Kinship, Fractionalization and Corruption*

Mahsa Akbari† Duman Bahrami-Rad‡ Erik O. Kimbrough§

November 25, 2016

Abstract

Norms of nepotism and favoritism create corruption, subverting and disrupting impartial institutions and hampering economic development. However, the presence and strength of such norms varies widely within and between countries, and the literature has suggested that this variation is driven, in part, by ethnic fractionalization, with mixed results. We provide evidence for an overlooked–but deep-rooted–source of variation in corruption: *sub-ethnic fractionalization*, driven by mating patterns. The theory of kin selection provides a straightforward justification for norms of nepotism and favoritism among relatives; more subtly, it also implies that the returns to such norms may be influenced by mating practices. Specifically, in societies with high levels of sub-ethnic fractionalization, where endogamous (and consanguineous) mating within kin-group, clan and tribe increases the local relatedness of individuals, the relative returns to norms of nepotism and favoritism are high. In societies with exogamous marriage practices, the relative returns to norms of impartial cooperation with non-relatives and strangers are increased. Using cross-country and within-country regression analyses and a cross-country lab experiment, we provide evidence for this account. Our cross-country analyses show that corruption levels are robustly associated with consanguineous marriage rates, even when controlling for previously studied deep determinants of comparative development. Our within-country analysis exploits variation in consanguinity across Italian provinces and identifies the same pattern. Lab experiments in two countries with different mating patterns provide evidence for our proposed mechanism from subjects who interacted with kin, co-ethnics and strangers in a stylized corruption game.

JEL classifications: D7, D0, C9, J1

Keywords: corruption, fractionalization, institutions, mating patterns, consanguinity, experiments

---

*Kimbrough would like to thank the SSHRC Insight Grants Program (435-2015-0798) and the Simon Fraser University Teaching and Learning Centre Development Grants Program for funding this research. We would like to thank Quamrul Ashraf, Greg Dow, Simon Halliday, Alex Karaivanov, Jonathan Schulz, Bart Wilson, @hbdchick on Twitter, participants at Brown Bag Workshops in the Department of Economics and the FABLab at Simon Fraser University, seminar audiences in the Department of Biological Sciences at Simon Fraser University, the Karlsruhe Institute of Technology, Middlebury College, the University of Connecticut, the University of Massachusetts-Amherst, the University of Oklahoma, Washington State University, Williams College and attendees at the 2015 Canadian Economics Association annual conference, the 2015 and 2016 North American Meetings of the Economic Science Association, the 2016 Conference of the Association for the Study of Religion, Economics, and Culture, and the 2016 BC Economics Articulation Meetings for helpful comments. We would also like to thank Yoram Halevy and Anujit Chakraborty for helping us to conduct some of our experiments at ELVSE at the University of British Columbia, as well as the Moasser Research Center, the Tehran Thought Club, the West Azerbaijan Ministry of Education and Urmia University for assistance with recruiting and collecting data in Iran. We also thank Babak Jahanshahi and Erasmo Papagni for helping us collect data on Italy. All remaining errors are our own.

†PhD Candidate, Department of Economics, Simon Fraser University.

‡PhD Candidate, Department of Economics, Simon Fraser University.

§Corresponding Author: Associate Professor, Department of Economics, Simon Fraser University, email: ekimbrou@sfu.ca.

"Now it appears, that in the original frame of our mind, the strongest attention is confin'd to ourselves; our next is extended to our relations and acquaintances; and 'tis only the weakest which reaches to strangers and indifferent persons. This partiality, then, and unequal affection, must not only have an influence on our behaviour and conduct in society, but even on our ideas of vice and virtue..."

(David Hume, 1740, *A Treatise of Human Nature*, Section 3.2.2.)

"Part of our present difficulty is that we must constantly adjust our lives, our thoughts and our emotions, in order to live simultaneously within different kinds of orders according to different rules. If we were to apply the unmodified, uncurbed rules of the micro-cosmos (...say, our families) to the macro-cosmos (our wider civilization), as our instincts and sentimental yearnings often make us wish to do, *we would destroy it*. Yet if we were always to apply the rules of the extended order to our more intimate groupings, *we would crush them*."

(Friedrich Hayek, 1988, *The Fatal Conceit*, p.18.)

1 Introduction

Norms of solidarity, fidelity and self-sacrifice in favor of kin, tribe and clan have often been praised as virtues, but these virtues may become vices when they conflict with the abstract rules and formal institutions of the modern political and economic system. In particular, favoring kin *at the expense of others* may lead to corruption, disrupting or subverting impartial institutions and hampering economic development. In this paper, we provide evidence that a history of endogamous and consanguineous mating practices generates fractionalization between local, sub-ethnic groups, increases incentives for local favoritism, and thus encourages corruption.

Previous studies of corruption and its effects on growth have explored the idea that ethnic heterogeneity (and concomitant fractionalization) may cause corruption when individuals favor members of their own ethnic group. Mauro's (1995) influential study used ethnic fractionalization as an instrumental variable for corruption. Since then, several studies have investigated whether ethnic heterogeneity causes corruption, with mixed results. In support, Easterly and Levine (1997) found that ethnic fractionalization is positively correlated with corruption; La Porta *et al.* (1999), Treisman (2000) and Alesina *et al.* (2003) also found that fractionalization has a reduced-form relationship with corruption but reported non-robust results when controlling for other variables such as per capita income. However, Serra (2006) and Elbahnasawy and Revier (2012) found no significant effect of fractionalization on corruption. In addition to the cross-country studies, Glaeser and Saks (2006) and Dincer (2008) found a significant relationship between ethnic heterogeneity and corruption across US states. These contradictory results have encouraged skepticism (see e.g. Chuah *et al.*, 2013).

A typical regression model from the cross-country empirical studies is as follows:

$$C = \alpha + \beta EF + \gamma X + u$$

where C is a corruption index, EF is an ethnic fractionalization index[1] and X is a set of independent variables. The richest specifications in La Porta *et al.* (1999), and Alesina *et al.* (2003) include legal origins, religion, latitude, per capita income, country size and regional dummies.

However, while the motivation for such analysis is intuitively appealing, there is no obvious theoretical justification for the model or for a causal effect of ethnic fractionalization on corruption. Why should individuals favor members of their ethnic group?

Here we provide a framework, based in behavioral genetics, that explicitly connects ethnicity, kinship and corruption. While the theory may be unfamiliar to economists, "the biologically based approach shares strengths in common with the best of economic theory; it is parsimonious, counter-intuitive, and falsifiable" (Cox and Fafchamps, 2007, p. 3759). The intuition comes from the biological notions of inclusive fitness and kin selection, which imply that genetic relatives, because they share genes with an interest in propagating themselves to the next generation, will sometimes be willing to incur costs to help one another (see e.g. Hamilton, 1964a,b). A model of kin selection requires high *relatedness* between agents in order to generate corruption and favoritism. Thus, shared ethnicity *per se* is insufficient, explaining the weak and contradictory findings noted above. As we discuss below, various factors including geography and cultural practices can lead to increased relatedness at the local level, thereby raising the relative returns to norms of favoritism and corruption. Under this view, typical models are misspecified because they ignore the role of *sub-ethnic fractionalization* in corruption.

To understand how sub-ethnic fractionalization can help account for corruption, consider Table 1 derived from Alesina *et al.* (2003) which lists a few countries with low ethnic and linguistic heterogeneity, but relatively high levels of corruption.[2] Although Yemen, Tunisia, Saudi Arabia and Bangladesh are relatively homogeneous in terms of ethnicity and language, they are highly fractionalized due to the presence of and competition between other close-knit kin-based and local groups such as extended families, tribes, clans, and religious groups (see e.g. Lewis, 2014, on clan structures in the Gulf of Aden). We argue that distinctive family structures and mating patterns (e.g. the preference for cousin marriage in many African and Asian countries) generate

[1] As a measure of heterogeneity within countries, empirical studies have used fractionalization indices from two sources: (I) the ethnolinguistic fractionalization index (often referred to as ELF) from the Atlas Narodov Mira compiled from sources in the former Soviet Union (Bruk and Apenchenko, 1964), and (II) the ethnic, linguistic, and religious fractionalization indices provided by Alesina *et al.* (2003). Both sources define fractionalization as the probability that two randomly drawn individuals from a country's population belong to two different groups.

[2] The fractionalization index in the table is the simple average of ethnic fractionalization and linguistic fractionalization from Alesina *et al.* (2003), and the range of the fractionalization index in the table is the same as Mauro (1995)'s ethnolinguistic fractionalization table. For the corruption index in the table, we used the 2014 Corruption Perception Index provided by Transparency International (http://www.transparency.org/research/cpi/overview).

such sub-ethnic fractionalization and increase local relatedness, thereby encouraging corruption, despite a lack of ethnic heterogeneity (see Section 2 below).[3]

Fractionalization index	0-5%	5-15%	15-35%	35-55%	55-75%
	Yemen *Tunisia*	*Saudi Arabia* *Bangladesh*	...	...	...
Corruption index	0-20%	20-40%	40-60%	60-80%	80-100%
	...	...	*Saudi Arabia* *Tunisia*	*Bangladesh*	*Yemen*

Table 1: **Misspecification due to omission of *sub*-ethnic fractionalization.**

A second puzzle for the view that heterogeneity *per se* causes corruption can be seen in Table 2 (also derived from Alesina *et al.*, 2003), which lists a number of countries, all of which are highly ethnically and linguistically fractionalized:

Fractionalization index	0-5%	5-15%	15-35%	35-55%	55-75%
	... ...	... ...	... ...	Switzerland Belgium *Iraq* *Uzbekistan*	Canada Luxembourg *Iran* *Pakistan*
Corruption index	0-20%	20-40%	40-60%	60-80%	80-100%
	Canada Luxembourg Switzerland	Belgium		*Iran* *Pakistan*	*Iraq* *Uzbekistan*

Table 2: **Misspecification due to conflation of ethnic and *sub*-ethnic fractionalization.**

Although, e.g., both Canada and Pakistan are ethno-linguistically heterogeneous, Canada has effective, impartial institutions; while Pakistan is quite corrupt. Crucially, the countries differ in the importance of sub-ethnic groups such as extended family, tribe and clan to social and political life. Pashtuns, one of the largest ethnic groups in Afghanistan and Pakistan "are said to having [sic] developed the world's largest tribal society, ... [with] sub-tribes, clans and sub-clans down to the local lineages and families" (Glatzer, 2002, p. 3). Similar arguments contrast Switzerland, Luxembourg, and Belgium on one hand to Iran, Iraq, and Uzbekistan on the other.

To make our argument about sub-ethnic fractionalization and inclusive fitness more precise, we introduce a bribery model where a *private agent* offers a bribe to an *official*, and if the official

[3]See also Sailer (2004) for an analysis of clans, corruption and state-building in Iraq in light of cousin marriage practices and hbdchick (2014) who has made related arguments in the context of European mating patterns and the Hajnal line (Hajnal *et al.*, 1976).

accepts the bribe and makes a corrupt effort, a negative externality is imposed on third parties called *citizens*. This is a well-known model of corruption used in a number of laboratory studies.[4]

We employ a utility function that embeds the implications of inclusive fitness and show how sub-ethnic fractionalization may encourage corruption. In short, from the point of view of inclusive fitness, shared genes imply shared interests. Thus when parties are sufficiently related to one another, they may be willing to take risks and impose externalities on unrelated (or less related) third parties in order to help their kin. Such kin altruism may encourage corruption in the presence of culture- and geography-driven sub-ethnic fractionalization, which increases in-group relatedness locally, raising the relative return to corruption.

While it is possible that persistent differences in mating patterns between populations could eventually lead to genetic differences between those populations (increasing the relative frequency of "genes for" kin altruism due to differential selection pressures[5]), in practice, different gene frequencies are not necessary for sub-ethnic fractionalization to encourage corruption. Assuming that all human populations possess similar genetic predispositions to kin altruism, the key to our argument is that changes in local relatedness due to mating patterns and family (or clan or tribal) structures change the relative returns to kin altruism vis-a-vis alternative impersonal, impartial mechanisms for sustaining cooperation. In particular, endogamous marriage practices directly increase local relatedness and raise the relative return to norms of kin favoritism; while, exogamous marriage practices directly reduce local relatedness, raising the relative returns to (and need for) norms of trust and cooperation with strangers and non-relatives.

Note that we are not claiming that increased local relatedness is the only way to encourage norms of favoritism (and concomitant corruption). Many groups extend norms of kin altruism to affines, friends and other less-related individuals by adopting cultural practices that create fictive kinship, and it has been argued that these practices piggy-back on, or hijack, the evolved mechanisms for kin cooperation and extend them to non-kin (see Henrich, 2015, for a summary).[6] Nevertheless, our key claim is that geographical or cultural factors that increase or decrease local relatedness will influence the relative returns to different norms.

To provide evidence for our account, we combine data from population genetics, corruption,

[4] E.g. see Abbink *et al.* (2002); Cameron *et al.* (2009); Alatas *et al.* (2009); Barr and Serra (2010); Rivas (2013).

[5] See Hamilton (1975) for a theoretical treatment, and see hbdchick (2014) for a provocative argument that this might apply to human populations.

[6] Incest taboos present another example of how social norms can harness biological mechanisms: "Incest taboos are social norms that evolved culturally to regulate sex and pair-bonding between non-close relatives by harnessing innate intuitions and emotional reactions that originally arose via genetic evolution to suppress sexual interest among close relatives, especially siblings. By harnessing innate incest aversion and labeling distant relatives as 'brothers' and 'sisters,' cultural evolution seized a powerful lever to control human behavior, since incest taboos can strongly influence mating and marriage, and kin-based altruism can be extended through social norms. If you control mating and marriage, you get a grip on much of the larger social structure, and even aspects of peoples cognition and motivation" (Henrich, 2015, p. 153).

and comparative development studies to test this hypothesis in a cross-country and within-country regression analysis. As a measure of sub-ethnic fractionalization, we collect data on national and regional (within-Italy) rates of consanguineous (cousin) marriage. We find that consanguinity rates have a substantial and positive association with corruption, both across countries and within Italy, even after controlling for other "deep" determinants of comparative development. This suggests that sub-ethnic fractionalization is an alternative but important channel through which history can explain variation in present day institutional quality.

While we cannot allay all endogeneity concerns with our regression analyses, three factors suggest that using variation in consanguinity to study the effects of sub-ethnic fractionalization is a reasonable approach. First, consanguinity has a direct impact on local relatedness (and thus, the relative returns to norms of local favoritism) since the offspring of a consanguineous marriage will be more closely related than the offspring of a randomly mating pair.

Second, consanguinity has multiple, not-necessarily-overlapping historical causes, limiting the likelihood that a single omitted variable could account for our findings. As discussed later, historical exposure to Christianity and Arab domination are important determinants accounting for much of the variation in consanguinity rates today. For example, a long-standing cousin marriage ban by the Catholic Church has also been enshrined by civil law in many Christian countries, and a preference for cousin marriage seems to have spread with the Arab conquests in the early centuries of Islam. Nevertheless, the association between consanguinity and corruption holds in regression analysis across regions living under the same religion (such as predominantly-Catholic Italian provinces). Moreover, while religion has been important in shaping consanguinity patterns, there is evidence that norms favoring or disapproving of consanguinity have multiple other pre-industrial origins as an adaptation to: (i) the economic organization of societies (for example, foraging, pastoralism or different forms of agriculture), (ii) differing inheritance or property rules, (iii) geographical constraints, (iv) parasite threats, etc., (see e.g. Goody, 1983; Cavalli-Sforza *et al.*, 2004; Hoben *et al.*, 2010; Walker and Bailey, 2014).

Third, consanguinity norms may persist even as a society undergoes major social and economic changes. For example, in many European majority-Protestant countries, consanguinity is permitted, but rarely practiced, perhaps because of ingrained norms acquired under Catholicism. Another important source of persistence can arise from the complementarity between norms of consanguinity and socio-economic structure. For example, under strict consanguinity prohibitions extended to third (and even as far as sixth) cousins in Europe, those (especially women) living in small groups or remote regions had to emigrate to find a legitimate marriage partner. These ties facilitated future marriages, exchanges, and other inducements to impartial cooperation, which in turn increased the relative benefits of out-marriage, therefore perpetuating this cultural practice (e.g. see Cavalli-Sforza *et al.*, 2004; Greif, 2006).

Finally, to complement our regression analyses and provide a test of the proposed mechanism, we also design a cross-cultural lab experiment to test the theory's predictions directly, comparing the bribery and corruption behavior of strangers, co-ethnics and kin in Canada and Iran, exploiting the fact that the two countries are both ethnically (and linguistically) fractionalized by standard measures but vary substantially in their degree of sub-ethnic fractionalization, due to cultural differences in family structure. 849 students from different ethnic origins in Canada and Iran participated in a bribery game, in which the first mover chooses whether to offer a bribe and the second mover chooses to accept or reject it. If he accepts the bribe, the second mover also decides whether to make a corrupt effort to benefit the first mover, thereby imposing a negative externality on a passive third player. Subjects play the three-player bribery game with one unrelated person and one co-ethnic (or sibling, in the Kin treatment). Three possible assignments of roles to two co-ethnics (kin) create three treatments through which we explore the effect of ethnic (kinship) ties on the frequency of corrupt acts.

Our design allows us to test the hypothesis that bribery and corruption will be more frequent in the treatment with co-ethnics (kin) as first and second movers and less frequent in the treatments with one of the co-ethnics as the first or second mover and the other as the passive third party. We can also test for differences between co-ethnics and kin in the same roles within-country and for differences across countries that reflect differences in norms (plausibly related to differences in sub-ethnic fractionalization). We find evidence of favoritism in both countries, but among non-kin the pattern is more pronounced in Iran. Robustness checks using friends, rather than relatives, and varying incentives provide support for cross-country normative differences consistent with our theory.

2 Theory and hypotheses

Corruption can be defined as "abuse of public office for private gain" (World Bank, 1997, p. 8). *Public office* can be abused in hiring for governmental positions, manipulating government procurement or facilitating/limiting access to basic goods or services in places like hospitals, schools, police departments, etc. *Private gain* is often realized through *bribery*, with gifts, money, or similar benefits offered in exchange for official actions. However, enforceable contracts for such exchanges are impossible because corruption is typically illegal. Therefore, *bribery* necessitates implicit contracts which rely on trust and cooperation.

Seen from a game-theoretic perspective, bribery is a social dilemma much like a trust game (see e.g. Berg *et al.*, 1995; Fehr and Fischbacher, 2003) where (i) a sequential exchange takes place in the absence of enforceable contracts, (ii) both players are better off exchanging their goods or favors, and (iii) there is also a strong temptation to cheat, e.g. by accepting the bribe and failing to reciprocate. However, as noted by Abbink *et al.* (2002), the trust game lacks two essential components of bribery: the possibility of negative externalities and the risk of penalty.

2.1 A basic model of bribery

Figure 1 shows our bribery game inspired by Abbink *et al.* (2002). Player 1 represents a private agent and player 2 represents a public official. Player 1 may offer a bribe (t) to player 2 in the hope that player 2 will misuse his office to benefit her (B). If player 1 offers a bribe, she also incurs a small cost (c) of initiating the relationship with the official. The private agent's benefit from the official's corrupt effort, B is high enough that $B > t + c$.

The official, player 2, has the option of accepting t but making no effort or making a corrupt effort and incurring a cost (e). The effort cost is low enough that $e < t$. If the official chooses to make the corrupt effort, there is a small probability (ϵ) of getting caught, where both private agent and official end up with zero payoffs. If the official is not caught, the negative externality of the official's corrupt effort on citizens, who have no move in the game, is X_i, which is displayed below the payoff vectors whenever it occurs. Assuming $\sum X_i \geq B$, the game also captures another characteristic of corruption; it is inefficient.

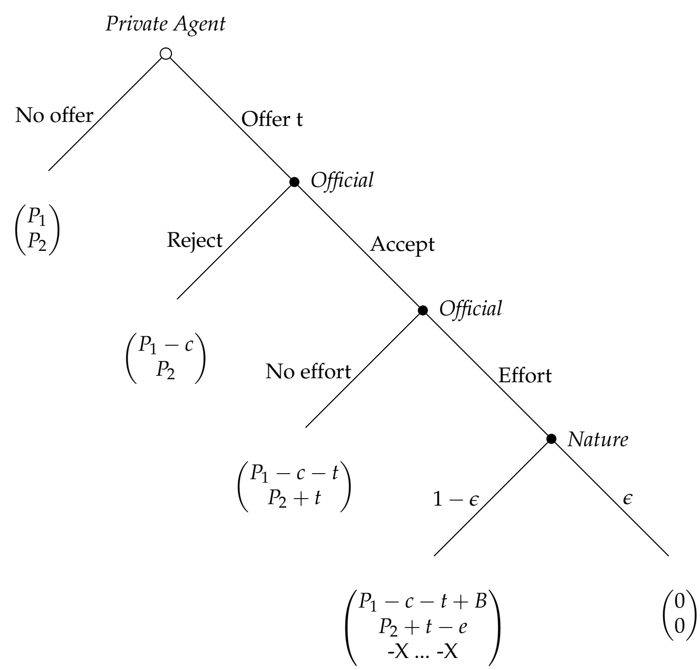

Figure 1: **A basic bribery game.**

In the unique subgame perfect equilibrium of the one-shot game, the official accepts the offer but makes no effort, and the private agent chooses not to offer a bribe to the official. However, from field observations and experimental studies, we know that "corruption exists, bribes are paid, and favors are reciprocated" (Lambsdorff, 2012, p. 280). One possible source of observed corruption is nepotism, and its antecedent biological or kin altruism.[7]

2.2 Inclusive fitness, kin altruism, and nepotism

Sequentially played social dilemmas such as the bribery game allow agents to engage in altruistic behavior: one party may incur a cost in order to provide a larger benefit to another (in this case at a cost to third parties). In this section, we develop a theoretical explanation for why members of kin-based, tribal and other local, sub-ethnic groups might display high levels of trust and reciprocation (and hence corruption) in a bribery game, based on kin altruism. While the theoretical approach from biology may be foreign to many economists, we agree with Cox and Fafchamps (2007) who note that biological theory has much to offer to economists who wish to understand demographic influences on behavior.

Kin selection theory and inclusive fitness

Altruistic behaviors like self-sacrifice, non-reciprocal help and subordination of private interests for the greater good of the group are all commonly observed among kin. Such altruistic behaviors seem to contradict both models of individual self-interest and Darwinian natural selection, because behaving altruistically is disadvantageous for the altruist, by definition. Intuitively, individuals that incur costs in order to provide fitness benefits to others will have lower fitness than free-riders, and hence, *prima facie*, should have their numbers dwindle. However, Hamilton (1964a)'s *kin selection* or *inclusive fitness* theory provides a simple and empirically successful argument explaining how such altruistic behavior could evolve under natural selection.

