ON THE DYNAMICS OF CORRUPTION*

Costas Azariadis* **and Yannis M. Ioannides****

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Abstract. To examine the impact of culture on the joint evolution of corruption and per capita GDP, we augment the standard lifecycle model of capital accumulation by two endogenous state variables that describe institutions and social norms, and by two cultural parameters that proxy for personal morality, and group individualism or collectivism. Institutions that regulate economic incentives are decided by majority vote over a one-dimensional agenda that pits "stronger" against 'weaker" property rights.

For societies that share the same economic fundamentals but differ in culture, our main theoretical finding is the following: there exist cultural convergence clubs separated by a barrier that corresponds to a bifurcation in the space of collectivism and initial social norms. Societies with collectivist cultures and corruption-tolerant norms behave very differently from all others. Outcomes in those societies feature: (a) highly nonlinear GDP and corruption dynamics; (b) dominant roles for culture and social norms as engines of institutional quality and growth; (c) majorities that favor diluted property rights; and (d) slow convergence to balanced growth paths. These results appear to agree with scatter plots from international data for several alternative measures of corruption or culture, raising the likelihood that formal econometric tests of them will prove fruitful.

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* Department of Economics, Washington University, St. Louis, MO 63130. azariadi@wustl.edu

** Department of Economics, Tufts University. Medford, MA 02155. T:617-627-3294. F:617-627-3917. yannis.ioannides@tufts.edu [Corresponding author]

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1 Overview

Corruption and rent-seeking, two antisocial activities with potentially grave collective side effects, command much attention in development economics because they suggest plausible answers to a fundamental question raised long ago by North and Thomas (1973) and Easterlin (1981): Why isn't the whole world developed? Responses to this question by almost every neoclassical growth theory, from Solow (1956) to Romer (1990), seem inadequate because they identify proximate growth causes with economic fundamentals alone (factor accumulation motivated by patience, new ideas and high rates of return), ignoring deeper social forces (institutions and culture) that may be better suited to explain developmental hurdles. While culture may be slow-varying and may be treated as exogenous, institutions are largely endogenous. The present paper seeks to understand the nature and consequences of this endogeneity.

Both anecdotal sources and empirical work[1] cite corruption and rent-seeking as major channels through which weak social institutions and permissive cultural traits[2] thwart economic growth, by weakening rights to private property and undermining the enforcement of of laws intended to protect those rights. Corruption and rent-seeking divert capital and labor from legitimate wealth creation into illegal, wasteful and inefficient activities like burglary, robbery, bribery and extortion. We call this diversion *rent-seeking* when it benefits someone in the private sector, and *corruption* when the gainer works in the public sector[3]. [4].

Figure 1 is a scatter plot of international data from the period 1985-2017 providing information about the culture, social norms and per capita GDP relative to the United States for

[1] *Cf.* among others Murphy, Shleifer and Vishny (1993), Gelfand *et al.* (2011a), Kyriacou (2016) and Gorodnichenko and Roland (2017).

[2] Guiso, Sapienza and Zingales (2006) and Alesina and Giuliano (2015) discuss modern definitions of the terms "institutions" and "culture" used in social science research.

[3] This definition of rent-seeking differs somewhat from the usual one of earning monopoly income in factor markets or acquiring influence over regulatory processes. For richer definitions of what constitutes corrupt activity, see the surveys by Bardhan (1997) and Aidt (2003). A different approach, due to Berthélemy, Pissarides and Varoudakis (2000), explores the notion that rent seeking thwarts economic growth by redirecting skilled labor to rent seeking activities, which themselves are caused by such policy distortions as red tape, taxes, price controls, and trade restrictions. Their empirical findings suggest such distortions to be particularly serious in economies that are poor in human capital.

