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Social trust and central-bank independence

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ABSTRACT

Central banks have become more independent in many countries. A common rationale has been the existence of a credibility (or lack-of-trust) problem for monetary policy. This indicates a possible and until now unexplored link between social trust and central-bank independence. Our empirical findings, based on data from 149 countries, confirm such a link, in the form of a u-shaped relationship. We suggest that two factors help explain this finding: the *need* for this kind of reform and the *ability* with which it can be implemented. At low trust, the need for central-bank independence is sufficiently strong to bring it about, in spite of a low ability to undertake reform. At high trust, the ability to undertake reform is sufficiently strong to bring high independence about, in spite of a low need for it. At intermediate trust levels, lastly, neither need nor ability is strong enough to generate very independent central banks.

JEL classification:

E52, E58, P48, Z13.

Keywords:

Central banks, Independence, Credibility, Trust, Inflation, Monetary policy, Reform

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1. Introduction

Social trust – as measured by the share of people who think that most people can be trusted – seems conducive to the reaching of quite a few social and economic goals. For example, it is positively related to economic growth (Zak and Knack, 2001; Berggren et al., 2008), GDP per capita (Dearmon and Grier, 2009), trade (Guiso et al., 2009), stock-market size (Guiso et al., 2008) and financial integration (Ekinici et al., 2007). Societies in which people think that most people can be trusted thus tend to exhibit many widely valued qualities that are lacking in low-trust societies.

We propose to study whether trust affects central-bank independence. Pinpointing the determinants of this kind of independence is of interest, since previous studies have generally found it to entail low inflation rates – see, e.g., Brumm (2006), Acemoglu et al. (2008), Crowe and Meade (2008) and Klomp and de Haan (2010a). Our hypothesis is that social trust is a factor of importance – in fact, there is a connection between the rationale for making central banks more independent and trust, since the quest to give central banks an independent role largely builds on a perceived credibility (or lack-of-trust) problem. According to the literature on time-inconsistency in monetary policy, starting with Kydland and Prescott (1977) and Barro and Gordon (1983), policymakers have an incentive to renege on their pronounced inflation goals through surprise inflation, which causes the public to eventually not trust announcements of such goals.¹ The equilibrium outcome is the inflation rate at which no further gains can be obtained through inflation surprises. This situation entails inefficiently high inflation with no reduction in unemployment. Rogoff's (1985) solution involves the delegation of monetary policymaking to a conservative central banker, that is, one that puts a lower weight on the loss associated with unemployment than policymakers, resulting in lower inflation in equilibrium. Despite this connection, no previous study has to our knowledge analyzed the relationship between social trust and central-bank independence.

We study social and not particularized trust. The former is unrelated to information about specific persons or organizations – it captures a basic outlook on people in general – while the latter refers to trust in people or organizations one knows or knows something about. Our primary motivation for looking at social trust is that we theorize that central-bank independence is a function of trust towards “everybody”, since a decision to delegate power arguably depends on an assessment, by those undertaking the delegating, of the reactions of very broad groups of

¹ Even though the empirical evidence for time inconsistency is not conclusive, several studies suggest that it is a real problem (see, e.g., Ireland, 1999; Berlemann, 2005; Sachsida et al., 2011).

unidentified actors, such as politicians, voters and civil servants. Only social trust, we argue, fully captures this broad, trusting outlook that is related to a willingness to undertake reform.²

To understand the relationship between trust and central-bank independence we propose two mechanisms that work in opposite directions. On the one hand, there is the *ability* to undertake reforms. This ability is positively related to trust: the more people trust others, the easier it is to agree on delegation of power and to overcome social conflict and strife. On the other hand, there is the *need* for reform. In a setting with low trust, the credibility problem of monetary policy is plausibly very high, and the need to implement central-bank independence reforms is therefore seen as more urgent. At high trust levels, this need is much smaller, since trust can be seen as an informal institution that serves as a substitute for a credible formal institution. In all, the two factors identified indicate a non-linear relationship between trust and central-bank independence. If the need is sufficiently strong at low trust levels, and if the ability is sufficiently high at high trust levels, we obtain a u-shaped relationship when putting the two mechanisms together.

We investigate the relationship empirically by making use of Arnone's et al. (2007) central-bank independence index.³ Social trust is defined as the share of the population that think that most people can be trusted. Previous studies of the determinants of central-bank independence do not include social trust but rather focus on factors such as interest groups and political institutions (Posen 1993), past inflationary experience and political instability (de Haan and van't Hag, 1995), inflation aversion (Hayo, 1998), checks and balances and the design of the political system (Moser, 1999), political fragmentation, legal culture and labour-market structure (Hayo and Hefeker, 2002) and socio-political turbulence and a balance of power between the executive and the legislature (Carmignani et al., 2008).

This study most closely relates to Hayo and Voigt (2008), who look at the effects of judicial independence and trust in the legal system on central-bank independence and inflation rates. They find that both factors are positively related to independence and negatively related to inflation rates. The idea is that there is a second-order commitment problem (Moser, 1999), such that politicians

² This is not to say that it would not be of interest to study the effects on central-bank independence of trust in the central bank as well: such an analysis would be complementary to this one. However, at this point, there are to our knowledge no cross-country data on trust in central banks, so this will have to be a topic for future research.

³ Note that our dependent variable is the level of central-bank independence, while the theory discusses factors that affect central-bank reforms. This forms a consistent story if one views the level as the end result of a period of reforms, which took place in many countries in the 1990s.

may have an incentive to influence monetary policy by trying to intervene in the work of the independent central bank, and that an independent and trusted legal system may make such attempts difficult to undertake. The trust measure, and the suggested mechanism for why this kind of trust matters, is different compared to the one used in this study. We also use another outcome variable: a broad central-bank independence index instead of the turnover rate of central-bank governors (although we use the latter measure in a robustness test).

Our results indeed suggest a u-shaped relationship between social trust and the level of central bank independence. In general, low- and high-trusting societies both tend to delegate considerable power from politicians to independent central bankers, while countries with intermediate levels have a lower degree of independence. Thus, the institutional framework in this area seems to be affected by the level of social trust, a relationship that has not been recognized previously.

2. Theoretical preliminaries

We argue that the relationship between social trust and central-bank independence is a function of two factors: the ability to establish independence and the perceived need to do so. Social trust affects these two factors, which in turn affect the probability and magnitude of reform. As the level of central-bank independence is the end result of a period of reforms, social trust can therefore also be expected to influence this level.

2.1. The ability to undertake central-bank independence reform

In order for mutually beneficial agreements to come about, actors need assurance that they will not be exploited by opportunists and that agreements are reliable. As explained by Knack and Keefer (1997), this can come about through written contracts and formal legal institutions, but this is a costly and imperfect method. An alternative mechanism, which reduces the need for contracts and formal institutions for agreements to come about, is provided by trust.

This reasoning also applies to political decision-making. When reforms are contemplated, there are many obstacles to overcome. Politicians may need assurance that other politicians will not undermine their decisions later on; that bureaucrats will co-operate and not shirk or work for a different agenda; that voters will not quickly withdraw their support as a result of the reforms; and that interest groups will not spend large resources to block or undo the reforms. Such assurance can

to some extent come from credible formal institutions, such as a division of power with a strong and independent legal system acting as a check on legislation, but trust can provide an alternative mechanism through which politicians can obtain assurance of the kinds just mentioned, making them more inclined to and able to undertake reforms.

More specifically, *if politicians trust each other*, both within and between party groups, agreement on reform will be easier (Boix and Posner, 1998; Knack, 2002). Interests are more easily aligned, and gridlock less probable, when political actors do not perceive other such actors to be opportunistic and when they believe that agreements will be adhered to. As an example, Den Butter and Mosch (2003) find that trust among policymakers and among other key actors on the political scene in the Netherlands greatly facilitated the implementation of reforms that contributed to a strong economic development.

