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The formal and informal institutional framework of capital accumulation

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Abstract: This paper studies the impact of social trust and formal legal institutions on capital accumulation in a panel of countries. The results not only confirm that both social trust and the quality of formal legal institutions have a positive impact on capital accumulation, but also show that they are substitutes. Specifically, the impact on capital accumulation of an upgrade of the quality of formal legal institutions is larger when social trust is low than when social trust is high, and vice versa. These findings apply both to total investment and to its foreign component, foreign direct investment.

Keywords: investment, foreign direct investment, formal legal institutions, trust.

JEL classification: E020, E220, F210, O110.

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1. Introduction

Although five decades of theoretical and empirical research have uncovered a flurry of determinants of economic growth, the role of capital accumulation as a key driver has seldom been challenged. The classic studies of Levine and Renelt (1992) and Sala-i-Martin (1997) even showed the investment ratio to be the most robust correlate of growth. At the same time, investment has been found to be sensitive to its institutional environment, as reported for instance by Barro (1991), Mauro (1995), and Méon and Sekkat (2005). These findings give support to North's (1990) view that secure property rights over capital and profits are necessary to give an incentive to accumulate capital.

It is thus tempting to jump to the conclusion that a set of simple institutional reforms would guarantee capital accumulation, and should be uniformly adopted. However, yielding to that temptation would be ill-advised. Indeed, as Rodrik (2007) points out, attempts at importing the same set of good practices everywhere may prove futile, if not counterproductive, if they do not take their environment into account. As Dixit (2009) points out, the informal institutional environment, which chiefly includes trust, matters as much as the formal environment. Williamson (2009) nicely summarizes the distinction between formal and informal institutions by defining the former as those that are government defined and enforced, while the latter are private constraints. Evidence supports the view that formal rules interact with their informal environment. In some instances, both factors have been found to be substitutes. For instance, Johnson et al. (2002a) observed in a sample of Eastern European post-communist countries that firms resorted to bilateral relationships where courts were inefficient. Steer and Sen (2010) describe how Vietnamese firms compensate for the shortcomings of the formal legal system by using relational contracts. At the aggregate level, Ahlerup et al. (2009) report evidence that trust and the quality of government interact negatively in growth regressions, suggesting that they are substitutes.

Conversely, formal and informal rules have also been found to be complements. For instance, Lambert-Mogiliansky et al. (2007) observe that the outcome of the enactment of bankruptcy law in Russia differed across regions, depending on the popularity of governors and the quality of their relationship with the federal center. Bjørnskov (2011) studies the impact of legal quality on corruption, observing that it reduces corruption in high-trust countries but has no significant effect in low-trust countries. In other words, legal quality and trust are complements. At the aggregate level, Williamson (2009) reports evidence of a positive interaction between formal and informal institutions in regressions where the dependent

variable is per capita output. This is consistent with the idea that formal and informal institutions are complements.

Surprisingly, no attempt has been made at empirically investigating the interaction of formal and informal rules in determining investment. This is precisely the aim of our paper. To do so, we investigate the impact of formal legal institutions and generalized trust on capital accumulation in a large panel of countries, paying careful attention to the interaction between formal institutions and trust. Trust can be defined as the willingness to make oneself vulnerable to another person's actions, based on beliefs about his/her trustworthiness (Bohnet, 2008). Williamson (1993) argues that trust in transactions can often be interpreted as the outcome of calculativeness, but remarks that social trust is affected by the culture of the society where it is embedded. He argues that a society that closes the eyes to lying and hypocrisy would limit the efficiency of contracts. Social trust is therefore a key informal institution. Since the influential studies of Putnam (1993) and Knack and Keefer (1997), social trust has repeatedly been found to affect economic outcomes, but its interaction with formal institutions has been almost entirely overlooked.

The interaction of trust with formal institutions matters in several respects. Firstly, from a policy perspective, it is important to determine whether local informal factors may affect the impact of formal incentives to invest in a country. If so, then policy advisers will have to take local culture into account before formulating recommendations. In other words, the same set of measures will not be relevant everywhere and irrespective of the local context. Our paper makes a contribution in this respect and may qualify the general literature devoted to the institutional determinants of investment by analyzing how formal and informal factors interact. Secondly, the paper contributes to the literature on the impact of trust by investigating the extent to which it may interact with formal institutions. Thirdly, the paper contributes to our understanding of the interaction of legal rules and their environment by including foreigners in the picture. Whereas our main focus is the overall investment ratio, we add to our baseline results by studying the determinants of the foreign component of capital accumulation, namely foreign direct investment (FDI). Indeed, all the studies in the literature have focused on how the interaction of legal rules and their environment can shape domestic outcomes. By assessing their impact on FDI, we observe how foreigners react to the local formal and informal characteristics of the local country.

To address those questions, the rest of the paper is organized as follows. In the next section, we discuss the formal and informal determinants of capital accumulation by surveying the existing literature. In the third section, we describe our empirical strategy. Baseline

empirical results are reported in section 4. Section 5 reports robustness checks and an extension to FDI, while Section 6 concludes.

2. Theoretical framework

We start this section by recalling that trust and informal institutions directly affect capital accumulation. We then separately survey arguments suggesting that they could be substitutes and arguments suggesting that they could be complements.

2.1. The direct impact of formal institutions and trust

The key reason why formal regulations may affect capital accumulation is the gist of the classic argument of North and Weingast (1989) and North (1990). If property rights over capital and profits are insecure, then incentives to invest will be low.

The argument applies particularly well to the finance sector, with a subsequent impact on investment. Financial transactions are virtually impossible if property rights are not clearly defined, because the lender must be confident that the borrower will eventually repay his/her debt. Unsurprisingly, the law and finance literature spurred by La Porta et al. (1997, 1998, 2000) repeatedly reported a strong relation between formal laws and financial development. The impact of formal institutions on financial development provides an indirect channel through which formal institutions can affect capital accumulation. The impact of financial development is highlighted in a number of theoretical contributions, going back to the early works of Greenwood and Jovanovic (1990) or Bencivenga and Smith (1991), and surveyed in Levine (2005). Castro et al. (2004, 2009) merge the two strands of literature in a model that relates investor protection and investment through capital market imperfections.

Empirically, the impact of formal institutions on investment has been repeatedly reported. The finding of an impact of the quality of formal institutions on aggregate investment goes back to the early contributions of the empirical literature on the impact of institutions on growth, such as Mauro (1995) and Knack and Keefer (1995). In addition, the quality of institutions impacts the foreign component of investment, foreign direct investment, as documented for instance by Méon and Sekkat (2004) or Alfaro et al. (2008).

The notion that trust may have sizeable economic effects goes back at least to the groundbreaking works of Arrow (1972), Coleman (1988), and Putnam (1993). Its potential impact on economic growth was discussed by Putnam (1993) and Helliwell and Putnam (1995).

Arrow (1972) underlined that most transactions involved “an element of trust”, especially when carried out over a period of time. This applies precisely to investment. More specifically, Knack and Keefer (1997) argue that agents in more trustworthy societies need to devote fewer resources to ensuring they are not exploited in a transaction. In such societies, contracting is easier and monitoring less necessary. Chen (2000) argues that the need for complete contracts will be lower in societies where there is some level of trust. Zak and Knack (2001) show how that notion can be incorporated into a general equilibrium model, making it possible to describe the impact of trust on growth.

In addition, because trust reduces the cost of information, it may increase not only the quality of that information but also its quantity. As Dearmon and Grier (2011) remark, firms know about a wider variety of investment opportunities and may more accurately assess their chances of success in a trusting society. In a nutshell, higher levels of social trust reduce transaction costs, and because investment is less risky and less costly, it should be larger in more trusting countries.

From an empirical point of view, the positive impact of trust on total investment was reported in the original contributions of Knack and Keefer (1997) and Zak and Knack (2001). More recently, Dearmon and Grier (2009, 2011) found that higher levels of trust lead to greater physical and human capital accumulation, with a potential positive interaction with education.

2.2. Formal incentives and trust as substitutes

The idea that trust could substitute for formal laws rests on the presumption that trust basically solves the same problems of opportunism, moral hazard, and collective action as do formal rules. If the government is unable or unwilling to back property rights or contracts, then agents will have to rely on informal mechanisms. Trust is therefore a palliative, and will allow transactions that are not protected by formal rules. Knack and Keefer (1997) and Zak and Knack (2001) use that argument to argue that trust should affect investment, but do not go as far as to consider that trust and formal rules should interact. Guiso et al. (2004) apply the same reasoning to financial transactions.

