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Daron Acemoglu
Simon Johnson
Todd Mitton

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Corresponding author: Simon Johnson, Research Department, 10-700, IMF, 700 19th Street, N.W., Washington, DC 20431; (202)623-8720 phone, (202)589-8720 fax, sjohnson@imf.org.

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ABSTRACT

We study the determinants of vertical integration in a new dataset of over 750,000 firms from 93 countries. Existing evidence suggests the presence of large cross-country differences in the organization of firms, which may be related to differences in financial development, contracting costs or regulation. We find cross-country correlations between vertical integration on the one hand and financial development, contracting costs, and entry barriers on the other that are consistent with these "priors". Nevertheless, we also show that these correlations are almost entirely driven by industrial composition; countries with more limited financial development, higher contracting costs or greater entry barriers are concentrated in industries with a high propensity for vertical integration. Once we control for differences in industrial composition, none of these factors are correlated with average vertical integration. However, we also find a relatively robust differential effect of financial development across industries; countries with less-developed financial markets are significantly more integrated in industries that are more human capital or technology intensive.

Daron Acemoglu
Department of Economics
MIT, E52-380B
50 Memorial Drive
Cambridge, MA 02142-1347
and NBER
daron@mit.edu

Simon Johnson
Sloan School of Management
MIT, E52
50Memorial Drive
Cambridge, MA 02142-1347
and NBER
sjohnson@mit.edu

Todd Mitton
BYU
todd.mitton@byu.edu

1 Introduction

Casual empiricism suggests the presence of significant differences in the organization of production across countries. For example, firms are often thought to be larger and more vertically integrated in less developed countries. Khanna and Palepu (1997, 2000) provide evidence consistent with this view and suggest that this is because market and contractual relationships are more costly in less-developed countries. Nevertheless, there has not been a systematic analysis of cross-country differences in vertical integration and their causes. Our primary aim in this paper is to make a first attempt at such a systematic analysis and to investigate the relationship between various institutional characteristics and vertical integration across countries.

Three well-established theories offer predictions on how differences in (specific) institutional characteristics of countries should affect vertical integration. First, according to the highly influential Transaction Cost Economics (TCE) theory pioneered by Williamson (1975, 1985), the internal organization of a firm is designed to improve incentives and limit agency costs. Vertical integration is perhaps the best known application of this theory. Vertical integration encourages specific investments and reduces holdup problems when markets are imperfect.[1] According to TCE, vertical integration should therefore be more prevalent when it is harder to write long-term contracts between upstream and downstream firms.

A second body of work emphasizes the importance of contracts and other relationships between firms and financial intermediaries. In this view, credit market imperfections affect the organization of the firm. Monitoring and contract enforcement are costly, so entrepreneurs need collateral in order to obtain financing (Banerjee and Newman, 1993, Legros and Newman, 1996), and they may need to rely on bank financing (Diamond and Rajan, 2005, Diamond, 2004). When credit markets have greater imperfections and when a lack of financial development limits the pool of potential entrepreneurs, there should be less entry and, most likely, larger firms in a country (Rajan and Zingales, 1998, Kumar, Rajan and Zingales, 1999). Larger firms are more likely to produce some of their own inputs or market some of their own outputs, so the financial view suggests that better financial institutions and credit markets may be associated with less vertical integration.

Third, recent work by Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2002) and the

[1] See the surveys by Holmstrom and Tirole (1989), Joskow (2005), and Whinston (2001). See also the related but different approach to vertical integration in the property rights theory developed by Grossman and Hart (1986) and Hart and Moore (1990), which points out both the benefits and the costs of vertical integration on incentives to undertake relationship-specific investments. Other important theoretical contributions in the area of vertical integration include Klein, Crawford and Alchian (1978), Bolton and Whinston (1992), Aghion and Tirole (1997), Baker, Gibbons, and Murphy (2002), and Legros and Newman (2003).

World Bank (2005) stresses the importance of regulatory barriers to entry. Ease of entry is also found to be related to firm size across countries (Klapper, Laeven, and Rajan, 2004). If there is less entry, presumably this makes vertically integrated firms more likely. Consequently, the regulation view suggests a relationship between entry regulations and vertical integration.

To investigate the cross-country determinants of vertical integration and the role of specific institutional features emphasized by these three theories, we use a new dataset of over 750,000 firms from 93 countries. Our methodology follows the finance literature in taking the United States as a benchmark (Rajan and Zingales, 1998), and we combine our firm-level data with the U.S. input-output tables (which is assumed to accurately describe the technological possibilities in other parts of the world). While there are some limitations to our data, it nonetheless provides a new opportunity to understand how the organization of production differs across countries. We have three sets of results.

First, we find cross-country correlations between measures of specific institutions emphasized by the theories and vertical integration. In particular, there is more vertical integration in countries with greater contracting costs between firms, as measured by indices of contract enforcement costs. Vertical integration is also higher in countries with less credit or greater credit market imperfections, as indicated by a lower level of credit market development (although this result is stronger in firm-level data than in country-level data). Finally, vertical integration is also higher in countries with greater barriers to entry, as measured by indices of the regulation of entry.

Second, however, we find that these cross-country differences in vertical integration are almost entirely accounted for by differences in industrial composition across countries. Once we control for differences in industrial composition, contracting costs, credit market development, and entry regulation have little explanatory power for differences in vertical integration. Thus, it is *not* the case that countries with greater contracting costs, credit market imperfections, or entry regulations tend to be more vertically integrated in a given sector. Rather, such countries tend to be concentrated in sectors that are naturally vertically integrated wherever they are in the world. We document that this lack of a relationship between these specific institutional features and vertical integration is highly robust.

To further explore this phenomenon, we create an index of the "vertical integration propensity" of each country based on its industrial composition and the natural tendency of each industry to vertically integrate (proxied by the vertical integration of that industry in the United States). Contracting costs, financial development, and entry regulation are all significantly correlated with a country's vertical integration propensity, and this difference in industrial composition explains the correlation between these measures and vertical integration in regressions that do not control for industrial composition. However, because countries with higher contracting costs, weaker financial development, and greater entry regulation are also typically poorer, it is again not possible to conclude that these specific institutional features are the cause of differences in vertical integration propensity. In fact, when we control for log GDP per capita, our specific measures of institutions lose significance; log GDP per capita is a more robust predictor of the vertical integration index and of a country's vertical integration propensity.[2]

Overall, we conclude from this set of results that measures of contracting costs, financial development and regulation have limited explanatory power for the level of vertical integration in a country. These results therefore shed some doubt on the importance of these specific institutional factors in accounting for cross-country patterns of vertical integration.

Nevertheless, our third set of results suggest that differences in financial development (and financial institutions) across countries have an important effect on vertical integration in the more human capital and technology-intensive sectors. We document this by looking at the effect of the interaction between financial development and industry characteristics (in particular, physical capital, human capital and technology intensity) on vertical integration. We find that even after controlling for industrial composition and for per capita GDP, greater credit market development is associated with less vertical integration in industries that are human capital and technology intensive. This suggests that a lack of financial development may be preventing efficient organization of production in relatively high-tech and high human capital industries, though we are not able to rule out other potential explanations for this differential effect. In any case, it has to be emphasized that even these interaction results cannot be interpreted as causal relationships, and it may be some other (omitted) characteristics that lead to the relationship between vertical integration and the interaction of industry characteristics and financial development.

Our paper relates to the existing literature in a number of ways. The comparative finance literature finds that countries with less financial development will tend not to develop in industries requiring greater external finance (Rajan and Zingales 1998), but has not investigated cross-country differences in vertical integration or in the internal organization of firms.[3]

[2] The effect of GDP per capita may capture the relationship between sectoral composition and the stage of development, or the effect of some "broader" institutional features related to the enforcement of property rights, state-society relations or political stability (e.g., Acemoglu, Johnson and Robinson, 2001, 2002).

[3] There is a large literature on vertical integration in specific industries in the United States, including Joskow's (1987) seminal paper on ownership arrangements in electricity generating plants, Stuckey's (1983) study of integration between aluminium refineries and bauxite mines, Monteverde and Teece's (1982) investigation of integration in the automobile industry, Masten's (1984) work on the aerospace industry, Ohanian's (1994) work on the pulp and paper industry, Klein's (1988) work on the Fisher Body and General Motors relationship, Baker and Hubbard's (2001, 2003) study of the trucking industry, Lerner and Merges' (1998) work on the biotech sector, and Chipty's (2001) paper on market foreclosure in the cable television industry. Woodruff's (2002) work on the Mexican footwear industry is the only paper we are aware of that provide a systematic study of vertical integration in a developing economy. Finally, Antràs (2003) studies the relationship between capital intensity and outsourcing using 23 U.S. industries.

Also related to our paper are cross-country comparative studies, including Bain (1966), Pryor (1972), Scherer (1973), Nugent and Nabli (1992), Kumar, Rajan and Zingales (1999), Desai, Gompers, and Lerner (2003), Fisman and Sarria-Allende (2004) and Klapper, Laeven, and Rajan (2003).[4] These papers typically focus on concentration, firm size, and entry. Earlier papers use OECD data, while more recent papers use data from the Amadeus database for Western and Eastern Europe, or from the Worldscope database, which contains information only for relatively large publicly traded firms. Our dataset is, to the best of our knowledge, unique in allowing us to look at a relatively broad cross-section of countries and a large sample of firms, including both private and public companies and medium-size as well as large firms. In addition, none of these studies focuses on the internal organization of the firm or vertical integration.

The paper proceeds as follows. The next section describes the data used for the study. Section 3 reports our basic results on the relationship between vertical integration and specific measures of institutions, including results controlling for industrial composition and a series of robustness checks. Section 4 discusses how specific measures of institutions relate to the vertical integration propensity of countries. Section 5 reports interaction results. Section 6 concludes.

2 Data and Descriptive Statistics

Our firm-level data come from WorldBase. This database, compiled by Dun & Bradstreet for the primary purpose of providing business contacts, contains information on millions of public and private firms around the world. For each firm, WorldBase reports the 4-digit SIC code of the primary industry in which the firm operates, and the SIC codes of up to five secondary industries, listed in descending order of importance.[5] WorldBase includes data for 213 different countries. We exclude 19 of these because they are not defined as countries in the World Bank on-line World Development Indicators database.[6] In addition, because not all of the countries in WorldBase include reporting of secondary industries, our analysis is restricted to 93 countries for which this information is available.

[4] Another well-known approach, the market foreclosure theory, views vertical integration as a method of increasing monopoly power by downstream firms (e.g., Perry, 1978, Aghion and Bolton, 1987, Hart and Tirole, 1990, Ordover, Salop, and Saloner, 1990, and Chipty, 2001). We show that our results are robust to controlling for measures of antitrust regulations (as in Dutz and Hayri, 1999). However, because the available data on cross-country differences in antitrust regulation are more limited, we do not focus on antitrust issues in this paper.

[5] In the entire sample, approximately 64% of firms report one SIC code, 24% report two codes, 8% report three codes, 2% report four codes, 1% report five codes, and less than 1% report six codes. Note that we do not have the breakdown of sales by SIC for firms active in multiple industries.

[6] This excludes 15 non-independent territories, three independent countries below the World Bank size threshold, and one disputed territory. Taiwan is retained despite not being in the World Bank database.