Second, *if politicians trust bureaucrats*, this means that they are more prone to delegate power. A major reason for this is that trust mitigates the principal-agent problem; another is that it fosters a sense of co-operation (Boix and Posner, 1998). Bjørnskov (2010) shows empirically that public officials are more honest and therefore more trustworthy in societies with high trust.

Third, *if politicians trust voters*, the latter are believed to assess politicians in a generous and long-term manner, which may facilitate reforms that are socially beneficial in the longer run albeit costly during a transition. Trust in this direction may stem from an expectation of trust in the other direction: social trust implies trust “overall”. For example, if compensation is promised to cover temporary losses, trust from voters to politicians increases the perceived credibility of such a promise, which should reduce resistance to reforms (Heinemann and Tanz, 2008). Reformers are then less worried about immediate electoral punishment.

This reasoning can be applied to level of central-bank independence and the reforms that precede and determine it. Initially, there are some politicians who consider a reform desirable, perhaps because they think it will help bring about lower inflation. As Neumann (1991) and Hayo and Voigt (2008) clarify, for such a reform to be credible, independence needs to be built on a certain institutional structure that guarantees the absence of meddling from the politicians. However, McCallum (1997) and Hayo and Voigt (2008) also point out that there is a second-order commitment problem, such that politicians may still have an incentive to intervene in the *formally* but not necessarily *actually* independent central bank, e.g., influencing governors or the goals for the bank. While *de facto* judicial independence coupled with the public’s trust in legal institutions seem to solve large parts of this problem, we propose that social trust offers an alternative solution to the problem. If trust is present, credibility can be established more easily in a given institutional setting.

Hence, we suggest that trust is positively related to the chance for and size of reform: by making enduring agreement between politicians easier, by politicians having confidence in independent central bankers, by politicians believing that voters will regard the reform generously, and by politicians not seeing a risk for interest-group activity aiming to undermine reform attempts.

Lastly, although we discuss trust between various groups, we indeed see this section as exploring the consequences of *social* trust, which encompasses people in general. This means that it encompasses groups of people, like politicians, bureaucrats as voters, among others, as well – *but not because they are assessed on the basis of how they have acted in their capacities as politicians, bureaucrats and voters* but because they are part of a society in which an attitude of general trust is present. As Knack and Keefer (1997, p. 1253) put it: “Government officials in societies with higher [social] trust may be perceived as more trustworthy, and their policy pronouncements as thus being more credible.” Furthermore, social trust applies to “all” groups without any particular differentiation, including the three identified in this section, unlike particularized trust, e.g., in the form of “institutional” trust, which is directed narrowly at identified groups on the basis of knowledge about how they have carried out specific tasks. The difference between the two with regard to different groups is not, then, that the one does not relate to groups while the other one does but that social trust covers groups as part of people in general while particularized trust covers groups *qua* groups evaluated on group-specific grounds. In addition, social trust extends over time and concerns not only today’s members of these groups but also tomorrow’s. Politicians contemplating reform can be expected to be more prone to engage in reform if they believe in the good intentions and promise-keeping qualities of future political decision-makers. Particularized trust, on the other hand, is essentially backward-looking.

2.2. The need to undertake central-bank independence reform

A second factor of importance is the perceived need to make the central bank more independent. This perceived need follows from the credibility problem of monetary policy, which is big at low levels of trust and which is decreasing in trust.⁴ The reason is that trust can be expected to reduce the problem of time-inconsistency: if there is mutual trust between politicians and voters, the latter do not expect the former to renege on their stated commitments, and the former – in striving

⁴ A perceived need for central-bank independence in low-trust countries need not only be domestic: there can also be *external demands* for such independence, e.g., from the IMF and external lenders (Cukierman, 2008, p. 726).

to continue to be perceived as trustworthy – will hesitate to increase inflation surprisingly. If politicians do not trust each other, there is easily a suspicion that opposing parties will default on their promises in this area in the future. With low trust there is hence weak “social discipline” on monetary policy that makes central-bank independence essential for achieving credibility for a low-inflation approach. The absence of such discipline also implies a low propensity for punishment of opportunism, which Bjørnskov (2010) argues is present in high-trust settings. When people trust each other, they have high expectations and will react more strongly if the agents misbehave, which functions as an incentive not to misbehave. This in turn makes the perceived need for institutional reform smaller: monetary policy-makers are assumed to behave well and avoid such things as inflation surprises.⁵

This is not to say, however, that the perceived need for central-bank independence is necessarily low in an absolute sense in high-trust countries, only that it is lower than in low-trust countries. One reason for the presence of a perceived need in high-trust countries is that even if the majority of people in such countries think that most people can be trusted, few probably trust everybody else wholly and unconditionally. A second reason is that there are individuals in high-trust countries that do not think that most people can be trusted. The highest trust levels, in the Scandinavian countries, are at about 65% of the population – which means that about 35% do not think that most people can be trusted. These two reasons for “incomplete” social trust imply that central-bank independence might still be needed. Nevertheless, all else equal, the perceived need for such independence can be expected to be smaller the higher the level of social trust.

2.3. Putting ability and need together

When putting ability and perceived need together, we can illustrate the relationship between trust and central-bank independence as in Fig. 1.

⁵ This idea that social trust can reduce a need for high-quality institutions is supported by related research. Ahlerup et al. (2009) find that the positive marginal effect of social trust on growth decreases with institutional strength. Aghion et al. (2010), Bergh and Bjørnskov (2011) and Pinotti (2012) indicate that the higher the degree of social trust, the less economic interventionism. As examples of countries with high trust, the Scandinavian states can be mentioned. Bergh (2011) argues that they are also among the most economically free in areas other than the size of the welfare state. Lookofsky (2008) notes that the centuries-old Scandinavian tradition of accepting oral agreements as legally binding can be seen as a reflection of a culture characterized by social trust.

[Fig. 1 near here]

We have the two curves A and N. The former refers to the ability of relevant decision-makers to implement reform in this area (as explicated in Section 2.1); the latter refers to the perceived need to have reform (as explicated in Section 2.2). Summing the two curves produces the u-shaped curve A+N, which gives the “full” relationship between our two main variables.

2.4. *The nature of the influence of social trust*

Even if social trust affects the ability and the perceived need to undertake reform, and thereby the resulting level of central-bank independence in the way suggested in Section 2.3, it is neither necessary nor sufficient for reform to come about. If, say, relatively high trust were necessary, this would imply that high central-bank independence could not be established in low-trust countries (which, according to our theoretical reasoning, it can, due to the high perceived need for reform there). And if relatively high trust were sufficient, this would imply that all countries above a certain trust level would all have high central-bank independence (which is not necessarily the case, even if the ability to undertake reform is high, due to the low perceived need for reform there). Moreover, it could not then be explained why central-bank independence levels vary between countries of equal trust levels – such variation implies that other factors must be relevant as well.

Rather, social trust can be seen as a kind of *catalyst* that influences some but not all of the necessary and jointly sufficient conditions for reform, and the degree to which these conditions are met varies between countries. This explains why countries with similar trust levels have different levels of central-bank independence, or why they have had similar levels of central-bank independence established at different points in time. According to our reasoning above, low or high trust (compared to intermediate levels) makes it more likely that all necessary and jointly sufficient conditions for reform are met, but it alone is neither necessary nor sufficient.

Inspired by Leighton and López (2012) we suggest the following necessary (and maybe jointly sufficient) conditions for central-bank independence reform: that certain ideas have emerged and have been accepted (such as the identification by academic economists of the risk for time inconsistency in monetary policy), that there is a perception of a problem that needs to be solved (high inflation rates) and that some individuals are willing to lead the initiation of a reform process. In

our view, trust arguably affects the latter two of these conditions (by affecting the perceived need for reform and by affecting the ability to undertake reform), but it does not solely cause these necessary conditions to be met and it does not, as we see it, affect the first necessary condition. Social trust thus affects but does not solely cause the implementation of reform and the resulting levels of central-bank independence.

