The Collateral Channel under Imperfect Debt Enforcement*

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Abstract

Does a country's ability to enforce debt contracts affect the sensitivity of economic activity to collateral values? To answer this question, we introduce a novel industry-specific measure of real asset redeployability - the ease with which real assets are transfered to alternative uses - as a proxy for collateral liquidation values. Our measure exploits the heterogeneity of expenditures in new and used capital and the heterogeneity in the composition of real asset holdings across U.S. industries. Using a cross-industry cross-country approach, we find that industry size and growth are more sensitive to collateral values in countries with weaker debt enforcement. Our estimates indicate that the differential effect is sizeable. The sensitivity of economic activity to collateral values is not affected by a country's financial development once the quality of debt enforcement is accounted for. We then rationalize our empirical findings based on a model of credit under imperfect enforcement and discuss an important implication of our empirical result: macroeconomic volatility generated by fluctuations in collateral values is higher in countries with weaker debt enforcement institutions.

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1 Introduction

Financial frictions imply that a firm's borrowing capacity depends on the collateral value of its pledgeable real assets. This dependence is at the core of a collateral channel that amplifies the effect of real shocks on economic fluctuations when economic activity affects the collateral value of real assets (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997). While prior research has found a positive relationship between the price of real estate and investment of U.S. firms (Chaney et al., 2010) or between the price of land and debt capacity of Japanese firms (Gan, 2007), little is known about how the magnitude of the collateral channel varies across environments characterized by different levels of financial frictions.[1] In this paper, we analyze how cross-country variation in debt enforcement affects the sensitivity of economic activity to collateral values. We find that industry size and growth are more sensitive to collateral values in countries with weaker debt enforcement institutions. We rationalize this finding based on a stylized model of credit under imperfect enforcement in which the quality of debt enforcement affects the bargaining power of the lender in the process of renegotiating the debt contract after a borrower's repudiation.

Our empirical investigation is based on a cross-industry cross-country approach. We regress an economic outcome, either the relative size or the growth rate of value added in an industry, on the interaction between the industry's collateral value and the country's quality of debt enforcement, controlling for industry and country fixed effects and other determinants of economic performance. Because no comprehensive data on collateral values of different real asset types are available and observed collateral values would not necessarily meet the expected resale values upon default, we construct a novel industry-specific measure of real assets' redeployability - the ease with which real assets used by firms in an industry are transferred to alternative uses - as a proxy for the industry's collateral liquidation value (Williamson, 1988; Shleifer and Vishny, 1992). In a first step, we compute the redeployability of different asset types by exploiting the heterogeneity of expenditures in new and used capital across U.S. industries. We consider a real asset to be more redeployable if industries purchase on average a high share of used capital of that type; and we define the redeployability of an industry's real assets portfolio as the weighted average of the redeployability index of each real asset type, where the weights are the shares of capital of each type in the total capital stock employed by the industry. Our measure is designed to capture technological factors such as the degree of specificity of real assets to industries and therefore the long-term collateral value of an industry's real assets. As a proxy for a country's quality of debt enforcement, we use Djankov et al. (2008)'s measure of the efficiency of debt enforcement procedures.

Using data on 28 manufacturing industries located in 67 countries over the period 1980-2000, we find that the differences in size and growth between industries with high and low collateral values are larger in countries with weaker debt enforcement institutions. Our estimates predict

[1] Chaney et al. (2010) provide evidence that the sensitivity of investment to collateral values is stronger for financially constrained firms based on firm-level indicators of credit constraints.

that a representative industry located in a country that ranks at the 25th percentile of the debt enforcement quality index (like Guatemala) would shrink by 0.3 percentage points in terms of value added relative to GDP with respect to the same industry in a country ranked at the 75th percentile (like Sweden) if its collateral value would decline from the 75th to the 25th percentile of the redeployability index. This differential effect is economically significant as the average size of an industry in the sample equals 0.64%. The differential effect predicted by the growth regression amounts to an extra 1.6 percentage points drop of annual growth in the country with weak debt enforcement institutions. Again, this effect is sizable as it compares to an average annual growth rate of 2.18%. These findings are robust to controlling for the standard determinants of economic peformance and using instrumental variables. They are also robust to using alternative measures of debt enforcement and economic activity, varying the sample periods and controlling for alternative channels that might spuriously drive our results through their correlation with the channel we highlight.

Our main results rest on the assumption that secured lending is an important financing instrument for firms in all countries. However, it might be the case that in countries where collateral pledging is too costly due to institutional weaknesses, firms resort to alternative forms of financing like unsecured loans, third-party guarantees and relationship lending (see Menkhoff et al., 2011) or leasing (see Eisfeldt and Rampini, 2009). As a consequence, the importance of the collateral channel for aggregate activity might be smaller in those countries. In light of this argument, we run our benchmark regression in subsamples of rich and poor countries and expect to find no significant effect in the latter group of countries. Our estimates are indeed in line with this hypothesis. We find a negative and significant effect of the quality of debt enforcement on the collateral channel in the sample of rich countries but no significant effect in the sample of poor countries.

We further show that the basic source of variation in the collateral channel across countries is the quality of debt enforcement in the sense that financial development has no impact on the collateral channel when the effect of institutions is taken into account. We also disentangle the effect of legal rules devised to protect creditors and of their enforcement in alleviating financial constraints. We find that only debt enforcement has a significant effect on the collateral channel. Altogether, our results suggest that if the objective of a policymaker is to mitigate the sensitivity of economic activity to fluctuations in collateral values then her focus should be on improving the quality of legal institutions devised to enforce debt contracts rather than financial development alone.

We rationalize this empirical evidence in a stylized model of credit under imperfect enforcement. The framework implies a standard credit constraint for a borrower that is due the fact that the cash-flows of her project are non-contractible and she may repudiate the debt contract. Since the credit multiplier of the borrower is positively associated with the liquidation value of the real assets pledged as collateral, our model features a collateral channel. This collateral channel is amplified or mitigated when debt enforcement institutions weaken depending on how debt enforcement is interpreted. If the quality of debt enforcement affects the bargaining power of the lender in the process of renegotiating the debt contract after repudiation (see e.g. Jermann and Quadrini, 2009), then the collateral channel is amplified in the presence of weak debt enforcement institutions. Fluctuations in collateral values have a larger impact on the share of the surplus that the lender is able to obtain from the renegotiation process when this share is lower because of a lower bargainning power. Alternatively, if the quality of debt enforcement affects the lender's ability to repossess assets from a liquidated borrower (see e.g. Eisfeldt and Rampini, 2007, 2009), the collateral channel is mitigated in the presence of weak debt enforcement institutions. Intuitively, the fluctuation in the credit multiplier arising from a given fluctuation in the collateral value corresponds to the fraction of the collateral that the lender is able to repossess which is lower in countries with weaker institutions. Our empirical results unambiguously favour the first interpretation.

The stylized model we present provides a basis for discussing an implication of our empirical findings. As the sensitivity of economic activity to collateral values is stronger in countries with weak debt enforcement institutions, macroeconomic volatility generated by comparable fluctuations in collateral values will be higher in countries with weaker institutions. This result is in line with empirical evidence presented in Acemoglu et al. (2003) and Koren and Tenreyro (2007). Acemoglu et al. (2003) find that the development of institutions is the driver in the reduction of macroeconomic volatility, while Koren and Tenreyro (2007) show that 50 percent of the difference in volatility between developed and developing countries is explained by differences in country-specific volatility. Our empirical investigation thus suggests a specific channel through which the quality of institutions causes macroeconomic volatility.

This paper contributes to the large literature analysing the effect of judicial efficiency on financial and economic development initiated by the seminal papers of La Porta et al. (1997, 1998) and Demirgüc-Kunt and Maksimovic (1998). A strand of this literature analyses bank loans across countries or across regions within countries characterized by heterogenous contract enforcement efficiency or creditor protection. A general finding of these papers is that financing conditions are worse under weaker institutions (see e.g. Laeven and Majnoni, 2005; Jappelli et al., 2005; Qian and Strahan, 2007; Bae and Goyal, 2009). Closest to our paper are Liberti and Mian (2010) who show that a worsening in financial development driven by weaker institutions is associated with an increase in the difference in collateralization rates between high- and low-risk borrowers.

The collateral channel is also related to recent findings in the empirical literature in corporate finance on the effect of collateral values on financial contracts. Empirical evidence shows that U.S. firms using real assets with low collateral values sign financial contracts characterized by higher costs, smaller size and shorter maturity than firms with high collateral values (see e.g. Benmelech et al., 2005; Benmelech and Bergman, 2008; Benmelech, 2009; Benmelech and Bergman, 2009; Gavazza, 2010). Finally, our paper is related to the evidence on fire sales of collateral. Pulvino (1998) documents that financially constrained airlines receive lower prices for their used aircrafts than their unconstrained competitors. Acharya et al. (2007) uses data of defaulted firms to show that industry distress affects collateral liquidation values, in particular for industry-specific assets. Benmelech and Bergman (2011) provide evidence that bankrupt firms impose a negative externality on other firms operating in the same industry through their effect on collateral values. In contrast to these papers on collateral values in fire sales, we focus on the long term value of collateral and use a mesure of redeployability that captures technological factors.

The paper is organized as follows. In the next section we explain the empirical strategy used to identify the effect of debt enforcement on the sensitivity of economic activity to collateral values. We introduce our novel industry-specific measure of real assets' redeployability and describe the data on economic activity and debt enforcement in Section 3. Section 4 presents the results of the empirical analysis and the robustness checks. In section 5, we provide a theoretical framework that rationalizes our empirical results and discuss their implication for the relationship between institutions and macroeconomic volatility. We conclude in Section 6.

2 Empirical Strategy

We adopt a cross-industry cross-country approach to identify the effect of the quality of debt enforcement on the sensitivity of economic activity to collateral values. As discussed more deeply in the next section, we build an industry-level measure of redeployability of real assets using U.S. data as a proxy for the collateral value. Specifically, we estimate the parameters of the following empirical model :

$$Y_{ic} = \beta \times \mathit{Redeployability}_i \times \mathit{Debt\ Enforcement}_c + \gamma X_{ic} + \eta_i + \eta_c + \varepsilon_{ic} \quad (1)$$

where i and c indexes industries and countries, respectively. The dependent variable Y_{ic} measures an economic outcome either the share of the industry in the country's GDP or the industry growth. The variable of interest is the interaction term $\mathit{Redeployability}_i \times \mathit{Debt\ enforcement}_c$, where $\mathit{Redeployability}_i$ measures the redeployability of the industry's real assets and $\mathit{Debt\ Enforcement}_c$ measures the quality of debt enforcement in the country. X_{ic} is a set of additional determinants of economic activity, η_i an industry fixed effect, η_c a country fixed effect and ε_{ic} a random error. The coefficient β quantifies the effect of the quality of debt enforcement on the magnitude of the collateral channel. For example, a negative and significant point estimate of β would indicate that the sensitivity of economic activity is stronger in countries with weaker debt enforcement.

The cross-industry cross-country approach allows to include industry and country fixed effects to control for any determinants of economic activity that vary at the industry or country level and thus reduces the concern of omitted variable bias. [2] However, we still need to include potential determinants of economic activity that vary over both dimensions and might be correlated with the interaction term $\textit{Redeployability}_i \times \textit{Debt Enforcement}_c$. Our results would be misleading if we omit to control for these alternative channels, since the channel we identify would absorb all their effect. We take care of this problem in Section 5.3.2.

The second reason to be cautious about the estimate of β is the potential endogeneity of $\textit{Debt Enforcement}_c$. If industries with lower real assets' redeployability increase their size and growth rate, policymakers might be tempted to improve insolvency institutions. This process might result in making debt enforcement endogenous to the evolution of economic activity. To solve this problem, we estimate the emprical model (1) using the method of instrumental variables (IV). Following La Porta et al. (1998), the legal origin of *commercial laws* is the instrument usually used for financial development in the finance and growth literature. We slightly depart from the literature in that respect. Djankov et al. (2008) provide country-level data on the legal origin of *bankruptcy laws* and the quality of debt enforcement.[3] They find that the legal origin of bankruptcy laws is one of the most important cross-country determinants of debt enforcement quality. Based on that evidence, instrumenting debt enforcement by the legal origin of brankruptcy laws seems more appropriate. We also have to take care of the potential endogeneity of $\textit{Redeployability}_i$. Our strategy is to exclude the United States from our regressions, as the redeployability index is calculated from U.S. industry data. This strategy is standard in the literature employing an industry characteristic measured in a benchmark country in a cross-industry cross-country framework (see e.g. Rajan and Zingales, 1998; Claessens and Laeven, 2003; Fisman and Love, 2007). It is worth noting that an important aspect of the specification is that the redeployability of real assets is considered specific to the industry (no cross-country variation). To be valid, this approach requires that our redeployability measure based on U.S. industries data captures technological characteristics of the industry. We will discuss the adequacy of our measure of real assets' redeployability with this important assumption in Section 3.1.

