq [\bar{\mu} - \epsilon, \bar{\mu} + \epsilon]$. This implies that $Prob(\bar{\mu} - \epsilon \leq \mu \leq \bar{\mu} + \epsilon) \geq Prob(\bar{\mu}^N - \epsilon/2 \leq \mu \leq \bar{\mu}^N + \epsilon/2) \geq 1 - \delta$ for all $N \geq \widehat{N}$ and $S \geq \widehat{S}^N$, which is what we needed to show.

2.2.1 Benchmarking: Attenuation versus Amplification Bias

A useful starting point for understanding the implications of (10) is the special case where $\varepsilon_{sUS} = 0$ for all industries, which implies that $\sigma_{US}^2 = E\varepsilon_{sUS}^2 = 0$. In this case, US industry characteristics are equal to global industry characteristics, $z_{sUS} = z_s$ for all s . As a result, least-squares estimation of (6) is equivalent to least-squares estimation of (5). As β in (5) can be estimated consistently using least squares, the least-squares estimate of β in (6) must also be consistent. To see that this is an implication of (10) note that $\varepsilon_{sUS} = 0$ for all s implies $\sigma_{nUS} = 0$ and that substituting $\sigma_{US}^2 = \sigma_{nUS} = 0$ in (10) yields $\widehat{\beta}^a = \beta$.

Attenuation Bias Another interesting special case is when US industry characteristics differ from global industry characteristics but the discrepancy reflects US idiosyncrasies only. Formally, this corresponds to $\sigma_{US}^2 \neq 0$ and $\sigma_{nUS} = 0$. In this case, (10) simplifies to $\widehat{\beta}^a = \beta - \beta\sigma_{US}^2/Ez_{sUS}^2$. Hence, least-squares estimates are attenuated, $|\widehat{\beta}^a| < |\beta|$ for all $\beta \neq 0$. The intuition is that of the classical measurement error model.

But discrepancies between US and global industry characteristics can also result in an amplification bias, $|\widehat{\beta}^a| > |\beta|$. This can be seen most easily by assuming $\kappa = 0$ and rewriting (10) as

$$(11) \quad \widehat{\beta}^a = \beta + \beta \left(\frac{\theta - \sigma_{US}^2}{Ez_{sUS}^2} \right),$$

where $\theta = \lim_{N \rightarrow \infty} \left(\sum_n (x_n - \bar{x})x_n\sigma_{nUS} / \sum_n (x_n - \bar{x})^2 \right)$. Hence, there will be attenuation bias if $\theta < \sigma_{US}^2$ and amplification bias if $\theta > \sigma_{US}^2$. (There is also a knife-edge case $\theta = \sigma_{US}^2$ when the two countervailing forces shaping the bias offset exactly.)

We now investigate the source of amplification bias and give an example where (11) takes an especially simple form.

Amplification Bias To develop a better understanding of (11), and the condition for amplification bias $\theta > \sigma_{US}^2$, we simplify the model in (1) to⁵

$$(12) \quad y_{sn} = \beta x_n z_{sn}$$

and consider an alternative, two-step derivation of (11):

(i) Cross-Industry Analysis: For each country n obtain the least-squares effect of z_{sn} on y_{sn} using US industry characteristics z_{sUS} as a proxy for z_{sn} . This yields the following N country-specific least-squares estimates

$$(13) \quad \beta x_n + \beta x_n \left(\frac{\sigma_{nUS} - \sigma_{US}^2}{E z_{sUS}^2} \right) = \beta x_n + \beta \varphi_n \quad n = 1, \dots, N,$$

where βx_n is the true effect in country n , see (12), and $\beta \varphi_n = \beta x_n (\sigma_{nUS} - \sigma_{US}^2) / E z_{sUS}^2$ the country-specific bias due to using US industry characteristics as a proxy. Hence, the country-specific bias depends on σ_{nUS} , the covariance between unobserved industry characteristics in country n and the US.

(ii) Cross-Country Analysis: Obtain the least-squares effect of x_n on the country-specific estimates in (13). It is straightforward to check that this yields the right-hand side of (11).

This alternative derivation brings out that the bias $\widehat{\beta}^a - \beta = \beta(\theta - \sigma_{US}^2) / E z_{sUS}^2$ in (11) can be understood in terms of how the country-specific benchmarking bias $\beta \varphi_n$ in (13) varies with the country characteristic x_n . Consider the example where $\beta > 0$ and $x_n > 0$, which implies that βx_n in (12) is strictly positive for all countries. Suppose also that $\sigma_{nUS} < \sigma_{US}^2$. In this case, (13) implies that benchmarking yields least-squares estimates of the country-specific slopes βx_n that are *biased downwards* for all countries ($\beta \varphi_n < 0$). Still, if the country-specific downward bias $\beta \varphi_n$ becomes smaller in absolute value as x_n increases, the least-squares estimate of β will be *biased upwards*. Figure 1 illustrates this scenario when x_n takes two values only, $x_n \in \{x_l, x_h\}$.

Amplification and Attenuation Bias in a Simple Example An interesting special case where (11) takes a particularly simple form is the following. Suppose that the country-level variable x_n can take two values only, $x_n \in \{x_l, x_h\}$ with $x_l < x_h$. Suppose also that

⁵The first simplification is that we drop the industry and country fixed effects. This does not involve any loss of generality, but simplifies the notation. The second simplification is that we assume that $v_{sn} = 0$.

there are L countries with low x and H countries plus the US (the benchmark country) with high x .

Industry characteristics z_{sn} continue to be given by $z_{sn} = z_s + \varepsilon_{sn}$ in (2). But we assume a distribution of ε_{sn} that is a special case of (3). For the L countries in the x_l -group, ε_{sn} is generated by $L \cdot S$ independent draws from a $N(0, 1)$ distribution. For the US and the other H countries in the x_h -group, ε_{sn} is generated by S independent random vectors $(\varepsilon_{s1}, \varepsilon_{s2}, \dots, \varepsilon_{sH}, \varepsilon_{sUS})'$ drawn from a multivariate normal distribution,

$$(14) \quad \begin{pmatrix} \varepsilon_{s1} \\ \cdot \\ \varepsilon_{sH} \\ \varepsilon_{sUS} \end{pmatrix} \sim N \left(\begin{pmatrix} 0 \\ \cdot \\ \cdot \\ 0 \end{pmatrix}, \begin{pmatrix} & & & \sigma \\ & I & & \cdot \\ \sigma & \cdot & \cdot & \sigma \\ & & & 1 \end{pmatrix} \right),$$

where I is an identity matrix of size H and $-1 < \sigma < 1$. Hence, if $\sigma > 0$, there is a positive correlation between US industry characteristics and industry characteristics in other x_H -countries (while there is no correlation between US industry characteristics and industry characteristics in x_L -countries).

In this example, (11) takes a particularly simple form⁶

$$(15) \quad \widehat{\beta}^a = \beta + \beta \frac{x_l - (1 - \sigma)x_h}{(x_h - x_l) E(z_{sUS}^2)}.$$

Benchmarking therefore yields an attenuation bias if $x_l < (1 - \sigma)x_h$ and an amplification bias if $x_l > (1 - \sigma)x_h$. For example, if $x_h > 0$, there will be an amplification bias when the correlation between US industry characteristics and industry characteristics in other x_H -countries is strictly greater than $1 - x_l/x_h$.

The example lends itself to a Monte Carlo simulation. Suppose there are 30 industries, 50 countries in the x_l -group, and 25 countries plus the benchmark country in the x_h -group.⁷ Suppose also that $\beta = 0.5$, that $x_l = 190$ and $x_h = 200$, and that z_s takes a uniform distribution on $[-3, +3]$. Once a value for σ in (14) has been specified, this model can be used to generate data for y_{sn} and z_{sUS} by drawing ε_{sn} for each country and industry. The generated data can then be used to obtain a least-squares estimate of β by regressing y_{sn}

⁶Recall that θ in (11) is given by $\theta = \lim_{N \rightarrow \infty} \left(\frac{\sum_n (x_n - \bar{x}) x_n \sigma_{nUS}}{\sum_n (x_n - \bar{x})^2} \right)$. In the example, $\left(\frac{\sum_n (x_n - \bar{x}) x_n \sigma_{nUS}}{\sum_n (x_n - \bar{x})^2} \right) = \frac{H(x_h - \bar{x})x_h\sigma}{(H(x_h - \bar{x})^2 + L(x_l - \bar{x})^2)}$. Substituting for \bar{x} yields $x_h\sigma/(x_h - x_l)$ and hence that $\theta = x_h\sigma/(x_h - x_l)$. Substituting in (11) yields (15).