2.5. Reverse causality

Although we cannot rule out reverse causality – that central-bank independence affects social trust – we think the argument for its presence in our analysis is not very clear or strong. As we clarify in Sections 1 and 2.1, it is important to differentiate between social trust, which is the trust concept we use, and “particularized” trust (i.e., trust in organizations or identified groups of people, such as the central bank or the government). These concepts of trust are not only conceptually very different, but also not very closely related empirically (Hooghe and Stolle, 2002). We do not think it is reasonable to expect that *social* trust – the share of people in a society who think that most people can be trusted – is affected by the status or organizational form of the central bank (or by the related time-inconsistency problem). Social trust is a culturally deeply embedded characteristic of a society, which is quite stable over time – as shown by Bjørnskov (2007, pp. 3–5). In fact, he demonstrates that trust has been very stable across the period since 1980 – exactly the period during which central banks have become more independent. If reverse causality is a problem, one would then expect that trust had increased in a number of countries, but it has not.⁶ This stable character differentiates social trust from trust in, say, a government organization, which may fluctuate in accordance with citizens’ perceptions of how well and on what grounds government officials are carrying out their job – see, e.g., Guiso et al. (2007), Tabellini (2010) and Nunn and Wantchekon (2011). However, if we used, say, trust in the central bank as our dependent variable, there would be a distinct risk for a problem with reverse causality.

⁶ A further thing that lends credibility to social trust being stable and deeply culturally embedded is the strong correlation between current trust levels and the trust levels of third-generation immigrants in the United States (Uslaner, 2008; Algan and Cahuc, 2010; Bjørnskov and Tinggaard Svendsen, 2013). If institutional and organizational changes affect trust, we would not expect such clear associations.

3. Data

3.1. Dependent variable

To measure central-bank independence (CBI), our dependent variable, we make use of the index of Arnone et al. (2009). They apply the methodology of Grilli et al. (1991) to calculate a new index measuring central-bank independence for 163 central banks in 2003. This index measures two things, the ability of central banks to choose the final goal of monetary policy and how independently central banks can choose monetary-policy instruments. It ranges from zero (low independence) to one (high independence).

Merging the data for the CBI index with country background data renders a sample covering 149 countries for which the level of central-bank independence is observed at the end of 2003 (CBI₀₃). Table 1 shows descriptive statistics. For comparison, we also include data for the central-bank independence of 73 countries in 1989 (CBI₈₉), as reported by Cukierman et al. (1992).

[Table 1 near here]

Clearly, the level of CBI has increased dramatically around the world, confirming Cukierman's (2008, p. 723) statement that "most central banks in today's world enjoy substantially higher levels of both legal and actual independence than twenty years ago or earlier." For the countries for which we have data for both years, only five decreased their CBI level in this period.⁷

The measure we use captures *de jure* CBI. Is it a problem that we do not use a *de facto* measure, since there may be a discrepancy between the legal stipulations and the way things "really" work? We do not think so, for the following reasons.

First, in developed countries, we see no reason to expect *de facto* and *de jure* CBI to differ, at least not very much (Cukierman, 2008, p. 727). In such countries, the rule of law generally holds and formal institutions tend to be followed in political and legal practice. One thing that strengthens the

⁷ The type of measure that we use has been criticized by Forder (1998) on the grounds that different measures yield quite different results and that it is subjective which factors to include and how to measure and weigh them. While we agree that these constitute weaknesses and that our results should be interpreted keeping these points in mind, we still believe that our type of measure captures CBI to a reasonable degree, as suggested by Berger et al. (2001, pp. 22–23) and Arnone and Romelli (2012, pp. 4–5).

case for *de jure* CBI capturing *de facto* CBI rather well, at least for developed countries, is that quite a few studies do find a negative relationship between *de jure* CBI and inflation (as noted in Section 1). However, in developing countries, there is stronger reason to expect a divergence between *de facto* and *de jure* CBI, as the rule of law is sometimes weak there and where, consequently, formal institutions are not always adhered to in practice. Still, a relationship between *de jure* and *de facto* CBI is plausible. For example, it could be that *de jure* CBI is a necessary (but not sufficient) condition in developing countries for *de facto* CBI; or it could be that *de jure* CBI is positively correlated with *de facto* CBI – the more there is of the former, the more there is of the latter, although the correspondence is not 1-to-1. Thus, if a relationship can be established between social trust and *de jure* CBI, there is also *some* relationship between social trust and *de facto* CBI. Still, it might be wise to complement studies of central-bank independence in developing countries with a proxy for *de facto* CBI.

Second, even though our theoretical analysis primarily concerns *de facto* CBI, it also concerns *de jure* CBI in two ways, and hence, it can be related to the empirical analysis *even if* there should exist a discrepancy in the data between *de facto* and *de jure* CBI. (i) The part of our theory that is presented in Section 2.1 and that concerns the ability to undertake central-bank reform can refer to both *de facto* and *de jure* CBI. The latter case involves changes of formal rules, and our empirical measure documents that such changes have indeed occurred in many countries (see Table 1). We posit that the ability to undertake such reforms have been strengthened by social trust. (ii) The part of our theory that is presented in Section 2.2 and that concerns the perceived need to undertake central-bank reform can also refer to both *de facto* and *de jure* CBI. The latter kind of CBI is relevant to the extent that the perceptions of those able to bring about formal institutional change are such as to relate *de jure* CBI to inflation. They may, for example, hold that a change in the formal standing of the central bank is necessary for *de facto* CBI to occur, with reduced inflation as a consequence – and if so, this creates a link between the perceived need to undertake reform and *de jure* CBI.⁸

3.2. Explanatory variables

Our main explanatory variable is social trust, defined as the share of the population that answers “yes” to the first part of the question: “In general, do you think most people can be trusted

⁸ Despite the arguments in favor of using our measure of *de jure* CBI we complement our analysis by using a proposed indicator of *de facto* CBI – the turnover rate of central-bank governors (TOR). Results are reported in Section 5.2.

or can't you be too careful?" This question is correlated with measures of honest behavior (Knack and Keefer, 1997; Bjørnskov, 2007); the share of people who do not reply to it is very low, typically below 5%, which indicates that people grasp it clearly (Nannestad, 2008); both in-depth interviews (Uslaner, 2002) and the fact that replies to the question predict outcomes of trust experiments reasonably well when the stakes of anonymized games are of economic significance, suggest that the question measures trust in strangers or people whom the respondents do not know (Sapienza et al., 2007; Ostrom et al., 2009; Thöni et al., 2009).⁹ Following Bjørnskov (2007), we use the average of all available and credible observations in the five waves of the World Values Survey, supplemented by data from the LatinoBarómetro, the AfroBarometer, the Asian and East Asia Barometers, and the Danish Social Capital Project.¹⁰ All of these surveys have asked the same trust question.¹¹ This variable is quite stable over time, and by making use of averages of several data points we reduce the risk of having atypical data of individual years in our dataset. As the effect of social trust on central-bank independence is hypothesized to be non-linear, we include a linear as well as a quadratic trust variable in our regressions.

In addition, we use a set of economic and political control variables, based on previous studies that have looked at the determinants of central-bank independence (Posen, 1993; de Haan and van't

⁹ If social trust among the groups of individuals relevant for deciding on CBI deviates from the national average, as captured in our measure, this could make it hard to apply our theory to our findings. As data are not available for the relevant subgroups, we cannot test this strictly, but these subgroups comprise a major part of the population, which probably makes national average values a fairly good approximation of the average values in these groups. Moreover, some support for using the national average value comes from there being small differences in social trust between different socioeconomic groups (Uslaner, 2002, p. 113) and that even if you control for all known individual-level correlates plus state-level differences in the U.S., a high degree of the variation in social trust is explained by inheritance (Algan and Cahuc, 2012).