Hamilton solved the problem by focusing on selection at the level of the *gene* rather than the *individual*. We can imagine "a gene which causes its bearer to behave altruistically towards other organisms, e.g. by sharing food with them" (Okasha, 2013). We expect the altruist gene to be eliminated because it is disadvantageous for the altruist. But what if altruists share food only with those with whom they also share genes? Since there is a certain probability that the recipients of the food will also carry copies of that gene, the altruistic gene can in principle spread by natural selection. Thus altruistic behavior may increase the number of copies of the altruistic gene in the next generation, and thus "the incidence of the altruistic behavior itself" (*Ibid*.).

Hamilton demonstrated that an altruistic gene will be favored by natural selection and will spread in the population when a certain condition, known as *Hamilton's rule*, is satisfied. Ac-

[7]Of course we do not claim it is the only source - repeat interaction, reciprocity and threats may also facilitate corruption, even among non-kin. The purpose of the one-shot game described here is merely to provide a simple framework in which to highlight the role of kinship as another important potential causal factor.

cording to Hamilton's rule, a *donor* provides an altruistic act if $rB > C$, where C is the cost of the altruistic act to the donor, B is the benefit of the act to the *recipient*, and r is the coefficient of relatedness between the donor and the recipient. This rule is based upon expected costs and benefits in terms of *inclusive fitness* which represents one's own fitness[8] plus the weighted sum of relatives' fitness, where the weights are the coefficients of relatedness. Then from a *gene's eye view* an individual benefits not only through personal reproduction, but also by helping the reproduction of others who share some of their genes (Okasha, 2013; Cox and Fafchamps, 2007).

Therefore, all else equal, more closely related individuals are more likely to behave altruistically towards one another. There is a lot of supporting evidence for this claim in other contexts: kinship patterns correlate with within-household violence, allocation of food, provision of childcare, and safeguards against infanticide, as well as migrant workers' remittances to their families, willingness to murder political rivals and form stable alliances, taking sides in disputes, emotional and material support within social networks, cooperation under catastrophic circumstances, membership in cooperative labor units, organ donation rates, etc. (see e.g. Cox and Fafchamps, 2007; Madsen *et al.*, 2007; Bowles and Posel, 2005; Fellner and Marshall, 1981).

The genetic relatedness of two individuals can be approximated by the *coefficient of relatedness*, that is, the expected fraction of identical by descent genes that are shared between two individuals in a *randomly mating population*. The value of the relatedness coefficient for identical twins is 1, for full siblings and fraternal twins 1/2, for parents and offspring 1/2, for grandparents and grandchildren 1/4, for first cousins 1/8, and so-on to a randomly chosen pair who have a relatedness coefficient of 0 (Okasha, 2013).[9] "J. B. S. Haldane once remarked, it would make sense to dive into a river to save two drowning siblings or eight drowning cousins" (Siegfried, 2006, p. 85). See Appendix A for further detail.

Ethnicity and relatedness

Genomic methods allow us to measure relatedness between and within populations. The genetic distance of two populations can be measured by F_{ST} known as the *coancestor coefficient*: "the probability that two alleles at a given locus selected at random from two populations will be different, [...] F_{ST} is strongly related to how long two populations have been isolated from each other. When two populations split apart, their genes can start to change as a result either

[8]Fitness should be thought of as reproductive success, e.g. as the expected number of progeny.

[9]In reality, even in a random mating population, a parent might share more than half of her genes with her offspring; "half those genes are surely identical because they came from the parent, while gene sharing with the other half of the child's genome is just what is shared with any random member of the population." Hence, a more precise way to think of relatedness is to "think of gene sharing in excess of random gene sharing" (Harpending, 2002, p. 142), and the coefficient of relatedness is more properly defined as $r = (Q - \overline{Q})/(1 - \overline{Q})$, where Q is the relatedness of the two individuals, while $\overline{Q}$ is the average relatedness in the population (Nowak *et al.*, 2010, p. 1059).

of random genetic drift or natural selection" (Spolaore and Wacziarg, 2009, p. 481). As shown by Harpending (2002), for large populations, genetic distance between two populations implies genetic similarity within those populations. Therefore, F_{ST} also measures the coefficient of kinship between members of the same population; for a random mating population, F_{ST} is simply half of the coefficient of relatedness, r.[10]

Between some ethnic groups, empirical estimates suggest that relatedness is not far above zero, so that co-ethnics are unlikely to be sufficiently related for kin selection to substantially influence behavior. For example according to Cavalli-Sforza *et al.* (1994), the genetic distance between English and French populations is $F_{ST} = 0.0024$. Therefore, in a world consisting of only English people, the kinship of any randomly chosen pair is zero, but in a world consisting of both English and French populations, two random English (or French) people have a relatedness of only $r = 0.0048$ (in between the relatedness of 3rd and 4th cousins under random mating).[11]

Sub-ethnic fractionalization and relatedness

Underlying the coefficients of relatedness noted above is a crucial assumption: random mating, "that mates are chosen with complete ignorance of their genotype (at the locus under consideration), degree of relationship, or geographic locality" (Gillespie, 2004, p. 13). The key to our argument about the role of sub-ethnic fractionalization in corruption is that in many cases, sub-ethnic fractionalization invalidates the assumption of a randomly mating population. When mating is non-random, so that members of some local groups are more likely to mate within the group than outside the group (*endogamy* due to geography, culture, etc.), the expected relatedness of kin and group members is higher than under random mating.[12]

In other words, the expected relatedness of siblings and cousins are 1/2 and 1/8 respectively, but only under random mating. Deviations from random mating can be caused by cultural preferences for inbreeding. If for example, a society has a preference for cousin marriage, as is the case in many places, actual relatedness will exceed expected relatedness. For example, two off-

[10] An individual's coefficient of kinship with someone randomly chosen from his own population is F_{ST} while his kinship with someone from the other population is $-F_{ST}$. "Negative relatedness implies that two individuals share fewer genes than average" (Gardner and Stuart, 2006, p. R663).

[11] This is about how closely groups of friends are related to one another. Christakis and Fowler (2014) find that friends' genotypes tend to be positively correlated, and the increase in similarity relative to strangers is at the level of fourth cousins. The authors were aware that some of the similarity in genotypes can be explained by "a simple preference for ethnically similar others" or "distant relatives" (*Ibid.*, p. 10797). Therefore, they applied strict controls for such factors in their study. This suggests that there might be "some sort of kin detection system in humans [...] such that, for each individual encountered, an unspecified system may compute and update a continuous measure of kinship that corresponds to the genetic relatedness of the self to the other individual" (*Ibid.*, p. 10800).

[12] Related literature suggests that assortative matching (and mating) can encourage the evolution of (local) cooperation and favoritism. See e.g. Bergstrom (2003); Grimm and Mengel (2009) for theoretical and experimental evidence on cooperation, and also Hammond and Axelrod (2006); Efferson *et al.* (2008); Fu *et al.* (2012) on favoritism.

spring of a first-cousin marriage have a relatedness higher than 1/2 ($r = 1/2 + 1/2 \times 1/8$): with probability 1/2 they inherit a gene from the same parent at each locus, and with probability 1/2 they each inherent a gene from a different parent, in which case the probability of gene sharing is just the relatedness between their parents, 1/8. If this pattern repeats over generations, local relatedness only grows. Similarly, deviations from random mating can be caused by *population division*: geography "can prevent random mating if individuals are more likely to mate with neighbors than with mates chosen at random from the entire species" (Gillespie, 2004, p. 13).

Hamilton (1975) takes such an argument to its logical extreme, developing a model of endogamous colonies where the relatedness of all colony members can rise to the level of siblings under random mating (1/2). In such a world,

> "siblings, parents, and offspring will still be the individual's closest relatives. Owing to inbreeding, their relatedness will be above the value of 1/2 that applies under random mating. Thus an individual should be more altruistic than usual to his immediate kin. But other neighbors who are not immediate kin are now also closely related, and it is this reduced contrast between neighbors and close kin that will give what is probably the most striking effect: we expect less nepotistic discrimination and more genuine communism of behavior. At the boundary of the local group, however, there is a sharp drop in relatedness, [...] this drop may be such as to promote active hostility between neighboring groups" (Hamilton, 1975, p. 340).

From the above, it follows that we can rank social groups in increasing order of genetic relatedness. Relatedness is lowest among random members of a population; it is slightly higher, but typically still quite low, within an ethnic group; and it is increasing in sub-ethnic groups such as endogamous tribes and clans, extended family, and finally, highest among direct relatives.

Bribery game with inclusive fitness

Suppose the payoffs in the bribery game are in units of *biological reproductive fitness*.[13] According to inclusive fitness theory, if players in the bribery game are genetically related, their payoffs should include not only the fitness effects on themselves but also on the other parties involved.

In particular the benefits and costs to others should enter into in the players' payoffs weighted by the coefficient r, of genetic relatedness between them. Let r_{po} represent the genetic relatedness of the private agent and the official. Also, let $r_{pc} = 0$ be the sum of relatedness of the private agent to citizens, and let $r_{oc} = 0$ be the sum of relatedness of the official to citizens. Then, the payoffs to the bribery game should be modified as shown in the game tree of Figure 2.

[13]Of course, the analogy is imprecise in the sense that corruption is not transacted in units of fitness. However, in many cases, corruption influences the allocation of large quantities of resources (monetary and otherwise), which are correlated with reproductive success. In an extreme case, if a corrupt act results in one individual living to reproduce and another dying before reproduction, the effects are direct in fitness terms.

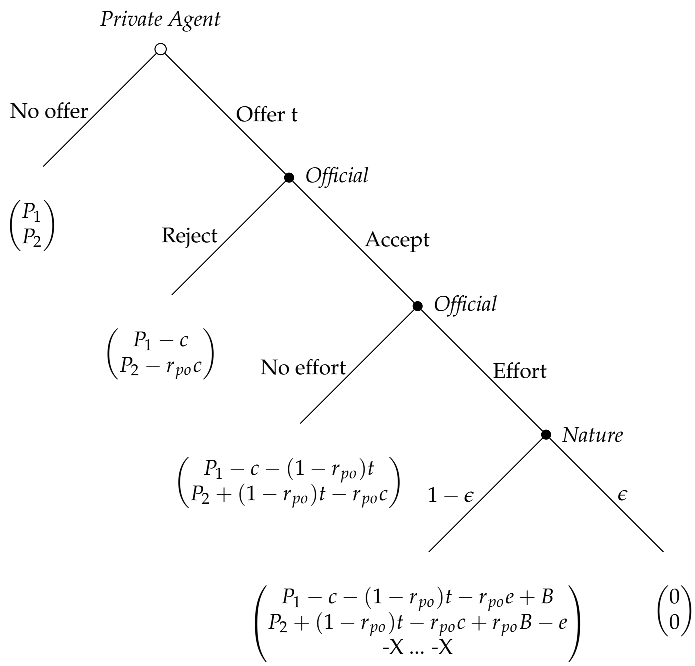

Figure 2: **Bribery game when Private Agent and Official are genetically related.**

In the bribery game with genetically related players, the subgame perfect equilibrium can be characterized as follows, by backward induction:

(I) If accepting the offer, the official honors the trust of the private agent and makes a corrupt effort on her behalf with a unique equilibrium strategy if

$$(1-\epsilon) > \frac{P_2 + (1-r_{po})t - r_{po}c}{P_2 + (1-r_{po})t - r_{po}c + r_{po}B - e} \tag{1}$$

and he accepts the offer if

$$(1-\epsilon) > \frac{P_2}{P_2 + (1-r_{po})t - r_{po}c + r_{po}B - e} \tag{2}$$

Implication 1: All else equal, the official is more likely to accept a bribe and make a corrupt effort as r_{po} increases.

(II) Assume that the conditions (3) and (4) hold and the official accepts the offer and exerts the corrupt effort as his unique equilibrium strategy. The private agent foresees the optimal strategy of the official; therefore she places trust and offers t in a unique equilibrium strategy if:

$$(1-\epsilon) > \frac{P_1}{P_1 - c - (1-r_{po})t - r_{po}e + B} \tag{3}$$

Implication 2: All else equal, the private agent is more likely to offer a bribe as r_{po} increases.

Note that while our example sets r_{oc} and r_{pc} equal to 0, if we allow r_{oc} to vary, the official is less likely to accept a bribe and make a corrupt effort as r_{oc} increases, and similarly, if we allow r_{pc} to vary, the private agent is less likely to offer a bribe as r_{pc} increases.

In-group favoritism among co-ethnics was Mauro's (1995) motivating example for using ethnic fractionalization as an instrumental variable for corruption: "bureaucrats may favor members of their same group"(*Ibid.*, p.693). But as our argument based on inclusive fitness highlights, ethnic fractionalization is unlikely to be sufficient to generate norms favoritism and corruption - it is also necessary to have high local relatedness to co-ethnics. As it turns out, fractionalization and high local relatedness are often correlated, but they needn't be, and moreover, it is possible to have high local relatedness due to sub-ethnic fractionalization, despite most people in a country being of the same ethnic background. Thus, under this framework, the key to understanding the effects of fractionalization on corruption is to identify the sources of sub-ethnic fractionalization, which increase relatedness (and the returns to favoritism and corruption) locally.

2.3 Consanguineous marriage, sub-ethnic fractionalization, and corruption

As noted above, geography- and culture-driven population division are the most common sources of sub-ethnic fractionalization. The influence of geography on population division should be obvious; as populations migrated around the world historically, they became isolated from one another due to vast distances and geographic barriers such as mountains, deserts and oceans that were only recently broken down by transportation technologies. Due to isolation, some groups accumulated relatively high local relatedness. However, our focus will be on culture-driven population division, in particular on the role of cultural preferences for and prohibitions of certain mating practices, which, when permitted, favor sub-ethnic fractionalization and thereby raise the relative returns to norms of favoritism and corruption.

One mating practice that directly increases local relatedness and encourages sub-ethnic fractionalization is a preference for consanguineous marriage, most prominently among cousins. In a cross-cultural ethnographic tabulation due to Murdock (1967) and Gray (1998), a total of 476 out of 1024 societies for which we have data either permitted or favored first and/or second-cousin marriage, and estimates suggest that roughly 10% of marriages around the world today are consanguineous (Bittles, 2012).[14,15]

[14]While the negative health effects of consanguinity are well-known (e.g. increased risk of autosomal-recessive disorders), some believe that there are countervailing positive effects as well (Jaber *et al.*, 1998).

[15]In a small sample, genomic estimates of the "inbreeding coefficient", which measures "the proportion of a genome that is 'autozygous' - homozygous for alleles inherited identically by descent from a common ancestor,"

The wide diversity in attitudes towards consanguinity in human societies partially originates in religious beliefs due to the common jurisdiction of religious institutions over marriage. Table 3 shows some of the diversity of religious attitudes toward cousin marriage around the world, and Appendix B summarizes the history of Christian and Islamic attitudes toward consanguinity. Of particular note are the fact that the Catholic Church has placed restrictions on cousin marriage since at least 500AD (sometimes extending these bans out to sixth cousins) and the fact that a persistent preference for cousin marriage can be seen in many Islamic countries, at rates as high as 50% of marriages.

Religion	Sect	Attitude toward Cousin Marriage
Judaism	Ashkenzi	Permitted
	Sephardi	Permitted
Christianity	Coptic Orthodox	Permitted
	Eastern Orthodox	Proscribed
	Protestant	Permitted
	Roman Catholic	Diocesan approval req.
Islam	Sunni	Permitted
	Shia	Permitted
Hinduism	Indo-European	Proscribed
	Dravidian	Permitted
Buddhism		Permitted
Sikhism		Proscribed
Confucian/Taoist		Partially permitted
Zoroastrian/Parsi		Permitted

Table 3: **Religious attitudes to consanguineous marriage (Bittles, 2012, p. 14).**

However, religion is not the only source of variation, and marriage norms may be particularly persistent, even as religious attitudes change. As one example, consanguineous marriage has long been prevalent in parts of Italy, despite it being an almost entirely Catholic country. Cavalli-Sforza *et al.* (2004) suggest this may be a result of persistent cultural norms imported during the Arab conquest of southern Italy over 1000 years ago. Going the other direction, majority-Protestant countries mostly legalized cousin marriage after centuries of living under the Catholic ban. Nevertheless, consanguinity remains rare in those countries. In the United States, cousin marriage is illegal in 25 states, though its frequency remains low even where it is legal.

Others have argued that consanguinity is a cultural adaptation to social and ecological circumstances. In his history of the family, Goody (1983) suggests that consanguinity may be a

are correlated as expected with consanguineous marriage rates (r = 0.349, p-value = 0.04, N = 26). The correlation would likely be higher except that the genomic measures also capture background (so-called "cryptic") inbreeding due to geographical population division (Pemberton and Rosenberg, 2014, p. 38).

property and wealth-preserving response to gender-egalitarian inheritance rules, which encourage the diffusion of property through out-marriage. A few studies have examined the causes and consequences of consanguinity in small-scale societies using detailed genealogies to directly measure relatedness. Walker and Bailey (2014) show that among forager peoples, such marriages are rare due to norms of exogamy and fission/fusion dynamics that disperse kin across groups, but among agropastoralists, particularly those that practice polygyny, the practice is more common, with average spousal relatedness rising as high as $r = 0.18$ (almost 50% greater than first cousins, $r = 0.125$). Using $\log(\text{surviving children})$ as a measure of fitness, estimates in Bailey *et al.* (2014) suggest that these marriage practices may be adaptive, with fitness maximized for moderate consanguinity among agropastoralists and with minimal consanguinity among foragers. Other evidence from Hoben *et al.* (2010) suggests that consanguinity may be more prevalent near the equator since it can raise the frequency of homozygosity for adaptive recessive mutations that defend against diseases and parasites, which are also more prevalent in warmer climes.

Regardless of its diverse origins, wherever it is practiced, consanguineous marriage directly increases local relatedness and encourages fractionalization, thereby altering the returns to norms of favoritism and norms of impartial cooperation. Thus, variation in consanguinity rates facilitates a test of our main hypothesis: that sub-ethnic fractionalization causes corruption.

To reiterate, our argument is that consanguinity increases incentives for kin altruism and hence for corruption, but the mechanism needn't be genetic. That is, while it might be possible to show that differential selection pressures resulting from persistent inbreeding could increase the relative frequency of "altruistic alleles" favoring kin altruism, genetic change (or genetic difference) is not necessary to explain a change in the relative importance of kin altruism (and consequent corruption) across groups. Instead, we assume that all humans possess the capacity for kin altruism as well as for cooperation with non-kin, and that the norms operating in any given society merely favor one or the other mechanism of cooperation, to varying degrees. Since humans are social creatures reliant on cultural norms of cooperation and information-sharing for survival, selection pressures also operate on these norms, so that a society's norms adapt to local conditions (Henrich, 2015). Thus, different mating patterns (due to culture or geography) may raise (or lower) the relative returns to norms of nepotism and local favoritism on the one hand and norms of impartiality, impersonal exchange and reciprocity on the other hand. For instance, in countries Christianized for at least 500 years (and long-exposed to consanguinity bans), we see a significant decrease in the importance of clans and lineage groups (Greif, 2006).

Moreover, cultural change and changes in local relatedness may be self-reinforcing. Historically, bans on consanguineous marriage were an important cause of migration, especially in agricultural societies where one male child inherited the family's land. Siblings without property, especially females, had to migrate to find marriageable men (Cavalli-Sforza *et al.*, 2004).

This exchange of people across distances may have increased the returns to impartial norms facilitating peaceful interaction with strangers, perhaps in the long run encouraging the development of large-scale institutions based on generalized trust, such as markets, which also facilitate out-marriage. Inducements to consanguinity (or absence of a ban) may have opposite effects. By shrinking the sphere of social interaction to a group of more closely related people, consanguinity may encourage norms of partiality and in-group favoritism, and such norms may be readily applied to affines and other fictive kin, generating tight-knit local groups at the expense of potential impartial and impersonal arrangements that would expand the possibilities for exchange more broadly. Moreover, the presence of these relatively higher returns could have an amplifying effect, further raising the incentive to consanguineous marriage; see Jones (2016) on feedback between social norms and kin altruism.[16]

Our argument is related to the literature that distinguishes between generalized morality and limited morality (or amoral familism) (Banfield, 1958; Platteau, 2000; Tabellini *et al.*, 2008). Limited morality is the extreme reliance on a narrow circle of family, friends or relatives; outside this circle, harming and cheating are allowed and frequent. In this narrow circle, people are raised to trust in-group members only. They are also taught to distrust people outside the circle, which hampers cooperation and exchange with strangers and outsiders, and as a result, impedes the development of formal institutions. Generalized morality is characterized by respect for abstract individuals and their rights, generalized trust and loyalty to general rules, which facilitates large-scale cooperation. The underlying mechanism that determines whether a society adopts limited morality has been attributed to strong versus weak family ties (Ermisch and Gambetta, 2010; Alesina and Giuliano, 2011, 2014), collectivism versus individualism (Yamagishi and Yamagishi, 1994; Yamagishi *et al.*, 1998), and clan versus corporation (Greif and Tabellini, 2015; Greif, 2006). We also contribute to this literature highlighting another mechanism: sub-ethnic fractionalization increases the relative returns to limited morality and therefore encourages corruption.

3 Empirical Strategy and Results

To provide evidence for a relationship between sub-ethnic fractionalization and corruption, we present data from cross-country regressions, within-country regressions and laboratory experiments. Each of the methods has limitations, and none of them can wholly address identification or endogeneity concerns, but our goal is that by approaching the problem at various levels of

[16]Todd and Garrioch (1985) make a similar point: while exogamous marriage in Europe served as a model for impersonal bureaucratic relations by creating links between unrelated individuals, endogamy impedes the creation of impersonal relationships by cutting "horizontally across the vertical edifice of the state, undermining the system and producing what in conventional administrative terms is called corruption" (p. 146).

granularity we can provide a set of robust, complementary tests of the main hypothesis: that sub-ethnic fractionalization causes corruption.

In our cross-country and within-country analyses, we employ data on consanguineous marriage as our measure of sub-ethnic fractionalization. As discussed in Appendix C, Bittles and Black (2015) have collected data on consanguinity at the country level from a multitude of sources, including surveys, public health studies, and church records. While our cross-country consanguinity sample is neither random nor representative, it covers the large majority of the global population. For our within-country analysis, the data on consanguinity has more complete coverage, as Cavalli-Sforza *et al.* (2004) have collected data on consanguinity in Italian provinces. While consanguineous marriage patterns are not the only source of sub-ethnic fractionalization, they have the virtue of directly increasing local relatedness, which should increase corruption by raising the relative returns to norms of favoritism as discussed above. This makes such data well-suited for testing our hypotheses.