Our sample consists of all firms in these countries in the September 2002 WorldBase file, with a maximum of 30,000 per country (a limit imposed due to cost constraints). For those countries with more than 30,000 firms, the 30,000 largest are selected, ranked by annual sales. We include firms from all industries, except those operating only in "wholesale trade" and "retail trade" (we explain this omission below). After these adjustments to the data, we have a base sample of 769,199 firms in 93 countries.

We use the benchmark input-output accounts published by the Bureau of Economic Analysis (BEA) to calculate the degree of vertical integration for each firm in our sample (see Lawson, 1997, for a discussion of the accounts). Our methodology follows the approach of Fan and Lang (2000).[7] The input-output accounts report the dollar value of each input used to produce the output of 498 different industries in the U.S. economy. We use the 1992 input-output accounts because these are the most recently published at the 6-digit input-output (IO) code level. Input-output tables from the U.S. should be informative about input flows across industries, to the extent these are determined by technology. For example, in all countries, car makers need to obtain tires, steel, and plastic from plants specialized in the manufacture of those goods.[8]

We begin by matching the 4-digit SIC codes from each firm in our sample with the appropriate 6-digit IO code, using the BEA's concordance guide (see Lawson, 1997). Following Fan and Lang (2000), we exclude IO code 69.01 and 69.02 (wholesale and retail trade) from our analysis because the input-output classification system does not define these categories finely enough to allow meaningful vertical integration calculations – almost all 4-digit SIC codes between 5000 and 5999 map into just these two IO codes.

For every pair of industries, IO_i and IO_j, the input-output accounts allow us to calculate the dollar value of IO_i required to produce a dollar's worth of IO_j in the United States. This amount, which we call the vertical integration coefficient, VI_{ij}, represents the opportunity for vertical integration between IO_i and IO_j, i.e., when it is higher, there is more use of input i in the production of output j.

Using the full set of vertical integration coefficients (i.e., VI_{ij} for every IO_i and IO_j), we calculate a vertical integration index for each firm in our dataset. The index is denoted by v_{cif} for firm f in industry i in country c, and is defined as

$$v_{cif} = \frac{1}{|N_f|} \sum_{j \in N_f} VI_{ij},$$

[7] See also Acemoglu, Aghion, Griffith and Zilibotti (2004) for an application of a similar methodology on UK data.

[8] The use of the same input-output table across countries is justified when all countries share the same technology frontier and when either all production functions are Leontief or there is factor price equalization. However, even when these stringent assumptions are not satisfied, we expect there to be a correlation in the input use patterns across countries.

where N_f is the set of industries in which firm f is active and $|N_f|$ denotes the number of these industries. In words, we first sum the VI_{ij} coefficients between the firm's primary industry and all industries in which the firm operates. This sum represents the dollar value of inputs from industries in which the firm operates that is required to produce one dollar's worth of the firm's primary output. We then create a similar index v_{cif} for secondary industries in which a firm operates. The vertical integration index is then the average of these sums for each firm, and as such represents the average opportunity for vertical integration in all lines of a business in which the firm is active.[9]

Across all 769,199 firms in our dataset, this index ranges from 0 (i.e., no vertical integration) to 53.5 (i.e., an average of 53.5 cents worth of the inputs required to produce one dollar's worth of output are produced by industries in which the firm operates).

For an example of how the vertical integration index is created, consider a Japanese auto maker in our data (primary code 59.0301) which also has two secondary sectors in the WorldBase data: automotive stampings (41.0201) and miscellaneous plastic products (32.0400). The VI_{ij} coefficients between these industries are as shown in the following table:

			Output (j)	
		Autos	Stampings	Plastics
	Autos	.0043	.0000	.0000
Input (i)	Stampings	.0780	.0017	.0000
	Plastics	.0405	.0024	.0560
	SUM	.1228	.0041	.0560

The table shows that, for example, the VI_{ij} coefficient for stampings to autos is 0.078, indicating that 7.8 cents worth of automotive stampings are required to produce a dollar's output of autos, and this automaker has the internal capability to produce those stampings. (Notice that industries have VI_{ij} coefficients with themselves; for example, miscellaneous plastic products are required to produce miscellaneous plastic products.) The bottom row shows the sum of the VI_{ij} for each industry, for example, 12.3 cents worth of the inputs required to make autos can be produced within this firm. The vertical integration index for this firm, v_{cif}, is then the average of the sums in the bottom row.[10]

We construct a country-level vertical integration index, denoted by v_c, by averaging all v_{cif} in the country.[11] In regressions using the country-level indices we weight the regression by the number of firms included in the average for each index (an approach analogous to performing firm-level regressions). In addition, we look directly at firm-level regressions. The first two

[9] We also conducted extensive robustness checks using only the primary (SIC) industry of each firm. The results are essentially unchanged.

[10] The index could also be constructed putting greater weight on the more important industries. While it seems natural to emphasize the primary industries in the index, WorldBase does not report sales breakdowns by industry, so the weightings would be somewhat arbitrary. We have constructed the index using different weighting schemes and find little difference in the results.

[11] We use the simple average. Weighted averages (based on sales or employees) produce similar results.

rows of Panel A of Table 1 report descriptive statistics for the vertical integration index at the firm and country level.

Panel A of Table 1 also provides descriptive statistics for the other country-level measures we use as independent variables. Row 4 is the log of GDP per capita in 2000. Our GDP estimates are PPP adjusted and are taken from the World Factbook.[12] Row 5 reports log population, taken from World Bank data for the year 2000.

Rows 6 and 7 of Table 1 report our two primary measures of contracting institutions. Row 6 reports the cost of enforcing a commercial contract, i.e., between two firms, from the World Bank (2004) Doing Business dataset. This is the cost of enforcing a debt contract worth 50% of Gross National Income (GNI) per capita. The cost is measured as a percent of the amount of the debt contract. Row 7 reports the number of procedures needed to collect the same contract, again from World Bank (2004). This variable is emphasized in the underlying academic study, Djankov et al (2003).

In Rows 8 and 9 we report our two primary measures of credit market development. Our first credit market measure, in Row 8, directly captures the availability of external finance. This is the value of domestic credit provided to the private sector (as a percent of GDP), taken from World Bank data for the year 2000. This measure has been used frequently in other work (see, e.g., Rajan and Zingales, 1998). Row 9 reports our second measure, the cost of creating collateral, as a percent of GDP per capita. Property has to be registered before it can be used as collateral, and the analysis of the World Bank (2005) suggests this is an important component of the costs of borrowing from the banking system.

Rows 10 and 11 report our two primary measures of entry regulation. Row 10 presents entry costs by new firms in each country (as a percent of GDP per capita). These data are available for 61 countries in our sample. They are obtained from the World Bank (2004) and are constructed using the methodology in Djankov et al (2002). In Row 11 we report an alternative measure of entry barriers – the number of procedures needed for entry.

In robustness checks, we use other measures of contracting costs, credit market development, and entry barriers, with very similar results (see Appendix Table A3). Appendix Table A1 reports correlation coefficients of the country-level variables. The other rows of Panel A in Table 1 report summary statistics on the vertical integration propensity by country (Row 3, discussed in Section 4), and the number of employees per firm (Row 12). Panel B reports characteristics of relevant industries from U.S. data (discussed in Section 5).

[12] On the web at: http://www.cia.gov/cia/publications/factbook/. This covers a larger sample than the World Bank GDP estimates, and the two estimates are very similar for the countries for which they overlap.

3 Determinants of Vertical Integration

3.1 Country-level Results

According to theories emphasizing the role of contracting institutions in the internal organization of the firm, such as Williamson (1975, 1985), we should see a negative correlation between vertical integration and the quality of contracting institutions. Theories built on credit market constraints would suggest a negative association between vertical integration and credit market development. Finally, models of entry posit a relationship between vertical integration and entry barriers. Consequently, we would expect these variables to be correlated with cross-country differences in vertical integration. We investigate this question in Tables 2 and 3. Table 2 uses aggregate data, while Table 3 uses firm-level data.

Table 2 shows the relationship between aggregate indices of vertical integration and our specific measures of institutions. The following simple model is estimated by OLS:

$$v_c = \mathbf{x}_c' \boldsymbol{\beta} + \varepsilon_c, \tag{1}$$

where v_c is our index of aggregate vertical integration for country c calculated as described in the previous section, $\mathbf{x}_c$ is a vector of country-level variables including the specific measures of institutions, and ε_c is an error term capturing all omitted factors. We do not interpret equation (1) as capturing a causal relationship, but as a convenient way of describing the correlation between specific measures of institutions and vertical integration around the world.

Columns 1 through 3 of Table 2 present results for our measures of contracting costs. Column 1 uses the cost of enforcing a contract. This variable is positive, with a coefficient of 1.72 and a standard error of 0.53. When contracting costs are higher, there is more vertical integration, as predicted by TCE. This relationship is illustrated in Figure 1, Panel A, which shows graphically the positive relationship between contracting costs and vertical integration. In Column 2 of Table 2 we add log population to control for country size, and the coefficient on contract enforcement cost decreases in magnitude, but remains significant. Column 3 uses the number of procedures needed to enforce a contract. The results are similar to those in Column 1 – the coefficient on contract enforcement procedures is positive and significant, as would be predicted by TCE. A one standard deviation reduction in the cost of enforcing contracts is associated with between 1/4 and 1/2 a standard deviation fall in the country-level vertical integration propensity, which is a large effect.

Columns 4 through 6 present results for our measures of credit market development. Columns 4 and 5 show that the coefficient on credit market development is negative, which suggests that stronger financial development is associated with less vertical integration. Nevertheless, the coefficient is not significant. This relationship is illustrated in Figure 1, Panel B, which shows a weak negative relationship between credit market development and vertical integration. Column 6 of Table 2 shows that the coefficient on cost to create collateral is neither significant nor of the expected sign. In the country-level regressions, there appears to be little evidence that credit market development is related to vertical integration.

Columns 7 through 9 present results for the two measures of entry regulation. Column 7 uses the cost of entry. This variable has a positive effect, with a coefficient of 1.28 and a standard error of 0.30. This positive relationship is consistent with priors; higher entry costs are associated with greater vertical integration, and the effect is large; a one standard deviation fall in entry costs is associated with about a 1/2 standard deviation decline in country-level vertical integration. Panel C of Figure 1 shows this significant positive relationship graphically. Column 8 show that this relationship holds when we control for log population, and Column 9 shows that the relationship holds with our second measure of entry regulation, the number of procedures required for entry.

3.2 Firm-level Results

In Table 3 we repeat the regressions of Table 2 using firm-level data.

A potential concern with the results in this paper is sample selection. Our dataset contains different numbers of firms from different countries, and this variation in the selection of samples of firms could be a source of variation in vertical integration. The main source of the problem would be potential correlation between vertical integration and firm size (combined with differential selection on firm size across countries). For example, it could be that relatively larger companies are more vertically integrated and from countries with weaker institutional environments we only observe relatively larger companies. We can partially deal with this sample selection problem by estimating our main equation at the firm level, and controlling for firm size. In other words, the estimating equation now becomes

$$v_{cf} = \mathbf{x}_c' \boldsymbol{\beta} + \mathbf{z}_f' \boldsymbol{\phi} + \varepsilon_{cf}, \tag{2}$$

where v_{cf} is vertical integration in firm f in country c, $\mathbf{x}_c$ is the set of country-level covariates as before, and $\mathbf{z}_f$ is a set of firm-level covariates. Because the variables of interest, our specific measures of institutions, vary only at the country level, whenever we report regressions of this sort, the standard errors are corrected for clustering at the country level.