¹⁰ As a sensitivity analysis below, we use only those social trust values that precede central-bank independence reforms.

¹¹ Since established trust scholars consider the Iranian and Chinese World Values Survey data, as well as the Canadian 2000 trust value in the World Values Survey, as unreliable, on grounds that we find convincing, we exclude them. For example, Bjørnskov (2007, p. 12) writes: "... China and Iran have official generalized trust scores that are approximately 35 percentage points higher – more than two standard deviations – than what would be predicted by a baseline specification that explains about half of the cross-country variation. All remaining results are therefore obtained in a sample that excludes these countries". Cf. Uslaner (2002, p. 226; 2009, p. 38). However, when including them in all regressions in Table 3 below, we find that neither signs nor statistical significance change.

Hag, 1995; Hayo, 1998; Carmignani et al., 2008; Hayo and Voigt, 2008; Dreher et al., 2010). Economic characteristics included in the empirical analysis are the level of inflation, measured by the annualized percentage change in consumer prices from IMF (2011); unemployment, from ILO (2011); gross domestic product (GDP) per capita in US dollars, and the use of fund and credits from the International Monetary Fund, both from World Bank (2011).

The motivation for including inflation is that countries characterized by high inflation could be more prone to implement central-bank independence reforms than countries with low inflation. On the other hand, low values might be an effect of a historically high level of central-bank independence, suggesting that there might be a reverse-causality problem. As for unemployment, the time-inconsistency model of monetary policy implies that the benefit of surprise inflation is higher the larger the gap between the desired unemployment rate and the natural rate of unemployment. Hence, to the extent that low inflation is valued highly, countries with high unemployment could have a larger incentive to increase the level of central-bank independence (Cukierman, 1994).¹² GDP per capita is a standard variable to differentiate between countries on the basis of wealth, but it is unclear what the sign of a possible effect is. As for IMF credits, it has been suggested that reforms to increase central-bank independence have been implemented, especially in less-developed countries, to signal creditworthiness to foreign investors (Maxfield, 1997). We therefore expect this measure to be positively related to the level of central-bank independence.

Political factors used in the analysis are political fragmentation in parliament, whether the country is a federation or not (Lundell and Karvonen, 2003), the number of previous coups (Marshall and Marshall, 2007), the quality of government (International Country Risk Guide, 2008) and a dummy capturing whether the country is a democracy or not (Cheibub et al., 2010). Political fragmentation has a theoretically ambiguous effect: it makes it more difficult to agree on making the central bank more independent, but it also makes the politicians more motivated to tie the hands of the opposition when those in power alternate. The federation dummy takes the value one if the country can be classified as a federation, and zero otherwise. It is a measure of institutional checks and balances, which could be expected to affect the level of central-bank independence, as central banks in such countries tend to be more independent to begin with (Moser, 1999). The average number of coups in the previous 10-year period is included as a measure of political instability, since

¹² Although we would ideally have liked to use the difference between actual and, say, the non-accelerating inflation rate of unemployment (NAIRU), there are not, to our knowledge, sufficient cross-country data for the latter variable to enable this. If unemployment follows NAIRU quite closely, as Elmeskov (1994) suggests, our approach should, however, work as an approximation.

politically unstable countries are plausibly less prone to concern themselves with institutional reforms that delegate power to central banks (Cukierman, 1994). We include the quality of government measure (which is an average of indicators of corruption, law and order and bureaucratic quality), since it could be argued (i) that the way formal institutions work overall affects decisions about how independent the central bank should be and (ii) that social trust might be a proxy for the quality of formal institutions (such that the effect of the former is small if the latter is high). Lastly, the democracy dummy is used since policymakers in democratic countries are arguably more likely to delegate power from themselves to central bankers.¹³

We add two more control variables. The first is the CBI index developed by Cukierman *et al.* (1992), to analyse whether the 2003 level of CBI depends on the initial level of CBI.¹⁴ The second is a dummy for members of the ESCB (European System of Central Banks), since the Maastricht Treaty required the central banks of member states to be independent before the ESCB's establishment date.

Finally, missing data is a potential problem for us, as for many other studies using macro data. Since missing data (if not random) can obscure the analysis, we complement our analyses of the fully observe sample with a multiple imputation approach (following Graham *et al.*, 2003).¹⁵ The multiple imputation approach has been shown to produce unbiased parameter estimates that reflect the uncertainty associated with the missing observations and to provide adequate results in cases of high rates of missing data (Schafer and Graham, 2002). Multiple imputation is also robust to violations of assumptions in the underlying imputation model (Schafer, 1997, p. 136; Allison, 2000; King *et al.*, 2001).¹⁶

¹³ In our sample, 21 countries changed from autocracy to democracy and 5 from democracy to autocracy during the 10-year periods. In such cases, this dummy measures the fraction of the period in which the country has been a democracy.

¹⁴ Our interpretation of CBI_{89} is that it captures past unobserved history, and not controlling for it could distort our inference. However, since including the dependent variable at an earlier date could be interpreted as a test of the change in CBI, we have tried excluding it, and doing so does not change our main results.

¹⁵ Observations are not randomly missing in the case of our data.

¹⁶ We also report results using traditional mean imputation, i.e., we replace missing values with the mean value of the observed observations for each variable. This type of imputation does not affect the slope estimates in linear regressions, but suffers the disadvantage of lowering variability in the variables. The multiple imputation method avoids the latter problem.

This approach involves three phases. In the first, the missing data are replaced m times to generate m complete data sets. In the second, each of the m complete data sets is analyzed separately. Lastly, the results from the m complete data sets are combined for inference. An iterative Markov Chain Monte Carlo (MCMC) method (Gilks et al., 1995) is used to impute the missing observations. The MCMC is used to simulate a predictive distribution for the missing observations based on the mean and covariance structure of the observed data. The imputed values are then drawn from this distribution. Rubin (1987) shows that there is little advantage in producing and analyzing more than a few imputed datasets. Based on this, the current study utilizes five imputed sets of data. The empirical analysis is performed on each of these datasets and the estimation results for each are later combined, using the rules established by Rubin (1987), to produce one set of estimation results. The means, standard deviations and missing observation for all variables (with imputed values) averaged over the five data sets are shown in Table 2.

[Table 2 near here]

4. Outline of empirical analysis

The level of central-bank independence is observed at the end of 2003. A potential problem when deciding what years of the economic and political background variables to include is that the level of central-bank independence observed in 2003 was achieved through reforms in different years prior to 2003; likewise small, gradual change has occurred in some countries after the reforms. Analyzing the cross-section of central-bank independence levels in 2003 with explanatory variables measured during the reform period would then risk including values from time periods *after* the actual central-bank independence level was achieved. This could bias our inference since, e.g., the level of independence would affect inflation.

To avoid this we let the ten-year periods before the years in which central-bank independence reforms occurred – where the reform-occurrence data come from Daunfeldt et al. (2013) – determine the values of the explanatory variables (with the exception of social trust).¹⁷ Hence, for a country recorded to have undertaken a major central-bank independence reform in 1998, we assume that this was the year when the level of central-bank independence observed in 2003 was

¹⁷ Models using five-year periods have also been estimated. All results remain qualitatively the same.

achieved. For such a country, we therefore use the average value of the explanatory variables in 1988–1997, and in this manner we use individual time periods for each country.¹⁸

Unlike the other explanatory variables, our main variable of interest, social trust, is not in the main analysis measured as the average of annual values during the 1980s or of the ten-year average of the decade before reform was undertaken. Instead, for this variable, we use the average of all available observations, based on all waves from the World Values Survey and complementary surveys asking the same question. This implies that the values derive from a period from the early 1980s until the mid-2000s. As previously discussed, we argue that this is not a severe problem, both because social trust is a stable variable that changes little over time and because there is no strong theoretical reason to expect central-bank independence to influence the general level of social trust in a society. In addition, there are relatively few observations available for social trust, which means that we would experience a severe loss in data if we used the same approach as for the other explanatory variables. Still, we do this as a robustness check in Section 5.2.