As our measure of country-level corruption, we follow La Porta *et al.* (1999) and Alesina *et al.* (2003) and use data on institutional quality from ICRG. Our main analysis for Italy uses associative crime as a measure of corruption, though our findings are robust to alternative measures as noted in Appendix E. All data are described in detail in Appendix C.

In our analysis, we show that there is a significant relationship between consanguinity and corruption at the country level, even when controlling for other well-known determinants of comparative development and institutions.[17] Then we show that consanguinity also correlates with corruption across Italy, even when including similar control variables to those in the cross-country regressions. Finally, we report the results of an experimental corruption game in Iran and Canada where we experimentally manipulate relatedness, bringing strangers, co-ethnics and kin (siblings) into the lab, to test for kin and ethnic favoritism directly. Consistent with the theory, we observe more kin favoritism than ethnic favoritism in both countries; moreover, we only observe evidence of ethnic favoritism in Iran, despite the fact that both countries are similarly ethnically fractionalized.

3.1 Cross-country analysis

Figure 3 displays average ICRG institutional quality data from 1984-2011 alongside consanguinity data from Bittles and Black (2015). Grey colored areas indicate missing data. Although we have consanguinity data for 72 countries, in our primary analyses, there are 67 countries for which we have the full set of covariates used in our main regression analyses. In this sample, we

[17]In one of the only related studies we are aware of, Woodley and Bell (2013) identified a significant negative relationship between a country's level of democracy and the rate of consanguinity.

find a negative and highly significant correlation between institutional quality and consanguinity (Spearman's $\rho = -0.56$, p-value < 0.001, N = 67).[18]

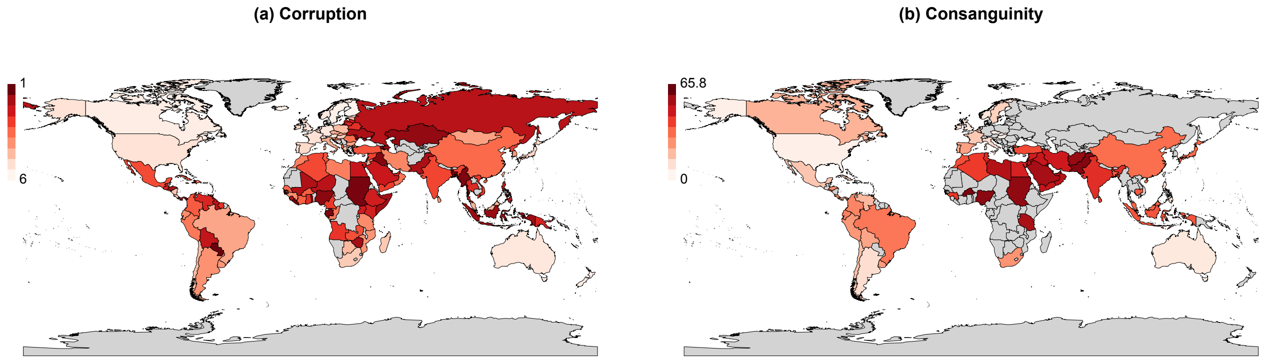

Figure 3: **Corruption and consanguinity around the world.**

Regression analysis

While the correlational evidence is strong, we also conducted a series of Tobit regressions controlling for relevant confounds and alternative explanations. We use Tobit because the dependent variable is restricted to the interval [0,6]. Results with OLS are qualitatively similar.

Our empirical strategy follows La Porta *et al.* (1999) and Alesina *et al.* (2003) who attempted to address the endogeneity of corruption by focusing on "(reasonably) exogenous sources of variation" (La Porta *et al.*, 1999, p. 223) in the *economic, geographical, political and cultural* characteristics of countries. Hence, we do not include political variables or variables capturing public policy. Instead, our analysis focuses on "more fundamental, or at least historically predetermined" variables (LaPorta *et al.*, 1999, p. 230; see also Treisman 2000, p. 409).

The most obvious economic heterogeneity across countries that can affect corruption is economic development, but development is almost certainly endogenous to corruption. While, there is evidence that poor countries are perceived to be more corrupt than rich ones, so that per capita income is a potential determinant of corruption, corruption itself can reduce per capita income (see e.g. Mauro, 1998; Tanzi and Davoodi, 1998; Campos *et al.*, 1999; Lambsdorff, 2003). As noted by Treisman (2000), one exogenous variable that is correlated with economic development but is unaffected by corruption is a country's latitudinal distance from the equator (indeed, log GNI per capita averaged over 1984-2011 correlates with latitude, Spearman's $\rho = 0.59$, p-value

[18]The result is similar if we instead use the 2013 Corruption Perception Index provided by Transparency International (http://www.transparency.org/research/cpi/overview) as our measure of corruption (Spearman's $\rho = -0.49$, p-value < 0.001, N = 67).

< 0.001, N = 67).[19] In addition to latitude, we also include regional dummies from Alesina *et al.* (2003) for Sub-Saharan Africa, East Asia and Pacific, Latin America and Caribbean and country size (population). Following the literature, we also include ethnic fractionalization and legal origins as sources of exogenous variation in country-level political characteristics, and we report heteroskedasticity robust standard errors.

After reporting a basic model using the variables described above, our main analysis relies on cross-country variation in cultural traits. First we consider the effects of a cultural preference for (and prohibitions of) consanguineous mating practices by adding consanguinity rates to the basic model, and then, in a series of regressions we allow consanguinity to compete with alternative cultural traits believed to influence corruption in the literature.

Main findings

Table 4 displays our first set of regressions. A full description of the variables is presented in Appendix C, Table C1, and the omitted legal origin dummy in the regressions is the British one.

Column (1) presents our basic regression model, inspired by La Porta *et al.* (1999) and Alesina *et al.* (2003), which includes a set of historically predetermined and exogenous economic, geographical and political variables. In column (2), we run the same regression using only the sample of countries for which consanguinity data exists and find qualitatively similar results. In column (3), we include consanguinity rates to account for sub-ethnic fractionalization, and the estimated coefficient is significant at the 1% level, almost doubles the R^2 and remains significant in alternative specifications using different measures of economic development. These estimates imply that a 1 standard deviation increase in consanguinity is associated with a reduction in quality of governance (i.e. increase in corruption) by about 0.75 standard deviations.

Latitude remains a significant determinant of corruption. This provides strong evidence that whatever the effect of corruption on growth, higher economic development is associated with lower corruption, as noted by Treisman (2000). When we include income per capita in the regression instead of latitude, in column (4), consanguinity is still highly significant. To address the endogeneity of income per capita more formally, we also used latitude as an instrument for income per capita in column (5) which yields similar results. In this instrumental variable regression, the Wald test of exogeneity (alpha) does not reject the null hypothesis of no endogeneity, so the point estimates are consistent. From significance at 1%, latitude becomes insignificant when income per capita is also included in the regression in column (6). The most plausible

[19]One possible indirect connection is through an effect of latitudinal distance from the equator on consanguinity rates. As noted above, Hoben *et al.* (2010) argue that relative parasite prevalence near the equator may raise the returns to consanguinity by raising the frequency of homozygosity for adaptive recessive mutations (e.g. parasite immunities). We find a high correlation between distance from the equator and consanguinity which provides further reason to control for latitude in our regressions (Spearman's ρ = -0.45, p-value < 0.001, N = 67).

VARIABLES	(1) Basic model	(2) Basic model restricted sample	(3) and Consanguinity	(4) Income instead of Latitude	(5) Latitude as instrument	(6) both Income and Latitude	(7) without Income and Latitude
Consanguinity			-4.463***	-3.664***	-2.513**	-3.566***	-5.087***
			(0.702)	(0.826)	(1.215)	(0.799)	(0.711)
Ethnic fractionalization	-0.062	-0.222	0.524	0.074	-0.123	0.226	0.319
	(0.452)	(0.617)	(0.469)	(0.420)	(0.380)	(0.433)	(0.511)
Log population	-0.104	-0.132	-0.175	0.105	0.297	0.042	-0.132
	(0.101)	(0.154)	(0.118)	(0.114)	(0.214)	(0.118)	(0.117)
Latitude	3.014***	3.586***	1.898**			1.026	
	(0.828)	(1.156)	(0.801)			(0.766)	
Log GNI per capita				0.712***	1.288**	0.592**	
				(0.234)	(0.517)	(0.243)	
Africa	-0.272	0.068	0.388	0.765*	1.209**	0.766*	0.217
	(0.256)	(0.448)	(0.343)	(0.410)	(0.534)	(0.408)	(0.333)
East Asia	-0.021	0.340	-0.440	-0.592	-0.275	-0.364	-0.983**
	(0.299)	(0.424)	(0.431)	(0.360)	(0.373)	(0.376)	(0.406)
Latin America	-0.182	0.451	-0.807***	-0.788***	-0.365	-0.604**	-1.310***
	(0.244)	(0.300)	(0.298)	(0.276)	(0.399)	(0.287)	(0.257)
Socialist legal origin	-1.349***	-0.903***	-1.212***	-0.706**	-0.470	-0.871***	-0.998***
	(0.266)	(0.303)	(0.285)	(0.304)	(0.330)	(0.314)	(0.331)
French legal origin	-0.250	-0.550*	-0.239	-0.057	-0.011	-0.135	-0.114
	(0.173)	(0.278)	(0.188)	(0.204)	(0.225)	(0.203)	(0.213)
German legal origin	0.570*	0.434	0.446	-0.163	-0.619	-0.044	0.401
	(0.340)	(0.375)	(0.312)	(0.252)	(0.437)	(0.266)	(0.337)
Scandinavian legal origin	1.238***	0.690*	0.787**	1.131***	0.984***	0.878***	1.313***
	(0.353)	(0.383)	(0.298)	(0.238)	(0.246)	(0.283)	(0.295)
Constant	3.216***	3.313**	4.643***	0.495	-3.269	1.005	5.147***
	(0.825)	(1.348)	(0.930)	(1.602)	(3.564)	(1.618)	(0.812)
σ	0.773***	0.779***	0.600***	0.575***		0.567***	0.632***
	(0.043)	(0.067)	(0.059)	(0.050)		(0.047)	(0.069)
α					-0.696		
					(0.546)		
Observations	134	67	67	67	67	67	67
Pseudo R-squared	0.247	0.199	0.377	0.407		0.417	0.342

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: **Regression analysis of the relationship between consanguinity and corruption.** Higher values of the dependent variable imply lower corruption.

interpretation is that latitude affects corruption only through income per capita which indicates that latitude is a reasonable proxy for income per capita in the regressions.

Compared to those in common law countries, governments in countries of socialist legal origin are more interventionist, and thus the observed negative effect of socialist legal origin on institutional quality in all regressions is consistent with previous findings.

While Alesina *et al.* (2003) note the difficulty of disentangling the independent effect of ethnic fractionalization from income per capita and latitude because of the high pairwise correlations, their ethnic fractionalization index is insignificant in all specifications, even excluding controls for income per capita and latitude. As another robustness check, we replicate three specifications from La Porta *et al.* (1999) and Alesina *et al.* (2003), restricting the sample to countries for which we also have consanguinity data (see Appendix D), and our results continue to hold. As the authors along with Treisman (2000) note, ethnic fractionalization has a reduced form relationship with corruption and is not typically significant after controlling for per capita income and latitude, while consanguinity remains highly significant in columns (3)-(7), with or without one or both of income per capita and latitude.

Alternative interpretations and confounds

Given concerns about the endogeneity of income to corruption, we will retain latitude as our proxy for economic development in subsequent regressions. From here on, we build upon specification (3) which controls for historical and predetermined variables. To assure the robustness of our interpretation, we compare our preferred cultural metric of consanguinity against alternative theories of culture and also consider possible confounds.

Religion. Religion is the most important historical cultural factor affecting institutions. Religion is potentially relevant to our analysis in two ways: through an indirect effect on corruption via consanguinity and through a direct effect on corruption as discussed in previous work (see La Porta *et al.*, 1999; Alesina *et al.*, 2003; Treisman, 2000).

A preference for consanguineous marriage is common in the Islamic world, and thus consanguinity rates and the percent of the country practicing Islam are highly correlated (Spearman's ρ = 0.73, p-value < 0.001, N=67).[20] In contrast, Catholicism has imposed a long-standing ban on consanguineous marriage, and this is evinced by a strong negative correlation between the share of a country practicing Catholicism and consanguinity (Spearman's ρ = -0.57, p-value $<$ 0.001, N=67). Finally, while Protestant religions do not officially ban consanguineous marriage, the frequency is quite low, and we find a large negative correlation between a country's share of Protestants and consanguinity (Spearman's ρ = -0.53, p-value < 0.001, N=67).

La Porta *et al.* (1999) and Treisman (2000) offered reasons why Protestantism may be a cultural deterrent to corruption, beyond its relationship to consanguinity. They argue that Protestantism is associated with attitudes such as Weber (1958)'s "Protestant work ethic" and a separation of church and state, both of which may have been conducive to growth and quality government, while countries that were predominantly Catholic or Muslim during this period were relatively more insular, hierarchical and interventionist (see La Porta *et al.*, 1999, p. 229).

In column (2) of Table 5, we include variables indicating the share of each country's population that practices Protestantism, Catholicism, and Islam; the excluded category is "other religions". We confirm La Porta *et al.* (1999) and Treisman's (2000) finding that the proportion of Protestants in a country's population is associated with lower corruption relative to other religious groups. Moreover, Islam and Catholicism are both associated with higher corruption.

[20]Note, however, that we find a significant correlation between consanguinity and corruption even if we focus only on minority-Muslim countries (Spearman's ρ = -0.43, p-value = 0.002, N=47).

Note that we also controlled for consanguinity, and though the coefficient is smaller, it remains highly significant. The significant coefficients on religion in our regressions confirm previous findings and suggest an additional effect of religion that is independent of its influence on consanguinity traditions. Lipset and Lenz (1999) argue that "Protestantism reduces corruption, in part, because of its association with individualistic, non-familistic relations" (Treisman, 2000, p. 428). Family ties and individualism are the next cultural traits that we discuss.

Family ties. As Cavalli-Sforza *et al.* (2004) note, consanguinity "may be especially attractive where family values are especially important, the size of extended families is large, and social contacts are much more frequent with close relatives" (p. 287). This suggests that sub-ethnic fractionalization (measured as consanguinity) may simply reflect the relative importance of family ties across countries, since "strong and stable social relations (such as family ties and group ties) promote a sense of security within such relations but endanger trust that extends beyond these relations" (Yamagishi *et al.*, 1998, p. 166-8). Several studies confirm the negative correlation of strong family ties with general trust (Yamagishi and Yamagishi, 1994; Yamagishi *et al.*, 1998; Fukuyama, 1995; Ermisch and Gambetta, 2010; Alesina and Giuliano, 2011). Moreover, there is evidence that the strength of family ties contributes to the explanation of heterogeneity in corruption (among other macroeconomic variables, see e.g. Alesina and Giuliano, 2010, 2014), and we find a large correlation between their measure of family ties and consanguinity (Spearman's ρ = 0.58, p-value < 0.001, N=45). Nevertheless, in column (3) which includes data on family ties, as with religion, consanguinity remains a highly significant predictor of corruption, despite losing nearly 1/3 of our observations to missing data on family ties; moreover, the coefficient on family ties is also significant, suggesting that the variables' effects on corruption are independent and do not necessarily capture the same underlying factors.

Trust. In contrast to the partiality that may be engendered by family ties, generalized trust is often considered to be a foundation of impartial institutions, and consistent with Yamagishi *et al.* (1998) and others, trust and family ties are negatively related in the sample for which we also have consanguinity data (Spearman's ρ = -0.52, p-value < 0.001, N=45). As measured in the World and European Values Surveys, trust has been shown to correlate with institutional quality and economic development (Uslaner, 2005; Francois and Zabojnik, 2005; Tabellini, 2010). One possible concern is that consanguinity-driven sub-ethnic fractionalization is an endogenous response to lack of trust, creating binding ties to encourage and enforce cooperation in the absence of other means. Perhaps surprisingly, we find no significant relationship between generalized

VARIABLES	(1) Basic model	(2) and Religion	(3) and Family ties	(4) and Trust	(5) and Individualism	(6) and Genetic diversity	(7) and Geography
Consanguinity	-4.463***	-2.411***	-3.853***	-4.663***	-3.028***	-3.494***	-3.874***
	(0.702)	(1.044)	(0.616)	(0.744)	(1.120)	(0.854)	(0.838)
Ethnic fractionalization	0.524	0.451	0.969*	0.846*	0.600	0.274	-0.140
	(0.469)	(0.406)	(0.569)	(0.429)	(0.469)	(0.463)	(0.375)
Islam		-1.492***					
		(0.408)					
Catholicism		-0.904***					
		(0.329)					
Protestantism		1.553**					
		(0.702)					
Family ties			-1.261***				
			(0.450)				
Trust				1.562			
				(0.977)			
Individualism					1.928**		
					(0.821)		
Genetic diversity						48.933	
						(67.500)	
Genetic diversity squared						-40.988	
						(50.427)	
Geographical controls							yes
Log population	-0.175	-0.284**	-0.329*	-0.257**	-0.311**	-0.223*	-0.126
	(0.118)	(0.118)	(0.185)	(0.126)	(0.146)	(0.119)	(0.152)
Latitude	1.898**	1.695***	1.138	1.531*	0.582	2.296***	-4.349**
	(0.801)	(0.605)	(1.108)	(0.885)	(0.909)	(0.801)	(1.754)
Africa	0.388	-0.232	-0.037	0.680	0.276	0.639*	0.446
	(0.343)	(0.302)	(0.304)	(0.504)	(0.414)	(0.356)	(0.306)
East Asia	-0.440	-0.497	-0.464	-0.526	-0.123	-0.582	-0.643*
	(0.431)	(0.416)	(0.457)	(0.444)	(0.503)	(0.463)	(0.363)
Latin America	-0.807***	-0.790**	-0.776**	-0.631**	-0.353	-1.305**	-0.895***
	(0.298)	(0.294)	(0.312)	(0.299)	(0.443)	(0.500)	(0.310)
Socialist legal origin	-1.212***	-1.115***	-1.440***	-1.054***	-0.756**	-1.084***	-0.989***
	(0.285)	(0.208)	(0.367)	(0.328)	(0.355)	(0.315)	(0.267)
French legal origin	-0.239	0.156	-0.259	-0.140	-0.172	-0.130	-0.047
	(0.188)	(0.180)	(0.244)	(0.266)	(0.226)	(0.202)	(0.191)
German legal origin	0.446	0.087	0.008	0.491	0.820**	0.151	0.122
	(0.312)	(0.246)	(0.488)	(0.297)	(0.344)	(0.357)	(0.325)
Scandinavian legal origin	0.787**	-0.780	0.255	0.400	0.999***	0.802**	0.916**
	(0.298)	(0.589)	(0.368)	(0.393)	(0.330)	(0.321)	(0.384)
Constant	4.643***	5.805***	6.127***	3.224**	4.901***	-9.197	9.296***
	(0.930)	(0.955)	(1.428)	(1.323)	(1.152)	(22.443)	(1.537)
σ	0.600***	0.508***	0.514***	0.560***	0.578***	0.580***	0.500***
	(0.059)	(0.043)	(0.082)	(0.053)	(0.051)	(0.058)	(0.053)
Observations	67	67	45	56	57	67	65
Pseudo R-squared	0.377	0.492	0.504	0.435	0.416	0.401	0.503

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: **Regression analysis of the relationship between consanguinity and corruption: potential confounds.** N varies due to missing data for some countries. See Appendix E.1 for analogous estimates of column (1) for each subsample.

trust and consanguinity (Spearman's ρ = -0.19, p-value = 0.16, N=56).[21] Nevertheless, when we

[21]Note that this insignificant relationship holds if we also restrict the sample to countries for which we have family ties data (p-value = 0.27). This may reflect an ambiguity in the question as it is asked in the WVS and EVS; in particular, while previous analyses have typically interpreted the question as referring to trust of strangers (see e.g. Johnson and Mislin, 2012, for a discussion), the question as asked does not make this distinction, leaving it up to the respondent to determine the reference group. In societies with high levels of sub-ethnic fractionalization,

control for trust in the regression analysis in column (4), it is insignificant; while consanguinity remains a highly significant predictor of corruption.

Individualism and collectivism. Differences in family and group ties in some countries have also been highlighted as part of another well-known cultural difference; some cultures are characterized by *individualism* and others by *collectivism*. Individualistic cultures emphasize the mutual independence of individuals; while, collectivistic cultures emphasize the bonds and obligations of group membership (see e.g. Oyserman *et al.*, 2002, for a survey). As with family ties, our measure of consanguinity may instead reflect underlying collectivism. We thus collected data on country-level individualism from (Hofstede, 2001). Individualism and consanguinity are highly negatively correlated (Spearman's ρ = -0.50, p-value < 0.001, N=57), and column (5) includes this as an explanatory variable. Indeed, there is little surprise that individualism and corruption are related since two of the questions underlying the individualism score ask about forms of nepotism (see Appendix C). Nevertheless, as with religion and family ties, in this regression consanguinity remains a highly significant predictor of corruption; while, individualism is also significant suggesting that the variables affect corruption independently and do not necessarily capture the same underlying factors.

Genetic diversity. Empirically, the genetic diversity of indigenous populations around the world (measured as mean expected heterozygosity) decreases with geographic (great circle) distance from Ethiopia (Ramachandran *et al.*, 2005; Pemberton *et al.*, 2013). This correlation is thought to reflect the prehistoric "out of Africa" exodus of Homo sapiens to settlements around the world. These migrations, which happened over thousands of years, resulted in a "serial founder effect", in which small founding populations at each new settlement carried with them only a portion of the genetic diversity of the source population.[22] Ashraf and Galor (2013) show that country-level predicted genetic diversity has an inverted U-shaped relationship with economic development, which could confound the interpretation of our measure of sub-ethnic fractionalization. In column (6) of Table 5, we control for predicted genetic diversity and predicted genetic diversity squared, following Ashraf and Galor (2013) (see Appendix C for details on the variables). Although consanguinity and predicted genetic diversity are highly correlated (Spearman's ρ = 0.50, p-value < 0.001, N=67), the coefficient on consanguinity remains sizable and highly significant. In an unreported regression, we instead include migratory distance from East Africa as an instrument for genetic diversity, and the results are qualitatively unchanged.

"most people" [with whom you interact] may refer to a different reference set than in societies with low levels of sub-ethnic fractionalization.