Ahlerup et al. (2009) provide an elaborate formalization of those arguments that specifically focuses on investment. They model an investment decision where lenders must rely either on the trustworthiness of borrowers or on the propensity of courts to enforce debt contracts to get their money back. Trustworthiness is modelled as a non-monetary benefit to borrowers of repaying their debt. In that framework, increased social trust will make investment

contracts possible if the probability that courts will enforce contracts is low, because it provides lenders with an informal guarantee that they will be refunded. In that case, increased social trust will increase investment. Conversely, if the probability that courts will enforce contracts is sufficiently high, then lenders will sign investment contracts regardless of the level of social trust, and investment will be irresponsive to social trust. The upshot of that argument is that trust and formal contract enforcement by courts are substitutes. Specifically, the marginal impact of trust is lower if the formal enforcement of contracts is more likely, and vice versa.

Dearmon and Grier (2011) reach a similar conclusion by remarking that, in trustful environments, the need for very precise contracts is reduced, as well as the probability of litigation. Accordingly, trust makes it possible to economize on formal rules, and higher trust should result in efficiency gains, hence more investment.

The literature reports numerous examples where formal institutions and trust, or social capital, act as substitutes at the microeconomic level. For instance, Bigsten et al. (2000) observed in Burundi, Cameroon, Ivory Coast, Kenya, Zambia, and Zimbabwe, that long-term relationships between manufacturing firms were used to deal with contract non-performance. They also observed that firms were keener on resorting to courts and lawyers in countries where legal institutions were more effective, in line with the notion that informal institutions substitute for weak formal institutions. By the same token, bilateral relationships were found to be used to compensate for weak legal systems in Eastern European post-communist countries by Johnson et al. (2002a). Using measures of social capital that encompass trust, Guiso et al. (2004) observe that, in Italy, households from regions with higher social capital have better access to formalized credit. Moreover, Guiso et al. (2004) find that the marginal impact of social capital is greater in regions with weaker legal enforcement, implying that legal enforcement and social capital are substitutes. Steer and Sen (2010) observe Vietnamese entrepreneurs are forced to resort to informal mechanisms because there is no well-functioning legal system. Using a survey of formal and informal firms in the garment industry in Bolivia, Annen (2013) observes that informal firms substitute social capital for the accessibility and safety of operating in the formal sector, thereby reaching similar sales.

Macroeconomic evidence is scarcer. Ahlerup et al. (2009) estimate growth regressions and provide evidence of a positive interaction between trust and the quality of government, as measured by corruption and law and order, in determining growth. They also report some evidence of a similar effect on investment in single-year cross-country regressions. Dearmon and Grier (2011) find that institutional reforms leading to less corruption and more law and order are less effective at promoting investment in countries with high levels of trust.

2.3. Formal incentives and trust as complements

Trust and formal determinants of investment can be complements because trust is a component of what Tabellini (2008) refers to as generalized morality. Similarly, Arrow (1972) pointed out that trust reflects not only the average likelihood that people abide by informal contracts, but also the way in which the nationals of a country obey the formal laws and regulations of their country. Algan and Cahuc (2009) also use trust as a measure of civic virtue.

Dixit (2009) fleshes out the complementary nature of formal and informal rules. He remarks that two conditions have to be met for a law to be effective. Firstly, citizens must expect the government to succeed in enforcing that law.¹ Secondly, citizens must expect that others will abide by it. Both conditions are related to civic virtue and trust. The first point is a restatement of Knack and Keefer's (1997) argument that government officials in societies with higher trust are perceived as more trustworthy.² The second point is a direct implication of trustworthiness.

An alternative theoretical argument is provided by Bjørnskov (2011). He sets up a formal model where a civil servant considers whether he/she should accept a bribe to grant a license. Accepting the bribe increases the civil servant's income, but entails a fix moral cost and a positive probability of getting caught. To determine the minimum bribe that he/she will accept, the civil servant weighs the certain moral cost of taking a bribe against its expected benefit, which increases with the probability of not getting caught. The minimum bribe is then an increasing function of the ratio of the moral cost of taking a bribe to the probability of not getting caught. On the one hand, virtuous civil servants, who face a larger moral cost, can only be suborned with a large bribe. On the other hand, the size of the bribe may decrease when the probability of getting caught diminishes. The outcome of the model is therefore that the propensity to take a bribe is a function of both a formal institution, the probability of getting caught when being bribed, and an informal institution, morality, that directly relates to trust. More to the point, raising the moral cost of taking a bribe increases the marginal impact of

¹ Raiser et al. (2008) provide an illustration of that condition. Using the BEEPS survey across 26 transition countries, they find that trust among firms, measured by the level of prepayment, is larger when firms are more confident in the formal legal system. Jackson (2013) suggests that the relation should be observable at moderate levels of contract enforcement in particular, with a possible reversal for very high levels of contract enforcement.

² This argument may also be applied to courts. It may thus imply that courts should be more independent in more trusting societies, which, as Hayo and Voigt (2007) argue, is a precondition for the respect of property rights. In line with that presumption, Voigt and Gutmann (2013) report evidence that property rights lead to faster growth, but only once the judicial system is independent enough.

increasing the probability of catching corrupt civil servants, because it decreases the benefit of the bribe relative to the certain moral cost of taking it. The model thus suggests that trust and formal institutions can be complements.

The above argument implies that if a formal regulation designed to promote investment is implemented, it may have a greater effect in a society with higher trust. Conversely, the positive impact of trust on investment is bound to be larger if formal regulations are investment-friendly, because citizens will abide by investment-friendly rules as opposed to the contrary. As a result, trust and formal regulations will be complements.

To our knowledge, the only direct evidence of a positive interaction between trust and formal regulation is provided by Bjørnskov (2011), who observes that legal quality and trust are complements in reducing corruption. We are in particular aware of no such test pertaining to investment or FDI.

Indirect evidence is given by studies showing that the impact of formal laws depends on informal factors affecting the behavior of courts. Johnson et al. (2002b) used a survey of Eastern European firms in the late 1990's, and observed a significant positive relation between their managers' belief in the reliability of courts and their propensity to reinvest earnings. Jappelli et al. (2005) similarly observed that credit is less widely available in Italian provinces with longer trials and larger backlogs, even though legal rules are determined at national level and are thus the same everywhere. Laeven and Woodruff (2007) studied the impact of legal protection on the size of firms in Mexico. They observed that the same legal system led to larger firm size in provinces with more efficient courts. In a cross-country study, Safavian and Sharma (2007) confirmed that creditor rights and efficient courts were complements.

More generally, Dawson (2013) relates the observed differences in the rule of law between two otherwise similar countries, Jamaica and Barbados, to differences in state legitimacy acquired at independence. In other words, an informal political culture, rooted in history, appears to be a complement to the formal legal framework. In line with the microeconomic evidence, Williamson (2009) reports macroeconomic evidence of a positive interaction between formal and informal institutions in regressions where the dependent variable is per capita output.

3. Empirical analysis

To investigate the interaction of formal and informal rules in determining capital accumulation, we interact both sets of rules in a standard long-run investment equation in a panel setting:³

$$\begin{aligned} \log(\text{Investment}/\text{GDP})_{it} = & \alpha_1. \log(\text{GDP}_{0it}) + \alpha_2. \log(\text{School}_{it}) + \alpha_3. \text{Trust}_i \\ & + \alpha_4. \text{Formal rule}_{it} + \alpha_5. \text{Trust}_i * \text{Formal rule}_{it} + \eta_{it} \end{aligned} \quad (1)$$

where:

- $(\text{Investment}/\text{GDP})_{it}$ is country i 's investment to GDP ratio in period t ;
 GDP_{0it} is country i 's initial per capita GDP (in real \$US) in period t ;
 School_{it} is country i 's average primary school ratio over period t ;
 Trust_i is country i 's trust score;
 Formal rule_{it} is an index increasing with the quality of formal legal rules in country i in year t ;
 η_{it} is the error term.

The sources of the variables used are reported in Appendix 2. Initial per capita GDP is controlled for to take convergence into account. We therefore expect it to exhibit a negative coefficient, because countries that are initially better off grow more slowly and need to invest less.

Primary school enrolment is included to proxy the stock of human capital. Investment is bound to be more productive in countries with a better trained workforce. We consequently expect that variable to bear a positive sign.

Trust is measured by the standard trust index, defined as the share of survey respondents in a country who reply affirmatively to the standard question “In general, do you think most people can be trusted?”, which has been asked in a number of surveys since the late 1950s. The trust data employed in this paper essentially derive from the five waves of the World Values Survey (Inglehart et al., 2004), but are supplemented by data from the 1995 and 2003 LatinoBarometro, the 2001-2004 Asian and East Asian Barometers, the 2001-2007 AfroBarometer, and the 2002-2004 Danish Social Capital Project.