Our dependent variable, central-bank independence (CBI), is measured in terms of an index bounded between zero and one. We use linear regression to study its determinants and transform the dependent variable from a fraction (0–1) to a continuous variable by means of the logistic transformation.¹⁹

$$y = \ln(x/(1-x)). \quad (1)$$

Although transforming the dependent fractional variable makes it more suitable for analysis with linear regression, a less *ad hoc* and more efficient approach is to account for the fractional feature by use of a regression model based on the beta distribution. In the current analysis we employ beta regressions to test the robustness of results obtained from the conventional linear regression models. Following Ferrari and Cribari-Neto (2004), the density of the beta distribution is parameterized as

$$f(y | \mu, \phi) = \frac{\Gamma(\phi)}{\Gamma(\mu\phi)\Gamma((1-\mu)\phi)} y^{\mu\phi-1} (1-y)^{(1-\mu)\phi-1}, 0 < y < 1, \quad (2)$$

¹⁸ As a robustness test, we use the mean values of the explanatory variables from the pre-reform period (1980–1989), using the same time period for all countries. The results are qualitatively similar. Using the mean values of the explanatory variables from 1994–2003 for countries without an explicit CBI reform in the period under study does not affect the main results either. Results are available on request.

¹⁹ Direct analysis of the fractional variable with linear regression does, however, give similar results in terms of signs and significance.

where $E(y) = \mu$ and $\text{var}(y) = V(\mu)/(1 + \phi)$ is the mean and variance of the distribution, respectively. Note here that the mean is bounded between zero and one, i.e., $0 < \mu < 1$, and that $\phi > 0$ can be interpreted as a precision parameter in the sense that, for fixed μ , the larger the value of ϕ , the smaller the variance of y . By using a logit linking function for the mean, explanatory variables are introduced in the model, as follows:

$$\mu = \frac{\exp^{x_i^T \beta}}{1 + \exp^{x_i^T \beta}}, \quad (3)$$

where $x_i^T = (x_{i1}, \dots, x_{ik})$, $i = 1, \dots, n$, are the k explanatory variables for the sample of n countries and $\beta = (\beta_1, \dots, \beta_k)$ is a vector of unknown parameters. The parameters are identified by maximum likelihood based on the above beta density.

5. Empirical results

5.1. Main results

Estimation results for linear and beta regression models on non-imputed, mean imputed and multiple imputed samples are displayed in Table 3.

[Table 3 near here]

The results for all models indicate a non-linear (u-shaped) relationship between the level of social trust and CBI, in line with our theoretical reasoning in Section 2.²⁰ The hypothesis of a linear

²⁰ With regard to the multiple imputed samples, the estimate of social trust varies between -3.558 and -3.287, while social trust² varies between 4.323 and 4.709. This indicates a high degree of similarity between these samples. Moreover, the two estimates are jointly significant in virtually all our estimations.

relationship against the quadratic alternative is rejected at the 5% level for all models. We have also included higher order polynomials, e.g., cubic terms: these are, however, insignificant. The relationship is illustrated in Fig. 2, evaluated at the means of the other explanatory variables and based on the estimates from the beta regression for the multiple imputed samples.²¹ The results suggest that low-trusting countries have relatively independent central banks, which we interpret as a result of a perceived need for independence in a setting with little confidence in monetary policy-makers. It thus seems that countries with low degrees of trust feel a stronger need to delegate power to independent central banks to achieve credibility for a low-inflation goal. Countries with a high level of social trust likewise have quite independent central banks. Our interpretation is that trust in these countries reflects a high ability to reform, as trust facilitates consensus and the reaching of agreement with regard to letting non-politicians making important decisions. Countries at intermediate levels of trust seem to have neither sufficient need nor sufficient ability to establish high independence.

[Fig. 2 near here]

Given that the beta regression for the multiple imputed samples indicate the best fit, measured by the pseudo R^2 , we focus, in the remainder of this section, on interpreting results from this specification. As can be seen in Table 3 there is a positive association between previous inflation and central-bank independence, implying that the perceived need for reform is greater where inflation has been high. Being a federation is positively related to our dependent variable, which indicates that countries which are already delegating power from the central political level are more prone to grant the central bank a more autonomous role. Highly political fragmented countries have a higher degree of central-bank independence than countries characterized by less political competition, suggesting that politicians may be eager to tie the hands of subsequent governments. The democracy dummy changes sign: While it is positive (when significant) for the imputed samples, it is negative and significant for the non-imputed sample. This can probably be explained by

²¹ The non-linear effect in Fig. 2 is displayed for a country with average characteristics. We have also evaluated the relationship at actually observed values for each country's explanatory variables and aggregated over all values of the social trust variable. This exercise gives a similar figure, although the fitted values imply that high-trusting countries have a higher fitted CBI level than low-trusting countries.

selection, since few non-democracies are included in the latter sample.²² The ESCB dummy is positive and statistically significant, capturing that members of the ESCB were required to make their central banks more independent.

A Chi-2 test indicates the joint statistical significance of the explanatory variables at the 1% level; and the fit of the model is good for this type of data, as implied by the relatively high pseudo R^2 . However, the rest of the explanatory variables are not statistically significant, which is especially interesting since they are frequently used in the previous literature trying to explain central-bank independence where social trust has not been used for this purpose (de Haan and Van't Hag, 1995; Hayo and Hefeker, 2002; Carmignani et al., 2008). Notably, our measure of the quality of government is not significant, and its exclusion does not really affect the estimates for social trust. This indicates that trust (which can be seen as a kind of informal institution) has an independent effect and does not serve as a proxy for high-quality formal institutions.²³

[Table 4 near here]

In order to make the size of the effects clear, as well as indicate the loss in efficiency due to missing observations, we also present marginal effects (ME) and the percentage of the total variation due to variation in the point estimates between the five imputed samples in Table 4. The marginal effects show the change in the predicted dependent variable for a 1% change in the explanatory variable for each variable, while keeping all variables at their mean values. Note here that the marginal effect calculated for social trust varies with the level of social trust due to the non-linear relationship. To exemplify, the relationship (shown in Fig. 2) indicates that for a shift in social trust from 3% (Cape Verde) to 38% (Germany) the level of CBI falls by 0.129, while an increase in social trust from 38% to 64% (Sweden) increases the level of CBI by 0.079. We consider these effects quite

²² Although Cheibub et al. (2010) provide good arguments for using this dummy measure of democracy, such as its being more transparent and less arbitrary than alternative measures, we have nevertheless replaced it with the Polity IV measure of democracy as a sensitivity test. Reassuringly, this does not change any of our main conclusions, especially not regarding the relation between social trust and CBI; the estimate of this democracy measure itself always turns out statistically insignificant. Results are available upon request.

²³ We have used the second area of the Economic Freedom Index (Gwartney et al., 2012), legal system and property rights, as an alternative measure of institutional quality, and the results are qualitatively similar. Results are available upon request.

sizable. The uncertainty added due to missing observations for the estimates corresponding to the social trust variables, i.e., the linear and quadratic terms, are 10.3% and 15.4%, respectively. Despite this added uncertainty due to missing data, the effects are significant at the 5% level.