[22] Evidence of subsequent admixture complicates this view; see e.g. Lazaridis *et al.* (2016).

Geographical factors. Cavalli-Sforza *et al.* (2004) report that "following the national trend" most consanguineous marriages were celebrated in the mountains "with a clear decreasing trend moving down" to the hills, in the plain and finally in the city (p. 37-38). This suggests that cross-country differences in consanguinity rates may be a consequence of heterogeneity in geographical barriers to migration and exogamy. As a proxy for geographical barriers, we use the terrain ruggedness index from Nunn and Puga (2012). As explained in the data description in Appendix C, terrain ruggedness captures the average elevation differences of adjacent lands in each country. Perhaps surprisingly, ruggedness is not significantly correlated with consanguinity (Spearman's ρ = -0.14, p-value = 0.270, N = 67). In column (7), in addition to ruggedness and with a similar logic, we also included a variety of other geographic controls, taken from Ashraf and Galor (2013): soil suitability for agriculture, mean elevation, mean temperature, mean precipitation, percentage of the population living in tropical and subtropical zones, percentage of population living in temperate zones, and percentage of land near a waterway. Consanguinity again remains a highly significant predictor of corruption.

Additional robustness checks. To assuage concerns about the changing number of observations in Table 5 as we include additional variables for which we have limited data, in Table E1 in Appendix E.1, we compare the basic specification including only consanguinity from column (1) and the specification including each cultural variable, restricting to the sample for which we have data on both measures. Finally, since the data on consanguinity were collated from 448 studies over many decades, we report additional analysis in Table E2 in the appendix that addresses data collection dates. Our results remain robust in both tables.

Summary

While the evidence is compelling, such cross-country analyses can never allay all endogeneity concerns. Indeed, ethnic conflict resulting from ethnic fractionalization, greater intensity of local group interaction due to family ties, and collectivistic in-group loyalty all might encourage consanguinity-driven sub-ethnic fractionalization (or vice versa) for various reasons. Moreover, corrupt, low-quality governance may cause all of these variables indirectly. In many countries with weak institutions "social safety nets are incomplete or nonexistent and households must cope with an unforgiving environment of severe poverty and shocks to economic and physical well-being [. . .] especially against a backdrop of inadequate formal credit and insurance markets and a minimal welfare state" (Cox and Fafchamps, 2007, p. 3714). In such an environment, kin-based, tribal and ethnic networks may play an important role in helping households to manage shortages and uncertainty by supporting informal exchanges including gifts, feasts, rotating saving, informal loans, intermarriage and arranged marriages. These networks rely on in-group trust and reciprocity to enforce informal contracts and provide families with risk-sharing, insurance, and information - all functions which, in developed countries, are typically carried out by markets. Kinship, tribal and ethnic networks also help to organize the provision of public goods, a role that, in developed countries, is usually performed by government. But unlike governments, these networks do not have the power to tax or mobilize resources. Therefore, the provision of public goods relies on local, informal exchange of favors (see Cox and Fafchamps, 2007; Alesina and La Ferrara, 2005; Johnson and Earle, 2000). Thus, there is reason to believe that weaker institutions may also increase sub-ethnic fractionalization, raising the relative returns to kin-based, clan and tribal organization and concomitant norms of local favoritism.

Overall, our cross-country results are consistent with the idea, rooted in inclusive fitness, that sub-ethnic fractionalization, by increasing the relative returns to norms of favoritism, is an important cause of corruption. However, due to data limitations (e.g. small N, sample selection issues) and potential confounds (endogeneity, historical path dependencies, etc.), we next report analysis exploiting historical variation in consanguinity within a developed country that controls for any country-specific factors such as legal institutions and country-wide social norms.

3.2 Within-country analysis (Italy)

To further test the hypothesis that sub-ethnic fractionalization causes corruption, while controlling for country-specific institutional and cultural factors, we collected data on corruption and consanguinity in Italian provinces. Our consanguinity data are from Cavalli-Sforza *et al.* (2004) and are based on records of Papal dispensations for consanguineous marriages kept in the Vatican archives. Because consanguinity was officially banned by the church, couples who wished to circumvent the ban had to request approval from their local diocese. Detailed records of these marriages were preserved by the church and compiled in province-level statistics. Data on actual corruption crimes in Italy are not available at the provincial level. Therefore, exploiting a known link between corruption and associative crime (i.e. criminal conspiracy and mafia association, see Fiorino *et al.*, 2012), we use the latter as a proxy for corruption.

The link is straightforward: corruption is essential for criminal organizations because it facilitates the operation of illegal markets for goods and services such as cigarettes, drugs, prostitution, gambling, as well as activities such as car-theft, extortion, tax evasion, etc. In particular, corruption allows criminal organizations to obtain information about potential attempts to subvert their operations (by law enforcement or competitors), supports the deletion, falsification or destruction of incriminating evidence, and may be used to neutralize judges, prosecutors, police or experts who might interfere with their plans.[23,24]

Thus, we proxy for province-level corruption by using the number of associative crimes per 100,000 inhabitants of the province. Our data on associative crimes and control variables cover the period 2000-2013. All variables are described in detail in Appendix C, Table C2. Because of missing data on consanguinity or corruption (partly due to changes in the number of provinces since the year 2000), our analysis is based on data from 101 provinces. Note that even if associative crimes were independent of corruption, they would provide an appropriate means to test the effect of consanguineous traditions on the relative importance of norms of trust, cooperation and harm to in-groups and strangers.

Figure 4 displays corruption and consanguinity by province in Italy. We use the log transformation of consanguinity rates to bring the contrast into sharper relief for the figure, but our statistical analysis uses the raw rate of consanguinity as in the cross-country analysis. Grey-colored regions in the figures have missing data. Overall, we find a positive and highly significant correlation between consanguinity rates and our measure of corruption in Italian provinces (Spearman's ρ = 0.55, p-value < 0.001, N=101).

Since associative crime is not a measure of actual corruption, but only of the crimes reported and detected by the police, it may underestimate the true phenomenon because of judicial inefficiency. Making matters worse, the most corrupt regions may be those in which such crimes are least likely to be reported or detected. Thus, in Appendix E.2, we show that our regression results are robust to using an alternative measure of corruption from Golden and Picci (2005) based on computing the ratio of the value of existing physical infrastructure stocks (in 1998) to the expected value of infrastructure given government expenditures over the period 1954-1997. "The intuition underlying this measure is that, all else equal, governments that do not get what they pay for are those whose bureaucrats and politicians are siphoning off more public monies in corrupt transactions" (Golden and Picci, 2005, p. 41). The measure is available for 90 provinces for which we also have consanguinity data, and it is highly correlated with consanguinity (Spearman's ρ = -0.63, p-value < 0.001, N=90). See Figure E3 and Table E6.

[23] A model by Kugler *et al.* (2005) connects corruption and associative crimes, based on criminal organizations' attempts to avoid punishment by bribing law enforcement and otherwise engaging in local corruption.

[24] The proposed connection is also borne out in the available data. Data on corruption crimes exist at the region level (N = 20), so we report region-level correlations between consanguinity and corruption crimes in Appendix E.2, and the results are consistent with the province-level analysis. Moreover, aggregating our proxy measure of corruption, "associative crime", to the region level, the two measures are highly correlated, even with a small number of observations, suggesting that associative crime is a reasonable proxy for corruption (Spearman's $\rho = 0.49$, p-value $= 0.03$). See also Gounev and Bezlov (2010) who analyzed links between organized crime and corruption for The European Commission. Their analysis includes case studies on several European countries including Italy, where corruption and organized crime "are closely intertwined" (p. 157) and "criminal organizations such as the mafia are the most visible in terms of exercising power" (p. 163).

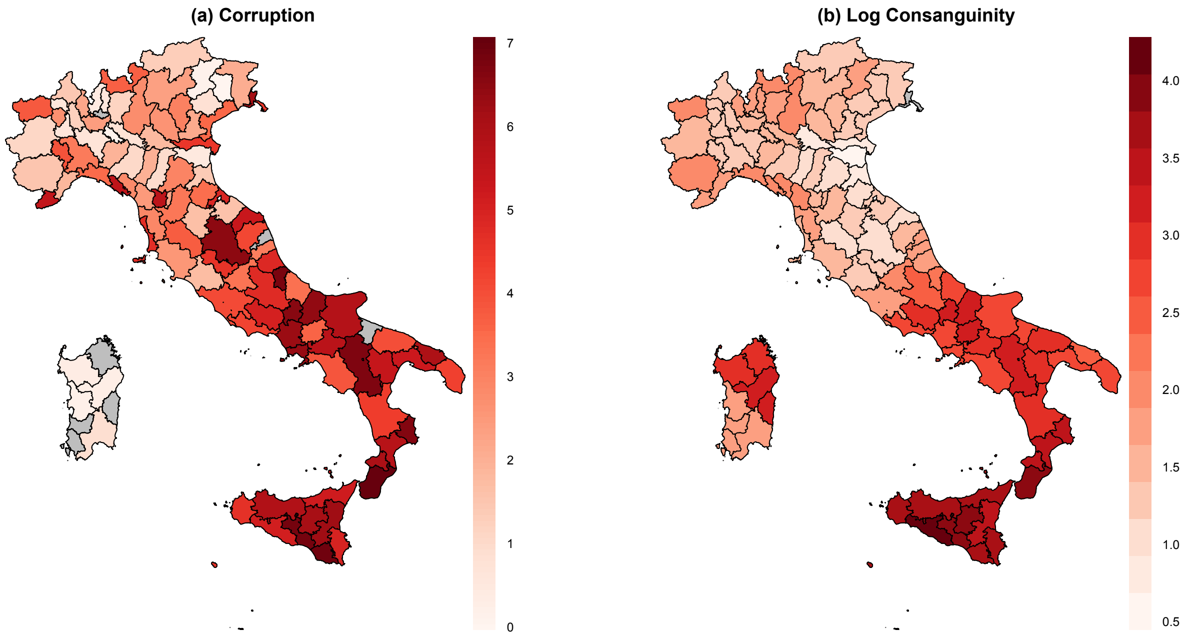

Figure 4: **Corruption and consanguinity in Italy.**

Regression analysis

As in the cross-country analysis, we regress our measure of corruption on a variety of controls and include consanguinity rates as our measure of sub-ethnic fractionalization. As noted by Del Monte and Papagni (2007), per capita income and the relative size of the agricultural sector "are often used as proxy variables for the level of development" (Del Monte and Papagni, 2007, p. 390). Again, due to the likely endogeneity of income per capita to corruption, we use the share of agriculture in the regression. In fact, the two variables are highly correlated (Spearman's ρ = -0.37, p-value < 0.001, N=101), so share of agriculture is a good proxy for per capita income. We also control for the population of the provinces. These variables are averaged over 2000-2013.

A well-known fact about corruption in Italy is that the corruption level is higher in the south. This difference is usually attributed to cultural differences between the south and north (Banfield, 1958; Putnam *et al.*, 1994). Figure 4b shows high consanguinity rates in southern Italy. Therefore, the impact on corruption that we attribute to consanguinity might instead result from some other feature of southern Italy related to corruption. Therefore, we also included a dummy variable in the regressions for the provinces in so-called *Mezzogiorno regions*: southern Italy (Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria) and the islands (Sicilia, Sardegna). Including this dummy variable assures a stringent test of our hypothesis because southern Italy and the islands also happen to have the highest consanguinity rates.

We computed the consanguinity rate of Italian provinces for the period 1945-1964, since these are available for all provinces and do not include sample variation due to either World War. The underlying data, however, date back to 1911, and Cavalli-Sforza *et al.* (2004) provide evidence that heterogeneity in consanguinity rates across Italy at the start of their time period was unrelated to a large vector of demographic, social and economic variables (e.g. birth/death rates, infant mortality, population density, immigration/emigration, literacy, and industrialization). Moreover, their evidence suggests that trends in consanguinity in Italy were similar across the entire country, despite substantial differences in levels (see Appendix E.2).

Main findings

Table 6 displays the results of our first set of regressions. Our baseline specification in column (1) reveals a large and significant coefficient on agricultural share of income, indicating a negative relationship between development and institutional quality in Italy. In column (2), we add a dummy for the South and Islands, which renders agricultural share of income insignificant. However, this dummy also becomes insignificant once we include consanguinity in column (3). This suggests that modern cultural differences between northern and southern Italy might be driven by historical differences in mating patterns between the two regions, perhaps "as a remote consequence of Arab domination in Sicily and southern Italy in the eighth to the eleventh centuries" (Cavalli-Sforza *et al.*, 2004, p. 3).

VARIABLES	(1) Basic model	(2) and South/ Islands	(3) and Consanguinity	(4) Income instead of Share of agriculture	(5) both Income and Share of agriculture	(6) without Income and Share of agriculture
Consanguinity			4.267**	4.304**	4.278**	4.318**
			(1.681)	(1.699)	(1.704)	(1.675)
Share of agriculture	12.707***	3.445	2.325		2.557	
	(4.408)	(4.263)	(3.622)		(3.987)	
Log population	0.069	0.024	0.017	-0.001	0.029	0.010
	(0.124)	(0.113)	(0.116)	(0.127)	(0.132)	(0.116)
South and Islands		1.186***	0.348	0.394	0.348	0.398
		(0.222)	(0.352)	(0.328)	(0.354)	(0.328)
Log value added per capita				-0.016	0.018	
				(0.080)	(0.089)	
Constant	0.451	0.946	0.855	1.092	0.755	1.016
	(1.654)	(1.497)	(1.525)	(1.567)	(1.629)	(1.510)
Observations	101	101	101	101	101	101
R-squared	0.106	0.327	0.440	0.437	0.440	0.437

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: **Regression analysis of the relationship between consanguinity and corruption in Italy.**

From the estimates in column (3), the effect of consanguinity on corruption is quite large: a one standard deviation increase in consanguinity rate is associated with a roughly 1/2 standard deviation increase in associative crimes per hundred thousand inhabitants in the province. Moreover, the 55 percentage point difference in consanguinity involved in moving from the least to the most consanguineous region would predict an increase of roughly 2.3 associative crimes per hundred thousand, about 40% of the difference between the most and least-corrupt region.

In columns (4) - (6), we show that our results are robust whether we control for share of agriculture or income. Contrary to the cross-country analysis, population, income and its proxy are not significant in the regressions. This suggests that between-province variability of population or the degree of development is too low to capture its effect on corruption. Consanguinity is associated with significantly higher corruption in all specifications. We use column (3) of the table as the baseline for subsequent regressions.

Alternative interpretations and confounds

As in the cross-country analysis, there are a variety of potential geographic and cultural confounds that must be addressed to increase confidence in our results.

Civil society. One cultural difference across Italian regions that may influence the quality of institutions and the level of corruption is the extent of civil society (civicness). The intuition is that more civically active areas may have better developed a capacity for effective government as citizens acquire habits, skills and values through participation in non-governmental organizations. Putnam *et al.* (1994) contrasts cooperation rooted in civil society to that based on Banfield's (1958) notion of 'amoral familism' in which heavy reliance on kinship ties results in lack of general trust and community cohesion. Our first measure of civicness is Putnam *et al.* (1994)'s civic involvement index, which is an aggregation of five indicators measured between 1860 and 1921, on a scale of 1 to 9. This measure of civicness is negatively correlated with consanguinity (Spearman's ρ = -0.73, p-value < 0.0000, N=101). This might suggest that consanguinity is just a product of lack of civicness. However, controlling for civic involvement in column (2) of Table 7, consanguinity remains highly significant, although the results also confirm Putnam *et al.* (1994)'s hypothesis; civicness exhibits a modest but significant negative relationship with corruption. As a second measure of civicness, in column (3) we use the number of voluntary organizations (established before 1945) per 100,000 inhabitants, with qualitatively similar results.

Autocratic history. 14th-century Italy was divided into four areas with distinct governments. Noting the strong correlation between an area's degree of historical autocracy/republicanism and its index of civic involvement, Putnam *et al.* (1994) argue that this reflects path dependence through which autocratic traditions of the past reduce institutional quality today. "The southern territories once ruled by the Norman kings constitute exactly the seven least civic regions, [...] the Papal States correspond to the next three or four regions up the civic ladder, [...] At the other end of the scale, the heartland of republicanism in 1300 corresponds uncannily to the

VARIABLES	(1) Basic model	(2) Civic involvement (1860-1921 AD)	(3) Voluntary organizations (established before 1965)	(4) Autocracy (circa 1300 AD)
Consanguinity	4.267**	4.029**	4.220**	2.917*
	(1.681)	(1.609)	(1.691)	(1.732)
Share of agriculture	2.325	2.085	2.551	4.766
	(3.622)	(3.574)	(3.644)	(3.182)
Log population	0.017	0.001	0.031	-0.024
	(0.116)	(0.114)	(0.119)	(0.113)
South and Islands	0.348	-0.265	0.314	(omitted)
	(0.352)	(0.530)	(0.358)	
Civic involvement		-0.127*		
		(0.067)		
Voluntary organizations			-0.007**	
			(0.004)	
Ex-communal republics				-0.262**
				(0.129)
Papal states				0.377
				(0.239)
Kingdom of Sicily				0.676*
				(0.365)
Constant	0.855	2.069	0.722	1.490
	(1.525)	(1.554)	(1.555)	(1.476)
Observations	101	101	101	92
R-squared	0.440	0.457	0.443	0.542

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: **Regression analysis of the relationship between consanguinity and corruption in Italy, in light of Putnam *et al.* (1994).**

most civic regions of today, followed closely by the areas still further north in which medieval republican traditions, though real, had proved somewhat weaker" (Putnam *et al.*, 1994, p. 133). Autocratic traditions were more common in the south (where consanguinity is also prominent today), which might suggest that consanguinity reflects the historical continuity of governance patterns circa 1300 AD.

To control for this possibility, we created four historical autocracy/republicanism dummies for provinces that reflect early 14th century governance by communal republics, ex-communal republics, the Papal states, and the Kingdom of Sicily, respectively (N = 92; missing data is due to missing regions in the map in Putnam *et al.*, 1994). Since the South and Islands dummy includes all the regions from the Kingdom of Sicily, that dummy variable drops from the regression. The omitted dummy in the regression is for the communal republics. These findings confirm Putnam *et al.* (1994)'s hypothesis that regions with more autocratic governance at the beginning of the fourteenth century have weaker institutions today, but a (weakly) significant effect of consanguinity remains, even after controlling for this history.

Past political domination. Another historical path dependence may have arisen from waves of colonization and political domination to which different parts of Italy were subjected in the

Middle Ages, which carried with them cultural, political and institutional baggage that could influence outcomes today. "The two extreme cases are identified by the State of the Church, that was an example of corrupt institutions and administrative inability, and Austria that is usually portrayed as a good administrator that did not implement exploiting or extracting policies" (Di Liberto and Sideri, 2015, p. 13). An instrument designed to capture the effect of these historical differences was constructed by Di Liberto and Sideri (2015) using dummy variables that identify, for each province, the administration that presided *continuously* during the period 1560-1659: Spanish, Papal, Austrian, Venetian, Sabaudian and Independent. In column (2) of Table 8, we include these variables as additional controls; the omitted dummy is for Spanish domination. As expected, Papal administration during 1560-1659 is associated with higher corruption today, and having remained independent at that time is also associated with higher corruption. However, consanguinity remains significant in the regression.

Family types, family ties. Consanguinity may be most attractive when extended families are close-knit and there are frequent interactions with kin, and strong family ties have been implicated as a source of corruption. Thus, the observed effect of consanguinity may instead simply proxy for family ties. Consistent with this idea, a number of studies have shown that medieval family types as classified by Todd (1990) are associated with current regional or cross-country differences in development and institutions (e.g. Duranton *et al.*, 2009; Galasso and Profeta, 2011; Alesina *et al.*, 2015). Todd's classification of family types comes from the cohabitation patterns between generations within families (nuclear or extended) and inheritance practices (equal or unequal division of assets among children). Todd (1990) uses his classification of family types "to explain relative levels of diffusion or resistance to important societal changes such as Protestantism, secularism, or political ideology" (Alesina and Giuliano, 2014, p. 180), where e.g. nuclear family structures encourage children to the leave the home, weakening the influence of extended family on norms and behavior.

According to Todd (1990), Italy had three family types; incomplete stem family (extended family, unequal inheritance), communitarian family (extended family, equal inheritance), and egalitarian nuclear family (nuclear family, equal inheritance). In column (3) of Table 8, we controlled for family types where the omitted dummy is the incomplete stem family. Consanguinity remains highly significant in the regression. The communitarian family type, characterized by both cohabitation with extended family and egalitarian inheritance, is also significantly associated with higher corruption. As a second and more recent measure of family ties, following Alesina *et al.* (2015) we used the fraction of youth aged 18-34 living with at least one parent, averaged over the period 2002-2009 (from ISTAT). Controlling for this measure of family ties in column (4), consanguinity remains significant.

VARIABLES	(1) Basic model	(2) Dominations (1560-1659 AD)	(3) Family types (Middle Ages)	(4) Family ties	(5) Ruggedness
Consanguinity	4.267**	4.152**	4.600***	4.620***	3.884**
	(1.681)	(1.732)	(1.693)	(1.727)	(1.753)
Share of agriculture	2.325	1.710	2.327	2.088	2.808
	(3.622)	(3.794)	(3.597)	(3.767)	(3.685)
Log population	0.017	0.017	0.011	0.029	0.058
	(0.116)	(0.116)	(0.118)	(0.114)	(0.109)
South and Islands	0.348	0.819**	0.403	0.071	0.293
	(0.352)	(0.383)	(0.346)	(0.515)	(0.357)
Papal		0.849***			
		(0.218)			
Austrian		-0.185			
		(0.178)			
Venetian		0.320*			
		(0.170)			
Sabaudian		0.314			
		(0.190)			
Independent		0.514***			
		(0.162)			
Communitarian family			0.392**		
			(0.192)		
Egalitarian nuclear family			0.007		
			(0.193)		
Family ties				0.028	
				(0.043)	
Mountain					0.259
					(0.239)
Hill					0.764***
					(0.268)
Constant	0.855	0.454	0.743	-0.886	-0.033
	(1.525)	(1.532)	(1.584)	(2.818)	(1.428)
Observations	101	101	101	101	101
R-squared	0.440	0.483	0.464	0.444	0.466

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: **Regression analysis of the relationship between consanguinity and corruption in Italy: additional confounds.**

Ruggedness. We attempt to control for potential geographic influence on consanguinity by controlling for the fraction of each province's land area covered by mountain, hill and plain lands with reference to national area from ISTAT. In column (5), the fraction of plain lands is the excluded category. Consanguinity remains a significant predictor of corruption. The fraction of hill lands is also significant in the regression, consistent with other evidence that rugged terrain reduces the effectiveness of administration.