³ Following Islam's (1995) panel growth regressions, the sample period (1984-2009) is divided into five shorter periods of five years each, except the first sub-period, which counts six years. More precisely, the periods are: 1984-1989, 1990-1994, 1995-1999, 2000-2004, and 2005-2009. Using five-year periods allows using a panel structure while abstracting from short-run output fluctuations.

At the aggregate level, trust and trustworthiness are approximately the same. According to Bjørnskov (2007), this is because a country's citizens cannot have systematically biased beliefs about the trustworthiness of their fellows. Such a bias seems implausible, especially as most national trust scores are stable over time. They thus tend to reflect long-run equilibria. Those conclusions are in line with the findings of the literature on trust responsiveness surveyed in Bjørnskov (2007, 2010). That interpretation of the trust question is moreover supported by experimental evidence. Glaeser et al. (2000) find that responses to the trust question correlate with senders' trustworthiness in the standard trust game. Sapienza et al. (2013) furthermore observe that responses to the trust question correlate with behavior in a modified trust game where all players play as both senders and receivers, when the stakes are economically meaningful. Berggren and Bjørnskov (2011) provide a detailed survey of the reasons why the trust question indeed captures social trust.

We consider that social trust does not vary significantly in the medium term. Indeed, Bjørnskov (2007) emphasizes that social trust scores are generally very stable over time. Moreover, Uslaner (2008), Guiso et al. (2008), and Tabellini (2008) document a strong correlation between present-day trust levels of second and third generation immigrants in the US and that of their family's country of origin. While some countries are observed in one period only, others are monitored in several waves of each survey. For the latter, we averaged all available observations.

To assess the quality of the formal regulatory framework, our key index is the "Legal Structure and Security of Property Rights" component of the Fraser index constructed by Gwartney et al. (2010).⁴ This component assesses the extent to which formal laws and contracts are enforced. More precisely, it aggregates information on judicial independence, court impartiality, protection of property rights, military interference in rule of law and the political process, integrity of the legal system, legal enforcement of contracts, and regulatory restrictions on the sale of real property. The scores range from zero to 10, with higher values indicating a better environment.⁵

⁴ We also considered the "investment profile" index of the International Country Risk Guide (ICRG), published by the PRS Group. The results obtained with that index are reported in the robustness checks section.

⁵ One should note that the correlation between the trust index and the "Legal Structure and Security of Property Rights" component of the Fraser index though positive is far from perfect, with a coefficient of correlation of only 0.63. For instance, Bangladesh and Singapore have similar levels of trust, 24.83 for Singapore and 22.22 for Bangladesh, but Singapore's property-rights index was 8.33 in the last five-year period of our sample, versus 3.15 for Bangladesh. Conversely, Iran and Turkey had similar property-rights indices, 5.84 for Iran and 5.86 for Turkey, but very different trust scores. Iran's trust is was 37.9 while Turkey's equal to 9. Such discrepancies make identifying the interaction of the two variables possible.

By interacting formal institutions and trust, we let the marginal impact of formal institutions be a linear function of trust, and vice versa.⁶ From (1), one can indeed show that:

$$\frac{\partial \text{Log}(\text{Investment}/\text{GDP})_{it}}{\partial \text{Formal rule}_{it}} = \alpha_4 + \alpha_5 \text{Trust}_i \quad (2a)$$

$$\frac{\partial \text{Log}(\text{Investment}/\text{GDP})_{it}}{\partial \text{Trust}_i} = \alpha_3 + \alpha_5 \text{Formal rule}_{it} \quad (2b)$$

Expressions (2a) and (2b) show that the sign of the coefficient of the interaction term, α_5 , will signal the nature of the relation between the two variables. If, as expected, the coefficient of institutional quality, α_4 , is positive, then a positive α_5 will signal that formal institutions and trust are complements. If α_5 is negative, they will be substitutes.

4. Findings

Equation 1 is estimated using both the OLS and GMM methods. GMM makes it possible to take advantage of the panel structure of the dataset, and to control for endogeneity. One important issue when using GMM, however, is the choice of instruments. These should be highly correlated with the variables to be instrumented (i.e. strong) and uncorrelated with the error term (i.e. valid). In general, papers using GMM report the test of overidentifying restrictions to assess the validity of the instruments but do not explicitly test whether they are strong (see Bazzi and Clemens, 2013, and the references therein). However, as Bazzi and Clemens (2013) point out, the literature shows that tests of overidentifying restrictions are invalid when instruments are weak. Moreover, when using more than one instrumental variable, each of the instruments can appear strong in isolation but be so highly correlated with the others that all of them are weak when used jointly. To deal with this issue, an adaptation of Stock and Yogo's (2005) rule of thumb should be used before running a GMM estimation to test whether the instruments are jointly strong. The instruments can be considered strong enough if the F-statistic of the first-stage regression, where the variables to be instrumented are regressed on the instruments, is above 10. This is the approach we have adopted here.

⁶ For in depth discussions of the method and interpretation of models including an interaction term, the interested reader may refer to Brambor et al. (2006).

Table 1 displays the estimates of equation (1) over a sample of non-primary products exporters (including oil). Merging the various data sources and dropping missing values, we end up with a sample of 46 developed and developing countries (see Appendix 1) over the period 1984-2009. The first two columns report the result of OLS estimations controlling for fixed country effects, while the last two give the results of GMM estimations. The regressions reported in the odd-numbered columns are linear: those in the even-numbered columns include an interaction term. In GMM estimations, the instruments are the lagged initial per capita GDP, the lagged average primary school ratio, the lagged indicator of formal rules, and an indicator of ethno-linguistic fractionalization. The F-statistic discussed above is well above 10, meaning that the instruments are strong. Furthermore, the null hypothesis of no overidentifying restrictions cannot be rejected at standard levels of significance. Both models are therefore correctly identified.

Table 1 Dependent variable: log (Investment / GDP), 5-years averages

| | (1.1) | (1.2) | (1.3) | (1.4) |
|--|---------------------|---------------------|--------------------|---------------------|
| | OLS | | GMM | |
| Constant | -2.289 (2.68)*** | -3.142 (3.65)*** | -1.405 (2.26)** | -11.611 (2.41)** |
| Log(Initial real per capita GDP) | -0.054 (2.23)** | -0.054 (2.54)** | -0.083 (2.03)** | -0.102 (1.09) |
| Log(Primary school enrolment ratio) | 0.240 (1.282) | 0.295 (1.61) | 0.070 (0.468) | 1.173 (1.69)* |
| Trust | 0.001 (0.452) | 0.024 (5.04)*** | 0.001 (0.39) | 0.233 (2.23)** |
| Legal Structure and Security of Property Rights (Fraser index) | 0.021 (1.69)* | 0.103 (5.55)*** | 0.040 (1.47) | 0.649 (2.03)** |
| Trust*Legal Structure and Security of Property Rights (Fraser index) | | -0.003 (5.44)*** | | -0.026 (2.14)** |
| Number of observations | 210 | 210 | 178 | 178 |
| Adjusted R ² | 0.02 | 0.11 | | |
| F-statistic for the strength of the instrument; F (20, 784) | | | 36.76 | 36.76 |
| Test of over identifying restrictions; P-value | - | - | 0.749 | 0.679 |
| Marginal effect of trust at min. formal institutions | | 0.018 (4.87)*** | | 0.182 (2.25)** |
| Marginal effect of trust at mean formal institutions | | 0.004 (2.78)*** | | 0.062 (2.30)** |
| Marginal effect of trust at max. formal institutions | | -0.002 (1.38) | | -0.027 (1.25) |
| Marginal effect of formal institutions at min. trust | | 0.087 (5.30)*** | | 0.497 (1.99)** |
| Marginal effect of formal institutions at mean trust | | 0.016 (1.39) | | -0.128 (1.45) |
| Marginal effect of formal institutions at max. trust | | -0.096 (3.84)*** | | -1.137 (2.15)** |

t-statistics heteroskedastic and autocorrelation consistent. Absolute t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In all regressions, the control variables exhibit the expected sign or are insignificant. More precisely, the coefficient of initial per capita GDP rate is either negative and significant at the five-percent level or insignificant, suggesting a catch-up effect. Similarly, the coefficient of the school enrolment rate is always positive, and is significant at the ten-percent level in regression 1.4.

Let us now focus on the two variables of interest. Both linear regressions, 1.1 and 1.3, suggest that the level of trust is insignificant. In these regressions, the index of formal legal institutions bears a positive coefficient, in line with predictions, but the coefficient fails to be

significant in regression 1.3. It is, however, significant at the ten-percent level in regression 1.1. Those results may suggest that informal institutions are inconsequential once formal institutions are controlled for, but non-linear regressions show that such a conclusion would be ill-advised.