[4] Hsieh and Klenow (2009) report that improved within-industry factor reallocation in India and China through the 1990s could have raised total factor productivity by 40-60%

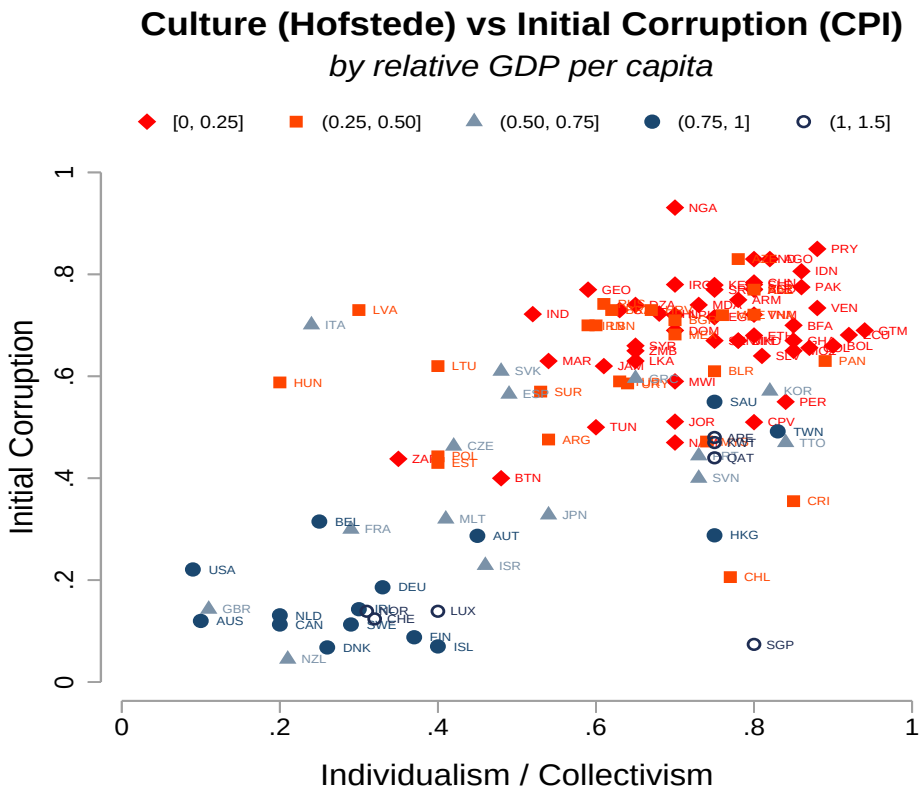

Figure 1: Culture (Hofstede) and Initial Corruption (CPI)

a large sample of about 100 countries. Culture in that figure is proxied by the Hofstede individualism vs. collectivism index,[5] which we normalize to vary within the interval $[0, 1]$; the Corruption Perception Index (CPI), which we also normalize in the interval $[0, 1]$, describes initial corruption that we take as a proxy for social norms related to inherited tolerance for anti-social economic activity; and relative per capita GDP is given as a period-average in relative income quartiles. The bottom GDP per capita quartile, marked as rhombus points, contains 44 of the world's poorest economies. All of these show substantial initial corruption of at least 0.40 points; and all of which but two have a collectivism index of at least 0.50.

[5]It is defined as follows. Individualism signals that there is a greater importance placed on attaining personal goals. A person's self-image in this category is defined as "I." Collectivism indicates that there is a greater importance placed on the goals and well-being of the group. A person's self-image in this category is defined as "We". See Hofstede (2001) and Hofstede *et al.* (2010). The data are accessible at : https://geerthofstede.com/research-and-vsm/dimension-data-matrix/ and https://hi.hofstede-insights.com/national-culture

How much and through what mechanisms can poor social norms and collectivist culture impede economic performance? Under what circumstances do societies allow anti-social activities to fester, thus trapping themselves into vicious cycles of weak institutions, habitual corruption and poverty? These are the central questions which we explore at first for an arbitrary and exogenous choice of the institutions that enforce property rights in a standard, off-the-shelf model of neoclassical growth in an open economy. Later we assume that the selection of those institutions comes from majority voting under a universal franchise. The paper seeks a tractable and testable description of the institutional and cultural mechanisms that appear most likely to drive corruption dynamics in an open economy, and to advance or retard national economic progress.

Analytical tractability is hard to preserve in environments of complex interactions that span economics, politics, history and culture. To maintain tractability, we focus on the simplest and most intuitive patterns of demographics, technology, tastes, and social interplay that appear to illuminate the dynamics of corruption without much pretense of generality. Simple as they are, these patterns lead to plausible conjectures that may well accord with more robust analyses than the ones we are able to provide in this paper. We explore cultural poverty traps in an extended parametric example whose robustness we explore in the Technical Appendix.