⁷This reflects roughly the number of industries and countries in studies using industry value added data (e.g. Rajan and Zingales, 1998; Fisman and Love, 2007).

on $x_n z_{sUS}$ where n refers to all countries except the benchmark country.⁸ We repeat the process of drawing ε_{sn} for each country and industry 1000 times, which yields 1000 different datasets and 1000 different least-squares estimates. Figure 2 plots the average least-squares estimate (dashed red line) and the least-squares estimate implied by the asymptotic least-squares formula in (15) (solid blue line) for different values of σ . It can be seen that the benchmarking approach goes from underestimating the true value $\beta = 0.5$ for small positive values of σ to overestimating it for larger values of σ .⁹ The figure also illustrates that the formula in (15) predicts the Monte Carlo result quite well.

2.2.2 Additional Sources of Benchmarking Bias

When $\kappa \neq 0$ in (4), there is a correlation between (unobservable) country-industry factors affecting industry outcomes directly, which are captured by v_{sn} in (1), and country-industry factors affecting industry outcomes through the interaction, which are captured by ε_{sn} in (2). This gives rise to an additional source of benchmarking bias that is likely to be relevant in practice. To see this in the simplest possible case, suppose that $\beta = 0$. In this case (10) can be written as $\hat{\beta}^a = \kappa\pi / Ez_{sUS}^2$ where $\pi = \lim_{N \rightarrow \infty} \left(\sum_n \sigma_{nUS}(x_n - \bar{x}) / \sum_n (x_n - \bar{x})^2 \right)$ is the least-squares slope when regressing σ_{nUS} on x_n . Hence, even though $\beta = 0$, benchmarking industry characteristics will lead to a strictly positive $\hat{\beta}^a$ if κ and π have the same sign and a strictly negative $\hat{\beta}^a$ if κ and π have the opposite sign. The standard cross-industry cross-country approach can therefore result in a significant interaction effect although in fact there is no interaction between country and industry characteristics. Intuitively, the bias arises because US industry characteristics are more closely related to the industry characteristics of some countries than others and industry characteristics and industry outcomes are jointly determined.

2.3 Avoiding the Benchmarking Bias

In some circumstances it is possible to avoid the benchmarking bias and obtain a consistent estimate of β . To see when this is the case, suppose we observed an industry characteristic γ_s that is proportional to the global industry characteristic z_s , $\gamma_s = \mu z_s$. This allows estimating (6) using an instrumental-variables (2SLS) approach with $\gamma_s x_n$ as an instrument for $z_{sUS} x_n$. The resulting estimate of β would be consistent because γ_s is correlated with z_{sUS} (both reflect the global industry characteristic) but uncorrelated with the residual of the

⁸The cross-industry cross-country literature always excludes the benchmark country from the regression analysis. We follow this convention although it makes no difference in practice.

⁹To ensure that the variance-covariance matrix in (14) is positive semi-definite, σ cannot exceed a value that depends on H . This is the reason why the largest σ in Figure 2 is well below 1.

estimating equation detailed in (7). As is well understood, such an instrumental-variables approach would continue to yield consistent estimates if instead of γ_s we used a consistent estimator $\hat{\gamma}_s$, see Wooldridge (2002), Section 6.1.2 for example. To see that obtaining such a consistent estimator is feasible in some circumstances, note that (5) can be rewritten as $y_{sn} = \alpha_n + \alpha_s + \gamma_s x_n + \omega_{sn}$ and that the industry-specific slopes $\gamma_s = \beta z_s$ are proportional to z_s as long as $\beta \neq 0$. Moreover, the industry-specific slopes in (5) can be estimated consistently using least squares under the (usual) assumption that $plim_{N \rightarrow \infty} \frac{1}{N} \sum_n \omega_{sn} = 0$.¹⁰ Hence, if $plim_{N \rightarrow \infty} \frac{1}{N} \sum_n \omega_{sn} = 0$, β can be estimated consistently using a two-step approach. First, obtain least-squares estimates $\hat{\gamma}_s$ of the industry-specific slopes in (5). If these slopes are jointly significant, apply 2SLS to (6) using $\hat{\gamma}_s x_n$ as an instrument for $z_{sUS} x_n$.¹¹

The two-step instrumental-variables approach can be applied to the Monte Carlo data we generated at the end of Section 2.2.1. The first step involves using one of the generated datasets to obtain least-squares estimates $\hat{\gamma}_s$ of the industry-specific slopes in $y_{sn} = \gamma_s x_n + \omega_{sn}$. The second step involves obtaining a 2SLS estimate of β by estimating $y_{sn} = \beta z_{sUS} x_n + residual_{sn}$ using $\hat{\gamma}_s x_n$ as an instrument for $z_{sUS} x_n$. Repeating this for each of the 1000 generated datasets yields 1000 2SLS estimates of β . Figure 3 plots the average of these estimates (solid blue line) for different values of σ . It can be seen that the average 2SLS estimate stays much closer to the true value of $\beta=0.5$ than the average estimate obtained using the benchmarking approach (dashed red line).

3 The Capital Reallocation Hypothesis: From Theory to Empirical Testing

According to an influential conjecture, higher levels of financial development lead to capital being reallocated more rapidly from declining industries to industries with good investment opportunities (e.g. Bagehot, 1873; Schumpeter, 1911; Rajan and Zingales, 1998; Levine 1997 and 2005; Fisman and Love, 2007). To develop the implications of this conjecture for industry growth, we embed it in a multi-industry world equilibrium model with country-specific and global demand and supply shifts. We also discuss under which conditions the capital reallocation hypothesis can be tested with the available industry data.

¹⁰A sufficient condition for this assumption to be satisfied in our empirical framework is that x_n is bounded above and below.

¹¹Rejection of the hypothesis that the slopes in (5) are zero implies rejection of the hypothesis $\beta = 0$.

3.1 Theoretical Framework

The world consists of a continuum of open economies inhabited by households with love-for-variety preferences for goods in a continuum of industries. Firms take goods prices as given and prices adjust to clear goods markets. In economies with perfect financial markets, the allocation of capital equalizes rates of return across industries. In financially underdeveloped economies, there are frictions that slow down the reallocation of capital towards sectors with high returns to capital.

Preferences, Demand, and Technology The continuum of open economies has mass N and the continuum of industries has mass S . Each industry consists of varieties differentiated by country of origin. Household preferences at time t are $U_t = \int_0^S \ln \left(\int_0^N B_{snt}^{1-\rho} c_{snt}^\rho dn \right)^{1/\rho} ds$ with $\rho < 1$, where c_{snt} is consumption of the country- n variety in industry s in period t and B_{snt} is a preference shifter. These preferences imply that households spend a constant share of income in each industry and that the elasticity of substitution between varieties in the same industry is $1/(1 - \rho)$.

Households take prices as given and maximize utility subject to their budget constraint, $\int_0^N \int_0^S p_{snt} c_{snt} ds dn \leq m_{ht}$, where m_{ht} denotes expenditures of household h in period t and p_{snt} is the price of the country- n variety in industry s . The implied demand function for each variety is

$$(16) \quad c_{snt} = B_{snt} M_{st} \left(\frac{p_{snt}}{P_{st}} \right)^{-1/(1-\rho)},$$

where $P_{st} = \left(\int_0^N B_{snt} p_{snt}^{-\rho/(1-\rho)} dn \right)^{-(1-\rho)/\rho}$ is the price index for industry s and M_{st} real world expenditures in industry s . Hence, demand for the country- n variety in industry s is increasing in the preference shifter and world expenditures in industry s , and decreasing in its relative price p_{snt}/P_{st} .

Each variety can be produced by a continuum of firms using the country-industry specific production technology

$$(17) \quad q_{snt} = A_{snt} K_{snt}$$

where q_{snt} is output, A_{snt} total factor productivity, and K_{snt} capital.

Capital Allocation with Perfect Financial Development In countries with perfect financial markets, the return to capital $p_{snt} A_{snt}$ in each industry is equal to the user cost of capital r_t ,

$$(18) \quad p_{snt} A_{snt} = r_t.$$

Combined with demand in (16) and supply in (17), (18) implies the inter-industry capital allocation

$$(19) \quad K_{snt}^* = A_{snt}^{\rho/(1-\rho)} B_{snt}^{1/(1-\rho)} \frac{M_{st} P_{st}^{1/(1-\rho)}}{r_t^{1/(1-\rho)}},$$

which we refer to as the frictionless allocation of capital. Hence, an industry will be allocated more capital if there is an upwards shift in demand and, as long as the elasticity of substitution between varieties is greater than unity, if there is an increase in total factor productivity. Moreover, capital is increasing in industry expenditures as well as prices charged by the international competition, and decreasing in the user cost of capital.