Non-linear estimations are reported in columns 1.2 and 1.4. In both regressions, the coefficients of trust, of formal institutions, and of the interaction term are all individually significant at the five-percent level. More precisely, the coefficients of both trust and formal institutions are positive. More to the point, the interaction terms are negative. These findings first suggest that formal and informal institutions both have a positive effect on investment. Second, the negative sign of the interaction term implies that the two variables are substitutes. In other words, the marginal impact of one variable decreases when the other variable increases.

To interpret those regressions correctly, however, one should not look only at the individual coefficients of trust and formal legal institutions. Individual coefficients should be combined in order to compute meaningful marginal effects. The bottom panel of Table 1 reports the marginal effects of trust and of formal institutions implied by regressions 1.2 and 1.4. The first three rows are devoted to the marginal effect of trust, evaluated at the minimum, mean, and maximum levels of the formal legal institutions index in our sample.⁷

We see that the marginal effect of trust decreases when the Fraser index increases, which is the consequence of the negative sign of the interaction term. More importantly, we observe that the marginal impact of trust is significantly positive at the one-percent level of significance for the minimum value of the Fraser index. It remains positive and significant at the same level when the Fraser index takes its average value. However, when the index reaches its maximum value, the marginal effect of trust turns statistically insignificant at standard levels of significance. The finding is the same in both regression 1.2 and 1.4. The implication is that, while trust and the formal protection of property rights are substitutes, trust matters only as long as the formal institutional framework has not reached a certain quality threshold. Beyond that threshold, trust becomes unimportant for the investment ratio.

The bottom three rows of Table 1 are devoted to the marginal effect of the formal legal institutions index, evaluated at the minimum, mean, and maximum levels of trust in our sample.⁸ The results mirror the results obtained for trust. We see that the marginal effect of the

⁷ The minimum value of the property right index is 1.94, and corresponds to El Salvador during the 1990-1994 period. The mean value of 6.69 corresponds to Greece during the 1995-1999 period, and the maximum value of 8.69 corresponds to Norway during the 2000-2004 period.

⁸ The minimum value of the trust score is 5.77, and was observed in Brazil. The mean value is 29.66, which is the order of magnitude of the trust score in Estonia or Italy. The maximum value is 68.08 and was observed in Denmark.

Fraser index decreases when trust increases, due to the negative sign of the interaction term. It is significantly positive at the five-percent level for the lowest level of trust, and insignificant when trust takes its mean value. Here, however, the marginal impact of formal institutions is significantly negative when trust takes its highest value. In other words, regressions 1.2 and 1.4 confirm that formal institutions and trust are substitutes, but suggest that increasing the security of property rights may reduce investment when trust is high enough.

Figure 1: Marginal effects of trust and Legal Structure and Security of Property Rights (Fraser index) implied by regression 1.4

Fig. 1a: Marginal effect of trust as a function of the Legal Structure and Security of Property Rights index

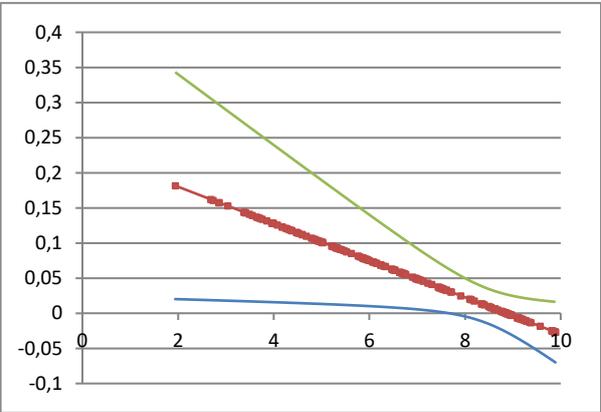
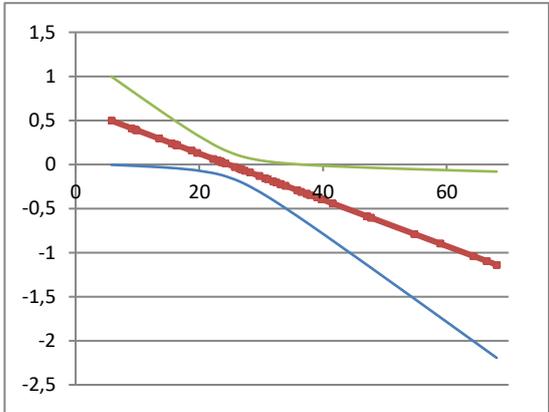


Fig. 1b: Marginal effect of Legal Structure and Security of Property Rights as a function of trust



Figures 1a and 1b plot the marginal effects and the ten-percent confidence intervals implied by regression 1.4.⁹ More specifically, Figure 1a plots the marginal impact of trust for each value of the Fraser index observed in our sample. It confirms that the marginal effect of trust decreases with the protection of property rights. Most importantly, it shows that the marginal effect of trust is significantly positive in the large majority of observations. The marginal effect of trust is only insignificant for observations where the Fraser index exceeds 8, a value that corresponds to Belgium or Ireland.

Figure 1b displays the marginal impact of the quality of legal structure and security of property rights. It confirms that the marginal impact decreases when trust increases. Here, we also see that the marginal effect is significantly positive when trust is low; it becomes insignificant when the trust index exceeds 16 percent (the level of Lebanon or Ecuador), and is

⁹ Note that fewer observations appear in Figure 1b than in Figure 1a, because trust is time-invariant. There is, therefore, one observation by country in Figure 1b while each country appears as a distinct observation for each year in the sample in Figure 1a, because the estimated marginal impact of trust changes every year.

significantly negative for values exceeding 31 percent (the level of Luxembourg or Jordan). Here, the majority of observations remain in the positive or insignificant zone, but the marginal effect of formal institutions turns negative for a fraction of the observations.

Figures 1a and 1b can be complemented by a quantitative assessment of our results. Because the dependent variable is measured in logarithm, estimated marginal effects measure semi-elasticities that can be directly interpreted as such. Let us first compare the marginal impact of trust on investment in two countries with a low and an average property-rights index. In the last period of the sample, Ecuador had an average property-rights index of 3.634, while Kenya's was 5.466, one standard-deviation above Ecuador's. Because the property-rights index is low enough in both countries, Regression 1.4, our favored specification, implies that the semi-elasticity of the investment ratio to trust is significantly positive in both countries. However, this metric in Ecuador is 0.139, while it is only 0.091 in Kenya.

By the same token, we can compare the marginal impacts of improving the property-rights index in two countries with different trust scores. Let us consider Brazil, whose trust score is 5.77, the lowest in the sample, and Venezuela, whose score is 14.11, about half a standard deviation above Brazil's. Regression 1.4 implies that the semi-elasticity of the investment ratio to property rights is 0.499 in Brazil, but only 0.282 in Venezuela.

To sum up, our key finding is that trust and formal legal institutions act as substitutes in determining capital accumulation. Specifically, when the quality of one of the two forms of institutions is weak, the other has a positive marginal effect on the investment ratio. As a corollary, the marginal impact of the quality of one form of institutions decreases when the quality of the other increases. We find that trust has a positive effect when formal institutions are weak, but that its effect becomes insignificant when the quality of formal institutions exceeds a certain threshold.

Our results for formal institutions map those obtained for trust. We report strong evidence that the marginal impact of formal institutions is the largest when trust is at its lowest. The marginal impact of formal institutions also decreases and becomes insignificant when trust increases. We moreover observe that the marginal impact of formal institutions can become negative in very high-trust environments. This finding may be interpreted as suggesting that the formal environment may become too protective when trust is strong enough, thereby deterring investment.

5. Robustness checks and extensions

In this section, we check the robustness of our results to the use of different sets of control variables, the presence of outliers, the possibility of a non-linear interaction between trust and formal institutions, and an alternative measure of the formal protection of property rights. We then extend our results by using an alternative trust measure and distinguishing between trust in various groups of individuals or institutions. Finally, we check whether the finding that we have observed for the aggregate investment ratio applies equally to FDI.

5.1. Different sets of control variables

We have so far used a standard but parsimonious specification. To make sure that our key result is not due to the omission of key variables, we control here for an alternative measure of the human capital stock, for a development dummy variable, for a measure of the quality of the country's infrastructure, and for a measure of the country's trade openness.¹⁰

In our baseline regressions, we have proxied the stock of human capital by the primary school ratio. However, one may argue that secondary education may be necessary for adjusting to technology changes, and is therefore another prerequisite of investment. To make sure that our focus on primary education does not drive our results, we replaced the primary school ratio by the secondary school ratio in our regression. The outcome of that regression is displayed in the first column of Table 2. We observe that the measure of the human capital stock does not correlate with growth at standard levels of significance. However, the results for trust and the Fraser index remain unaffected by the replacement of primary schooling by secondary schooling. In other words, the coefficients of trust and of the Fraser index are both positive and significant at least at the five-percent level, and the coefficient of the interaction term is negative and significant at the one-percent level, in Regression 2.1. Marginal effects are also unaffected. The marginal effect of trust remains positive at least until the Fraser index assumes its mean value, and is insignificant for its maximum value. The marginal effect of the Fraser index is positive at the ten-percent level for low values of trust, insignificant around the mean value, and significantly negative for very large values.

