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The relationship between trust in legal institutions and the vertical integration of firms in manufacturing industries

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Abstract:

Existing literature has studied how legal institutions influence vertical integration of firms. This literature has mostly used contract enforcement costs to study this relationship. Using trust in legal institutions as an alternative measure for institutional quality might show a different relationship, because the level of trust may reflect how legal institutions are regarded in the integration decision. Using data on the level of vertical integration amongst 15 manufacturing industries in 87 countries for the years 1996-2017, pooled ordinary least squares regressions and fixed effects regressions are estimated. This study finds that trust in legal institutions is negatively related to vertical integration at industry level, after controlling for fixed effects. Financial development moderates this relationship.

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1. Introduction

In the beginning of 2020, the coronavirus pandemic started in the Chinese city Wuhan. A lockdown was enforced in the city to stop the spread of the virus. This had major consequences for the transportation of goods from China to the rest of the world. Wuhan is an important transport hub in China. It is regarded as the thoroughfare of China (Huifeng, 2020). As there was no transportation from Wuhan due to the lockdown, manufacturers in the rest of the world could not receive production parts they needed. This resulted in production issues around the world, as many firms depend on Chinese production and transportation for their supply chains (Gunia, 2020). For example, electronics manufacturer Philips produces parts for its products in Wuhan and resembles all the parts in Europe (Pols, 2020).

The coronavirus pandemic has shown how dependent firms are on the in-time supply of production inputs. This brings up the issue of the organizational form of firms. Firms can reduce their dependency on others by integrating parts of the production chain. This is called vertical integration. After integrating a part of the production chain, the firm produces a part the product itself and does not rely on others to produce this part.

When a firm wants to produce a product, it has to make the decision what level of vertical integration it will use. A firm can focus on only one part of the product or supply chain. Then, the firm relies on other firms to produce and supply the needed inputs. The firm sells its product to consumers with a salesperson or to other firms. These firms then further develop the product or sell it to the consumer. On the other hand, a firm can also decide to produce (part of) the input itself, use its product as input for a further developed product or purchase the inputs and sell the product without a salesperson. All these actions involve vertical integration. The decision what level of vertical integration to use, is called the integration decision.

Research has found that institutional factors influence the level of vertical integration (Khanna & Palepu, 2000). Institutional factors are rules, formal or informal, that shape society. One of these institutional factors are contract enforcement costs (Acemoglu, Johnson & Mitton, 2009; Macchiavello, 2012). If a firm decides to depend on other parties in the production chain, a contract has to be made. If conflicts arise with regards to this contract, the contract has to be enforced legally. The enforcement of the contract results in legal costs. To avoid these costs, firms can use vertical integration so they do not rely on contracts with other parties. However, this logic has not been completely confirmed. Acemoglu et al. (2009) have only found an interaction effect between contract enforcement costs and financial development on the propensity for firms to vertically integrate. Macchiavello (2012) has found an interaction effect between contract enforcement costs and the contract-intensity of industries on the level of vertical integration. Both studies have not found a direct effect of contract

enforcement costs on vertical integration. A possible explanation for this is that vertical integration does not solve contractual conflicts. Another explanation is that vertical integration also results in costs, for example bureaucracy costs.

The results of Acemoglu et al. (2009) and Macchiavello (2012) show that legal institutions could have a role in the integration decision. However, how firms perceive and trust legal institutions can be relevant as well. For example, if a firm does not trust legal institutions to enforce the contract, even though there are low objective enforcement costs, the effect of contract enforcement costs might not be the same as the effect of the trust in legal institutions. Therefore, trust in legal institutions might play a relevant role in the integration decision. Trust in legal institutions is influenced by factors such as culture and the perceived performance of these institutions (Yang & Tang, 2010). Trust in legal institutions is known to be associated with economic outcomes, such as the size of the informal economy (Wallace & Latcheva, 2006). However, its effect on the integration decision has not been studied yet.

As explained, trust in legal institutions might have a different effect on vertical integration than contract enforcement costs, because trust in legal institutions is influenced by more factors than the performance of these institutions only. This results in the following research question:

Is trust in legal institutions related to the level of vertical integration in industries and if so, how are they related?

This study investigates the effect of trust in legal institutions on vertical integration alone, but also in combination with other factors. These other factors are contract enforcement costs, financial development and market concentration. These three factors are investigated as moderators of the effect of trust in legal institutions on vertical integration.

This study fills a clear gap in the existing literature. As described, research has been conducted on the effect of contract enforcement on vertical integration (Acemoglu et al., 2009; Macchiavello, 2012). However, these studies use objective measures to investigate the effects. As argued, the analysis of a subjective measure (i.e. trust) could complement these studies. A subjective measure of the quality of contracting institutions has been used to study the effect of this quality on vertical integration (Du, Lu & Tao, 2012). However, this study does not completely investigate the effect of trust in legal institutions. In addition, Du et al. (2012) use cross-sectional data on firms in China. The current study uses panel data on industries amongst many different countries.

The societal relevance of this study is that it sheds more light on the organizational form of firms and products chains and the effect of institutional factors in general on this form. The importance

of product chains is highlighted by the current coronavirus pandemic. Due to lockdowns across the world supply chains are disrupted (Liao & Fan, 2020). Firms have to cease production because they no longer receive their inputs. This shows the risks involved when relying on other firms to produce needed inputs, especially for international production chains. Therefore, it is useful to understand vertical integration better and how institutional factors influence vertical integration.

Richardson (1996) briefly mentions that vertical integration is socially undesirable. If governments agree with Richardson, the results of this study could be informative about the social value of fostering trust in legal institutions for the organizational form of firms in a country.

This study uses data from Industrial Statistics 2 (INDSTAT2) database from the United Nations Industrial Development Organization (UNIDO). This database contains information on the output and value added of 15 manufacturing industries across 87 countries from 1996 until 2017. This results in a panel dataset with observations per industry per country for multiple years. The database on worldwide government indicators from the World Bank is used for the data on trust in legal institutions across countries. To analyse the data, pooled ordinary least squares and fixed effects regressions are used.

The main result of this study is that trust in legal institutions is negatively related to vertical integration at industry level. This relationship is robust to controlling for all time-invariant factors. This relationship is less negative when the level of financial development is high. There is no evidence that contract enforcement costs and market concentration moderate the relationship between trust in legal institutions and vertical integration.

The remainder of this paper is organized as follows. First the theoretical framework is discussed in Chapter 2. Relevant literature on vertical integration and trust in legal institutions is used to formulate four hypotheses. In Chapter 3, the data and methodology are described. Afterwards the results of the empirical analysis are presented in Chapter 4. At last, in Chapter 5 the results are discussed and a conclusion is drawn.

2. Theoretical framework

This chapter describes how an effect of trust in legal institutions on vertical integration fits in the economic literature. First three theories are used to explain why firms use vertical integration in general. Next, trust in legal institutions is explained. Thereafter, it is discussed how trust in legal institutions can be related to vertical integration and whether this can be explained by the three main theories. At last three possible moderators for this relationship are described.

2.1 Vertical integration

Different general theories have been developed to explain why firms do or do not use vertical integration. Agency theory and Transaction Costs Economics are widely used and Property Rights Theory has gained much attention in the economic literature (Kim & Mahoney, 2005). These theories are mostly used to explain vertical integration.

Agency theory states that firms try to minimize agency costs. Agency costs are "*the costs of structuring, bonding and monitoring contracts between agents*" (Jensen, 1983, p. 331). Agency costs arise both in firms with low and high levels of vertical integration. Coordination problems between independent firms can cause agency costs (Cadot, 2015). These costs disappear by integrating. However, then bureaucracy costs arise (D'Aveni & Ravenscraft, 1994).

Agency costs can be seen as a subtype of transaction costs (Mahoney, 1992). Transaction costs in general can also be used to explain vertical integration. Williamson (1979) has developed Transaction Costs Economics and states that firms can use vertical integration to minimize transactions cost. Transaction costs follow from concluding and enforcing a contract. Incomplete contracts cause costs, because incomplete contracts can result in opportunistic behaviour. Williamson (1979) argues that vertical integration is mostly used when there is a recurring transaction that involves transaction-specific investments and when the transaction is made under great uncertainty. Transaction-specific investments and uncertainty are called the Transaction Costs Economics factors.

Grosmann and Hart (1986) have developed Property Rights Theory to explain vertical integration. This theory looks at ownership and the incentives that follow from the distribution of ownership. When a contract is agreed upon, some property rights transfer between parties, while others remain with their original owner. This theory assumes contracts to be incomplete. Therefore, not all property rights are specified in the contract. The non-specified property rights remain with the original owner. These rights are called residual rights. The distribution of the ownership over the residual rights determines the level of interest from either party and therefore also the level of relation-specific investments from both parties.

The transfer of property rights leads to distortions in the distribution of incentives. The distribution of ownership can prevent one of the contracting parties to receive the required return on its investment. If a party does not receive a return equal to or higher than the initial investment, this party will not invest. When both parties remain independent, they both have incentives to only invest moderately. When one party integrates the other party, the integrating party becomes owner of all residual rights. The integrating party then has an incentive to overinvest and the integrated party has an incentive to underinvest. Whether vertical integration takes place or not, investment distortions take place. These distortions always lead to a loss in surplus. Firms choose the ownership structure that minimizes this loss. This means that a firm integrates another firm, if the increase of control by the integrating firm increases productivity more than the decrease in control by the integrated firm decreases productivity (Grossmann & Hart, 1986).

Whinston (2003) explains one of the differences between Transaction Costs Economics and Property Rights Theory. Both theories assume that contracts are incomplete and lead to opportunistic behaviour of one of the parties to a contract. Transaction Costs Economics assumes that after integrating the other party, opportunistic behaviour does no longer take place. The integrating firm then can control the other party and coordinate investments. Property Rights Theory however does not make this assumption. This theory assumes that opportunistic behaviour takes place regardless whether one of the contracting parties has integrated the other party. Integrating another firm does not mean that the investments of both firms are coordinated, as the decision to invest remains with the management of the integrated party. Whinston (2003, p. 4) formulates that the integration decision that follows from the Property Rights Theory "*involves a comparison of the efficiency costs of opportunistic behaviour in the various possible organizational forms.*"

The three theories for vertical integration have been empirically tested. Transaction Costs Economics has been empirically tested in, for example, the airline industry (Monteverde & Teece, 1982). Agency Theory has been used to explain franchising (Lafontaine & Shaw, 2005). Acemoglu, Griffith, Aghion and Zilibotti (2010) have found more empirical support for Property Rights Theory than for Transaction Costs Economics.