The last potential problem for the identification of the collateral channel is measurement errors of the interaction term. We address the potential measurement error problem of $\textit{Debt Enforcement}_c$ by using the legal origin of countries' bankruptcy laws as an instrument. The collateral value of real assets depends on factors varying at the country and industry levels and idiosyncratic terms. Due to a lack of data availability and other reasons explained in Section 4.1, we do not attempt to measure the actual collateral value of real assets, but we measure the industry-specific component of it, which is the redeployability of real assets

[2] The inclusion of industry and country fixed effects comes at the cost of not being able to identify the collateral channel and the overall effect of debt enforcement on economic activity since both are subsumed in the fixed effects. However, as they are not the main objects of interest in our paper, this disadvantage is strongly overbalanced by the advantage arising from the reduction in omitted variable bias.

[3] Up to some exceptions, the legal origin of bankruptcy laws is identical to the legal origin of commercial laws reported in La Porta et al. (1998).

arising from technological factors. It still could be that we measure the redeployability of real assets with some error. Under the assumption that idiosyncratic terms are uncorrelated with industry-specific variables, this would lead to a classical attenuation bias with β being biased towards zero[4]. At the time, we do not have instruments for the redeployability of real assets to address this issue. Further testing of the collateral channel with an appropriate instrument is an important task left for future research.

3 Data

3.1 Measuring the Redeployability of Real Assets

3.1.1 Motivation and Methodology

Testing the effect of imperfect debt enforcement on the collateral channel requires that we observe the collateral liquidation values of different types of real assets in order to compute the collateral value of a portfolio of real assets owned by an industry. Such a direct approach poses two problems. First, no comprehensive data on collateral liquidation values are available for a wide range of real assets.[5] Second, at the time the debt contract is signed observed collateral liquidation values do not necessarily meet the expected resale values upon default.

We therefore have to find an indirect way to capture the expected value of collateral to lenders upon default. We follow Williamson (1988) and Shleifer and Vishny (1992) who argue that the liquidation value of a real asset is closely related to the ability to redeploy it to other firms. The identification of the redeployability of a real asset in liquidation first requires to determine the potential buyers. We assume that the potential buyers of a used real asset are the firms already operating it. Second, we need to find the determinants of the redeployability of a real asset in liquidation to the potential buyers. We suppose that a real asset is more easily redeployed to firms in an industry whose expenditures in used assets of that type represent a large fraction of their total expenditures in capital. The first assumption is standard in the literature on financial contracts and liquidation values (see Benmelech and Bergman, 2008; Benmelech, 2009; Benmelech and Bergman, 2009; Gavazza, 2010). Regarding the second one, we rather consider the investment flows of used capital instead of the stock of capital since investment in used real assets is a more accurate proxy for liquidity and better capture trading frictions in secondary markets. This assumption is based on Gavazza (2011) who investigates the role of trading frictions in real asset markets. He argues that traders must incur trading

[4]Formally, the problem is the follwing: suppose that the true model of the economy is $Y_{ic} = \beta \times \textit{Collateral Value}_{ic} \times \textit{Debt Enforcement}_c + \gamma X_{ic} + \eta_i + \eta_c + \varepsilon_{ic}$, with $\textit{Collateral Value}_{ic} = \alpha_c + \alpha_i + \alpha_{ic}$ but instead, we estimate $Y_{ic} = \beta \times \textit{Redeployability}_i \times \textit{Debt Enforcement}_c + \gamma X_{ic} + \eta_i + \tilde{\eta}_c + \nu_{ic}$, where $\nu_{ic} = \beta \times (\alpha_{ic} - u_i) \times \textit{Debt Enforcement}_c + \varepsilon_{ic}$ and $\tilde{\eta}_c = \eta_c + \beta \times \alpha_c \times \textit{Debt Enforcement}_c$ with $\textit{Redeployability}_i = \alpha_i + u_i$. Under the assumptions $E[\alpha_i \alpha_{ic}] = E[\alpha_i \varepsilon_{ic}] = E[\alpha_i u_i] = E[\alpha_{ic} u_i] = E[\varepsilon_{ic} u_i] = 0$, $\hat{\beta}$ is plagued by a classical measurement error bias (attenuation bias).

[5]There are data avalaible on firm-level transaction prices for one particular type of real asset, namely commercial aircrafts. See Pulvino (1998) and Gavazza (2011).

costs to find a trading partner because secondary markets of real assets are decentralized. The value of the search process to match buyers and sellers increases with the market size of used capital as the probability to find a good match is larger. Therefore if the market of used capital of a given type is thin, market participants do not search exhaustively for the best matches which reduces on average the number of transactions and the transaction prices. Using datasets concerning the market of commercial aircrafts, Gavazza (2011) provides evidence consistent with these predictions. He finds that an aircraft model with a thinner market (i.e. with a lower stock or fewer operators) is less frequently traded and fetches lower average transaction prices.

To compute a proxy for the collateral liquidation value of a real asset based on its redeployability, we exploit the heterogeneity in the expenditures in used and new capital of that type across industries. Based on the two aforementioned assumptions, we measure the redeployability of real assets of type a as

$$Redeployability_a = \sum_i \left(\frac{E_{a,i}^{used}}{E_i^{used} + E_i^{new}} \right) \tag{2}$$

where total expenditures in used and new capital by industry i is given by $E_i^{used} = \sum_a E_{a,i}^{used}$ and $E_i^{new} = \sum_a E_{a,i}^{new}$, respectively. Then to construct a proxy for the sector-level collateral value, we aggregate the asset-type redeployability measures across all real assets owned by firms in industry i. Specifically, we build an industry measure of redeployability as a weighted average of the rededeployability corresponding to each real asset a

$$Redeployability_i = \sum_a \omega_{a,i} \times Redeployability_a \tag{3}$$

where the weight $\omega_{a,i}$ is the share of real assets of type a in total real assets owned by industry i. In contrast to observed collateral liquidation values, the asset-type based measure (2) serves to capture the long-term collateral value of a real asset. This strategy puts less emphasis on current market condition and prices, and fits better to the need to measure the expected collateral value of a portfolio of real assets owned by an industry.

The industry measure of real assets' redeployability (3) is computed solely from U.S. data and extrapolated to industries located in other countries.[6] The validity of this approach relies on two basic assumptions. First, there is a technological reason why some industries purchase a lower share of used capital of a given type (due for instance to the specificity of the asset required in the production process) and own a different portfolio of real assets. If the U.S.

[6]This approach is based on Rajan and Zingales (1998) and frequently used in the finance and growth literature (see Claessens and Laeven, 2003; Braun, 2005; Ilyina and Samaniego, 2011). In contrast to these studies, we use industry-level data to compute the redeployability measure instead of firm-level data, because firm-level data from Compustat does not offer a high enough level of disaggregation for asset types. However we are not the first to use industry-level data in order to compute an industry-specific characteristic and apply the same empirical methodology (see Nunn, 2007).

economy can be considered as relatively frictionless and thus represents a good benchmark, the computation of the redeployability from U.S. data should reflect exogenous characteristics of the industry production technology. As shown in Table A1 of the appendix, measures of redeployability are highly correlated across different decades (1960's, 1970's, 1980's and 1990's). The Spearman's rank correlation coefficients are above 0.9 with the null hypothesis of independance strongly rejected (below the 1 percent level of significance).[7] These findings support the assumption that the determinants of redeployability in expression (3) are mainly technological and can be considered as industry-specific at least for the US economy. Second, we assume that the technological differences underlying the ranking of redeployability across industries persist across countries. Unfortunately, we cannot test whether the industry measures of redeployability are highly correlated across countries since no data on real assets with high enough disaggregation at the asset level are available for other countries.

3.1.2 The Measure

The measure of redeployability of each type of real asset given in expression (2) is calculated combining two distinct sources that provide data on capital expenditures for a wide range of U.S. manufacturing and non-manufacturing sectors.[8] The Detailed Fixed Assets Tables from the Bureau of Economic Analysis (BEA) detail the expenditures in private nonresidential real assets for 73 types, belonging to the broad categories *Equipment* and *Structures*. This database is available on a yearly frequency over the period 1901-2009, but only provides data on total capital expenditures without disaggregeting expenditures in used and new real assets of each type. On the contrary, the Annual Capital Expenditure Survey (ACES) dataset from U.S. Census Bureau provides data on used and new capital expenditures on an annual basis over the period 1994-2006 but only for the two broad categories *Equipment* and *Structures*. To extract the available information from the two datasets, we decompose expression (2) into two main determinants of the redeployability of real asset a, namely the market *liquidity* and the degree of *nonspecificity* of the used asset

$$Redeployability_a = \sum_i \underbrace{\left(\frac{E_{a,i}^{used} + E_{a,i}^{new}}{E_i^{used} + E_i^{new}} \right)}_{\equiv Liquidity_{a,i}} \times \underbrace{\left(\frac{E_{a,i}^{used}}{E_{a,i}^{used} + E_{a,i}^{new}} \right)}_{\equiv Nonspecificity_{a,i}} \tag{4}$$

The first determinant, *liquidity*, accounts for the *relative* thickness of the asset market and is averaged over the period 1980-2000 for each real asset in each industry using the Detailed Fixed Assets Tables.[9] The second determinant, *nonspecificity*, captures the degree of substitutability

[7]Note that Pearson correlations are of the same order of magnitude and highly statistically significant.

[8]The industrial classification of the two datasets is not similar. See the the details in appendix B.1 for the conversion.

[9]Since our measure of redeployability represents a proxy for all the countries in our sample, we do not calculate the *absolute* liquidity provided by industries as in the aforementioned studies, but the liquidity provided for an asset a *relative* to total assets.

between used and new capital. We average it over the available time period for each real asset in each industry using the ACES dataset. Since used and new capital expenditures are only split into two broad categories *Equipment* and *Structures*, the nonspecificity measure is equal for all real assets that fall into the same category.[10] Ramey and Shapiro (2001) claim that these two ingredients can be considered as a plausible characterization of secondary capital markets. They argue that capital specialization at the firm level entails search costs to find potential buyers with the best match to the real asset's characteristics and thus ready to pay a price close to its fundamental value. In line with Gavazza (2011), a thin market and a high degree of specificity for a real asset increase the search costs and hence decreases its liquidation value.

The industry measure of redeployability (3) based on the asset-type redeployability (4) is calculated for manufacturing and non-manufacturing industries identified by the North American Industry Classification System (NAICS). For interpration purposes, we normalize it by dividing the redeployability of each sector by the highest redeployability index. Since data on economic activity are detailed at the 3-digits ISIC Rev. 2 classification and only available for industries in the manufacturing sector, we match industries corresponding to both classifications and report the measure only for manufacturing industries. The details of the concordance can be found in Appendix B.1.[11] We tabulate the measure of redeployability of real assets by ISIC industry in ascending order in Table 1. According to our measure, the industries that have the most redeployable assets are *Leather products*, *Wearing apparel* and *Textiles* while the ones with the lowest measure are *Transport equipment*, *Footwear*, *Iron and steel* and *Fabricated metal products*. A second source of heterogeneity in liquidation values is the relative quantity of tangible assets used by firms. We report in Table 1 the measure of *Tangibility* of assets from Braun (2005) as well as the Pearson's coefficent correlation between the two measures. The two source of heterogeneity are distinct as we cannot reject the null hypothesis of no correlation.[12]

3.2 Measures of Debt Enforcement and Economic Activity

To test the collateral channel under imperfect debt enforcement, we use the measure of efficiency of debt enforcement procedures constructed by Djankov et al. (2008) as a proxy for the quality of debt enforcement. Djankov et al. (2008) presented a case study of an identical firm about to default on its debt to insolvency practitioners in 88 countries. They then collected

[10]Almeida et al. (2009) and Campello and Giambona (2010) argue that equipment capital is less specific than other types of capital, like buildings (falling into category *Structure*). This assumption is confirmed by our measure. On average, the ratio of used to total capital expenditures is equal to 7.8 percents for *Equipment* and to 5.6 percents for *Structures*

[11]Our strategy is to link each of the two classifications to the 6-digits NAICS 2002 classification and then use the number of NAICS 2002 categories that link BEA and ISIC categories to choose which BEA category is attributed to a ISIC category. The advantage of this method is that all ISIC categories are mapped. However, for some ISIC categories the same BEA category is attributed, which reduces the variability of our measure across industries.

[12]The significance level of the correlation coefficient is 31.3%.