To go from capital stocks to capital growth we log-differentiate (19) over time and take productivity growth $\Delta \ln A_{sn}$ and demand growth $\Delta \ln B_{sn}$ to be the sum of a country specific, an industry specific, and a country-industry specific component, i.e. $\ln A_{sn} = a_n + a_s + a_{sn}$ and $\Delta \ln B_{sn} = b_n + b_s + b_{sn}$. This implies that frictionless industry capital growth in country n can be written as

$$(20) \quad \Delta \ln K_{sn}^* = \Delta \ln K_s^* + \Delta \ln K_n^* + \varepsilon_{sn},$$

where $\varepsilon_{sn} = \rho a_{sn}/(1-\rho) + b_{sn}$. $\Delta \ln K_s^*$ is frictionless capital growth at the industry level due to global demand and supply shifts, which captures global industry investment opportunities. $\Delta \ln K_n^*$ reflects country-specific demand and supply shifts.¹²

Capital Allocation with Frictions Consider a group of countries that experience industry-specific demand and supply shifts starting from a situation where rates of return are equalized across industries. To capture that financial underdevelopment may slow down inter-industry capital reallocation in response to demand and supply shifts, we use a partial adjustment model where the speed of adjustment may depend on the country's level of financial development $\phi_c \in [0, 1]$,¹³

$$(21) \quad \Delta \ln K_{sn} = ((1-\lambda) + \lambda\phi_n) \Delta \ln K_{sn}^*$$

¹²Koren and Tenreyro (2007) document global shocks to industry growth using the same international industry data we will be using for our empirical work in Section 4. They also quantify the relative importance of global industry shocks, industry shocks that are idiosyncratic to countries, and country-specific shocks. They find that country-specific shocks (which will be absorbed by country-specific fixed effects in our empirical work) are most important. Global industry shocks and industry shocks idiosyncratic to countries are of a similar order of magnitude.

¹³The partial adjustment model postulates partial adjustment of a variable to its target and has been used to model the adjustment of employment (e.g. Nickel, 1986) and capital (e.g. Flannery and Rangan, 2006). In our application, the target is the frictionless capital stock and the partial adjustment model is therefore $K_{snt+1} - \ln K_{snt} = \pi (\ln K_{snt+1}^* - \ln K_{snt})$. When the speed of adjustment depends on financial development, $\pi = (1-\lambda) + \lambda\phi_n$, and countries start from a situation where rates of return are equalized across sectors, this yields (21).

with $\lambda \in [0, 1]$. The scenario of perfect financial development corresponds to $\phi_n = 1$. In this case, actual capital growth is identical to frictionless capital growth, $\Delta \ln K_{sn} = \Delta \ln K_{sn}^*$. When financial development is less than perfect, $\phi_n < 1$, industry capital growth will be $(1 - \lambda) + \lambda\phi_n$ times what it would have been in the frictionless scenario. Hence, when $\lambda = 0$, inter-industry capital reallocation is not distorted (slowed down) by financial underdevelopment. The closer λ to 1, the stronger the distortion implied by financial underdevelopment.

With sufficient data on capital stocks at the country-industry level, we could test whether financial underdevelopment slows down capital reallocation towards industries with good investment opportunities using (20) and (21). But there is little international capital data and almost none at the industry level. On the other hand, there is value added data at the industry level for a large sample of countries (e.g. Rajan and Zingales, 1998; Fisman and Love, 2007). It is therefore worthwhile to examine whether the inter-industry capital reallocation hypothesis can be tested with value added data. This requires taking the step from industry capital growth to industry value-added growth. Industry value-added growth is $\Delta \ln Y_{sn} = \Delta \ln(p_{sn}A_{sn}K_{sn})$, which can be written as $\Delta \ln Y_{sn} = \Delta \ln(p_{sn}A_{sn}) + \Delta \ln(K_{sn})$ where $\Delta \ln(p_{sn}A_{sn})$ is the growth rate of the return to capital in each industry. Using demand in (16), supply in (17), and the definition of frictionless capital in (19), allows us to rewrite the growth in the return to capital as

$$(22) \quad \Delta \ln(p_{sn}A_{sn}) = (1 - \rho)(\Delta \ln K_{sn}^* - \Delta \ln K_{sn}) + \Delta \ln r.$$

Hence, the return to capital will be growing faster than the user cost of capital if the industry gets less than the frictionless amount of capital. Moreover, the wedge between industry returns and user cost is smaller the greater the elasticity of substitution between varieties.

Using (21) and (22) in $\Delta \ln Y_{sn} = \Delta \ln(p_{sn}A_{sn}) + \Delta \ln(K_{sn})$, allows us to obtain industry value-added growth as a function of frictionless capital growth

$$(23) \quad \Delta \ln Y_{sn} = ((1 - \theta) + \theta\phi_n) \Delta \ln K_{sn}^* + \Delta \ln r,$$

where $\theta = \lambda\rho$. One important implication of (23) is that the effect of financial development on industry value-added growth depends on the product of λ , the effect of financial underdevelopment on inter-industry capital reallocation, and ρ , which captures the elasticity of substitution between varieties. Available estimates of ρ at the level of industry disaggregation we employ in our empirical work are between 0.8 and 0.9, see Feenstra (2004) and Broda and Weinstein (2006). Hence, θ should be quite close to λ in practice.¹⁴

¹⁴Broda and Weinstein (2006), for example, find an average elasticity of substitution among varieties during the 1972-1998 period between 6 and 11, depending on the level of disaggregation. These estimates imply a value of ρ between 0.8 and 0.9.

3.2 Testing the Capital Reallocation Hypothesis

Making use of (20) allows us to rewrite (23) as

$$(24) \quad \Delta \ln Y_{sn} = \alpha_n + [(1 - \theta)\Delta \ln K_s^*] + \theta\phi_n [\Delta \ln K_s^* + \varepsilon_{sn}] + (1 - \theta)\varepsilon_{sn},$$

where $\alpha_n = ((1 - \theta) + \theta\phi_n) \Delta \ln K_n^* + \Delta \ln r$ depends on country-specific terms only. It is straightforward to check that (24) is a special case of the empirical framework in Section 2. Hence, we can apply the estimation approaches discussed there.

(i) US Benchmarking: One way to go from (24) to an equation that can be estimated with the available data is to use US industry capital growth as a proxy for industry investment opportunities. This yields the following estimating equation

$$(25) \quad \Delta \ln Y_{sn} = \alpha_n + [(1 - \theta)\Delta \ln K_s^*] + \theta\phi_n \Delta \ln K_{sUS} + residual_{sn}.$$

As shown in Section 2.2, estimating (25) with least squares (using industry fixed effects to capture the term in square brackets) yields a consistent estimate of θ if US capital growth reflects global investment opportunities only. If this is not the case, estimates of θ may be biased upwards or downwards.

(ii) Addressing Benchmarking Bias: Under what conditions can we address the benchmarking bias following the approach discussed in Section 2.3? Breaking up the term in the second square bracket in (24), $\Delta \ln K_s^* + \varepsilon_{sn}$, yields

$$(26) \quad \Delta \ln Y_{sn} = \alpha_n + [(1 - \theta)\Delta \ln K_s^*] + [\theta\Delta \ln K_s^*] \phi_n + (1 + \theta(\phi_n - 1))\varepsilon_{sn}.$$

The terms in square brackets, $(1 - \theta)\Delta \ln K_s^* = \alpha_s$ and $\theta\Delta \ln K_s^* = \gamma_s$, depend solely on the industry. Moreover, because global industry investment opportunities are equal to industry growth in a country with perfect financial development ($\phi_{PF} = 1$) subject to global shocks only, it follows that

$$(27) \quad \Delta \ln K_s^* = \alpha_s + \gamma_s \phi_{PF}.$$

If $plim_{N \rightarrow \infty} \frac{1}{N} \sum_n \varepsilon_{sn} = 0$, least-squares estimation of (26) yields consistent estimates of the industry-specific intercepts α_s and the industry-specific slopes γ_s . Substituting these estimates in (27), yields a consistent estimate of global industry investment opportunities

$\Delta \ln \widehat{K}_s^*$. The interaction between financial development and estimated global industry investment opportunities, $\phi_n \Delta \ln \widehat{K}_s^*$, can then be used as an instrument for $\phi_n \Delta \ln K_{sUS}$ to obtain a consistent estimate of the interaction effect in (25), see Wooldridge (2002), Section 6.1.2 for example.