2.2 Trust in legal institutions

Legal institutions are institutions such as courts, the police and the law. Personal characteristics influence the level of trust in legal institutions (Yang & Tang, 2010). For example, unemployment has a negative effect on the level of trust. The amount of legal knowledge and political information one has, has a negative effect on trust in legal institutions. Cultural values largely influence trust in legal institutions. At last, the evaluation of performance of legal institutions has a large positive effect on

the level of trust (Yang & Tang, 2010). Tyler (2001) has found that the evaluation of legal institutions is not primarily determined by their outcomes on society or by instrumental factors such as the amount of legal costs or the time needed for a legal procedure. Instead, legal institutions are evaluated by the perceived level of fairness the litigants are treated with.

Research has shown that legal institutions are related to economic outcomes. Property rights protection and the efficiency of contract enforcement are positively related to firm size (Beck, Demirgüç-Kunt & Maksimovic, 2006). Beck et al. (2006) explain that this relationship does not mean that firms become larger to compensate for underdeveloped legal institutions. They argue that this effect means that developed legal institutions are a condition for firms to grow larger.

Another example, is that the legal environment in a country determines the size of its capital markets (La Porta, Lopez-de-Silanes, Shleifer & Vishny, 1997). The legal environment entails the legal rules and the enforcement of these rules. If the legal environment protects investors more against expropriation by other shareholders or providers of external finance, investors are more willing to sell their shares or to raise debt. This increases the size of capital markets.

Research has also shown that economic outcomes are related to trust in legal institutions. Wallace and Latcheva (2006) find that the size of the informal economy in developing countries is negatively related to trust in legal institutions. This relationship depends on the type of informal economy. The informal economy consists of the black economy, defined as "*economic activity undertaken for cash of money*", the social economy, that is "*non-monetary forms of help"*, and the household economy, which means "*household subsistence activities"* (Wallace & Latcheva, 2006, p.81). The black economy is outside the law and often illegal, while the other two types are outside of legislation and a-legal. People involved in the black economy distrust legal institutions. People involved in social or household economies on the other hand do not distrust legal institutions. The effect differs strongly amongst countries. In some countries the effect of the size of the black economy is strong, while in other countries there is no effect. Wallace and Latcheva mention that the effect of the size of the black economy is mostly weak in countries with developed market economies.

2.3 Trust in legal institutions and vertical integration

Research has already found that the quality of governance, and thus institutions, explains differences in productivity growth (Olson, Sarna & Swamy, 2000). Productivity and vertical integration are related. However, the direction of this relation is unclear. Hortaçsu and Syverson (2007) find that productivity is positively related to vertical integration in the cement industry in the United States. However, Li, Lu and Toa (2017) find a negative correlation between productivity and vertical integration in developing countries.

The effect of institutions on productivity and the relationship between productivity and vertical integration suggests that country-level factors might also influence the level of vertical integration. Countries with emerging markets have higher levels of integration. This can be explained by the fact that these markets are hampered by missing functions of institutions and therefore replicate these functions themselves, which results in larger firms (Khanna & Palepu, 2000).

More recent research has looked into the effects of financial and legal institutions on the level of vertical integration (Acemoglu et al., 2009). When legal institutions are better, contract costs are less. Acemoglu et al. (2009) hypothesize that vertical integration is more likely when credit market imperfections are lower, but that the effect of contract enforcement costs is ambiguous. They also hypothesize that there is a positive interaction effect between developed credit markets and contract enforcement costs, because firms then have the financial ability to solve their contractual issues. The results show a relationship between both factors and vertical integration, but this is driven by differences in industrial composition between countries. However, the interaction effect is supported. Vertical integration is more likely when there are high contract enforcement costs and more developed credit markets.

Macchiavello (2012) looks at the same issue and finds that developed countries have higher levels of vertical integration. Financial development is negatively related to vertical integration. He also finds that better contract enforcement is associated to relatively higher levels of vertical integration in contract-intensive industries. However, there is only weak evidence for a direct role of contract enforcement costs. Macchiavello uses Property Rights Theory to explain this result. This theory assumes that opportunistic behaviour exists both in relations between non-integrated firms and integrated firms, as explained in paragraph 2.1. Macchiavello (2012) mentions that the result that contract enforcement costs have no direct effect on the level of vertical integration, might mean that the contractual issues the industries in his sample experience, cannot be solved by integrating the party that causes these issues.

Both studies show that legal institutions play a role in the determination of the level of vertical integration. They use objective measures for contract enforcement to study the effects. These measures might not reflect best how firms think about the legal institutions in their country. If a firm does not have much trust in the legal institutions to make the right decision, the firm might not want to depend on legal enforcement, even though costs to enforce the contract legally might be low. In light of this concern, it is relevant to look at the study by Shervani, Frazier and Challagalla (2007) on the moderating role of market power of the firm on the effects of transaction-specificity and uncertainty (the Transaction Costs Economics factors) on vertical integration. They think that both objective and subjective measures should be used to study market power as a moderator. Besides this,

they argue that the level of market power should also be measured from the perspective of the independent firm that is used in the production chain by the firm. A firm may not benefit from its market power if the independent firm in the production or supply chain does not experience the level of market power the same (Shervani et al., 2007). This last argument suggests to use a subjective measure to capture the experience of the independent firm properly.

The same can be said for the objective measurement of contract enforcement. If a firm does not experience contract enforcement to be of high quality, even though there are low objective enforcement costs, the impact of this measure might not be the same as the impact of the trust in legal institutions. Therefore, trust in legal institutions might play a relevant role in the integration decision. Besides this, trust in legal institutions is not only influenced by legal costs, but also by factors that are not objectively measurable. For example, cultural values influence the level of trust in legal institutions (Yang & Tang, 2010). An objective measure as contract enforcement costs does not capture the influence of cultural values. This relates to the research of Jahedi and Méndez (2014) on the reasons to use subjective measures. They have used an experiment to study the advantages and disadvantages of subjective measures. They argue that subjective measures can be useful if objective measures do not capture all relevant factors that affect the variable of interest. Subjective measures can capture (some) unobservable factors (Jahedi & Méndez, 2014). As explained, cultural values are unobservable and influence trust in legal institutions. Therefore, the effect trust in legal institutions as a subjective measure on vertical integration can be different from the effect of contract enforcement costs as an objective measure.

Research has already shown that trust in general can have an effect on vertical integration. Zaheer and Venkatraman (1995) have found that social factors play a role in the decision which organizational structure to use. They hypothesize that trust between contracting parties has a negative effect on quasi-integration. Quasi-integration is a form of vertical integration in which one firm does not own another firm or fully internalizes a production process, but both parties are dependent of one another. When parties trust each other to comply with the contract, they do not behave opportunistically. This reduces transaction costs. However, empirically they have found a negative relationship. This suggests that the level of trust between the parties to a contract rises due to quasi-integration. Zaheer and Venkatraman (1995) have shown that trust between parties is related to vertical integration. This suggests that other forms of trust might play a role in the integration decision. It also shows that investigating the effect of trust in legal institutions on vertical integration is not only a relatively simple distinction between objective and subjective measures of contract enforcement, but that it may also explain vertical integration better.

Du et al. (2012) have studied the effect of contracting institutions on vertical integration, while using a subjective measurement of the quality of these institutions. They asked CEOs of firms in China

how they perceive the quality of contracting institutions. They find a negative effect of the quality of contracting institutions on the level of vertical integration. This effect is not driven by industry structure, such as in the study by Acemoglu et al. (2009). The researchers use data on whether a city was under British administration as an instrumental variable to further study the effect. The effect of the quality of contracting institutions remains negative and significant. However, legal origins are known to influence many economic outcomes. For example, legal origin is associated to the development of financial institutions (La Porta et al., 1997). Du et al. (2012) control for these known effects, but it still remains likely that legal origins affect vertical integration through other channels than the quality of contracting institutions only.

However, there is a difference between the perceived quality of contracting institutions and trust in legal institutions. The measurement of Du et al. (2012) shows the perceived quality of contracting institutions. This is not the same as the level of trust in legal institutions. As explained in paragraph 3.2, the quality of legal institutions does not primarily determine the level of trust in these institutions. Trust in legal institutions is determined more by the perceived fairness of the procedure followed and by cultural values. Therefore, the result of Du et al. (2012) does not capture the same effect on vertical integration as the effect of trust in legal institutions.

The relationship between trust in legal institutions and vertical integration can be explained by using Transaction Costs Economics. This theory states that incomplete contracts cause transaction costs, because the contract has to be renegotiated. Firms are then more likely to vertically integrate if contracts are more likely to be incomplete. This assumes that if a contract is complete, the contract can be enforced. If the other party is not willing to follow the contract, the contract has to be enforced through a legal procedure. This procedure itself results in costs. To avoid these costs a firm can vertically integrate. Then there is no longer a relationship and contract with the other party, so also no risk of having to bear legal costs.

If legal institutions do not function correctly, the result of a legal procedure might be uncertain. If a firm trusts legal institutions to enforce the contract, the firm can make a decision between the costs of vertically integrating and the costs of a legal procedure. If a firm does not trust the legal institutions to enforce the contract, it might bear the legal costs without a positive result. If the firm decides not to vertically integrate, it decides to bear the risk of following a legal procedure. If the outcome of this procedure is not in favour of the firm, the firm is left with less than it had, as the firm has to pay the legal costs.