Additional robustness checks. Although we prefer agricultural share of income as a measure of economic development, our findings are qualitatively unchanged when we control for per capita income; see Table E4. Our results are also robust to altering cutoff dates for computing consanguinity rates from 1945-1964 to 1950-1964, 1955-1964, or 1960-1964; see Table E5.

Finally, we report analysis using three alternative corruption metrics available only at the region level (N = 20), and our results are qualitatively unchanged. Moreover, each of these measures of institutional quality is strongly and negatively correlated with province-level associative crime (Spearman's $\rho < -0.43$, all p-values ≤ 0.05). See also Figures E1 and E2 in Appendix E.2.

Summary

In each specification and controlling for a variety of possible historical and geographical confounds, consanguinity is a significant predictor of corruption. As in the cross-country analysis, these data are highly consistent with a model in which corruption is in part driven by sub-ethnic fractionalization, as reflected in consanguinity.[25]

3.3 Laboratory Experiments

The third prong of our approach employs experiments to directly test the effects of kinship and co-ethnicity on corruption in a stylized laboratory game. Subjects play a one-shot, three-person bribery game, in which Person A may attempt to bribe Person B, who can choose whether to incur a corruption cost, thereby helping A and harming Person C. In each triplet, there are two "related" people (either co-ethnics or kin) and one unrelated person. By varying assignment of people to roles (e.g. A related to B vs. A related to C), we can test the predictions of inclusive fitness theory directly.

We conducted the experiments in two large, ethnically heterogeneous cities: Vancouver, Canada and Urmia, Iran.[26] Importantly for our motivation, both Iran (0.67) and Canada (0.71) are similarly ethnically fractionalized according to the measure developed in Alesina *et al.* (2003). Vancouver is the largest city in the province of British Columbia and has seen a large influx of people from East and South Asia in the last 30 years. Today, the two most common ethnic backgrounds are English and Chinese. Urmia is the capital of West Azerbaijan Province in Iran, and the city has been home to numerous ethnic groups during its long history. Today, Azeri Turks and Kurds are the two main ethnic groups in the city.

While Vancouver and Urmia are both multi-ethnic metropolises with populations around 600,000, they differ in the cultural and institutional environment, specifically regarding the importance and structure of kin networks. Extended family is very important in Urmia, and clans

[25]One further implication of our theory that our current data does not allow us to test is that *local crime*, in which neighbors are targets, should be less common in regions with high consanguinity rates. Buonanno and Vanin (2015) provide related evidence consistent with our findings and with this hypothesis as well. Using the distribution of surname frequencies from Italian phonebooks, they show that municipalities with more surname concentration (i.e. with more endogamy) exhibit both more tax evasion (of a federal tax) and less local crime.

[26]Our experiments in Iran were conducted in collaboration with the Moaser Research Center which possesses a permit from the Ministry of Science, Research and Technology to conduct research in Economics and Management. The center took full responsibility for planning, ethical review and official approvals to run experiments in Iran.

and tribes continue to have influence in the region.[27] Moreover, consanguineous marriages are very common in Urmia; consanguinity rates for Azeri Turks and Kurds in Iran are 31.6% and 40.1%, while the rate for Iran as a whole is 32.3% (Bittles and Black, 2015). On the contrary, family structure in Vancouver is mostly nuclear and consanguinity is very rare; in Canada, the rate is 1.5% (Bittles and Black, 2015). This variation in cultural milieu also allows us to compare the effects of background consanguinity (and its possible effects on social norms) on corruption.

It can be argued that experiment results in Vancouver and Urmia can not be readily generalized to Canada and Iran, but this doesn't interfere with our ability to test the main implication of inclusive fitness, which can be tested within-country. Nevertheless, the cross-country comparison provides suggestive evidence that speaks to our hypotheses. Moreover, subsequent robustness checks conducted in Tehran (described below) indicate no city effect.

The game

Subjects participated in the bribery game shown in Figure 5, which is a simplified version of the game described in Section 2. Unlike above, there is no risk of punishment. We remove this possibility to eliminate a source of noise, as the impact of punishment has been investigated in previous experimental studies (e.g. Abbink *et al.*, 2002). For simplicity, we also assume that only one citizen suffers the negative externality of corruption. We chose our parameters so that bribery (A choosing "Transfer") and corruption (B choosing "Accept/Right") do not occur in the subgame perfect Nash equilibrium with unrelated, payoff-maximizing agents, and our design also ensures that the payoffs resulting from successful bribery and corruption are both inequitable and inefficient relative to the status quo, so that distributional and social welfare preferences do not predict corruption. However, as in our treatments below, depending on the relatedness of A, B and C, inclusive fitness models may predict corruption.

Because of the negative connotation attached to words like "bribe", "corrupt effort", and "negative externality", we applied non-normative language in the experiment using words like "Transfer/Not-transfer", "Reject/Accept", "Right/Left", "payoff added/deducted".[28] In order to make full use of our limited sample, we elicited Person B's strategies using the strategy method, so that we know what he/she would have chosen, had Person A offered the bribe.

Payoffs were displayed in Experimental Currency Units, and our conversion rates tried to assure that the stakes were purchasing power-equivalent across the societies. We used local pizza prices as our measure of students' purchasing power since both cities have many pizza shops,

[27] http://www.iranicaonline.org/articles/kurdish-tribes

[28] While Abbink and Hennig-Schmidt (2006) and Barr and Serra (2009) find no effect of framing in laboratory corruption games, their experiments were run with a single sample. To avoid risk of culture-specific framing effects, we erred on the side of caution.

and pizza is popular among students. The price of a medium pizza in Vancouver including tax is around 15 CAD and in Urmia around 15000 Tomans[29]. Therefore, in Vancouver, we paid $7 for arriving on time and converted ECU in the experiment at a rate of 10 ECU = $1. In Urmia, we paid 7000 Tomans for arriving on time and paid 10 ECU = 1000 Tomans. At the conclusion of the experiment a subset of subjects completed a post-experiment questionnaire (see Appendix F.3).

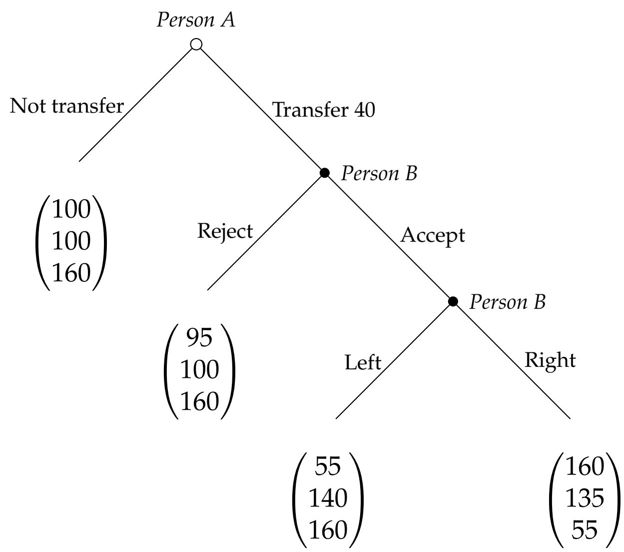

Figure 5: **Bribery game in the experiment.** Each terminal node shows the payoffs for Person A, Person B and Person C, from top to bottom.

Design and treatments

We employ a one-shot, between-subject design. Our treatments vary 1) whether the related pair of subjects in each triplet are related by kin (K) or co-ethnicity (C), and 2) the assignment of subjects to roles. This generates the following treatments, where S refers to the Stranger:

KKS/CCS. Persons A and B are kin/co-ethnics. A(B) knows that B(A) is kin/co-ethnic and also knows that B(A) knows that A(B) is kin/co-ethnic. No information regarding the ethnicity of Person C is given to A or B, and C has no information about the ethnicity of the other players or their being related by kin or co-ethnicity.

KSK/CSC. Persons A and C are kin/co-ethnics. A(C) knows that C(A) is kin/co-ethnic and also knows that C(A) knows that A(C) is kin/co-ethnic. No information regarding the ethnicity

[29] Although the Rial is the official currency of Iran, Iranians employ the term 'Toman', meaning 10 rials

of Person B is given to A or C, and B has no information about the ethnicity of the other players or their being related by kin or co-ethnicity.

SKK/SCC. Person B and C are kin/co-ethnics. B(C) knows that C(B) is kin/co-ethnic and also knows that C(B) knows that B(C) is kin/co-ethnic. No information regarding the ethnicity of Person A is given to B or C, and A has no information about the ethnicity of the other players or their being related by kin or co-ethnicity.

We randomly assigned one of the three treatments at the kin/ethnic level to each triple of subjects. Subjects were matched in triplets with their kin/co-ethnic based on their self-reported kinship/ethnic origin in a pre-experiment questionnaire (see Appendix F.2). Pre-experiment questionnaires were collected from subjects online or in paper, prior to the experiment. In the questionnaire, in addition to ethnic origin, we collected demographic information such as age group, gender, degree, and field of study to avoid highlighting the aim of our research. Before subjects learn their roles and information about subjects in the other roles, we mentioned that "you might observe some background information from the pre-experiment questionnaire about participants in the other roles." Also, we always included age-group information for other players in addition to ethnic origin information. We chose 18-30 as the age group to present in the experiment because it covered all the subjects we needed for our sample; therefore, age information was the same for all treatments. We were hoping that these cautions along with the between-subject design would minimize any possible experimenter effect.[30] The instructions and more detailed procedures of the experiment are presented in Appendix F, including sample pages showing how we exchanged information between subjects in the three-player game.

Subject pool

For the ethnic level treatments, our subject pool in Vancouver consisted of 180 Canadian-born undergraduate students with English or Chinese origins from the University of British Columbia and Simon Fraser University, both located in the Vancouver area. The subject pool in Urmia, Iran consisted of 180 Iranian-born undergraduate students with Azeri or Kurdish origins, taking courses in Urmia University during summer 2015. From each city, we collected data from 20 triplets in each of the three ethnic-level treatments (CCS, CSC, SCC).

For the kin level treatments, we collected data on all three matching schemes in Urmia and

[30]When we began our experiments in Vancouver, to present ethnic origin information, we used the word "ethnic origin" on the information page. Later, we dropped this word for the rest of the experiments in Vancouver and all the experiments in Iran, considering that it might affect subjects' choices due to the salience of "ethnicity". However, the results of experiments in Vancouver indicate that using the word "ethnic origin" had no effect on behavior.

only one matching scheme in Canada (KKS) since the inclusive fitness hypothesis can be tested within-country and recruiting subjects for the Kin treatment in Canada was extremely difficult. For these treatments, we asked students whether their sibling would like to participate in the experiment, and if they answered with "Yes", we also asked the occupation and age group of their sibling. Then we invited those pairs of siblings who both were 18-30 years old and students. For each pair of siblings, another randomly chosen student was invited to participate in the three-person game. In Urmia 180 subjects (60 sibling pairs + 60 others) participated in the three kin level treatments (KKS, KSK,SKK), with 20 triplets per treatment. In Vancouver, 39 subjects (13 sibling pairs + 13 others) participated in the KKS treatment.[31]

Finally, we conducted two robustness checks: 1) a "Friend" treatment in both countries, in which subjects were asked to bring a close friend to the laboratory and they participated together in the role of persons A and B. The Friend treatment is designed to test whether observed corruption among kin is driven by familiarity. In particular, the possibility in our design of 'gains from exchange' in corruption suggests that trusted friends might also be prone to cooperate at the expense of unknown 3rd parties; 2) a "High Cost" treatment involving variants of the Kin, Friend and Stranger treatments in which we increase the cost of corruption by player 2 to eliminate the mutual gains from corruption (such that player 2 is worse off by engaging in corruption than if player 1 had not offered the bribe). By varying the cost of helping, we can test the strength of norms of favoritism within and across countries. In total we collected data on an additional 90 subjects in Canada (10 triplets in the FFS treatment and 20 triplets in the FFS_High treatments) and on 180 additional subjects in Tehran, Iran (12 triplets each in the SSS, SSS_High, FFS_High, KKS_High and KKS_High_Cousins treatments). We conducted the SSS treatments to check for baseline differences in corruption among strangers between Tehran and Urmia.

Hypotheses

The inclusive fitness hypothesis states that the frequency of offering a bribe by players A and the frequency of accepting the bribe and making the corrupt effort by players B are positive functions of genetic relatedness to the other player and negative functions of genetic relatedness to the citizen. This hypothesis is best tested with the data from Urmia, where we have substantial variation in relatedness in all treatments (comparing the behavior of Kin to that of Strangers and Co-ethnics). We can also test this hypothesis in Vancouver with the same variation in relatedness but only in one of the treatments, where player A and B are related. Comparing behavior across countries we are able to test whether norms of favoritism and corruption are more prominent in

[31] We exclude from the sample one father-daughter pair since all other kin observations were on siblings. Interestingly, the father played the role of person B and was one of very few subjects to reject the bribe; his explanation for his decision indicated that he planned to compensate his daughter for her loss outside of the experiment.

Iran where we observe increased sub-ethnic fractionalization.

3.4 Experimental findings

First we report within-country comparisons testing for the effects of relatedness on behavior, and then we report between country comparisons, which provide suggestive evidence for the effects of sub-ethnic fractionalization. We conclude with a discussion of our Friend treatment, which highlights our interpretation of the findings.

Iran

The experimental results for Urmia, Iran are presented in Table 9. Each entry in the table shows the fraction of subjects choosing to engage in bribery or corruption, by treatment and matching scheme. Since we have Kin and Co-ethnic treatment data for all three matching schemes in Iran, we first test for the predicted comparative statics within and between the treatments.

	Kin		Co-Ethnic	
	Bribery	*Corruption*	*Bribery*	*Corruption*
A & B related	18/20	19/20	17/20	16/20
A & C related	1/20	7/20	10/20	10/20
B & C related	8/20	1/20	14/20	9/20

Table 9: **Relative frequency of bribery and corruption by treatment in Urmia, Iran**.

Let μ_k be the relative frequency of bribery in matching scheme k, with $k \in \{KKS, KSK, SKK\}$ in the Kin treatment and $k \in \{CCS, CSC, SCC\}$ in the Co-ethnic treatment. Under the hypothesis that bribery is increasing in relatedness of A and B and decreasing in relatedness of A and C, in the Kin treatment we expect that $\mu_{KKS} > \mu_{SKK} > \mu_{KSK}$, and a Cochran-Armitage test rejects the null hypothesis of equal relative frequency across the treatments in favor of the ordered alternative (technically, the alternative is that the ordering is weak, with at least one relationship strict, $\chi^2 = 28.93$, p-value < 0.001). Under the hypothesis, we expect the same ordering in the co-ethnic treatment. Again a Cochran-Armitage test rejects the null in favor of the alternative that $\mu_{CCS} > \mu_{SCC} > \mu_{CSC}$ ($\chi^2 = 5.66$, p-value = 0.02). We also expect to observe an effect of relatedness on the decision of B to engage in corruption (i.e. accept the bribe from A and reciprocate, harming C). Let ν_k be the relative frequency of corruption under matching scheme k. In the model based on inclusive fitness, corruption is hypothesized to increase in the relatedness of A and B and decrease in the relatedness of B and C; thus we expect that $\nu_{KKS} > \nu_{KSK} > \nu_{SKK}$. A Cochran-Armitage test rejects the null hypothesis of no difference in favor of the ordered alternative ($\chi^2 = 32.73$, p-value < 0.001). Similarly, we can reject the null hypothesis of equal relative frequency in favor of the alternative that $\nu_{CCS} > \nu_{CSC} > \nu_{SCC}$ ($\chi^2 = 5.04$, p-value = 0.02).

Although a Cochran-Armitage test provides evidence in support of both kin and ethnic favoritism, when compared with strangers' decisions as the baseline (recall that in both kin and ethnic treatments, they were not informed of the relationship between their counterparts), kin favoritism shows a strong effect (hypotheses $\mu_{KKS} > \mu_{SKK}$, $\mu_{KSK} < \mu_{SKK}$ and $\nu_{SKK} < \nu_{KSK}$ are confirmed, p-values = 0.003, 0.02, 0.05), but ethnic favoritism has a weak effect and appears only when player A and B are related by ethnicity (hypothesis $\mu_{CCS} > \mu_{SCC}$ is confirmed, p-value = 0.04, but not $\mu_{CSC} < \mu_{SCC}$ and $\nu_{SCC} < \nu_{CSC}$, p-values > 0.33, two-tailed proportions tests), i.e relatedness to C decreases the frequency of bribery and corruption in the kin treatment but not in the ethnic treatment.

Importantly, inclusive fitness also has implications for comparing the Kin and Co-ethnic treatments under the same matching scheme. Three hypotheses each on bribery and corruption rates arise from a model of inclusive fitness, and we report each hypothesis and a corresponding proportions test in Table 10, where the null hypothesis is no difference in proportions and the alternative hypothesis is one- or two-tailed in line with the theory. Here, the evidence is considerably more mixed. The bribery and corruption rates among co-ethnics who are in roles A and B are nearly as high as those of kin in the same roles, and all are at least 80%, so it is perhaps unsurprising that we do not observe significant differences between the treatments here, despite the comparative statics being in the predicted direction. Moreover, as predicted, while they are not identical, strangers' decisions (recall that they were not informed of the relationship between their counterparts) are not statistically distinguishable between treatments in our (admittedly small) sample. The strongest evidence is found in differences in the willingness to (potentially) harm a co-ethnic as compared to a sibling. When A and C are related, bribery is significantly less likely in the Kin treatment than in the Co-ethnic treatment, and similarly, when B and C are related, corruption is significantly less likely in the Kin treatment than in the Co-ethnic treatment. Overall, the Iranian data provides support for a model based in inclusive fitness, so now we turn to the Canadian sample.

Bribery			Corruption		
Hypothesis	χ^2	p-value	Hypothesis	χ^2	p-value
$\mu_{KKS} > \mu_{CCS}$	0	0.50	$\nu_{KKS} > \nu_{CCS}$	0.91	0.17
$\mu_{KSK} < \mu_{CSC}$	8.03	0.002***	$\nu_{KSK} \equiv \nu_{CSC}$	0.41	0.52
$\mu_{SKK} \equiv \mu_{SCC}$	2.53	0.11	$\nu_{SKK} < \nu_{SCC}$	6.42	0.006***

Table 10: **Hypothesis tests comparing Kin and Co-Ethnic treatments in Iran**

Canada

The experimental results for Vancouver, Canada are presented in Table 11. As in the table above, in each cell we report the fraction of subjects who choose bribery and corruption in each treatment and matching scheme. Recall that in the Canadian sample, we collected Kin data in only one matching scheme (KKS). Thus, we first compare bribery and corruption under each matching scheme in the Co-ethnic treatment, and then we turn to comparing the behavior of Kin and Co-ethnics when A and B are related.

	Kin		Co-Ethnic	
	Bribery	*Corruption*	*Bribery*	*Corruption*
A & B related	13/13	12/13	7/20	9/20
A & C related	NA	NA	6/20	7/20
B & C related	NA	NA	9/20	6/20

Table 11: **Summary of relative frequency of bribery and corruption by treatment**.

Define μ_{trt} and ν_{trt} as the share of subjects choosing bribery and corruption in a given matching scheme. If Co-ethnicity has the same effect in Canada as it does in Iran, then we would expect to see that $\mu_{CCS} > \mu_{SCC} > \mu_{CSC}$, and $\nu_{CCS} > \nu_{CSC} > \nu_{SCC}$. However, in both cases Cochran-Armitage tests are unable to reject the null hypothesis that the proportions are the same across matching schemes ($\chi^2 = 0.11$, p-value = 0.74 and $\chi^2 = 0.97$, p-value = 0.33, respectively). Comparing across treatments, a one-tailed proportions test rejects the null hypothesis of no difference in the share choosing bribery in favor of the alternative hypothesis that $\mu_{KKS} > \mu_{CCS}$ ($\chi^2 = 11.35$, p-value < 0.001). Similarly, we can reject equal proportions choosing corruption in favor of the alternative hypothesis that $\nu_{KKS} > \nu_{CCS}$ ($\chi^2 = 5.71$, p-value = 0.008). Thus, in our Canadian sample, we find little evidence of differences between matching schemes within the Co-ethnic treatment, but we find strong evidence that kinship between A and B increases both bribery and corruption relative to co-ethnicity. Next we compare behavior in Iran and Canada.

Cross-country comparisons

To compare rates of ethnic favoritism between two countries, we conduct a regression analysis combining the Ethnic treatment samples from both countries. We estimate two linear probability models, one each with bribery and corruption as the dependent variables. Our independent variables include a Canada dummy, dummies for the CSC and SCC matching schemes, Canada×matching interactions, and a constant term (which reflects the baseline rate of bribery or corruption in the CCS treatment in Iran). Table 12 displays the regression output.

In column (1), we see a negative and highly significant coefficient on the Canada dummy reflecting a lower rate of bribery in Canada under the CCS matching scheme (p-value = 0.011).

	Dependent variable:	
	Bribery	Corruption
	(1)	(2)
Canada	-0.500^{***}	-0.368^{**}
	(0.149)	(0.158)
CSC	-0.350^{**}	-0.316^{**}
	(0.149)	(0.158)
SCC	-0.150	-0.368^{**}
	(0.149)	(0.158)
Canada×CSC	0.300	0.231
	(0.211)	(0.225)
Canada×SCC	0.250	0.248
	(0.211)	(0.227)
Constant (CCS)	0.850^{***}	0.842^{***}
	(0.106)	(0.112)
Observations	120	111
R^2	0.150	0.102
F Statistic	4.009^{***} (df = 5; 114)	2.389^{**} (df = 5; 105)
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 12: **The Effects of Coethnicity in Canada and Iran.**

However, a Wald test cannot reject the null hypothesis that the coefficients on the Canada dummy and the Canada×CSC dummy sum to zero (F = 1.792, p-value = 0.183), and thus Canada's rate of bribery is indistinguishable from Iran's when A and C are related. Finally, using an analogous Wald test, we find a marginally significant difference in bribery rates between Canada and Iran in the SCC condition (F = 2.80, p-value = 0.097).

In column (2), we again see a negative and significant coefficient on the Canada dummy indicating that corruption is less likely in the CCS matching scheme in Canada (p-value = 0.022).[32] However, Wald tests reveal no significant differences in corruption rates between Iran and Canada in either of the other matching schemes in the Co-ethnic treatment (F = 0.736, p-value = 0.393, in the CSC condition, and F = 0.552, p-value = 0.459, under SCC).