We start with four basic premises: one, the main function of institutions is to protect property rights from challenges originating in the private sector;[6] two, the public sector is uniquely responsible for the protection of those rights;[7] three, weak property rights may endure not because enforcement is expensive, but rather because society cannot commit to side payments or other transfers that enable the gainers from stronger enforcement to compensate the losers;[8] and four, strong social interactions between younger and older generations, in

[6]This assumption encapsulates evidence by Acemoglu, Johnson and Robinson (2005a; 2005b) who find that property rights protection has a first-order effect on economic performance. We ignore challenges emanating from the public sector, e.g., bribery of the type analyzed by Blackburn, Bose and Haque (2006) or the threat of outright expropriation by the government.

[7]Enforcement is purely private in the early literature on social conflict modelled as predator-prey games that pit "marauders" with offensive weapons against "producers" wielding defensive ones. Cf. Skaperdas (1992), and Grossman and Kim (1995).

[8]For example, Acemoglu and Robinson (2000a) attribute the non-existence of side payments to rogue households as a natural consequence of an inability to pledge credible transfers that may induce predators

the form of consumption externalities, can lock in corruption-tolerant norms that encourage majority voting in favor of weak institutions.

1.1 Plan of the paper

Here is how the rest of the paper is organized. Section 1.2 outlines the main data sources and section 1.3 sums up key theoretical results. Section 1.4 connects our paper with the literatures on neoclassical growth, social conflict, corruption and development, especially with the conjecture that institutions and culture are "deep determinants" of economic performance. Sections 2 and 3 lay out a simple parametric model which illustrates the forces that shape household choices of occupations and consumption-saving plans.

Next we fix institutions in section 4 and study how corruption and income evolve for alternative exogenous institutional choices. Majority voting endogenizes institutions in section 5 and provides useful insights into the joint dynamics of corruption and GDP. Section 6 discusses conjectures, scatter plots of international data and potential empirical tests; the main body of the paper ends in section 7 with conclusions and extensions.

1.2 Data Sources

Informative proxies for culture and corruption exist in the literature and in international survey data sources collected periodically by a number of institutions. Nearly all sources provide cross sectional and time series data on official corruption, and many report information about aspects of institutional quality.

Regarding culture, in addition to Hofstede (1984), who used international survey data to define the intensity of conformism vs. individualism for many nations, families of culture proxies are available in the World Values Survey (WVS) and in work by Gelfand *et al.* (2011b) and Falk *et al.* (2018). WVS and Fisman and Miguel (2007) report proxies for moral values, social norms, and related cultural concepts; Inglehart and Welzel (2017) sum up some of the

to give up activities in which they may have a substantial comparative advantage and considerable earning power.

WVS data in a "cultural map of the world." Particularly notable among those is the set of proxies proposed by Falk *et al.* (2018), the only one developed by economists. These are time-invariant measures of patience, risk-taking, positive reciprocity, negative reciprocity, altruism and trust. They are discussed in more detail in section 6. As we clarify below, Hofstede's measure fits our theory best.[9]

Regarding institutional quality, we have worked with numerous alternative indices and obtained generally comparable results. In what follows we focus only on three of these indices. One of them is a component of the World Bank's World Governance Indicators. The other two are provided by the International Country Risk Guide of the PRS Group. Details of their definitions are provided in section 6 below.

Little information exists about the extent of private sector rent-seeking, much of which is criminal activity in the underground economy and typically microeconomic in nature. All we have to go on are imputations of underground economy size like those of Schneider (2005) for OECD nations. Other authors, such as Berthélemy *et al.* (2000) proxy it by the size of the public sector. In what follows, our assumptions make official corruption a proxy for private rent-seeking.