¹⁰ We also ran regressions including continental dummies. Collinearity between regional dummies and the level of trust inflated standard errors. As a consequence, while the signs of key coefficients were unaffected, those coefficients turned out insignificant at standard levels of significance. However, they were significant when dropping the level of trust from the set of control variables in those regressions to deal with collinearity. Specifically the coefficients of the Fraser index and of the interaction term were both significant at the one-percent level, the former being positive and the latter negative. Those results are available upon request.

Table 2. Additional control variables
 Dependent variable: log (Investment / GDP), 5-years averages

| | (2.1) | (2.2) | (2.3) | (2.4) | (2.5) |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|
| Constant | -7.100 (3.32)*** | -7.212 (2.65)*** | -11.095 (2.54)** | -10.203 (2.01)** | -11.547 (2.40)** |
| Log(Initial real per capita GDP) | 0.054 (0.497) | 0.013 (0.11) | 0.031 (0.19) | -0.17 (1.151) | -0.103 (1.055) |
| Log(Primary school enrolment ratio) | | | 0.805 (1.301) | 1.006 (1.363) | 1.172 (1.68)* |
| Log(Secondary school enrolment ratio) | -0.194 (0.844) | | | | |
| Trust | 0.219 (2.65)*** | 0.248 (2.36)*** | 0.217 (2.33)** | 0.223 (2.28)** | 0.231 (2.22)** |
| Legal Structure and Security of Property Rights (Fraser index) | 0.800 (2.71)** | 0.627 (2.18)** | 0.621 (2.09)** | 0.623 (2.07)** | 0.643 (2.04)** |
| Trust*Legal Structure and Security of Property Rights (Fraser index) | -0.028 (2.7)*** | -0.028 (2.36)*** | -0.024 (2.22)** | -0.025 (2.2)** | -0.026 (2.13)** |
| Dummy for developing countries | | | 0.357 (1.03) | | |
| Log(Telephone) | | | | 0.079 (0.49) | |
| log(Freedom to Trade) | | | | | -0.002 (0.004) |
| Number of observations | 177 | 177 | 177 | 177 | 177 |
| Test of over identifying restrictions; P-value | 0.340 | 0.289 | 0.841 | 0.807 | 0.674 |
| Marginal effect of trust at min. formal institutions | 0.133 (2.27)** | 0.194 (2.35)*** | 0.17 (2.15)** | 0.175 (2.11)** | 0.181 (2.05)** |
| Marginal effect of trust at mean formal institutions | 0.039 (2.3)** | 0.062 (2.11)** | 0.059 (2.25)** | 0.059 (2.17)** | 0.061 (2.15)** |
| Marginal effect of trust at max. formal institutions | -0.03 (1.51) | -0.027 (1.37) | -0.024 (1.1) | -0.027 (1.23) | -0.027 (1.16) |
| Marginal effect of formal institutions at min. trust | 0.43 (2.11)** | 0.467 (2.05)** | 0.482 (1.86)* | 0.48 (1.85)* | 0.497 (1.83)* |
| Marginal effect of formal institutions at mean trust | -0.058 (1.1) | -0.196 (1.30) | -0.1 (1.35) | -0.124 (1.46) | -0.126 (1.35) |
| Marginal effect of formal institutions at max. trust | -0.845 (2.19)** | -1.263 (2.27)*** | -1.039 (2.05)** | -1.099 (2.03)** | -1.13 (1.95)* |

t-statistics heteroskedastic and autocorrelation consistent. Absolute t-statistics in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

While controlling for education is common practice in the growth literature, it is also well known that education has been considered as one of the transmission mechanisms of social trust to growth since Coleman's (1988) study. To make sure that this does not affect our results, we run a regression without any indicator of human capital. The results are reported in Column

2.2. Again, the results for trust and the Fraser index are unaffected by not controlling for schooling. The coefficients of trust and of the Fraser index remain positive and significant at least at the five-percent level, and the coefficient of the interaction term is negative and significant at the one-percent level. The marginal effect of trust is positive for the lowest and mean values of the Fraser index, and turns insignificant for its maximum value. The marginal effect of the Fraser index is positive at the five-percent level for low values of trust, insignificant around the mean value, and significantly negative at the one-percent level for very large values of trust. Our key results therefore hinge neither on the choice of the measure of schooling nor on controlling for schooling.

We have so far pooled developing and developed countries. However, investment rates in the two groups may differ in a systematic way, for instance because they belong to different clubs, as suggested by Quah's (1996) findings, or are structurally different, as argued by Eberhardt and Teal (2013). To make sure that systematic differences across the two groups did not drive our results, we added a dummy variable for developing countries to the set of regressors. The results of that regression are displayed in the third column of Table 2.

The results show that the developing countries dummy is insignificant at standard levels. However, the coefficients of trust and of the Fraser index remain both positive and significant at the one-percent level. Moreover, the coefficient of the interaction term remains negative and significant at the five-percent level. The marginal effect of trust is positive and significant at the five-percent level when the formal institutional index takes its lowest value then decreases to a point where it becomes insignificant. The marginal effect of the formal institutional index is positive and significant at the five-percent level in low-trust countries, becomes insignificant in average-trust countries, and turns out negative and significant at the five-percent level for countries with the largest informal institutional index. Our previous results are therefore robust to controlling for the specific nature of developing countries.

The quality of a country's infrastructure may affect the incentive to invest there, as Reinikka and Svensson (2002) observe. At the same time, the quality of infrastructure may be affected by the quality of the country's institutions. To make sure that our results are not driven by the omission of infrastructure quality, we control for the number of phone lines per thousand inhabitants. The regression is displayed in the fourth column of Table 2. The number of lines turns out to be insignificant in that regression. However, the coefficients of trust, of the Fraser index, and of the interaction term are all statistically significant at the five-percent level and keep their previous signs, confirming the robustness of our results. Controlling for infrastructure quality does not affect either the signs or the significance of marginal effects.

Thus, the marginal impact of trust is significantly positive up to a certain level of quality of formal institution, beyond which it turns out insignificant. As before, the marginal effect of formal institutions is positive when trust is low enough, becomes insignificant beyond a certain threshold, and significantly negative when trust is very high.

We also controlled for openness to trade, because the quality of institutions may affect trade, as observed by Méon and Sekkat (2008), and, at the same time, the incentives to invest in a country. As indicator of openness, we use the index published by the Fraser Institute called “Freedom to Trade Internationally”. An increase in the index means higher openness. The resulting regression is displayed in the last column of Table 2. Openness to trade turns out insignificant at standard levels of significance, but controlling for it leaves the coefficients of trust, of the Fraser index, and of the interaction term both qualitatively and quantitatively unaffected. Marginal effects are affected neither qualitatively nor quantitatively by controlling for freedom to trade.

5.2. Outliers

As the sample consists of only 46 countries, single countries could have a substantial influence on the estimates. To assess the sensitivity of our results to a specific country, we run a country jackknife. In other words, we drop each individual country in turn, and estimate the same specification 46 times on a sample consisting of the remaining 45 countries. Table 3 reports the outcome of the two regressions that resulted in the largest and smallest absolute values of the coefficient of the interaction term, because it the key coefficient of interest.¹¹

It shows that our results do not depend on the inclusion of any single country in the sample. We obtain the largest absolute value of the coefficient of the interaction term when Thailand is dropped, and the smallest absolute value of the coefficient when Malaysia is dropped. The coefficient of the interaction term is significant at the five-percent level in the first case, and significant at the one-percent level in the second case.

¹¹ We also ran a regression where all Nordic countries (Denmark, Finland, Iceland, Norway and Sweden) were dropped at the same time, because those countries are known to exhibit very high levels of trust and may thus be outliers. Again, dropping those countries did not affect our key results. The result of that regression is available upon request.