Table 1. Redeployability of Real Assets and Tangibility of Assets

ISIC	Industrial sector	Redeployability	Tangibility
384	Transport equipment	.6093	.2548
324	Footwear, except rubber or plastic	.6396	.1167
371	Iron and steel	.6396	.4581
381	Fabricated metal products	.6396	.2812
341	Paper and products	.6510	.5579
372	Non-ferrous metals	.6540	.3832
362	Glass and products	.6631	.3313
382	Machinery, except electrical	.6631	.1825
383	Machinery, electric	.6848	.2133
385	Professional and scientific equipment	.6848	.1511
351	Industrial chemicals	.6881	.4116
352	Other chemicals	.6881	.1973
355	Rubber products	.6995	.3790
356	Plastic products	.6995	.3448
390	Other manufactured products	.7034	.1882
311	Food products	.7338	.3777
313	Beverages	.7338	.2794
314	Tobacco	.7338	.2208
342	Printing and publishing	.7413	.3007
353	Petroleum refineries	.7492	.6708
354	Miscellaneous petroleum and coal products	.7492	.3038
361	Pottery, china, earthenware	.7537	.0745
369	Other non-metallic mineral products	.7537	.4200
332	Furniture, except metal	.7708	.2630
331	Wood products, except furniture	.7718	.3796
321	Textiles	.8056	.3730
322	Wearing apparel, except footwear	.8896	.1317
323	Leather products	.8896	.0906
Mean		0.7172	0.2977
Correlation		1	-0.19^{a}

Notes: Redeployability is the redeployability of real assets used by U.S. firms between 1981-2000 in industry i and is defined by expression (3) in the text. *Tangibility* of assets is the median ratio of net property, plant and equipment to total assets over U.S. firms in industry i (see Braun, 2005). [a] indicates that the null hypothesis of no correlation is not rejected at 10% level.

their responses on various aspects corresponding to domestic procedures required to enforce the debt contract. The measure of debt enforcement efficiency defines the present value of the terminal value of the firm minus bankruptcy costs and combines data on three aspects of debt enforcement. The first aspect considers whether the firm is kept as going concern or sold piecemeal, assuming its value is lower in the latter case. The second aspect is the legal costs associated with the enforcement procedure. The third aspect measures the opportunity costs arising from the time to resolve the enforcement procedure and the level of interest rates. A formal description of the measure is provided in Appendix B.1.

A major drawback of the measure constructed by Djankov et al. (2008) is that it is based on responses collected after our sample period. Ideally, we would like to use a measure of debt enforcement quality that covers the period 1980 to 2000 considered in the empirical analysis. Indeed, insolvency procedures may have evolved over time in response to economic performance and using ex-post values is known as raising deeper issues concerning endogeneity. We believe the concern to be small for two reasons. First, as mentioned in the section devoted to the empirical strategy, we adress the issue of reverse causality using IV. Second, measures of institutions are shown to be persistent over long periods of time (Acemoglu et al., 2001, 2002). However in a robustness check, we proxy the quality of debt enforcement by the average size of debt market over the period 1980-2000 since Djankov et al. (2008) provides evidence that their measure of debt enforcement quality is a strong predictor of debt market size across countries. Table 2 reports the measure of debt enforcement quality with the associated debt market size for the three most and three least efficient countries across two groups, the high-income and middle- to low-income countries. We observe that high-income

Table 2. Debt Enforcement and Debt Market Size across Countries

High-Income Countries			Middle- and Low-Income Countries		
Country	Debt Enforcement	Debt Market Size	Country	Debt Enforcement	Debt Market Size
Singapore	0.961	0.981	Mexico	0.726	0.177
Japan	0.955	1.627	Colombia	0.648	0.295
Netherlands	0.949	1.106	Tunisia	0.566	0.592
...			...		
Greece	0.538	0.348	Brazil	0.134	0.300
Hungary	0.467	0.286	Venezuela	0.131	0.312
Italy	0.453	0.539	Turkey	0.066	0.146
Number of countries	25	25		26	26
Mean	0.782	0.794		0.364	0.375
t-test of difference in means	9.13**	5.01**			
Correlation	1	0.454*		1	0.338^{+}

Notes: This table reports the efficiency of debt enforcement from Djankov et al. (2008) for the 3 most and 3 least efficient countries across high-income and non high-income countries present in our regression samples. For these countries, it reports debt market size measured as the average ratio of private credit by deposit money bank and other financial institutions to GDP between 1981-2000. To classify countries, we use the World Bank classification of countries. We also present the means and correlations of the two measures for each group, and *t*-statistics for the difference in means across the two groups. **: significant at 1% level. *: significant at 5% level. $^{+}$: signficant at 10% level.

countries have more efficent debt enforcement procedures than those in middle- and low-income countries. The difference is highly statistically significant showing some heterogeneity in debt enforcement across countries. Moreover debt market size is significantly correlated with debt market size associated to each group of countries.[13]

Economic activity is measured using production data collected annually by the United Nations Industrial Developlment Organization (UNIDO). Specifically, we use the database compiled by Nicita and Olarreaga (2007) which covers 100 countries over the period 1976-2004. The data are disaggregated into 28 industries of the manufacturing sector according

[13]The Spearman correlation for the sample holding the two groups is equal to 0.661 and significant at the 1% percent level.

to the ISIC Rev. 2 classification. Our main measure of economic activity is the sectoral value added, which represents the contribution of a particular manufacturing industry to the country's GDP. Specifically, we focus on two types of economic outcome. First, we adopt an allocation perspective and ask how resources are allocated across industries with different collateral values within a country characterized by a certain quality of debt enforcement. In this perspective, Y_{ic} in regression (1) is measured as the mean share of value added of industry i to GDP in country c over the period 1981-2000. We then consider a growth perspective and concentrate on industrial growth. The dependent variable defines the average annual real growth rate of value added of industry i in country c over the period 1980-2000, and is measured as the log of real value added in 2000 less the log of real value added in 1980 (divided by 20). Note that we average these measures on economic outcome over the period 1980-2000 to maximize the country coverage.

However, due to differences in country coverage between datasets of debt enforcement and economic activity, our dataset includes 67 countries (instead of the 88 potential countries). For some of these countries data on economic activity for the years 1980, 2000 and in-between are missing. Moreover, we drop the benchmark country, the United States, as the redeployability index is calculated from U.S. industry data. The sample in the basic allocation regression reduces to 62 countries associated to 1641 observations (instead of 1736=62×28 possible observations). In growth regressions, we are left with data on 35 countries associated to 829 observations (instead of 980=35×28 possible observations). The countries included in the allocation and growth regressions with the number of industries available for each country are listed in Table A.3. in the Appendix.

4 Empirical Analysis

4.1 The Collateral Channel and Debt Enforcement

We report the estimation of the empirical equation (1) in Table 3. The OLS estimates with two-way clustered standard errors are shown in the first four columns, while in the last four columns we report the IV estimates with heteroskedasticity robust standard errors.[14] Consistently with the two perspectives on economic activity adopted in the paper, we present the estimates related to the allocation of economic activity within a country in panel A and those related to economic growth in panel B. The estimation of our baseline specification using OLS is presented in the first column. It includes our variable of interest, i.e. the interaction between the industry's real assets' redeployability and the country's quality of debt enforcement (*Redeployability* × *Debt enforcement*) as well as country and industry dummy variables. The coefficient estimate on our variable of interest has a negative sign and is significant at the 5% level in both panels. These results indicate that industries with a low

[14] When the standard errors are clustered two-way by industry and country, the number of clusters become too large to compute the IV estimates with two-way clustered standard errors as in OLS regressions.

Table 3. The Effect of Imperfect Debt Enforcement on the Collateral Channel

	OLS				IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Allocation: Y_{ic} = value added to GDP								
Redeployability × Debt enforcement	**−0.043***	**−0.053****	**−0.043***	**−0.049***	**−0.070****	**−0.078****	**−0.066****	**−0.071****
	(0.018)	**(0.018)**	**(0.019)**	**(0.021)**	**(0.014)**	**(0.014)**	**(0.014)**	**(0.015)**
Tangibility × Debt enforcement		−0.025*		−0.024		−0.033**		-0.023^{+}
		(0.013)		(0.015)		(0.015)		(0.012)
Depreciation × Debt enforcement			0.002**	0.002**			0.003**	0.003**
			(0.001)	(0.001)			(0.001)	(0.001)
Obsolescence × Debt enforcement			0.006^{+}	0.004			0.008**	0.006**
			(0.003)	(0.003)			(0.002)	(0.002)
Capital intensity × Capital				0.006				0.004
				(0.010)				(0.010)
Skill intensity × Skill				0.002				0.001
				(0.003)				(0.002)
Natural resources intensity × Natural resources				0.001				0.001^{+}
				(0.001)				(0.000)
Differential effect (percentage points)	**−0.17**	**−0.21**	**−0.17**	**−0.22**	**−0.27**	**−0.30**	**−0.26**	**−0.32**
Hansen J test (p-value)	–	–	–	–	0.374	0.406	0.330	0.848
Kleinbergen-Paap statistic	–	–	–	–	219.5	104.8	96.55	13.85
R^2	0.203	0.204	0.205	0.547	0.182	0.181	0.112	0.539
Observations	1641	1641	1641	1101	1641	1641	1641	1101
Countries	62	62	62	41	62	62	62	41

Table 3. (*Continued*)

	OLS				IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
B. Growth: Y_{ic} = real growth of value added								
Redeployability × Debt enforcement	**−0.262***	**−0.250***	**−0.268***	**−0.277****	**−0.405****	**−0.384****	**−0.409****	**−0.412****
	(0.125)	**(0.115)**	**(0.123)**	**(0.104)**	**(0.102)**	**(0.106)**	**(0.099)**	**(0.104)**
Tangibility × Debt enforcement		0.029		0.033		0.021		0.021
		(0.044)		(0.049)		(0.053)		(0.056)
Depreciation × Debt enforcement			0.001	0.002			0.006	0.008
			(0.003)	(0.003)			(0.005)	(0.005)
Obsolescence × Debt enforcement			0.009	0.014^{+}			0.009	0.015
			(0.007)	(0.008)			(0.012)	(0.012)
Initial industry share				−0.106*				−0.124**
				(0.045)				(0.044)
Differential effect (percentage points)	**−1.04**	**−0.99**	**−1.06**	**−1.10**	**−1.61**	**−1.52**	**−1.62**	**−1.64**
Hansen J test (p-value)	–	–	–	–	0.568	0.186	0.415	0.253
Kleinbergen-Paap statistic	–	–	–	–	119.5	44.39	59.02	19.30
R^2	0.599	0.599	0.599	0.605	0.596	0.596	0.594	0.600
Observations	829	829	829	829	829	829	829	829
Countries	35	35	35	35	35	35	35	35

Notes: All regressions include both country and industry fixed effects and a constant (coefficient estimates not reported). In Panel A, the dependent variable is the average share of each 3-digit ISIC industry's real value added to each country's GDP over the period 1981-2000. In Panel B, the dependent variable is the annual compounded growth rate in real value added over the period 1980-2000 for each 3-digit ISIC industry in each country. The main variable of interest *Redeployability* × *Debt enforcement* denotes the product of these two variables. *Redeployability* defined by expression (3) in the text is the redeployability of real assets owned by each 3-digit ISIC U.S. industry between 1981-2000. *Debt enforcement* is a time-invarying variable constructed by Djankov et al. (2008) and denotes the efficiency of debt enforcement procedures in each country. *Tangibility* from Braun (2005) is the median ratio of net property, plant and equipment to total assets over U.S. firms in each 3-digit ISIC industry. *Depreciation* and *Obsolescence* from Ilyina and Samaniego (2011) are the industry rate of capital depreciation and the embodied technical change in capital measure based on Cummins and Violante (2002). Columns 1 to 4 report the OLS estimates. Columns 5 to 8 report IV results obtained by GMM with *Debt enforcement* instrumented by the legal origin of a country's bankruptcy laws. The differential effect measures in percentage points how much smaller (slower) an industry at the 25th percentile of the redeployability of real assets would become (grow) with respect to an industry at the 75th percentile when the industries are located in a country at the 25th percentile of debt enforcement rather than in one at the 75th percentile. Standard errors clustered two-way by industry and country (columns 1-4) and heteroskedasticity robust standard errors (columns 5-8) are reported in parentheses. **: signficant at 1% level. *: signficant at 5% level. $^{+}$: signficant at 10% level.

collateral value represents a relatively smaller share of the economy (panel A) and grows more slowly (panel B) in countries characterized by weak debt enforcement.

In this paper, we test the effect of the quality of debt enforcement on the sensitivity of economic activity to collateral values. Our focus is thus on the *intensive margin* of collateral use following the terminology of Benmelech and Bergman (2009). However, the collateral value of a defaulted firm also depends on its share of tangible assets, which can be termed as the *extensive margin* of collateral use. This aspect has been shown empirically relevant for the relative performance of industries in different contexts (Braun, 2005; Manova, 2008). To precisely identify the collateral channel under imperfect debt enforcement that works through the intensive margin of collateral use (i.e. real assets' redeployability), we thus add an interaction between the share of tangible assets and the quality of debt enforcement (*Tangibility* $\times$ *Debt enforcement*) to our baseline specification in column 2. Our coefficient of interest is not significantly affected by the inclusion of this interaction term. This finding indicates that an industry whose tangible assets are difficult to redeploy will perform relatively worse than an industry whose tangible assets are easy to redeploy in a country with weak debt enforcement *even if* both industries own the same share of tangible assets. The estimates also indicate that industries with a smaller share of tangible assets represent a relatively smaller share of an economy in countries with weak debt enforcement, whereas the effect on growth is not significant.