5.2. Robustness analysis and extensions

We have carried out a number of robustness checks and extensions. First, we investigate whether multicollinearity poses a problem. The highest unconditional correlations are found between the variables social trust and its square (0.96), social trust and quality of government (0.74), social trust and GDP per capita (0.63) and party fragmentation and democracy (0.63). To get an indication of the extent to which high correlations affect our results, variance inflation factors indicate that only social trust and its square stand out as a potential problem. Therefore, a model specification using a mean-centered social trust variable and its square have been employed.²⁴ Results from this regression, as well as for specifications excluding and including the other highly correlated variables, are reported in Table 5.

[Table 5 near here]

As indicated by the results, the non-linear u-shape remains significant throughout, both when using the less correlated mean-centered social trust variables (the first model specification) and when excluding variables with relatively higher correlations. Overall, the mean variance inflation factors are below the conventional thumb rule of 10 for all models. Thus, our results pertaining to social trust do not seem to be spuriously caused by collinearity.²⁵

Second, we conduct our regressions for developed and developing countries separately (following the classification in Arnone et al., 2009, where we merge developing and emerging economies). In the left part of Table 6, we report beta regression results for the multiple imputed samples. As can be seen in the first two regressions, we find a u-shaped relationship for both groups of countries, with statistical significance in the case of developed countries. To better understand the

²⁴ Mean-centering of the social trust variable, i.e. subtracting the mean value of social trust from each observation, reduces the correlation between social trust and its square from 0.97 to 0.59 and the variance inflation factors for both variables to below 6.

²⁵ Results for the mean and multiple imputed samples for the corresponding model specifications are similar.

non-significance for developing countries, we looked at the distribution of social trust scores for the two groups and found that there are few developing countries with high such scores. This feature of the data, rather than social trust not being important, might explain why we do not get statistical significance for a u-shape. Our third regression in Table 6 gives some credence to such an explanation: when excluding the squared term, we get a statistically significant, negative relationship between social trust and CBI for developing countries. This indicates that the part of our theory that concerns a perceived need for CBI reform, and which supports a negative relationship, is relevant for these countries, while the ability to undertake reform, which has to do with high trust levels, cannot be shown to matter.²⁶

[Table 6 near here]

Third, our main CBI measure is of a *de jure* kind. Relating to the discussion in Section 3.1 above concerning the relationship between *de jure* and *de facto* CBI, we have conducted an analysis using a proposed proxy for (absence of) *de facto* CBI: the turnover rate of central-bank governors (TOR).²⁷ The TOR is calculated based on the number of actual turnovers, excluding regular turnovers, and the data come from Dreher et al. (2008, 2010) and Sturm and de Haan (2001). Results from this analysis are reported in Table 6 for the non-imputed sample. For the full sample, the results suggest a positive relationship between social trust and the TOR, while a non-linear relationship is not supported. Since a higher turnover rate implies a lower level of central-bank independence, the positive relationship with social trust means that CBI decreases as social trust increases. This is consistent with one of the theoretical mechanisms proposed in our paper: that social trust affects the perceived need for central-bank independence. The more trust there is, the less need to “take away” decision-making powers from politicians and give it to an independent central bank. The other theoretical mechanism which we propose, that social trust affects the ability to agree on reform,

²⁶ When looking at the non-imputed sample, with very few observations for each group, we find that the u-shaped relationship for social trust is significant for the full sample but for neither group separately. This suggests that an important part of the variation driving the significant results for the full sample comes from variation *between* developed and developing countries and not just from variation within each group. Results are available upon request.

²⁷ A drawback with TOR is that it needs to be calculated over a “sufficiently” long period. Using too few years yields a variable with low variation between countries. We have used data from 2003–2009 to get a measure that is comparable to our main CBI measure.

does not seem relevant for this measure, at least not for the full sample. One possible reason could be that perceived need trumps the ability to agree, in the sense that even if the latter increases with social trust, it is of no importance if nobody wishes for what could be agreed upon. We then split the samples into developing and developed countries separately, and results are reported in Table 6 for the non-imputed sample. They indicate that a non-linear specification obtains for developing countries, i.e., central-bank independence first decreases (TOR increases) with increasing social trust, but for higher levels of social trust the effect reverses (implied by the squared social trust variable). Thus, the inverse u-shape found for TOR corresponds to a u-shaped relationship for central-bank independence for developing countries, in line with our theory. We do not find significant results for developed countries, but as pointed out by Klomp and de Haan (2010b) and Vuletin and Zhu (2011), this may reflect that TOR is a measure more suited for developing than for developed countries (while the opposite holds for our *de jure* CBI measure). When we use the imputed samples (from which results are available upon request), the non-linear effect is not significant for developing countries. Rather, we find a positive relation between social trust and the TOR, i.e., a negative relation between social trust and CBI. Interestingly, this mirrors the finding for developing countries when using our *de jure* CBI measure and when excluding the quadratic social trust variable, as reported in the previous paragraph.²⁸

Fourth, even though we see no strong reason for social trust to be affected by central-bank independence (as discussed in Section 2.5), we nevertheless undertake a robustness exercise in which we only use the average of those trust values that predate CBI reforms in each country (applying the same methodology as for the other explanatory variables). The drawback is that the number of countries for which social trust is observed is considerably reduced. Using this “before CBI-reform” social trust variable does, however, not change the relationship between social trust and CBI – see Table 6. Reassuringly, the same u-shaped relationship attains statistical significance. This is not surprising, since the correlation between “the before CBI-reform” social trust variable and the one used in the main analysis is 0.96.

Fifth, de Jong (2002) investigated how three cultural variables related to central-bank independence in a sample of 18 OECD countries. They were power distance, uncertainty avoidance

²⁸ However, it bears noting that the TOR measure, like other measures of CBI, has its problems as well. For example, it has been suggested that the turnover rate can be low precisely because governors follow the wishes of the government, and governors could be replaced for other reasons than being at odds with the government, such as being offered new jobs. See Brumm (2000), Klomp and de Haan (2010c, p. 446) and Cargill and O’Driscoll (2012, pp. 34–36).

and masculinity, and he found that the first of these was related to central-bank independence in a statistically significant way. That study illustrates the relevance of taking cultural factors into account as possible determinants of institutional arrangements. However, a question is whether the cultural factors looked at by de Jong are more basic than social trust and whether trust retains its influence if we take these other factors into account. Adding them to both linear and beta regressions, for the non-imputed sample (with new cultural factors for 42 countries) and the mean or multiple imputed samples, reveals first and foremost that the non-linear results regarding social trust are robust – indeed, the u-shaped relationship is retained with statistical significance in all specifications. Looking at de Jong’s three cultural factors reveals that the most consistent influence on central-bank independence comes from uncertainty avoidance, which is positively related to such independence, while power distance – the variable identified by de Jong to matter the most – attains statistical significance only in the case of the non-imputed sample. Masculinity play no role in models based on the non-imputed or mean imputed samples, but attains a positive influence on CBI in the beta regression based on the multiple imputed samples, as reported in Table 6.

Sixth, to see to what extent our results are affected by extreme observations, we have re-estimated models on a sample excluding the top and bottom 5 percentiles of the social trust distribution, as well as on samples trimming the tails of the CBI distribution. The results, which are can be seen in Table 6, indicate the same non-linear and statistically significant effect for social trust.

6. Concluding remarks

The worldwide increase in central-bank independence is one of the most important and significant trends in economic policy during the two last decades. The purpose of this paper has been to try to explain central-bank independence as a function of social trust. Interestingly, no previous study of the determinants of central-bank independence has analyzed this relationship, in spite of there being a natural link between the basis for making central banks more independent – i.e., a credibility or lack-of-trust problem – and social trust.

On grounds of theory, social trust can be expected to affect the level of central-bank independence differently depending on the trust level. At high levels of trust we expect a positive effect, since the ability to implement reform is high. Trust entails lower transaction costs of political agreement about reform and makes it easier for politicians to delegate power to independent central bankers. Politicians in high-trusting societies not only trust each other but independent central bankers as well. At low levels of trust, we likewise expect a positive effect, in this case because the

perceived need for independence provides a strong incentive to reform the standing of the central bank. This is because the time-inconsistency problem is worse and the credibility of political decision-making weaker. Lastly, countries with an intermediate trust level have neither the sufficient perceived need nor the sufficient ability to implement far-reaching reforms, which is why we expect a lower degree of independence for that group.