Table 3. Country jackknife

Dependent variable: log (Investment / GDP), 5-years averages

| | (3.1) | (3.2) |
|--|--|---|
| | Largest absolute coefficient of the interaction term | Smallest absolute coefficient of the interaction term |
| Excluded country | Thailand | Malaysia |
| Trust*Legal Structure and Security of Property Rights (Fraser index) | -0.034 (2.051)** | -0.017 (3.338)*** |
| Trust | 0.297 (2.093)** | 0.156 (3.805)*** |
| Legal Structure and Security of Property Rights (Fraser index) | 0.833 (1.986)* | 0.156 (3.805)*** |
| Number of observations | 173 | 173 |
| Test of over identifying restrictions; P-value | 0.82 | 0.16 |
| Marginal effect of trust at min. formal institutions | 0.232 (2.101)** | 0.123 (3.919)*** |
| Marginal effect of trust at mean formal institutions | 0.078 (2.081)** | 0.045 (4.172)*** |
| Marginal effect of trust at max. formal institutions | -0.036 (1.378) | -0.012 (0.931) |
| Marginal effect of formal institutions at min. trust | 0.639 (1.951)* | 0.303 (2.449)*** |
| Marginal effect of formal institutions at mean trust | -0.164 (1.412) | -0.102 (2.092)** |
| Marginal effect of formal institutions at max. trust | -1.459 (2.047)** | -0.755 (3.619)*** |

t-statistics heteroskedastic and autocorrelation consistent. Absolute t-statistics in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

In both cases, the key results obtained in baseline regressions are confirmed. Specifically, the coefficient of the interaction term is always negative, implying that trust and formal legal institutions are substitutes. Moreover, the marginal impact of trust is significantly positive when formal institutions are weak, but becomes insignificant when the quality of formal institutions exceeds a certain threshold. By the same token, the marginal impact of formal institutions is the largest when trust is at its lowest. It decreases and becomes insignificant when trust increases, but becomes significantly negative in countries with the highest level of trust.

5.3. Nonlinearities

We have so far assumed that the marginal impact of trust was a linear function of the security of property rights index, and, conversely, that the marginal effect of the property rights index was a linear function of trust. However, those marginal effects may themselves be nonlinear.

To allow for nonlinearities in the impact of trust, we define four dummy variables corresponding to the quartiles of the property right index. We interacted those dummy variables with the trust indicator. We then included the interaction term and the dummy variables in the regressions as explanatory variables. In doing so, we let the marginal impact of trust differ across quartiles of the property rights index. We used the same method to let the marginal impact of the property rights index differ across quartiles of the trust index. The relations were estimated using the same method as before.

The first column of Table 4 displays the results of the regressions where the impact of trust is allowed to be nonlinear. In those regressions, the marginal impact of trust appears insignificant in the first quartile of property rights. It becomes significantly positive at the ten-percent level in the second quartile, and insignificant in other quartiles. Those results therefore refine the baseline findings. They confirm that trust matters little where property rights are safe, and that it can substitute for the protection of property rights in countries where they are weak. The new result is that trust has no significant effect in countries where property rights are extremely weak.

Table 4. Non-linear interactions
 Dependent variable: log (Investment / GDP), 5-years averages

| | (4.1) | (4.2) |
|--|-------------------|--------------------|
| Log(Initial real per capita GDP) | -0.17 (1.097) | 0.273 (1.008) |
| Log(Primary school enrolment ratio) | 0.387 (0.764) | 0.284 (0.333) |
| Trust * Dummy categorized following Property Rights 1 | -0.044 (0.416) | |
| Trust * Dummy categorized following Property Rights 2 | 0.087 (1.672)* | |
| Trust * Dummy categorized following Property Rights 3 | 0.01 (0.446) | |
| Trust * Dummy categorized following Property Rights 4 | 0.00 (0.00) | |
| Dummy categorized following Property Rights 1+ | -1.029 (0.199) | |
| Dummy categorized following Property Rights 2 | -3.77 (1.464) | |
| Dummy categorized following Property Rights 3 | -1.974 (0.633) | |
| Dummy categorized following Property Rights 4 | -1.635 (0.349) | |
| Property Rights (Fraser index) * Dummy categorized following Trust 1 | | 0.384 (1.742)* |
| Property Rights (Fraser index) * Dummy categorized following Trust 2 | | -0.412 (1.117) |
| Property Rights (Fraser index) * Dummy categorized following Trust 3 | | -0.364 (1.625) |
| Property Rights (Fraser index) * Dummy categorized following Trust 4 | | 1.012 (0.587) |
| Dummy categorized following Trust 1++ | | -7.323 (1.368) |
| Dummy categorized following Trust 2 | | -3.133 (1.089) |
| Dummy categorized following Trust 3 | | -2.74 (0.637) |
| Dummy categorized following Trust 4 | | -14.755 (0.806) |
| Number of observations | 177 | 177 |
| Test of over identifying restrictions; P-value | 0.121 | 0.303 |

t-statistics heteroskedastic and autocorrelation consistent. Absolute t-statistics in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

+ The number 1, 2, 3 and 4 indicate that the dummy takes the value 1 when Property Rights is below the first quartile, between the first and the second quartiles, between the second and third quartiles, and above the third quartile respectively. Otherwise the dummy takes the value 0.

++ Similar to + for the Fraser index instead of trust.

The second column of Table 4 displays the results of the regressions where the impact of property rights is allowed to be a nonlinear function of trust. In that regression, the marginal impact of property rights is positive and significant at the ten-percent level in the lowest quartile of trust. It is insignificant in the other quartiles. Those results confirm that property rights matter little where trust is high, and that they can substitute for trust in countries where trust is low.

5.4. Alternative measures of formal legal institutions

Our results have so far rested on one measure of the quality of formal legal institutions. To make sure they are not driven by a bias in a particular index, we replace the Fraser index by the International Country Risk Guide (ICRG) “investment profile” index published by the PRS Group. The index is the sum of three basic indices assessing three distinct dimensions of the formal environment of investment, namely contract viability, profit repatriation, and payment delays. It ranges from zero to 100, with higher values indicating a better environment. Table 5 reports the results obtained with the ICRG index.

Regression 5.1 displays the results of a linear regression. The coefficient of initial GDP per capita is significantly negative at the ten-percent level, in line with its expected sign. The school enrolment ratio bears a positive sign as expected but turns insignificant at standard levels of significance. We now observe that trust bears a positive sign that is significant at the ten-percent level. The coefficient of the ICRG index is insignificant.

Regression 5.2, where formal institutions and trust are interacted, is broadly in line with our baseline regression 1.4. It confirms that the marginal impact of trust decreases with the quality of formal institutions. It also confirms that the marginal impact of trust is significantly positive, at the five-percent level, when the ICRG index takes its minimum value. The marginal effect of trust becomes insignificant when the ICRG index reaches its average value. It even becomes significantly negative, though only at the ten-percent level, when the ICRG index takes its maximum value.

Table 5. An alternative measure of formal legal institutions (ICRG index)
 Dependent variable: log (Investment / GDP), 5-years averages

| | (5.1) | (5.2) |
|---|-------------------|---------------------|
| Constant | -4.393 (1.86)* | -9.688 (2.59)*** |
| Log(Initial real per capita GDP) | -0.533 (1.8)* | -0.088 (0.79) |
| Log(Primary school enrolment ratio) | 1.211 (1.54) | 0.196 (0.35) |
| Trust | 0.071 (1.91)* | 0.247 (2.29)** |
| Legal Structure and Security of Property Rights | -0.005 (0.13) | 1.004 (2.26)** |
| Trust*Legal Structure and Security of Property Rights | | -0.030 (2.18)** |
| Number of observations | 186 | 186 |
| Test of over identifying restrictions; P-value | 0.64 | 0.562 |
| Marginal effect of trust at min. formal institutions | | 0.173 (2.32)** |
| Marginal effect of trust at mean formal institutions | | 0.007 (0.49) |
| Marginal effect of trust at max. formal institutions | | -0.112 (1.9)* |
| Marginal effect of formal institutions at min. trust | | 0.831 (2.28)** |
| Marginal effect of formal institutions at mean trust | | 0.128 (2.03)** |
| Marginal effect of formal institutions at max. trust | | -1.031 (2.09)** |

Absolute t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The bottom rows of Table 5 show that the marginal effect of formal institutions is again positive and significant at the five-percent level when trust takes its minimum value. It remains significantly positive at the five-percent level when trust is average, but becomes significantly negative at the five-percent level when trust reaches its maximum value in the sample. Those results therefore confirm our baseline findings.

5.5. Alternative measures of trust

To assess the effect of trust, we have so far used the standard trust indicator. One may however be concerned about what this measure of trust actually measures. In particular, responses could reflect trust in public institutions. The World Values Survey contains other questions that can be used to address those concerns. In this section, we use them first as

alternative measures of the same concept of generalized trust, then to study separately trust in more specific entities.

