THE JOURNAL OF FINANCE • VOL. LVIII, NO. 6 • DECEMBER 2003

Financial Development, Property Rights, and Growth

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ABSTRACT

In countries with more secure property rights, firms might allocate resources better and consequentially grow faster as the returns on different types of assets are more protected against competitors' actions. Using data on sectoral value added for a large number of countries, we find evidence consistent with better property rights leading to higher growth through improved asset allocation. Quantitatively, the growth effect is as large as that of improved access to financing due to greater financial development. Our results are robust using various samples and specifications, including controlling for growth opportunities.

RECENTLY, NUMEROUS PAPERS HAVE ESTABLISHED that financial development fosters growth and that a country's financial development is related to its institutional characteristics, including its legal framework. The financial development and growth literature has established that finance matters for growth both at the macroeconomic and microeconomic level (King and Levine (1993), Levine (1997)). The law and finance literature has found that financial markets are better developed in countries with strong legal frameworks (La Porta et al. (1998), Beck, Demirgüç-Kunt, and Levine (2003)). These well-developed financial markets make it easier for firms to attract financing for their investment needs (Demirgüç-Kunt and Maksimovic (1998), Rajan and Zingales (1998)). Related work has established that debt structures of firms differ across institutional frameworks (Rajan and Zingales (1995), Demirgüç-Kunt and Maksimovic (1999), and Booth et al. (2000)).[1]

*Claessens is from the University of Amsterdam and CEPR and Laeven is from the World Bank. We are grateful to Richard Green (the editor) and an anonymous referee who helped us to substantially improve the paper. We thank Thorsten Beck, Sudipto Dasgupta, Charles Goodhart, Simon Johnson, Ross Levine, Inessa Love, Enrico Perotti, Sheridan Titman, and Chris Woodruff for helpful suggestions, and Ying Lin for excellent research assistance. We received helpful comments from seminar participants at Korea University, Universidad Argentina de la Empresa, London School of Economics, Stockholm School of Economics, University of Amsterdam, the 17th Annual Congress of the European Economic Association in Venice, and the Third Annual Conference on Financial Market Development in Emerging and Transition Economies at Hong Kong University of Science and Technology. We thank Raghu Rajan and Luigi Zingales for the use of their data, Ray Fisman and Inessa Love for providing their data on U.S. sectoral sales growth, and Walter Park for providing his index data on patent rights. The views expressed in this paper are those of the authors and do not necessarily represent those of the World Bank.

[1] In particular, it has been established that firms in developing countries have a smaller fraction of their total debt in the form of long-term debt.

Thus far the literature has not paid much attention to differences across countries in terms of firms' asset structure, that is, to differences in the allocation of investable funds by firms across various types of assets. However, these differences are large as well. Demirgüç-Kunt and Maksimovic (1999) find that firms in developing countries have higher proportions of fixed assets to total assets and less intangible assets than firms in developed countries. This is surprising since the literature on firms' optimal capital structure (Harris and Raviv (1991)) suggests that a lack of long-term financing—typical in a developing country—would make it more difficult to finance fixed assets. Why is it that firms in developing countries have more fixed assets? Is it that they need more fixed collateral to attract external financing? Or does the preference for fixed assets and a corresponding lower share of intangible assets arise in countries with worse property rights because the returns on fixed assets are easier to secure from the firm's point of view than the returns on intangible assets? More generally, what is the role of property rights in terms of affecting investment patterns of firms?

In this paper, we empirically explore the role of property rights in influencing the allocation of investable resources. We start from the well-established proposition that greater financial sector development increases the availability of external resources and thereby enhances firm investment. We also acknowledge the literature demonstrating the importance of a good legal framework and well-established property rights for overall economic growth. In terms of channels through which property rights affect firm growth, we focus on the allocation of investable resources by a firm. At the firm level, our idea of property rights is the degree of protection of the return on assets against powerful competitors. This notion of property rights is different from what is common in the literature where it is typically regarded as the protection of assets against actions by government. By focusing on the asset side of a firm's balance sheet, we instead use the term property rights as referring to the protection of entrepreneurial and other investment in firm assets against actions of other firms. We argue that a firm operating in a market with weaker property rights may be led to invest more in fixed assets relative to intangible assets because it finds it relatively more difficult to secure returns from intangible assets than from fixed assets.

The argument goes as follows. A firm is always at risk of not getting the returns from its assets (tangible or intangible) due to actions by the government, its own employees, or other firms. Since our notion of property rights is protection against powerful competitors, rather than against the government, we assume no risk of expropriation by the government (or equivalently, we assume the risk to be identical for tangible and intangible assets). For the firm's employees and other firms, in particular powerful competitors, it is relatively easy to steal the intangible assets of a firm if property rights are not secure. In a narrow sense, this is because the value of many intangible assets—patents (property rights to inventions and other technical improvements), copyrights (property rights to authors, artists, and composers), and trademarks (property rights for distinctive commercial marks or symbols)—purely derive from the existence of (intellec-

tual) property rights. Without property rights protection, employees can simply walk away with many of a firm's intangible assets and competitors can easily copy them. As such, property rights in a narrow sense are very important for securing returns on intangible assets. In contrast, stealing physical property such as buildings and machinery is more difficult, particularly for competing firms, even when general property rights are not secure. In a broader sense therefore, property rights matter more for securing returns from intangible assets than from tangible assets. It follows that property rights matter more for intangible assets than for tangible assets. More generally, we argue that the degree to which firms allocate resources in an optimal way will depend on the strength of a country's property rights, with the allocation effect being important for consequent firm growth.

As noted, the literature has already shown that across countries, firm growth is affected by the development of financial markets. As such, there are two effects to consider in a cross-country study, a finance effect and an asset allocation effect. The finance effect determines the available resources for investment and thus affects firm growth. The asset allocation effect determines the efficiency of firm investment and thus also affects growth. We empirically investigate the importance of the finance and asset allocation effects for different industries in a large number of countries. We find less growth in countries with a lower level of financial development, consistent with the hypothesis that firms lack access to finance and thus underinvest. And in countries with less secure property rights, there is less growth, consistent with the hypothesis that the allocation of firms' investment is inefficient as firms underinvest in intangible assets. Our results are robust to using different country samples and estimation techniques, including instrumental variables and variations in country controls. Empirically, the two effects appear to be equally important drivers of growth in sectoral value added. Our estimates predict that the difference in growth rates between the 75th and 25th percentile intangible-intensive industry will be 1.4% per year higher in a country with a property rights index of five, the 75th percentile country, compared to an index of three, the 25th percentile country. For comparison, the average growth rate in our sample is 3.4% per year. Therefore, a differential rate of 1.4% due to an improvement in the property rights index from three to five represents a large increase.

Although we do an array of robustness tests, our results do come with provisos. Apart from the usual caveats related to possible weaknesses in the data and the choice of a particular time period and country sample, there are methodological issues. Most important may be the fact that to test fully for the role of the asset allocation mechanism, we need both an instrument for the mechanism and an instrument for property rights. While instruments for the property rights have been developed, instruments for the actual asset allocation do not (yet) exist. When and if appropriate instruments are found, the asset allocation mechanism needs to be tested further.

The paper is structured as follows. Section I reviews the related literature, develops the finance and asset allocation effects, and presents our methodology to separate the two effects empirically. Section II presents the data used in our

empirical application. Section III presents the empirical results concerning the relationships between growth in value added and the finance and asset allocation effects. Section IV presents a number of robustness tests, and Section V concludes.

I. Related Literature and Hypothesis

Our work is related to several strands of literature. The starting point is the work by King and Levine (1993), Levine and Zervos (1998), Beck, Levine, and Loayza (2000), and others that has established an empirical link between financial development and economic growth. Also related is the law and finance literature initiated by La Porta et al. (1997). This literature focuses on the relationship between the institutional framework of a country and its financial development (see also La Porta et al. (1998), Rajan and Zingales (1998), and Demirgüç-Kunt and Maksimovic (1998)). The literature has established that financial sector development is higher in countries with better legal systems and stronger creditor rights since such environments increase the ability of lenders to collateralize their loans and finance firms. In an extension, Beck et al. (2003) show that both legal systems and a country's initial endowments are important determinants of financial development and private property rights protection, with initial endowments explaining relatively more of the cross-country variation in financial development than legal origin.

The second strand we draw on is the capital structure literature (Myers (1977), Titman and Wessels (1988), and Harris and Raviv (1991)). This literature relates firms' liability structure to firm asset choices, among others. It has established that real, tangible assets, such as plant and equipment, can support more debt than intangible assets. In particular, fixed assets can support more long-term debt because they have greater liquidation and collateralizable value. Holding other factors constant, debt ratios will be lower the larger the proportion of firm values represented by intangible assets (Myers (1977)). Bradley, Jarrell, and Kim (1984) provide empirical support for the argument that a larger amount of intangible assets reduces the borrowing capacity of a firm.[2]

The third strand of literature relates to the role of property rights in affecting overall investment and investment patterns. Besley (1995) shows the role of property rights for investment incentives and provides evidence for the importance of property rights in the context of land ownership by farmers in Ghana. Johnson, McMillan, and Woodruff (2002) show for a sample of firms in post-communist countries that weaker property rights discourage the reinvestment of firm earnings, even when bank loans are available, suggesting that secure property rights are both a necessary and sufficient condition for entrepreneurial investment. The role of property rights in affecting investment patterns has also been acknowledged, although less explicitly studied. Mansfield (1995) hints that there may be a relationship between the protection of property rights and the allocation of investable resources between fixed and intangible assets. Using a survey of firm

[2] Work by Rajan and Zingales (1995) and Demirgüç-Kunt and Maksimovic (1999) confirms that debt maturity and asset structures for cross sections of countries are related in this way, with firms with more fixed assets being able to support a greater amount of long-term debt.

managers, he states that "most of the firms we contacted seemed to regard intellectual property rights protection to be an important factor . . . [influencing] investment decisions" (p. 24). Stern, Porter, and Furman (2000) show that the strength of a country's intellectual property rights affects its innovative capacity, as measured by the degree of international patenting. In developing countries, the lower degree of investment in intangible assets may relate to the weaker protection of property rights. More generally, the institutional economics literature (North (1990)) suggests that investment in particular types of assets will be higher the more protected the property rights of the assets are.

These three strands have not yet merged in investigating empirically the effects of institutions on both firm financing and asset allocation, and consequently on growth. Here we want to test two hypotheses: whether firms in countries with better developed financial systems have more access to finance and are therefore able to invest more overall, and whether firms in countries with better property rights invest more efficiently across types of assets. In turn, both aspects will be reflected in higher growth rates. The law and finance literature has already established that firms in a country with a better legal framework and more developed financial markets find it easier to attract external financing. Empirical investigation of how a country's property rights protection affects firms' asset allocation has not yet occurred.