Overall, the data indicate that significant between-country behavioral differences in ethnic favoritism arise primarily in the CCS treatment. This is consistent with the observation that sub-ethnic fractionalization is more extensive in Iran (than in Canada) and with the possibility that norms towards co-ethnics can hijack some of the psychology of kinship norms. Crucially, though, Iranians and Canadians show very similar rates of kin favoritism, consistent with the idea that inclusive fitness has shaped all human societies.

To support these observations statistically, Table 13 reports linear probability models where

[32]The number of observations is lower here because we exclude the nine Persons B who chose "reject"; our results are qualitatively unchanged if we include them.

the dependent variable is bribery in column (1) and corruption in column (2), restricted to the CCS and KKS samples. To test for treatment and country effects, we include a Canada dummy, a Kin dummy and a Canada×Kin interaction, as well as a constant term that captures the probability of bribery and corruption in the CCS treatment in Iran.

	Dependent variable:	
	Bribery	Corruption
	(1)	(2)
Canada	-0.500^{***}	-0.368^{***}
	(0.114)	(0.114)
Kin_treatment	0.050	0.108
	(0.114)	(0.113)
Canada×Kin_treatment	0.600^{***}	0.418^{**}
	(0.171)	(0.172)
Constant	0.850^{***}	0.842^{***}
	(0.080)	(0.081)
Observations	73	70
R^2	0.344	0.267
F Statistic	12.05^{***} (df = 3; 69)	8.001^{***} (df = 3; 66)
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 13: **Comparing the Effects of Kinship and Co-ethnicity Across Countries, KKS and CCS**

In each column, the Canada dummy is negative and significant, highlighting again the lower rate of bribery and corruption in the CCS treatment in Canada. Moreover, the Kin dummies are both insignificant, suggesting that the Kin treatment has no marginal effect on bribery and corruption in Iran. However, the Canada×Kin interactions are both positive and significant, and the sum of the Canada dummy and the Canada×Kin interaction is statistically indistinguishable from 0 for both bribery (F = 0.611, p-value = 0.437) and corruption (F = 0.151, p-value = 0.699), driving home the point that kin favoritism operates similarly in both countries.

Robustness: the Friend and High Cost treatments

One limitation of our basic design is that the effect of kinship cannot be separated easily from that of familiarity. Kin, especially those of similar ages who are willing to attend a laboratory experiment together, are likely to have a good relationship built on reciprocity and generosity that might be reflected in their willingness to cooperate with one another (at a third party's expense). The Friend treatment allows us to highlight an important aspect of our interpretation of the findings: while the theory is grounded in the biological notion of inclusive fitness, we do not claim that observed behavioral differences across groups, treatments, and individuals are caused by genetic differences. To reiterate, our view is that norms of favoritism and norms of impartial cooperation are substitutes from the point of view of individuals seeking to cooperate for mutual gain. Both types of norms are present to varying degrees in all societies, but they vary in relative importance as a result of (among many possible causes) mating practices. In the FFS treatment conducted in Canada, we observe bribery in 9/10 pairs and corruption in 10/10 pairs, indicating that bribery and corruption in these small stakes decisions are just as likely among friends as among kin and substantially more so than among co-ethnics (one-tailed proportions tests, $\chi^2 = 5.22$, p-value = 0.011 and $\chi^2 = 5.81$, p-value = 0.008, for bribery and corruption, respectively). In almost all societies, norms of favoritism exist among friends, and like marriage norms, these may constitute an instance in which the biological machinery for kin altruism is co-opted to support cooperation among non-relatives.[33,34] Therefore, in a consanguineous society—where the gains from local altruism are higher, norms of favoritism among friends tend to be stronger too.

	Kin (low cost)		Friend (low cost)		Stranger (low cost)[a]	
	Bribery	*Corruption*	*Bribery*	*Corruption*	*Bribery*	*Corruption*
Canada	13/13	12/13	9/10	10/10	9/20	7/20
Iran	18/20	19/20	NA	NA	30/52	22/52

	Kin (high cost)[b]		Friend (high cost)		Stranger (high cost)	
	Bribery	*Corruption*	*Bribery*	*Corruption*	*Bribery*	*Corruption*
Canada	NA	NA	13/20	9/20	NA	NA
Iran	24/24	22/24	11/12	10/12	1/12	1/12

[a]Includes 40 pairs from Urmia in the SKK and SCC treatments.
[b]Includes 12 sibling and 12 cousin pairs.

Table 14: **Summary of relative frequency of bribery and corruption when A & B are related**.

Note that we might expect the behavior of kin and friends to differ if there were no gains from exchange in our experiment (i.e., if the payoffs to A and B after Transfer→Accept→Right were 160 and 90, respectively). To test this conjecture we also conducted the High Cost variants of the treatment where player A and B are related as friends in both countries (N = 20 triplets in Canada and N=12 in Iran). In Iran, we also conducted versions of the High Cost treatment where players A and B are related as siblings and as cousins (N = 12 for both).[35] As seen in Table 14, we did not conduct a full factorial experiment due to difficulties recruiting subjects (we

[33]But there is evidence that friends are more closely related than random individuals; supra note 11.

[34]This co-optation is reflected in the use of kinship words, e.g. 'brother' and 'sister', to refer to close friends.

[35]In Iran, these followup experiments were conducted in Tehran instead of Urmia. One reason to do this was to see if our basic results were unique to Urmia or generalized to the larger and more cosmopolitan city of Tehran. We ran a low cost SSS treatment in Tehran and the frequency of bribery (8/12) and corruption (5/12) were not significantly different from the SKK and SCC treatments conducted in Urmia (22/40 and 17/40, p-values > 0.7, two-tailed proportions tests). In addition, as seen in Table 14, experiments with siblings and cousins in the treatment with high effort cost in Tehran rules out the possibility of weak kin and relative ties in Tehran relative to Urmia.

struggled to recruit kin in Canada) and to obviousness of the results (in case of the Low Cost FFS treatment in Iran). The new experiments are described in more detail in appendix F.4.

Consistent with our conjecture, the key finding here is that in Canada, high effort cost significantly decreases the frequency of bribery and corruption among friends relative to the experiment with low effort cost among kin or friends. Pooling over the bribe/accept decisions in Canada, the frequency of corrupt acts is 22/40 in the High Cost FFS versus 19/20 in the Low Cost FFS and 25/26 in the Low Cost KKS (p-values < 0.01, two-tailed proportions tests). However, in Iran, the frequency of bribery and corruption among friends in high effort cost variants is not distinguishable from experiments with kin, for either Low or High cost variants. Pooling over the bribe/accept decisions in Iran, the frequency of corrupt acts in the High Cost FFS is 21/24 versus 37/40 in the Low Cost KKS and 46/48 in the High Cost KKS, which includes both siblings and cousins (p-values > 0.4, two-tailed proportions tests). The same is true about the frequency of bribery and corruption among cousins in high effort cost variant in Iran. In other words, friends and cousins are willing to incur a cost to benefit each other in Iran same as kin do, but in Canada, such a cost significantly decreases the willingness to benefit a friend.

4 Conclusion

Countries around the world exhibit vast differences in levels of corruption, and understanding the sources of these differences is crucial to improving governance. We provide evidence from cross-country, within-country and experimental data that *sub-ethnic fractionalization* is an important determinant of corruption. In regions with high sub-ethnic fractionalization, that is, those regions that have prominent endogamous tribal, clan and extended family structures (as measured by rates of cousin marriage), corruption is relatively prevalent, even after controlling for previously studied deep determinants of corruption. Motivating our argument with the notion of inclusive fitness from biology, we argue that differences in mating practices and family structure provide the source of this correlation. In particular endogamous (and consanguineous) mating practices that increase relatedness between individuals at the local level raise the relative returns to norms of kin altruism, nepotism, and favoritism; while, exogamous mating practices raise the relative returns to norms of impartial, generalized cooperation. Our findings suggest that historical differences in mating practices (due to religion, geography, and local circumstance) may have had a powerful influence on today's norms; however, due to data limitations our analyses do not allow us to identify a direct causal link. Future work should seek to address these limitations to better understand the potential links between mating patterns, norms and institutions.

References

ABBINK, K. and HENNIG-SCHMIDT, H. (2006). Neutral versus loaded instructions in a bribery experiment. *Experimental Economics*, **9** (2), 103–121.

—, IRLENBUSCH, B. and RENNER, E. (2002). An experimental bribery game. *Journal of Law, Economics, and Organization*, **18** (2), 428–454.

ALATAS, V., CAMERON, L., CHAUDHURI, A., ERKAL, N. and GANGADHARAN, L. (2009). Subject pool effects in a corruption experiment: A comparison of indonesian public servants and indonesian students. *Experimental Economics*, **12** (1), 113–132.

ALESINA, A., ALGAN, Y., CAHUC, P. and GIULIANO, P. (2015). Family values and the regulation of labor. *Journal of the European Economic Association*.

—, DEVLEESCHAUWER, A., EASTERLY, W., KURLAT, S. and WACZIARG, R. (2003). Fractionalization. *Journal of Economic growth*, **8** (2), 155–194.

— and GIULIANO, P. (2010). The power of the family. *Journal of Economic growth*, **15** (2), 93–125.

— and — (2011). Family ties and political participation. *Journal of the European Economic Association*, **9** (5), 817–839.

— and — (2014). Family ties. In P. Aghion and S. N. Durlauf (eds.), *Handbook of Economic Growth*, vol. 2A, North Holland: Netherlands, pp. 177–215.

— and LA FERRARA, E. (2005). Ethnic diversity and economic performance. *Journal of Economic Literature*, **43**, 762–800.

ASHRAF, Q. and GALOR, O. (2013). The'out of africa'hypothesis, human genetic diversity, and comparative economic development. *The American Economic Review*, **103** (1), 1.

BAILEY, D. H., HILL, K. R. and WALKER, R. S. (2014). Fitness consequences of spousal relatedness in 46 small-scale societies. *Biology letters*, **10** (5), 20140160.

BANFIELD, E. C. (1958). The moral basis of a backward society. *New York: Glencol*, **3**, 4.

BARR, A. and SERRA, D. (2009). The effects of externalities and framing on bribery in a petty corruption experiment. *Experimental Economics*, **12** (4), 488–503.

— and — (2010). Corruption and culture: An experimental analysis. *Journal of Public Economics*, **94** (11), 862–869.

BERG, J., DICKHAUT, J. and MCCABE, K. (1995). Trust, reciprocity, and social history. *Games and economic behavior*, **10** (1), 122–142.

BERGSTROM, T. C. (2003). The algebra of assortative encounters and the evolution of cooperation. *International Game Theory Review*, **5** (03), 211–228.

BITTLES, A. and BLACK, M. H. (2015). Global patterns & tables of consanguinity.

BITTLES, A. H. (2012). *Consanguinity in context*, vol. 63. Cambridge University Press.

BOWLES, S. and POSEL, D. (2005). Genetic relatedness predicts south african migrant workers' remittances to their families. *Nature*, **434** (7031), 380–383.

BRUK, S. and APENCHENKO, V. (eds.) (1964). *Atlas Narodov*. Moscow: Miklukho-Maklai Ethnological Institute at the Department of Geodesy and Cartography of the State Geological Committee of the Soviet Union.

BUONANNO, P. and VANIN, P. (2015). Social closure, surnames and crime, quaderni-Working Paper DSE.

CAMERON, L., CHAUDHURI, A., ERKAL, N. and GANGADHARAN, L. (2009). Propensities to engage in and punish corrupt behavior: Experimental evidence from australia, india, indonesia and singapore. *Journal of Public Economics*, **93** (7), 843–851.

CAMPOS, J. E., LIEN, D. and PRADHAN, S. (1999). The impact of corruption on investment: Predictability matters. *World development*, **27** (6), 1059–1067.

CAVALLI-SFORZA, L. L., MENOZZI, P. and PIAZZA, A. (1994). *The history and geography of human genes*. Princeton university press.

—, MORONI, A. and ZEI, G. (2004). *Consanguinity, Inbreeding, and Genetic Drift in Italy*. No. 39 in Monographs in Population Biology, Princeton University Press: Princeton.

CHRISTAKIS, N. A. and FOWLER, J. H. (2014). Friendship and natural selection. *Proceedings of the National Academy of Sciences*, **111** (Supplement 3), 10796–10801.

CHUAH, S.-H., FAHOUM, R. and HOFFMANN, R. (2013). Fractionalization and trust in india: A field-experiment. *Economics Letters*, **119** (2), 191–194.

COX, D. and FAFCHAMPS, M. (2007). Extended family and kinship networks: economic insights and evolutionary directions. *Handbook of development economics*, **4**, 3711–3784.

DEL MONTE, A. and PAPAGNI, E. (2007). The determinants of corruption in italy: Regional panel data analysis. *European Journal of Political Economy*, **23** (2), 379–396.

DI LIBERTO, A. and SIDERI, M. (2015). Past dominations, current institutions and the italian regional economic performance. *European Journal of Political Economy*, **38**, 12–41.

DINCER, O. C. (2008). Ethnic and religious diversity and corruption. *Economics Letters*, **99** (1), 98–102.

DURANTON, G., RODRÍGUEZ-POSE, A. and SANDALL, R. (2009). Family types and the persistence of regional disparities in europe. *Economic Geography*, **85** (1), 23–47.

EASTERLY, W. and LEVINE, R. (1997). Africa's growth tragedy: policies and ethnic divisions. *The Quarterly Journal of Economics*, pp. 1203–1250.

EFFERSON, C., LALIVE, R. and FEHR, E. (2008). The coevolution of cultural groups and ingroup favoritism. *Science*, **321** (5897), 1844–1849.

ELBAHNASAWY, N. G. and REVIER, C. F. (2012). The determinants of corruption: Cross-country-panel-data analysis. *The Developing Economies*, **50** (4), 311–333.

ERMISCH, J. and GAMBETTA, D. (2010). Do strong family ties inhibit trust? *Journal of Economic Behavior & Organization*, **75** (3), 365–376.

FEHR, E. and FISCHBACHER, U. (2003). The nature of human altruism. *Nature*, **425** (6960), 785–791.

FELLNER, C. H. and MARSHALL, J. R. (1981). Kidney donors revisited. In E. J. P. Rushton and R. M. Sorrentino (eds.), *Altruism and Helping Behavior: Social, Personality and Developmental Perspectives*, Lawrence Erlbaum Associates: New Jersey.

FIORINO, N., GALLI, E. and PETRARCA, I. (2012). Corruption and growth: Evidence from the italian regions. *European Journal of Government and Economics*, **1** (2), 126–144.

FRANCOIS, P. and ZABOJNIK, J. (2005). Trust, social capital and economic development. *Journal of the European Economic Association*, **3** (1), 51–94.

FU, F., TARNITA, C. E., CHRISTAKIS, N. A., WANG, L., RAND, D. G. and NOWAK, M. A. (2012). Evolution of in-group favoritism. *Scientific Reports*, **2** (460).

FUKUYAMA, F. (1995). *Trust: The Social Virtues and the Creation of Prosperity*. New York: Free Press.

GALASSO, V. and PROFETA, P. (2011). When the state mirrors the family: the design of pension systems, cEPR Discussion Paper No. DP8723.

GARDNER, A. and STUART, A. (2006). Spite. *Current Biology*, **16** (17), R662–R664.

GILLESPIE, J. (2004). *Population genetics: a concise guide*. Johns Hopkins University Press.

GLAESER, E. L. and SAKS, R. E. (2006). Corruption in america. *Journal of Public Economics*, **90** (6), 1053–1072.

GLATZER, B. (2002). The pashtun tribal system. *Concept of tribal society*, pp. 265–282.

GOLDEN, M. A. and PICCI, L. (2005). Proposal for a new measure of corruption, illustrated with italian data. *Economics & Politics*, **17** (1), 37–75.

GOODY, J. (1983). *The development of the family and marriage in Europe*. Cambridge University Press.

GOUNEV, P. and BEZLOV, T. (2010). Examining the links between organised crime and corruption, center for the Study of Democracy.

GRAY, J. P. (1998). Ethnographic atlas codebook. *World Cultures*, **10** (1), 86–136.

GREIF, A. (2006). Family structure, institutions, and growth: the origins and implications of western corporations. *The American economic review*, pp. 308–312.

— and TABELLINI, G. (2015). The clan and the corporation: Sustaining cooperation in china and europe. *Available at SSRN 2565120*.

GRIMM, V. and MENGEL, F. (2009). Cooperation in viscous populations—experimental evidence. *Games and Economic Behavior*, **66** (1), 202–220.

HAJNAL, J., LEIBENSTEIN, H. and RICHARD A, E. (1976). European marriage patterns in perspective. *Population and Development Review*, **2** (3-4), 101–43.

HAMILTON, W. D. (1964a). The genetical evolution of social behaviour. i. *Journal of Theoretical Biology*, **7** (1), 1–16.

— (1964b). The genetical evolution of social behaviour. ii. *Journal of Theoretical Biology*, **7** (1), 17–52.

— (1975). Innate social aptitudes of man: an approach from evolutionary genetics. *Biosocial anthropology*, **133**, 155.

HAMMOND, R. A. and AXELROD, R. (2006). The evolution of ethnocentrism. *Journal of Conflict Resolution*, **50** (6), 926–936.

HARPENDING, H. C. (2002). Kinship and population subdivision. *Population and Environment*, **24** (2), 141–147.

HAYEK, F. (1988). The collected works of friedrich august hayek, volume i, the fatal conceit, the errors of socialism.

HBDCHICK (2014). Big summary post on the hajnal line. https://hbdchick.wordpress.com/2014/03/10/big-summary-post-on-the-hajnal-line/.

HENRICH, J. (2015). *The Secret of Our Success: How Culture Is Driving Human Evolution, Domesticating Our Species, and Making Us Smarter*. Princeton University Press: Princeton.

HOBEN, A. D., BUUNK, A. P., FINCHER, C. L., THORNHILL, R. and SCHALLER, M. (2010). On the adaptive origins and maladaptive consequences of human inbreeding: Parasite prevalence, immune functioning, and consanguineous marriage. *Evolutionary Psychology*, **8** (4), 658 – 676.

HOFSTEDE, G. H. (2001). *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations*. Sage: New York.

HUME, D. (1740). *A Treatise of Human Nature*. Oxford: Oxford University Press, (2003) edn.

JABER, L., HALPERN, G. J. and SHOHAT, M. (1998). The impact of consanguinity worldwide. *Community Genetics*, **1** (1), 12–17.

JOHNSON, A. W. and EARLE, T. K. (2000). *The evolution of human societies: from foraging group to agrarian state*. Stanford University Press.

JOHNSON, N. D. and MISLIN, A. (2012). How much should we trust the world values survey trust question? *Economics Letters*, **116** (2), 210–212.

JONES, D. (2016). Socially enforced nepotism: How norms and reputation can amplify kin altruism. *PLoS ONE*, **11** (6), 1–13.

KUGLER, M., VERDIER, T. and ZENOU, Y. (2005). Organized crime, corruption and punishment. *Journal of Public Economics*, **89** (9), 1639–1663.

LA PORTA, R., LOPEZ-DE SILANES, F., SHLEIFER, A. and VISHNY, R. (1999). The quality of government. *Journal of Law, Economics, and organization*, **15** (1), 222–279.

LAMBSDORFF, J. G. (2003). How corruption affects persistent capital flows. *Economics of Governance*, **4** (3), 229–243.

— (2012). Behavioural and experimental economics as a guidance to anticorruption. In D. Serra and L. Wantchekon (eds.), *New advances in experimental research on corruption*, vol. 15, Emerald Group Publishing, pp. 279–300.

LAZARIDIS, I., NADEL, D., ROLLEFSON, G., MERRETT, D. C., ROHLAND, N., MALLICK, S., FERNANDES, D., NOVAK, M., GAMARRA, B., SIRAK, K., CONNELL, S., STEWARDSON, K., HARNEY, E., FU, Q., GONZALEZ-FORTES, G., JONES, E. R., ROODENBERG, S. A., LENGYEL, G., BOCQUENTIN, F., GASPARIAN, B., MONGE, J. M., GREGG, M., ESHED, V., MIZRAHI, A.-S., MEIKLEJOHN, C., GERRITSEN, F., BEJENARU, L., BLÜHER, M., CAMPBELL, A., CAVALLERI, G., COMAS, D., FROGUEL, P., GILBERT, E., KERR, S. M., KOVACS, P., KRAUSE, J., MCGETTIGAN, D., MERRIGAN, M., MERRIWETHER, D. A., O'REILLY, S., RICHARDS, M. B., SEMINO, O., SHAMOON-POUR, M., STEFANESCU, G., STUMVOLL, M., TÖNJES, A., TORRONI, A., WILSON, J. F., YENGO, L., HOVHANNISYAN, N. A., PATTERSON, N., PINHASI, R. and REICH, D. (2016). Genomic insights into the origin of farming in the ancient near east. *Nature*, **536** (7617), 419–424.

LEWIS, A. (2014). *Security, Clans and Tribes: Unstable Governance in Somaliland, Yemen and the Gulf of Aden*. Palgrave Macmillan: London.

LIPSET, S. M. and LENZ, G. S. (1999). corruption culture and markets, george mason university.

MADSEN, E. A., TUNNEY, R. J., FIELDMAN, G., PLOTKIN, H. C., DUNBAR, R. I., RICHARDSON, J.-M. and MCFARLAND, D. (2007). Kinship and altruism: A cross-cultural experimental study. *British Journal of Psychology*, **98** (2), 339–359.

MAURO, P. (1995). Corruption and growth. *The Quarterly Journal of Economics*, pp. 681–712.

— (1998). Corruption and the composition of government expenditure. *Journal of Public economics*, **69** (2), 263–279.

MURDOCK, G. P. (1967). *Ethnographic Atlas*. University of Pittsburgh Press.

NOWAK, M. A., TARNITA, C. E. and WILSON, E. O. (2010). The evolution of eusociality. *Nature*, **466** (7310), 1057–1062.

NUNN, N. and PUGA, D. (2012). Ruggedness: The blessing of bad geography in africa. *Review of Economics and Statistics*, **94** (1), 20–36.

OKASHA, S. (2013). Biological altruism. In E. N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy*, fall 2013 edn., Standford University Press.

OYSERMAN, D., COON, H. M. and KEMMELMEIER, M. (2002). Rethinking individualism and collectivism: Evaluation of theoretical assumptions and meta-analyses. *Psychological Bulletin*, **128** (1), 3 – 72.

PEMBERTON, T. J., DEGIORGIO, M. and ROSENBERG, N. A. (2013). Population structure in a comprehensive genomic data set on human microsatellite variation. *G3: Genes— Genomes— Genetics*, pp. g3–113.

— and ROSENBERG, N. A. (2014). Population-genetic influences on genomic estiamtes of the inbreeding coefficient: A global perspective. *Human Heredity*, **77** (1-4), 37–48.