Our empirical results confirm this theoretical reasoning: the relationship between the variables is shown to be u-shaped. The results largely withstand several robustness checks, such as using mean and multiple imputations (in addition to original data), using different regression methods (linear and beta regressions), dealing with potential multicollinearity problems, controlling for other cultural factors and removing extreme observations. When using a different measure of central-bank independence, the turnover rate of central-bank governors, results are slightly different, but social trust remains related to this independence measure (in the case of developing countries, the u-shaped relationship was reaffirmed as statistically significant).

Why is this finding important? We suggest that it contributes to a better understanding of why central-bank independence has been implemented in many countries, by introducing a new variable that has increasingly been shown to matter for economic, political, and social outcomes. As such, it can also probably have explanatory value for other types of institutional reforms.

There is surely more work to be done in this area. Newer data could shed light on how the relationship studied here has fared during the financial crisis. To get a firmer grasp of how central-bank independence actually works (or does not work), future studies could investigate cases of conflict between the government and the central bank and, not least, try to discern which factors generate *de facto* independence. The possible causality problem could also be addressed in novel ways, possibly through case studies and studies that, through new data, are able to more clearly identify exogenous variation. Lastly, we suggest that social trust is a suitable candidate for future studies on what makes institutional change and reforms in general come about.

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Tables and figures

Table 1

Central-bank independence in pre-reform period (CBI₈₉) and post-reform period (CBI₀₃).

	Restricted sample		Full sample
	CBI ₈₉	CBI ₀₃	CBI ₀₃
Mean	0.350	0.639	0.586
S.d.	0.179	0.197	0.197
Min	0.090	0.190	0.190
Max	0.820	0.940	1.000
Number of countries	73	73	149

Note: Restricted sample: Countries with observed CBI measures in both 1989 and 2003.

Full sample: Countries with observed CBI measure in 2003.

Table 2

Descriptive statistics and missing observations for explanatory variables.

	Mean	S.d.	Missing	Share
Social trust	0.25	0.12	46	31%
Pre-reform CBI	0.35	0.12	76	51%
Inflation	0.28	0.41	18	12%
GDP per capita	7994	8118	13	9%
Unemployment	0.09	0.05	82	55%
Federation	0.44	0.49	69	46%
IMF credits	0.23	0.49	1	1%
Party fragmentation	5934	1444	63	42%
Coups	0.04	0.09	26	17%
Democracy	0.60	0.49	0	0%
Quality of government	0.60	0.20	48	32%
ESCB membership	0.19	0.43	0	0%
Number of countries	149			

Note: Means and standard deviations for explanatory variables correspond to the average value over ten years preceding the implementation of major CBI reforms in each country. The number of missing observations pertains to the number of countries with incomplete observations during the period 1980–2003.

Table 3

Linear and beta regression results based on the non-imputed, mean imputed and multiple imputed samples.

Dependent variable: CBI index

Variable/Regression	Non-imputed sample		Mean imputed sample		Multiple imputed samples	
	Linear	Beta	Linear	Beta	Linear	Beta
Social trust	-3.027** (0.381)	-3.034** (0.468)	-2.553** (0.957)	-2.242** (0.896)	-4.028** (0.390)	-3.409** (0.323)
Social trust ²	3.245** (0.513)	3.636** (0.780)	3.503** (0.886)	3.076** (1.231)	5.150** (0.553)	4.508** (0.353)
Inflation	0.192* (0.113)	0.178** (0.089)	0.112** (0.001*)	0.113** (0.008)	0.153** (0.021)	0.181** (0.039)
Federation	0.382** (0.028)	0.359** (0.001)	0.409** (0.012)	0.395** (0.010)	0.036 (0.039)	0.113** (0.026)
Party fragmentation	0.269** (0.003)	0.233** (0.019)	0.088** (0.043)	0.079** (0.028)	2.177** (0.107)	1.734** (0.257)
Democracy	-0.284* (0.154)	-0.221** (0.073)	0.238** (0.043)	0.221** (0.048)	-0.013 (0.028)	0.214** (0.017)
Quality of government	0.223 (0.548)	-0.144 (0.275)	0.393 (0.384)	0.228 (0.278)	0.561** (0.241)	0.233 (0.193)
ESCB member	1.221** (0.055)	1.200** (0.018)	1.463** (0.076)	1.289** (0.067)	1.539** (0.240)	1.281** (0.142)
Constant	-1.399** (0.418)	-1.100** (0.160)	-0.786* (0.420)	-0.636* (0.3445)	-1.198** (0.436)	-0.920 (0.223)
Additional control variables	Yes	Yes	Yes	Yes	Yes	Yes
Log-likelihood	-	50.632	-	81.276	-	87.960
Chi-2 (ML); F (OLS)	6.53**	188.09**	9.23**	129.26**	11.07**	173.18**
R ² (Pseudo for ML)	0.43	0.28	0.47	0.55	0.52	0.59
Estimator	OLS	ML	OLS	ML	OLS	ML
Observations	46	46	149	149	149	149

Note: The dependent variable is the central-bank independence index of Arnone et al. (2009). The explanatory variables are the average of the values for the ten-year period preceding CBI reforms (different time periods in different countries). The additional control variables are: Pre-reform CBI, GDP per capita, Unemployment, IMF credits and Number of Coups. *significant at the 10% level, **significant at the 5% level. Clustered robust standard errors (between developed and developing countries) are used in all regressions.

Table 4

Marginal effects based on the beta regression for the multiple imputed samples.

Variable	ME	%
Social trust	-0.008	10.3
Social trust ²	0.011	15.4
Inflation	0.043	2.4
Federation	0.027	6.8
Party fragmentation	0.416	0.5
Democracy	0.052	19.3
Quality of government	0.056	41.1
ESCB membership	0.267	0.6

Note: ME show the marginal effects of each variable while keeping all other variables at their mean values. The marginal effect is the change in the predicted dependent variable for a 1% change in the explanatory variable, assuming that the effect does not change over that interval. % shows the percentage of the total variation which is due to variation in the point estimates between the five samples.

Table 5

Regressions with mean centered social trust and extensions excluding highly correlated variables.

Variable	Mean centered	Restricted 1	Restricted 2	Restricted 3	Full model
Social trust	-1.376** (0.119)	-2.475** (1.128)	-1.282** (0.102)	-2.219** (1.138)	-3.027** (0.381)
Social trust ²	3.245** (0.513)	4.465** (1.365)	1.729** (0.309)	2.151* (1.206)	3.245** (0.513)
Inflation	0.192* (0.114)	0.140** (0.051)	0.073** (0.033)	0.150 (0.098)	0.192* (0.113)
GDP per capita	0.027** (0.003)	-	-	-	0.027** (0.003)
Federation	0.382** (0.028)	0.468** (0.086)	0.493** (0.024)	0.405** (0.011)	0.382** (0.028)
Party fragmentation	0.269** (0.003)	-	0.291** (0.014)	0.287** (0.005)	0.269** (0.003)
Democracy	-0.284* (0.154)	-	-0.387** (0.013)	-0.369** (0.106)	-0.284* (0.154)
Quality of government	0.223 (0.548)	-	-	0.992 (0.808)	0.223 (0.548)
ESCB member	1.220** (0.055)	1.524** (0.071)	1.311** (0.050)	1.209** (0.051)	1.221** (0.055)
Constant	-1.959** (0.482)	0.238** (0.019)	-1.166** (0.015)	-1.682** (0.472)	-1.399** (0.418)
Additional control variables	Yes	Yes	Yes	Yes	Yes
Estimator	OLS	OLS	OLS	OLS	OLS
Mean VIF	2.68	6.47	6.15	6.29	6.53
Observations	46	46	46	46	46

Note: The dependent variable is the central-bank independence index of Arnone et al. (2009). The explanatory variables are the average of the values for the ten-year period preceding CBI reforms (different time periods in different countries). The additional control variables are: Pre-reform CBI, Unemployment, IMF credits and Number of Coups. *significant at the 10% level, **significant at the 5% level. Clustered robust standard errors (between developed and developing countries) are used in all regressions. All linear regressions are based on the non-imputed sample. Mean centered (column 1): Specification using the mean centered social trust variable and its square. Restricted 1 (column 2): Specification excluding GDP per capita, Party fragmentation, Democracy and Quality of government. Restricted 2 (column 3): Specification excluding GDP per capita and Quality of government. Restricted 3 (column 4): Specification excluding GDP per capita. Full model (column 5): Specification including all variables.