For our empirical tests, we use the setup of Rajan and Zingales (1998, RZ hereafter) to assess the relationship between financial development, property rights, and growth.[3] The RZ model relates the growth in real value added in a sector in a particular country to a number of country and industry-specific variables. In the case of RZ, the specific test focuses on financial development and the argument of RZ is that financially dependent firms can be expected to grow more in countries with a higher level of financial development. In addition to including country indicators and industry indicators, they overcome some of the identification problems encountered in standard cross-country growth regressions by interacting a country characteristic (financial development of a particular country) with an industry characteristic (external financial dependence of a particular industry). This approach is less subject to criticism regarding an omitted variable bias or model specification than traditional approaches and allows them to isolate the impact of financial development on growth. In the regression results explaining sectoral growth, RZ find a positive sign for the interaction between the external financial dependence ratio and the level of financial development. They also find a similar effect when including an interaction term between the typical external dependence variable for the particular sector and the quality of a country's legal framework.

Their results provide support for the finance effect. We expand the RZ model to test for the asset allocation effect. We add to the basic model in RZ a variable that is the interaction of the typical ratio for each industrial sector of intangible-to-

[3] Other papers that use this approach include Cetorelli and Gambera (2001), which investigates the effects of bank concentration on sectoral growth, and Fisman and Love (2003), which investigates the effects of trade credit usage on sectoral growth.

fixed assets and an index of the strength of countries' property rights. We then test whether industrial sectors that typically use many intangible assets grow faster (slower) in countries with more (less) secure property rights. If intangible-intensive sectors grow faster in countries with better property rights, then we have indirect evidence that property rights affect firms' asset choices and consequently (through that channel) growth. We also perform a number of robustness tests on the importance of controlling for country-specific factors and using instrumental variables to control for the possible (residual) endogeneity of some variables.

In line with RZ, we use U.S. firm data to construct proxies at the industry level for the typical external financial dependence for a particular industrial sector and the typical ratio of intangible to fixed assets for a particular industry. The presumption here is that the well-developed financial markets and the well-protected property rights in the United States should allow U.S. firms to achieve the desired financial and asset structures for their respective industrial sector. This approach offers a way to identify the desired extent of external financial dependence and the optimal asset mix of an industry anywhere in the world.[4] It assumes that there are technological and economic reasons why some industries depend more on external finance and intangible assets than others do, and that these differences, to a large degree, prevail across countries. This does not mean that we assume a sector in two countries with the same degree of property protection to have exactly the same optimal mix of intangibles and tangible assets. Local conditions such as growth opportunities are allowed to differ between countries. We only assume the rank order of optimal asset mixes across industries to be similar across countries. Furthermore, we explicitly conduct tests for the importance of this assumption.

Following RZ, the regressions include the industry's market share in total manufacturing in the specific country to control for differences in growth potential across industries. Industries with large market shares may have less growth potential than industries with small initial market shares when there is an industry-specific convergence. The initial share may also help to control for other variations between countries, such as in their initial comparative advantage among certain industries based on factors other than financial development and property rights protection. Finally, in line with RZ, we use country and industry dummies to control for country-specific and industry-specific factors.

II. Data

We use industry-specific and country-specific data from a variety of sources. Table I presents an overview of the variables used in our empirical analysis and their sources. Most of the variables are self-explanatory and have been used in other cross-country studies of firm financing structures and firm growth.

[4] The advantage of this approach is that we do not need information on the actual asset mix for industries in different countries. The comparability of such data would be limited because accounting practices, particularly with respect to intangible assets, differ greatly around the world.

In line with RZ, we use the ratio of private credit to GDP as a proxy for financial development. As proxies for the level of protection of property rights, we use three broad indexes of property rights and two indexes of intellectual property rights, as well as a specific index of patent rights. These indexes of property rights come from different sources, each having some advantages and disadvantages. Our main property rights index is the rating of protection of property rights from the Index of Economic Freedom constructed by the Heritage Foundation. This relatively broad index of property rights is available for a large set of countries and has been used by other researchers (e.g., Johnson, Kaufmann, and Zoido-Lobaton (1998) and La Porta et al. (1999, 2002)). A second index of property rights rates the protection of intellectual property rights in particular by using data from the "Special 301" placements of the Office of the U.S. Trade Representative (USTR). "Special 301" requires the USTR to identify those countries that deny adequate and effective protection for intellectual property rights or deny fair and equitable market access for persons that rely on intellectual property protection. Countries can be placed on different lists depending on their relative protection of intellectual property. For example, countries which have the most onerous or egregious acts, policies, or practices and which have the greatest adverse impact on relevant U.S. products are designated "priority foreign countries." As such, the index weights the degree of property rights protection with the economic impact that protection deficiencies have on U.S. trade. We use these qualifications to construct an index of intellectual property rights protection. The third index is the patent rights index constructed by Ginarte and Park (1997). This index focuses more specifically on the protection of patents. A fourth index is the property rights index of the World Economic Forum (2002), which measures the general legal protection of private property in a country. The fifth index is the intellectual property rights index of the World Economic Forum, which measures the protection of intellectual property in a country. The two World Economic Forum indexes are available only for the year 2001. The sixth index is the property rights index constructed by Knack and Keefer (1995) using data from the International Country Risk Guide (ICRG). This index measures property rights in a broad sense and includes five measures: quality of the bureaucracy, corruption in government, rule of law, expropriation risk, and repudiation of contracts by the government. Table I presents more details on these six indexes of property protection.

Our main index of protection of property rights covers the period 1995 to 1999; the Special 301 index of protection of intellectual property rights covers the period 1990 to 1999; the World Economic Forum indexes refer to 2001; and the Knack and Keefer index covers the period 1982 to 1995. The growth regressions, however, include data for the period 1980 to 1989, as in RZ. Ideally, one would want to use property rights indexes for the period 1980 to 1989 as well; however, this is not possible for the property rights indexes available to us due to data limitations. The one exception is the Ginarte and Park patent rights index, for which we do have data for the period 1980 to 1989. Therefore, this index does not suffer from the nonoverlapping time period problem and we can use the patent rights index for the year 1980—the beginning of the period 1980 to 1989—in the regressions.

Table I

Definition and Source of the Variables

This table describes the variables collected for our study. The first column gives the names of the variable as we use it. The second column describes the variable and provides the source from which it was collected.

Variable	Description
Property (Freedom)	A rating of property rights in each country (on a scale from 1 to 5). The more protection private property receives, the higher the score. The score is based, broadly, on the degree of legal protection of private property, the probability that the government will expropriate private property, and the country's legal protection of private property. The index equals the median rating for the period 1995 to 1999. Source: The Index of Economic Freedom from the Heritage Foundation. We reversed the original order of the index.
Intellectual Property (301)	An index of intellectual property rights (on a scale from 1 to 5). The more protection private property receives, the higher the score. The index is calculated using the "Special 301" placements of the Office of the U.S. Trade Representative (USTR). Special 301 requires the USTR to identify those countries that deny adequate and effective protection for intellectual property rights or deny fair and equitable market access for persons that rely on intellectual property protection. Countries that have the most onerous or egregious acts, policies, or practices and that have the greatest adverse impact on relevant U.S. products are designated "Priority foreign countries." Countries can also be placed on other lists. We assign the following ratings: 1 = Priority foreign countries; 2 = 306 Monitoring; 3 = Priority watch list; 4 = Watch list; 5 = Not listed. The index equals the median rating for the period 1990 to 1999. Source: International Intellectual Property Alliance. Original source: USTR.
Patent rights (GP)	An index of patent rights (on a scale from 0 to 5) in 1980. The more protection patents receive, the higher the score. The index criteria are: coverage, membership, duration, enforcement, and loss of rights. Source: Ginarte and Park (1997).
Property (WEF)	An index of property rights (on a scale from 1 to 7) in 2001. The more protection private property receives, the higher the score. A 1 indicates that assets are poorly delineated and not protected by law, while 7 indicates that assets are clearly delineated and protected by law. Source: Global Competitiveness Report, World Economic Forum (2002).
Intellectual property (WEF)	An index of intellectual property rights (on a scale from 1 to 7) in 2001. The more protection intellectual property receives, the higher the score. A 1 indicates that intellectual property protection is weak or nonexistent, while 7 indicates that intellectual property protection is equal to the world's most stringent. Source: Global Competitiveness Report, World Economic Forum (2002).
Property (ICRG)	A measure of property rights in each country (on a scale from 0 to 10). The index equals the average rating between 1982 and 1995. The more protection private property receives, the higher the score. The score is based on the average of five measures: quality of the bureaucracy, corruption in government, rule of law, expropriation risk, and repudiation of contracts by the government. Source: International Country Risk Guide and Knack and Keefer (1995).
Private credit	Private credit divided by GDP in 1980. Source: Rajan and Zingales (1998) and the International Financial Statistics of the International Monetary Fund.

Variable	Description
Market cap	Stock market capitalization divided by GDP in 1980. Source: Rajan and Zingales (1998).
Accounting	Accounting standards in 1983 (on a scale from 0 to 90). Higher scores indicate more disclosure. Source: Center for International Financial Analysis and Research and Rajan and Zingales (1998).
Human capital	Human capital is the average for 1980 of the years of schooling attained by the population over 25 years of age. Source: Barro and Lee (1993).
Rule of Law	Assessment of the law and order tradition in the country (on a scale from 0 to 10). Average of the months of April and October of the monthly index between 1982 and 1995. Lower scores indicate less tradition for law and order. Source: International Country Risk Guide and La Porta et al. (1997).
Legal origin	Identifies the legal origin of the Company Law or Commercial Code of each country. There are four possible origins: (1) English Common law, (2) French Commercial Code, (3) German Commercial Code, and (4) Scandinavian Commercial Code. Source: La Porta et al. (1999).
European settler mortality	European settler mortality rate, measured in terms of deaths per annum per 1000 "mean strength." Source: Acemoglu et al. (2001).
GDP per capita	The logarithm of GDP per capita in 1980. Source: World Development Indicators of the World Bank.
Growth in value added	Average annual real growth rate of value added in a particular sector in a particular country over the period 1980 to 1989. The sectors are classified on the basis of ISIC. Source: United Nations Database on Industrial Statistics and Rajan and Zingales (1998).
Growth in average size	Average growth in average size by ISIC sector over the period 1980 to 1989. Source: United Nations Database on Industrial Statistics and Rajan and Zingales (1998).
Growth in number	Average growth in number of establishments by ISIC sector over the period 1980 to 1989. Source: United Nations Database on Industrial Statistics and Rajan and Zingales (1998).
Fraction of sector in value added	Fraction of ISIC sector in value added of total manufacturing sector in 1980. Source: Rajan and Zingales (1998).
Financial dependence	External financial dependence of U.S. firms by ISIC sector averaged over the period 1980 to 1989. Source: Rajan and Zingales (1998).
Sales growth	Real annual growth in sales of U.S. firms by ISIC sector averaged over the period 1980 to 1989. Source: Fisman and Love (2002).
Tobin's Q	Tobin's Q of U.S. firms by ISIC sector averaged over the period 1980 to 1989. Tobin's Q is defined as the sum of the market value of equity plus the book value of liabilities over the book value of total assets. Source: COMPUSTAT.
Intangible intensity	Ratio of intangible assets-to-net fixed assets of U.S. firms by ISIC sector over the period 1980 to 1989. Source: COMPUSTAT. Intangibles is COMPUSTAT item 33 and represents the net value of intangible assets. Intangibles are assets that have no physical existence in themselves, but represent rights to enjoy some privilege. In COMPUSTAT, this item includes blueprints or building designs, patents, copyrights, trademarks, franchises, organizational costs, client lists, computer software patent costs, licenses, and goodwill (except on unconsolidated subsidiaries). Intangibles excludes goodwill on unconsolidated subsidiaries, which are included in Investments and Advances under the Equity Method (COMPUSTAT item 31). Net fixed assets is COMPUSTAT item 8 and represents net property, plant and equipment, which equals gross property, plant and equipment (COMPUSTAT item 7) less accumulated depreciation, depletion and amortization (COMPUSTAT item 196).