This means that the firm decides between the risk of bearing legal costs and the risk of losing the legal procedure on one hand and the costs of vertical integration on the other hand. If the firm uses no vertical integration, it faces the risk to bear legal costs and lose a legal procedure. If a firm fully

integrates the production process, there is no risk of bearing legal costs and losing a legal procedure. However, vertical integration results in costs, for example in bureaucracy costs. Therefore, firms choose to use the optimal level of vertical integration. At this level, the legal costs and the costs involved when losing the legal procedure, corrected for the probability that the firm has to legally enforce a contract, are equal to the costs of the chosen level of vertical integration.

Trust in legal institutions influences the perceived risk of losing the procedure. In case of this decision, a firm is more likely to vertically integration than when it does not take the risk of losing the legal procedure into account. The risk of losing the legal procedure to enforce the contract is linked to the Transaction Costs Economics factor uncertainty. If firms are dealing with more uncertainty, they are more likely to vertically integrate. As explained, the same holds for uncertainty around the outcome of a legal procedure.

If firms are more likely to vertically integrate when they do not trust legal institutions, this would be reflected on country and industry level. In general, all firms in a country perceive the risk of losing a procedure to the same extent. As discussed in section 2.2 cultural values, the evaluation of the performance and fairness of legal institutions and their outcomes and instrumental factors influence the level of trust in legal institutions. These factors are not likely to differ amongst firms in the same country. Therefore, the level of trust in legal institutions can be evaluated on the country level. Vertical integration of firms can be evaluated on the industry level, because the level of vertical integration of an industry is the sum of the levels of vertical integration of individual firms. This leads to the first hypothesis:

> *Hypothesis 1: Trust in legal institutions at country level is negatively related to the level of vertical integration at industry level.*

This hypothesis does not directly relate to Agency Theory and Property Rights Theory. Noorderhaven (1992) mentions that most studies that use Agency Theory neglect the question how contracts are enforced. Contract enforcement can be divided between internal and external contract enforcement. Internal enforcement entails that parties enforce the contract themselves. External enforcement entails that a third party enforces the contract. Noorderhaven argues that Agency Theory cannot explain internal enforcement, when external enforcement is absent. Well-functioning external contract enforcement can be regarded as an assumption of Agency Theory, although this assumption does not fit with the individualistic perspective of Agency Theory.

If external contract enforcement is regarded as an assumption of Agency Theory, trust in the third party that will enforce the contract might be part of this assumption. As Noorderhaven (1992) argues, external contract enforcement has to function well. This means that if parties do not perceive

external enforcement to function well, the existence of external contract enforcement might not work through into the relationship between the parties. If firms perceive external enforcement to function well and thus trust legal institutions, the assumption is fulfilled. However, trust in legal institutions does not affect whether coordination costs or bureaucracy costs arise. Therefore, the level of trust in legal institutions does not relate to vertical integration. This shows that Agency Theory cannot explain how trust in legal institutions is related to vertical integration.

Whether or not firms have a high level of trust in legal institutions, the distribution of ownership does not differ. This means that the incentives for contracting parties do not change between different levels of vertical integration. Therefore, Property Rights Theory cannot explain a relationship between trust in legal institutions and vertical integration. However, the perspective on property rights does shed another light on trust in legal institutions. Acemoglu and Verdier (1998) state that if contracts are not enforced as they should be, for example due to corruption, parties do not invest. The party that does not own the residual rights invests without directly receiving a return. This party needs a contract to receive this return. If contracts are not enforced, this party anticipates that it will not receive its returns and thus does not invest.

This can be extended to trust in legal institutions. If a party does not trust that a contract will be enforced, it anticipates this and does not invest. However, Property Rights Theory assumes that opportunistic behaviour also exists after integrating this party. Therefore, this interpretation suggests that trust in legal institutions is rather a condition, than a factor that influences the level of vertical integration.

As explained in the section before the first hypothesis, Transaction Costs Economics can explain the relationship between trust in legal institutions and vertical integration. This relationship cannot be explained by Agency Theory and Property Rights Theory.

2.4 Factors moderating the relationship between trust in legal institutions and vertical integration

This section describes three possible moderators for the relationship between trust in legal institutions and vertical integration. First contract enforcement costs as a moderator are described. Thereafter, it is discussed how financial development could be a moderator. At last market concentration as moderator is described.

2.4.1 The moderating role of contract enforcement costs

As explained, firms have to make the decision between the risk of losing a legal procedure combined with the risk of bearing legal costs and the costs of vertical integration. Because this decision involves

a combination of trust in legal institutions and contract enforcement costs, there might be an interaction effect between both factors.

Acemoglu et al. (2009) already have found an interaction effect between contract enforcement costs and financial development on the propensity for vertical integration. Vertical integration is more likely when there are high contract enforcement costs and developed credit markets. However, Acemoglu et al. (2009) and Macchiavello (2012) have not found a direct effect of contract enforcement costs on vertical integration. These results show that contract enforcement costs do not have an effect on vertical integration, but can moderate the effects of other determinants of vertical integration. This suggests that contract enforcement could indeed moderate the effect of trust in legal institutions on vertical integration.

If contract enforcement costs are high, a high level of trust in legal institutions might not be relevant. Although the firm has trust in a fair outcome of legal procedures, the high costs still cause the firm to integrate to avoid bearing those costs. This means that the effect of trust in legal institutions on the level of vertical integration depends on the amount of contract enforcement costs.

As explained when formulating the first hypothesis, this moderating role can be reflected on industry and country level. Doing so assumes that contract enforcement costs do not vary between firms in the same country. This also means that the extent to which a firm can easily bear these costs does not differ between firms. These assumptions and the explained logic lead to the second hypothesis:

> *Hypothesis 2: Contract enforcement costs at country level moderate the relationship between trust in legal institutions and vertical integration at industry level, such that the relationship is less negative when contract enforcement costs are high.*

2.4.2 The moderating role of financial development

Acemoglu et al. (2009) have also found a positive interaction effect between on contract enforcement costs and financial development on the propensity for vertical integration. Contract enforcement costs reflect the severity of contract enforcement issues. If contract enforcement issues are more severe, a firm would want to use vertical integration to avoid these issues. The firm then needs the financial abilities to integrate. Du et al. (2012) also have studied an interaction effect between the quality of contracting institutions and financial development. They have found no interaction effect on vertical integration.

The severity of contract enforcement issues might not only be influenced by contract enforcement costs. If a firm does not trust legal institutions to produce the right judgement in the procedure to enforce a contract, contract enforcement issues are more severe. The firm then wants

to integrate and needs financial resources to do so. If a country has a better developed financial system, firms have better access to financial resources. This means that there could be an interaction effect between trust in legal institutions and the level of financial development on the level of vertical integration. If the level of financial development is high, firms that want to vertically integrate can do so. In such a situation, the relationship between trust in legal institutions and vertical integration is more negative. The high level of financial development means that a lack of finance cannot be a reason not to integrate, which means that the role of trust in legal institutions becomes more important.

As the level of financial development is equal for all firms in a country, the interaction effect can be reflected at country level. Comparable to hypothesis 2, it is assumed that an equal level of financial development means that financial services are equally accessible. This leads to the third hypothesis:

> *Hypothesis 3: Financial development at country level moderates the relationship between trust in legal institutions and vertical integration at industry level, such that the relationship is more negative when the level of financial development is high.*

2.4.3 The moderating role of market concentration

Besides interaction effects with factors on a country level, the market in which a firm operates can also influence its integration decision. Research has found that market concentration has a positive effect on vertical integration (Tucker & Wilder, 1977; Levy, 1985). An explanation, amongst others, for the existence of this effect is that if a market is not concentrated, the market is an efficient place for transactions (Balakrishnan & Wernerfelt, 1986). Then vertical integration is less likely, because the market concentration does not cause contract enforcement issues. De Fontenay and Gans (2005) have used Property Rights Theory to study this effect, so that managers can earn rents after vertical integration and thus can have incentives to improve the performance of their firm. They have found mathematically that the incentives for strategic vertical integration are higher when there is competition compared to a monopoly. Aghion, Griffith and Howitt (2006) have found a U-shaped relationship between competition and vertical integration. By looking at the incentive to innovate, they explain that firm have an incentive to vertically integrate at low and high levels of competitions, but not at a moderate level of competition. These studies show that competition can influence vertical integration.

Market concentration has been used before as a moderator for firm level effects (Shervani et al., 2007). This paper has studied the moderating role of market power of a firm on the effects of asset specificity, internal uncertainty and external uncertainty on the level of vertical integration of the firm. These three factors follow from Transaction Costs Economics. Market power could be a moderator for

these effects, because a firm with a high level of market power can influence the behaviour of another firm without having to integrate this firm. Shervani et al. (2007) have found that market power indeed moderates the effects of asset specificity, internal uncertainty and external uncertainty on vertical integration. They have not found a direct effect of market power on vertical integration, which is contrary to Tucker and Wilder (1977) and Levy (1985).

Following the results of Tucker and Wilder (2005) and Levy (1985) that market concentration has a positive effect on vertical integration, the relationship between trust in legal institutions and vertical integration might be different for different levels of market concentration. If market concentration is low in an industry and therefore vertical integration is not needed, firms in that industry do not have to enforce their contract legally. Because of the low level of market concentration, the firm could easily switch to another firm. In such a situation, the effect of trust in legal institutions on vertical integration is expected to be smaller. If market concentration is high in an industry, vertical integration is needed and thus contracts need to be legally enforced. In this situation, firms in that industry cannot switch easily. Therefore, the relationship between trust in legal institutions and vertical integration would be more negative. This leads to the fourth hypothesis:

> *Hypothesis 4: Market concentration at industry level moderates the relationship between trust in legal institutions and vertical integration at industry level, such that the relationship is more negative when market concentration is high.*

3. Data & Methodology

This chapter describes the data and methodology that are used to test the hypotheses. First, all the data sources are mentioned and explained. This section is divided per type of variable. Next, the descriptive statistics are shown for the data. At last, the empirical methods are described and explained.