Table 6
Regression results for robustness tests.

Variable/Sample	Developed and developing countries			Governor turnover rate (TOR)		Pre-reform trust	Cultural factors	Trimmed sample
	Developed	Developing	Developing	Full	Developing	Full	Full	Full
Social trust	-12.258** (5.84)	-2.242 (1.687)	-1.320** (0.589)	0.240** (0.09)	0.861** (0.11)	-3.077* (1.74)	-3.594** (0.27)	-10.193** (0.27)
Social trust ²	13.458** (6.83)	1.806 (2.972)	-	-	-1.077** (0.38)	4.923** (0.91)	4.833** (0.38)	16.441** (0.47)
Inflation	-1.173 (3.92)	0.221* (0.131)	0.218* (0.132)	0.001 (0.03)	-0.010 (0.03)	0.216** (0.03)	0.173** (0.04)	0.117** (0.03)
Federation	0.238 (0.51)	0.074 (0.116)	0.070 (0.115)	0.003** (0.00)	0.032 (0.04)	0.080** (0.03)	0.116** (0.03)	0.082** (0.02)
Party fragmentation	2.230** (1.31)	1.487** (0.411)	1.505** (0.409)	-0.001 (0.00)	0.010 (0.02)	1.588** (0.26)	1.717** (0.34)	1.791** (0.27)
ESCB member	0.975** (0.36)	1.348** (0.285)	1.329** (0.279)	-0.061** (0.02)	-0.105** (0.02)	1.275** (0.20)	1.266** (0.10)	1.321** (0.12)
Power distance	-	-	-	-	-	-	-0.247 (0.68)	-
Uncertainty avoidance	-	-	-	-	-	-	0.175** (0.01)	-
Masculinity	-	-	-	-	-	-	0.131** (0.04)	-
Constant	-0.159 (1.28)	-0.568 (0.632)	-0.697 (0.612)	0.162** (0.07)	0.051 (0.28)	-1.026** (0.31)	-0.874 (0.12)	-0.023 (0.16)
Additional control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R ² /Log-likelihood	0.53	0.46	0.46	0.19	0.45	86.63	88.20	88.23
Imputation	Multiple	Multiple	Multiple	Non	Non	Multiple	Multiple	Multiple
Regression	Beta	Beta	Beta	Linear	Linear	Beta	Beta	Beta
Estimator	ML	ML	ML	OLS	OLS	ML	ML	ML
Observations	26	123	123	53	31	149	149	133

Note: Columns 1–3 contain an analysis separating developed and developing countries. Columns 4–5 contains an analysis of the alternative dependent variable *Governor turnover rate* (TOR) as a measure of *de facto* central bank independence. Column 6 contains an analysis using only the average social trust values predating CBI reforms. Column 7 contains an analysis including these cultural factors: Power distance, Uncertainty avoidance and Masculinity. Column 8 contains an analysis of a trimmed sample, excluding the top and bottom 5 percentiles of the social trust distribution. Except for the TOR estimates, where we use the turnover rate of central-bank governors, the dependent variable is the central-bank independence index of Arnone et al. (2009). The explanatory variables are the average of the values for the ten-year period preceding CBI reforms (different time periods in different countries). Clustered robust standard errors (between developed and developing countries) are used for all models including the full sample. *significant at the 10% level; **significant at the 5% level. The additional controls are: Pre-reform CBI, GDP per capita, Unemployment, IMF credits, Number of Coups, Democracy and Quality of government.

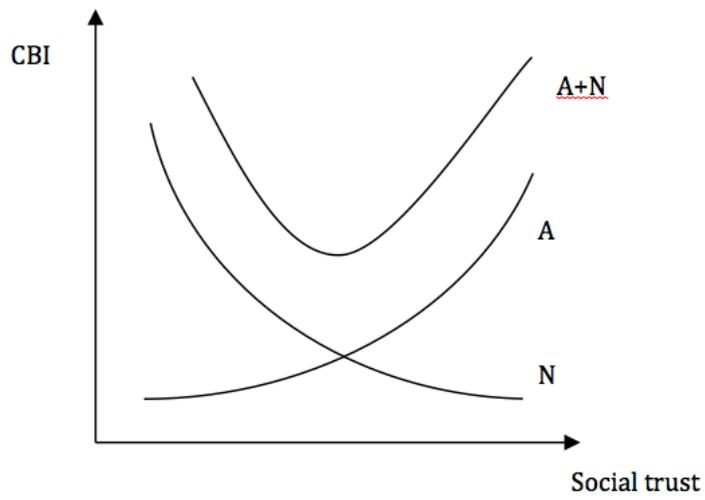


Fig. 1. The theoretical relationship between social trust and central-bank independence (CBI). Note: Curve A refers to the ability to undertake reforms that increase CBI, while curve N refers to to the perceived need to implement such reforms. The full relationship between trust and central-bank independence is given by A+N.

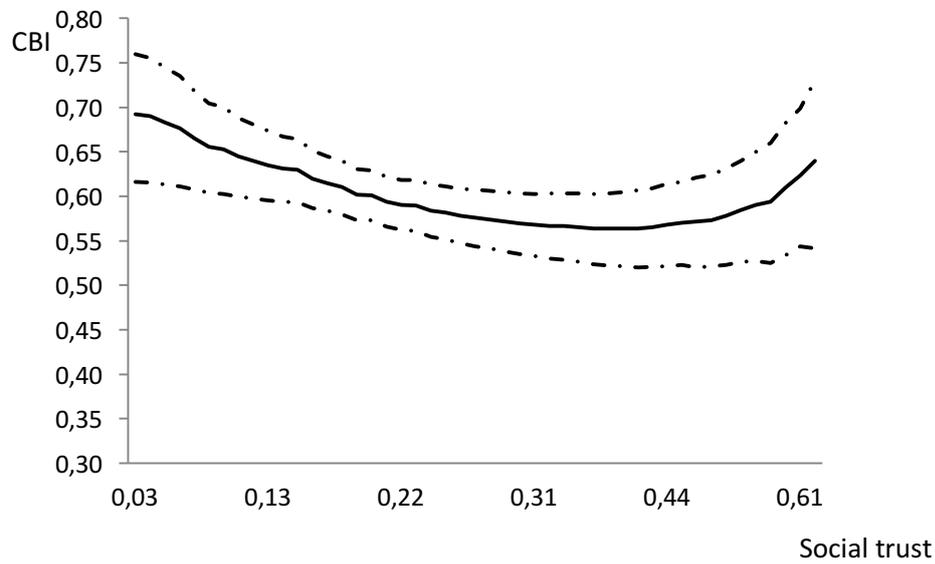


Fig. 2. Fitted level of CBI and 95% confidence interval for an average country. Note: The figure is based on estimates from the beta regression for the multiple imputed samples and evaluated at the means of the other explanatory variables.