Table 3 reports the results from the estimation of (2) (with the log of the number of employees included as a measure of firm size).[13] The general pattern is the same as in the country-level regressions in Table 2. On the whole, the results are somewhat stronger and more precise.

[13] We also experimented with regressions controlling for second, third and fourth order polynomials in firm size, and found very similar results (details available upon request).

Columns 1 through 3 again show that our measures of contracting costs are positively correlated with vertical integration, as would be predicted by TCE. The magnitude and significance of the coefficients is greater that the comparable estimates in Table 2 in all three columns. However, the standard deviation of the firm-level vertical integration index is much larger than the standard deviation of the country-level vertical integration index, so the implied effect of contracting costs on vertical integration is smaller (about 1/4 of the size in Table 2).

Columns 4 through 6 now report a statistically significant correlation between credit market development and vertical integration. In particular, the coefficient on domestic credit to the private sector is now -0.34 with a standard error of 0.15. As would be predicted, greater financial development is associated with less vertical integration. The measure of the cost to create collateral remains insignificant at the firm level.[14]

Columns 7 through 9 again show that our measures of entry regulation are positively correlated with vertical integration. With these measures, the firm-level results are somewhat smaller than the corresponding country-level results.

Overall, the country-level and firm-level regressions show that the measures of contracting institutions, credit market development, and regulation policy all appear to be correlated with the level of vertical integration in a country.

3.3 Industrial Composition

The results in Tables 2 and 3 documented the cross-country correlation between specific measures of institutions and the aggregate level of vertical integration. However, a missing element in our analysis thus far has been the lack of a control for differences in industrial composition across countries. It could be, for example, that countries with weaker institutional environments have economic activity concentrated in sectors that naturally have greater vertical integration. The simplest strategy to investigate whether industrial composition is an important concern is to include a full set of industry dummies in the firm-level regressions.

Consequently, the estimating equation becomes:

$$v_{cif} = \mathbf{x}_c'\boldsymbol{\beta} + \mathbf{z}_f'\boldsymbol{\phi} + \delta_i + \varepsilon_{cif}, \qquad (3)$$

where v_{cif} is vertical integration of firm f in industry i of country c, $\mathbf{x}_c$ and $\mathbf{z}_f$ are country-level and firm-level covariates as before, and most importantly, the δ_i's are a full set of industry dummies. The presence of the dummies enables the model to capture cross-industry differences in the technological or other determinants of vertical integration. The industry

[14] We also performed additional tests with accounting standards as the explanatory variable. While we find that better accounting standards are also associated with less vertical integration, the relationship is somewhat weaker statistically (a coefficient of -0.99 with a standard error of 0.55). This result may be attributed to the fact that the accounting standards variable is only available for 30 of our sample countries.

dummies are defined at the two-digit IO level, which results in a set of 76 dummy variables.[15] As with the estimates of equation (2), we cluster the standard errors at the country level to take account of the fact that the key explanatory variables do not vary by firm (or industry).

The inclusion of a full set of industry dummies implies that in equation (3), all cross-country comparisons are relative to the "mean propensity to integrate" in a particular industry. In other words, this regression looks at, for example, whether firms in a country with worse contracting institutions are more of vertically integrated relative to firms in a country with better contracting institutions in the *same* industry.

Table 4 reports the results from the estimation of equation (3) with the full set of industry dummies included. The striking result is that there is no longer a significant relationship between any of the measures of specific institutions and vertical integration; the exception is the cost of creating collateral, but this has the "wrong" sign. Evidently, the correlation between specific institutional factors and vertical integration depicted in Tables 2 and 3 was primarily due to differences in the industrial composition of production across countries. As a result, there is no evidence that, within a given industry, vertical integration is more prevalent in countries with greater contracting costs, weaker credit market development, or greater entry regulation.

More specifically, as we document in greater detail in the next section, countries with worse contracting institutions, more limited financial development and higher entry barriers are more concentrated in industries that have typically higher vertical integration, such as mining (ferrous and nonferrous), petroleum and gas, leather, fabrics, chemicals, apparel, and electronic components.

The lack of a correlation between our specific measures of institutions and vertical integration can be interpreted in different ways. One possibility is that our measures of specific institutions do not adequately capture cross-country differences in these factors. Naturally, the various proxies for contracting institutions, financial development, and regulation policy are imperfect and potentially measured with error. Nevertheless, in addition to the results of Tables 2 and 3, previous work shows that these indices do have significant information content, and are correlated with economic outcomes (see, e.g., Djankov et al, 2002, 2003). Thus the lack of correlation between these measures and vertical integration is unlikely to be driven entirely by measurement error.

A second interpretation is that, even if these institutional factors do not affect the degree to which a given firm chooses to vertically integrate, they have an impact on economic outcomes across countries by influencing industrial composition. We investigate this possibility in the next section.

[15] We use the primary industry of each firm, i.e., the IO code matched to the SIC code that comes first in WorldBase.

The final possibility is simply that these specific institutions have no impact on average vertical integration across countries. Such an interpretation would be a challenge to the theories discussed in the introduction, which (implicitly or explicitly) suggest that differences in contracting costs, credit markets, or regulation policy should have a major effect on cross-country patterns of vertical integration. We will see in Section 5 that this interpretation needs to be qualified; one of these factors, financial development, has a significant effect on vertical integration in the human capital and technology-intensive industries.

3.4 Robustness Checks

Before investigating the relationship between specific institutions and vertical integration further, we present a series of robustness checks of our results to this point. We verify that without controls for industry, the correlation between specific institutions and vertical integration is robust. In addition we show that the lack of a correlation between these variables after controlling for industry is also robust with two minor exceptions.

In Table 5 we present a series of three robustness checks. In this table we alternate columns of firm-level results without industry dummies, as in equation (2), with columns of firm-level results with industry dummies, as in equation (3). We present each robustness check only for our first proxy for each of the three types of institutions.

Panel A of Table 5 reports results for manufacturing industries only. We define "manufacturing" industries according to the BEA's classification, which means we exclude basic industries (such as agriculture and mining), and service industries (such as lodging, repair services, legal services, and health services), as well as transportation, communications, utilities, and finance-related industries. Columns 1 and 2 show that contracting costs remain significant in this sample, but lose significance once industry dummies are included. Columns 3 and 4 show that greater credit market development is associated with less vertical integration in this sample, and that the significance disappears when industry dummies are included. Columns 5 and 6 show that entry regulation remains significant in this sample, but once again not when industry dummies are included.

Panel B of Table 5 presents results excluding the most and least vertically integrated industries in the sample. The purpose of this robustness check is to assess if results are driven by a small number of industries that technologically have a high or low level of vertical integration. We rank the vertical integration of industries by estimating vertical integration coefficients (dummies) for each industry in a firm-level regression of vertical integration on industry dummies using only U.S. data. We use U.S. data since vertical integration patterns in the United States are likely to be most informative about the tendency of industries to vertically integrate their activities in an environment with relatively developed financial markets and contracting institutions (and relatively free entry). These estimated dummy coefficients are reported in Appendix Table A2 and the methodology is discussed further in the next section. The results in Panel B of Table 5 are similar to those in Panel A, and show that our findings are robust to this change. The exception is that the coefficient on domestic credit to the private sector is now slightly below standard levels of significance without industry dummies (Column 3).

Panel C of Table 5 presents results that include only industries that are present in 90% of the countries in our sample. The purpose here is to assess if our results are driven by industries that only appear in a small subset of countries in the sample. Panel C shows that this is not the case. The results are similar to those presented previously – the institutional measures have strong explanatory power when industry dummies are not included, but very little explanatory power when industry dummies are included. As in Panel B, this is only weakly true for the financial development measure, which is now not significant in Column 3.

In Table 6 we further check the robustness of our results by repeating the test using an alternative database. For this robustness check, we use the Worldscope database, which has been used extensively in the previous literature. It should be noted, however, that for the purposes of this paper, Worldscope is not as well suited to the investigation here as our primary data source, WorldBase. From WorldBase we get over 50 times the number of observations as in Worldscope, with data from roughly twice as many countries. In addition, WorldBase includes privately held and medium-sized firms, whereas Worldscope only includes large, publicly traded firms.

Panel A of Table 6 reports results of regressions similar to those reported previously, but with the methodology described earlier now repeated on the Worldscope database. Panel A of Table 6 shows that the results are similar using the Worldscope database. Column 1 shows that the coefficient on contracting costs is 1.82, very close to the 1.86 obtained in our baseline results. The standard error is higher than in the baseline results, perhaps because the number of countries included in the regression is fewer, so that the coefficient is slightly below standard levels of significance. Column 2 shows that, as in our baseline results, contracting costs have little explanatory power when industry dummies are included.

Column 3 of Panel A shows that the coefficient on credit market development is -1.27, with a standard error of 0.35, which is a considerably stronger result than in our baseline results. Furthermore, in contrast to our baseline results, Column 4 shows that although the coefficient on financial development is weakened when industry dummies are included, the coefficient remains significant and is one of the two exceptions to the general pattern of the significant effects disappearing once industry dummies are included.

Column 5 of Panel A shows that the coefficient on the entry cost is 2.16, with a standard error of 0.94, which is somewhat stronger than our baseline results. Again, Column 6 shows the significance of the coefficient disappears when industry dummies are included.

Another concern with the results is that we have not so far incorporated information on business groups, which are important particularly in a number of Asian countries (see, for example, Khanna and Palepu, 2000). Panel B of Table 6 investigates this issue. We adjust the Worldscope data for group affiliations for Asian countries using data from Claessens et al (2000).[16] In this adjustment, we treat all firms belonging to the same business group as a single entity, and aggregate their firm-level data accordingly.

Panel B reports the group-adjusted results. In general, the results are similar to the unadjusted results shown in Panel A. The coefficients on the institutional measures are greater than the corresponding measures in Panel A when industry dummies are not included. With industry dummies included, the coefficient on domestic credit to the private sector remains negative and marginally significant, though with a substantially smaller magnitude than in Panel A.

Additional robustness checks in Appendix Table A3 show that alternative measures of specific institutions are also correlated with vertical integration. The results are robust to measuring contracting costs as the time required to enforce a contract or the procedural complexity of contract enforcement (as in Djankov et al, 2003), to measuring credit market development as the disclosure index (from World Bank, 2005) and the interest rate spread between lending and borrowing rates (from World Bank data from 2000), and to measuring entry costs as the time required for entry (as in Djankov, et al, 2002). In addition, Table A3 shows that stronger antitrust regulation is associated with less vertical integration (with antitrust measured as in Dutz and Hayri, 1999). In all cases, there is a correlation between vertical integration in these specific institutions, and this correlation disappears when we include industry dummies (i.e., when we control for industrial composition).