For the other property rights indexes, we use index values as of their first available date.

Although the indexes of property protection are from different sources and for different time periods, they appear quite related and are highly positively correlated. The correlation between our main property rights index and the other five indexes of protection of (intellectual) property rights ranges, for example, from 0.49 to 0.78. The fact that the property rights indexes relate to different time periods could nevertheless raise concerns in our specification, in part because property rights may have evolved in response to economic performance. We believe these concerns to be small, mostly because measures of institutional frameworks have been found to be stable over long periods of time (Acemoglu, Johnson, and Robinson (2001, 2002)). Also, RZ show that the sample means of the accounting standards variable they use do not differ significantly between 1983 and 1990.

This stability also applies to our property rights indexes, which do not change much over the time for which they are available. Table II shows that the mean property rights index for countries sampled in the first and last available year is not statistically significantly different for any of the three indexes. Note that the sample mean of the Ginarte and Park patents rights index—the only index for which we have data for the period 1980 to 1989—for countries sampled in 1980 does not significantly differ statistically from the sample mean in 1990 for the same set of countries. In addition, we find that the relative ordering of the different property rights indexes does not change much over time, as the Spearman rank order correlations of the respective indexes are high. A *t*-test of differences further confirms that the property rights indexes in the first and last available year are not statistically different. As a further robustness check, we also perform our regressions instrumenting the property rights indexes with variables that predate the period 1980 to 1989, using the methodology used by Beck et al. (2000) and by Acemoglu et al. (2001).

Table III presents the summary statistics of the country-specific variables grouped by developing and developed countries (Table AI in the Appendix presents the same summary statistics, but by individual country). We only use the classification developing versus developed countries to illustrate the differences in the various variables by institutional settings. The country summary statistics show that, as a group, developing countries have less developed financial systems, weaker law and order systems, worse protection of (intellectual) property rights, and fewer patents per capita. All variables except for the stock market capitalization-to-GDP ratio and the accounting standards show a statistically significant difference between the two groups of countries. Other work has documented extensively the differences in the degree of law and order between developed and developing countries. This difference in legal frameworks partly relates to the difference in the private credit-to-GDP ratio between these two groups of countries, where low contract enforcement environments have hindered the development of financial systems in developing countries.

The degree of financial development and the protection of property rights tend to go together and are both related to the overall level of development of a country. As such, it could be difficult to analyze the differential effects of financial

Table II

Stability of Property Rights Measures over Time

This table reports for each of the three property rights indexes the sample mean and standard deviation for the first year and the last year of the sample period across all sampled countries, the *t*-statistic for a test of difference in the sample means assuming unequal variances, the rank order correlation coefficient, and a test of independence of the property rights indexes in the first year and the last year of the sample period. The null hypothesis of the test of independence is that the property rights indexes are independent. The sources and definitions of the data are reported in Table I. Significance level [a] corresponds to 1%.

Property rights index	Year	Statistics across Countries			Test of Difference in Means *t*-statistic	Rank Order Correlation Spearman's ρ	Test of Independence *p*-value
		Mean	Std. Dev.	Number of Observations			
Property (Freedom)	1995	3.93	0.96	44			
Property (Freedom)	2000	3.89	0.97	44	− 0.22	0.90	0.000[a]
Intellectual property (301)	1990	4.29	0.60	28			
Intellectual property (301)	2000	4.03	0.81	28	− 1.36	0.76	0.000[a]
Patents (GP)	1980	2.69	0.91	44			
Patents (GP)	1990	2.74	1.00	44	0.29	0.97	0.000[a]

Table III
Descriptive Statistics of Institutional Variables

This table reports summary statistics of the variables used in our study. For each variable, we report the mean across all sampled countries, across developing countries, and across developed countries. To classify countries as developing or developed, we use the World Bank classification of countries. For comparison purposes, we also present *t*-statistics of tests of differences in the means of the variables across developing and across developed countries. The sources and definitions of the data are reported in Table I. Significance level [a] corresponds to 1%.

	Means across Countries			*t*-Tests of Difference in Means
	Developed Countries	Developing Countries	All Countries	Developed vs. Developing Countries
Property (Freedom)	4.68	3.42	3.96	7.10[a]
Intellectual property (301)	4.47	3.74	4.12	3.97[a]
Patents (GP)	3.33	2.20	2.67	5.44[a]
Property (WEF)	6.11	4.69	5.33	7.66[a]
Intellectual property (WEF)	5.74	3.47	4.51	10.64[a]
Property (ICRG)	9.14	5.42	7.03	11.82[a]
Private credit to GDP	0.49	0.26	0.36	4.37[a]
Market capitalization to GDP	0.24	0.17	0.20	0.64
Law and order	9.23	4.40	6.67	11.74[a]
Accounting standards	0.65	0.66	0.65	− 0.12
Settler mortality rate	2.49	4.36	4.03	− 6.25[a]
Human capital	7.92	4.07	5.84	5.72[a]
GDP per capita	9.04	6.84	7.79	10.28[a]
Number of countries	19	25	44	

development and property rights on the level of external financing available and the allocation of investment across different assets. However, the correlation between the two concepts is not perfect. That is, there exist countries with good property rights and underdeveloped financial systems. Chile, for example, scores high on the protection of property rights (with a property rights index of five) but its level of financial development is only average (reflected by a level of private credit to GDP of 36%). France, on the other hand, has a relatively well-developed financial system (reflected by a level of private credit to GDP of 54%) but the protection of its property rights is only average (with a property rights index of four). Calculating the simple correlation between the property rights index and the level of financial development, 0.59, confirms that the relationship between the two concepts is high but not perfect. The correlations of the interaction variables are even less perfect, less than 0.20.

Our data set includes 45 countries.[5] For the growth regressions, as in RZ, we need to drop the benchmark country, the United States, and we are therefore left

[5] The countries include Australia, Austria, Bangladesh, Belgium, Brazil, Canada, Chile, Colombia, Costa Rica, Denmark, Egypt, Finland, France, Germany, Greece, India, Indonesia, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Korea, Malaysia, Mexico, Morocco, the Netherlands, New Zealand, Nigeria, Norway, Pakistan, Peru, the Philippines, Portugal, Singapore, South Africa, Spain, Sri Lanka, Sweden, Turkey, the United Kingdom, the United States, Venezuela, and Zimbabwe.

with 44 countries. As we collected additional data, the number of countries included in our data set somewhat exceeds that in RZ, who use data on 41 countries.

Like RZ, we construct benchmark data on an industry basis. We use the benchmark data from RZ for all of our industry variables, but construct our own intangible-to-fixed assets variable. We assume that the intangible-to-fixed assets ratio for each industry in the United States forms a good benchmark (like RZ, who use the U.S. external financial dependence ratio as a benchmark). We refer to the ratio of intangible to fixed assets as the intangible intensity. In the same way RZ calculate the external financial dependence ratios by industry, we calculate the benchmark of intangible intensity using COMPUSTAT data on U.S. firms for the years 1980 to 1989. We measure intangibles by the net value of intangible assets, that is, using COMPUSTAT item 33. Generally, intangibles are assets that have no physical existence in themselves but represent rights to enjoy some privilege. In COMPUSTAT, this item includes blueprints or building designs, patents, copyrights, trademarks, franchises, organizational costs, client lists, computer software patent costs, licenses, and goodwill (except on unconsolidated subsidiaries). Intangibles in the COMPUSTAT data excludes goodwill on unconsolidated subsidiaries, which are included in investments and advances under the equity method (COMPUSTAT item 31). We measure tangibles by net fixed assets, that is, using COMPUSTAT item 8. This represents net property, plant, and equipment, which equals gross property, plant, and equipment (COMPUSTAT item 7) less accumulated depreciation, depletion, and amortization (COMPUSTAT item 196).

Table IV reports the intangible-intensity benchmarks for U.S. firms in different industrial sectors on a two-digit SIC level. The total number of firms used to calculate these benchmarks is 5,241. The average intangible-intensity ratio during the 1980s for U.S. manufacturing firms is 77%. The variation of intangible intensity across industries is large: It ranges from as low as 2.0% for the petroleum and coal products industry to as high as 454% for the printing and publishing industry. The variation concurs with notions of what constitute relatively capital-intensive versus more knowledge-intensive industries. The stone, clay, glass, and concrete products industry, for example, relies mainly on fixed assets for production, as would be expected since the technology used in this sector is well-established and embodied in the fixed assets. It has an intangible-intensity ratio of 5%. The chemical and allied products industry and the electrical and electronic industry, in contrast, rely heavily on intangible assets as inputs, such as patents and licenses. They have an intangible-intensity ratio of 96% and 77%, respectively. The data show that the various technical and economic reasons that make various types of products require different input mixes can be benchmarked well at the industry level.

III. Empirical Results

In this section, the regression results are presented. In the first set of regressions, the dependent variable is the average annual real growth rate of value added in a particular sector in a particular country over the period 1980 to 1989,

Table IV
Sectoral Measure of Intangible Intensity

The table reports the measure of intangible intensity for each sector based on U.S. firm-level data. Intangible intensity is measured by the ratio of intangible assets to net fixed assets. The data are averages for all U.S. firms in the COMPUSTAT (U.S.) database for the period 1980 to 1989. For external financial dependency benchmarks across sectors, we refer to the original source: Table I in Rajan and Zingales (1998). The table also reports the number of U.S. firms used to construct the benchmark for each industrial sector. As in Rajan and Zingales (1998) we focus on manufacturing firms and use 1980 to 1989 data to construct the benchmarks. The total number of firms is 5,241.