4 Data and Estimation Results

4.1 Data

Our industry value added data come from the Industrial Statistics of the United Nations Industrial Development Organization, which has data for up to 28 3-digit International Standard Industrial Classification manufacturing industries for a maximum of about 80 countries. Most research using these data focuses on the 1980-1989 period where coverage is highest. We report results for the 1980-1989 period, with 1607 country-industry observations in 67 countries, and the 1980-1995 period, with 1354 country-industry observations in 58 countries. Following the literature, our samples do not include countries with data for less than 10 industries and with less than five years of data for each country-industry. We also follow the literature in dropping the US because it is the country used for industry benchmarking.

Our US proxy for industry investment opportunities, US industry capital growth, is taken from the NBER Manufacturing Productivity Database (Bartelsman and Gray, 1996).¹⁵ We use the same database to obtain US industry employment growth. Our main proxy for financial development is credit provided to the private sector relative to GDP, averaged over the relevant sample period (for more on this measure of financial development see Levine, 2005, and Djankov *et al.*, 2007).¹⁶ The data are taken from the World Bank's World Development Indicators. We also present results for a broader index of total finance, which sums bank credit and stock market capitalization, and for an index of state ownership of banks. The Data Appendix lists country samples, variable definitions, and data sources. Our Web Appendix contains more details on the main industry-level variables, as well as further empirical results.¹⁷

¹⁵Wurgler (2000) and Fisman and Love (2007) examine the financial development interaction with industry growth opportunities, which they proxy by value-added growth and sales growth respectively. Our focus is on investment opportunities and we therefore use capital growth as a proxy. Ciccone and Papaioannou (2006) argue theoretically and empirically that capital growth reflects expectations about the future profitability of investment better than value-added or sales growth.

¹⁶See La Porta *et al.* (1997, 1998) and Djankov *et al.* (2007) for empirical evidence on the determinants of financial development and private credit in particular.

¹⁷For example, empirical results for the 1970-1989 period and the 1970-1995 period. The Web Appendix is available at www.antoniociccone.eu.

4.2 Main Results

Least-Squares Estimation The baseline estimating equation is

$$(28) \quad \Delta \ln Y_{sn} = \alpha_n + \alpha_s + \beta FD_n \Delta \ln K_{sUS} + residual_{sn},$$

where FD_n denotes financial development in country n and $\Delta \ln K_{sUS}$ the US proxy for investment opportunities in industry s . Our least-squares results for 1980-1989 are in Table 1, Panel A and our results for 1980-1995 in Table 2, Panel A.

Column (1) of Table 1, Panel A shows that the interaction between financial development and industry investment opportunities enters positively and is statistically significant for 1980-1989. Hence, industries with better investment opportunities, as proxied by US capital growth, grew faster in financially developed countries. Column (2) controls for the log of industry value added at the beginning of the sample period. This control is used in the literature to account for initial differences in the production structure (e.g. Rajan and Zingales, 1998; Fisman and Love, 2003; Claessens and Laeven, 2003; Aghion *et al.* 2010). It can be seen that initial value added enters significantly. The coefficient on the interaction effect changes little.¹⁸ The coefficient implies an annual growth differential of approximately 1 percentage point between the industry at the 75th percentile and the industry the 25th percentile of $\Delta \ln K_{sUS}$ (Plastic Products versus Industrial Chemicals) when they operate in a country with private credit at the 75th percentile rather than a country close to the 25th percentile (Chile versus Ecuador). This effect is large relative to mean and median annual industry value-added growth in our sample (1.5% and 1.3% respectively).

Rajan and Zingales (1998) argue that financial development affects industry growth differentially because industries differ in their technological demand for external finance. The specification in column (3) adds the Rajan and Zingales interaction between financial development and the external-finance dependence of industries, which they proxy by 1 minus the cash-flow to investment ratio of US industries.¹⁹ The interaction between financial development and industry investment opportunities remains positive and statistically significant.

Industry growth may also be affected by slow labor reallocation across industries due to inflexible labor market institutions (e.g. Blanchard, 2000; Caballero *et al.* 2006). The specification in column (4) adds an interaction between US-industry employment growth over the 1980-1989 period and the Botero *et al.* (2004) index of labor market regulation.

¹⁸Since the initial industry value added control does not emerge from our theoretical framework, we estimated all specifications without it. This did not affect our main results, see our Web Appendix. We keep the control to facilitate comparison with the existing literature.

¹⁹The original Rajan and Zingales data is for a mix of 3- and 4-digit industries. We use the data of Klingebiel, Kroszner, and Laeven (2007), which is available for all 3-digit industries in our sample.

This index reflects the flexibility of employment arrangements, the power of unions, and the generosity of social benefits. The interaction between financial development and industry investment opportunities continues to enter positively and significantly.²⁰

Column (5) controls jointly for the labor market interaction and the Rajan and Zingales interaction. The coefficient on the interaction between financial development and industry investment opportunities remains statistically significant and in line with our previous results.

Table 2, Panel A presents the same results for the (smaller) 1980-1995 sample. The interaction between financial development and industry investment opportunities is always positive but the effect is weaker than in the 1980-1989 sample. Still, the effect remains statistically significant, except in the last column where none of the interactions enters significantly.

Instrumental-Variables Estimation We estimate global industry investment opportunities, $\Delta \ln K_s^*$ in (27), as explained in Section 3.2. We first estimate $\Delta \ln Y_{sn} = \alpha_n + \alpha_s + \gamma_s FD_n + residual_{sn}$ with least squares using data for all countries except the US. Then we obtain the estimate of global investment opportunities as predicted industry growth in a country with perfect (in practice, US) financial development $\Delta \widehat{\ln K_s^*} = \widehat{\alpha}_s + \widehat{\gamma}_s FD_{US}$.

First-Stage Estimation Our instrumental-variables approach uses the interaction between country characteristics and estimated global industry investment opportunities, $x_n \Delta \widehat{\ln K_s^*}$, as an instrument for $x_n \Delta \ln K_{sUS}$. In particular, we instrument $FD_n \Delta \ln K_{sUS}$ in (28) with $FD_n \Delta \widehat{\ln K_s^*}$. The corresponding first stage is a least-squares regression of $FD_n \Delta \ln K_{sUS}$ on country fixed effects, industry fixed effects, and $FD_n \Delta \widehat{\ln K_s^*}$.²¹ This regression yields a point estimate of 0.48 with a t -statistic of 11.06 for the 1980-1989 period, and a point estimate of 0.49 with a t -statistic of 10.11 for the 1980-1995 period.²²

²⁰This remains true when we use sub-components of the labor-market regulation index. The finance interaction continues to be statistically significant when we use cross-country (non-US) industry employment growth data to instrument US employment growth by predicted employment growth in a country with the US level of labor market regulation. The necessary data is available from the Industrial Statistics of the United Nations Industrial Development Organization. See the Web Appendix for detailed empirical results.

²¹The least-squares standard error of the coefficient on $FD_n \Delta \widehat{\ln K_s^*}$ is valid for testing the null hypothesis of no effect (the relevant hypothesis as far as instrument strength is concerned) although the industry-specific part of the interaction is estimated, see Wooldridge (2002), Section 6.1.1.

²²Estimated global industry investment opportunities turn out to explain a significant part of US industry capital growth. A least-squares regression of $\Delta \ln K_{sUS}$ on $\Delta \widehat{\ln K_s^*}$ yields a point estimate of 0.48 with a t -statistic of 3.54 for 1980-1989 ($R^2 = 0.33$), and a point estimate of 0.49 with a t -statistic of 3.33 for 1980-1995 ($R^2 = 0.34$). Hence, an improvement in the global (non-US) investment opportunity of 1 percentage point translates into an increase in US capital growth of around 0.5 percentage points. See our Web Appendix for figures illustrating the strong link.