We have argued that the redeployability of a real asset determines the expected value of collateral to lenders upon default. There are, however, other characteristics of a real asset that could influence it. If our measure of redeployability is correlated to those characteristics, omitting them would bias the estimate of our coefficent of interest. We therefore control for the interactions of two such characteristics with the quality of debt enforcement in column 3. The first is the *depreciation* rate of capital in each industry and the second is a measure of *obsolescence* or embodied technical change in capital. A real asset with a higher physical or technological depreciation rate is expected to have a lower collateral value. Although both characteristics affect significantly the relative allocation of economic activity with the expected sign, as can be seem from column 3 in Panel A, their inclusion does not alter the collateral channel under imperfect debt enforcement that works through the real assets' redeployability. In column 3 of Panel B, we further see that only the redeployability of real assets matter for distinguishing the relative growth performance due to institutions.

In column 4, we further control for the standard determinants of the production structure and industry growth of an economy. In the allocation regression, we add interactions between industry factor intensities and country factor endowments (*Capital intensity* $\times$ *Capital*, *Skill intensity* $\times$ *Skill*, *Natural ressources intensity* $\times$ *Natural ressources*). In line with the Hecksher-Ohlin-Samuelson theorem, Romalis (2004) shows that these interaction terms explain a large part of the within-country variation in the structure of exports across industries. These factors might as well explain variations in the structure of the domestic production.

Due to the lack of availability of data on factor endowments for all countries, our regression sample drops from 62 to 41 countries. Interestingly, our coefficient of interest remains unchanged when estimated on this sub-sample including these additional controls. In the growth regression, we include the share of the industry in GDP at the beginning of the sample period to account for the potential 'catch-up' effect for industries representing a small size of the economy. As expected, this coefficient is negative and significant, but again our coefficient of interest is not affected qualitatively and quantitatively.

As mentionned in the empirical methodology, we are concerned with the potential endogeneity of debt enforcement. We therefore perform an instrumental variables (IV) estimation of equation (1). To determine the most suitable method, we peformed the Pagan-Hall test of heteroskedasticity of the error term (not shown). The null hypothesis of no heteroskedasticity is strongly rejected (at a significance level below 1 percent). As a result, we use the Generalized Method of Moments (GMM) to identify our coefficient of interest β since this estimator is more efficient than the Two-Stage Least Squares estimator in case of heteroskedasticity. The identification strategy using IV method relies on two assumptions. The first assumption known as the orthogonality condition states that the instrumental variables must be uncorrelated with the disturbance term. We perform the Hansen J test to test the null hypothesis of exogeneity. The second assumption requires that the excluded instruments are sufficiently correlated with the included endogenous regressors. We rely on the Kleinbergen-Paap statistic to test whether the legal origin of a country's bankruptcy law is a valid instrument for the quality of debt enforcement.[15]

Our estimates of equation (1) using GMM are reported in columns 5 to 8 of Table 3. We see that the results are qualitatively unaffected by the instrumentation procedure. Across the different specifications, our coefficient of interest is higher in absolute value. As discussed in Section 3, this result can be attributed to an attenuation bias due to measurement errors in debt enforcement quality. The p-values of the Hansen J test are above 0.1 and the Kleinbergen-Paap statistics are above the associated critical values in all 8 regressions. Therefore the overidentification and weak instrument tests validate our identification strategy requiring that the interaction between the legal origin of a country's bankruptcy law and industry's repedeployability is truly exogenous and affects only indirectly the industrial allocation and growth through the correlation with our endogenous variable of interest. In the rest of the paper, we will thus only report GMM estimates.

Besides statistical estimates and their significance, we are interested in the economic importance of the channel we identify. To gain insight, we calculate the differential effect in terms of

[15] The Kleinbergen-Paap statistic should be used when non-i.i.d errors are assumed as in our case. However, this come at a cost approximating its unknown critical values with those of the Cragg-Donald statistic. Conversely the Cragg-Donald statistic has a known asymptotic distribution under the assumption of i.i.d errors. The null hypothesis of the weak instrument test is that the bias of the IV estimator, relative to the bias of OLS, exceeds the 5% threshold at the significance level of 5%. The critical value of the Cragg-Donald statistic associated with this test is 13.91 with 1 included endogenous regressor and 3 instrumental variables as in our baseline regression. For the critical values in other regressions, see Stock and Yogo (2002).

economic outcomes for an industry with a low collateral value (25th percentile) with respect to an industry with a high collateral value (75th percentile) when debt enforcement worsens from the 75th to the 25th percentile of debt enforcement quality.[16] The industry at the 75th percentile is *Food, beverages and tobacco products* (high collateral value). The industry at the 25th percentile is *Fabricated metal products* (low collateral value). The calculated differential effect is reported for each regression in Table 3 directly below the coefficient estimates. Our first observation is that the effect both in terms of allocation and growth through which the channel we identify operates is economically sizable. The point estimate of column 8 in Table 3 implies that the *Glass and products* industry would become 0.32 percentage points smaller in terms of value added to GDP relative to the *Potery, china and earthenware* industry if a country like Sweden would reach the level of debt enforcement quality of Guatemala. In comparison, the value added of the average industry in the sample represents 0.64 percents of GDP. Likewise the coefficient estimate in the growth regression predicts that the industry with a low collateral value would grow annually 1.64 percentage points less than the high collateral value industry in Jordan compared to Hong Kong. This is a substantial decrease compared to the average annual industry growth of 2.18% in the sample.

4.2 The Collateral Channel and Debt Enforcement: Poor vs. Rich Countries

In the analysis above, we have shown that the quality of debt enforcement matters for the collateral channel but we have assumed that secured credit was offered homogeneously across countries. There is litte evidence on the incidence of secured credit in credit markets across countries, but Fleisig (1996) notes that a major impediment to secured credit in developing countries are weak enforcement institutions. In countries where collateral pledging is too costly due to institutional weaknesses, firms may resort to alternative forms of financing like unsecured loans, third-party guarantees and relationship lending (see Menkhoff et al., 2011) or leasing as argued by Eisfeldt and Rampini (2009).[17] We therefore conjecture that the quality of debt enforcement affects the relationship between economic activity and collateral values only in countries where secured credit is an important form of financing. Accordingly, we divide the sample into poorer and richer countries and run our main regression separately in both sub-samples.

In Table 4, we report the regression results when the sample is divided into rich and poor countries according to 3 different criteria. The first criterion is whether a country's GDP per capita in 1980 is above or below the median GDP per capita. The second criterion is

[16] The differential effect of debt enforcement on the collateral channel is calculated as:
$\Delta\widehat{Y} = \widehat{\beta} \times \left(\textit{Redeployability}_{\text{low}} - \textit{Redeployability}_{\text{high}}\right) \times \left(\textit{Debt Enforcement}_{\text{low}} - \textit{Debt Enforcement}_{\text{high}}\right)$

[17] Leasing costs are affected by the leased asset's liquidity as shown by Gavazza (2010) for the in aircraft industry. However, there is no evidence that leasing costs are affected by the quality of enforcement institutions. Benmelech and Bergman (2010) show that while higher protection of creditor provided by law fosters investment in newer aircraft types owned by airlines, the vintage of leased aircrafts is not affected.

whether a country is classified as High- or Middle/Low-Income by the World Bank and the third criteria is whether a country is a member of the OECD or not. Consistent with our conjecture, we find that imperfect debt enforcement has a significant impact on the sensitivity of economic activity to collateral values only in rich countries. The coefficients on the interaction term *Redeployability* $\times$ *Debt enforcement* are negative and significant in columns 1, 3 and 5 (between -0.085 and -0.091 in the allocations regression and between -0.599 and -0.727 in the growth regressions) whereas they are insignificant in the poor countries sub-samples (columns 2, 4 and 6). Compared to the estimates obtained for the full sample, estimates for the sub-sample of rich countries are larger in absolute terms. However, the range of the debt enforcement index is smaller in the sub-samples. The differential effect calculated for the sub-sample of rich countries ranges from -0.12 to -0.24 in the allocation regression which is one to two thirds smaller than in the full sample. It still represents between one sixth and one third of the average industry size in the sample. The differential effect in the growth regressions ranges from -0.78 to -0.95 which is about half of the effect calculated in the full sample. However, the economic significance of the differential effect is much higher in the sample of rich countries, as the average industry growth ranging from 0.43% and 0.60% is smaller in this group of countries.

4.3 The Source of The Differential Effect: Legal vs. Financial Development

The results presented in the previous section raise the question whether the quality of debt enforcement is the basic source of the sensitivity of economic activity to collateral values or whether it is only a proxy for financial development. Djankov et al. (2008) show that the quality of debt enforcement procedures is strongly correlated with the development of debt markets. Therefore, our interaction term would capture the effect of financial development if industries with different levels of real assets' redeployability are affected differently by a change in financial development. For example, Liberti and Mian (2010) show that the development of credit markets shifts the composition of collateralizable assets from non-specific towards firm-specific, i.e. non-redeployable, assets. Williamson (1988) argues that firms with specific assets are optimally financed by equity. Following these arguments, improvements in the development of the credit and stock markets would benefit relatively more the firms with a lower redeployability.

We rule out these two alternative explanations and show that financial development does not affect the sensitivity of economic activity to collateral values beyond its correlation with debt enforcement institutions. To obtain this result, we proceed as follows. First we estimate equation (1) including the interaction term *Redeployability* $\times$ *Financial development* instead of the interaction invloving debt enforcement. In columns 1 and 2 of Table 5 we present the estimates obtained when *Financial development* is proxied with the size of the debt market, respectively the size of the stock market. As expected, the coefficient on both interaction

Table 4. The Effect of Imperfect Debt Enforcement on the Collateral Channel : Poor vs. Rich Countries

	Initial GDP		WB Income Group		OECD	
	Above Median	Below Median	High Income	Middle-Low Income	Members	Non-Members
	(1)	(2)	(3)	(4)	(5)	(6)
A. Allocation						
Redeployability × Debt enforcement	**−0.085****	**0.014**	**−0.091****	**0.029**	**−0.091****	**0.029**
	(0.024)	**(0.097)**	**(0.028)**	**(0.118)**	**(0.028)**	**(0.118)**
Differential effect (percentage points)	**−0.24**	**0.03**	**−0.12**	**0.05**	**−0.12**	**0.05**
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes
Hansen J test (p-value)	0.787	–	0.864	–	0.864	–
Kleinbergen-Paap statistic	222.1	8.350	240.2	5.501	240.2	5.501
R^2	0.582	0.571	0.628	0.575	0.628	0.575
Observations	560	541	476	625	476	625
Countries	21	20	18	23	18	23
B. Growth						
Redeployability × Debt enforcement	**−0.727****	**−0.323**	**−0.651****	**0.378**	**−0.599****	**−0.280**
	(0.197)	**(0.303)**	**(0.174)**	**(0.903)**	**(0.187)**	**(0.241)**
Differential effect (percentage points)	**−0.95**	**−0.79**	**−0.85**	**−0.68**	**−0.78**	**−0.69**
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes
Hansen J test (p-value)	0.278	0.717	0.271	–	0.138	–
Kleinbergen-Paap statistic	49.72	18.87	29.96	22.94	26.08	36.57
R^2	0.498	0.617	0.511	0.581	0.543	0.608
Observations	438	391	502	327	438	391
Countries	18	17	21	14	18	17

Notes: All regressions include both country and industry fixed effects and a constant (coefficient estimates not reported) and are estimated by GMM with *Debt enforcement* instrumented by the legal origin of a country's bankruptcy laws. The dependent variable is: in Panel A, the share of real value added of each 3-digit ISIC industry to GDP of each country; in Panel B, the annual compounded growth rate in real value added for each 3-digit ISIC industry in each country. *Redeployability* defined by expression (3) in the text is the redeployability of real assets owned by each 3-digit ISIC U.S. industry over the specified time period. *Debt enforcement* is the time-invaryning country-specific variable measuring the efficiency of debt enforcement procedures (constructed by Djankov et al. (2008)). Additional controls include the standard determinants of comparative advantage as in Table 3 (Panel A) and the initial industry share corresponding to the dependent variable (Panel B). Initial GDP is a country's GDP per capita in 1980. The differential effect measures in percentage points how much smaller (slower) an industry at the 25th percentile of the redeployability of real assets would become (grow) with respect to an industry at the 75th percentile when the industries are located in a country at the 25th percentile of debt enforcement rather than in one at the 75th percentile. Heteroskedasticity robust standard errors are reported in parentheses. **: signficant at 1% level. *: signficant at 5% level. $^{+}$: signficant at 10% level.

terms is negative and significant, giving some credit to the two mechanisms explained above. The point estimates differ slightly from those in Table 3 as the magnitudes of the variables measuring debt enforcement and debt market development differ. However, when we include in addition our interaction term of interest *Redeployability* × *Debt enforcement* (columns 3 and 4), we first observe that our coefficient of interest is significant and has the expected sign. Second, the interactions involving *Financial development* become insignificant. We interpret this result as evidence that any variation in financial development that is uncorrelated to a variation of debt enforcement quality has no impact on the sensitivity of economic activity to collateral values.