1.3 Key Findings

We treat the quality of institutions as exogenous and fixed by choosing a particular value of the ratio of property-right enforcers to predatory rent-seekers. This allows us to obtain one key result about the influence of institutions. In individualist societies, where social interactions are relatively weak, current antisocial behavior depends strongly on institutions and weakly on norms; the reverse is true in collectivist societies where social interactions are intense. This dichotomy emanates from the direct effect of institutions on cash incomes. Those incomes are all important in individualist environments but matter less in conformist ones where social approbation can be significant for lifecycle utility. In either type of society, stronger property rights reduce corruption and rent seeking in both the short and long runs;

[9] In related empirical work we have also explored, but do not report here, all of the available measures of culture.

GDP improves.

Contrary to what one may expect from recent empirical work[10], our model suggests that collectivism does not necessarily go hand in hand with poor results. Figure 1 shows four "collectivist" nations, Hong Kong, Singapore, South Korea and Taiwan, to have performed well over the length of time covered by our data. The reason why is that conformism elevates the impact of social norms and weakens the influence of institutions. Good outcomes are in principle achievable in a collectivist society, even one with weak property rights, if initial norms are sufficiently good. Figure 1 hints that collectivist societies have the most to lose from bad norms, and also the most to gain from good ones.

Treating the quality of institutions as an outcome of a joint political/economic process strikes a balance between two countervailing cultural forces: the degree of collectivism, denoted by σ, and beginning-of-time social norms, denoted by x_0. Collectivism raises the importance of inherited norms in occupational choice by "taxing" the utility of those who deviate from acceptable behavior. If collectivism is sufficiently high, it can form a formidable cultural mix with corruption-tolerant norms, one that encourages anti-social, and thus unproductive, occupational choices. It also sustains political support in favor of weak institutions, and thus guides vulnerable societies to high levels of corruption and poverty. For each value of collectivism σ above some cutoff σ_c there exists a critical value $\tilde{x}(\sigma)$ of inherited norms that turns any combination (σ, x_0) above $(\sigma_c, \tilde{x})$ into a forbidding development barrier. This outcome is hinted by the data in Figure 1 and illustrated by our theoretical model in the bifurcation diagram of Figure 8.

1.3.1 Empirical Conjectures

The main prediction of our theory is that collectivist societies with a checkered past of tolerating corruption will behave very differently from all other societies, both in the short run and the long run. As Figure 8 illustrates, high values of the exogenous collectivism parameter and the initial value of corruption (σ, x_0) have important consequences for the quality of institutions, for economic performance, and for the joint dynamic properties of

[10]See, for example, the last three references in fn. 1.

corruption and GDP per capita. In particular, colectivist cultures and weak social norms define a "club" whose members habitually choose institutions of low quality under majority rule, misallocating inputs to unproductive uses and limiting themselves to modest economic performance. Both GDP per capita and corruption turn out to be quite persistent, even more so when (σ, x_0) have larger values. We examine these conjectures via scatter plots of international country-level data on GDP per capita, corruption and institutional quality using several indices of institutional quality, corruption, and culture.

1.4 Connections with the Literature

Our main innovations are three: to nest corruption within a neoclassical growth framework; to model the role of culture as a conduit modulating social interactions between individual households and society at large; and to conclude that collectivist or traditionalist societies, like those we often find among the world's poorer emerging economies, bifurcate from the individualist societies that are emblematic of the richer regions of Europe and of European offshoots. Figures 1 and 9–12 illustrate this pattern. The outcome is two convergence clubs with one resembling a poverty trap, like those analyzed by Azariadis and Drazen (1990), documented by Quah (1993) and recently surveyed by Johnson and Papageorgiou (2020). Unlike other approaches to corruption, such as Shleifer and Vishny (1993), Banerjee (1997) and many others in a voluminous literature, ours is explicitly macroeconomic.

In the traditionalist societies of our model, cultural norms and social habits are powerful drivers of economic performance. These societies appear to be "captives" of their past: institutional quality has a limited impact on economic decisions. Heterogeneity regarding property rights reemerged in the early 1990s as an important parameter for the development/growth nexus. Skaperdas (1992), Grossman and Kim (1995) and others worked out formal models of property rights and rent-seeking as one-shot non-cooperative games between a predator and a victim. Nash equilibria of such games are typically wasteful, with too much conflict and too much spending on weapons if the players are very different in their comparative advantage. Efficiency is nearly achieved when player endowments are almost

identical and their interests are closely aligned, as they are in our model when culture is individualistic. Empirical work provisionally confirms this insight: Easterly and Levine (1997), Alesina and Giuliano (2015), and Spolaore and Wacziarg (2016) report that ethnolinguistic diversity correlates negatively with both institutional quality and economic performance. We do not, however, pursue further such dimensions of heterogeneity. The substantial heterogeneity in preferences across countries and the even larger within-country heterogeneity revealed by Falk *et al.* (2018), which we discuss further in section 6 below, have not yet been linked to political outcomes.