Second-Stage Estimation Table 1, Panel B reports our instrumental-variables (2SLS) estimates of (28) for the 1980-1989 period. The coefficient on the interaction between financial development and industry investment opportunities is positive and statistically significant. This continues to be the case when we control for the initial log level of industry value added in column (2). Moreover, the interaction effect changes little when we control for the Rajan and Zingales (1998) interaction between financial development and industry external-finance dependence in column (3), the interaction between labor market regulation and industry employment growth in column (4), or both in column (5). Comparing the instrumental-variables results in Panel B with the least-squares results in Panel A indicates that least-squares estimates are attenuated.²³

Table 2, Panel B presents the same results for the (smaller) 1980-1995 sample. The interaction between financial development and industry investment opportunities is always positive and statistically significant. Moreover, and in contrast to our least-squares results, the effect tends to be somewhat stronger for 1980-1995 than 1980-1989.

4.3 Additional Evidence and Sensitivity Analysis

Legal Quality, Property Rights, and Human Capital In Tables 3 and 4 we examine whether the link between financial development and growth in industries with better investment opportunities is driven by the effectiveness of the legal system or property rights protection, two important aspects of the quality of a country's institutions. We also examine whether it is human capital rather than financial development that drives growth in industries with better investment opportunities. Table 3 reports results for the 1980-1989 period and Table 4 for 1980-1995. We report least-squares estimates in Panel A and instrumental-variables (2SLS) estimates in Panel B.

Columns (1)-(2) use Djankov, McLiesh, and Shleifer's (2007) index of legal system ineffectiveness to examine whether industry growth is explained by the interaction between the legal system and investment opportunities, rather than the interaction of investment opportunities with financial development. In column (1) we find that countries with ineffective legal systems experience slower growth in industries with better investment opportunities. Column (2) shows that the financial development interaction remains a positive and statistically significant determinant of growth in industries with better investment opportunities.²⁴

Claessens and Laeven (2003) find that property rights protection, as proxied by the

²³A Hausman test yields that the difference between the least-squares and instrumental-variables estimate is statistically significant at the 0.1% level.

²⁴Our instrumental-variables approach instruments (all) $x_n \Delta \ln K_{sUS}$ interactions with $x_n \Delta \widehat{\ln K_s^*}$. Hence all interactions involving industry investment opportunities are treated symmetrically.

Heritage Foundation's economic freedom index, improves resource allocation across industries. We therefore examine whether property rights protection also has an effect on growth in industries with better investment opportunities. Column (3) shows that countries with better property rights protection see faster growth in industries with better investment opportunities. The specification in column (4) adds the financial development interaction with industry investment opportunities, which enters positively in both sample periods but is statistically significant only for the 1980-1995 period. Our instrumental-variables estimates yield a statistically significant interaction between industry investment opportunities and financial development for both sample periods.

Taking advantage of industry growth opportunities may be easier in countries with a well-educated labor force. Columns (5)-(6) examine this issue by adding an interaction between industry investment opportunities and country-level average years of schooling in 1980 from Barro and Lee (2001). Column (5) indicates that countries with higher levels of schooling see faster growth in industries with better investment opportunities. Column (6) shows that the financial development interaction remains a positive and statistically significant determinant of growth in industries with better investment opportunities. This result holds for both sample periods, whether we use a least-squares or an instrumental-variables approach.

Column (7) controls jointly for all the factors examined in the previous columns. The interaction between financial development and industry investment opportunities remains positive and statistically significant in both sample periods and for both estimation methods.

Economic versus Financial Development Table 5 examines whether financial development continues to have an effect on growth in industries with better investment opportunities when the country's level of economic development is accounted for. Our measure of economic development is GDP per capita in 1980 from the Penn World Tables. The presumption is that GDP per capita summarizes the many factors contributing to the economic development of a country. Least-squares estimation yields a positive and statistically significant effect of the interaction between financial development and industry investment opportunities. Our instrumental-variables estimates also yield a statistically significant interaction between financial development and industry investment opportunities. Hence, financial development raises growth in industries with better investment opportunities even when economic development is accounted for.

Alternative Measures of Financial Development Table 6 explores alternative measures of financial development. Columns (1)-(2) use a very broad measure of financial devel-

opment, the sum of bank credit and stock market capitalization relative to GDP. The data are from the World Bank's World Development Indicators. The interaction between financial development and industry investment opportunities enters statistically significantly, whether we use least squares or instrumental variables. Columns (3)-(4) report results when we use an index of government ownership of banks in 1970 to capture financial (under)development. The index is taken from La Porta *et al.* (2002) and refers to 1970.²⁵ Our results show that the interaction of government ownership with industry investment opportunities enters with a negative and statistically significant coefficient. Hence, greater government ownership of banks lowers growth in industries with better investment opportunities.

5 Summary

Using international industry data to examine the economic effects of cross-country differences in financial development, institutional quality, and other potential determinants of aggregate economic activity is attractive for two main reasons. It permits testing whether the impact of, say, financial underdevelopment or malfunctioning institutions is strongest in the industries where it should be theoretically. This helps bringing empirical work closer to the mechanisms emphasized by economic theory. Moreover, using international industry data also allows addressing some of the reverse causation and omitted variable issues present in standard cross-country empirical work.

But the cross-industry cross-country approach is not without potential pitfalls. It requires specifying which industries should be affected most by financial underdevelopment, malfunctioning institutions, etc. The lack of international data on the relevant industry characteristics has led most of the literature to rely on US data. We have derived the bias of this approach and shown that proxying the relevant industry characteristics with US data (or data from another benchmark country) can result in an attenuation bias or an amplification bias. We also described circumstances allowing for an alternative approach that yields consistent estimates. As an application, we have examined whether financial development facilitates the reallocation of capital from declining industries to industries with good investment opportunities.

²⁵La Porta *et al.* (2002) also have data for 1995, which post-dates our sample periods.

Data Appendix

- **Countries in the 1980-1989 and 1980-1995 sample:** Australia, Austria, Belgium, Bangladesh, Bolivia, Barbados, Canada, Chile, Côte d'Ivoire, Cameroon, China, Colombia, Costa Rica, Cyprus, Ecuador, Egypt, Spain, Finland, France, United Kingdom, Greece, Hungary, Indonesia, India, Ireland, Iran, Islamic Rep., Iceland, Israel, Italy, Jamaica, Jordan, Japan, Kenya, Korea, Rep., Kuwait, Morocco, Sri Lanka, Malta, Mexico, Mauritius, Malawi, Malaysia, Netherlands, Norway, New Zealand, Philippines, Poland, Portugal, Senegal, Singapore, Sweden, Trinidad and Tobago, Turkey, Uruguay, Venezuela, Zimbabwe. **Only 1980-1989:** Burundi, Central African Republic, Denmark, Fiji, Germany, Luxembourg, Pakistan, Panama, Papua New Guinea, South Africa, Swaziland. **Only 1980-1995:** El Salvador, Tanzania.

Variable Definitions and Sources

Country-Industry Specific

- **Value Added Growth** [$\Delta \ln Y_{sn}$]: Annual change of log value added in industry s in country n . Source: United Nations Industrial Development Organization, Industrial Statistics, 2005.
- **Initial Conditions:** Natural logarithm of value added in the beginning of the sample (1980). Source: United Nations Industrial Development Organization Statistics, 2005.

Industry-Specific

- **US External Finance Dependence:** Industry reliance on external sources of financing, defined as the industry-level median of the ratio of capital expenditure minus cash flow to capital expenditure for U.S. firms averaged over the period 1980-1989. Source: Klingebiel, Kroszner, Laeven (2007); constructed as in Rajan and Zingales (1998) at the 3-digit ISIC. Original source: COMPUSTAT.
- **US Employment Growth:** Annual change of log employment in the US over the 1980-1989 or 1980-1995 period. Source: NBER-CES Manufacturing Industry Database (Bartelsman and Gray, 1996).
- **US Capital Growth** [$\Delta \ln K_{sUS}$]: Annual change of log real capital stock in industry s in the US over the 1980-1989 or 1980-1995 period. Source: NBER-CES Manufacturing Industry Database (Bartelsman and Gray, 1996).