Table 6. Alternative trust measures
Dependent variable: log (Investment / GDP), 5-years averages

| | (6.1) | (6.2) | (6.3) | (6.4) | (6.5) | (6.6) |
|---|-------------------------|-----------------------|---------------------------|--------------------------------|--------------------------------|----------------------------|
| | Fair | Conf. in the gov. | Conf. in the police | Conf. the justice system | Conf. in major companies | Conf. in your family |
| Constant | -1.427 (0.614) | -17.22 (1.92) * | -7.141 (1.948) * | -13.227 (2.952) *** | -22.087 (1.232) | -14.784 (0.464) |
| Log(Initial real per capita GDP) | 0.052 (0.657) | 0.302 (1.495) | -0.056 (0.647) | 0.148 (1.74) * | -0.347 (1.137) | -0.163 (2.12)** |
| Log(Primary school enrolment ratio) | -0.909 (1.283) | -0.453 (0.555) | -0.617 (0.759) | 0.95 (2.549) ** | -2.094 (0.689) | -1.316 (1.231) |
| Trust | 8.122 (2.32) ** | 11.268 (1.75) * | 5.236 (2.91) *** | 3.98 (1.713) * | 23.325 (1.067) | 5.443 (0.706) |
| Legal Structure and Security of Property Rights (Fraser index) | 0.463 (2.53) ** | 1.934 (1.594) | 1.512 (2.19) ** | 0.528 (0.915) | 5.788 (1.165) | 4.815 (1.009) |
| Trust*Legal Structure and Sec. of Prop. Rights | -0.994 (2.61) *** | -1.484 (1.61) | -0.863 (2.27) ** | -0.378 (1.04) | -4.071 (1.143) | -1.26 (1.00) |
| Number of observations | 57 | 118 | 118 | 144 | 148 | 110 |
| Test of over identifying restrictions; P-value | 0.135 | 0.327 | 0.311 | 0.561 | 0.414 | 0.062 |
| Marginal effect of trust at min. formal inst. | 5.885 (2.19) ** | 8.389 (1.801) * | 3.562 (3.054) *** | 3.246 (1.987) ** | 15.427 (1.021) | 1.852 (0.426) |
| Marginal effect of trust at mean formal inst. | 2.11 (1.469) | 1.14 (1.523) | -0.652 (0.542) | 1.478 (3.439) *** | -3.388 (0.786) | -3.416 (1.394) |
| Marginal effect of trust at max. formal inst. | -1.649 (1.584) | -3.409 (1.205) | -3.297 (1.473) | 0.238 (0.173) * | -16.938 (1.188) | -7.018 (1.304) |
| Marginal effect of formal inst. at min. trust | 0.273 (2.275) ** | 0.726 (1.553) | 0.78 (2.106) ** | 0.188 (0.745) | 1.454 (1.226) | 0.444 (1.076) |
| Marginal effect of formal inst. at mean trust | -0.001 (0.008) | -0.146 (1.3) | 0.023 (0.336) | -0.099 (1.98) ** | 0.148 (0.939) | 0.024 (0.544) |
| Marginal effect of formal inst. at max. trust | -0.406 (2.226) ** | -1.605 (1.622) | -0.655 (2.405) ** | -0.415 (1.244) | -2.417 (1.091) | -0.175 (0.825) |

t-statistics heteroskedastic and autocorrelation consistent. Absolute t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

We first calculated an alternative measure of generalized trust by computing the share of respondents who answered “People try be fair” to the question “Do you think most people try to take advantage of you or try to be fair?”. This formulation has been used as an alternative to the usual trust question by Fehr et al. (2003) and D’Hernoncourt and Méon (2012). It addresses more specifically than the usual question how trust in others may affect economic transactions. Its main drawback is that it is available for 40 countries only.

The result of the regression using the alternative measure of general trust leads to results that are similar to those already obtained. Specifically, we find that trust bears a positive coefficient significant at the five-percent level, that the property rights index bears a coefficient that is negative and significant at the one-percent level, and that the interaction term is negative and significant at the one-percent level. In other words, the results are unaffected if we use the alternative measure of trust.

We then focused on measures of trust in more specific entities. In the World Values survey, respondents were asked to rate their confidence in the following entities on a one to four scale (1. A great deal; 2. Quite a lot; 3. Not very much; 4. Not at all): the government, the police, the justice system, major companies, and their family. We computed the average response in each country, inverted it so that it increases with confidence, and then used it instead of the baseline trust measure. In all regressions below, the Security of Property Rights is measured with the Fraser index. The results are displayed in the second to sixth columns of Table 6.

The regressions using specific measures of trust lead to distinct results. Trust indices exhibit a positive coefficient in all regressions, but are only significant in the regressions where trust is defined as pertaining to the government, police, and justice system. Property rights bear a positive sign in all regressions, but their coefficient is only statistically significant in the regression where trust pertains to the police. Finally, the interaction term is negative in all regressions, but is only significant in the regression where trust pertains to the police.

Marginal effects sketch a similar picture. We observe that the marginal effects of trust indices always decrease with the quality of the protection of property rights. However, they are never significant when trust pertains to major companies or the family. When trust pertains to the government or the police, its marginal effect is significant and positive when the property rights index takes its lowest value. Those marginal effects become insignificant at the mean value of the property rights index and beyond. These results are in line with those obtained with more general measures of trust. The results obtained when trust pertains to the justice system are broadly similar. The marginal effect of trust is positive and significant at the one-percent

level for the lowest value of the property-rights index, and decreases thereafter. However, it remains significant at the ten-percent level even in countries where the property rights index takes its highest value.

The marginal effects of property rights lead to similar results. They are never significant when trust pertains to major companies or to the family. They are now also insignificant everywhere when trust pertains to the government. When trust pertains to the police, we find that the marginal impact of property rights is positive and significant at the five-percent level when trust takes its lowest value, insignificant at its average value, and significantly negative at its largest value. When trust pertains to the justice system, the marginal impact of property rights is only significant around the average value of trust. It is however insignificant when trust takes its lowest and highest values.

The results obtained with more specific trust indices broadly match those obtained with generalized trust. While generalized trust does not decompose into trust in specific entities, the results of this section may suggest that trust in public entities such as the government, the police, and the justice system is instrumental in driving the results of previous sections.

5.6. Is foreign investment different?

Our aim in this section is to investigate whether foreign investors react to domestic formal and informal rules in a way similar to domestic investors. In particular, we want to test whether formal and informal rules are complements or substitutes in attracting foreign investors.

Previous research has shown FDI to be sensitive to a series of formal policies chosen at the country level and affected the country's general investment climate. Alfaro et al. (2008) is a recent example of a general assessment of the impact of institutions on FDI. Other contributions, like Méon and Sekkat (2004), Daude and Stein (2007), or Kinda (2010) distinguish the impact of the various dimensions of the investment climate in developing countries and underline the impact of formal policies and institutions.

To our knowledge, the only direct evidence of an impact of trust on FDI is provided by Guiso et al. (2009), who observe that bilateral trust between two countries results in higher bilateral FDI. They do not, however, consider the impact of generalized trust on overall FDI inflows, as we do. The two notions are conceptually different. Bilateral trust measures how agents from one country perceive the trustworthiness of another. Bilateral trust may reflect the affinity of the nationals of the two countries, without assessing their general trustworthiness. Trust measures how agents from one country perceive their own trustworthiness.

To test the impact of formal institutions and trust on FDI, and be consistent with the long-term perspective of the previous section, we apply to FDI the same specification as to the investment ratio.

$$\begin{aligned} \log(FDI/GDP)_{it} = & \beta_1. \log(GDP_{0it}) + \beta_2. \log(School_{it}) + \beta_3. Trust_i \\ & + \beta_4. Formal\ rule_{it} + \beta_5. Trust_i * Formal\ rule_{it} + \eta_{it} \end{aligned} \quad (3)$$

where $(FDI/GDP)_{it}$ is country i 's FDI to GDP ratio in period t , and all the other variables are defined as in previous section.

The relation between per capita GDP and FDI is debated in the empirical literature (Asiedu, 2002). For instance, Schneider and Frey (1985) consider per capita GDP as reflecting firstly the wealth of the residents of the host country and then demand. The expected sign of the corresponding coefficient is therefore positive. In contrast, Edwards (1990) interprets per capita GDP as the inverse of the return on capital in the host country. Thus the coefficient of per capita GDP in the FDI equation is expected to be negative. A higher real per capita income is supposed to decrease the attractiveness of FDI.

Human capital is expected to attract FDI, and is usually found to do so in studies of the impact of the institutional determinants of FDI, such as Méon and Sekkat (2004) and Alfaro et al. (2008). We therefore expect it to bear a positive sign.

The FDI to GDP ratio was retrieved from the World Development Indicators database. All the other variables are drawn from the same sources as in previous section.

Finally, the sample covers the same period as in previous section, namely 1984-2009, and features 58 countries.