PLATTEAU, J.-P. (2000). *Institutions, social norms, and economic development*, vol. 1. Psychology Press.

PUTNAM, R. D., LEONARDI, R. and NANETTI, R. Y. (1994). *Making Democracy Work: Civic Traditions in Modern Italy*. Princeton University Press: Princeton.

RAMACHANDRAN, S., DESHPANDE, O., ROSEMAN, C. C., ROSENBERG, N. A., FELDMAN, M. W. and CAVALLI-SFORZA, L. L. (2005). Support from the relationship of genetic and geographic distance in human populations for a serial founder effect originating in africa. *Proceedings of the National Academy of Sciences of the United States of America*, **102** (44), 15942–15947.

RIVAS, M. F. (2013). An experiment on corruption and gender. *Bulletin of Economic Research*, **65** (1), 10–42.

SAILER, S. (2004). Cousin marriage conundrum. In T. Folger and S. Pinker (eds.), *The Best American Science and Nature Writing 2004*, Mariner Books.

SERRA, D. (2006). Empirical determinants of corruption: A sensitivity analysis. *Public Choice*, **126** (1-2), 225–256.

SIEGFRIED, T. (2006). *A Beautiful Math:: John Nash, Game Theory, and the Modern Quest for a Code of Nature*. National Academies Press.

SPOLAORE, E. and WACZIARG, R. (2009). The diffusion of development. *The Quarterly Journal of Economics*, **124** (2), 469–529.

TABELLINI, G. (2010). Culture and institutions: Economic development in the regions of europe. *Journal of the European Economic Association*, **8** (4), 677–716.

— *et al.* (2008). The scope of cooperation: Values and incentives. *The Quarterly Journal of Economics*, **123** (3), 905–950.

TANZI, V. and DAVOODI, H. R. (1998). *Roads to nowhere: how corruption in public investment hurts growth*, vol. 12. International Monetary Fund.

TODD, E. (1990). *L'invention de l'Europe [The invention of Europe]*. Seuil.

— and GARRIOCH, D. (1985). *The explanation of ideology: Family structures and social systems*. Blackwell Oxford.

TREISMAN, D. (2000). The causes of corruption: a cross-national study. *Journal of public economics*, **76** (3), 399–457.

USLANER, E. M. (2005). Trust and corruption. In J. G. Lambsdorff, M. Taube and M. Schramm (eds.), *The New Institutional Economics of Corruption*, Routledge, pp. 76–93.

WALKER, R. S. and BAILEY, D. H. (2014). Marrying kin in small-scale societies. *American Journal of Human Biology*, **26** (3), 384–388.

WEBER, M. (1958). The protestant ethic and the spirit of capitalism, trans. *Talcott Parsons (New York: Charles Scribner's Sons, 1958)*, **182**.

WOODLEY, M. A. and BELL, E. (2013). Consanguinity as a major predictor of levels of democracy: A study of 70 nations. *Journal of Cross-Cultural Psychology*, **44** (2), 263–280.

WORLD BANK, W. (1997). Helping countries combat corruption: the role of the world bank.

YAMAGISHI, T., COOK, K. S. and WATABE, M. (1998). Uncertainty, trust, and commitment formation in the united states and japan 1. *American Journal of Sociology*, **104** (1), AJSv104p165–194.

— and YAMAGISHI, M. (1994). Trust and commitment in the united states and japan. *Motivation and emotion*, **18** (2), 129–166.

Appendices to Akbari, Bahrami-Rad and Kimbrough (2016)

A Quantitative description of genetic relatedness and distance

First let us explain some vocabulary. A "locus" is a place on a chromosome where an "allele" resides. A locus is not a tangible object, it is a map describing where to find an allele, which is the piece of DNA in that location. Some books use gene as a synonym for an allele. An individual has two alleles at a particular locus, one from the mother and the other from the father. Alleles are identical by descent if they share a common ancestor allele in a relatively short time in the past, say, the past 10 generations (Gillespie, 2004, p. 6-8). Identity by descent is used as the basis of a quantitative description of relatedness. One simple measure is the "coefficient of kinship notated as f_{xy} which is the probability that two alleles, one from individual X and one from individual Y, are identical by descent. This coefficient can be written as

$$f_{xy} = \frac{1}{4}p_1 + \frac{1}{2}p_2$$

where p_1 and p_2 are, respectively, the probabilities of sharing one and two identical by descent alleles (p_0 is the probability of sharing 0 identical by descent alleles). The intuition is that there are two mutually exclusive ways that two chosen alleles from X and Y might be identical by descent; they share exactly one allele or exactly two alleles. The term $\frac{1}{4}p_1$ in the equation above is the probability that X and Y share exactly one identical by descent allele times the conditional probability that these two alleles are chosen from X and Y. The term $\frac{1}{2}p_2$ is the probability that X and Y share exactly two identical by descent allele times the conditional probability that two identical alleles are chosen from X and Y.

Relationship	p_0	p_1	p_2
Identical twin (IT)	0	0	1
Parent-offspring (PO)	0	1	0
Full sibs (FS)	1/4	1/2	1/4
First cousins (FC)	3/4	1/4	0

Table A1: **Identity by descent.**

It follows that $f_{PO} = 1/4$, $f_{FS} = 1/4$ and $f_{FC} = 1/16$. The "coefficient of relatedness", r, is one-half of the mean number of shared alleles ($p_1 + 2p_2$),

$$r = \frac{1}{2}r_1 + r_2$$

therefore,

$$f_{xy} = \frac{1}{2}r$$

and $r_{PO} = 1/2$, $r_{FS} = 1/2$ and $r_{FC} = 1/8$ (Gillespie, 2004, p. 121-123).

It follows that f_{xy} is defined over the the range of [0, 0.5]. It is important that the coefficient of kinship not be confused with the coefficient of relatedness, r. In a random mating population, the relationship between the two coefficients is simple: the coefficient of relatedness is just twice the coefficient of kinship, therefore in the range of [0, 1]. The coefficient of relatedness could be interpreted as the expected fraction of alleles that are shared identical by descent between two individuals (Harpending, 2002). Table A2 summarizes coefficients of relatedness for kin relationships.

The expected coefficients of relatedness computed from Table A1 are valid only under the assumption of random mating. With consanguineous marriages, actual relatedness will exceed expected relatedness.

Relationship to you	Relatedness coefficient
identical twin	1
fraternal twin, parent, child, sibling	1/2
grandparent, grandchild, aunt, uncle, niece, nephew	1/4
great-grandparent, great-grandchild, great-aunt, great-uncle, great-niece, great-nephew, first-cousin	1/8
second-cousin	1/32
n^{th} cousin	$1/2^{2n+1}$
a perfect stranger	0

Table A2: **Expected relatedness of individuals under random mating.**

For example, two offspring from a first-cousin marriage (drawn from a previously randomly mating population) have a relatedness higher than 1/2 ($r = 1/2 + 1/2 \times 1/8 = 0.5625$): with probability 1/2 they inherit a gene from the same parent at each locus, and with probability 1/2 they each inherent a gene from a different parent, in which case the probability of gene sharing is just the relatedness between their parents, 1/8. Individuals born of consanguineous union have segments of their genomes that are *homozygous* as a result of inheriting identical ancestral genomic segments through both parents. The extra term in the relatedness of offspring of a first-cousin marriage (i.e. $1/2 \times 1/8$) represents the expected homozygous genome of offspring of first cousins. The extra term is ($1/2 \times 1/32$) for offspring of second-cousins; ($1/2 \times 1/4$) for offspring of double-first cousins; and ($1/2 \times 1/2$) for the offspring of sibling or parent-offspring (incestuous) unions. Therefore, "offspring of second cousins are expected to have children with 1/64 of their genome homozygous; offspring of first cousins, 1/16; offspring of double-first cousins, 1/8; and offspring of incestuous union, 1/4" (Woods *et al.*, 2006, p. 889).

If this pattern repeats across generations, local relatedness only grows. Woods *et al.* (2006) found that in individuals with a recessive disease whose parents were first cousins and drawn from two populations with a long history of consanguinity (Pakistani and Arab) and a third population with a short history of consanguinity (Irish traveler), on average, 11% of their genomes were homozygous, ranging between 5% and 20% (consider that the expected homozygousity for offspring of first-cousins is 6.25% and for offspring of incestuous unions is 25%). This implies "that prolonged parental inbreeding has led to a background level of homozygosity increased $\sim$ 5% over and above that predicted by simple models of consanguineous marriage between first-cousins. This has important clinical and research implications". If we consider 11% as the extra term in the relatedness of the offspring of first-cousins, we will obtain 0.61, i.e. in a population with a long history of consanguinity which continues to practice first-cousin unions, we can expect the relatedness 0.61 for siblings and parent/child, instead of expected 0.5 relatedness in a randomly mating population. For the same consanguineous population, the relatedness of cousins will be ($0.61 \times 0.61 \times 0.61 = 0.226981$), instead of ($0.5 \times 0.5 \times 0.5 = 0.125$) in a randomly mating population. To update Haldane's famous line, in such a population, one would jump into a river to save only 4.40 drowning cousins, where the threshold was 8 under random mating.

B Religion and Consanguinity

As noted in the text and in Table 3, religious traditions have diverse relationships to cousin marriage practices. Below we summarize Christian and Islamic views on consanguinity.

Catholic and Orthodox Christianity. In the early Christian era, consanguineous marriages were common,[1] and there are few direct biblical prohibitions on marriage among close kin.[2] The laws and customs of the Roman empire with respect to domestic life, "conformed to patterns that were wide-spread throughout Mediterranean and Middle East" that permitted and even encouraged consanguinity. Thus the Christian religion emerged in a setting in which such practices were tolerated. In other regions to which Christianity later spread such as Greece and Egypt, the earlier presence of close marriage was yet more marked (Goody, 1983, p. 39).

However, in the centuries after the conversion of the Roman Empire to Christianity, radical changes occurred with respect to the issue of marriage to kin. For the first two-hundred years after Constantine, the legality of consanguinity was in flux.[3] Roman Catholic authority stepped in to settle the issue. Pope Gregory I (AD 540-604) in a letter to Augustine, 'the first Bishop and apostle of the English' confirms that a certain secular law in the Roman state allows cousin marriage and advises that 'it is necessary that the faithful should only marry relations three or four times removed, while those twice removed must not marry in any case' (Goody, 1983, p. 36). This letter was significant because through it, the Church asserted (implicitly) its jurisdiction over marriage and the family, a position that Christian churches still maintain today.

Biological relationship	Genetic relationship	Roman classification	Germanic classification
First cousin	Third degree	Fourth degree	Second degree
Second cousin	Fifth degree	Sixth degree	Third degree
Third cousin	Seventh degree	Eighth degree	Fourth degree

Table B1: **Genetic and religious classification of consanguinity (Bittles 2012, p. 16).**

[1]On one hand, it has been suggested that with the aim of favoring outbreeding, pre-Christian Roman law forbade all unions among people within the seventh degree of consanguinity, and the Church "initially followed the Roman" regulations on consanguineous marriages (Cavalli-Sforza *et al.*, 2004, p. 29,31). On the other hand, some authors argue that there is not enough evidence suggesting prohibition of consanguineous unions at the very earliest stage in Roman history (Goody, 1983, p. 53). However, it seems that in the early Christian era, consanguineous marriages were common either due to "relaxed" (Cavalli-Sforza *et al.*, 2004, p. 29) earlier prohibitions or because Roman "law had nothing to say against most forms of close marriage" (Goody, 1983, p. 39). For example, the first Christian emperor, Constantine the Great married his son and daughters to his half-brother's children (Goody, 1983, p. 53).

[2]The only types of forbidden relationships in the Bible are found in the Levitical prohibitions in The Old Testament. For example, a man could not marry his mother (Lev. 18:7), his sister (Lev. 18:12, 20:19), his father's sister (Lev. 18:12, 20:19), his mother's sister (Lev. 18:13, 20:19), or his son's daughter (Lev. 18:10). A man could marry his niece (Cavalli-Sforza *et al.*, 2004, p. 29).

[3]Following the acceptance of Christianity as the official religion of the Eastern Roman Empire, Theodosius the Great (AD 378-395) condemned unions between first cousins in a law made in AD 384, although it was still possible to effect such marriages by imperial dispensation. In AD 405, his son, Arcadious (AD 378-408) legalized cousin marriages once again for the Eastern Roman Empire, however, his younger brother and the Western Roman emperor, Honorious (384-423), who himself married his dead wife's sister, permitted marriages among cousins in AD 409 only if the parties obtained an imperial dispensation. It was not until later that under civil legislation they became freely permissible once again. In AD 533, the validity of cousin marriage in the secular law of the Eastern Roman Empire, the *institutes* of Justinian (482-565), was recognized as perfectly legitimate (Goody, 1983, p. 55; Cavalli-Sforza *et al.*, 2004, p. 29-30; and Bittles, 2012, p. 16).

Within the Roman Catholic Church, the stringency of the restrictions continued to increase over time. A canon attributed to various popes and embodied in a letter of Pope Gregory III (AD 731-741) forbade marriage to the seventh degree of consanguinity in AD 732 (i.e. to 3rd cousins, see Table B1), and confusion resulting from differences in the Germanic and Roman systems of consanguinity evaluation eventually led to the ban being extended all the way to 6th cousins in 1076 (7th degree in the Germanic system). Not only were these extended prohibitions attached to blood ties, but they were also assigned to affinal kinship such as marriage to the dead brother's widow, spiritual kinship such as marriage to god-children and fictional kinship such as adoption, "producing a vast range of people, often resident in the same locality, that were forbidden to marry" (Goody, 1983, p. 56). While the bans were later loosened and dispensations have typically been available in specific cases, prohibitions on first cousin marriage remain in effect today.[4] Similarly, within the Greek Orthodox Church, first-cousin marriages were prohibited by AD 692, a policy which remains in place.

It is worthwhile to briefly discuss the possible reasons behind Church prohibitions of consanguineous marriages. From Gregory's letter to Augustine, it is clear that he understood the potential negative health consequences of inbreeding - 'the offspring of such marriages cannot thrive' - and that he had a moral opposition to incest, derived from his reading of scripture (Goody, 1983, p. 36-37). More importantly for our purposes, it seems that the potential impact on social behavior had not gone unnoticed by the Church. St. Augustine of Hippo, writing in the early 5th century, noted that restrictions on consanguinity expand the scope for mutually beneficial cooperation: "for affection is now given its proper place, so that men, for whom it is beneficial to live together in honorable concord, may be joined to one another by the bonds of diverse relationships: not that one man should combine many relationships in his sole person, *but that those relationships should be distributed among individuals, and should thereby bind social life more effectively by involving a greater number of persons in them*" (Augustine, 1998, Book 15, Ch. 16, *italics* added). Similar arguments were later echoed by Thomas Aquinas, who worried that "consanguineous marriages would 'prevent people widening their circle of friends'" (Goody, 1983, p. 57).[5] This suggests an awareness of the sorts of favoritism that might generate corruption.

It seems that as the Church extended prohibitions to remoter degrees of consanguineous marriage, large kinship groups such as clans, lineages, and tribes gradually disappeared throughout Europe. There is a large and significant negative correlation between the spread of Christianity (for at least 500 years) and the absence of clans and lineage groups in Europe (Greif, 2006, p. 309) which may have facilitated the emergence of impartial economic and political institutions, nuclear families and individualistic culture.

Protestant and Anglican Christianity. As the Protestant Reformation emphasized a return to scripture, Martin Luther's (1483-1546) views on consanguinity were based on the Levitical prohibitions and did not include a ban on cousin marriages; similarly, John Calvin (1509-1564) and his followers based their views on scripture, though they extended Levitical guidelines to a wife's relatives so that affinity and consanguinity were treated equivalently. The Church of England grew directly out of a dispute between Henry VIII (1491-1547) and the Catholic Church about marriage law, and its creation led to changes in

[4]The prohibition on consanguineous marriages was reduced to 4th degree relationships (third cousin) in AD 1215. The ban also reduced to 2nd degree relationships (first cousin or closer) for South American Amerindians in 1537, later for the indigenous population of The Philippines, and for black populations in 1897. After 1917, the consanguinity prohibition was reduced in all populations, initially to second cousins or closer and in 1983 to first cousins or closer, which remains current law (Cavalli-Sforza *et al.*, 2004; Bittles, 2012; Goody, 1983).

[5]Goody (1983) also suggests a number of other possible, complementary reasons for the bans, including attempts to increase fealty to the Church by diminishing the role of the family (rooted in Jesus' entreaties to deny the family, e.g. Matthew 10: 34-37) and Church desire to acquire property by leaving the deceased without eligible heirs. The latter argument finds support in the tendency of the Church to oppose any practice that expanded the number of kin, e.g. divorce, polygamy, and adoption.

consanguinity law that allowed for first cousin marriage (Goody, 1983, p. 168-177).

In the emergent Protestant denominations, marriages up to and including first-cousin unions were permitted under Reformed Church law.[6] However, "many Protestant reformers discouraged marriages within the third degree. While Luther did not think they were positively harmful, he considered them to be 'inexpedient on the ground that people would marry without love merely to keep property within family, while poor women would be left spinsters'" (Goody, 1983, p. 181-2). In practice, consanguinity rates remained low in the Protestant world, as seen in Figure 3 in Section 3 below, perhaps due to ingrained norms from centuries of prohibition.

Islam. Today, consanguinity rates are high in Islamic countries, though "contrary to widespread Western opinion, there is no specific guidance in the Qur'an to encourage consanguinity" (Bittles, 2012, p. 22) and "marriage between cousins is not prescribed by the Qur'an" (Courbage and Todd, 2014, p. 33). The permitted degrees of consanguinity within Islam closely match the Levitical guidelines with one exception: a prohibition of uncle-niece marriage (Qur'an 4:23). In addition to the Qur'an, Muslims recognize two other sources of Islamic Law (Sharia) which bear on consanguinity: the Hadith (oral pronouncements of the Prophet Mohammad) and the Sunnah (the deeds of the Prophet).[7] "The overall attitude to consanguineous marriage within Islam is somewhat ambiguous" (Bittles, 2012, p. 22) since a Hadith of the Prophet Muhammad stated: "Do not marry cousins as the offspring may be disabled at birth" (Akrami and Osati, 2007, p. 314); while, according to the Sunnah, two of Muhammad's wives were his first cousins, and the Prophet Muhammad married his daughter, Fatima to his cousin Ali.[8] "Thus, [despite the content of the Hadith] for Muslims, the practice of cousin marriage could potentially be interpreted as following the example provided by the Sunnah" (Bittles, 2012, p. 22).

In any case, evidence suggests that cousin marriage customs in Islamic countries "probably antedated the spread of Arabs" (Cavalli-Sforza *et al.*, 2004, p. 284) and "predated Islam" (Courbage and Todd, 2014, p. 33). A preference for consanguinity is reflected in "the well known Iranian proverb 'the first cousin's marriage contract has been recorded in heaven,'" though the preference "is merely a cultural and local custom rather than a religious belief" (Akrami and Osati, 2007, p. 315). Nevertheless, cousin marriage is not forbidden or clearly discouraged in Islam, and it is likely that "Islam served as a vehicle for the geographical spread of the endogamous practices [...] the model was adopted not for religious reasons but because it was the practice of a prestigious group, the Arabs, bearers of the message of the Qur'an" (Courbage and Todd, 2014, p. 33-4). One explanation suggesting why the conversion to Islam may have encouraged the high prevalence of cousin marriages in Islamic countries is the Quranic law on the inheritance of property which entitled daughters to inherit half of the amount received by sons, and wives to receive a share from their husbands. A dowery (Mahr) also is specified in Islamic law as part of the marriage arrangement. Under these circumstances, consanguineous marriages could prevent part of the family wealth from leaving the clan (Goody, 1983, p. 32).

Other religions. In Table 3, we summarize other religions' views on consanguineous marriage based on Bittles (2012), p. 23-28. Suffice to say that there has historically been a great diversity of practices around the world, with many groups banning cousin marriage outright and certain groups favoring even closer marriages (e.g. Dravidian Hindu and Sephardic Jewish preference for uncle-niece marriages).

[6]"An exception to this generalization is provided by the State Lutheran Church of Sweden, which until 1680 refused to recognize first-cousin unions, and from 1680 to 1844 approval was required from the King of Sweden before a first-cousin union could proceed" (Bittles, 2012, p. 20).

[7]In Shi'a Islam, law also derives from the oral pronouncements and deeds of the twelve Imams.

[8]The first Imam, in the Shi'a tradition, and the fourth of the Rashidun Caliphate according to Sunni tradition.