The role of creditor protection in alleviating financial constraints has been emphasized in the litterature analyzing the effect of legal institutions on economic outcomes. The first studies in this category have focused on the quality of legal rules devised to protect creditors (see La Porta et al., 1997, 1998). A second and more recent strand of the literature has analyzed the enforcement of legal rules rather than the law itself (see Djankov et al., 2003, 2008). Accordingly, we disentangle the effects of creditor rights and of the enforcement of debt contracts on the collateral channel. In column 5 we present the estimates of equation (1) when we include an interaction between *Redeployability* × *Creditor rights* in addition to our variable of interest. We use Djankov et al. (2007)'s creditor rights index computed for 129 countries over the period 1978 - 2003. This index measures whether different powers are provided by a country's legal code to a secured creditor in bankruptcy.[18] The results show that the quality of enforcement of secured debt contracts has a significant and negative effect on the sensitivity of economic activity to collateral values. On the contrary, creditor rights in bankruptcy do not affect significantly the collateral channel. Interestingly, this result complements Bae and Goyal (2009)'s findings that the enforceability of contracts matters for bank loan size and maturity whereas creditor rights does not. Accordingly, policymakers should focus on improving the quality of legal institutions devised to enforce debt contract to mitigate the sensitive of economic activity to fluctuations in collateral values in their country.

4.4 Robustness Analysis

4.4.1 Standard Robustness Tests

We analyse the robustness of our main result using a series of tests. The estimation results of several alternative specifications of equation (1) are reported in Table 6. First, we use different measures of debt enforcement quality. In the first two columns, we use the recovery rate of secured creditors from Djankov et al. (2008) (column 1) and World Bank (2008) (column 2). An advantage of the second measure is that it is available for a larger sample of countries, but it corresponds less to our sample period as it has been computed more recently. Then, we take three measures of the efficiency of the judicial system in the collection of an

[18] We refer the reader to Djankov et al. (2007) for a detailed description of the index.

Table 5. The Source of the Differential Effect: Legal vs. Financial Development

	(1)	(2)	(3)	(4)	(5)
A. Allocation: Y_{ic} = value added to GDP					
Redeployability × Debt market size	−0.066**		−0.027		
	(0.014)		(0.018)		
Redeployability × Stock market size		−0.070**		0.007	
		(0.020)		(0.013)	
Redeployability × Debt enforcement			**−0.047***	**−0.082****	**−0.088****
			(0.029)	**(0.017)**	**(0.022)**
Redeployability × Creditor rights					0.003
					(0.007)
Additional controls	Yes	Yes	Yes	Yes	Yes
Hansen J test (p-value)	0.119	0.000	0.296	0.153	0.554
Kleinbergen-Paap statistic	32.74	23.90	131.2	197.7	27.10
R^2	0.476	0.471	0.516	0.505	0.506
Observations	1398	1313	1101	1101	1101
Countries	53	49	41	41	41
B. Growth: Y_{ic} = real growth of value added					
Redeployability × Debt market size	−0.268**		0.046		
	(0.078)		(0.154)		
Redeployability × Stock market size		−0.184*		0.058	
		(0.083)		(0.087)	
Redeployability × Debt enforcement			**−0.481***	**−0.487****	**−0.570****
			(0.213)	**(0.132)**	**(0.146)**
Redeployability × Creditor rights					0.060
					(0.049)
Additional controls	Yes	Yes	Yes	Yes	Yes
Hansen J test (p-value)	0.119	0.006	0.395	0.492	0.726
Kleinbergen-Paap statistic	135.5	61.26	17.66	79.51	32.63
R^2	0.552	0.559	0.599	0.598	0.591
Observations	998	968	829	829	829
Countries	43	41	35	35	35

Notes: All regressions include both country and industry fixed effects and a constant (coefficient estimates not reported) and are estimated by GMM with *Debt enforcement* and *Creditor rights* instrumented by the legal origin of a country's bankruptcy laws and the level of financial development (*Debt market size* and *Stock market size*) instrumented by the legal origin of a country's commercial laws. The level of financial development is the following: (i) *Debt market size* defined as the average ratio of private credit by deposit money bank and other financial institutions to GDP in each country between 1981-2000; (ii) *Stock market size* defined as the ratio of stock market capitalization to GDP in each country, averaged over the period 1981-2000. The index *Creditor rights* from Djankov et al. (2007) measures the legal rights of creditors against a defaulting debtor in each country, averaged over the period 1981-2000. In Panel A, the dependent variable is the share of real value added of each 3-digit ISIC industry to GDP of each country averaged over the period 1981-2000. In Panel B, the dependent variable is the annual compounded growth rate in real value added over the period 1980-2000 for each 3-digit ISIC industry in each country. The main variable of interest *Redeployability* × *Debt enforcement* is defined as in Table 3. Additional controls include the standard determinants of comparative advantage as in Table 3 (Panel A) and the initial industry share (Panel B). Heteroskedasticity robust standard errors are reported in parentheses. **: signficant at 1% level. *: signficant at 5% level. $^+$: signficant at 10% level.

Table 6. Standard Robustness Tests

	Measure of debt enforcement					Dependent variable			Instrument	Code	Time period	
	Recovery Djankov	Recovery WB	Time	Procedures	Costs	Investment	Output	Exports	Settler mortality	BEA	1980s	1990s
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
A. Allocation												
Redeployability × Debt enforcement	**−0.064****	**−0.083****	**−0.151****	**−0.114****	**−0.182****	**−0.305****	**−0.351****	**−0.546****	**−0.105****	**−0.122****	**−0.069****	**−0.093****
	(0.013)	**(0.016)**	**(0.040)**	**(0.026)**	**(0.039)**	**(0.097)**	**(0.085)**	**(0.128)**	**(0.021)**	**(0.026)**	**(0.016)**	**(0.018)**
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hansen J test (p-value)	0.808	0.340	0.060	0.069	0.212	0.406	0.294	0.219	–	0.806	0.594	0.910
Kleinbergen-Paap statistic	175.6	176.6	95.70	60.82	135.1	97.5	107.4	110.8	92.23	70.52	89.66	121.6
R^2	0.517	0.477	0.457	0.496	0.499	0.481	0.655	0.310	0.528	0.600	0.515	0.445
Observations	1101	1373	1101	1101	1101	1028	1101	1108	681	675	1094	1044
Countries	41	52	41	41	41	38	41	41	25	41	41	40
B. Growth												
Redeployability × Debt enforcement	**−0.376****	**−0.425****	**−0.977****	**−0.781****	**−0.969****	**−0.441***	**−0.378****	**−0.441****	**−0.395****	**−0.459****	**−0.288***	**−0.582****
	(0.089)	**(0.097)**	**(0.285)**	**(0.277)**	**(0.247)**	**(0.188)**	**(0.099)**	**(0.117)**	**(0.152)**	**(0.130)**	**(0.124)**	**(0.158)**
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hansen J test (p-value)	0.538	0.671	0.226	0.083	0.164	0.452	0.782	0.790	–	0.221	0.288	0.483
Kleinbergen-Paap statistic	154.4	330.1	23.89	21.35	92.17	60.5	126.0	206.9	37.67	74.41	100.9	127.4
R^2	0.602	0.556	0.575	0.575	0.601	0.625	0.568	0.485	0.661	0.579	0.484	0.591
Observations	829	961	812	812	812	540	844	1495	417	539	1148	850
Countries	35	41	34	34	34	26	35	60	18	35	44	37

Notes: All regressions include both country and industry fixed effects and a constant (coefficient estimates not reported) and are estimated by GMM with *Debt enforcement* instrumented by the legal origin of a country's bankruptcy laws (except in Column 8 where the log of European settler mortality from Acemoglu et al. (2001) is used as an instrument). The dependent variable is the following: (i) Columns 1 to 5, and 9 to 12 in Panel A: the share of real value added of each 3-digit ISIC (BEA, Column 10) industry to GDP of each country; (ii) Columns 6 to 8 in Panel A: the share of real investment, output, and exports of each 3-digit ISIC industry to total investment, output and exports resp. in the manufacturing sector of each country; (iii) Columns 1 to 5, and 9 to 12 in Panel B: the annual compounded growth rate in real value added for each 3-digit ISIC (BEA, Column 10) industry in each country; (iv) Columns 6 to 8 in Panel B: the annual compounded growth rate in real investment, output and exports resp. for each 3-digit ISIC industry in each country. Each dependent variable is averaged over the following period: (a) 1981-2000 (Columns 1 to 10); (b) 1981-1990 (Column 11); (c) 1991-2000 (Column 12). *Redeployability* defined by expression (3) in the text is the redeployability of real assets owned by each 3-digit ISIC (BEA, Column 10) U.S. industry over the specified time period. *Debt enforcement* is a time-invarying country-specific variable and denotes the following: (i) the recovery rate for secured creditors (constructed by Djankov et al. (2008), Column 1, and by World Bank (2008), Column 2); (ii) the efficiency of the judicial system in the collection of an overdue debt measured by $(1500 - Time)/1500$ in Column 3, $(60 - Procedures)/60)$ in Column 4 and $(6 - \ln(Costs))/6$ in Column 5 (data from World Bank (2004) on time, the number of procedures and the official costs to recover debt through courts); (iii) the efficiency of debt enforcement procedures (constructed by Djankov et al. (2008), Columns 6 to 12). Additional controls include the standard determinants of comparative advantage as in Table 3 (Panel A) and the initial industry share corresponding to the dependent variable (Panel B). Heteroskedasticity robust standard errors are reported in parentheses. **: signficant at 1% level. *: signficant at 5% level. +: signficant at 10% level.

overdue debt from World Bank (2008): the time required for dispute resolution (column 3), the number of procedures involved in (column 4) and the official costs of going through court procedures (column 5). We scale each variable so that all values lie in the unit interval, with a higher value representing a better judicial quality, in order to facilitate the comparison of the estimated coefficients. We see in the results that the estimated coefficients remain negative and significant at the 1% level for all alternative measures in both the allocation and growth regressions.

We have argued that the dependence of an industry's investment capacity on the collateral value of its pledgeable real assets is underlying the sensitivity of economic activity to collateral values. We provide evidence for our argument by running the baseline regression with industry investment instead of value added as a dependent variable. The results in column 6 show that weaker debt enforcement significantly exacerbates the sensitivity of industry investment to collateral values. In columns 7 and 8, we additionally use domestic output and exports respectively as alternative measures of economic activity. The results show that domestic production and the pattern of trade also are more sensitive to collateral values in countries with a lower quality of debt enforcement. This result complements Nunn (2007) who finds that contract enforcement quality is a source of comparative advantage in trade. Next, in column 9, we use the settler mortality in former European colonies from Acemoglu et al. (2001) instead of the legal origin of bankruptcy law to instrument our institutional variable. This results in a large drop in the number of countries included in the regression, but does not affect our basic result. In column 10, we aggregate sectoral data to match the BEA industry Code, on which our redeployability index is based. Doing so allows to have a single redeployability value for each industry. Finally, we analyze the robustness of our results over different time periods. In columns 11 and 12, we report our estimates of equation (1) for two sub-periods, 1981-1990 and 1991-2000. Our results are qualitatively and quantitavely similar for the alternative industry classification and the two different time periods.

4.4.2 Testing Alternative Explanations

The allocation and growth of economic activity may in principle be affected by many channels. Our results could be misleading if we omit to control for significant channels that are correlated with our interaction term, since the latter would absorb all the effect of the omitted variables. We therefore include a series of alternative explanations to test whether our results are spuriously driven by the correlation of our interaction term with these alternative determinants of economic activity at the sectoral level.

We explore three alternative explanations for our results. First, we argue that the production of complex goods involves the use of specific assets. For example, in the O-ring production function of Kremer (1993) the elaboration of more complex products is associated with a larger number of differentiated tasks to be performed which likely requires more specific assets. Moreover, the degree of complexity of a product determines the need for good institutions to enforce contracts, as it is harder to write a complete sale contract for a complex product than for a simple one (Berkowitz et al., 2006; Levchenko, 2007). We account for this channel in several ways. We use the Herfindhal index of intermediate goods from Cowan and Neut (2007) as a direct proxy for product complexity. We also argue that firms producing more complex goods are more intensive in R&D. These firms are more dependent on the availability of skilled workers which in a cross-country perspective is positively correlated with the quality of institutions. A production process that involves more tasks is also likely to last longer and thus shift cash-flow earnings later in time, increasing the need to use external finance. In columns 1 to 3 of Table 7, we show that even though these industry characteristics affect the allocation of economic activity, their inclusion does not diminish the relevance of our channel. In column 4, we use a different approach which consists in adding to our baseline specification the interaction between average PPP-adjusted GDP per worker and industry dummies. As worker productivity is positively correlated with product complexity, country's GDP per worker should be a good proxy for the ability of a country to produce complex goods. Adding these 28 extra regressors therefore allows to control for the product complexity channel in an unrestricted way. We see that our coefficient of interest becomes slightly lower in absolute terms in the allocation regression, but remains highly significant, whereas our growth results remain unaffected.

Second, it is possible that firms using specific real assets also need relationship-specific inputs. In that case, our measure of real asset redeployability would capture the need for contract enforcement. As shown by Nunn (2007), industries which rely on relationship-specific investments benefit more from better contract enforcement institutions. To account for this channel, we add an interaction term of *Contract intensity* $\times$ *Rule of law* in column 5. Moreover, as the quality of different institutions is highly correlated within a country, our variable measuring the quality of debt enforcement could capture the effect of the quality of institutions in general. To take care of that, we add an interaction between our industry-specific variable and the initial level of a country's GDP, which is highly correlated with the quality of institutions. We see that our results are not affected qualitatively and quantitatively by including these alternative channels.