SIC Code	Industrial Sectors	Intangible Intensity	Number of Firms
20	Food and kindred products	0.75	304
21	Tobacco manufactures	0.49	21
22	Textile mill products	0.21	131
23	Apparel and other textile products	0.53	139
24	Lumber and wood products	1.20	97
25	Furniture and fixtures	0.49	87
26	Paper and allied products	0.20	130
27	Printing and publishing	4.54	202
28	Chemicals and allied products	0.96	556
29	Petroleum and coal products	0.02	86
30	Rubber and miscellaneous plastics	0.46	191
31	Leather and leather products	0.33	41
32	Stone, clay, glass, and concrete products	0.05	96
33	Primary metal industries	0.11	191
34	Fabricated metal products	0.31	277
35	Industrial machinery and equipment	0.25	795
36	Electrical and electronic equipment	0.77	815
37	Transportation equipment	0.24	262
38	Instruments and related products	0.90	660
39	Miscellaneous manufacturing industries	2.29	160
	Mean	0.76	
	Median	0.48	
	Standard deviation	1.03	

with one observation per sector in each country. The specification for the first set of regressions is as follows:

$$\begin{aligned} Growth_{j,k} = {} & Constant + \Psi_1 \cdot Industry\ dummies_j \\ & + \Psi_2 \cdot Country\ controls_k \\ & + \psi_3 \cdot Industry\ share\ of\ manufacturing\ value\ added_{j,k} \\ & + \psi_4 \cdot External\ dependence_j \cdot Financial\ development_k \\ & + \psi_5 \cdot Intangible\ intensity_j \cdot Property\ rights_k \\ & + \varepsilon_{j,k}, \end{aligned} \tag{1}$$

where each industry is indicated by index j and each country by index k. Uppercase Greek letters indicate vectors of coefficients, indexed by industry j or

country *k*. Growth is the average annual real growth rate of value added in industry *j* in country *k*. The industry dummies correct for industry-specific effects. The vector of country control variables differs per specification and can include the following variables: private credit to GDP, index of property rights, stock market capitalization to GDP, human capital, rule of law, accounting standards, and the logarithm of per capita GDP. The exact vector of country control variables is described in greater detail in the presentation of the specific empirical results. As a measure of financial development, we use private credit to GDP. As a measure of external financial dependence at the sectoral level, we use the data from RZ. As a measure of intangible intensity, we use the ratio of intangible to fixed assets for U.S. firms on the sectoral level. For the property rights index, we use the Economic Freedom property rights index.

The results are presented in Table V. We first discuss the basic regression specifications, which are estimated using OLS and include country dummies (columns 1 to 3). Industry dummies (not reported) are used in all regressions. The industry's market share in total manufacturing in a specific country has a negative sign in all regressions, in line with RZ, suggesting that there is some industry-specific convergence. In terms of the main hypotheses, we find that industrial sectors that rely relatively more on external finance develop disproportionately faster in countries with better-developed financial markets because the coefficient for the interactive variable private credit to GDP times external financial dependence is positive and statistically significant (at the 1% level, column 1). Hence, consistent with the findings of RZ, we find that financial development facilitates economic growth through greater availability of external financing. As noted by Beck et al. (2000) and others, the quality of the legal system influences financial sector development and overall growth. Interacting the external financial dependence variable with the index of the quality of the legal framework used by La Porta et al. (1998), instead of the financial development variable, also leads to a positive coefficient (not reported). The regression result confirms the law and finance view that increased availability of external financing and better legal systems enhance firm growth.

In terms of the asset allocation effect, we find that industrial sectors using relatively more intangible assets develop faster in countries with better protection of property rights, because the coefficient for the interactive variable property rights times intangible intensity is statistically significant and positive (column 2). Hence, better property rights facilitate economic growth as they favor growth through better asset allocation, that is, in firms that would naturally choose a higher share of investment in intangible assets.[6] The asset allocation effect on growth appears to be in addition to the increase in firm growth due to greater external financing, since in the regressions where both the external financial dependence and the intangible-intensity variables are included (column 3), both interactive variables are statistically significant. Additionally, the coefficients in

[6] Exclusion of sectors with a relatively high estimated usage of intangible assets, such as printing and publishing and/or miscellaneous manufacturing industries, does not qualitatively alter the results (not reported).

Table V

The Average Effect of Financial Development and Property Rights on Industrial Growth

The dependent variable is the average annual real growth rate of value added in a particular sector in a particular country over the period 1980 to 1989. Table I describes all variables in detail. As a measure for protection of property rights, we use the property rights index from the Index of Economic Freedom from the Heritage Foundation. All regressions include industry dummies and a constant but these are not reported. Regressions (1) to (3) and regressions (6) to (8) include country dummies but these are not reported. Regressions (4) and (5) include country-specific variables rather than country dummies. Regression (6) uses legal origin as the instrumental variable (IV) for property rights. Regression (7) uses European settler mortality as IV for property rights. Robust standard errors are shown below the coefficients. The United States is dropped as it is the benchmark. Significance levels [a] and [b] correspond to 1% and 5%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6) IV legal origin	(7) IV mortality
Fraction of sector in value added of manufacturing in 1980	−1.041[a]	−0.9721[a]	−1.076[a]	−1.040[a]	−0.4511[a]	−0.9672[a]	−1.463[a]
	(0.2454)	(0.2482)	(0.2491)	(0.2210)	(0.1028)	(0.2480)	(0.3658)
Sectoral measure of financial dependence * private credit to GDP	0.1401[a]		0.1354[a]	0.1376[a]	0.0509[a]		
	(0.0383)		(0.0376)	(0.0380)	(0.0204)		
Sectoral measure of intangible intensity * property (freedom)		0.0103[a]	0.0092[a]	0.0091[a]	0.0067[a]	0.0090[a]	0.0259[b]
		(0.0029)	(0.0028)	(0.0033)	(0.0024)	(0.0033)	(0.0107)
Private credit to GDP				−0.0213	0.0488[a]		
				(0.0163)	(0.0151)		
Property (freedom)				−0.0004	0.0030		
				(0.0050)	(0.0058)		
Stock market capitalization to GDP					0.0253[a]		
					(0.0068)		
Human capital					−0.0008		
					(0.0017)		
Rule of law					0.0019		
					(0.0022)		
Accounting standards					0.0428[b]		
					(0.0180)		
Log of per capita GDP					−0.0205[a]		
					(0.0043)		
R^2	0.2711	0.2548	0.2757	0.1028	0.2386	0.2547	0.2391
N	1242	1277	1242	1242	830	1277	635
Number of countries	44	44	44	44	33	44	23

the regressions including both effects are of similar magnitudes as in the two regressions where each of them was included separately (columns 1 and 2), suggesting that the two variables measure complementary effects.[7]

The effects of external financial development and property protection on firm growth are not only both statistically significant but are also equally economically important. We can use the regression coefficient estimates of Table V to infer how much higher the growth rate of an industry at the 75th percentile of intangible intensity would be compared to an industry at the 25th percentile level, when the industries are located in a country at the 75th percentile of property protection, rather than in a country at the 25th percentile. The industry at the 75th percentile, instruments and related products, has an intangible-intensity ratio of 0.90. The industry at the 25th percentile, textile mill products, has an intangible-intensity ratio of 0.21. The country at the 75th percentile of property protection has a value of five for the property rights index and the country at the 25th percentile has a value of three. The estimated coefficient for the interaction term in regression 2 of Table V equals 0.010 and we can set the industry's initial share of manufacturing at its overall mean. The regression coefficient estimates therefore predict the difference in growth rates between the 75th and 25th percentile intangible-intensive industry to be 1.4% per year higher in a country with a property rights index of five compared to one with an index of three. For comparison, the average growth rate is 3.4% per year. Therefore, a differential rate of 1.4% due to an improvement in the property rights index from three to five represents a large increase.

The effect of financial development on differential real firm growth can be calculated in a similar way using the estimated coefficient for the interaction term of regression 1 in Table V of 0.140. The coefficient estimate predicts the difference between the growth rate of the 75th and 25th percentile external financial dependence industry to be 1.4% higher in a country at the 75th percentile of financial development compared to one at the 25th percentile.[8] Thus, the effects of property protection and financial development on differential firm growth are not only both statistically significant, but also of similar economic importance. In other words, the asset allocation effect is economically as important as the finance effect.

The relative importance of the two effects can also be demonstrated by a comparison of two countries, Egypt and Finland. Egypt is a country with a relatively low degree of property protection, having a value of three for the property rights

[7] The two interacted variables, external financial dependence and intangible intensity interacted with financial development and property rights indexes, do appear to measure different concepts as the correlation between these variables is low. The correlation between the external financial dependence variable interacted with the financial development measure and the intangible intensity measure interacted with the property rights index is 0.149. Similar correlations are found when the other four property rights indexes are used (not reported).

[8] RZ used the same approach to compute the effect of financial development on differential real firm growth. Our estimated effect differs somewhat from the differential growth rate effect estimated in RZ, 1.3%, because our sample is slightly larger and because we use private sector credit instead of total capitalization as our measure of financial development.

index (at the 25th percentile of property protection), while Finland is a country with a relatively high degree of property protection, having a value of five for the property rights index (at the 75th percentile of property protection). The regression coefficient estimates predict that if Egypt had had the same property rights as Finland, but its actual financial development, then the growth rate in value added of its industry at the median level of intangible intensity, 0.48, would have been 1.0% per year higher. Egypt is also a country with a relatively low level of financial development, with a level of private credit to GDP of 21% (at the 25th percentile of financial development), while Finland is a country with a relatively high level of financial development, with a level of private credit to GDP of 48% (at the 75th percentile of financial development). If Egypt had had the same financial development as Finland, but its actual degree of property protection, then the growth rate in value added of its industry at the median level of external financial dependence, 0.23, would have been 0.9% per year higher. Again, the two effects are quite large and of comparable magnitude.

These numerical interpretations can be compared to the results found by Hall and Jones (1999) and Acemoglu et al. (2001) for the effects of institutions on output and income level. Hall and Jones (1999) explore the effects of differences in institutions and government policies, which they call social infrastructure, on output per worker in a cross section of countries. Their findings imply that the observed difference in social infrastructure between Niger and the United States is more than enough to explain the 35-fold difference in output per worker. Acemoglu et al.'s (2001) findings imply that improving Nigeria's institutions to the level of Chile could, in the long run, lead to as much as a 7-fold increase in Nigeria's income (in practice Chile is over 11 times as rich as Nigeria). Although these papers study the effects of institutions on the output or income level, rather than the rate of growth, it shows that our results are of comparable orders.