C Empirical data description

Cross country regressions: Variable name	Description and source
Consanguinity	As a working definition, unions contracted between persons biologically related closer than second cousins are categorized as consanguineous. Bittles and Black (2015) provided a compilation of the proportion of consanguineous marriages from 262 journal papers and book chapters which report consanguinity percentages of 448 samples of different sizes in different locations of 72 countries based on household surveys, Roman Catholic Church dispensations, parish records, civil registrations, marriage registrations and surveys on blood donors, obstetric inpatients, hospital outpatients, hospital births, etc that include information for around 9.8 million marriages. The sample of countries is non-random since the data were collected for other purposes (e.g. the public health studies disproportionately sample high consanguinity societies since these are the societies with higher rates of genetic disorders), but the coverage is broad. Data collection periods vary from 1922 to 2013, with around 90% after 1950, 75% after 1960, 50% after 1970, 40% after 1980, 30% after 1990 and 15% after 2000. We collected this data from *www.consang.net* in December 2015 and computed the mean percentage of consanguineous marriages for each country by weighting the individual estimates according to sample size. Note that (i) the data on Czechoslovakia in the period 1961-64 is used for both the Czech Republic and Slovakia; (ii) some sample studies were reported twice, once at the city level and once for the province, in which case we considered only the province level report; (iii) we also ignored the studies listed as "Minorities and Isolates" to avoid overweighting outliers. Source: *Bittles and Black (2015).*
Corruption	Measures financial corruption in the form of demands for special payments and bribes connected with import and export licenses, exchange controls, tax assessments, police protection, or loans, and actual or potential corruption in the form of excessive patronage, nepotism, job reservations, 'favor-for-favors', secret party funding, and suspiciously close ties between politics and business. In our tables, this measure is averaged over 1984-2011. La Porta *et al.* (1999) and Alesina *et al.* (2003) used the average of the months of April and October in the monthly index between 1982 and 1995, and we did so in the replication of their tables. Source: *Political Risk Services, International Country Risk Guide (2012).*
Ethnic fractionalization	Measures ethnic fractionalization; the probability that two randomly selected individuals from a population belong to different ethnic groups. Source: *Alesina et al. (2003).*

Ethonolinguistic fractionalization	Average value of five different indices of ethonolinguistic fractionalization. Its value ranges from 0 to 1. The five component indices are: (1) index of ethonolinguistic fractionalization 1960, which measures the probability that two randomly selected people from a given country will not belong to the same ethnolinguistic group (the index is based on the number and size of population groups as distinguished by their ethnic and linguistic status); (2) probability of two randomly selected individuals speaking different languages;(3) probability of two randomly selected individuals do not speak the same language; (4) percent of the population not speaking the official language; and (5) percent of the population not speaking the most widely used language. The data is collected using Easterly and Levine (1997). The sources of the components of the average index are (1) Bruk and Apenchenko (1964); (2) Muller (1964); (3) Roberts (1962); (4) and (5) Gunnemark (1991). Source: *La Porta et al. (1999)*.
Family ties	Measures the strength of family ties by looking at three variables from the World Value Survey (WVS) and the European Social Survey (EVS) which capture beliefs regarding the importance of the family in the respondent's life, the duties and responsibilities of parents and children, and the love and respect for one's own parents. The first question asks how important the family is in one person's life and can be answered with (i) Very important; (ii) Rather important; (iii) Not very important; (iv) Not at all important, which in our measure of family ties, take values of 4 to 1, respectively. The second question asks whether the respondent agrees with one of the two statements (taking the values of 2 and 1, respectively): (i) Regardless of what the qualities and faults of one's parents are, one must always love and respect them; (ii) One does not have the duty to respect and love parents who have not earned it. The third question prompts respondents to agree with one of the following statements (again taking the values of 2 and 1, respectively): (i) It is the parents' duty to do their best for their children even at the expense of their own well-being; (ii) Parents have a life of their own and should not be asked to sacrifice their own well-being for the sake of their children. Following Alesina and Giuliano (2010), we extract the first principal component from the whole data set with all individual responses for the original variables. Source: *WVS (Six waves, 1981-2014) and EVS (four waves, 1981-2008)*.
Trust	Measures generalized trust by considering the following question from the World Value Survey (WVS) and the European Social Survey (EVS): "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?" The answer could be either "Most people can be trusted" or "Can't be too careful", which in our measure of trust, take values of 2 and 1, respectively. Source: *WVS (Six waves, 1981-2014) and EVS (four waves, 1981-2008)*.

Individualism	Addresses the degree of interdependence a society maintains among its members. It has to do with whether people's self-image is defined in terms of "I" or "We". In Individualist societies people are supposed to look after themselves and their direct family only. In Collectivist societies people belong to 'in groups' that take care of them in exchange for loyalty. The individualism/collectivism questionnaire asks respondents to choose a number between 1 to 5 where they feel more comfortable between the following pairs of statements: (i) People have strong loyalty to the group(s) they belong to (ii) People choose their friends based on common likes/dislikes/interests; (i) The conventions/rules of the group I belong to influence my behaviour (ii) I have full personal freedom; (i) I am concerned with what the others think about me (ii) I am concerned only with my own rules and objectives; (i) People are promoted/recognized based on their loyalty and age (ii) People are promoted based on competence, no matter their age; (i) It is immoral for a boss not to offer a job to a relative (ii) It is immoral for a boss to offer a job to a relative. The latter two questions may help explain the strong correlation between individualism and institutional quality. Source: *Hofstede (2001)*, extended using (*http://geert-hofstede.com/countries.html*).
Predicted genetic diversity	The expected heterozygosity (genetic diversity) of a given country as predicted by (the extended sample definition of) migratory distance from East Africa (i.e., Addis Ababa, Ethiopia). This measure is calculated by applying the regression coefficients obtained from regressing expected heterozygosity on migratory distance at the ethnic group level, using the worldwide sample of 53 ethnic groups from the HGDP-CEPH Human Genome Diversity Cell Line Panel. The expected heterozygosities and geographical coordinates of the ethnic groups are from Ramachandran *et al.* (2005). Expected heterozygosities are constructed by measuring actual heterozygosity within an ethnic group at a sample of selectively-neutral loci and averaging over the loci. Source: *Ashraf and Galor (2013)*.
Geographical controls	(i) Ruggedness Terrain ruggedness measures small-scale terrain irregularities. The ruggedness calculation takes a point on the earth's surface and calculates the difference in elevation between this point and each of the points on the grid 30 arc-seconds (926 meters on a meridian) in each of the eight major directions of the compass (north, northeast, east, southeast, south, southwest, west, and northwest). The terrain ruggedness index at the central point is given by the square root of the sum of the squared differences in elevation between the central point and the eight adjacent points. Then by averaging across all grid cells in the country not covered by water, each cell weighed by its latitude-varying sea-level surface, the average terrain ruggedness of the country's land area is obtained. Ruggedness is measured in hundreds of meters of elevation difference for grid points 30 arc-seconds apart. Source: *Nunn and Puga (2012)*.

(ii) Soil suitability for agriculture
The soil suitability component, based on soil carbon density and soil pH, of an index of land suitability for agriculture. The soil suitability data are reported at a half-degree resolution by Ramankutty *et al.* (2002) and are aggregated to the country level by Michalopoulos (2012) by averaging across grid cells within a country. For additional details on the soil suitability component of the land suitability index, the interested reader is referred to the definition of the land suitability variable above. Source: *Ashraf and Galor (2013)*.
(iii) Mean elevation
The mean elevation of a country in km above sea level, calculated using geospatial elevation data reported by the G-ECON project (Nordhaus, 2006) at a 1-degree resolution, which, in turn, is based on similar but more spatially disaggregated data at a 10-minute resolution from New *et al.* (2002). The measure is thus the average elevation across the grid cells within a country. The interested reader is referred to the G-ECON project website for additional details. Source: *Ashraf and Galor (2013)*.
(iv) Mean temperature
The intertemporal average monthly temperature of a country in degrees Celsius per month over the 1961-1990 time period, calculated using geospatial average monthly temperature data for this period reported by the G-ECON project (Nordhaus, 2006) at a 1-degree resolution, which, in turn, is based on similar but more spatially disaggregated data at a 10-minute resolution from New *et al.* (2002). The measure is thus the spatial mean of the intertemporal average monthly temperature across the grid cells within a country. See the G-ECON project website for additional details. Source: *Ashraf and Galor (2013)*.
(v) Mean precipitation
The intertemporal average monthly precipitation of a country in mm per month over the 1961-1990 time period, calculated using geospatial average monthly precipitation data for this period reported by the G-ECON project (Nordhaus, 2006) at a 1-degree resolution, which, in turn, is based on similar but more spatially disaggregated data at a 10-minute resolution from New *et al.* (2002). The measure is thus the spatial mean of the intertemporal average monthly precipitation across the grid cells within a country. The interested reader is referred to the G-ECON project web site for additional details. Source: *Ashraf and Galor (2013)*.
(vi) Percentage of population living in tropical/subtropical/temperate zones
The percentage of a country's population in 1995 that resided in areas classified as tropical/subtropical/temperate by the Köppen-Geiger climate classification system. This variable was originally constructed by Gallup *et al.* (1999) and is part of Harvard University's CID Research Datasets on General Measures of Geography. Source: *Ashraf and Galor (2013)*.

	(vii) Percentage of land near a waterway The percentage of a country's total land area that is located within 100 km of an ice-free coastline or sea-navigable river. This variable was originally constructed by Gallup *et al.* (1999) and is part of Harvard University's CID Research Datasets on General Measures of Geography. Source: *Ashraf and Galor (2013)*.
Latitude	The absolute value of the latitude of the country, scaled to take values between 0 and 1. The data is collected from CIA (1996). Source: *La Porta et al. (1999)*.
Log GNI per capita	Logarithm of GNI per capita in current US dollars averaged over the period 1984-2011. Source: *World Bank Development Indicators (WDI), Data retrieved Online in December 2015*.
Log GNP per capita	Logarithm of GNP per capita in current U.S. dollars averaged over the period 1970-1995. The data is collected from WDI. Source: *La Porta et al. (1999)*.
Log population	Logarithm of population averaged over the period 1984-2011. Source: *World Bank Development Indicators (WDI), Data retrieved Online in December 2015*.
Log population (1960)	Logarithm of population in 1960. This is the variable used in Alesina *et al.* (2003) for the country size. Our data source might be different. Source: *Penn World Table, Data retrieved Online in December 2015*.
Regional dummy variables	Dummy variable for (1) Sub-Saharan Africa, (2) East Asia Pacific, and (3) Latin America and Caribbean. Source: *World Bank* (*http://www.worldbank.org/en/country*).
Legal origin dummy variables	Identifies the legal origin of the 212 Company Law or Commercial Code of each country. There are five possible origins: (1) English Common Law; (2) French Commercial Code; (3) German Commercial Code; (4) Scandinavian Commercial Code; and (5) Socialist/Communist Laws. The data is collected using La Porta *et al.* (1998), American Association of Law Libraries and Flores (1989) and CIA (1996). Source: *La Porta et al. (1999)*
Religion dummy variables	Identifies the percentage of the population of each country that belonged to the three most widely spread religions in the world in 1980. For countries of recent formation the data is available for 1990-1995. The numbers are in percent (scale from 0 to 100). The three religions identified here are: (1) Roman Catholic; (2) Protestant and (3) Muslim. The residual is called "other religions". The data is collected using Barrett (1982), Worldmark (1995), Statistical Abstract of the World (1995), UN (1995), CIA (1996). Source: *La Porta et al. (1999)*.

Table C1: Description of the data for cross-country analysis

Within country (Italy) regressions: Variable name	Description and source
Consanguinity	The data reported by Cavalli-Sforza *et al.* (2004) on consanguineous marriages, for 5-year periods from 1910 to 1964, comes from the Vatican's Secret Archives in which requests for dispensations from the consanguinity impediment, sent by the Bishops to the Sacred Congregation of the Sacraments in Rome, were recorded with information of the name of the diocese of marriage, the date and the degree of relationship between the spouses. They grouped 280 Italian dioceses into the provinces present in 1961, for which the number of total marriages was available from year to year. They report four major degrees of consanguinity; uncle-niece/aunt-nephew, first cousins, first cousins once-removed, second cousins. However, the bishops of the islands (Sardinia and Sicily) were granted the privilege to accord the dispensation for consanguineous unions beyond degree III, i.e. first cousins once-removed and second cousins were not recorded in the Vatican Archives, and therefore are not reported for Sicily and are obtained from another source for Sardinia. Thus, we have only considered uncle-niece/aunt-nephew and first cousin unions to compute consanguinity rates for Italian provinces. We have also chosen 5-year periods from 1945 to 1964 for which the data is available in all reported provinces. We computed the consanguinity rate for each province as the average of consanguinity percentages of four 5-year periods (1945-1949, 1950-1954, 1955-1959, 1960-1964) weighted by the number of marriages. For newly created provinces, we used the consanguinity rate of the province they belonged to in year 1961. This gave us consanguinity rates of 108 Italian provinces. Source: *Cavalli-Sforza et al. (2004)*.
Corruption	Province-level number of associative crimes reported by the police to the court per 100,000 inhabitants averaged over 2000-2013. Associative crimes include *criminal association* (article 416: when three or more persons associate together in order to commit more than one crime) and *Mafia-type association* (article 416-bis: participating in a Mafia-type unlawful association including three or more persons). The data is available for 103 Italian provinces. Source: *ISTAT*.
Share of agriculture	Province-level share of agriculture in total value-added averaged over 2000-2013. Source: *ISTAT*.
Log value added per capita	Logarithm of province-level total value added (at current prices millions Euros) averaged over 2000-2013. Source: *ISTAT*.
Log population	Logarithm of province-level population averaged over 2000-2013. Source: *ISTAT*.
Dummy for South and Islands	Dummy variable for provinces in the Mezzogiorno region including southern Italy (Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria) and the islands (Sicilia, Sardegna). Source: *ISTAT*.

Civic involvement	An integer index ranging from 1 to 9 which combines five variables observed in the late 19th century and early 20th century; (i) Membership in mutual aid societies (1873-1904); (ii) Membership in cooperatives (1889-1915); (iii) Strength of the mass parties (1919-1921); (iv) Turnout in the few relatively open elections (1919-1921) before Fascism brought authoritarian rule to Italy; (v) The longevity of local associations founded before 1860. Source: *Putnam et al. (1994)*.
Autocracy	A categorical variable that identifies, for each province, the type of governance with differing degrees of autocracy (versus republicanism) at the beginning of the fourteenth century; (i) The feudal monarchy founded by the Normans in the Mezzogiorno; (ii) The Papal States with their variegated mixture of feudalism, tyranny, and republicanism; (iii) The heartland of republicanism, those communes which had retained republican institutions into the fourteenth century; and (iv) The erstwhile republican areas further north that had, by this time, fallen prey to signorial rule. (Putnam *et al.*, 1994, p. 133). The information regarding republican and autocratic traditions is missing for some peripheral provinces. Source: *Putnam et al. (1994)*.
Dominations	A categorical variable that identifies, for each province, the administration that presided during the period of the Spanish domination in Italy, 1560-1659; Spanish, Papal, Austrian, Venetian, Sabaudian and Independent. Source: *Di Liberto and Sideri (2015)*.
Family types	A categorical variable that identifies, for each province, Todd (1990)'s classification of family types which is argued to be very similar to what the geography of family types would have been in the Middle Ages. The three family types common in Italy were the following; (i) incomplete stem family (characterized by an extended family with several generations living under one roof and the inheritance of the house and the land by one son – generally, the eldest – who stays at home); (ii) Communitarian family (characterized by an extended family in which all the sons can get married and bring their wives to the family home and equal division of inheritance among children); (iii) Egalitarian nuclear (characterized with total emancipation of children in adulthood to form independent families and equal division of inheritance among children). Source: Duranton *et al.* (2009).
Voluntary organizations	Region-level number of voluntary organizations established before 1965 per 100,000 inhabitants at year 2001. The variable takes the same value for all provinces within a region. Source: *ISTAT*.
Family ties	Region-level fraction of youth aged 18-34 living with at least one parent averaged over 2002-2009. The variable takes the same value for all provinces within a region. Source: *ISTAT*.
Mountain/Hill/Plain	Province-level fraction of mountain/hill/plain areas with reference to national area as reported in 1999 and 2000. Source: *ISTAT*.
Alternative corruption metrics	(i) Corruption crimes (region level, N=20) Region-level number of corruption crimes convicted of felony by final judgment per 100,000 inhabitants averaged over 2000-2011. Corruption crimes include the following types of crimes defined under the title *offenses against public administration*: crimes of peculation, malversation, bribery, and corruption. Source: *ISTAT*.

(ii) Infrastructure (province level, N=92, and region level, N=20)
The difference between a measure of the value of existing physical quantities of public infrastructure and the cumulative price government has paid for public capital stocks. Where the difference is larger between the monies spent and the existing physical infrastructure, more money is being siphoned off to mismanagement, fraud, bribes, kickbacks, and embezzlement; that is, corruption is greater. The measure is created for Italy's 92 provinces and 20 regions as of the mid-1990s, controlling at the regional level for possible differences in the costs of public construction. Inspecting the data, the province-level ratios reported in the appendix appear to be the inverse of the ratios reported in the text for regions, so we have taken the inverse to align the interpretation of the province and region-level measures. Source: *Golden and Picci (2005)*.
(iii) European Quality of Governance Index (EQI 2010) (region level, N=20)
This measure is constructed from recent surveys that elicit perceptions of and experience with governmental corruption, as well beliefs about impartiality and quality in the provision of government services. This research was funded by the EU Commission for Regional Development. Source: *Charron et al. (2014)*, available here (*https://nicholascharron.wordpress.com/european-quality-of-government-index-eqi/*).
(iv) Institutional performance (region level, N=20)
This measure is an index constructed by combining measures of policy processes and internal operation of government (Cabinet Stability, Budget Promptness, Statistical and Information Services), policy content (Reform Legislation, Legislative Innovation), and policy implementation (Daycare Centers, Family Clinics, Industrial Policy Instruments, Agricultural Spending Capacity, Local Health Unit Expenditures, Housing and Urban Development, Bureaucratic Responsiveness) over the period 1978-1985. Source: *Putnam et al. (1994), see Ch. 3*.

Table C2: Description of the data for within-country analysis (Italy)

D Replication and Extension of La Porta et al. (1999) and Alesina et al. (2003)

Here we report the results of regression analysis using the data from La Porta *et al.* (1999) and Alesina *et al.* (2003) in concert with our data from Bittles and Black (2015). Both analyses tested the robustness of the claim that ethnic fractionalization causes corruption. We first replicate their findings and then extend them by including our measure of consanguinity.

First, we note that there is a sizable correlation between ethnic fractionalization and consanguinity whether we use the Atlas Narodov Mira ethno-linguistic fractionalization data from La Porta *et al.* (1999) (Spearman's $\rho = 0.27$, p-value = 0.044, N = 57) or the more recent ethnic fractionalization data from Alesina *et al.* (2003) (Spearman's $\rho = 0.50$, p-value < 0.001, N = 72).

La Porta *et al.* (1999) report regression (1) of Table D1, which shows that the rate of ethnolinguistic fractionalization in 1964 is highly correlated with corruption, even after controlling for legal origins. They argue that their results "support the political theories [of corruption], since ethnolinguistic heterogeneity and legal origin remain extremely important factors shaping government performance"(La Porta *et al.*, 1999, p. 266). In column (2), we replicate this analysis using only the countries for which we also have consanguinity data, and the magnitude and sign of the fractionalization coefficient are unchanged, though the effect of ELF becomes insignificant. When we add consanguinity to this regression in columns (3) and (4), the effect ethnolinguistic fractionalization is smaller and remains insignificant while consanguinity shows a significant effect on corruption.

VARIABLES	(1) La Porta (1999)	(2) La Porta (1999) restricted sample	(3) with Consanguinity	(4) with Consanguinity without ELF(1964)
ELF(1964)	-2.1657***	-2.4234	-1.3965	
	(0.7642)	(1.4742)	(1.5508)	
Consanguinity			-4.6174**	-5.2458***
			(1.9359)	(1.8685)
Socialist legal origin	-0.0716	-0.0835	-0.5047	-0.2050
	(0.6729)	(0.9334)	(0.8946)	(0.7042)
French legal origin	-0.7552	-1.5425*	-1.5460*	-1.2703*
	(0.5126)	(0.9048)	(0.8700)	(0.6609)
German legal origin	1.6525*	1.0769	1.0243	1.5493**
	(0.8933)	(1.0591)	(1.0292)	(0.6055)
Scandinavian legal origin	3.5506***	2.7045***	2.2703**	2.6711***
	(0.5879)	(0.9947)	(0.9734)	(0.6730)
Constant	6.6086***	7.4590***	7.8450***	7.3530***
	(0.6306)	(1.0704)	(1.0554)	(0.6780)
Observations	114	55	55	55
R-squared	0.2983	0.2551	0.3533	0.3352

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table D1: **Model specification Table (4), regression (7) from La Porta et al. (1999), including consanguinity.**

We find a similar result when we replicate the regressions from Alesina *et al.* (2003). They find a significant effect of their 2003 ethnic fractionalization index on corruption in regression (1) of Table D2. In column (2), we replicate their analysis including only those countries for which we have consanguinity data. As before, including consanguinity in specifications (3) and (4) yields findings very similar to those in Table D1, in which the effect of fractionalization disappears while consanguinity is significant. When we introduce additional control variables in Table D3 and include both measures in regression (3) or replace ethnic fractionalization with consanguinity in regression (4) of the table, consanguinity is still significant despite including additional control variables.[9]

VARIABLES	(1) Alesina (2003)	(2) Alesina (2003) restricted sample	(3) with Consanguinity	(4) with Consanguinity without EF(2003)
Ethnic fractionalization	-2.498**	-2.777*	-0.183	
	(0.981)	(1.394)	(1.196)	
Consanguinity			-10.382***	-10.493***
			(1.579)	(1.274)
Log population (1960)	0.076	0.203	-0.259	-0.253
	(0.260)	(0.340)	(0.244)	(0.249)
Africa	-0.902	0.202	1.475**	1.423**
	(0.569)	(1.061)	(0.709)	(0.598)
East Asia	-1.650**	-1.484	-2.249*	-2.280*
	(0.661)	(1.355)	(1.244)	(1.220)
Latin America	-2.127***	-1.101**	-2.888***	-2.921***
	(0.496)	(0.523)	(0.578)	(0.523)
Constant	7.295***	6.441***	9.112***	9.045***
	(1.052)	(1.485)	(0.996)	(0.995)
Observations	122	64	64	64
R-squared	0.278	0.172	0.519	0.519

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table D2: **Model specification Table (13), column (2) from Alesina et al. (2003), including consanguinity.**

[9]Our replications of previous studies give identical results for La Porta *et al.* (1999) in regression (1) of Table D1 but slightly different results for Alesina *et al.* (2003) in regression (1) of Table D2 and Table D3, possibly because we used different data sources for population and regional dummies.

VARIABLES	(1) Alesina (2003)	(2) Alesina (2003) restricted sample	(3) with Consanguinity	(4) with Consanguinity without EF(2003)
Ethnic fractionalization	-1.029	-1.635	-0.225	
	(0.760)	(0.982)	(0.963)	
Consanguinity			-6.076***	-6.251***
			(2.092)	(1.909)
Log GNP per capita	1.028***	1.273***	0.879***	0.868***
	(0.176)	(0.198)	(0.276)	(0.274)
Log population (1960)	0.609***	0.796***	0.347	0.346
	(0.207)	(0.287)	(0.284)	(0.281)
Africa	1.224**	2.371**	2.344**	2.272***
	(0.576)	(0.988)	(0.924)	(0.820)
East Asia	-0.375	-0.100	-0.983	-1.040
	(0.616)	(1.049)	(1.153)	(1.138)
Latin America	-0.672	0.304	-1.230*	-1.285*
	(0.444)	(0.467)	(0.701)	(0.646)
Socialist legal origin	1.065**	0.942	0.546	0.578
	(0.521)	(0.677)	(0.848)	(0.839)
French legal origin	-0.075	-0.331	-0.181	-0.175
	(0.373)	(0.548)	(0.489)	(0.482)
German legal origin	0.103	-1.008	-0.050	0.034
	(0.638)	(0.686)	(0.609)	(0.513)
Scandinavian legal origin	2.157***	1.482**	1.409***	1.468***
	(0.472)	(0.642)	(0.507)	(0.456)
Constant	-3.978**	-6.617***	-1.137	-1.092
	(1.764)	(2.412)	(3.411)	(3.371)
Observations	120	62	62	62
R-squared	0.564	0.623	0.695	0.695

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table D3: **Model specification Table (13), column (3) from Alesina et al. (2003), including consanguinity.**