3.1 Data sources

3.1.1 Dependent variable

The data for the measurement of the level of vertical integration come from the Industrial Statistics 2 (INDSTAT2) database from the United Nations Industrial Development Organization (UNDIO) (United Nations Industrial Development Organization, n.d.). This database includes the value added and output per sector per country. 174 countries are included with up to 23 different manufacturing industries. These industries are shown in Table A.1 in Appendix A. The industries are categorized using the two-digit level of the International Standard Industrial Classification of All Economic Activities (ISIC) Revision 3 of the United Nations Statistics Division (UNSD). The data are collected from 1986 until 2018. The variables are measured in US dollars, but are not adjusted for the purchasing power parity value.

Observations are only included if both the value added and the output is available for a sector in a country for a specific year. Observations are excluded if the value added is greater than the output and if value added is negative. These observations show measurement errors, because value added is a proportion of output. Observations are as well excluded if value added or output is zero.

The level of vertical integration is determined per industry by the ratio of value added over output. This ratio shows the proportion of output that is produced within the industry. A higher ratio is associated with a higher level of vertical integration. This measurement of vertical integration has also been used by Macchiavello (2012). As this measure shows a proportion, it has a value between 0 and 1.

3.1.2 Main explanatory variable

The data for the trust in legal institutions are derived from the database of the World Bank on worldwide governance indicators (The World Bank, n.d.a). This organisation has data on the rule of law across many countries. This reflects the extent to which agents have trust in legal institutions. This includes amongst others the quality of contract enforcement and property rights. The World Bank uses over 30 sources on the rule of law to construct an index. The data from the individual sources is rescaled to fit on a scale of 0 to 1 (The World Bank, n.d.b). The index consists of a weighted average of the rescaled data. The index is rescaled to a standard normal distribution. This distribution ranges from

around -2,5 to around 2,5. The index is available for 214 countries from 1996 up to 2018. The index is not available for 1997, 1999 and 2001.

3.1.3 Moderating variables

To represent contract enforcement costs, the number of procedures needed to enforce a contract is used. A higher number of procedures reflects higher contract enforcement costs, because court fees might be applicable and an extra procedure means extra work for the lawyer. This measure has also been used by Macchiavello (2012) and Du et al. (2012). The data for this measure comes from the study of Djankov, La Porta, Lopez-de-Silanes and Shleifer (2003). They have collected data on the quality of courts in 109 countries from questionnaires. Lawyers answered questions on the procedure to evict a tenant and to collect a check. These are typical legal situations. Amongst other questions, the lawyers were asked to state the number of independent procedural actions needed to evict a tenant and to collect a check. An independent procedural action is "*a step of the procedure, mandated by law or court regulation, that demands interaction between the parties or between them and the judge or court officer*" (Djankov et al., 2003, p. 469). The results are converted into an index ranging from 0 to 1. The countries with the lowest and highest number of independent procedural actions have a score of respectively 0 and 1. The current study uses the number of procedures needed to collect a check, as this reflects the situation of a firm enforcing a contract the most.

Contract enforcement costs are also used as control variable. Acemoglu et al. (2009) have found a correlation between contract enforcement costs and vertical integration. Macchiavello (2012) also has found weak evidence for an effect of contract enforcement costs on vertical integration. Instrumental factors such as the amount of legal costs involved with a legal procedure influence the level of trust in legal institutions, according to Tyler (2001). Therefore, contract enforcement costs have to be included as control variable.

The data on financial development are derived from the Global Financial Development database of the World Bank (The World Bank, n.d.c). Following Acemoglu et al. (2009) and Rajan and Zingales (1998), the financial development of a country is measured as the value of domestic credit provided to the private sector as a percentage of GDP. This measure is for most countries available from around 2000 to 2017. 214 countries are included.

The data on market concentration across the 21 different manufacturing industries are derived from a dataset of the United States Census Bureau (USCB) on concentration ratios amongst manufacturing industries from the economic census of 2012 (United States Census Bureau, n.d.). The UCSB has determined the Herfindahl-Hirschman index for the 50 largest companies for different manufacturing industries. This index is the sum of squares of the market shares of the 50 largest companies.

The manufacturing industries are categorized using the North American Industry Classification System (NAICS) on a three-digit level. The UNSD states that the data collected under the NAICS and the ISIC are comparable (United Nations Statistical Division, 2002). The 21 manufacturing industries for which the concentration ratios are available, are matched to the manufacturing industries from the ISIC. The matching is based on the descriptions the UCSB and the UNIDO show in their dataset. The industries for which no clear match can be made, are not matched. 8 ISIC industries cannot be clearly matched. 15 ISIC industries can be matched. The matched industries are described in Table A.2 in Appendix A.

Using the concentration ratios of the different industries in the United States assumes that these ratios are representative of or correlated with the concentration ratios of the same industries in other countries. Acemoglu et al. (2009) assume this as well for their data on the capital-intensity across industries and show that this assumption is likely to hold. Capital-intensity is a determinant of industrial concentration (Bhattacharya, 2010). Capital-intensity is also used as a measurement for competition and concentration (Telser, 1966). Therefore, the assumption that the concentration ratio equal amongst the same industries in different countries is likely to hold.

3.1.4 Control variables

Gross domestic product (GDP) per capita is added as control variable. Acemoglu et al. (2009) have found a strong significant negative effect of GDP per capita on propensity for vertical integration in a country. They think that this suggests that differences in the stage of development are the reason for differences in the propensity for vertical integration between countries.

GDP per capita could be related to trust in legal institutions in different ways. As mentioned, trust in legal institutions is related to the size of the informal economy in developing countries (Wallace & Latcheva, 2006). The economic literature does not agree on the effect of GDP on the size of the informal economy. Elgin and Oztunali (2014) have found a positive relationship between GDP per capita and the size of the informal economy for countries with low-quality institutions, but a negative relationship for countries with high-quality institutions. Giles, Tedds and Werkneh (2002) have found evidence that suggests that there is Granger causality from GDP per capita to the size of the informal economy. Duarte (2017) has found only a weak relationship between GDP and the size of the informal economy.

Although the economic literature does not agree on the relationship between GDP per capita and the size of the informal economy, this shows that GDP per capita has to be included as a control variable. Another reason for this is that trust in legal institutions can be related to the development of countries. The stage of development can be reflected by GDP per capita. For example, corruption influences the level of trust in legal institutions (Wallace & Latcheva, 2006). Treismann (2000) has

found that corruption is negatively related to economic development. He measured economic development by GDP per capita. Using the distance to the equator as an instrumental variable he argues that economic development has a negative causal effect on corruption.

Trust in legal institutions is also influenced by the performance of these institutions, although not primarily (Tyler, 2001). Tabellini (2010) has found that the performance of government institutions moderates the relationship between culture and economic development. Culture itself also influences trust in legal institutions (Yang & Tang, 2010).

For all these reasons it can be concluded that there might be a relationship between economic development and trust in legal institutions and between economic development and vertical integration. Therefore, GDP per capita is included as control variable.

The data on the GDP per capita across countries is derived from the dataset of the World Bank (The World Bank, n.d.d). This data is measured in current US dollars. The logarithmic value of GDP per capita is used to adjust for the fact that the distribution of GDP per capita is right skewed.

GDP per capita is the only control variable that is used. GDP per capita can reflect the development of a country. The stage of development is probably a very influential factor. Khanna and Palepu (2000) have found that countries with emerging markets have higher levels of vertical integration. This can be reflected by GDP per capita. As is further described in Section 3.3, multiple dummies are included, which capture many characteristics. Therefore, only GDP per capita is included as control variable.

3.2 Descriptive statistics

The sample that is used consists only of observations from 1996, 1998, 2000 and 2002 until 2017. These are the years for which all data are available. Observations that have missing values for a variable are excluded. 15 manufacturing industries are included. These industries can be found in Table A.1 in appendix A. 87 countries are included. These countries can be found in Table A.3 in Appendix A. The distribution of the logarithmic value of GDP per capita is shown in Figure A.1 in Appendix A. This figure shows that countries with different GDPs per capita are in the sample. Countries with a high GDP per capita are a bit more represented than countries with a low GDP per capita.

Table 3.1 Descriptive statistics

	Statistics				
Variable	**Observations**	**Mean**	**Standard deviation**	**Minimum**	**Maximum**

Vertical integration	18,428	0.33	0.12	0.01	0.99
Trust in legal institutions	18,428	0.53	0.94	-1.72	2.10
Contract enforcement costs	18,428	0.32	0.20	0.03	1.00
Financial development	18,428	75.40	49.70	0.19	253.26
Concentration ratio	18,428	138.28	160.06	10.40	722.80
Log GDP per capita	18,428	9.14	1.36	5.05	11.69

Table 1 shows the descriptive statistics for all the variables. It stands out that there are industries with very low and very high levels of vertical integration. The level of trust in legal institutions fits on purpose of the World Bank a standard normal distribution from around -2,5 to around 2,5, as described. The amount of contract enforcement costs, measured by the number of procedures needed to collect a check, fits as well a specific scale ranging from 0 to 1 on purpose. The level of financial development of countries and the concentration ratios of industries both have a low minimum and high maximum compared to the mean. For both variables the standard deviation is around the same size as the mean.

Table 3.2 Correlation matrix with all variables

		Rows					
Variable		**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
(1)	Vertical integration	1					
(2)	Trust in legal institutions	-0.03***	1				
(3)	Contract enforcement costs	0.06***	-0.51***	1			
(4)	Financial development	-0.03***	0.57***	-0.43***	1		
(5)	Concentration ratio	-0.27***	-0.04***	0.01	-0.02*	1	

(6)	Log GDP per capita	0.01	0.77***	-0.35***	0.62***	-0.03***	1

Note. * p < 0.05, ** p < 0.01, *** p < 0,001.

Table 2 shows the correlation between al variables. The correlations between the level of vertical integration and the other variables are relatively low. The correlation between the level of vertical integration and the level of trust in legal institutions is negative, which is in line with the first hypothesis. The most remarkable correlation is the correlation between the level of vertical integration and GDP per capita. This correlation has a value of 0.01 and insignificant. This insignificant correlation is not in line with the literature discussed in section 3.1.