Country-Specific

- **Financial Development** [FD_n]: Domestic credit to the private sector relative to GDP. Domestic credit refers to financial resources provided through loans, purchases of non-equity securities, trade credits, and other accounts receivable that establish a claim for repayment. We use the natural logarithm of the average of the variable over the period 1980-1989. Source: World Bank World Development Indicators Database (2005).
- **Total finance**: Alternative index of financial development that incorporates both private credit and stock market capitalization. Total finance is the sum of bank credit to GDP and stock market capitalization to GDP. We assume that unavailable stock market capitalization data implies inexistent stock markets. We use the natural logarithm of the average of the variable over the period 1980-1989. Source: World Bank World Development Indicators Database (2005).
- **State Bank Ownership**: Government ownership of banks in 1970. Source: La Porta, Lopez-de-Silanes, and Shleifer (2002).
- **Economic Development**: Natural logarithm of real per capita GDP in 1980. Source: Penn World Tables 5.6.
- **Property Rights**: Index of property rights protection ranging from 1 to 5, with higher values indicating better protection. The index is calculated as in Claessens and Laeven (2003) and refers to the 1995-1999 period (no earlier data is available). Source: The Index of Economic Freedom (The Heritage Foundation), 2005 edition.
- **Labor Market Regulation**: Labor-market regulation index based on the existence of alternative employment contracts, the cost of increasing hours, the cost of firing, and the formality of dismissal procedures. The variable ranges from zero to a hundred where higher values indicate a greater extent of labor market regulation. Source: Botero, Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2004).
- **Legal Inefficiency**: Index of the ineffectiveness of the legal/court system, based on the number of days to resolve a payment dispute through courts. Source: Djankov, McLiesh and Shleifer (2007).
- **Schooling**: Average years of schooling of the population aged 25 and over in 1980. Source: Barro and Lee (2001).

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Figure 1: Illustrating the LS Amplification Bias

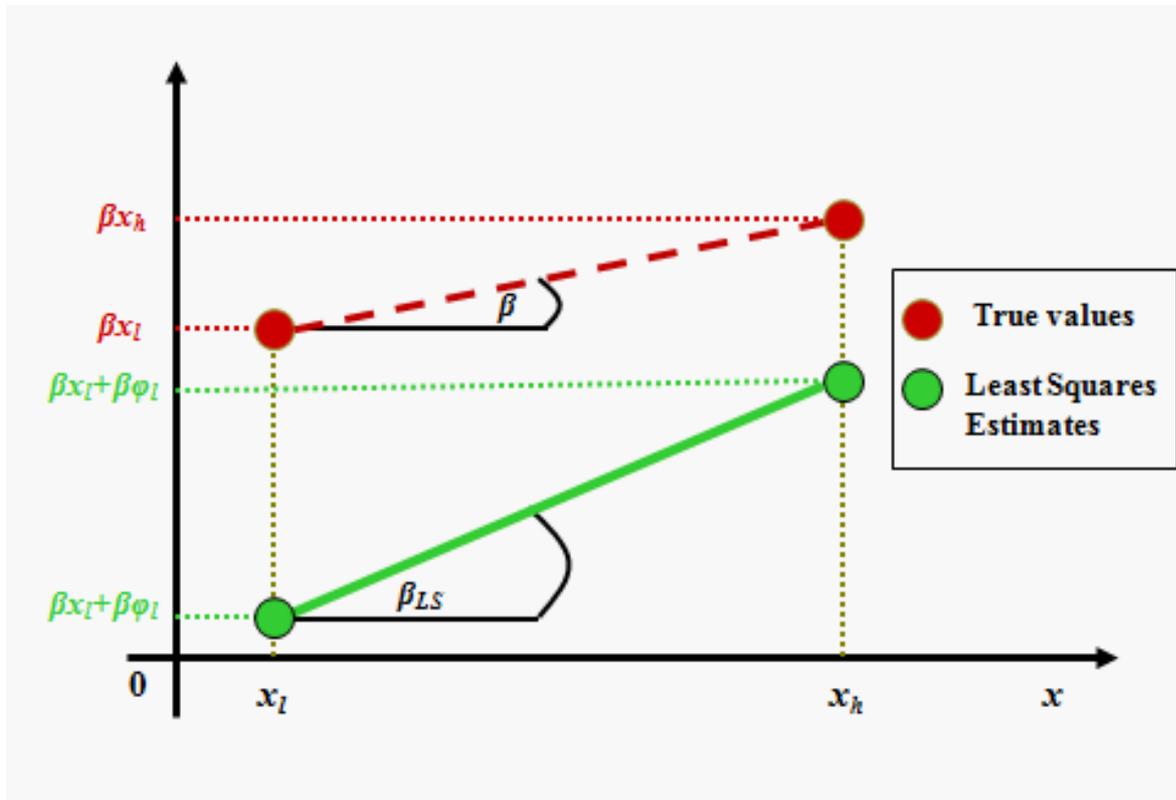


Figure 1 illustrates the amplification bias of the standard cross-industry cross-country estimator when x takes only two values. The slope of the dashed red line is the true effect and the slope of the solid green line the least-squares estimate. The green line is based on equation (13). See the Sub-Section entitled "Amplification Bias" in Section 2.2.1 for an explanation.

**Figure 2: Monte Carlo Simulation
LS Benchmarking Bias**

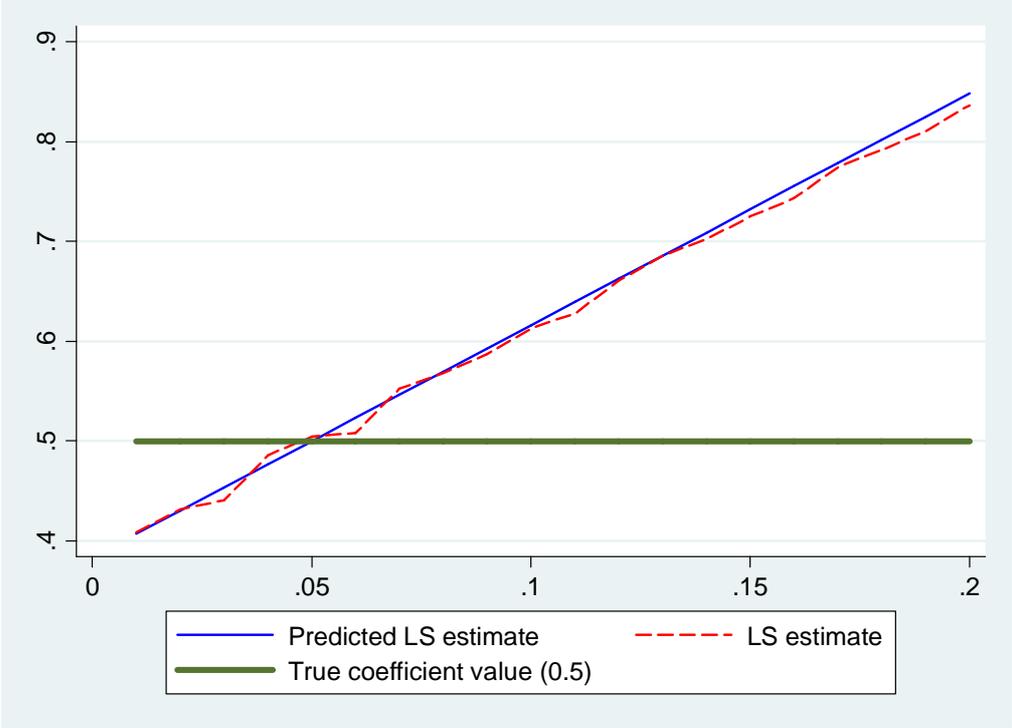


Figure 2 plots the bias of the standard cross-industry cross-country estimator in a Monte Carlo simulation (on the vertical axis) for different values of σ (on the horizontal axis) in (14). The dashed red line is the average least-squares (LS) estimate from the Monte Carlo simulation. The solid blue line is the asymptotic bias implied by equation (15). The true parameter value is 0.5. See the Sub-Section entitled "Amplification and Attenuation Bias in a Simple Example" in Section 2.2.1 for an explanation.