4 Vertical Integration Propensity

We now investigate the reason why the significant correlation between vertical integration and our measures of specific institutions disappears when industry dummies are included in the regressions. For each country, we calculate the propensity to vertically integrate according to industrial composition:

$$\hat{V}_c = \sum_i \hat{\delta}_i \frac{S_{ci}}{S_c},$$

where $\hat{\delta}_i$'s are the estimates of the industry dummies (reported in Table A2) from a firm-level regression of vertical integration on industry dummies using U.S. data, S_{ci} is total sales in

[16] We are unable to do any such adjustments to our primary dataset because our data do not include firm names.

industry i in country c, and S_c is total sales in country c. The dummies $\hat{\delta}_i$'s measure the average level of vertical integration in industry i in the U.S., so $\hat{V}_c$ measures the average tendency for vertical integration in the country due to its industrial composition. In other words, $\hat{V}_c$ measures the extent of vertical integration in a country if the country had the average level of vertical integration in the United States corresponding to each industry.[17] Consequently, the source of variation in $\hat{V}_c$ arises purely from the industrial composition of the country.

In Table 7, we report results from regressions similar to those in equation (1), but with the vertical integration propensity of each country, $\hat{V}_c$, as the dependent variable. The explanatory variables are the specific measures of institutions as used previously. The results in Panel A of Table 7 show a strong correlation between specific measures of institutions and vertical integration propensity. Vertical integration propensity is significantly higher in countries with high contracting costs (Columns 1 and 2), in countries with high costs to create collateral (Column 4) and in countries with high entry regulations (Columns 5 and 6). Stronger credit market development is also associated with less vertical integration propensity, though this effect is not statistically significant (Column 3). In Column 7, we include all measures simultaneously. In this regression, contract enforcement costs and procedures required for entry emerge as having the most significant correlations with vertical integration propensity.

Figure 2 illustrates graphically the relationships reported in the regressions of Table 7. Panel A shows a strong positive relationship between contracting costs and vertical integration propensity, Panel B shows a negative (but not significant) relationship between credit market development and vertical integration propensity, and Panel C shows a strong positive relationship between entry costs and vertical integration propensity.

The results in Panel A of Table 7 illustrate why the correlation between vertical integration and specific measures of institutions disappears when we control for industrial composition (industry dummies). Countries with weaker institutions, as measured by contracting costs, credit market development, and entry regulation, tend to be concentrated in industries with a high technological propensity for vertical integration. Consequently, when we do not control for industrial composition, we see sizable differences in vertical integration across countries, but when we take into account of these differences in industrial composition, the correlations disappear.

How should these results be interpreted? On the one hand, the relationship between the specific institutional features and vertical integration propensity might itself reflect omitted

[17] In alternative tests we have also calculated the industry dummy coefficients using data from all G7 nations and also using data from all 93 countries in our dataset. The results are very similar to our baseline results and are available upon request.

factors.[18] On the other hand, it is plausible that this relationship could be related to the effect of these specific institutional characteristics on the industrial composition of a country. The evidence we present next favors the former interpretation.

Panel B of Table 7 repeats the regressions of Panel A, but also including log GDP per capita as an additional explanatory variable. GDP per capita is a potential control both for the effect of the stage of development on industrial composition and may also capture the effect of other (broader) institutional features that are omitted from the regression. The results in Panel B indicate that the explanatory power of per capita GDP subsumes the explanatory power of the specific measures of institutions. In Column 1, for example, per capita GDP has a coefficient of -0.69, with a standard error of 0.14, whereas the coefficient on contract enforcement costs is insignificant. The results are similar in other columns; contract enforcement procedures is the only measure that is significant, but it has the opposite of the sign it had without GDP (negative rather than positive).

Panel B shows that the most robust relationship is that richer countries are more concentrated in industries with lower vertical integration propensity. The strong negative relationship between log GDP per capita and vertical integration propensity is shown graphically in Panel D of Figure 2.[19]

One concern with Table 7 is that the vertical integration propensity measure, $\hat{V}_c$, constructed using industrial composition of countries based on our primary data source, which may not be as representative of the overall industrial composition as some other international datasets. To address this concern, we repeat the analysis of Table 7, calculating $\hat{V}_c$ using industrial composition calculated from an alternative data source. Of the alternative data sources available, the United Nations Industrial Development Organization (UNIDO) database is probably best suited to the task. While the country coverage is not as extensive as WorldBase, it is available for a large number of countries and offers good coverage of industrial composition in those countries. UNIDO does not offer firm-level data, but its industry-level data is sufficient for calculating $\hat{V}_c$ when combined with our estimates of vertical integration coefficients, $\hat{\delta}_i$'s, from our WorldBase dataset.

Accordingly, we calculate the vertical integration propensity, $\hat{V}_c$, as defined above, but with industrial composition of countries, S_{ci}/S_c, calculated from the UNIDO database. Table 8 reports results of regressions using this measure of $\hat{V}_c$. Panel A shows results without log

[18] Potentially important among these omitted factors are broad institutional characteristics, related to property rights enforcement, corruption, state-society relations and political stability, as well as any effect on the stage of economic development on industrial composition. Appendix Table A1 shows that the correlation of per capita GDP with the specific institutional measures is generally high, suggesting that such omitted effects could be important.

[19] These results are not inconsistent with a view in which these specific measures of institutions indirectly affect vertical integration propensity through their effect on per capita GDP. Nevertheless, since many other factors affect GDP per capita, we do not find this view compelling.

GDP per capita. The results are generally similar to those in Panel A of Table 7. All our measures of specific institutions have coefficients of the same sign as in Table 7. All but two of the coefficients that were significant in Table 7 are significant in Table 8, a difference that may be attributable to the smaller number of countries included in the regressions in Table 8. Panel B of Table 8 shows that, again, per capita GDP dominates the specific measures of institutions in explaining vertical integration propensity. Though not always significant in this sample of countries, per capita GDP shows a strong negative correlation with a country's vertical integration propensity.

We further investigate the relationship between log GDP per capita and vertical integration in Table 9. Because, as Tables 7 and 8 show, per capita GDP has a strong correlation with vertical integration propensity, we would expect that per capita GDP would also be correlated with the vertical integration index. In Panel A of Table 9 we estimate firm-level regressions without industry dummies as in equation (2), and in Panel B we estimate regressions with industry dummies as in equation (3), and in each case per capita GDP is included as the main coefficient of interest. Panel A demonstrates a significant negative correlation between per capita GDP and vertical integration, which is consistent with the relationship between this variable and the vertical integration propensity (and is also consistent with "priors"). For example, in Column 1, the coefficient on per capita GDP is -0.48, with a standard error of 0.11, indicating that there is less vertical integration in richer countries. Columns 2 through 7 show that this relationship holds when we control for each of our measures of specific institutions. At the same time, the coefficients on the measures of specific institutions themselves are not significant. Panel A further demonstrates that the explanatory power of per capita income subsumes the explanatory power of specific institutional factors. Panel D of Figure 1 illustrates the relationship between per capita GDP and vertical integration graphically.

Despite the strong correlations in Panel A, Panel B of Table 9 shows that even this relationship does not hold when we control for industrial composition. In Panel B, the coefficient on log GDP per capita is now positive and generally not significant. Evidently, the entire correlation between GDP per capita and vertical integration is also due to industrial composition (or due to the relationship between GDP per capita and the vertical integration propensity, documented above).

Overall, we conclude that there is no evidence that any of the specific institutional features we have focused on or per capita income are systematically related to vertical integration once we take into account differences in industrial composition associated with the level of economic development.

5 Differential Effects Across Industries

The results in the previous sections may suggest that there are no robust regularities in cross-country vertical integration patterns once we control for industrial composition. In this section, we show that this is not entirely true by looking at the differential effects of these characteristics across industries.

The regression equations so far impose a "constant effect" of specific institutional characteristics on vertical integration. Another possibility is that these characteristics have differential effects across industries. For example, some industries may be systematically more vertically integrated in countries with weak institutions while other industries are more vertically integrated in countries with strong institutions. This might result, for instance, if both market transactions and contracting relationships within firms are more imperfect in poor countries, but also avoiding market imperfections are more important for some industries (leading to more vertical integration), whereas contracting problems make vertical integration more problematic for other industries.

5.1 Specifications with Interaction Effects

Motivated by these considerations, we estimate regressions of the following form

$$v_{cif} = \alpha y_c m_i + \beta x_c m_i + \mathbf{z'}_f \boldsymbol{\phi} + \delta_i + \eta_c + \varepsilon_{ci}. \tag{4}$$

where y_c represents (log) income per capita, x_c represents one of our measures of specific institutions, and m_i represents industry-level characteristics, such as capital intensity, human capital intensity, and technology intensity. The main effect for m_i is already taken out by the full set of industry dummies, the δ_i's. The main coefficient of interest in this specification is β, and for this reason, we also include in this equation a full set of country dummies, η_c. The term $y_c m_i$ is included to investigate whether the interaction is between the specific institutional features and industry characteristics as opposed to some other factor related to income per capita (for example, a broader notion of institutional differences). As with all specifications that include interactions, all main effects are evaluated at their sample mean values. We also include firm-level characteristics, specifically a measure of firm size (as $\mathbf{z}_f$).

Estimates from equation (4) are reported in Table 10. Following the methodology in Rajan and Zingales (1998), all of the industry-level measures are based on U.S. data. In doing so we are assuming (analogous to assumptions made in Rajan and Zingales, 1998) that characteristics of industries in the U.S. economy are representative of (or at the very least correlated with) the characteristics of the same industries in other countries. Descriptive statistics for these measures are found in Panel B of Table 1.

We use three industry-level measures as interactions: physical capital intensity, human capital intensity, and the ratio of office and computing equipment to total equipment, which we refer to as "technology intensity" throughout. We take these measures from Autor, Katz and Krueger (1998), who calculate these using data from the National Income and Product Accounts (NIPA) for the year 1990. Physical capital intensity is defined as the log of capital investment to value added, human capital intensity is defined as the log of employees (full-time equivalent) to output, and as noted above, technology intensity is defined as the log of net capital stock in office, computing, and accounting machinery to total net capital equipment. We use the concordance that these authors developed to map the NIPA industries to our IO industries.

The interaction of log GDP per capita with the industry characteristic is not included in Panel A of Table 10, but is added in Panel B. Columns 1 through 3 present results with physical capital intensity as the industry characteristic. Panel A shows that the strongest effect is for credit market development interacted with capital intensity (Column 2). The coefficient of 0.42, with a standard error of 0.16, would suggest that firms in capital intensive industries are more likely to be vertically integrated in countries with greater financial development. However, in Panel B, including per capita GDP interacted with capital intensity eliminates the significance of credit market development interacted with capital intensity.

Columns 4 through 6 of Table 10 investigate the relationship between human capital intensity and vertical integration. In these columns, the strongest effect comes from the interaction between financial development and human capital or technology intensity. For example, in Column 5 of Panel A, the coefficient on the interaction term is -0.44, with a standard error of 0.18. This indicates that in countries with relatively strong financial development, vertical integration is less prevalent in human capital intensive industries. This effect is of a reasonable magnitude. For example, the coefficient estimate implies that in countries with the strongest financial development, a movement from the lowest human capital industry to the highest is associated with about a 1/4 standard deviation *fall* in the vertical integration index, whereas in countries with the weakest financial development, the same increase in human capital intensity is associated with a 1/5 standard deviation *rise* in the vertical integration index.