The correlation between the concentration ratio and the other variables is relatively low as well. The correlation between the concentration ratio and contract enforcement costs is insignificant. The low correlation between the concentration ratio and GDP per capita shows that the concentration ratios of different industries is similar amongst countries with the same GDP per capita. This suggests that the assumption that these ratios are representative of or correlated with the concentration ratios of the same industries in other countries, as has been made, seems plausible.

The correlations between the trust in legal institutions, the number of procedures and financial development are relatively high. This suggests that the level of trust in legal institutions and the level of financial development are relatively high in developed countries and the number of procedures needed to collect a check is relatively low in these countries. The correlations between these variables and GDP per capita support this suggestion.

3.3 Methodology

To study the effects of trust in legal institutions on vertical integration (VI) the following model is used.

$$\begin{aligned} VI_{ict} = \ & \beta_0 + \beta_1 * Country_{ic} + \beta_2 * Industry_{ic} + \beta_3 * Year_t + \beta_4 * Trust\ in\ legal\ institutions_{ct} \\ & + \beta_5 * Trust\ in\ legal\ institutions_{ct} * Number\ of\ procedures_c \\ & + \beta_6 * Trust\ in\ legal\ institutions_{ct} * Financial\ development_{ct} \\ & + \beta_7 * Trust\ in\ legal\ institutions_{ct} * Concentration\ ratio_i \\ & + \beta_8 * Number\ of\ procedures_c + \beta_9 * Financial\ development_{ct} \\ & + \beta_{10} * Concentration\ ratio_i + \beta_{11} * GDP\ per\ capita_{ct} + \varepsilon_{ict} \end{aligned}$$

VI_{ict} means the level of vertical integration for industry i in country c in year t. The variables country, industry and year are a set of country, industry and year dummies. The country dummy takes 1 as value if the industry is of the specific country. The industry dummy takes 1 as value if the industry is of the specific ISIC industry type. The year dummy takes 1 as value if the observation is of the specific year. This means that for each observation one country dummy, one industry dummy and one year

dummy are included. These dummies are included to control for all country, industry and year specific variables, that are not explicitly included in the model. The number of procedures in included to be able to separate the effect of trust in legal institutions from the effect of contract enforcement costs on vertical integration. As discussed in section 3.1 the logarithmic value of the GDP per capita is included as control variable.

This model is estimated with a pooled ordinary least squares (OLS) regression. This means that the specific combinations of an industry in a country are ignored. Every observation on an industry in a country in a certain year is regarded as one observation. Heteroskedasticity robust standard errors are used.

Besides a pooled OLS regression, a fixed effects model is also used. The benefit of this method is that it controls for all time-invariant variables within the period 1996 to 2017. Between-year variations can be exploited to investigate the effect of trust in legal institutions on vertical integration. This means that the model explains differences in the level of vertical integration between years by the differences of the independent variables between years. This results in the following model.

$$\begin{aligned} VI_{ict} = \ & \alpha_{ic} + \beta_1 * Year_t + \beta_2 * Trust\ in\ legal\ institutions_{ct} \\ & + \beta_3 * Trust\ in\ legal\ institutions_{ct} * Contract\ enforcement\ costs_c \\ & + \beta_4 * Trust\ in\ legal\ institutions_{ct} * Financial\ development_{ct} \\ & + \beta_5 * Trust\ in\ legal\ institutions_{ct} * Concentration\ ratio_i \\ & + \beta_6 * Financial\ development_{ct} + \beta_7 * GDP\ per\ capita_{ct} + \ \varepsilon_{ict} \end{aligned}$$

VI_{ict} means the level of vertical integration for industry i in country c in year t. The constant α_{ic} captures all time-invariant variables for industry i in country c. This constant captures the industry and country dummies from the pooled OLS model. Contract enforcement costs, financial development and the concentration ratio are included as moderators. Because the concentration ratios of industries and the amount of contract enforcement costs do not vary over time, these variables are not included as control variables. The logarithmic value of GDP per capita is included as control variable. This is a time-variant variable. As described in section 3.1 this variable could influence the level of vertical integration and the level of trust in legal institutions. The variable year is a set of dummies. The year dummy takes 1 as value if the observation is of the specific year. This model also uses heteroskedasticity robust standard errors.

A pooled OLS regression and a fixed effects model are both used, although the assumptions of the fixed effects model are less strict. The reason for this is that the data on trust in legal institutions might not reflect between-year variations well enough. Trends over longer periods can be analysed,

but small changes from year to year are often due to changes in the methods to collect the data (World Bank, n.d.b). Therefore, both methods are needed to achieve reliable results.

4. Results

This chapter describes the results that follow from the different models. First, the results on the relationship between trust in legal institutions and vertical integration from the pooled OLS regression are reported. Next, the pooled OLS regression with the moderators included are described. Subsequently the fixed effects regression results are described. At the end of this chapter it is discussed whether the hypotheses are accepted or rejected.

4.1 Pooled OLS regression

This section describes the results of the pooled OLS regressions on the relationship between legal institutions and vertical integration. In Table 4.1 the results of the pooled OLS regressions are reported. The models include different sets control variables.

Table 4.1 Results of a pooled OLS regression explaining vertical integration

	Models			
Variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Trust in legal institutions	-0.0039*** (0.0009)	-0.0070*** (0.0015)	-0.0088*** (0.0013)	-0.0214*** (0.0049)
Contract enforcement costs		0.0320*** (0.0052)	0.0298*** (0.0049)	-0.2183*** (0.0583)
Log GDP per capita		0.0059*** (0.0011)	0.0065*** (0.0010)	0.0144*** (0.0036)
Constant	0.3350*** (0.0011)	0.2721*** (0.0102)	0.1489*** (0.0110)	0.4711*** (0.0399)
Observations	18,428	18,428	18,428	18,428
R^2	0.0009	0.0053	0.1620	0.4609
Industry dummies	No	No	Yes	Yes
Country dummies	No	No	No	Yes
Year dummies	No	No	No	Yes

Notes. Robust standard errors are between parentheses. The independent variable has a value between 0 and 1. Trust in legal institutions has a value between approximately -2,5 and 2,5. The variable contract enforcement costs has a value between 0 and 1. Contract enforcement costs are measured by the number of procedures needed to collect a check. The industry base category for the wearing apparel and fur manufacturing industry (ISIC 18). The country base category is Argentine. The year base category is 1996. * $p < 0.05$, ** $p < 0.01$, *** $p < 0{,}001$.

Model 1 shows a significant negative coefficient of trust in legal institutions on vertical integration. This means that an increase in trust in legal institutions is related to a decrease in the level of vertical integration at industry level. This model does not control for any other variable. Therefore, the negative coefficient only reflects the negative correlation between trust in legal institutions and vertical integration, as shown in Table 3.2. The explanatory power of this model, as measured by the R^2, is very low.

Model 2 controls for contract enforcement costs and GDP per capita. The negative effect of trust in legal institutions on vertical integration remains significant and even increases in size. Including the number of procedures shows that the negative effect of trust in legal institutions on vertical integration can be separated from the effect of the performance of legal institutions.

Models 3 includes industry dummies in addition to the control variables of Model 2. Again, the negative effect of trust in legal institutions on vertical integration remains significant and again increases in size. This model shows that the effect of trust in legal institutions is not driven by the industrial composition of the sample. After controlling for industrial composition, the coefficient remains significant and negative.

This result is quite interesting. Acemoglu et al. (2009) found a positive correlation between contract enforcement costs and the propensity for vertical integration. However, this result was driven by differences in industrial composition between countries. Model 3 shows that this is not the case for trust in legal institutions. In addition, the coefficient of contract enforcement costs remains significant and positive in Model 3 after controlling for industrial composition. This result is thus contrary to the results of Acemoglu et al. (2009).

Model 4 is the most extensive model. This model controls for the number of procedures, GDP per capita and for industry, country and year specific characteristics. The coefficient of trust in legal institutions on vertical integration is significant and negative. This effect means that if the level of trust in legal institutions in a country increases with 1 point, on a scale of -2,5 to 2,5, the level of vertical integration in industries in that country decrease with 0,02 points, on a scale of 0 to 1. This decrease in the level of vertical integration can be explained as that the output produced within the industry reduces by 2 percent points. This model explains 46% of the variance in the level of vertical integration.

For comparison, Model 2, without the industry, country and year dummies, explains 0,53% of the variance.

Interestingly, the coefficient of contract enforcement costs is negative in this model. This is contrary to the preliminary result of Acemoglu et al. (2009) that contract enforcement costs are positively related to the propensity for vertical integration without controlling for industrial composition.

This result is also not in line with the results of Macchiavello (2012). He has found some evidence that there is an interaction effect between contract enforcement costs, measured by the number of procedures needed to collect a check, and the contractual needs of industries on vertical integration. Industries with high contractual intensity are vertically integrated, independent of the quality of contract enforcement. However, industries with low contractual needs are only integrated in countries with a low quality of contract enforcement. Macchiavello explains this result by arguing that contracts are always hard to enforce, independent of the quality and costs of contract enforcement.

This logic would result in no direct effect of contract enforcement costs on vertical integration. However, Model 4 shows a negative coefficient. This means that if contract enforcement costs increase, the level of vertical integration in an industry decreases. It is hard to see why this would be so. The size of the coefficient is also relatively high. The amount of contract enforcement costs is measured on a scale of 0 to 1, where the country with the lowest amount of costs has a value of 0 and the country with the highest amount of costs has a value of 1. Therefore, a coefficient of -0.72 means that if the number of procedures increases with 1 point the level of vertical integration in industries decreases on average with 0.72 percent points.

The coefficient of trust in legal institutions on the level of vertical integration from model 4 cannot be interpreted as a causal effect. Although the industry, country and year dummies control for a substantial number of characteristics, most probably there still are characteristics or variables that are not controlled for. For example, characteristics that are specific for an industry, but do not apply for all industries of the same industry type are not controlled for. The same can be said for time-variant variables. Therefore, the negative coefficient can only be interpreted as a negative relationship.