Thus far, our specifications have focused on the differential effect on growth of property rights across industries with different asset mixes (captured by the interaction term of property rights and the intangible-intensity measure). To avoid possible biases caused by any omitted country-specific regressors, we have included country dummies to capture any institutional or other differences affecting growth, such as comparative advantage or general level of development. Since we are less interested in the importance of general country differences, we use this approach rather than a vector of specific country control variables. Still, the use of country dummies could introduce a misspecification to the extent that any omitted institutional differences important for growth are correlated with our two interaction variables. Examples of such country-specific variables that have been used in the general growth literature, besides financial depth and property rights, include the level of per capita GDP, human capital, and other institutional variables (Romer (1990), Barro (1991), and Levine and Zervos (1998), among others). Furthermore, we want to analyze the first-order country effects of property rights to investigate whether property rights affect firm growth mainly through the asset allocation channel or also in other ways. We therefore replace our country dummies with country-specific institutional and

other variables and thus perform a robustness check on whether any of our earlier results are affected if we control in other ways for country differences.

We start by documenting the fact that the effects of better property rights on growth work mostly through improved asset allocation as opposed through, for example, an improvement in the overall business environment that increases growth opportunities. We show this by including in our basic regression specification the property rights index (and private credit to GDP) directly in addition to the interacted variables. The results are reported in column 4 of Table V, where we exclude country dummies. We do not find a direct, statistically significant effect of the quality of a country's property rights on industrial sector growth. Most important, including the property rights index directly does not change the magnitude or the significance of the coefficients for the interaction variables in any meaningful way. Both the financial dependence and the asset mix interaction variables remain statistically significant and neither changes much in terms of magnitude. This suggests that the major effect of improved property rights on sectoral growth operates through improvements in asset allocation and that the interaction variable does not capture any general effects, for example, of improvements in the business environment leading to greater growth opportunities.

For other country-specific variables, we use the ratio of private credit to GDP in 1980, stock market capitalization over GDP in 1980, a measure of the level of human capital in 1980, a measure of the quality of the legal system, an accounting standards indicator, and the logarithm of per capita income in 1980. RZ and Cetorelli and Gambera (2001) have also used these variables in the same model. We expect a positive effect on growth of private credit to GDP and stock market capitalization to GDP as proxies for the development of the banking system and stock market respectively, and for financial development more generally. The level of human capital is measured as the average of the number of years of schooling attained by the population over 25 years of age in 1980 (as in Barro and Lee (1993)) and is expected to have a positive effect on growth in value added. The quality of the legal system is measured by the law and order tradition variable of La Porta et al. (1998) and is also expected to have a positive effect on growth. The accounting standards indicator is an index reflecting the quality of accounting standards and is taken from RZ. This variable is also expected to have a positive effect on growth since it proxies for the quality of information investors have regarding firms and that firms have regarding investment prospects. Per capita GDP is included to capture the convergence effects of the economy as a whole to a long-run steady state and is expected to have a negative coefficient (see, among others, Barro (1991)). The model continues to include industry dummies to control for any sector-specific effects and the property rights indexes. Since the country variables included in the two interaction terms—private credit to GDP and an index of property rights—are now also part of the country controls, we can assess both the overall effect of financial development and property protection on value added growth as well as the finance and asset allocation effects captured by the two interaction terms. Note that data on accounting standards is missing for some countries, reducing the sample of countries to 33.

The results of this specification are reported in column 5 of Table V. Except for the human capital variable, the country controls have the expected relationships with growth. The direct effect of the quality of property rights on growth remains insignificant, however, which suggests that better property rights by themselves do not translate into higher growth rates of sectoral value added. The depth of the financial system—measured by private credit to GDP and the size of the stock market as a ratio to GDP—has a positive and statistically significant influence on growth in sectoral value added. The degree of human capital in the country, proxied by the average number of years of schooling attained by the population over 25 years of age and the degree to which the rule of law applies, do not have a statistically significant effect on growth in sectoral value added. The accounting index, however, is statistically significantly positive. The general level of development, proxied by the log of income per capita, has a negative sign, confirming the convergence effect.

The focus of our attention, the interaction between property rights and the allocation of resources, is very robust to these changes in model specification. The coefficient on the interaction term between the property rights indexes and the intangible-intensity measure remains positive and statistically significant in both specifications. The size of the coefficient is also only somewhat smaller than those in the regressions with country dummies, and the coefficient remains statistically significant at the 1% level. The general result about the importance of the asset allocation effect is thus not altered. Also, the interaction term between financial development and external financial dependence remains statistically significant positive. The regression results in columns 4 and 5 thus show that the effect of property rights on growth operates in an important way through asset allocation, and does not have a direct, first-order effect on growth.

Another concern is that the quality of property rights is affected by the investment behavior of firms and the resulting growth patterns. At the macro level, countries that grow faster may demand greater property rights protection, since a larger share of economic output derives from more property-rights-intensive investments. At the more micro level, sectors that are more dependent on property rights may seek a higher degree of protection of property rights relevant to their industry. Due to these and other concerns about potential endogeneity, we instrument the property rights variable with a number of predetermined institutional variables. Following RZ, we use the colonial origin of a country's legal system (indicating whether the legal origin is English, French, German, or Scandinavian) as reported in La Porta et al. (1998) as one instrument. As also shown by La Porta et al. (1998), legal origin tends to have a long-lasting effect on a country's institutional structure, whereas the legal origin of a country is largely determined by the country colonizing it. As such, legal origin is a good instrumental variable and has been used in several other papers. Following Acemoglu et al. (2001), we also use the settler mortality rate of European bishops, soldiers, and sailors stationed in colonies in the 17th, 18th, and 19th centuries as an instrument. As argued by Acemoglu et al. (2001), the willingness of colonizing powers to settle and develop long-lasting institutions depended greatly on the ability of colonizers to survive physically. They show that the settler mortality rate is a good

instrumental variable for past institutional characteristics that last into today (in their application, the particular institutional characteristic is the risk of expropriation of private property).

The instrumental variables (IV) results based on the specification of column 2 are presented in columns 6 and 7, using respectively legal origin or mortality rates as instruments for property rights. Since the European countries had the institutions that they were exporting to their colonies, we can not apply settler mortality rates as an instrumental variable for the European countries, that is, the colonizing countries themselves. This reduces the sample to 23 countries when using mortality rates as an instrumental variable. The results are nevertheless very robust to the use of instruments.[9] We again find a statistically significant effect of property rights on growth in sectoral value added through the asset allocation of resources. Interestingly, the magnitude of the coefficients for the interaction variable increases when using mortality rates as an instrumental variable (column 7). Because restricting the sample to former colonies results in a large reduction in the number of observations, we will only use legal origin as an instrument for property rights in what follows.[10]

As an additional investigation into the channels through which financial development and property rights affect firm growth, and following RZ, we analyze whether industries in countries with better financial development and property rights grow faster because new establishments are added to the industry or because existing establishments grow faster. There are two reasons why it is interesting to decompose the effects of access to financing and asset allocation in terms of number and average size of firms. First, as highlighted by RZ, the creation of new establishments is more likely to require external funds, while the expansion of existing establishments may more easily rely on internal funds. Thus, the effect of financial development could be more pronounced for new firms than for the growth of existing firms. Second, new firms are often set up in reaction to and to take advantage of new technological developments, while established firms tend to grow through expansion of scale, perhaps also because they are slower in reacting to new developments.[11] Furthermore, existing firms may be able to preserve the value of their assets in ways other than by resorting to formal property rights (e.g., by using their name recognition, distribution or supply networks, or general economic and political influence). Thus, the importance of property rights that protect the returns to (new) technology and help assure a good allocation of an economy's overall resources might be more pronounced for the emergence of new firms than for the growth of existing firms.

[9] The first-stage regressions show strong relationships between the instrumented variables and the potentially endogenous variables, that is, between settler mortality and legal origin and property rights and financial development (not reported).

[10] The results presented in Table V are based on all available data (up to 44 countries). As a further robustness test, we also reestimated the regression models using the subset of 41 countries used in RZ, which implied excluding Indonesia, Jamaica, and Nigeria. The results are very similar to those in Table V (not reported).

[11] In fact, many new firms that take advantage of new technological developments are spun off from existing firms that have developed some elements of these new technologies.

As before, we follow RZ and use data derived from the UN Industrial Statistics Yearbook database for the growth in the number of establishments and the growth in the average size of existing establishments. The growth in the number of establishments is calculated by RZ as the logarithm of the number of end-of-period establishments less the logarithm of the number of beginning-of-period establishments. The average size of establishments in the industry is calculated by dividing the value added in the industry by the number of establishments, with the growth in average size again defined as the difference in logarithms. RZ report that in their sample of countries roughly two-thirds of the growth in value-added results from an increase in the average size of existing establishments, while the remaining one-third is accounted for by an increase in the number of establishments.

We use the same specification as for our basic regression but with the growth in number of establishments or the growth in average size as the dependent variable instead of the growth in total value added by sector. We use again industry dummies and do not use country-specific institutional variables, but country dummies. The time period studied remains 1980 to 1989. The exact specification is as follows:

$$\begin{aligned} Growth_{j,k} = {} & Constant + \Phi_1 \cdot Industry\ dummies_j \\ & + \Phi_2 \cdot Country\ dummies_k \\ & + \phi_3 \cdot Industry\ share\ of\ manufacturing\ value\ added_{j,k} \\ & + \phi_4 \cdot External\ dependence_j \cdot Financial\ development_k \\ & + \phi_5 \cdot Intangible\ intensity_j \cdot Property\ rights_k \\ & + \varepsilon_{j,k}, \end{aligned} \tag{2}$$

where the dependent variable is either the growth in the average size or the growth in the number of establishments in industry j in country k.

Table VI reports the results, with columns 1 and 2 depicting the OLS results and columns 3 and 4 the instrumental variable results. As Table VI indicates, the external financial dependence interacted with the financial development variable is statistically significant in explaining both the growth in average firm size (column 1) and the growth in the number of establishments (column 2). This contrasts with RZ, who do not find any statistical significance (see their Table VII), perhaps because they use accounting standards as a measure for financial development rather than private credit to GDP and do not include the asset allocation interaction variable.