Eventually, our interaction term could be capturing a general (proportional) effect of good institutions on economic activity if the economic outlook of the different industries is correlated with the redeployability of real assets. We would then expect industries with better economic opportunities to perform relatively better in countries with good institutions, independently of our channel. To account for this possibility, we add to our regression an interaction term between the economic activity in a benchmark country, and financial development in column 9 and initial GDP per capita in column 10. As in Fisman and Love (2007), we consider that the industrial economic activity in the U.S. economy is the benchmak by representing the global economic opportunities. Overall, we see that our coefficient of interest remains negative and significant at the 1% level in 13 out of 16 regressions (5% in the

Table 7. Testing Alternative Explanations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Allocation: Y_{ic} = value added to GDP								
Redeployability × Debt enforcement	**−0.040***	**−0.073****	**−0.061****	**−0.056***	**−0.063****	**−0.056***	**−0.040****	**−0.063****
	(0.016)	**(0.015)**	**(0.016)**	**(0.023)**	**(0.016)**	**(0.024)**	**(0.015)**	**(0.016)**
Product complexity × Rule of Law	0.009**							
	(0.002)							
R&D intensity × Human capital		0.004**						
		(0.001)						
External finance dependance × Financial development			0.010**					
			(0.002)					
Industry dummy × GDP per worker				–				
				–				
Contract intensity × Rule of law					0.011**			
					(0.002)			
Redeployability × Initial GDP per capita						-0.012^{+}		
						(0.007)		
Benchmark allocation × Financial development							0.760**	
							(0.120)	
Benchmark allocation × Initial GDP per capita								0.224**
								(0.032)
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hansen J test (p-value)	0.446	0.803	0.809	0.892	0.560	0.910	0.076	0.952
Kleinbergen-Paap statistic	22.69	103.0	56.36	61.60	45.80	51.34	54.86	90.31
R^2	0.530	0.517	0.520	0.574	0.520	0.519	0.542	0.539
Observations	1101	1101	1101	1101	1101	1101	1101	1101
Countries	41	41	41	41	41	41	41	41

Table 7. (*Continued*)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
B. Growth: Y_{ic} = real growth of value added								
Redeployability × Debt enforcement	**−0.409****	**−0.373****	**−0.384****	**−0.427****	**−0.401****	**−0.422****	**−0.400****	**−0.411****
	(0.105)	**(0.114)**	**(0.107)**	**(0.144)**	**(0.106)**	**(0.150)**	**(0.102)**	**(0.099)**
Product complexity × Rule of Law	0.030							
	(0.022)							
R&D intensity × Human capital		0.009						
		(0.008)						
External finance dependance × Financial development			0.031^{+}					
			(0.018)					
Industry dummy × GDP per worker				–				
				–				
Contract intensity × Rule of law					0.014			
					(0.013)			
Redeployability × Initial GDP per capita						0.013		
						(0.050)		
Benchmark growth × Financial development							0.111	
							(0.243)	
Benchmark growth × Initial GDP per capita								0.281**
								(0.089)
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hansen J test (p-value)	0.272	0.233	0.406	0.359	0.059	0.351	0.103	0.358
Kleinbergen-Paap statistic	11.32	91.09	46.38	42.97	81.23	48.80	47.44	105.5
R^2	0.595	0.618	0.601	0.636	0.597	0.601	0.626	0.633
Observations	829	754	829	829	829	829	788	788
Countries	35	32	35	35	35	35	35	35

Notes: All regressions include both country and industry fixed effects and a constant (coefficient estimates not reported) and are estimated by GMM with *Debt enforcement* instrumented by the legal origin of a country's bankruptcy laws. In Panel A, the dependent variable is the average share of each 3-digit ISIC industry's real value added to each country's GDP over the period 1981-2000. In Panel B, the dependent variable is the annual compounded growth rate in real value added over the period 1980-2000 for each 3-digit ISIC industry in each country. The main variable of interest *Redeployability* × *Debt enforcement* is defined as in Table 3. Each interaction term is the product of the corresponding two variables. The industry-specific variables, which are built using U.S. data, are the following: (i) *Product complexity* is the Herfindhal index of intermediate input use from Cowan and Neut (2007); (ii) *R&D intensity* is the ratio of R&D expenditures over capital expenditures; (iii) *External finance dependance* is the median ratio of capital expenditures minus cash-flows from operations to capital expenditures; (iv) *Industry dummy* is a dummy variable for each 3-digit ISIC industry; (v) *Contract intensity* reports the industry share of intermediate inputs that cannot be bought on organized exchanges and are not reference-priced; (vi) *Benchmark economic activity* averaged over the period 1980-2000 measures the industry value added to GDP in United States (Panel A) and the annual compounded growth rate in industry real value added in United States (Panel B). The country-specific variables are the following: (a) *Rule of law* measures the extent to which agents have confidence in and abide by the rules of society in 1996; (b) *Human capital* is log of the mean average years of schooling over the period 1981-2000; (c) *Financial development* is the average ratio of private credit by deposit money bank and other financial institutions to GDP in each country between 1981-2000; (d) *GDP per worker* is the log of the mean of real GDP per worker over the period 1981-2000; (e) *Initial GDP per capita* is the log of real GDP per capita in 1980. Additional controls include the standard determinants of comparative advantage as in Table 3 (Panel A) and the initial industry share (Panel B). Heteroskedasticity robust standard errors are reported in parentheses. **: signficant at 1% level. *: signficant at 5% level. $^{+}$: signficant at 10% level.

remaining cases) when the alternative channels are accounted for. Moreover, the coefficients are not significantly different from the coefficient estimated in the baseline regression.

5 A Stylized Model

In this section, we propose a stylized model of debt financing with repudiation and renegotiation to rationalize our empirical findings and in particular illustrate how a country's ability to enforce debt contracts affects the sensitivity of economic activity to collateral values.

5.1 The Environment

The world economy consists of multiple closed countries in which production is realized in multiple sectors. Each sector is represented by an entrepreneur who incurs debt from competitive lenders to invest in real assets K_t. The entrepreneur has access to a production technology that returns xA ($x > 1$) per unit of real assets invested, unless the real assets are liquidated before completion of the project in which case it only returns A. Lenders have access to funds at gross interest rate R.[19] All agents are infinitely lived.

The framework contains two frictions. First, debt enforcement is imperfect due to standard moral hazard considerations. The entrepreneur may default on the loan and divert cash flows. The lender negotiates under court's supervision an amount that the entrepreneur has to repay. The parameter $\rho \in [0, 1]$ captures the lender's bargaining power in debt renegotiation and indexes countries. Second, the real assets operated by an entrepreneur are imperfectly redeployable to other entrepreneurs. The liquidation value of a real asset is a fraction $\tau \in [0, 1]$ of its fundamental value, which we assume to be 1. Entrepreneurs are indexed by τ.

We make the following two assumptions.

Assumption 1. $A > R$

Assumption 2. $(x - 1)A > 1$

Assumption 1 ensures that investing funds in a project is more profitable than lending it even for a defaulting entrepreneur. Assumption 2 indicates that liquidation is inefficient even for sectors whose real assets are liquidated at their fundamental values (i.e. $\tau = 1$).

At the *beginning* of period t, the entrepreneur invests her wealth W_t in real assets k_t^c. Then the entrepreneur and the lender sign a debt contract defined by the triplet (r_t, D_t, k_t^c), where r_t is the gross lending rate, D_t the amount of debt and k_t^c the quantity of collateralized assets.[20]

[19] R would be the world interest rate in a small open economy framework.

[20] The assumption that only the assets financed with internal funds are collateralized can be rationalized in several ways: i) by assuming that installing capital takes time and is costly and that secured credit is extended only against installed capital and/or contracting is costly. In this context a *standard* credit multiplier requires an infinite number of debt contracts and capital installation. ii) by assuming that the production technology requires first an investment in tangible capital in order to run intangible capital, the latter being much more productive than tangible capital but not pledgeable as collateral. However, even in the framework with an infinite sequence of contracts, we would still obtain Propsition 1 under reasonable assumptions.

The entrepreneur invests the external funds D_t in real assets k_t, runs the project of total size $K_t = D_t + W_t$ and obtains a cash flow of AK_t. In the *middle* of period t, the entrepreneur decides whether or not to meet his debt obligations. In case of default, the entrepreneur and the lender may renegotiate the debt contract under the courts' supervision. If the parties do not find an agreement, courts seize the collateralized assets and transfer them to the lender who obtains τk_t^c, while the entrepreneur absconds with cash flow AK_t and gets $(x-1)Ak_t$ from the uncollateralized part of the assets. In case of debt repayment, the project continues at full size and returns the profit income $xAK_t - r_t D_t$. At the *end* of period t, the real assets fully depreciate and the entrepreneur saves a fixed fraction β of her end-of-period wealth.[21]

5.2 The Collateral Channel under Imperfect Debt Enforcement

In the middle of each period, entrepreneurs are left with three alternatives. The first one is debt repayement as specified in the debt contract. The second one is default. The third one is debt renegotiation under courts' supervision. As in Jermann and Quadrini (2009), we assume that in renegotiation the entrepreneur and the lender bargain over an amount e_t to be paid by the entrepreneur to avoid an inefficient liquidation. The surplus of reaching an agreement is $(x-1)AW_t - e_t$ for the entrepreneur and $e_t - \tau W_t$ for the lender.[22] We assume that the bargaining power of the lender is ρ. Therefore the weaker debt enforcement, the lower the bargaining power of the lender in the debt renegotiation process under courts' supervision. The Nash bargaining problem solves:

$$\max_{e_t \geq 0} [e_t - \tau W_t]^\rho [(x-1)AW_t - e_t]^{1-\rho}$$

The payment agreed upon the contractual parties under courts' supervision is:

$$e_t = \rho(x-1)AW_t + (1-\rho)\tau W_t \tag{5}$$

Proposition 1 describes the credit multiplier arising in this frameowrk and highlights the collateral channel under imperfect debt enforcement:

Proposition 1. *Under Assumptions 1 and 2, the entrepreneur in sector τ in country ρ invest $K_t = \nu(\tau,\rho)W_t$ in real assets with a credit multiplier given by*

$$\nu(\tau,\rho) = 1 + \frac{\rho(x-1)A + (1-\rho)\tau}{R} \tag{6}$$

The credit multiplier features a collateral channel as sectors with a high collateral value exhibit

[21]Therefore the entrepreneur consumes a fixed fraction $1-\beta$. This assumption can be rationalized with log preferences. It is well known that infinitely-lived agents with log utility have a saving function of the form $S_t = \beta\pi_t$ where β stands for the time discount factor.

[22]The entrepreneur obtains $xAK_t - e_t$ in case of agreement and $AK_t + (x-1)Ak_t = A(K_t - k_t) + xAk_t$ without any agreement under Assumption 2. As $W_t = K_t - k_t$, the surplus of reaching an agreement follows.

higher investment per unit of internal funds. Moreover, the collateral channel is stronger in countries with weak debt enforcement.

Proof. Under Assumption 2, the resulting liquidation of the firm in case of default triggers a loss of value for the entrepreneur (as $(x-1)AW_t > e_t$) and for the lender (as $e_t > \tau W_t$). Therefore both parties have an incentive to renegotiate the debt contract under courts' supervision in case of default. However, an entrepreneur τ renegotiates only when it is a profitable option, that is when the following incentive-compatiblity constraint is violated:

$$xAK_t - r_t D_t \geq xAK_t - e_t \tag{IC}$$

The left-hand side of (IC) is the profit income of the project in case of debt repayment. The right-hand side is the return of the project net of the agreed payment under courts' supervision. Therefore, if (IC) is satisfied, the entrepreneur always repays the competitive lender who charges a lending rate $r_t = R$ (zero-profit condition). Under Assumption 1, (IC) is binding so that $K_t = W_t + D_t$. Then the credit multiplier (6) follows directly from (IC) and (5). As $\frac{\partial \nu(\tau,\rho)}{\partial \tau} = \frac{(1-\rho)}{R} \geq 0$, there follows the collateral channel. However the collateral channel is stronger in countries with weak debt enforcement as $\frac{\partial^2 \nu(\tau,\rho)}{\partial \tau \partial \rho} = -\frac{1}{R} < 0$. □

The intuition behind Proposition 1 is straightforward. Entrepreneurs find optimal to renegotiate the debt contract. Firstly, the lender provides funds up to the net present value of payment agreed under courts' supervision (i.e. $\frac{e_t}{R}$) to deter such opportunistic behavior. Secondly, entrepeneurs with a high collateral value have to pay more to lenders in order to reach an agreement. As a result, they have larger debt and investment capacity ($\frac{\partial \nu(\tau,\rho)}{\partial \tau} \geq 0$). However, this collateral channel is stronger in countries with a lower quality of debt enforcement ($\frac{\partial \nu(\tau,\underline{\rho})}{\partial \tau} > \frac{\partial \nu(\tau,\overline{\rho})}{\partial \tau}$ with $\overline{\rho} > \underline{\rho}$ or equivalently $\frac{\partial^2 \nu(\tau,\rho)}{\partial \tau \partial \rho} < 0$).