4.2 Pooled OLS regression with moderators

This section describes the results of the pooled OLS regressions including the variables that moderate the relationship between trust in legal institutions and vertical integration. In Table 4.2, the four models are shown that investigate three different moderators. Models 5, 6 and 7 include only one out of the three moderators. Model 8 includes all three moderators to check the robustness of the results.

Table 4.2 Results of a pooled OLS regression explaining vertical integration, including moderating variables

	Models			
Variables	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Trust in legal institutions	-0.0046 (0.0093)	-0.0303*** (0.0059)	-0.0103* (0.0049)	-0.0075 (0.0105)
Contract enforcement costs	-0.2458*** (0.0602)	-0.2451*** (0.0587)	-0.2094*** (0.0553)	-0.2500*** (0.0572)
Financial development		-0,0004*** (0,0000)		-0,0004*** (0,0001)
Market concentration			-0.0013*** (0,0002)	-0,0013*** (0,0002)
Log GDP per capita	0.0152*** (0.0037)	0.0206*** (0.0039)	0.0149*** (0.0036)	0.0211*** (0.0039)
Trust in legal institutions * contract enforcement costs	-0.0508* (0.0250)			-0.0311 (0.0251)
Trust in legal institutions * financial development		0.0002*** (0.0000)		0.0002*** (0.0000)
Trust in legal institutions * market concentration			-0.0001*** (0.0000)	-0.0001*** (0.0000)
Constant	0.4737*** (0.0399)	0.4331*** (0.0409)	0.5306*** (0.0399)	0.4972*** (0.0410)
Observations	18428	18428	18428	18428
R^2	0.4610	0.4621	0.4700	0.4713
Country dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes

Notes. Robust standard errors are between parentheses. The independent variable has a value between 0 and 1. Trust in legal institutions has a value between approximately -2,5 and 2,5. The variable contract enforcement costs has a value between 0 and 1. Contract enforcement costs are measured by the number of procedures needed to collect a check. The industry base category for the wearing apparel and fur manufacturing industry (ISIC 18). The country base category is Argentine. The year base category is 1996. * $p < 0.05$, ** $p < 0.01$, *** $p <$ 0,001.

Model 5 includes an interaction term between trust in legal institutions and the number of procedures. Before discussing this interaction term, it is important to note that the effect of trust in legal institutions on vertical integration is insignificant in this model. The interaction term is significant and negative. The negative interaction effect means that the coefficient of trust in legal institutions on vertical integration is more negative, if the amount of contract enforcement costs in a country is higher. The number of procedures has a value between 0 and 1. Therefore, the interaction term can be explained as that if the amount of contract enforcement costs increases with 1 percent point, the negative coefficient of trust in legal institutions on vertical integration increases with 0.05. This results in an overall negative coefficient of trust in legal institutions on vertical integration in industries.

This result is interesting, because this means that the higher contract enforcement costs are, the more negative the relationship between trust in legal institutions and vertical integration is. This results in less vertical integration. This is contrary to the reasoning explained in paragraph 2.4.1 and to the theory of Acemoglu et al. (2009).

In Model 6 an interaction term between trust in legal institutions and the level of financial development is included. The coefficient of trust in legal institutions is significant and negative. The interaction term is significant and positive. This result shows that the overall coefficient of trust in legal institutions is less negative when there is a high level of financial development. This is not in line with the result of Du et al. (2012) that financial development does not moderate the effect of the quality of contracting institutions on vertical integration. Therefore, this result shows that trust in legal institutions does not behave the same as the perceived quality of contracting institutions.

Model 7 looks at a moderating role of market concentration. The coefficient of trust in legal institutions is significant and negative in this model. The interaction term between market concentration and trust in legal institutions is negative and significant. This means that if the market concentration is high, the coefficient of trust in legal institutions is more negative.

To interpret the resulting effect of trust in legal institutions on vertical integration more concretely, the minimum and maximum values for the market concentration can be substituted into the interaction term. When an industry has the lowest market concentration, the interaction term has a value of -0,0010. This results in an overall coefficient of trust in legal institutions on vertical integration for this industry of -0,0113. For the industry with the highest market concentration, the interaction term has a value of -0,0723. The overall coefficient of trust in legal institutions on vertical

integration for this industry of -0,0826. The coefficient of trust in legal institutions differs thus substantially amongst industry types, depending on their market concentrations.

Model 8 investigates whether the interaction terms are robust to the inclusion of the other interaction terms. Only the interaction term between trust in legal institutions and contract enforcement costs changes. This coefficient is insignificant in this model. This means that this interaction term is not robust. The other two interaction terms remain the same, so they are robust. A noteworthy result of Model 8 is that the effect of trust in legal institutions on vertical integration is insignificant. However, this does not change the meaning of the interaction terms, as explained by Models 6, 7 and 8. Finally, the explanatory power of Model 8 (in terms of R^2) is only marginally larger than the explanatory power of Model 4.

4.3 Fixed effects regression

This section describes the results of the fixed effects regressions modelling the relationship between legal institutions and vertical integration and three possible moderators of this relationship. The models are reported in Table 4.3. From the 18.428 observations, 1.238 groups of observations are made. These groups consist of a specific industry in a specific country.

Table 4.3 Results of a fixed effects regression explaining vertical integration with and without moderating variables

	Models				
Variables	**Model 9**	**Model 10**	**Model 11**	**Model 12**	**Model 13**
Trust in legal institutions	-0.0158* (0.0070)	-0.0204** (0.0071)	-0.0005 (0.0136)	-0.0291** (0.0087)	-0.0188 (0.0097)
Trust in legal institutions * Contract enforcement costs			-0.0600 (0,0382)		
Trust in legal institutions * Financial development				0.0002** (0.0001)	
Trust in legal institutions * Market concentration					-0,0001 (0,0001)
Financial development				-0,0003*** (0,0001)	

Log GDP per capita		0.0126* (0.0056)	0.0136* (0,0057)	0.0186** (0.0060)	0.0126* (0.0056)
Constant	0.3660** (0.0049)	0.2602*** (0.0486)	0,2463*** (0,0493)	0.2254*** (0.0495)	0,2602*** (0,0486)
Observations	18428	18428	18428	18428	18428
Groups	1238	1238	1238	1238	1238
Overall R^2	0.0046	0.0119	0.0224	0.0302	0.0176
Year dummies	Yes	Yes	Yes	Yes	Yes

Notes. Robust standard errors are between parentheses. The independent variable has a value between 0 and 1. Trust in legal institutions has a value between approximately -2,5 and 2,5. Contract enforcement costs has a value between 0 and 1. The year base category is 1996. * $p < 0.05$, ** $p < 0.01$, *** $p < 0{,}001$.

Model 9 only regresses trust in legal institutions on vertical integration. The coefficient is significant and negative. This coefficient does not reflect the correlation between both variables, as Model 1 from Table 4.1 does. The fixed effects model controls for all variables that do not differ over time.

However, Model 9 does not control for variables that do vary over time. In paragraph 3.1, it has been discussed why GDP per capita has to be included as a control variable. GDP per capita varies over time. Therefore Model 10 controls for this variable. The coefficient of trust in legal institutions remains significant and negative. The coefficient becomes a bit stronger.

The fixed effects regression result suggests that the relationship between trust in legal institutions and vertical integration in industries does not seem to be driven by time-invariant characteristics of the specific industry. However, this relationship cannot be interpreted as a causal effect. Time-variant variables are not controlled for. It is likely that there are time-variant variables, such as GDP per capita, that do influence the level of vertical integration and the level of trust in legal institutions. As these variables are not controlled for, the estimated coefficient is not a causal effect.

Model 11 investigates the role of contract enforcement costs as moderator of the relationship between trust in legal institutions and vertical integration. This model estimates an insignificant coefficient. Therefore, this model differs from Model 5. The coefficient of trust in legal institutions is insignificant as well. This result means that contract enforcement costs do not moderate the relationship between trust in legal institutions and vertical integration after controlling for time-invariant variables.

Model 12 investigates an interaction effect between trust in legal institutions and financial development. The estimated coefficient is significant and positive. This means that the conclusion based on the model estimated with a fixed effect regression does not differ qualitatively from the conclusion based on Models 6 and 8 estimated with a pooled OLS regression. This interaction term is the only significant interaction term, as explained above for Model 11 and below for Model 13. Therefore, it is not relevant to test whether this interaction term is robust to the inclusion of other moderators.

Model 13 estimates an insignificant coefficient for market concentration as moderator, contrary to Model 7. Again, the coefficient of trust in legal institutions is insignificant. This result means that market concentration also does not moderate the relationship between trust in legal institutions and vertical integration after controlling for time-invariant variables.

4.4 Accepting or rejecting the hypothesis

This section discusses whether the hypotheses are accepted or rejected. The first hypothesis investigates the sole relationship between trust in legal and vertical integration. This hypothesis states that trust in legal institutions is negatively related to vertical integration at industry level. This hypothesis is generally accepted. Model 1 shows that trust in legal institutions is negatively correlated to vertical integration. Model 4 controls for contract enforcement costs and GDP per capita, as well as industry, country and year characteristics. In this model the coefficient of trust in legal institutions on vertical integration at industry level is significant and negative. Controlling for contract enforcement costs means that the negative coefficient does not simply reflect the quality of the legal institutions when enforcing a contract. Including industry dummies shows that the relationship between trust in legal institutions and vertical integration is not driven by differences in industrial composition between countries.

Model 10 controls for all industry-specific time-invariant variables and for GDP per capita. The coefficient of trust in legal institutions on vertical integration at industry level is significant and negative. This result shows that the relationship is not driven by variables that remain constant over time. Hence, again, based on these results the first hypothesis is accepted.

Hypothesis 2 expects that the relationship between trust in legal institutions and vertical integration is less negative when contract enforcement costs are high. Model 5 estimates a significant negative interaction coefficient between trust in legal institutions and contract enforcement costs on vertical integration. This result is robust to including other moderators, as model 8 shows. This negative interaction coefficient means that the higher contract enforcement costs are, the stronger the negative relationship between trust in legal institutions and vertical integration is. However, Model 12

estimates an insignificant interaction coefficient with a fixed effects regression. Therefore, hypothesis 2 is rejected. Therefore, the explanation that high contract enforcement costs cause a firm to vertically integrate, although the firm has trust in a fair outcome of the legal procedure, is not supported.