One concern is that this interaction effect, like the patterns in Table 7, may reflect an interaction between industry characteristics and GDP per capita. However, the estimates in Panel B indicate that the significant interaction between financial development and human capital intensity is robust to controlling for log GDP per capita. In fact, the coefficient hardly changes when we include the interaction between GDP per capita and industry characteristics.

Columns 7 through 9 of Table 10 look at the relationship between technology intensity and vertical integration. As with human capital intensity, in Panel A, the strongest effect is again on credit market development interacted with technology intensity, which has a negative and significant coefficient. Panel B shows that this result is robust to including log GDP per capita interacted with technology intensity. The coefficient on entry cost interacted with technology intensity is also significant in Panel B, but not in Panel A.

Overall, the interaction results suggest that credit market development is an important determinant of vertical integration in certain industries. More credit market development appears to reduce vertical integration in technology and human capital intensive industries.

In Table 11 we perform additional tests to assess the robustness of the relationship between vertical integration and the interaction of credit market development with human capital intensity and technology intensity. In Columns 1 and 2 of Table 11 we control for financial development interacted with each industry's dependence on external finance. Rajan and Zingales (1998) show that financial development has a more pronounced effect on growth in industries that are more dependent on external finance, so part of our results might be capturing the interaction between financial dependence and financial development. To control for this, we follow Rajan and Zingales (1998) and calculate each industry's technological dependence on external finance based on U.S. data in the CRSP database. Our measure follows the exact definition in Rajan and Zingales (1998) and is computed from U.S. data from 1990-1999. Columns 1 and 2 show that financial development interacted with external dependence on finance has very little impact on vertical integration, whereas the interactions of financial development with human capital intensity (Column 1) and technology intensity (Column 2) retain significant explanatory power. In Columns 3 and 4, we repeat the tests using an alternative measure of financial dependence from Rajan and Zingales (1998), the industry's dependence on equity (calculated from the same CRSP data). Again, this does not affect the significance of our interactions with human capital intensity and technology intensity. The final columns of Table 11 repeat the robustness tests of Table 5. These columns show that our interaction results are robust to excluding the most and least vertically integrated industries (Columns 7 and 8), and to including only industries appearing in at least 90% of the sample countries (Columns 9 and 10). Finally, the interactions continue to have the right sign but are no longer statistically significant when we restrict the regression to manufacturing industries (Columns 5 and 6), which suggests that differences in vertical integration in some high human capital service industries (such as electric and gas utilities, repair services, and amusements) are important for the interaction results.

Overall, the results of Tables 10 and 11 illustrate an interesting pattern relating financial development to vertical integration. They suggest that, when financial development is limited, the greatest extent of vertical integration is to be found in industries with advanced technology and greater than average human capital requirements.

5.2 Interpretation

How do we interpret the interaction effects reported in Tables 10 and 11? At face value, they suggest that while financial development has little effect on average vertical integration, it reduces vertical integration in technology-intensive and human capital-intensive sectors. This also naturally implies that financial development must have some positive effect on vertical integration in less technology-intensive sectors.

To interpret this pattern, let us return to the theories related to financial development. The crux of these theories is that lack of external (bank and market) finance will prevent entry of new firms and productive investment by existing firms. While we may expect that this will lead to larger and thus more vertically integrated firms, in fact the opposite might also be the case. For example, it may be efficient (either technologically or because of contractual reasons) for downstream firms to integrate with their upstream suppliers, but such a relationship may not emerge if downstream firms are credit constrained. On the other hand, if upstream firms are credit constrained and cannot undertake the necessary investments, vertical integration may occur even when it is not efficient.

In this light, the patterns we document are consistent with a configuration whereby in countries with limited financial development, low-tech sectors are insufficiently integrated, while high-tech sectors are excessively integrated. To investigate this issue further, we looked for evidence that the productivity implications of vertical integration are different depending on industry characteristics. In particular, we estimated models with productivity (sales per employee) on the left hand side and the triple interaction of financial development, the firm-level vertical integration index and human capital intensity and also human capital intensity squared (or technology intensity and technology intensity squared) on the right hand side.[20] If both high vertical integration in the high-tech sectors and low vertical integration in the low-tech sectors of financially less-developed countries is inefficient, we may expect a non-monotonic effect of the triple interaction (so that vertical integration in financially less-developed countries is associated with lower productivity specifically in the sector with the lowest or highest technology or human capital needs). This exercise did not show a non-monotonic pattern (results available upon request). This may reflect the fact that some other mechanism is responsible for the differential effects of financial development, or it may result from the crudeness of the productivity measures in the WorldBase dataset. Further investigation of the nature and cause of these differential effects is an area for future research.

[20] And naturally we also included all the second level interactions, so that the triple interaction does not capture their omitted effects.

6 Conclusion

In this paper, we studied the cross-country determinants of vertical integration in a new dataset of over 750,000 firms from 93 countries. Our focus was on the effect of specific institutional features on the vertical integration decisions of firms. This focus was motivated by both empirics and theory. Casual empiricism and existing work suggest that there are large differences in the organization of production and firms across countries and this may be related to contracting problems. Relatedly, a body of influential theories suggest that contracting costs (contracting institutions), credit market development and regulation should be important determinants of vertical integration.

Our empirical results do not confirm the main predictions of these theories. Although there is a cross-country correlation between vertical integration on the one hand and contracting costs, financial development, and entry barriers on the other, we show that this is entirely driven by industrial composition. In particular, countries with higher contracting costs or more limited financial development are concentrated in industries with a high propensity for vertical integration. Once we control for differences in industrial composition, none of these factors seem to affect vertical integration.

Nevertheless, our results also point to a significant relationship between financial development and vertical integration. We find a relatively robust differential effect of financial development across industries: countries with less-developed financial markets are significantly more integrated in industries that are more human capital or technology intensive.

We view our paper as a first step in understanding the cross-country patterns of organization of firms. Despite the importance of the organization of production for productivity and the existence of various influential theories, we know very little about these patterns. The dataset and the approach in this paper can be useful in investigating other dimensions of differences in the organization of firms across countries.

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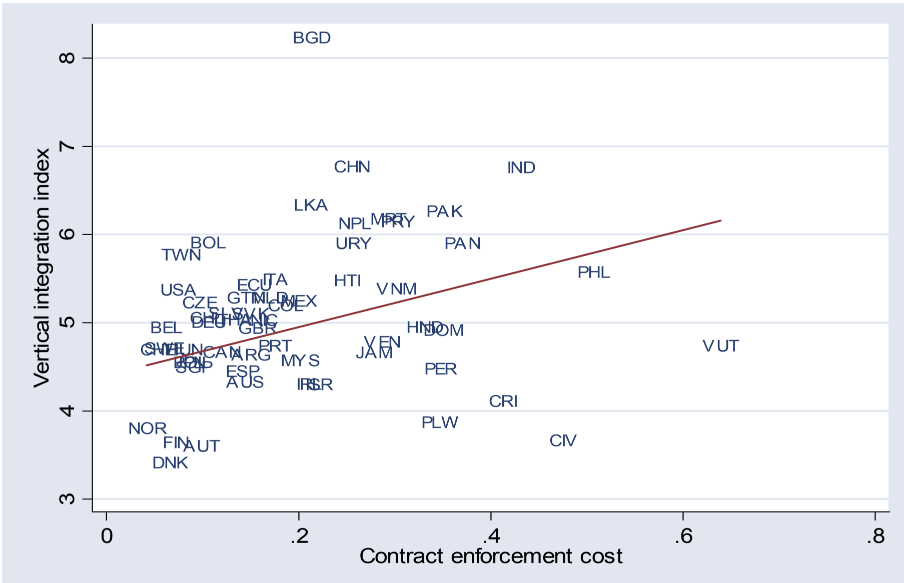
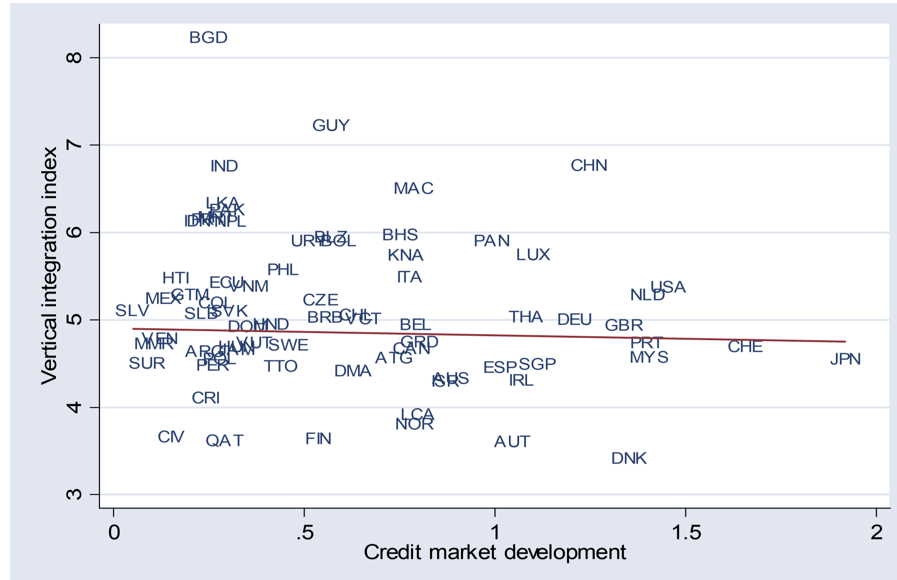
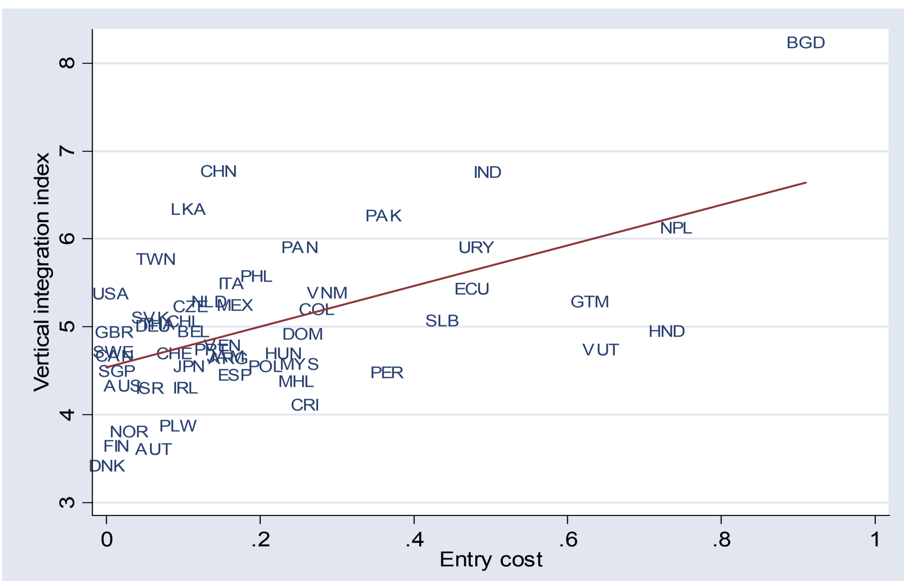
Figure 1
Vertical integration index across countries