**Figure 3: Monte Carlo Simulation
Comparing the LS and the IV Estimate**

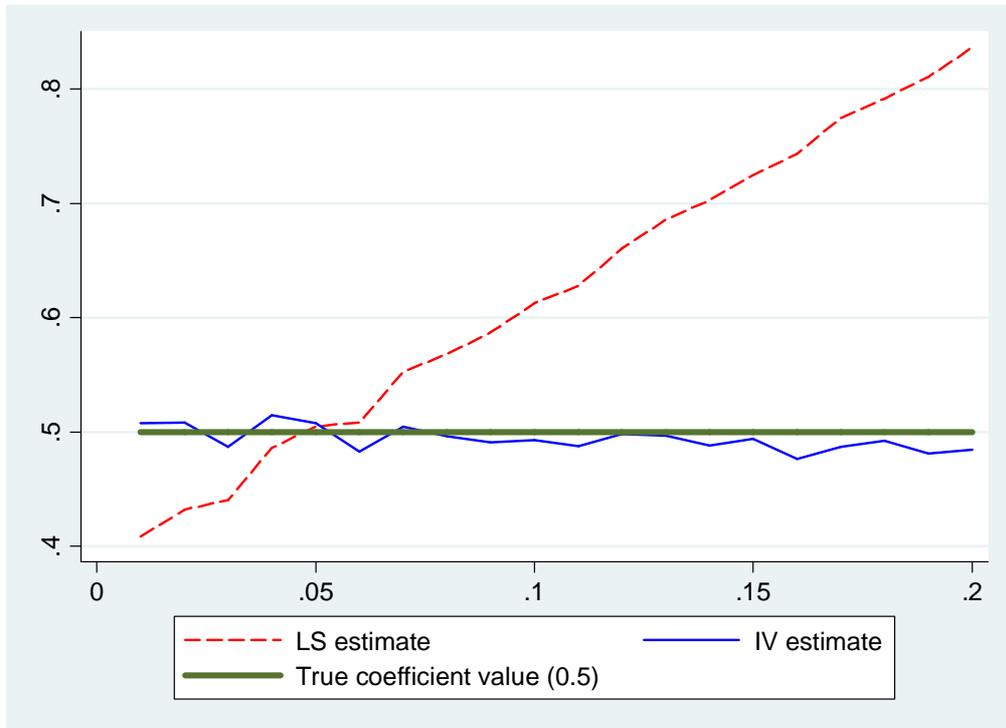


Figure 3 plots the bias of the standard cross-industry cross-country estimator and our alternative estimator in a Monte Carlo simulation (on the vertical axis) for different values of σ (on the horizontal axis) in (14). The dashed red line is the average least-squares (LS) estimate from the Monte Carlo simulation. The solid blue line is the average instrumental-variables (IV) estimate from the Monte Carlo simulation. The true parameter value is 0.5. See Section 2.3 for an explanation.

Table 1: Financial Development, Investment Opportunities, and Industry Growth

	(1)	(2)	(3)	(4)	(5)
Panel A: LS Estimates (1980-1989)					
Financial Development X Investment Opportunities	0.3183*** (0.1035)	0.3733*** (0.0994)	0.2809** (0.1198)	0.4454*** (0.0958)	0.3888*** (0.1176)
Financial Development X External Finance Dependence			0.0178** (0.0084)		0.0111778 (0.0076)
Labor Market Regulation X Employment Growth				-0.0932 (0.2939)	-0.1166346 (0.2932)
Initial Conditions		-0.0190*** (0.0031)	-0.0196*** (0.0032)	-0.0112*** (0.0024)	-0.0114*** (0.0025)
adj. R-squared	0.284	0.337	0.340	0.409	0.410
Panel B: 2SLS Estimates (1980-1989)					
Financial Development X Investment Opportunities	1.0610*** (0.2746)	1.0908*** (0.2555)	1.1169*** (0.3024)	1.0623*** (0.1842)	1.1445*** (0.2258)
Financial Development X External Finance Dependence			-0.0022 (0.0094)		-0.0072 (0.0090)
Labor Market Regulation X Employment Growth				-0.2155 (0.3012)	-0.2094 (0.3021)
Initial Conditions		-0.0196*** (0.0032)	-0.0196*** (0.0032)	-0.0120*** (0.0025)	-0.0118*** (0.0025)
Countries	67	67	67	49	49
Observations	1607	1607	1607	1268	1268
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes
Industry Fixed-Effects	Yes	Yes	Yes	Yes	Yes

The dependent variable is the annual growth rate of value added at the country-industry level for the period 1980-1989. The Financial Development X Investment Opportunities interaction is the product of industry-level investment opportunities (capital growth in the US) and country-level financial development. The Financial Development X External Finance Dependence interaction is the product of industry-level reliance on external finance (in the US) and country-level financial development. The Labor Market Regulation X Employment Growth interaction is the product of industry-level employment reallocation (employment growth in the US) and a country-level index of labor market regulation. The specifications in columns (2)-(5) include the initial (1980) log of value added at the country-industry level.

Panel A reports LS estimates using the benchmarking approach, which uses US industry characteristics (US capital growth) as a proxy for the relevant industry characteristics (industry investment opportunities). Panel B reports 2SLS estimates, where the interaction term between country-level financial development and industry investment opportunities (US capital growth) is instrumented with an interaction between financial development and estimated global (non-US) industry investment opportunities. All specifications include country fixed-effects and industry fixed-effects (coefficients not reported).

Heteroskedasticity-adjusted standard errors are reported in parentheses below the coefficients. ***, **, and * indicate statistical significance at the 99%, 95%, and 90% level respectively. The Data Appendix gives detailed variable definitions and data sources

Table 2: Financial Development, Investment Opportunities, and Industry Growth

	(1)	(2)	(3)	(4)	(5)
Panel A: LS Estimates (1980-1995)					
Financial Development X Investment Opportunities	0.2752** (0.1178)	0.3696*** (0.1144)	0.2481* (0.1383)	0.2995** (0.1177)	0.2287 (0.1447)
Financial Development X External Finance Dependence			0.0152* (0.0090)		0.0092 (0.0092)
Labor Market Regulation X Employment Growth				0.0775 (0.4067)	0.0480 (0.4146)
Initial Conditions		-0.0168*** (0.0027)	-0.0172*** (0.0028)	-0.0149*** (0.0022)	-0.0153*** (0.0022)
adj. R-squared	0.432	0.480	0.482	0.527	0.528
Panel B: 2SLS Estimates (1980-1995)					
Financial Development X Investment Opportunities	1.1893*** (0.3377)	1.2448*** (0.3078)	1.4956*** (0.4368)	0.9755*** (0.2395)	1.1793*** (0.3639)
Financial Development X External Finance Dependence			-0.0204 (0.0143)		-0.0176 (0.0144)
Labor Market Regulation X Employment Growth				0.0149 (0.4328)	0.0645 (0.4501)
Initial Conditions		-0.0179*** (0.0029)	-0.0174*** (0.0029)	-0.0160*** (0.0023)	-0.0153*** (0.0023)
Countries	58	58	58	45	45
Observations	1354	1354	1354	1076	1076
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes
Industry Fixed-Effects	Yes	Yes	Yes	Yes	Yes

The dependent variable is the annual growth rate of value added at the country-industry level for the period 1980-1995. The Financial Development X Investment Opportunities interaction is the product of industry-level investment opportunities (capital growth in the US) and country-level financial development. The Financial Development X External Finance Dependence interaction is the product of industry-level reliance on external finance (in the US) and country-level financial development. The Labor Market Regulation X Employment Growth interaction is the product of industry-level employment reallocation (employment growth in the US) and a country-level index of labor market regulation. The specifications in columns (2)-(5) include the initial (1980) log of value added at the country-industry level.

Panel A reports LS estimates using the benchmarking approach, which uses US industry characteristics (US capital growth) as a proxy for the relevant industry characteristics (industry investment opportunities). Panel B reports 2SLS estimates, where the interaction between country-level financial development and industry investment opportunities (US capital growth) is instrumented with an interaction between financial development and estimated global (non-US) industry investment opportunities. All specifications include country fixed-effects and industry fixed-effects (coefficients not reported). Heteroskedasticity-adjusted standard errors are reported in parentheses below the coefficients. ***, **, and * indicate statistical significance at the 99%, 95%, and 90% level respectively. The Data Appendix gives detailed variable definitions and data sources.