The third hypothesis investigates a moderating role of the level of financial development. It is expected that the relationship between trust in legal institutions and vertical integration is more negative when the level of financial development is high. Model 6 and Model 8 both estimate a significant positive coefficient for the interaction term between financial development and trust in legal institutions. The fixed effects regressions from Model 11 and Model 14 also estimate a significant positive interaction coefficient. These results show that the relationship between trust in legal institutions and vertical integration is less negative when there is a high level of financial development. Therefore, hypothesis 3 is rejected. This means that there is no empirical evidence that firms need a developed financial system to be able to vertically integrate, when they have no trust in legal institutions.

Hypothesis 4 expects a moderating role for the level of market concentration in an industry. It is hypothesized that the relationship between trust in legal institutions and vertical integration is more negative when market concentration is high. This hypothesis is the only hypothesis that specifically looks at the conditions an industry operates in and how this affects the relationship between trust in legal institutions and vertical integration in this industry. Model 7 estimates a significant negative interaction coefficient. This result is robust to including the other moderators in Model 8. This means that indeed the negative relationship between trust in legal institutions and vertical integration is stronger when market concentration is high. However, the fixed effects regression of Model 13 estimates an insignificant interaction coefficient. Therefore, hypothesis 4 is rejected.

5. Discussion & Conclusion

This study has researched the question: Is trust in legal institutions related to the level of vertical integration in industries and if so, how are they related? To answer this question, first the results are described. Next, the results are discussed. The validity and limitations of the results is described. Subsequently, the results are discussed with regards to how the results relate to the existing literature. Then, a conclusion is drawn. In the conclusion the research question is answered. At last suggestions for further research and the implications for theory and practice are described.

5.1 Overview of results

The main result of this study is that trust in legal institutions is negatively related to vertical integration at industry level. Both a pooled OLS regression and a fixed effects regression estimated a significant negative coefficient for trust in legal institutions on the level of vertical integration in an industry. The pooled OLS regression controlled for contract enforcement costs, GDP per capita and country, industry and year characteristics. The estimated coefficient was robust to controlling for these factors. The fixed effects regression controlled for GDP per capita and all time-invariant characteristics within 1996 until 2017. The negative coefficient was also robust to the inclusion of these factors. The first hypothesis states that that trust in legal institutions is negatively related to vertical integration at industry level. This hypothesis was accepted based on the results of the pooled OLS regression and the fixed effects regression.

The second, third and fourth hypothesis investigated how this relationship behaves when different circumstances change. Hypothesis 2 expects that the relationship between trust in legal institutions and vertical integration is less negative when contract enforcement costs are high. The pooled OLS regression estimated a significant negative coefficient between trust in legal institutions and contract enforcement costs on vertical integration at industry level. The fixed effects regression estimated an insignificant coefficient. Therefore, hypothesis 2 was rejected. The result from the fixed effects regression shows that the significant negative coefficient estimated with the pooled OLS regression is driven by time-variant factors.

Hypothesis 3 expected an interaction effect between trust in legal institutions and vertical integration. The relationship between trust in legal institutions and vertical integration was hypothesized to be more negative when the level of financial development is high. The pooled OLS regression and the fixed effects regression estimated a significant positive coefficient. This means that the relationship between trust in legal institutions and vertical integration is less negative when there is a high level of financial development. Therefore, this hypothesis was rejected.

The last hypothesis looked at an industry characteristic, namely the level of market concentration in this industry as a moderator. The pooled OLS regression estimated a significant negative coefficient. The fixed effects regression estimated an insignificant coefficient. Therefore, hypothesis 4 that states that the relationship between trust in legal institutions and vertical integration is stronger when market concentration is high, was rejected.

5.2 Discussion

This section discusses the internal and external validity, combined with the limitations that follow from these aspects. Then, the link of this study to the economic literature is discussed.

5.2.1 Internal validity

The main concern with regards to the internal validity of the results of this study is that it is likely that there are variables that affect trust in legal institutions and vertical integration in industries, that are not controlled for. Formally this is known as an omitted variable bias, which entails that the coefficient of trust in legal institutions is related to the error term. Therefore, the estimated coefficient could be caused by these characteristics, rather than a true effect of trust in legal institutions on vertical integration.

This concern is larger for the pooled OLS regression models, than for the fixed effects regression models. The pooled OLS regression models only control for a limited number of observed characteristics, although the country, industry and year dummies capture a lot of variation, which is shown by a large increase in explained variation in the models. The fixed effects regression models control for all time-invariant characteristics and thus for a lot of characteristics. However, time-variant characteristics are not controlled for and an influence of these characteristics on trust in legal institutions and vertical integration is likely to be present. This concern means that the results cannot be interpreted as causal effects, but only as a relationship.

This concern is the reason that the interaction effects of contract enforcement costs and market concentration differ between the results from the pooled OLS regressions and the results from the fixed effects regressions. The pooled OLS regression contains an omitted variable bias, because these regressions do not control for unobserved characteristics. After controlling for unobserved time-invariant characteristics with the fixed effects regressions, the interaction terms were insignificant. Therefore, an omitted variable bias explains why the hypotheses on contract enforcement costs and market concentration were rejected, contrary to the results of the pooled OLS regressions.

An omitted variable bias could also explain why the regression estimated a positive interaction coefficient between trust in legal institutions and the level of financial development. Hypothesis 2

expected the relationship between trust in legal institutions and vertical integration to be more negative, when the level of financial development is high. There can be time-variant characteristics that affect the level of financial development, trust in legal institutions and vertical integration. As these characteristics are not controlled for, the interaction term between financial development and trust in legal institutions captures these characteristics as well. Therefore, the estimated coefficient can be biased, which can explain why the hypothesis was rejected.

A similar concern is that trust in legal institutions is measured at country level. This means that all sorts of country characteristics can affect the results. Country characteristics that remain constant over time are controlled for by the country dummy or the fixed effect. Country characteristics that change over time are not controlled for and are thus omitted variables. For example, industrial composition could affect and bias the results.

Another concern is the possibility of reversed causality between trust in legal institutions and vertical integration. Vertically integrated firms or industries might be less likely to be confronted with a contractual conflict. Therefore, these firms or industries might be less likely to reach out to legal institutions and thus have less experience with these institutions. This could lead to level of trust in legal institutions that is based on misconceptions about these institutions. This could bias the results.

However, the level of trust in legal institutions is measured on country level and not on firm or industry level. This means that the level of trust that is used in the analysis, is not influenced by a specific firm or industry. Therefore, reversed causality is not likely to be a concern.

The sample and data sources can also result in concerns. Section 3.2 describes that different types of countries are represented in the sample. Developed countries as well as developing countries, measured by the GDP per capita, are included. Developed countries are more represented than developing countries. This could mean that the true relationship between trust in legal institutions and vertical integration for all countries can be different than the found results.

To address this concern Models 10 until 14 have been estimated separately for developed and developing countries with a fixed effects regression. To divide the countries in these two groups the classification of the International Monetary Fund has been used (International Monetary Fund, 2020). The results are that the negative relationship between trust in legal institutions is significant and negative for developing countries, but insignificant for developed countries. The coefficients of all the moderators are insignificant for both developing and developed countries. The differences with the main results show that the concerns with regards to the sample and data sources are serious.

With regards to the results on the moderating effect of market concentration, another concern rises. The assumption has been made that that the market concentration ratios of industries of the United States of America are representative of the concentration ratios of the same industries in other countries. It was argued that this assumption is likely to hold. However, if this assumption does not

hold, the result on market concentration as a moderator can be invalid. If this assumption does not hold, this concern could explain why no moderating role of market concentration has been found. Future studies could test whether market concentrations of industries are the same amongst countries.

5.2.2 External validity

The external validity of the results can be discussed on firm and industry level. This study uses data on the level of vertical integration in industries. This means that the results may not be the same at firm level. However, the level of vertical integration of an industry is an aggregate of all the firms in this industry. Therefore, it is unlikely that the effect of trust in legal institutions on vertical integration is much different for firms than for industries.

This study used data on manufacturing industries. The negative relationship between trust in legal institutions and vertical integration might be different for non-manufacturing industries. However, only analysing the manufacturing industry suffices to answer the research question. The reason for this is that Acemoglu et al. (2009) have found an effect of contract enforcement on vertical integration. This effect is stronger for industries that are more capital-intensive. This means that if an effect of trust in legal institutions on vertical integration is found, this is likely to be of the same sign in non-manufacturing industries, but that the size of the effect might be different. The capital intensity of the manufacturing industry is generally seen as high (Frankenfield, 2020). This means the relationship between trust in legal institutions and vertical integration might be smaller for non-manufacturing industries, but this relationship is still likely to be negative for these industries.

5.2.3. Link to the economic literature

The result that trust in legal institutions is negatively related to vertical integration in industries is in line with the study of Du et al. (2012). Their study showed that the perceived quality of contracting institutions has a negative effect on vertical integration by firms in China. The results of the current study are contrary to the studies of Acemoglu et al. (2009) and Macchiavello (2012). Both studies found that contract enforcement costs are not directly related to vertical integration. This difference most likely is due to the distinction between trust in legal institutions and contract enforcement costs. As explained in paragraph 2.4, trust in legal institutions is affected by more factors than only contract enforcement costs. This can explain why the results are contrary to the results of Acemoglu et al. (2009) and Macchiavello (2012).

The result that contract enforcement costs do not moderate the relationship between trust in legal institutions and vertical integration is not in line with the study of Acemoglu et al. (2009). They

found an interaction effect between contract enforcement costs and financial development. The current study does not find a moderating role of contract enforcement costs.