Table 7. Dependent variable: log (FDI / GDP), 5-years averages

| | (7.1) | (7.2) |
|--|-----------------------|----------------------|
| Constant | -27.541 (8.796)*** | -44.787 (5.05)*** |
| Log(initial real per capita GDP) | 0.129 (0.67) | 0.228 (0.987) |
| Log(primary school enrolment ratio) | 1.830 (2.382)*** | 3.224 (2.753)*** |
| Trust | -0.001 (0.165) | 0.397 (1.961)** |
| Legal Structure and Security of Property Rights (Fraser index) | 0.037 (0.395) | 1.467 (1.993)** |
| Trust*Legal Structure and Security of Property Rights | | -0.053 (2.017)** |
| Number of observations | 199 | 199 |
| Test of over identifying restrictions; P-value | 0.03 | 0.422 |
| Marginal effect of trust at min. formal institutions | | 0.294 (1.939)* |
| Marginal effect of trust at mean formal institutions | | 0.049 (1.488) |
| Marginal effect of trust at max. formal institutions | | -0.131 (2.120)** |
| Marginal effect of formal institutions at min. trust | | 1.159 (1.980)** |
| Marginal effect of formal institutions at mean trust | | -0.115 (0.971) |
| Marginal effect of formal institutions at max. trust | | -2.169 (2.009)** |

t-statistics heteroskedastic and autocorrelation consistent. Absolute t-statistics in parentheses. ***

p<0.01, ** p<0.05, * p<0.1.

As in previous sections, we start by estimating a linear model, then include interaction terms. The results of those regressions are reported in Table 7. The results of linear regressions are reported in column (7.1), while the estimations of models where formal regulations are interacted with trust are reported in column (7.2). In both columns, the measure of formal institutions is the Fraser index.

In both regressions, the null hypothesis of no overidentifying restrictions cannot be rejected at standard levels of significance. Both models are therefore correctly identified.

In both regressions, the coefficient of initial real per capita GDP turns insignificant, suggesting that FDI does not contribute much to the catching-up process. Conversely, we observe that FDI inflows are sensitive to the stock of human capital, because the coefficient of

the school enrolment ratio is always positive and statistically significant at the one-percent level.

We can now turn to the coefficients of interest, namely those of institutions, trust, and their interaction. In the linear model reported in column 7.1 the coefficient of the Fraser index is insignificant. Moreover, trust exhibits a negative sign but is insignificant. The results of the model including an interaction term between trust and the Fraser index, and reported in column 7.2, displays expected results. In that model, both trust and the Fraser index exhibit a positive coefficient that is significant at the five-percent level. Those coefficients imply that the marginal impact of trust in countries with a Fraser index close to zero is positive, and that the marginal impact of the Fraser index in countries with a trust score close to zero is positive. Most of all, we again observe that the coefficient of the interaction term is negative, implying that the two types of institutions are substitutes.

Again, we have to turn to marginal effects, and look at the bottom panel of Table 7 to correctly interpret the results. We observe that the marginal impact of trust in countries where the Fraser index takes its minimum value is positive and significant at the ten-percent level. Because of the negative sign of the interaction term, we observe that the marginal impact of trust declines as the Fraser index increases. As a result, the marginal impact of trust becomes statistically insignificant at standard levels of significance when the Fraser index takes its mean value. Finally, the marginal effect of trust becomes significantly negative when the Fraser index takes its maximum value. The evolution of the marginal effect of the protection of property rights, reported in the bottom rows of column 7.2, mirrors the change in the marginal effect of trust. Specifically, the marginal effect of the Fraser index is positive and significant at the five-percent level where trust takes its lowest value; becomes insignificant when trust takes its mean value; and it turns negative and significant at the five-percent level when trust takes its highest value.

Taken together, these results mean that an informal institution, trust, can substitute for the quality of formal institutions, and vice versa. Our results are therefore evidence that formal and informal institutions are also substitutes when it comes to attracting foreign direct investment.

6. Concluding comments

In the paper, we have analyzed the interaction of formal and informal institutions in determining capital accumulation. We confirmed that the formal protection of property rights contributes to increasing capital accumulation. We also found that trust had an independent positive impact on capital accumulation. Accordingly, countries with a culture of trust and trustworthiness invest more.

Most importantly, we find evidence that formal institutions and trust are substitutes. These findings seem fairly general. We have found that they apply not only to the overall investment ratio, but also to the foreign component of investment, FDI. The findings are moreover robust. They are resilient to considering various sets of control variables, using alternative measures of the formal protection of property rights, and considering alternative measures of generalized trust. A jackknife estimation shows that they are driven by no specific country in the sample. When allowing the interaction of trust and the formal protection of property rights to be non-linear, we find that the bulk of the interaction takes place in countries where both variables do not take extreme values. In other words, trust cannot compensate for extremely weak formal protection of property rights, and does not matter in countries with high formal protection of property rights. Conversely, formal property rights do not matter in very low-trust or very high-trust countries.

What our results mean is that some countries with higher levels of generalized trust may be capable of investing as much as countries with better formal regulations but less trust. Put differently, countries willing to foster investment may be able to economize on formal regulations because they can rely on their citizens' trustworthiness. The impact of trust is, however, not limited to its moderating influence on the effect of formal institutions. Our results show that it has a direct impact on the investment ratio. It may, moreover, also be a determinant of the quality of institutions. Future research investigating the dynamic impact of trust on formal institutions will refine the assessment of the overall effect of trust on capital accumulation.

Appendix 1: List of countries in the sample

| | | | |
|--------------------|-------------|-------------|----------------|
| Australia | El Salvador | Kenya | Senegal |
| Austria | Finland | Korea, Rep. | South Africa |
| Belgium | France | Kuwait | Spain |
| Brazil | Germany | Luxembourg | Sweden |
| Canada | India | Malaysia | Switzerland |
| Colombia | Indonesia | Malta | Thailand |
| Costa Rica | Ireland | Mexico | Turkey |
| Cyprus | Israel | Morocco | United Kingdom |
| Denmark | Italy | Netherlands | United States |
| Dominican Republic | Jamaica | Norway | Uruguay |
| Ecuador | Japan | Pakistan | |
| Egypt | Jordan | Panama | |

Appendix 2: Sources of the variables

| Variable | Source |
|--|--|
| Investment | World Development Indicators |
| GDP | World Development Indicators |
| Primary school enrolment ratio | World Development Indicators |
| Secondary school enrolment ratio | World Development Indicators |
| Telephone | World Development Indicators |
| Dummy for developing countries | World Development Indicators |
| Legal Structure and Security of Property Rights (Fraser index) | Gwartney et al. (2010) |
| Freedom to Trade | Gwartney et al. (2010) |
| Legal Structure and Security of Property Rights (ICRG) | International Country Risk Guide (ICRG), PRS Group |
| Trust | World Values Survey (Inglehart et al., 2004), LatinoBarometro, Asian and East Asian Barometers, AfroBarometer and the Danish Social Capital Project. |
| Fair | World Values Survey (Inglehart et al., 2004) |
| Conf. in major companies | World Values Survey (Inglehart et al., 2004) |
| Confidence in the government | World Values Survey (Inglehart et al., 2004) |
| Confidence in the police | World Values Survey (Inglehart et al., 2004) |
| Confidence in your family | World Values Survey (Inglehart et al., 2004) |
| Confidence the justice system | World Values Survey (Inglehart et al., 2004) |

Appendix 3: Descriptive statistics

| | Mean | Std. Dev. | Minimum | Maximum |
|----------------------------|--------|-----------|---------|---------|
| Ratio of investment to GDP | -1.565 | 0.200 | -1.990 | -0.919 |
| Real per capita income | 9.424 | 1.026 | 7.133 | 11.164 |
| Primary schooling | 4.618 | 0.129 | 4.005 | 4.994 |
| Trust | 31.280 | 15.223 | 5.774 | 68.076 |
| Property rights (Fraser) | 6.723 | 2.025 | 1.940 | 9.890 |
| Property rights (ICRG) | 8.226 | 2.172 | 3.267 | 12.000 |

Appendix 4: Correlation matrix

| | Ratio of investment to GDP | Real per capita income | Primary schooling | Trust | Property rights (Fraser) | Property rights (ICRG) |
|----------------------------|----------------------------|------------------------|-------------------|-------|--------------------------|------------------------|
| Ratio of investment to GDP | 1.000 | | | | | |
| Real per capita income | -0.040 | 1.000 | | | | |
| Primary schooling | -0.062 | 0.263 | 1.000 | | | |
| Trust | 0.096 | 0.509 | -0.076 | 1.000 | | |
| Property rights (Fraser) | 0.080 | 0.772 | 0.123 | 0.665 | 1.000 | |
| Property rights (ICRG) | -0.007 | 0.523 | 0.146 | 0.258 | 0.433 | 1.000 |

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