Interestingly, the asset allocation variable interacted with the property rights variable is not significant when explaining the growth in the average size of firms but is significant when explaining the growth in the number of establishments. This finding is consistent across all of our measures of property rights (not reported). It is also not affected by using legal origin as an instrumental variable for property rights (columns 3 and 4). It suggests, in terms of affecting growth through asset allocation, that the protection of property rights is most important through stimulating the growth of new establishments. Well-protected

Table VI

The Average Effect of Financial Development and Property Rights on Growth in Average Size and Growth in the Number of Establishments

The dependent variable is either the average growth in average size or the average growth in the number of establishments of a particular sector in a particular country over the period 1980 to 1989. Table I describes all variables in detail. All regressions include industry dummies, country dummies, and a constant but these are not reported. Regressions (3) and (4) use legal origin as the instrumental variable (IV) for property rights. Robust standard errors are shown below the coefficients. The United States is dropped as it is the benchmark. For Costa Rica, France, Indonesia, Italy, Jamaica, the Netherlands, South Africa, and Zimbabwe, we do not have data on the growth of the average size and the number of establishments. Significance levels [a], [b], and [c] correspond to 1%, 5%, and 10%, respectively.

	(1) Growth Average Size	(2) Growth Number	(3) Growth Average Size IV Legal Origin	(4) Growth Number IV Legal Origin
Fraction of sector in value added of manufacturing in 1980	−0.8687[a]	−0.3399[b]	−0.8396[a]	−0.3038[c]
	(0.3131)	(0.1702)	(0.3143)	(0.1624)
Sectoral measure of financial dependence * private credit to GDP	0.0856[a]	0.0480[b]		
	(0.0289)	(0.0220)		
Sectoral measure of intangible intensity * property (freedom)	0.0001	0.0069[a]	−0.0007	0.0082[b]
	(0.0021)	(0.0022)	(0.0036)	(0.0034)
R^2	0.4329	0.3656	0.4164	0.3619
N	1071	1104	1100	1133
Number of countries	36	36	36	36

property rights can thus influence growth by allowing new firms to come to market in those industries that typically rely less on tangibles in their optimal production mix. For established firms relying more on intangible inputs, growth seems less affected by the strength of property rights in the country. This may be because such firms have other means of protecting their returns from investments.

IV. Further Robustness Tests

We have already shown that the results are robust to different control variables, to alternative means of controlling for country differences, to the use of instrumental variables, and to changes in the sample of countries. We next present evidence that the results are also robust to the particular measure of protection of property rights chosen, to differences in growth opportunities related to the level of general development, and to inclusion of data from alternative time periods.

First, we use the five alternative measures of the degree to which countries protect property rights: Special 301, the patent rights index of Ginarte and Park (1997), the property rights index and the intellectual property rights index of the

Table VII

The Average Effect of Financial Development and Property Rights on Industrial Growth: Alternative Measures of Property Rights

The dependent variable in all regressions is the average annual real growth rate of value added in a particular sector in a particular country over the period 1980 to 1989. Table I describes all variables in detail. We use five alternative measures for protection of property rights. In regressions (1) and (6), we use a measure for protection of intellectual property rights which is calculated using the Special 301 placements of the Office of the U.S. Trade Representative. We use the median rating during 1990 to 1999. In regressions (2) and (7), we use the patent rights index by Ginarte and Park (1997). We use the rating for the year 1980. A higher rating of the patent rights index indicates more protection of patent rights. In regressions (3) and (8), we use the property rights index of the World Economic Forum. We use the rating for the year 2001. In regressions (4) and (9), we use the intellectual property rights index of the World Economic Forum. We use the rating for the year 2001. In regressions (5) and (10), we use the property rights index of Knack and Keefer (1995). Average over 1982 to 1995. All regressions include industry dummies, country dummies, and a constant, but these are not reported. Robust standard errors are shown below the coefficients. The United States is dropped as it is the benchmark. Significance levels [a] and [b] correspond to 1% and 5%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Fraction of sector in value added of manufacturing in 1980	−0.5225[a]	−0.9592[a]	−1.053[a]	−1.055[a]	−0.9802[a]	−0.5708[a]	−1.064[a]	−1.139[a]	−1.141[a]	−1.082[a]
	(0.1561)	(0.2449)	(0.2655)	(0.2659)	(0.2493)	(0.1625)	(0.2458)	(0.2652)	(0.2656)	(0.2503)
Sectoral measure of financial dependence * private credit to GDP						0.0740[a]	0.1357[a]	0.1355[a]	0.1360[a]	0.1353[a]
						(0.0252)	(0.0382)	(0.0389)	(0.0390)	(0.0376)
Sectoral measure of intangible intensity * intellectual property (301)	0.0062[a]					0.0052[b]				
	(0.0023)					(0.0021)				
Sectoral measure of intangible intensity * patents (GP)		0.0074[a]					0.0066[a]			
		(0.0026)					(0.0026)			
Sectoral measure of intangible intensity * property (WEF)			0.0109[a]					0.0093[a]		
			(0.0029)					(0.0027)		
Sectoral measure of intangible intensity * intellectual property (WEF)				0.0072[a]					0.0062[a]	
				(0.0019)					(0.0018)	
Sectoral measure of intangible intensity * property (ICRG)					0.0043[a]					0.0037[a]
					(0.0012)					(0.0012)
R^2	0.3269	0.2521	0.2581	0.2575	0.2548	0.3592	0.2734	0.2789	0.2786	0.2755
N	1119	1277	1211	1211	1277	1090	1242	1179	1179	1242
Number of countries	36	44	42	42	44	36	44	41	41	44

World Economic Forum, and the property rights index of Knack and Keefer (1995). The regression specification we use is identical to model (1) in Section III, where we include industry and country dummies and the fraction of sector in value added in manufacturing in 1980. We include the interaction term between intangible intensity and the property rights index, varying between the five property rights indexes. We also estimate specifications that include, besides the interaction term between the property rights index and the intangible-to-fixed assets measure, also the interaction term between external financial dependence and private credit to GDP. The estimation technique remains OLS. The dependent variable is the same as in Table V, the real growth rate in sectoral value added of a particular country over the period 1980 to 1989.

The results are presented in Table VII and are very similar to those of column 2 and 3 of Table V. Both without including the interaction term between external dependence and financial development (columns 1 to 5) and with including this interaction term (columns 6 to 10), we find statistically significant coefficients on the interaction term between the intangible-intensity measure and all of the five alternative property rights measures. The results with the alternative measures of the degree of property rights protection are also robust to the use of legal origin and European settler mortality as instruments (not reported). This suggests that the results are not due to the particular property rights index chosen.

Second, we want to investigate whether growth opportunities differ across industries and countries in such a way that they confound the relationships between our interaction variables and growth in sectoral value added. In particular, it is possible that the external financial dependence and asset mix variables are proxies for growth opportunities at the sectoral level. Provided that financial development is high and property rights are protected, it may not be those industries with a particular external financial dependence or intangible intensity that grow fast, but rather those with better growth opportunities. If these growth opportunities happen to be correlated with our financial development and property rights variables, then a bias in the estimations can arise. In particular, countries with similar levels of financial development or property rights may experience the same growth patterns across industries because their firms face similar patterns of growth prospects, not because their levels of financial sector development or quality of property rights protection imply a greater supply of resources for firms or a better allocation of resources by firms. Correspondingly, countries with different levels of financial development or property rights may have different growth opportunities and consequently grow in different ways, not because of differences in the supply of external financing or the protection of property rights.

In a recent paper, Fisman and Love (2002) explore this hypothesis using the RZ model, focusing on financial development. They use the actual U.S. sales growth at the sectoral level as a measure for sectoral growth opportunities at a global level. When they substitute the industry's actual sales growth for the industry's external financial dependence ratio in the interaction term with financial development, they find a positive coefficient for this new interaction variable. Furthermore, when including both the old and new interaction variables, that is, the

industries' external financial dependence times countries' financial development as well as the industries' actual sales growth times countries' financial development, they find that the interaction variable with external financial dependence is no longer statistically significant. This suggests, if indeed actual U.S. sales growth rates are a good proxy for (global) growth opportunities, that it is the similarity (or difference) in growth opportunities for countries at similar (or different) levels of financial development that leads to the positive relationship between growth and the interaction variable external financial dependence times countries' financial sector development.

A similar possibility may arise with respect to the asset allocation hypothesis and our asset mix variable. If growth opportunities systematically vary across countries with the degree of property rights protection, then a statistically significant coefficient for our interaction variable could be inaccurately interpreted as support for the asset allocation hypothesis. To investigate this possibility, we use the same approach as Fisman and Love (2000). Specifically, we interact both the external financial development and property rights variables with the U.S. sectoral sales growth rates and include these two new interaction variables as well in the regressions. The estimation technique remains OLS, and the dependent variable remains the average annual real growth rate of value added in a particular sector in a particular country over the period 1980 to 1989. The new specification thus becomes

$$\begin{aligned} Growth_{j,k} = {} & Constant + \Gamma_1 \cdot Industry\ dummies_j \\ & + \Gamma_2 \cdot Country\ dummies_k \\ & + \gamma_3 \cdot Industry\ share\ of\ manufacturing\ value\ added_{j,k} \\ & + \gamma_4 \cdot External\ dependence_j \cdot Financial\ development_k \\ & + \gamma_5 \cdot Growth\ opportunities_j \cdot Financial\ development_k \\ & + \gamma_6 \cdot Intangible\ intensity_j \cdot Property\ rights_k \\ & + \gamma_7 \cdot Growth\ opportunities_j \cdot Property\ rights_k \\ & + \varepsilon_{j,k}. \end{aligned} \tag{3}$$

In this extended specification of the model, we include the interaction between the growth opportunities of industry j and financial development in country k, and the interaction between the growth opportunities of industry j and property rights in country k.

Table VIII shows the results where the specifications vary in how many interacted variables they include and which proxy we use for growth opportunities. Columns 2 to 4 in Table VIII show the regression results of adding the interacted U.S. sales growth variable in this way to the model, with column 1 repeating the results of column 3 of Table V. Column 2 confirms the result of Fisman and Love, that is, the interaction term between financial development and U.S. sales growth "dominates" the interaction term between financial development and external financial dependence in terms of sectoral growth, as the coefficient on the interaction term between financial development and external financial dependence is no longer statistically significant. In column 3, we add the interaction term between

property rights and U.S. sales growth. Although this new interaction term is also statistically significant, our main result—a positive relationship between sectoral growth and the interaction term property rights and asset mix—is robust to this change in specification, although the statistical significance for our main result decreases somewhat. When we add both new interaction variables, that is, the interaction between U.S. sales growth and financial development and between U.S. sales growth and property rights, to the model (column 4), our main result still holds, but the RZ and Fisman and Love variables are no longer statistically significant. This suggests that the asset allocation effect remains an important explanation of firm growth.