The most active strand of the literature, and the one closest to this paper, pursues the "Protestant ethic" conjecture made a long time ago by Weber(1930), extended more recently by North and Thomas (1973), Acemoglu *et al.* (2005a, 2005b), and explored since by many others. The gist of the Weber-North-Acemoglu conjecture amounts to a claim that institutions and culture are fundamental causes of economic performance. Culture and institutions are evocative names for social forces that sometimes work in tandem and occasionally oppose each other. Theory suggests that these forces are not easy to separate, nor are they exogenous. In our model, for instance, feedback loops connect institutions and culture. Institutional quality is proxied by a scalar chosen by the median voter; culture is partly endogenous and time-varying (social norms or civic conventions), and partly exogenous and fixed (degree of individualism, personal morality index). One feedback loop binds culture with politics because voting outcomes generally depend on current social norms — less so in individualistic societies, and more so in conformist ones. Current voting, in turn, shapes today's occupational choices, thus feeding into future norms.

Richer and subtler definitions of these forces abound in the literature. Early work by North (1991) and Greif (1994, 2006) defines culture and institutions inclusively as humanly devised rules, that is, as the informal and formal constraints which regulate social interactions and shape our beliefs as to how people will act or react in various circumstances. More recent contributions by Guiso, Sapienza and Zingales (2006), Tabellini (2008a), Alesina and Giuliano (2015), and Gorodnichenko and Roland (2017) contrast deliberately designed in-

stitutions[11] from slowly evolving culture. Culture is presumed to embody norm-generating values;" trust", "respect" and other forms of civic habits and predominant attitudes; or, equivalently, entrenched beliefs which various social groups transmit fairly unchanged from one generation to the next. The consensus view seems to be that institutions are an endogenous political outcome acting as a constraint on individual behavior. Culture is, at least in part, an exogenous description of preferences and values,[12] and therefore a "deeper" force than institutions.

If we interpret culture as originating in social norms alone, recent empirical work provides some support for its primacy over institutions, even in the form of long-ago cultural indicators. Tabellini (2008a, 2008b, 2010) reports that both GDP and institutional quality correlate positively with civic measures of trust, morality and respect. Guiso *et al.* (2016) uncover in Italian data an interesting connection between current regional measures of good civic habits and medieval status as a city state. Using data from former colonial African nations, Michalopoulos and Papaioannou (2014) find that ethnic groups sharing a common culture perform at about the same level, even when they live under different institutions and are separated by national borders. All these reports seem consistent with our description of conformist societies in section 5: norms replicate themselves as they exert decisive influence via politics over the choice of institutions, corruption and GDP; individual attributes, like heterogeneity regarding moral scruples and others, are relatively unimportant. Long-run economic performance is also sensitive to initial norms: poor civic culture can become a formidable development barrier.

Individualist societies turn out to behave rather differently. To proxy culture, Kyriacou (2016) and Gorodnichenko and Roland (2017) use genetic distance from the U.K. (and the U.S.) as an index for individualism which they regard as synonymous with meritocracy,

[11] Acemoglu and Robinson (2000b and elsewhere) link institutional progress in 19th century Western Europe to the spread of voting rights which they model as an equilibrium outcome in a game between the "elite" and the "masses". Elites have decision-making power which they agree to share more widely when the probability of a mass revolt becomes sufficiently high.