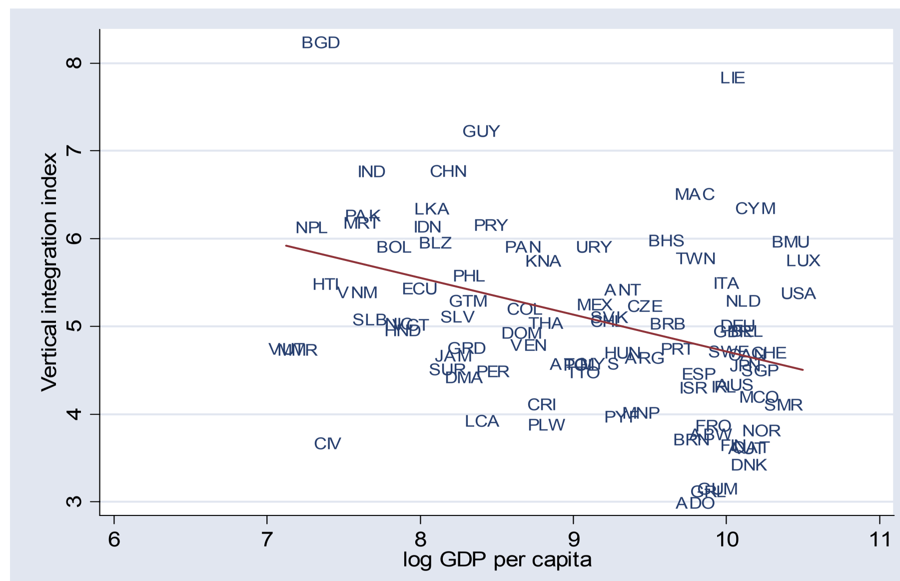
Panel A: Vertical integration and contracting costs



Panel B: Vertical integration and credit market development



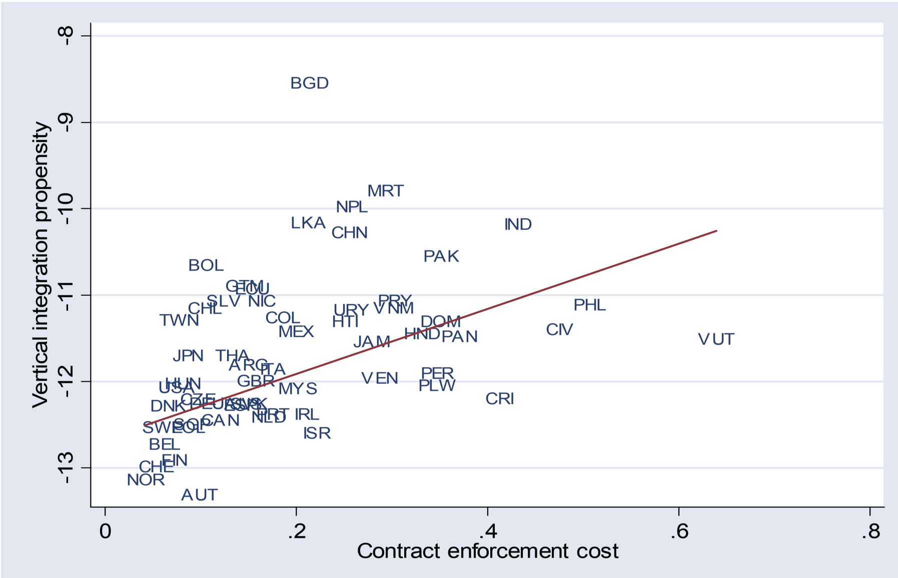
Panel C: Vertical integration and entry costs



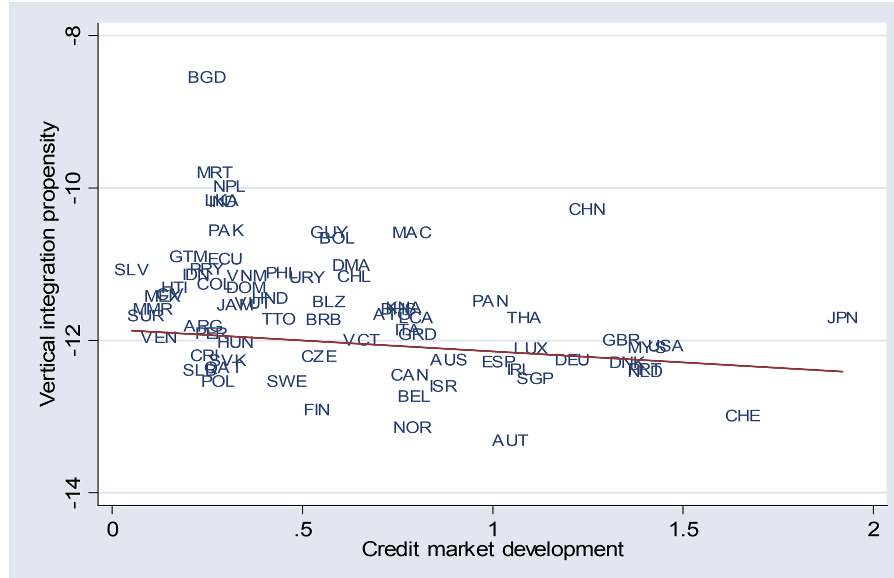
Panel D: Vertical integration and per-capita GDP

Figure 2

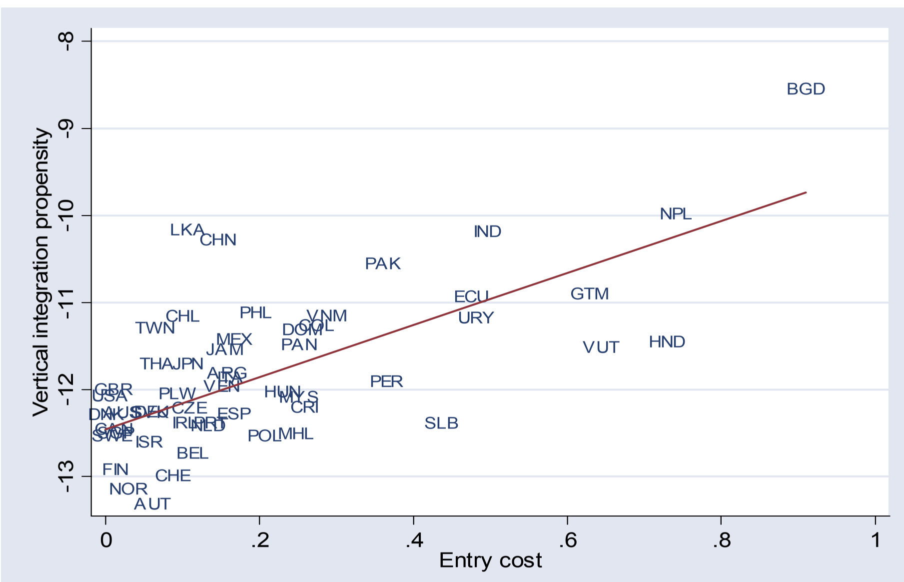
Vertical integration propensity across countries



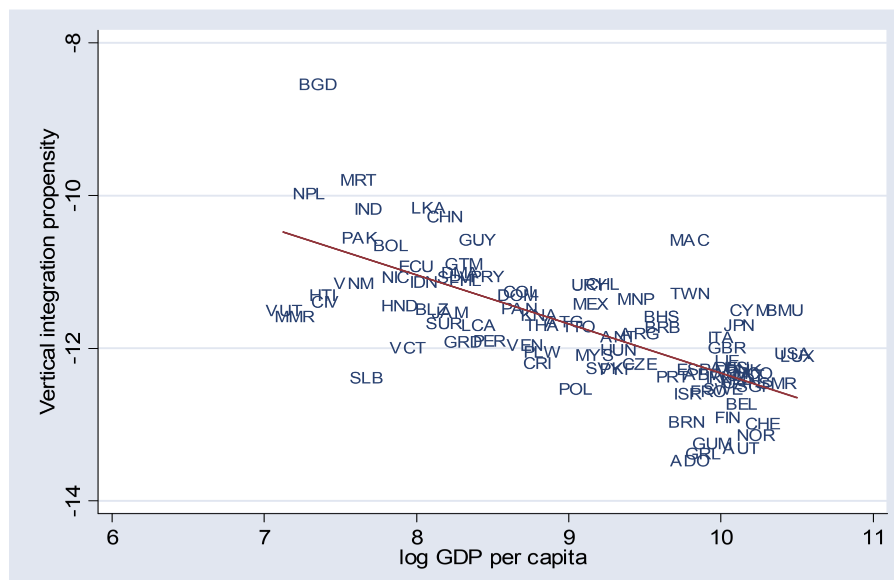
Panel A: Vertical integration propensity and contracting costs



Panel B: Vertical integration propensity and credit market development



Panel C: Vertical integration propensity and entry costs



Panel D: Vertical integration propensity and per-capita GDP

Table 1
Descriptive statistics

	Mean	25th Pctile	Median	75th Pctile	St. Dev.	N
Panel A: Key variables						
(1) Vertical integration index, firm level	4.87	0.46	3.34	6.79	5.58	769,199
(2) Vertical integration index, country level	4.98	4.38	4.93	5.50	1.00	93
(3) Vertical integration propensity	-11.81	-12.33	-11.84	-11.30	0.96	93
(4) GDP per capita (log)	9.03	8.21	9.17	9.98	1.00	93
(5) Population (log)	14.95	12.39	15.52	16.96	2.75	93
(6) Contract enforcement cost (% of debt)	0.26	0.11	0.18	0.30	0.26	61
(7) Contract enforcement procedures (/10)	2.80	2.20	2.70	3.50	0.94	61
(8) Credit market development (% GDP)	0.54	0.29	0.54	0.87	0.43	73
(9) Credit collateral cost (% GDP per capita)	0.13	0.01	0.05	0.16	0.23	55
(10) Entry cost (% GDP per capita)	0.38	0.09	0.17	0.47	0.49	61
(11) Entry procedures (/10)	0.88	0.70	0.90	1.10	0.35	61
(12) Number of employees (log)	3.86	2.56	3.74	5.00	1.87	676,046
Panel B: U.S. industry characteristics						
(13) Capital intensity (log)	-0.72	-1.00	-0.86	-0.58	0.55	67
(14) Human capital intensity (log)	-4.80	-5.11	-4.71	-4.55	0.49	67
(15) Technology intensity (log)	-2.96	-3.64	-2.80	-2.09	1.00	67

The table presents descriptive statistics of data used in subsequent tables. Panel A presents firm-level and country-level data used in regression analysis. Vertical integration measures and number of employees come from the Sept. 2002 WorldBase database. GDP per capita comes from the 2000 World Factbook. Population and credit market development come from 2000 World Bank data. Contract enforcement cost, contract enforcement procedures, credit collateral cost, entry cost, and entry procedures are based on World Bank (2004, 2005) and Djankov et al. (2002, 2003). Panel B presents U.S. industry characteristics used as interacation terms in Section 5. Industry characteristics come from Autor, Katz, and Krueger (1998).