The measure of growth opportunities used in Fisman and Love, that is, the actual sales growth at the sectoral level, is an ex post measure. It is therefore highly correlated with actual growth in value added, our dependent variable, and as such may not be the best measure to use for growth opportunities and could explain the reduced significance of the interaction variables in columns 3 and 4. As an alternative, more forward-looking proxy for growth opportunities, we use Tobin's Q ratio, that is, the ratio of the market value of the firm to the book value of its assets. We use COMPUSTAT data to construct the industry-level median of the time-average Tobin's Q of U.S. firms during the period 1980 to 1989. The results of using this alternative measure of growth opportunities in the interaction variables are presented in columns 5 to 7 of Table VIII. In contrast to the actual sales growth measure, we find that the interaction variables with Tobin's Q do not enter significantly in any of the regressions, showing that the results are dependent on the proxy used for growth opportunities. Our main result is strengthened, however, as the coefficients for the interaction variable property rights and asset mix become more statistically significant. This suggests that growth opportunities, as measured by firms' Tobin's Q, do not vary across countries in such a systematic way with the degree of property rights protection as to affect the relationship between property rights and actual growth that is occurring through improved asset allocation.

As a third robustness test, we investigate whether using U.S. sectoral data biases our results in some way. It could be the case, for example, that investment opportunities in poorer countries are different from those in the United States due to differences in the general level of a country's development rather than differences in property rights. For a poor country with the same property rights as a rich country, for example, the sectoral measure of intangible intensity may not relate in the same way to relative growth rates because growth opportunities differ due to its general lower level of development. Any relationship between growth and our interaction term of intangible intensity times property rights may then be spurious because it reflects differences in growth opportunities, and not the asset allocation effect. We test for this possibility by adding an interaction variable between the U.S. sectoral asset mix and countries' per capita GDP to the regression. We use the level of per capita GDP as a measure of the overall level of a country's economic development and of corresponding country-level investment opportunities. The same robustness test was performed by RZ, but then by using an interaction between external dependence and per capita GDP.

Table VIII

The Average Effect of Financial Development and Property Rights on Industrial Growth: Different Growth Opportunities and Income Levels

The dependent variable in all regressions is the average annual real growth rate of value added in a particular sector in a particular country over the period 1980 to 1989. Table I describes all variables in detail. All regressions include industry dummies, country dummies, and a constant, but these are not reported. Robust standard errors are shown below the coefficients. Regression (9) includes only those observations for which the property rights index takes a low value of three, regression (10) includes only those observations for which the property rights index takes a median value of four, and regression (11) includes only those observations for which the property rights index takes a high value of five. The United States is dropped as it is the benchmark. Significance levels [a], [b], and [c] correspond to 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9) Property Index = 3	(10) Property Index = 4	(11) Property Index = 5
Fraction of sector in value added of manufacturing in 1980	−1.076[a]	−1.071[a]	−1.074[a]	−1.072[a]	−1.068[a]	−1.064[a]	−1.066[a]	−1.077[a]	−1.466[a]	−0.9445[a]	−0.2194[c]
	(0.2491)	(0.2496)	(0.2471)	(0.2478)	(0.2510)	(0.2522)	(0.2528)	(0.2503)	(0.2255)	(0.3819)	(0.1178)
Sectoral measure of financial dependence * private credit to GDP	0.1354[a]	0.0649	0.0896[a]	0.0617	0.1176[a]	0.1124[a]	0.1183[a]	0.1353[a]			
	(0.0376)	(0.0458)	(0.0338)	(0.0457)	(0.0364)	(0.0324)	(0.0364)	(0.0376)			
Sectoral measure of sales growth * private credit to GDP		1.170[c]		0.5671							
		(0.6806)		(0.5426)							
Sectoral measure of Tobin's Q * private credit to GDP					0.0318		−0.0136				
					(0.0430)		(0.0363)				
Sectoral measure of intangible intensity * property (freedom)	0.0092[a]	0.0075[a]	0.0048[c]	0.0046[c]	0.0088[a]	0.0071[a]	0.0071[a]	0.0086[b]			
	(0.0028)	(0.0025)	(0.0026)	(0.0026)	(0.0028)	(0.0028)	(0.0028)	(0.0038)			
Sectoral measure of sales growth * property (freedom)			0.3377[b]	0.2915[c]							
			(0.1731)	(0.1612)							
Sectoral measure of Tobin's Q * property (freedom)						0.0185	0.0198				
						(0.0129)	(0.0133)				
Sectoral measure of intangible intensity * per capita GDP 1980								0.0005	−0.0049	0.0027	0.0056
								(0.0022)	(0.0046)	(0.0023)	(0.0045)
R^2	0.2757	0.2793	0.2832	0.2839	0.2761	0.2783	0.2784	0.2757	0.3030	0.3781	0.4546
N	1242	1242	1242	1242	1242	1242	1242	1242	387	381	471
Number of countries	44	44	44	44	44	44	44	44	14	13	15

If investment opportunities relate systematically to a country's level of development and affect the ability of sectors with different asset mix to grow, rather than a country's property rights affecting growth through the asset mix chosen, then this new interaction variable should be significant and our old interaction variable should no longer be significant. The specification becomes

$$\begin{aligned} Growth_{j,k} = {} & Constant + \Theta_1 \cdot Industry\ dummies_j \\ & + \Theta_2 \cdot Country\ dummies_k \\ & + \theta_3 \cdot Industry\ share\ of\ manufacturing\ value\ added_{j,k} \\ & + \theta_4 \cdot External\ dependence_j \cdot Financial\ development_k \\ & + \theta_5 \cdot Intangible\ intensity_j \cdot Property\ rights_k \\ & + \theta_6 \cdot Intangible\ intensity_j \cdot Per\ capita\ GDP_k \\ & + \varepsilon_{j,k}. \end{aligned} \tag{4}$$

In this extended specification of model (1), we include the interaction between the intangible intensity of industry *j* and per capita GDP of country *k*.

Controlling for differences in the level of development in this way does not alter our main result since the new interaction variable is not statistically significant, while our old interaction variable still is significant (column 8 in Table VIII). Thus, variations in property rights across countries that lead to different growth patterns do not seem to be due to simple differences in investment opportunities related to the level of development, but rather to differences in the asset mix chosen in response to variations in property rights.

As an alternative robustness test along the same lines, we test whether for countries with the same level of property rights, investment opportunities differ in a systematic way with income levels such as to confound the relationship between assets mix and growth. If investment opportunities across sectors do not vary in a systematic way with income level, then for the same level of property rights, we should not find an effect across countries of the income level variable interacted with the asset mix variable. Columns 9 to 11 in Table VIII show the results of regressions for three subsamples of countries with each having the same degree of protection of property rights (as measured by our main property rights index), but different levels of per capita GDP. Using this specification, we do not find an income level effect since the coefficients for the interaction term between asset mix and per capita GDP are insignificant in each of the three cases.

Finally, we explore the robustness of our result to the time period chosen. Particularly, we explore the sensitivity of results to the inclusion of data from the 1990s. First, we use as the dependent variable the average annual real growth rate of value added in a particular sector in a particular country over the period 1980 to 1999, rather than only the 1980s. Using growth rates over a longer period has some advantages since we are interested in the long-run relationships between property rights, financial development, and growth. The main drawback of including growth data from the 1990s is that the number of countries drops sharply, from 44 to 19. This is because data on sectoral growth in value added

Table IX

The Average Effect of Financial Development and Property Rights on Industrial Growth: Different Time Periods

The dependent variable in all regressions is the average annual real growth rate of value added in a particular sector in a particular country. In regressions (1) and (3), the average annual real growth rate is calculated over the period 1980 to 1989. In regressions (2) and (4), the average annual growth rate is calculated over the period 1980 to 1999. Regressions (1) and (2) use intangible-intensity values based on data from the 1980s, while regressions (3) and (4) use intangible-intensity values based on data from the 1990s. Table I describes all variables in detail. All regressions include industry dummies, country dummies, and a constant, but these are not reported. Robust standard errors are shown below the coefficients. The United States is dropped from all regressions as it is the benchmark country. Significance levels [a], [b], and [c] correspond to 1%, 5%, and 10%, respectively.

	(1) Growth over 1980–89; Intangibility over 1980s	(2) Growth over 1980–99; Intangibility over 1980s	(3) Growth over 1980–89; Intangibility over 1990s	(4) Growth over 1980–99; Intangibility over 1990s
Fraction of sector in value added of manufacturing in 1980	−1.076[a]	−0.2256[b]	−1.047[a]	−0.1973[b]
	(0.2491)	(0.1012)	(0.2470)	(0.0974)
Sectoral measure of financial dependence * private credit to GDP	0.1354[a]	0.0449[c]	0.1398[a]	0.0516[b]
	(0.0376)	(0.0259)	(0.0379)	(0.0262)
Sectoral measure of intangible intensity * property (freedom)	0.0092[a]	0.0074[a]	0.0078[c]	0.0056[b]
	(0.0028)	(0.0018)	(0.0047)	(0.0026)
R^2	0.2757	0.6133	0.2735	0.6061
N	1242	478	1242	478
Number of countries	44	19	44	19

are not available for many countries, since the United Nations database on Industrial Statistics includes data on sectoral growth in value added with a lag of several years for most countries. The results of using growth rates over the 1980s and the 1990s are reported in column 2 of Table IX, where column 1 reports for ease of comparison the results using the same specification for the 1980s (as already reported in Table V, column 3). We find that our main result is not qualitatively altered, because the coefficients for both the interactive variable external financial dependence times financial development and the interactive variable intangible intensity times property rights remain statistically significant and positive.

As a further robustness test of the time period studied, we also reestimated model (1) using the growth data of the 1980s, but with the sectoral intangible-intensity variable measured over the 1990s rather than the 1980s. This test investigates whether the use of a particular time period for the benchmark, industry level of intangible intensity, affects our findings. Our main result does not change qualitatively either when using this different benchmark (column 3 in Table IX), although the statistical significance is reduced somewhat. This robustness should not be a surprise, since the correlation between the sectoral intangible-intensity variables for the two different time periods is high, 0.90. Our results are also robust to using the average growth rates over the period 1980 to 1999 and the intangible-intensity values for the 1990s (column 4 in Table IX). Overall, our results do not seem to be affected by the particular time period chosen.

V. Conclusions

Countries differ from each other in many ways. Two aspects are the degree of their financial sector development and the quality of their property rights. This paper argues that an environment with poorly developed financial systems and weak property rights has two effects on firms: First, it reduces the access of firms to external financing and, second, it leads firms to allocate resources in a suboptimal way. The importance of the lack of financing effect has already been shown in the law and finance literature. We investigate the importance of property rights for firm growth by studying its impact on firms' allocation of investable resources. We find evidence suggesting that the effect of insecure property rights on the asset mix of firms, the asset allocation effect, is economically as important as the lack of financing effect, because it impedes the growth of firms to the same quantitative magnitude. Furthermore, the evidence suggests that the asset allocation effect is particularly important in hindering the growth of new firms.