The result that the relationship between trust in legal institutions and vertical integration is less negative when the level of financial development is high is not in line with the result of Du et al. (2012). They have found no interaction effect between the quality of contracting institutions and financial development. Acemoglu et al. (2009) have found a positive interaction effect between on contract enforcement costs and financial development. This means that the relationship between contract enforcement costs and vertical integration is stronger when the level of financial development is high. Contrary to this logic, the current study finds that the relationship between trust in legal institutions and vertical integration is weaker when the level of financial development is high.

The results that market concentration is not a moderator of the relationship between trust in legal institutions and vertical integration is not in line with the study of Shervani et al. (2007). They found that market power of a firm moderates the effects of asset specificity, internal uncertainty and external uncertainty on the level of vertical integration of the firm. This study has found no evidence that market concentration moderates the relationship between trust in legal institutions and vertical integration at industry level.

5.3 Conclusion

The research question of this study was: Is trust in legal institutions related to the level of vertical integration in industries and if so, how are they related? Based on the results, this research question can be answered. Trust in legal institutions is negatively related to vertical integration at industry level. This relationship is less negative when the level of financial development is high. It is unclear whether the relationship between trust in legal institutions is also negative in developed countries. There is no evidence that contract enforcement costs and market concentration moderate the relationship between trust in legal institutions and vertical integration.

5.3.1 Suggestions for further research

This study shows that trust in legal institutions affects vertical integration. Recently, literature has looked into the role of institutions in the integration decision (Acemoglu et al., 2009; Macchiavello, 2012; Du et al., 2012). This literature investigates financial and legal institutions. The relationship of other institutions and vertical integration can be further researched. For example, an effect of the level of bureaucracy in local governments can be researched. The logic behind this effect is that the bureaucracy could for example result in problems with requesting licenses. To avoid these problems, a firm could outsource activities that need licenses.

Another suggestion for further research is to study the effects of the perception of factors that are known to influence vertical integration. For example, Shervani et al. (2007) find that market power is a moderator for factors that influence vertical integration. The moderating role of market power of an integrating firm could also be studied from the perception of the firm that should be influenced by the level of market power of the integrating firm.

5.3.2 Implications for economic theory and societal practice

The suggestions for further research show the implication of this study for the theory on vertical integration. Institutional factors and trust in institutions are related to vertical integration. Perceptions and subjective measures can have different effects on vertical integration than objective measures.

This study also entails an implication for governments. If governments think that vertical integration is undesirable, they could improve trust in legal institutions to decrease the level of vertical integration. However, this implication should be interpreted with caution, as this study does not find a causal effect of trust in legal institutions on vertical integration, but only a negative relationship between both factors.

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Appendix A Sample description

Table A.1 Overview of the ISIC industries from the INDSTAT2 dataset with corresponding NAICS code, including information about whether the industry is included in the analysis sample

ISIC-code	ISIC description	NAICS code	Included
ISIC Section C Division 15	Food and beverages	-	No
ISIC Section C Division 16	Tobacco products	-	No
ISIC Section C Division 17	Textiles	-	No
ISIC Section C Division 18	Wearing apparel, fur	315	Yes
ISIC Section C Division 19	Leather, leather products and footwear	316	Yes
ISIC Section C Division 20	Wood products	321	Yes
ISIC Section C Division 21	Paper and paper products	322	Yes
ISIC Section C Division 22	Printing and publishing	323	Yes
ISIC Section C Division 23	Coke, refined petroleum products, nuclear fuel	324	Yes
ISIC Section C Division 24	Chemicals and chemical products	325	Yes
ISIC Section C Division 25	Rubber and plastics products	326	Yes
ISIC Section C Division 26	Non-metallic mineral products	327	Yes
ISIC Section C Division 27	Basic metals	331	Yes
ISIC Section C Division 28	Fabricated metal products	332	Yes
ISIC Section C Division 29	Machinery and equipment (not elsewhere classified)	333	Yes
ISIC Section C Division 30	Office, accounting and computing machinery	334	Yes
ISIC Section C Division 31	Electrical machinery and apparatus	335	Yes
ISIC Section C Division 32	Radio, television and communication equipment	-	No

ISIC Section C Division 33	Medical, precision and optical instruments	-	No
ISIC Section C Division 34	Motor vehicles, trailers, semi-trailers	-	No
ISIC Section C Division 35	Other transport equipment	-	No
ISIC Section C Division 36	Furniture; manufacturing (not elsewhere classified)	337	Yes
ISIC Section C Division 37	Recycling	-	No

Note. Section C is the manufacturing industry.

Table A.2 Overview of the NAICS industries from the dataset of UCSB on concentration ratios across manufacturing industries with corresponding ISIC industry, including information about whether the industry is included in the analysis sample

NAICS code	**NAICS description**	**ISIC section C code**	**ISIC description**	**Included**
311	Food manufacturing	-	-	No
312	Beverage and tobacco product manufacturing	-	-	No
313	Textile mills	-	-	No
314	Textile product mills	-	-	
315	Apparel manufacturing	18	Wearing apparel, fur	Yes
316	Leather and allied product manufacturing	19	Leather, leather products and footwear	Yes
321	Wood product manufacturing	20	Wood products	Yes
322	Paper manufacturing	21	Paper and paper products	Yes
323	Printing and related support activities industries	22	Printing and publishing	Yes
324	Petroleum and coal products manufacturing	23	Coke, refined petroleum products, nuclear fuel	Yes
325	Chemical manufacturing	24	Chemicals and chemical products	Yes
326	Plastics and rubber products manufacturing	25	Rubber and plastics products	Yes
327	Non-metallic mineral products manufacturing	26	Non-metallic mineral products	Yes

331	Primary metal manufacturing	27	Basic metals	Yes
332	Fabricated metal manufacturing	28	Fabricated metal products	Yes
333	Computer and electronic product manufacturing	29	Machinery and equipment (not elsewhere classified)	Yes
334	Computer and electronic product manufacturing	30	Office, accounting and computing machinery	Yes
335	Electrical equipment, appliance and component manufacturing	31	Electrical machinery and apparatus	Yes
336	Transportation equipment manufacturing	-	-	No
337	Furniture and related product manufacturing	36	Furniture; manufacturing (not elsewhere classified)	Yes
339	Miscellaneous manufacturing	-	-	No

Table A.3 List of countries in the analysis sample

Countries			
Argentina	Egypt	Lebanon	Russian Federation
Australia	El Salvador	Lithuania	Senegal
Austria	Estonia	Luxembourg	Singapore
Bahrain	Finland	Malawi	Slovenia
Bangladesh	France	Malaysia	South Africa
Barbados	Georgia	Malta	Spain
Belgium	Germany	Mexico	Sri Lanka
Bolivia	Ghana	Morocco	Sweden
Botswana	Greece	Namibia	Switzerland
Brazil	Honduras	Netherlands	Tanzania
Bulgaria	Hong Kong	New Zealand	Thailand
Canada	Hungary	Nigeria	Trinidad and Tobago
Chile	India	Norway	Tunisia
China	Indonesia	Pakistan	Turkey
Colombia	Ireland	Panama	Ukraine
Costa Rica	Israel	Paraguay	United Kingdom
Côte d'Ivoire	Italy	Peru	United States of America

Croatia	Japan	Philippines	Uruguay
Cyprus	Jordan	Poland	Venezuela
Czech Republic	Kazakhstan	Portugal	Vietnam
Denmark	Kenya	Republic of Korea	Zambia
Ecuador	Latvia	Romania	

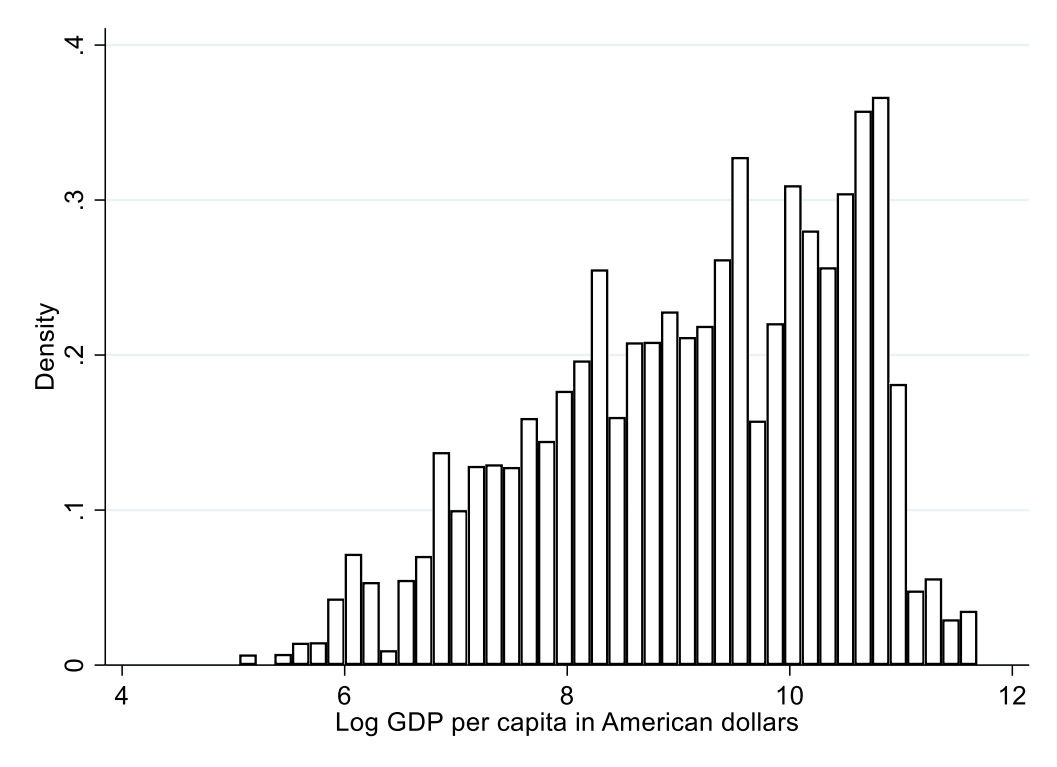

Figure A.1 Graph of the density of the logarithmic value of GDP per capita