We now investigate the effect of the collateral channel under imperfect debt enforcement on economic activity. Specifically, we study the change in sensitivity of industry allocation and growth to collateral values when debt enforcement becomes less efficient. The value added of sector τ located in country ρ is the profit income of the project:

$$\pi_t(\tau,\rho) = xAK_t - RD_t = [(xA-R)\nu(\tau,\rho) + R]W_t \tag{7}$$

from Proposition 1. As the entrepreneur τ saves a fixed fraction β of her end-of-period wealth (7), she has access to internal funds $W_t = \beta\pi_t(\tau,\rho) = \beta[(xA-R)\nu(\tau,\rho)+R]W_{t-1}$ at the beginning of period t. Therefore the growth in value added of sector τ located in country ρ can be simply written as:

$$g_t(\tau,\rho) = \frac{W_t}{W_{t-1}} = \beta[(xA-R)\nu(\tau,\rho)+R]$$

Let's define the share of industry τ in the economy as $s_t(\tau,\rho) \equiv \frac{\pi(\tau,\rho)}{Y_t(\rho)}$ where GDP in country ρ is the sum of value added in all sectors given by $Y_t(\rho) = \int_0^1 \pi(\tau,\rho)d\tau$. The change in sensitivity of sectoral allocation and growth to collateral values when debt enforcement is weaker is determined by the sign of the following cross derivatives

$$\begin{aligned}\frac{\partial^2 s_t(\tau,\rho)}{\partial\tau\partial\rho} &= \frac{\frac{\partial^2\pi_t(\tau,\rho)}{\partial\tau\partial\rho}Y_t(\rho) - \frac{\partial\pi_t(\tau,\rho)}{\partial\tau}\int_0^1 \frac{\partial\pi(\tau,\rho)}{\partial\rho}d\tau}{Y_t(\rho)^2} < 0 \\ \frac{\partial^2 g_t(\tau,\rho)}{\partial\tau\partial\rho} &= \beta(xA - R)\frac{\partial^2\nu(\tau,\rho)}{\partial\tau\partial\rho} < 0\end{aligned}$$

From Proposition 1, both expressions are negative.[23] Therefore Proposition 1 has the following implication:

Corollary 1. *An industry with a low collateral value represents a relatively smaller share of the economy and grows more slowly in countries characterized by weak debt enforcement.*

Proposition 1 states that the collateral channel is stronger when debt enforcement is weak. Indeed entrepreneurs with a low collateral value are more constrained in countries with weak debt enforcement which implies that they generate less profit out of internal funds (allocation effect) and as a result less investment next period (growth effect).

5.3 Discussion

5.3.1 Ability to Repossess and Unsecured Lending

A common feature in models with credit constraint is to consider the ability to repossess real assets in case of default as the enforcement parameter. Suppose the same environment as before except that repossessing the capital of a defaulted entrepreneur is costly. For every unit of seized capital by courts, the lender ends up with a fraction $\theta \in [0,1]$ of it. The balance is lost in the repossessing process. The credit multiplier is modified as follows:

$$\nu(\tau,\rho,\theta) = 1 + \frac{\rho(x-1)A + (1-\rho)\theta\tau}{R} \tag{8}$$

If we consider the case where the lender has no bargaining power in debt renegotiation under courts' supervision (i.e. $\rho = 0$), standard credit constraints are derived from (8). For instance, Kiyotaki and Moore (1997) consider the perfect enforcement case (i.e. $\theta = 1$), while in Eisfeldt and Rampini (2007) and Eisfeldt and Rampini (2009), θ lies in the unit inerval. If θ is interpreted as the debt enforcement parameter instead of ρ, the result on the effect of the quality of debt enforcement on the collateral channel is reversed. The collateral channel is stronger in countries with more *efficient* debt enforcement. The intuition

[23] We find $\frac{\partial\pi_t(\tau,\rho)}{\partial\tau} > 0$, $\frac{\partial\pi_t(\tau,\rho)}{\partial\rho} > 0$ and $\frac{\partial^2\pi_t(\tau,\rho)}{\partial\tau\partial\rho} < 0$ using the profit income (7) and the credit multiplier (6).

is straightforward. Sectors with high collateral value agree upon a relatively larger payment under courts' supervision when courts are able to repossess a larger fraction of real assets in case of default. Therefore entrepreneurs with high collateral value contract relatively more debt in countries with efficient debt enforcement. In other words, debt enforcement complements the collateral channel.

5.3.2 Volatility and Development

In this subsection we show the implication of Proposition 1 on the relationship between macroeconomic volatility and development. Suppose that the country ρ is populated by homogenous industries characterized by a long-term collateral value τ.[24] Developing countries are indexed by a low ρ since it is well known that they are institutional laggards. We assume exogenous shocks $\epsilon > 0$ to the long-term collateral value. Collateral value is equal to $\tau - \epsilon$ or $\tau + \epsilon$ with equal probability. The expression for the volatility at the country level can be written as:

$$V(\rho) \equiv E[g_t(\tau,\rho)^2] - \{E[g_t(\tau,\rho)]\}^2 = \frac{1}{4}[g_t(\tau+\epsilon,\rho) - g_t(\tau-\epsilon,\rho)]^2$$

The effect of debt enforcement on volatility is given by:

$$\frac{\partial V(\rho)}{\partial \rho} = \frac{1}{2}[g_t(\tau+\epsilon,\rho) - g_t(\tau-\epsilon,\rho)]\left[\frac{\partial g_t(\tau+\epsilon,\rho)}{\partial \rho} - \frac{\partial g_t(\tau-\epsilon,\rho)}{\partial \rho}\right] < 0$$

since $g_t(\tau+\epsilon,\rho) > g_t(\tau-\epsilon,\rho)$ and $\frac{\partial g_t(\tau-\epsilon,\rho)}{\partial \rho} > \frac{\partial g_t(\tau+\epsilon,\rho)}{\partial \rho}$ from Proposition 1. Therefore, Proposition 1 has the following implication on the relationship between volatility and development:

Corollary 2. *Developing countries are more volatile since debt contracts are weakly enforced.*

This result is in line with Acemoglu et al. (2003) and Koren and Tenreyro (2007). Acemoglu et al. (2003) find that the development of institutions is the driver in the reduction of macroeconomic volatility, while Koren and Tenreyro (2007) show that 50 percent of the difference in volatility between developed and developing countries is explained by differences in country-specific volatility. The intution behind these empirical results is straightforward if recessions and booms are interpreted as the the two states. As in Shleifer and Vishny (1992) and Benmelech and Bergman (2011), the collateral value is below its long-term value τ in a recession, while the opposite occurs in a period of boom. Therefore, the boom and bust cycle would lead to more volatility in developing countries as sectoral growth is more sensitive to change in collateral value when debt enforcement is weak.

[24]With this interpretation, we develop a measure for τ in the empirical section.

6 Conclusion

This paper has provided evidence that a country's ability to enforce debt contract affects the sensitivity of economic activity to collateral values. Using a novel industry-specific measure of real assets' redeployability as proxy for collateral liquidation values, we find that the differences in size and growth between sectors with high and low collateral values are larger in countries with weaker debt enforcement institutions. Our estimates suggest that the differential effect is sizeable. This finding is robust using controls for standard determinants of economic activity, instrumental variables and a battery of robustness checks.

We have also shown that the basic source of variation of the collateral channel across countries is debt enforcement in the sense that financial development has no impact on the collateral channel beyond the correlation with debt enforcement. This suggests that a policymaker interested in reducing macroeconomic volatility arising from fluctuations in collateral values should focus on improving the quality of legal institutions rather than the level of financial development alone. Our empirical investigation has highlighted some general aspects of the bankruptcy procedure that could be improved: reducing the time to resolve the dispute and the number of procedure and decreasing the costs occured in the procedure. How these improvements can be achieved in practice is however beyond the scope of our paper.

Appendix

A Sources and Description of Data

Redeployability of Real Assets. The Detailed Fixed Assets Tables are available on the website of the Bureau of Economic Analysis (BEA) (`http://www.bea.gov/national/FA2004/index.asp`). BEA provides data in current value on investment expenditures over the period 1901-2009 and on capital stock over the period 1947-2009 for 74 private nonresidential real assets for each of the 63 U.S. industries (3-digit level of disaggregation; 2002 NAICS classification). 42 assets fall into the category "Equipment" while the category "Structures" contains 32 types of capital. We use the tables providing for each industry i investment expenditures in used and new real assets of type a ($E_{a,i,t}$) and stock of asset a ($K_{a,i,t}$), both expressed in time t current million dollars value. To obtain $Liquidity_{a,i}$, we sum the current-value investment expenditures in capital a of industry i over the period 1981-2000 ($\sum_{t=1981}^{2000} E_{a,i,t}$) and then divide it by the sum of industry i's total current-value investment expenditures over the same period ($\sum_{a=1}^{74} \sum_{t=1981}^{2000} E_{a,i,t}$). To get the asset share $\omega_{a,i}$, we sum the current-value capital stock for real asset a of industry i over the period 1981-2000 ($\sum_{t=1981}^{2000} K_{a,i,t}$) and then divide it by the sum of industry i's total current-value capital stock over the same period ($\sum_{a=1}^{74} \sum_{t=1981}^{2000} K_{a,i,t}$). We repeat the procedure for each asset and industry considered in the tables.

The Annual Capital Expenditure Survey from the U.S. Census Bureau provide data over the period 1996-2006 on investment expenditures on used capital ($E_{a,i,t}^{used}$) and on new capital ($E_{a,i,t}^{new}$) expressed in time t current million dollars value (avalaible on the webpage `http://www.census.gov/econ/aces`). The database covers the same U.S. sectors as in the Detailed Fixed Assets Tables (1987 SIC classification for the period 1994-1997; 1997 NAICS classification for the period 1998-2006), but only for two broad categories of real assets, namely "Equipment" and "Structures". We convert the 1994-1997 data from the 1987 SIC classification into the 1997 NAICS classification using the detailed concordance available on the CENSUS website (`http://www.census.gov/eos/www/naics/concordances/concordances.html`). To obtain $Nonspecificity_{a,i}$, we sum the expenditures on used capital of industry i for category a of real assets over 1996-2006 ($\sum_{t=1996}^{2006} E_{a,i,t}^{used}$) and then divide it by the sum of total capital expenditures for the same category over the same period $[\sum_{t=1996}^{2006}(E_{a,i,t}^{used} + E_{a,i,t}^{new})]$.

The redeployability of assets used by industry i is reported according to BEA industry codes based on the NAICS classification. In order to match our measure of redeployability to the ISIC rev. 2 classification, we first use a concordance from NAICS02 (6-digits) to ISIC rev. 3 (4-digits) and then another one from ISIC rev. 3 to ISIC rev. 2 (3-digit), both available on the United Nations Statistics Division's website (`http://unstats.un.org/unsd/class/`). We attribute to each ISIC rev. 2 industry the value of redeployability of the BEA industry with which it shares the most NAICS02 categories.

TABLE A1. CORRELATIONS BETWEEN REDEPLOYABILITY OF DIFFERENT DECADES

Correlation	$Redep_{80s-90s}$	$Redep_{60s-70s}$	$Redep_{90s}$	$Redep_{80s}$	$Redep_{70s}$	$Redep_{60s}$
$Redep_{80s-90s}$	1					
	1					
$Redep_{60s-70s}$	0.92	1				
	0.94	1				
$Redep_{90s}$	0.99	0.91	1			
	0.99	0.91	1			
$Redep_{80s}$	0.98	0.93	0.95	1		
	0.98	0.95	0.96	1		
$Redep_{70s}$	0.92	0.99	0.90	0.93	1	
	0.93	0.99	0.92	0.95	1	
$Redep_{60s}$	0.92	0.97	0.90	0.92	0.95	1
	0.91	0.97	0.89	0.94	0.96	1

Notes: Spearman's rank correlation coefficients are reported on first lines while second lines refer to Pearson's correlation coefficients. The null hypothesis of independance is rejected below the 1% level of significance for Spearman's correlations. The Pearson's correlations are significantly different from zero below the 1% level. The redeployability of real assets $Redep_{i,t}$ defined in (3) has been calculated over different decades t for each industry i (manufacturing and non-manufacturing) present in the Detailed Fixed Assets Table from BEA. We use $Specificity_{a,i}$ computed for the period 1994-2006 since it is the most recent coverage that ACES database provides.

We also compute $Liquidity_{a,i}$ and $\omega_{a,i}$ for different periods of time using the same procedure as the one decribed above to get a correlation matrix of redeployability for the whole sample of industries (manufacturing and non-manufacturing) across time. The correlation matrix is displayed in Table A1. Note that the Spearman's and Pearson's correlation coefficients are of the same order of magnitude when only manufacturing industries are considered.
Note that in standard robustness tests (Table 7), we use the redeployability index $Redep_{80s}$ ($Redep_{90s}$) when we consider the time period 1980s in column 10 (1990s in column 11).