While we use the ratio of tangibles and intangible assets as a measure of asset mix, the implications of our results probably go beyond this particular asset choice and may imply that an efficient allocation of firm resources can more generally be impeded by weak property rights. Our results may imply that the degree to which firms allocate resources in an optimal way will depend on the strength of a country's property rights and that firms' asset allocation is an important channel through which property rights affect firm growth. Thus, our results may have the policy implication that, just as it is important to have a good finan-

cial system, requiring in turn a functioning legal system, it is also important to assure the protection of returns to different types of assets. To the extent that the emergence of the "new economy" has increased the economic returns to assets on which yields are more difficult to secure, our results could even underestimate the overall costs of weak property rights. If indeed new economy assets and future growth opportunities are more related to intangible assets, then any underallocation of investable resources towards intangible assets may impede the future growth of firms and economies more generally, and even more so going forward.

Appendix: The Values of the Institutional Variables by Individual Country

Table AI reports the values of the country variables for the countries studied. Property (freedom) is a rating of property rights in each country (on a scale from 1 to 5). The index equals the median rating for the period 1995 to 1999, and the source is the Index of Economic Freedom from the Heritage Foundation. We reversed the original order of the index. Intellectual property (301) is an index of intellectual property rights (on a scale from 1 to 5). The index is calculated using the Special 301 placements of the Office of the U.S. Trade Representative. The index equals the median rating for the period 1990 to 1999. Patent rights (GP) is an index of patent rights (on a scale from 0 to 5) in 1980. The source of the patent rights index is Ginarte and Park (1997). Property (WEF) is an index of property rights for the year 2001 (on a scale from 1 to 7). The source is the World Economic Forum (2002). Intellectual property (WEF) is an index of intellectual property rights for the year 2001 (on a scale from 1 to 7). The source is the World Economic Forum (2002). Property (ICRG) is a measure of property rights in each country (on a scale from 0 to 10). The index equals the average rating for the period 1982 to 1995. The source is Knack and Keefer (1995). Each property rights index is constructed such that the more protection property receives, the higher the score of the index. Private credit is private credit divided by GDP in 1980. The source is RZ and the International Financial Statistics of the International Monetary Fund. Market cap is stock market capitalization divided by GDP in 1980. The source is RZ. Accounting is accounting standards in 1983 on a scale from 0 to 90, with higher scores indicating more disclosure. The source is RZ. Human capital is the average for 1980 of the years of schooling attained by the population over 25 years of age. The source of the human capital variable is Barro and Lee (1993). Rule of law is an assessment of the law and order tradition in the country (on a scale from 0 to 10). The rating is the average of the months of April and October of the monthly index between 1982 and 1995. The source is La Porta et al. (1997). Legal origin identifies the legal origin of the Company Law or Commercial Code of each country. There are four origins: (1) English Common Law, (2) French Commercial Code, (3) German Commercial Code, and (4) Scandinavian Commercial Code. The source is La Porta et al. (1999). European settler mortality is the European settler mortality rate, measured in terms of deaths per annum per 1,000 mean strength. The source is Acemoglu et al. (2001). GDP per capita is the logarithm of GDP per capita in 1980. The source is the World Development Indicators of

Table AI
The Values of the Institutional Variables by Individual Country

Country	Property (Freedom)	Intellectual Property (301)	Patents (GP)	Property (WEF)	Intellectual Property (WEF)	Property (ICRG)	Private Credit	Market Cap	Accounting Standards	Human Capital	Rule of Law	Legal Origin	European Settler Mortality	GDP per Capita
Australia	5.00	4.00	3.23	6.20	6.00	9.30	0.28	0.38	0.70	10.08	10.00	1.00	2.15	9.20
Austria	5.00	5.00	3.81	6.40	6.20	9.45	0.77	0.03	0.48	6.22	10.00	3.00	n.a.	9.16
Bangladesh	2.00	n.a.	1.99	3.70	2.20	2.85	0.07	0.00	n.a.	1.68	n.a.	1.00	4.27	4.79
Belgium	5.00	5.00	3.38	5.90	5.50	9.58	0.29	0.09	0.63	8.79	10.00	2.00	n.a.	9.33
Brazil	3.00	3.00	1.85	5.00	4.10	6.64	0.23	0.05	0.69	2.98	6.32	2.00	4.26	7.41
Canada	5.00	4.00	2.76	6.20	5.80	9.73	0.45	0.46	0.68	10.16	10.00	1.00	2.78	9.26
Chile	5.00	4.00	2.41	5.60	4.20	6.44	0.36	0.34	0.60	5.99	7.02	2.00	4.23	7.84
Colombia	3.00	4.00	1.12	4.30	3.00	5.54	0.14	0.05	0.39	4.23	2.08	2.00	4.26	7.05
Costa Rica	3.00	n.a.	1.94	5.20	3.70	6.47	0.26	0.04	n.a.	4.81	n.a.	2.00	4.36	7.68
Denmark	5.00	5.00	3.62	6.40	6.30	9.80	0.42	0.09	0.62	10.14	10.00	4.00	n.a.	9.41
Egypt	3.00	3.00	1.99	5.60	4.10	4.96	0.21	0.01	n.a.	2.16	4.17	2.00	4.22	6.33
Finland	5.00	5.00	2.95	6.50	6.40	9.76	0.48	0.06	0.71	9.61	10.00	4.00	n.a.	9.23
France	4.00	5.00	3.90	6.40	6.60	9.37	0.54	0.10	0.76	5.97	8.98	2.00	n.a.	9.34
Germany	5.00	5.00	3.86	6.50	6.30	9.55	0.78	0.09	0.68	8.46	9.23	3.00	n.a.	9.42
Greece	4.00	3.00	2.46	5.00	3.90	6.56	0.44	0.08	0.44	6.56	6.18	2.00	n.a.	8.25
India	3.00	3.00	1.62	4.90	3.00	5.80	0.24	0.05	0.71	2.72	4.17	1.00	3.88	5.48
Indonesia	3.00	4.00	0.33	3.80	2.90	4.38	0.20	0.00	n.a.	3.09	3.98	2.00	5.14	6.21
Israel	4.00	4.00	3.57	6.30	4.90	7.22	0.67	0.35	n.a.	9.14	4.82	1.00	n.a.	8.18
Italy	4.00	4.00	3.71	6.20	5.70	8.07	0.42	0.07	0.69	5.83	8.33	2.00	n.a.	8.77
Jamaica	4.00	n.a.	2.86	4.90	3.50	5.05	0.15	0.02	n.a.	3.60	n.a.	1.00	4.87	7.11
Japan	5.00	4.00	3.94	6.10	5.50	9.34	0.86	0.30	0.67	8.17	8.98	3.00	n.a.	9.20
Jordan	4.00	4.50	1.86	5.80	4.60	5.15	0.54	0.50	n.a.	2.93	4.35	2.00	n.a.	7.01
Kenya	3.00	n.a.	2.57	n.a.	n.a.	5.58	0.20	0.00	n.a.	2.44	5.42	1.00	4.98	6.03
Korea, Rep.	5.00	3.00	3.28	4.70	4.00	6.90	0.50	0.08	n.a.	6.85	5.35	3.00	n.a.	7.25
Malaysia	4.00	4.00	2.57	5.20	3.50	7.09	0.48	0.65	0.78	4.49	6.78	1.00	2.87	7.43
Mexico	3.00	4.00	1.40	4.60	3.60	5.76	0.16	0.07	n.a.	3.51	5.35	2.00	4.26	7.88
Morocco	3.50	n.a.	2.38	n.a.	n.a.	5.05	0.16	0.02	n.a.	n.a.	n.a.	1.00	4.36	6.69
Netherlands	5.00	5.00	4.24	6.50	6.50	9.87	0.60	0.19	0.73	8.20	10.00	2.00	n.a.	9.32
New Zealand	5.00	4.00	3.32	5.90	5.30	9.80	0.19	0.33	0.61	12.14	10.00	1.00	2.15	8.92

Table AI
(continued)

Country	Property (Freedom)	Intellectual Property (301)	Patents (GP)	Property (WEF)	Intellectual Property (WEF)	Property (ICRG)	Private Credit	Market Cap	Accounting Standards	Human Capital	Rule of Law	Legal Origin	European Settler Mortality	GDP per Capita
Nigeria	3.00	n.a.	3.05	3.80	2.50	3.85	0.12	n.a.	0.62	n.a.	2.73	1.00	7.60	6.81
Norway	5.00	5.00	3.29	5.90	5.30	9.69	0.34	0.06	0.71	10.32	10.00	4.00	n.a.	9.51
Pakistan	4.00	4.00	1.99	n.a.	n.a.	4.21	0.25	0.03	0.69	1.74	3.03	1.00	3.61	5.67
Peru	3.00	4.00	1.02	4.10	3.00	4.19	0.11	0.06	n.a.	5.44	2.50	2.00	4.26	6.74
Philippines	4.00	4.00	2.67	4.30	2.90	3.62	0.28	0.10	0.63	6.00	2.73	2.00	n.a.	6.59
Portugal	4.00	5.00	1.98	5.30	4.90	7.94	0.52	0.01	0.52	3.23	8.68	2.00	n.a.	7.74
Singapore	5.00	4.00	2.57	6.50	5.60	8.69	0.57	1.62	0.73	3.69	8.57	1.00	2.87	8.45
South Africa	3.00	4.00	3.57	5.30	4.50	7.50	0.26	1.20	0.81	4.61	4.42	1.00	2.74	7.97
Spain	4.00	4.00	3.29	5.90	5.30	7.99	0.76	0.09	0.42	5.15	7.80	2.00	n.a.	8.53
Sri Lanka	3.00	n.a.	2.79	4.20	3.10	4.64	0.21	0.06	n.a.	5.18	1.90	1.00	4.25	5.53
Sweden	4.00	4.00	3.47	5.90	5.80	9.80	0.42	0.11	0.81	9.47	10.00	4.00	n.a.	9.57
Turkey	4.00	3.00	1.80	4.20	3.10	5.76	0.14	0.01	n.a.	2.62	5.18	2.00	n.a.	6.99
UK	5.00	5.00	3.57	6.30	6.10	9.40	0.25	0.38	0.80	8.35	8.57	1.00	n.a.	9.17
Venezuela	3.00	4.00	1.35	3.80	3.00	5.82	0.30	0.05	n.a.	4.93	6.37	2.00	4.36	8.29
Zimbabwe	3.00	n.a.	2.90	3.90	2.90	5.09	0.30	0.45	n.a.	2.40	3.68	1.00	n.a.	6.09
Average	3.96	4.12	2.67	5.33	4.51	7.03	0.36	0.20	0.65	5.84	6.67	1.91	4.03	7.79

the World Bank. More detail on the definitions and sources of the variables can be found in Table I. Countries are sorted in ascending alphabetical order. The abbreviation n.a. stands for not available.

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