Table 2

Vertical integration and contracting institutions, credit market development, and entry regulation (country level)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dependent variable is the vertical integration index								
Contract enforcement cost	1.72	0.89							
	(0.53)	(0.36)							
Contract enforcement procedures			0.241						
			(0.116)						
Credit market development				-0.08	-0.11				
				(0.18)	(0.17)				
Credit collateral cost						-0.36			
						(0.98)			
Entry cost							1.28	0.83	
							(0.30)	(0.24)	
Entry procedures									0.89
									(0.34)
Log population		0.32			0.21			0.33	
		(0.06)			(0.10)			(0.06)	
R-squared	0.15	0.50	0.08	0.00	0.22	0.00	0.13	0.51	0.17
Number of Observations	61	61	61	73	73	55	61	61	61

The table presents coefficient estimates from regressions of a country-level vertical integration index on specific measures of institutions. Robust standard errors are in parentheses. Regressions are weighted by the number of firms included in the calculation of the vertical integration index for each country.

Table 3

Vertical integration and contracting institutions, credit market development, and entry regulation (firm level)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			Dependent variable is the vertical integration index						
Contract enforcement cost	1.86	1.34							
	(0.44)	(0.35)							
Contract enforcement procedures			0.28						
			(0.10)						
Credit market development				-0.34	-0.32				
				(0.15)	(0.16)				
Credit collateral cost						0.00			
						(0.01)			
Entry cost							1.42	1.14	
							(0.26)	(0.23)	
Entry procedures									0.78
									(0.25)
Log population		0.20			0.22			0.22	
		(0.06)			(0.07)			(0.06)	
Log number of employees	0.26	0.19	0.27	0.27	0.19	0.27	0.26	0.19	0.25
	(0.05)	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.04)	(0.04)
R-squared	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Number of Observations	661,747	661,747	661,747	648,157	648,157	661,038	661,747	661,747	661,747

The table presents coefficient estimates from regressions of a firm-level vertical integration index on specific measures of institutions. Robust standard errors, adjusted for clustering within countries, are in parentheses.

Table 4

Vertical integration and contracting institutions, credit market development, and entry regulation (firm level)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dependent variable is the vertical integration index								
Contract enforcement cost	-0.09	-0.14							
	(0.45)	(0.47)							
Contract enforcement procedures			0.02						
			(0.07)						
Credit market development				0.02	0.02				
				(0.13)	(0.13)				
Credit collateral cost						-0.011			
						(0.004)			
Entry cost							0.12	0.10	
							(0.25)	(0.24)	
Entry procedures									-0.04
									(0.18)
Log population		0.02			0.01			0.01	
		(0.04)			(0.03)			(0.04)	
Log number of employees	0.05	0.04	0.05	0.04	0.04	0.04	0.05	0.04	0.05
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
R-squared	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Number of Observations	661,747	661,747	661,747	648,157	648,157	661,038	661,747	661,747	661,747

The table presents coefficient estimates from regressions of a firm-level vertical integration index on specific measures of institutions. Robust standard errors, adjusted for clustering within countries, are in parentheses. Also estimated but not reported are a set of industry dummies defined at the two-digit input-output level.

Table 5
Robustness checks (firm level)

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable is the vertical integration index					
Panel A: Manufacturing industries only						
Contract enforcement cost	1.16	0.08				
	(0.31)	(0.48)				
Credit market development			-0.50	-0.11		
			(0.18)	(0.12)		
Entry cost					1.05	0.20
					(0.28)	(0.28)
Log population	0.16	0.01	0.21	0.02	0.18	0.01
	(0.05)	(0.04)	(0.05)	(0.04)	(0.05)	(0.04)
Log number of employees	0.26	0.17	0.29	0.18	0.26	0.17
	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)
Industry dummies	No	Yes	No	Yes	No	Yes
R-squared	0.01	0.40	0.01	0.39	0.01	0.40
Number of Observations	253,614	253,614	239,093	239,093	253,614	253,614
Panel B: Most and least vertically integrated industries excluded						
Contract enforcement cost	1.00	-0.09				
	(0.31)	(0.46)				
Credit market development			-0.20	-0.03		
			(0.16)	(0.15)		
Entry cost					0.85	0.11
					(0.25)	(0.25)
Log population	0.16	0.01	0.17	0.00	0.17	0.00
	(0.04)	(0.04)	(0.05)	(0.04)	(0.05)	(0.04)
Log number of employees	0.17	0.05	0.17	0.05	0.17	0.05
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)
Industry dummies	No	Yes	No	Yes	No	Yes
R-squared	0.01	0.32	0.01	0.31	0.01	0.32
Number of Observations	544,067	544,067	531,300	531,300	544,067	544,067
Panel C: Industries appearing in at least 90% of countries only						
Cost to enforce a contract	1.46	-0.14				
	(0.46)	(0.47)				
Domestic credit to the private sector			-0.35	0.04		
			(0.20)	(0.15)		
Cost of entry					1.23	0.10
					(0.31)	(0.25)
Log population	0.23	0.02	0.24	0.01	0.25	0.02
	(0.08)	(0.04)	(0.08)	(0.04)	(0.08)	(0.04)
Log number of employees	0.16	0.04	0.17	0.03	0.16	0.04
	(0.05)	(0.03)	(0.05)	(0.03)	(0.04)	(0.03)
Industry dummies	No	Yes	No	Yes	No	Yes
R-squared	0.01	0.39	0.01	0.38	0.01	0.39
Number of Observations	567,179	567,179	560,644	560,644	567,179	567,179

The table presents coefficient estimates from regressions of a firm-level vertical integration index on specific measures of institutions. Robust standard errors, adjusted for clustering within countries, are in parentheses. In specified columns, industry dummies, defined at the two-digit input-output level, are also estimated but not reported. In Panel B, "most and least vertically industries" includes the 5% most and 5% least vertically integrated industries.

Table 6
Robustness checks with Worldscope data (firm level)

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable is the vertical integration index					
Panel A: Unadjusted data						
Contract enforcement cost	1.82	0.65				
	(0.93)	(0.72)				
Credit market development			-1.27	-0.81		
			(0.35)	(0.24)		
Entry cost					2.16	1.07
					(0.94)	(0.63)
Log population	0.05	-0.04	0.30	0.08	0.05	-0.04
	(0.13)	(0.09)	(0.12)	(0.08)	(0.14)	(0.09)
Log number of employees	0.04	0.04	0.02	0.03	0.03	0.04
	(0.05)	(0.04)	(0.05)	(0.04)	(0.05)	(0.04)
Industry dummies	No	Yes	No	Yes	No	Yes
R-squared	0.00	0.28	0.01	0.28	0.00	0.28
Number of Observations	9,914	9,914	9,596	9,596	9,914	9,914
Panel B: Group-adjusted data						
Contract enforcement cost	2.73	-0.38				
	(1.25)	(0.95)				
Credit market development			-1.47	-0.40		
			(0.38)	(0.20)		
Entry cost					2.50	0.62
					(1.02)	(0.63)
Log population	0.04	0.05	0.32	0.10	0.06	0.04
	(0.15)	(0.07)	(0.12)	(0.08)	(0.16)	(0.07)
Log number of employees	0.04	0.03	0.03	0.03	0.04	0.03
	(0.05)	(0.03)	(0.05)	(0.04)	(0.05)	(0.03)
Industry dummies	No	Yes	No	Yes	No	Yes
R-squared	0.00	0.35	0.01	0.36	0.00	0.35
Number of Observations	8,836	8,836	8,545	8,545	8,836	8,836

The table presents coefficient estimates from regressions of a firm-level vertical integration index on specific measures of institutions. Data come from the Worldscope database. Robust standard errors, adjusted for clustering within countries, are in parentheses. In specified columns, industry dummies, defined at the two-digit input-output level, are also estimated but not reported. In Panel B, "Group-adjusted" means that Asian firms belonging to the same business group are treated as a single entity.

Table 7

Vertical integration propensity (country level)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable is vertical integration propensity						
Panel A: Per-capita GDP not included							
Contract enforcement cost	1.87						1.53
	(0.73)						(0.68)
Contract enforcement procedures		0.28					-0.01
		(0.11)					(0.14)
Credit market development			-0.29				0.09
			(0.19)				(0.21)
Credit collateral cost				1.87			1.35
				(0.81)			(0.84)
Entry cost					1.43		-0.21
					(0.36)		(0.54)
Entry procedures						1.11	0.82
						(0.25)	(0.38)
R-squared	0.20	0.11	0.04	0.06	0.17	0.30	0.42
Number of Observations	61	61	73	55	61	61	53
Panel B: Per-capita GDP included							
Log GDP per capita	-0.69	-0.92	-0.79	-0.69	-0.72	-0.59	-0.89
	(0.14)	(0.12)	(0.11)	(0.12)	(0.15)	(0.14)	(0.16)
Contract enforcement cost	-0.02						0.23
	(0.37)						(0.41)
Contract enforcement procedures		-0.29					-0.26
		(0.11)					(0.12)
Credit market development			0.36				0.29
			(0.19)				(0.20)
Credit collateral cost				0.05			1.14
				(0.70)			(0.83)
Entry cost					-0.20		-0.28
					(0.30)		(0.34)
Entry procedures						0.32	0.32
						(0.24)	(0.27)
R-squared	0.52	0.58	0.58	0.52	0.52	0.53	0.69
Number of Observations	61	61	73	55	61	61	53

The table presents coefficient estimates from regressions of an index measuring a country's propensity for vertical integration on specific measures of institutions. Robust standard errors are in parentheses. Regressions are weighted by the number of firms per country.

Table 8

Robustness check of vertical integration propensity with UNIDO data (country level)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable is vertical integration propensity						
Panel A: Per-capita GDP not included							
Contract enforcement cost	2.51						1.58
	(0.81)						(1.01)
Contract enforcement procedures		0.28					-0.12
		(0.09)					(0.14)
Credit market development			-0.31				0.17
			(0.18)				(0.22)
Credit collateral cost				1.71			3.09
				(1.24)			(0.94)
Entry cost					0.86		0.61
					(0.42)		(0.69)
Entry procedures						0.42	0.52
						(0.24)	(0.46)
R-squared	0.20	0.34	0.09	0.12	0.09	0.10	0.52
Number of Observations	28	28	30	27	28	28	27
Panel B: Per-capita GDP included							
Log GDP per capita	-0.41	-0.33	-0.32	-0.49	-0.70	-0.48	-0.52
	(0.14)	(0.18)	(0.22)	(0.09)	(0.17)	(0.15)	(0.52)
Contract enforcement cost	0.99						0.88
	(0.83)						(1.28)
Contract enforcement procedures		0.13					-0.17
		(0.13)					(0.14)
Credit market development			-0.07				0.39
			(0.20)				(0.43)
Credit collateral cost				0.02			2.62
				(1.12)			(1.15)
Entry cost					-1.01		0.11
					(0.40)		(0.58)
Entry procedures						0.04	0.33
						(0.24)	(0.62)
R-squared	0.40	0.41	0.16	0.39	0.44	0.38	0.55
Number of Observations	28	28	30	27	28	28	27

The table presents coefficient estimates from regressions of an index measuring a country's propensity for vertical integration on specific measures of institutions. The propensity for vertical integration is calculated using data from the UNIDO database. Robust standard errors are in parentheses. Regressions are weighted by the number of firms per country.