Economic Outcomes. In our standard regressions, economic outcomes are measured using production data provided by Nicita and Olarreaga (2007) for 28 manufacturing sectors over the period 1976-2004. The data is originally from United Nations Industrial Development Organization (UNIDO) and is reported according to the 3-digit ISIC Rev. 2 classification. Value added is reported by UNIDO in thousend current US dollars. We divide value added by $[(CGDP_{ct}/RGDP_{ct})] \times (P_{ct}/100)$ to express value added in constant international dollars of industry i in country c at year t (va_{ict}). This deflation procedures is from Levchenko et al. (2009). Data on per capita nominal GDP ($CGDP_{ct}$) and real GDP ($RGDP_{ct}$) in international dollars, on the price level of GDP (P_{ct}) and population (POP_{ct}, in thousands) are taken from the Penn World Table (Heston et al. (2006)). Value added to GDP is the average share of real value added to real GDP of industry i in country c for the period 1981-2000 $[Y_{ic} = \sum_{t=1981}^{2000}(va_{ict}/RGDP_{ct} \times POP_{ct})/20]$. Real growth in value added is the annual compounded growth rate in real value added of industry i in country c over the period

1980-2000 $[Y_{ic} = (\log va_{ic,2000} - \log va_{ic,1980})/20]$.

In standard robustness tests (Table 6), we use gross fixed capital formation and output, which represents the value of goods produced in a year, whether sold or stocked, both from the UNIDO database. We apply the same transformations than for value added to obtain investment and output in constant international dollars. In the allocation regression, the dependent variable is the share of invesment (output) in industry i and country c to total investment (output) in the manufacturing sector of country c averaged over the years 1980-2000. Growth in investment (output) is the annual compounded growth rate in investment (output) of industry i in country c over the period 1980-2000. In column 8, we use export data from Feenstra et al. (2005) (4-digit level of disaggregation; SITC rev. 2 classification). We convert the export data in the SITC rev. 2 classification into the ISIC rev. 2 classification using the concordance produced by Muendler (available at `http://www.econ.ucsd.edu/muendler/html/resource.html`). In the allocation regression, the dependent variable is the share of exports in industry i and country c to total exports in country c averaged over the years 1980-2000. Growth in exports is the annual compounded growth rate in exports of industry i in country c over the period 1980-2000.

Debt Enforcement and Financial Development. The efficiency of debt enforcement is taken from Djankov et al. (2008). In this study, the authors have questionned insolvency practioneers from 88 countries to describe in detail how debt enforcement in their country will proceed with respect to an identical firm that is about to default on its debt. The firm is a hotel with a given number of employees, capital and ownership structure, value as a going concern and value if sold piecemeal. The value of the hotel is 100 (equal to the value of debt) if it kept as going concern but decreases to 70 if it sold piecemeal. Debt enforcement efficiency is defined as the present value of the terminal value of the firm minus bankruptcy costs. From collected responses of practioners, *Debt enforcement* efficiency is computed as $[100 \times GC + 70 \times (1 - GC) - 100 \times c]/(1 + r)^t$ where GC equals one if the hotel continues as a going concern and zero otherwise, c is the cost of debt enforcement procedures, t the time to resolve insolvency, and r the nominal lending rate prevailing in the country.

In standard robustness tests (Table 6), we use alternative measures of debt enforcement. First, we consider the recovery rate for secured creditors constructed as the efficiency of debt enforcement and defined as $[100 \times GC + 70 \times (1 - GC) - 12 \times (P - 1) - 100 \times c]/(1 + r)^t$ where P stands for the order of priority in which claims are paid. The measure of recovery rate is from Djankov et al. (2008) in column 1 and from World Bank (2008) in column 2. Then we use data from World Bank (2008) on the efficiency of the judicial system in the collection of an overdue debt: the time required for dispute resolution, the number of procedures involved in and the official costs of going through court procedures. As in Nunn (2007), we change and normalize each variable in order to get an alternative measure of debt enforcement increasing in it and ranging from zero to one [$(1500 - Time)/1500$ in Column 3, $(60 - Procedures)/60)$

in Column 4 and $(6 - \ln(Costs))/6]$ in Column 5.

We consider two types of variable as a proxy for the level of financial development. *Debt market size* in period t is defined as $0.5 \times \{[F_t/P_t^e + F_{t-1}/P_{t-1}^e]/[GDP_t/P_t^a]\}$ where F is credit by deposit money bank and other financial institutions to the private sectors (lines 22d + 42d), GDP is line 99b, P^e is end- of period CPI (line 64) and P^a is the average CPI for the give year. Data come from International Financial Statistics (IFS). *Stock market size* in period t taken from Beck et al. (2009) is calculated as debt market size with F defined as the value of listed shares. We average each variable over the period 1981-2000. The legal origin of a country's bankruptcy laws from Djankov et al. (2008) and the log of European settler mortality in former colonies from Acemoglu et al. (2001) are used as an instrument for debt enforcement, while the instrument for the level of financial development is the legal origin of commercial laws from La Porta et al. (1998).

Creditor rights is the mean value over the period 1981-2000 of the creditor rights index from Djankov et al. (2007).

Standard Controls and Alternative Channels. The *Initial industry share* is computed using the UNIDO dataset from Nicita and Olarreaga (2007), and defined as the share of the industry i's real value added to the country c's total manufacturing real value added in 1980 $(va_{ic,1980}/\sum_{i=1}^{28} va_{ic,1980})$.

Industry-specfic variables. The sector factor intensities *Capital intensity*, *Skill intensity*, *Natural resources intensity intensity* and financial characteristics are taken from Table 1 in Braun (2005). Note that *Tangibility* of assets is the median ratio of net property, plant and equipment to total assets over U.S. firms in industry i, while *External finance dependence* is the median ratio of capital expenditures minus cash-flows from operations to total capital expenditures over U.S. firms in industry i. Considering other industry-specific variables, *R&D intensity* is the ratio of R&D expenditures over total capital expenditures, *Depreciation* the industry rate of capital depreciation and *Obsolescence* the embodied technical change in industry capital based on Cummins and Violante (2002). These variables are from Ilyina and Samaniego (2011). *Product complexity* is the Herfindhal index of intermediate input use from Cowan and Neut (2007). *Contract intensity* comes from Levchenko (2010) and reports the industry share of intermediate inputs that cannot be bought on organized exchanges and is not reference-priced. *Benchmark economic activity* is computed using the UNIDO dataset from Nicita and Olarreaga (2007). In the allocation regression, it measures the value added to GDP of industry i in United States, while in the growth regression, it measures the annual compounded growth rate in industry real value added in United States. Both variables are averaged of the period 1980-2000.

Country-specfic variables. The stock of physical capital per worker in each country is constructed using the perpetual inventory method described in Hall and Jones (1999) where the investment data and the number of workers for each country c are taken from Penn World

Tables (Heston et al., 2006). Human capital is computed from the average years of schooling over the population in a given country using data from Barro and Lee (2001) with concave Mincerian returns to education. The computational method is from Caselli (2005). Data on aggregate natural resources endowment per capita are obtained from World Bank (1997). *Capital* and *Skill* are the log of the mean physical capital per worker and the mean human capital in country c for the period 1981-2000, respectively. *Natural resources* is the log of natural resources per capita. *Rule of law* ranging from -2.5 to 2.5 is computed from survey data by Kaufmann et al. (2009) and measures the extent to which agents have confidence in and abide by the rules of society in 1996. *Initial GDP per capita* is the log of real GDP per capita in 1980, while *GDP per worker* is the log of the mean of real GDP per worker over period 1981-2000. Data are from the Penn World Tables (Heston et al., 2006).

B Summary Statistics

Table A2. Summary Statistics

	Mean	Std. dev.	Min.	Max.	Obs.
A.1 Allocation regression variables					
Mean value added to GDP (1981-2000)	0.0064	0.0078	0	0.0628	1101
Redeployability × Debt enforcement	0.4019	0.1996	0.0402	0.8496	1101
Redeployability × Debt market size	0.3466	0.242	0.0272	1.4477	1398
Redeployability × Stock market size	0.2484	0.2517	0.0059	1.2679	1313
Redeployability × Creditor rights	1.3209	0.8087	0	3.5583	1101
Capital intensity × Capital	1.083	0.5773	0.2553	3.3159	1101
Skill intensity × Skill	2.2389	0.7886	0.7151	5.3224	1101
Natural resources intensity × Natural resources	2.1556	3.8282	0	10.8413	1101
A.2 Growth regression variables					
Real growth rate of value added (1980-2000)	0.0218	0.0546	-0.2215	0.2221	829
Redeployability × Debt enforcement	0.4624	0.1904	0.0402	0.8549	829
Redeployability × Debt market size	0.4411	0.2560	0.0895	1.4477	998
Redeployability × Stock market size	0.3145	0.3086	0.0061	1.8655	968
Redeployability × Creditor rights	1.4638	0.7974	0	3.5583	829
Initial share of value added to GDP (1980)	0.0394	0.0455	0.0002	0.5238	829
B. Country-specific variables[a]					
Efficiency of debt enforcement	0.5695	0.2656	0.066	0.9610	51
British legal origin (bankruptcy law)	0.2941	0.4602	0	1	51
French legal origin (bankruptcy law)	0.5686	0.5002	0	1	51
German legal origin (bankruptcy law)	0.0588	0.2376	0	1	51
Nordic legal origin (bankruptcy law)	0.0784	0.2715	0	1	51
Mean private credit to GDP (1981-2000)	0.5095	0.3535	0.0446	1.6274	67
Stock market capitalization to GDP (1981-2000)	0.3659	0.4116	0.0097	2.0971	61
British legal origin (common law)	0.3115	0.4669	0	1	61
French legal origin (civil law)	0.5246	0.5035	0	1	61
German legal origin (civil law)	0.0656	0.2496	0	1	61
Scandinavian legal origin (civil law)	0.0656	0.2496	0	1	61
Socialist legal origin	0.0328	0.1796	0	1	61
Creditor Rights	1.9608	1.1663	0	4	51
Log of mean physical capital per worker (1981-2000)	15.6618	0.8713	14.1073	16.9612	41
Mean human capital (1981-2000)	2.2498	0.4979	1.4253	3.2144	41
Log of natural resources per capita	8.8322	0.9051	6.9276	10.8413	41
C. Industry-specific variables					
Redeployability	0.7173	0.0688	0.6093	0.8896	28
Tangibility	0.2977	0.1392	0.0745	0.6708	28
Capital intensity	0.0695	0.0376	0.0181	0.1955	28
Skill intensity	0.9995	0.2771	0.5017	1.6558	28
Natural resources intensity	0.25	0.441	0	1	28

Notes: a: Summary statistics refer to the countries included in either the allocation or the growth regressions.

C Samples

Table A3. Sample in Allocation Regressions

Country	Number of industries	Country	Number of industries	Country	Number of industries
Argentina	28	Greece	28	New Zealand	28
Australia	28	Guatemala	28	Oman[a]	27
Austria	28	Hong Kong[a]	27	Panama[a]	27
Bulgaria[a]	28	Honduras	26	Peru	28
Brazil	13	Hungary[a]	28	Philippines	28
Botswana[a]	5	Indonesia	28	Poland[a]	28
Canada	28	Ireland	26	Portugal	28
Switzerland	5	Iran[a]	28	Romania[a]	28
Chile	28	Israel[a]	28	Russian Federation[a]	28
China[a]	26	Italy	28	Singapore[a]	24
Colombia	28	Jordan	27	El Salvador	28
Costa Rica	28	Japan	28	Slovakia[a]	26
Czech Republic[a]	24	Korea[a]	28	Slovenia[a]	23
Denmark	28	Kuwait[a]	27	Sweden	28
Algeria[a]	28	Sri Lanka	28	Thailand	28
Ecuador	28	Latvia[a]	26	Tunisia	27
Egypt	28	Morocco[a]	26	Turkey	28
Spain	28	Mexico	28	Uruguay	28
Finland	28	Malaysia	28	Venezuela	28
France	27	Netherlands	26	South Africa	28
United Kingdom	28	Norway	28		

Notes: The sample includes countries present in regressions using *Debt enforcement* without controlling for the standard determinants of comparative advantages where the dependent variable is the value added to GDP over the period 1981-2000. a: denotes countries missing in regressions where standard determinants of comparative advantages are used.

Table A4. Sample in Growth Regressions

Country	Number of industries	Country	Number of industries
Australia	20	Japan	27
Austria	22	Korea	28
Canada	27	Kuwait	22
Chile	28	Sri Lanka	27
Colombia	25	Morocco	26
Costa Rica	23	Mexico	18
Spain	27	Malaysia	26
Finland	26	Netherlands	26
France	23	Norway	26
United Kingdom	26	Panama	18
Hong Kong	21	Poland	10
Hungary	26	Portugal	27
Indonesia	22	Singapore	21
Ireland	26	Sweden	28
Iran	28	Tunisia	17
Israel	17	Turkey	26
Italy	26	Uruguay	21
Jordan	22		

Notes: The sample includes countries present in regressions using *Debt enforcement* where the dependent variable is the real growth of value added over the period 1980-2000.

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