**Table 3: Financial Development, Investment Opportunities, and Industry Growth
Alternative Adjustment Channels**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: LS Estimates (1980-1989)							
Financial Development X Investment Opportunities		0.3520*** (0.1125)		0.3098*** (0.1009)		0.3771*** (0.0992)	0.3544*** (0.1064)
Legal Inefficiency X Investment Opportunities	-0.2640*** (0.0783)	-0.1085 (0.0839)					-0.0435 (0.0892)
Property Rights X Investment Opportunities			0.2421*** (0.0656)	0.1485** (0.0668)			0.1571* (0.0911)
Schooling X Investment Opportunities					0.0668*** (0.0237)	0.0323 (0.0228)	-0.0013 (0.0296)
adj. R-squared	0.350	0.355	0.344	0.347	0.340	0.345	0.377
Panel B: 2SLS Estimates (1980-1989)							
Financial Development X Investment Opportunities		1.0411*** (0.2817)		0.9161*** (0.2240)		1.1854*** (0.2375)	1.0828*** (0.2488)
Legal Inefficiency X Investment Opportunities	-0.6206*** (0.1577)	-0.1617 (0.1596)					-0.0484 (0.2003)
Property Rights X Investment Opportunities			0.5074*** (0.1919)	0.2274 (0.1780)			0.3029 (0.2501)
Schooling X Investment Opportunities					0.1546** (0.0605)	0.0482 (0.0532)	-0.0411 (0.0619)
Initial Conditions	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries	58	58	65	65	63	63	54
Observations	1453	1453	1572	1572	1552	1552	1399
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the annual growth rate of value added at the country-industry level for the period 1980-1989. The set of explanatory variables includes interaction terms between industry-level investment opportunities (capital growth in the US) with country-level measures capturing legal inefficiency, property rights protection, schooling, and financial development. All specifications include the initial (1980) log of value added at the country-industry level.

Panel A reports LS estimates using the benchmarking approach, which uses US industry characteristics (US capital growth) as a proxy for the relevant industry characteristics (industry investment opportunities). Panel B reports 2SLS estimates, where the interactions between country-level characteristics (legal inefficiency, property rights protection, schooling, and financial development) and industry investment opportunities (US capital growth) are instrumented with interactions between estimated global (non-US) industry investment opportunities and the respective country-level characteristic. All specifications include country fixed-effects and industry fixed-effects (coefficients not reported). Heteroskedasticity-adjusted standard errors are reported in parentheses below the coefficients. ***, **, and * indicate statistical significance at the 99%, 95%, and 90% level respectively. The Data Appendix gives detailed variable definitions and data sources

**Table 4: Financial Development, Investment Opportunities, and Industry Growth
Alternative Adjustment Channels**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: LS Estimates (1980-1995)							
Financial Development X Investment Opportunities		0.2710* (0.1387)		0.1816 (0.1264)		0.4453*** (0.1092)	0.3315*** (0.1237)
Legal Inefficiency X Investment Opportunities	-0.3694*** (0.0868)	-0.2445** (0.1088)					0.0003 (0.1075)
Property Rights X Investment Opportunities			0.3475*** (0.0706)	0.2864*** (0.0757)			0.3272*** (0.0987)
Schooling X Investment Opportunities					0.0943*** (0.0303)	0.045 (0.0315)	-0.0353 (0.0384)
adj. R-squared	0.486	0.488	0.486	0.487	0.457	0.464	0.474
Panel B: 2SLS Estimates (1980-1995)							
Financial Development X Investment Opportunities		1.1294*** (0.3609)		0.8591*** (0.2757)		1.0036*** (0.2482)	0.9247*** (0.2846)
Legal Inefficiency X Investment Opportunities	-0.8070*** (0.1747)	-0.2706 (0.2107)					-0.0112 (0.2218)
Property Rights X Investment Opportunities			0.8412*** (0.2153)	0.5455*** (0.1944)			0.2974 (0.2378)
Schooling X Investment Opportunities					0.3308*** (0.0865)	0.2159*** (0.0757)	0.1268 (0.0821)
Initial Conditions	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries	52	52	57	57	55	55	49
Observations	1227	1227	1331	1331	1312	1312	1185
Country Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the annual growth rate of value added at the country-industry level for the period 1980-1995. The set of explanatory variables includes interaction terms between industry-level investment opportunities (capital growth in the US) with country-level measures capturing legal inefficiency, property rights protection, schooling, and financial development. All specifications include the initial (1980) log of value added at the country-industry level.

Panel A reports LS estimates using the benchmarking approach, which uses US industry characteristics (US capital growth) as a proxy for the relevant industry characteristics (industry investment opportunities). Panel B reports 2SLS estimates, where the interactions between country-level characteristics (legal inefficiency, property rights protection, schooling, and financial development) and industry investment opportunities (US capital growth) are instrumented with interactions between estimated global (non-US) industry investment opportunities and the respective country-level characteristic. All specifications include country fixed-effects and industry fixed-effects (coefficients not reported). Heteroskedasticity-adjusted standard errors are reported in parentheses below the coefficients. ***, **, and * indicate statistical significance at the 99%, 95%, and 90% level respectively. The Data Appendix gives detailed variable definitions and data sources.

**Table 5: Financial Development, Investment Opportunities, and Industry Growth
Accounting for Economic Development**

	1980-1989	1980-1995
	(1)	(2)
Panel A: LS Estimates		
Financial Development X Investment Opportunities	0.2879*** (0.1028)	0.2690** (0.1255)
Economic Development X Investment Opportunities	0.1118 (0.0755)	0.1237 (0.0977)
adj. R-squared	0.338	0.481
Panel B: 2SLS Estimates		
Financial Development X Investment Opportunities	1.3823*** (0.3665)	0.9125** (0.4298)
Economic Development X Investment Opportunities	-0.3807** (0.1645)	-0.1924 (0.1935)
Initial Conditions	Yes	Yes
Countries	67	58
Observations	1607	1354
Country Fixed-Effects	Yes	Yes
Industry Fixed-Effects	Yes	Yes

The dependent variable is the annual growth rate of value added at the country-industry level for the period 1980-1989 or the period 1980-1995. The Financial Development X Investment Opportunities interaction is the product of industry-level investment opportunities (capital growth in the US) and country-level financial development. The Economic Development X Investment Opportunities interaction is the product of industry-level investment opportunities (capital growth in the US) and country-level GDP per capita. Both specifications include the initial (1980) log of value added at the country-industry level.

Panel A reports LS estimates using the benchmarking approach, which uses US industry characteristics (US capital growth) as a proxy for the relevant industry characteristics (industry investment opportunities). Panel B reports 2SLS estimates, where the interaction between country-level economic development and industry investment opportunities (US capital growth) and the interaction between country-level financial development and industry investment opportunities are instrumented with interactions between the respective country-level characteristic and estimated global (non-US) industry investment opportunities. All specifications include country fixed-effects and industry fixed-effects (coefficients not reported). Heteroskedasticity-adjusted standard errors are reported in parentheses below the coefficients. ***, **, and * indicate statistical significance at the 99%, 95%, and 90% level respectively. The Data Appendix gives detailed variable definitions and data sources.

**Table 6: Financial Development, Investment Opportunities, and Industry Growth
Alternative Financial Development Measures**

	<u>1980-1989</u>	<u>1980-1995</u>	<u>1980-1989</u>	<u>1980-1995</u>
	(1)	(2)	(3)	(4)
Panel A: LS Estimates				
Total Finance X Investment Opportunities	0.2806*** (0.0877)	0.4031*** (0.1049)		
State Bank Ownership X Investment Opportunities			-0.7351*** (0.1726)	-0.7822*** (0.1985)
adj. R-squared	0.335	0.482	0.392	0.492
Panel B: 2SLS Estimates				
Total Finance X Investment Opportunities	0.7106*** (0.1796)	0.5527*** (0.1829)		
State Bank Ownership X Investment Opportunities			-2.2197*** (0.4313)	-1.9871*** (0.4424)
Initial Conditions	Yes	Yes	Yes	Yes
Countries	67	58	56	53
Observations	1607	1354	1452	1278
Country Fixed-Effects	Yes	Yes	Yes	Yes
Industry Fixed-Effects	Yes	Yes	Yes	Yes

The dependent variable is the annual growth rate of value added at the country-industry level for the period 1980-1989 or the period 1980-1995. The Total Finance X Investment Opportunities interaction is the product of industry-level investment opportunities (capital growth in the US) and country-level private credit plus stock market capitalization relative to GDP. The State Bank Ownership X Investment Opportunities interaction is the product of industry-level investment opportunities (capital growth in the US) and country-level government ownership of banks. All specifications include the initial (1980) log of value added at the country-industry level.

Panel A reports LS estimates using the benchmarking approach, which uses US industry characteristics (US capital growth) as a proxy for the relevant industry characteristics (industry investment opportunities). Panel B reports 2SLS estimates, where the interaction between country-level financial development and industry investment opportunities (US capital growth) is instrumented with an interaction between the country-level measure of financial development and estimated global (non-US) industry investment opportunities. All specifications include country fixed-effects and industry fixed-effects (coefficients not reported). Heteroskedasticity adjusted standard errors are reported in parentheses below the coefficients. ***, **, and * indicate statistical significance at the 99%, 95%, and 90% level respectively. The Data Appendix gives detailed variable definitions and data sources.