Table 9
Vertical integration and GDP per capita (firm level)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable is the vertical integration index						
Panel A: No industry dummies							
Log GDP per capita	-0.48	-0.40	-0.51	-0.55	-0.52	-0.42	-0.41
	(0.11)	(0.13)	(0.15)	(0.12)	(0.14)	(0.15)	(0.15)
Contract enforcement cost		0.72					
		(0.38)					
Contract enforcement procedures			-0.02				
			(0.13)				
Credit market development				0.07			
				(0.19)			
Credit collateral cost					-1.09		
					(0.73)		
Entry cost						0.45	
						(0.40)	
Entry procedures							0.26
							(0.26)
Log number of employees	0.25	0.25	0.25	0.24	0.24	0.25	0.25
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
R-squared	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Number of Observations	676,046	661,747	661,747	648,157	661,038	661,747	661,747
Panel B: Industry dummies included							
Log GDP per capita	0.08	0.14	0.22	0.14	0.06	0.19	0.14
	(0.08)	(0.09)	(0.12)	(0.09)	(0.08)	(0.09)	(0.09)
Contract enforcement cost		0.29					
		(0.41)					
Contract enforcement procedures			0.14				
			(0.09)				
Credit market development				-0.08			
				(0.16)			
Credit collateral cost					-0.01		
					(0.00)		
Entry cost						0.54	
						(0.24)	
Entry procedures							0.12
							(0.23)
Log number of employees	0.05	0.05	0.06	0.05	0.04	0.05	0.05
	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)
R-squared	0.38	0.40	0.40	0.40	0.40	0.40	0.40
Number of Observations	676,046	661,747	661,747	648,157	661,038	661,747	661,747

The table presents coefficient estimates from regressions of a firm-level vertical integration index on specific measures of institutions. Robust standard errors, adjusted for clustering within countries, are in parentheses. Also estimated in Panel B, but not reported, are a set of industry dummies defined at the two-digit input-output level.

Table 10

Interactions of industry characteristics with contracting institutions, credit market development, and entry regulation (firm level)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Industry characteristic interacted:	Capital intensity			Human capital intensity			Technology intensity		
	Dependent variable is the vertical integration index								
Panel A: Per-capita GDP × industry characteristic not included									
Contract enforcement cost	-0.62			0.41			-0.15		
	(0.34)			(0.36)			(0.20)		
Credit market development		0.42			-0.44			-0.27	
		(0.16)			(0.18)			(0.12)	
Entry cost			-0.43			0.22			-0.12
			(0.23)			(0.25)			(0.15)
Log number of employees	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
R-squared	0.43	0.42	0.43	0.43	0.42	0.43	0.43	0.42	0.43
Number of Observations	557,374	543,558	557,374	557,374	543,558	557,374	557,374	543,558	557,374
Panel B: Per-capita GDP × industry characteristic included									
Log GDP per capita	0.25	0.11	0.27	-0.20	0.00	-0.23	-0.13	0.04	-0.13
	(0.08)	(0.10)	(0.10)	(0.12)	(0.13)	(0.14)	(0.07)	(0.07)	(0.07)
Contract enforcement cost	0.08			-0.13			-0.48		
	(0.38)			(0.38)			(0.25)		
Credit market development		0.35			-0.44			-0.30	
		(0.20)			(0.22)			(0.14)	
Entry cost			0.21			-0.29			-0.39
			(0.33)			(0.35)			(0.19)
Log number of employees	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
R-squared	0.43	0.42	0.43	0.43	0.42	0.43	0.43	0.42	0.43
Number of Observations	557,374	543,558	557,374	557,374	543,558	557,374	557,374	543,558	557,374

The table presents coefficient estimates from regressions of a firm-level vertical integration index on specific measures of institutions interacted with U.S. industry characteristics. Industry characteristics are taken from Autor, Katz, and Krueger (1998). Robust standard errors, adjusted for clustering within country/industries, are in parentheses. Also estimated but not reported are a set of industry dummies defined at the two-digit input-output level, and a set of country dummies.

Table 11
Credit market development interaction results, additional robustness checks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Control for external dependence		Control for equity dependence		Manufacturing industries only		Most and least vertically integrated industries excluded		Industries appearing in at least 90% of countries only	
	Dependent variable is the vertical integration index									
Credit market development × human capital intensity	-0.44		-0.44		-0.21		-0.383		-0.45	
	(0.21)		(0.18)		(0.23)		(0.197)		(0.19)	
Credit market development × technology intensity		-0.302		-0.27		-0.05		-0.28		-0.30
		(0.153)		(0.12)		(0.11)		(0.13)		(0.13)
Credit market development × external dependence	0.00	-0.09								
	(0.12)	(0.15)								
Credit market development × equity dependence			0.06	0.08						
			(0.05)	(0.05)						
Log number of employees	0.04	0.04	0.04	0.04	0.19	0.19	0.05	0.06	0.03	0.03
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
R-squared	0.42	0.42	0.42	0.42	0.40	0.40	0.33	0.33	0.41	0.41
Number of Observations	543,202	543,202	543,202	543,202	239,093	239,093	432,681	432,681	464,531	464,531

The table presents coefficient estimates from regressions of a firm-level vertical integration index on credit market development interacted with U.S. industry characteristics. Human capital intensity and technology intensity come from Autor, Katz, and Krueger (1998). External dependence and equity dependence are defined as in Rajan and Zingales (1998). "Most and least vertically industries" includes the 5% most and 5% least vertically integrated industries. Robust standard errors, adjusted for clustering within country/industries, are in parentheses. Also estimated but not reported are a set of industry dummies defined at the two-digit input-output level, and a set of country dummies.

Table A1

Correlation coefficients of country-level variables

	Log GDP per capita	Log population	Contract enforcement cost	Contract enforcement procedures	Credit collateral cost	Credit market development	Entry cost	Entry procedures
Log GDP per capita	1.000	-0.199	-0.538	-0.498	-0.365	0.642	-0.660	-0.504
Log population		1.000	-0.245	0.025	-0.095	0.063	-0.071	0.196
Contract enforcement cost (% of debt)			1.000	0.120	0.210	-0.358	0.260	0.101
Contract enforcement procedures (/10)				1.000	0.212	-0.509	0.407	0.679
Credit collateral cost (% GDP per capita)					1.000	-0.344	0.417	0.306
Credit market development (% GDP)						1.000	-0.478	-0.387
Entry cost (% GDP per capita)							1.000	0.517
Entry procedures (/10)								1.000

Table A2
Estimated industry dummies for vertical integration

Industry (brief description)	Estimated dummy coefficient	Industry (continued)	Coefficient (continued)
Health/Education Services	-5.93	Radio/TV Broadcasting	-1.68
Maintenance Construction	-5.53	Manufacturing, Misc.	-1.56
Furniture, Household	-5.42	Machinery, Farm	-1.50
Household Appliances	-5.39	New Construction	-1.31
Automotive Service	-5.10	Machinery, Service Industry	-1.27
Wood Containers	-4.70	Industrial Equipment	-1.18
Eating/Drinking Places	-4.31	Utilities	-1.15
Furniture, Commercial	-4.27	Food	-0.91
Lodging/Personal Services	-4.23	Rubber	-0.84
Ordnance	-3.90	Paints	-0.79
Machinery, Industrial	-3.73	Textiles, Fabricated	-0.63
Ag/Forestry/Fishery Services	-3.72	Finance/Insurance	-0.49
Screw Machine/Stamping	-3.63	Mining, Chemical	0.05
Electrical, Misc.	-3.55	Engines	0.09
Footwear/Other Leather	-3.47	Motor Vehicles	0.38
Electric Lighting	-3.44	Real Estate	0.65
Scientific Instruments	-3.31	Transportation	1.26
Mining, Nonmetallic	-3.04	Metal Containers	1.44
Printing/Publishing	-3.04	Aircraft	1.53
Other Transportation Equipment	-2.89	Iron/Steel Manufacturing	1.57
Heating/Plumbing Fabrication	-2.87	Petroleum Refining	1.79
Optical Equipment	-2.81	Drugs/Cleansers	2.38
Machinery, Special	-2.68	Glass	2.66
Audio/Video Equipment	-2.65	Plastics	2.90
Machinery, Metalworking	-2.56	Computer/Office Equipment	3.31
Paperboard Containers	-2.52	Mining, Coal	4.71
Stone/Clay	-2.37	Electronic Components	4.91
Forestry/Fishery	-2.19	Nonferrous Metal Manufacturing	5.91
Lumber and Wood	-2.13	Apparel	6.19
Machinery, Mining	-2.13	Mining, Iron	6.50
Professional Services	-2.12	Communications, Not Radio/TV	6.94
Electrical Equipment	-2.03	Chemicals	9.02
Other Agricultural	-2.02	Fabrics	9.58
Other Fabricated Metal	-2.01	Amusement	10.06
Tobacco	-2.01	Livestock (omitted in regression)	10.88
Paper	-1.99	Leather	11.70
Textiles, Misc.	-1.96	Petroleum and Gas	13.33
Machinery, Misc.	-1.83	Mining, Nonferrous	17.08

The table reports estimated dummy variables in a firm-level regression of vertical integration on industry dummies using U.S. data.

Table A3

Vertical integration and alternative measures of specific institutions (firm level)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Dependent variable is the vertical integration index											
Contract enforcement time	0.09	0.02										
	(0.04)	(0.03)										
Procedural complexity			0.010	0.003								
			(0.006)	(0.004)								
Disclosure index					-0.14	-0.01						
					(0.05)	(0.03)						
Interest rate spread							0.037	-0.023				
							(0.018)	(0.013)				
Entry time									0.007	0.000		
									(0.003)	(0.002)		
Antitrust											-0.28	0.01
											(0.10)	(0.07)
Log number of employees	0.26	0.05	0.27	0.05	0.28	0.05	0.26	0.04	0.27	0.05	0.25	0.04
	(0.05)	(0.03)	(0.05)	(0.03)	(0.05)	(0.02)	(0.05)	(0.02)	(0.05)	(0.03)	(0.04)	(0.03)
Industry dummies	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.01	0.40	0.01	0.40	0.01	0.40	0.01	0.40	0.01	0.40	0.01	0.40
Number of Observations	661,747	661,747	661,580	661,580	661,693	661,693	639,677	545,928	661,747	661,747	655,929	655,929

The table presents coefficient estimates from regressions of a firm-level vertical integration index on specific measures of institutions. Robust standard errors, adjusted for clustering within countries, are in parentheses. Industry dummies are included where noted. Contract enforcement time is from Djankov et al (2003). Procedural complexity is an alternative measure of contracting costs from Djankov et al (2003), that has been shown significant in other work (see Acemoglu and Johnson, 2003). The disclosure index measures disclosure of company ownership (see World Bank, 2004). The interest rate spread is the spread between lending and borrowing rates in the country (from year 2000 World Bank data). Entry time is from Djankov et al (2003). The antitrust measure is based on survey data, with higher values of the index representing stronger antitrust regulation, as in Dutz and Hayri (1999).