[12] Recognizing that preferences may also evolve, albeit very slowly, Bisin and Verdier (2001), and Fernandez, Fogli and Olivetti (2013) explore possibilities of intergenerational change in cultural traits through parental investment or parental example. Fernandez *et al.* present evidence that parental example has a significant impact on female occupational choice in the U.S. among second-generation immigrants.

propensity to innovate, and absence of small-group favors (nepotism and client-patron relationships). Under this definition, they find that: (a) individualism is positively correlated with GDP, factor productivity, patents and the quality of governance; and (b) individualism causes growth even after controlling for institutions. Stronger individualism, i.e., closer genetic similarity to the United States, thus elicits better economic performance.

With culture being proxied by the Hofstede index and indicated on the horizontal axis of our Figure 8, we come to a more nuanced assessment of how individualism or conformism contribute to long-term income. Much as the Hofstede index helps as a particular abstraction of culture, our conjectures seem to accord with other cultural proxies. We next lay out an extended lifecycle growth model, to be previewed in Section 2.1, that guides our understanding of the details of how culture and institutions interact with corruption and national income.

2 A Growth-theory Framework

2.1 Model Preview

This section describes the social forces that guide the evolution of corruption and income over the long run. To do so we extend both the state space and the parameter space of Diamond's (1965) lifecycle model of capital accumulation, abstracting from public debt, population growth, technical change, or aggregate uncertainty. Economic fundamentals are simple and time-invariant: the world is made up of a large finite number of economically identical small open economies, which operate under a common time-invariant vector consisting of the world wage rate, interest yield and capital-labor ratio. The world credit market settles the equilibrium value of that vector which is treated as an exogenous parameter by every country. At the beginning of each time period, a young cohort of unit mass is born in each national economy. Cohorts contain two types of risk-neutral households with a two-period lifecycle: work one time unit, consume and save in youth, retire and consume in old age. Household types differ in their exogenously defined comparative advantage: type one has

a comparative advantage in the public sector; type two in the private sector. Technologies satisfy constant returns to scale and lifecycle utilities are homothetic.

All incomes and lifecycle utilities are proportional to the world wage rate which does not influence occupational choice. What does is the value of the expected after-tax lifecycle income earned in each alternative job, adjusted for negative interpersonal externalities, and for personal morality or scruples. Affecting all occupational choices, these income adjustments are equivalent to tax rates that are proportional to the difference of each person's occupational choice from the prevailing social norm, and also proportional to the distance between personal morality and moral "neutrality". Adjustments capture reduced enjoyment from current and future consumption due to personal scruples about antisocial acts, or to collective punishments ("shunning" or other forms of exclusion) meted out to those members of a conformist or traditional society who deviate from the behavioral codes set up by their elders.

Unadjusted "cash" incomes are transferred from workers to rent-seekers and from rent-seekers to enforcers in random meetings in which we assume that predators have all the bargaining power and victims have none. We model those meetings as two independent random matching processes under constant returns to scale. Each period, after honest workers have earned their after-tax income, they are matched with rent seekers. Rent seekers are in turn randomly matched with enforcers. Matching probabilities reflect the population ratio of enforcers to rent seekers, that is, the intensity of enforcement. These probabilities are public knowledge and, in equilibrium, are consistent with economy-wide occupational choices.

Honest enforcers return to the Treasury all income recovered from apprehended rent-seekers. Corrupt ("rogue") enforcers retain all confiscated loot for their own use at the risk of being themselves caught in the act by honest colleagues and forced to give up their entire income. To simplify matters, we assume that forfeiture of illegal income is the only loss from exposed antisocial acts ignoring other punishments like incarceration or other forms of social sanction. However, we do also explore other forms of punishment, such as ostracism; see section 4.3. Expected earnings from legitimate activity are proportional to the probability that the earner will avoid an undesired meeting with a predatory rent-seeker. By symmetry,

predatory rent-seeker incomes are proportional to the product of two probabilities: "predator finds victim," and "predator avoids enforcers."

In our setting, institutions are a policy variable and corruption is a time-varying endogenous state variable. Culture is described by two parameters: an exogenous unobservable moral code, or scruples, taking the form of an individual shock ε, and an observable country-specific exogenous social interactions index, σ, which differs across nations. The former parameter measures the intensity of remorse one feels when appropriating income from antisocial activities;[13] the latter parameter captures the extent of tolerance society shows for deviant occupational choices. Extreme values of the social interactions index σ define pure individualism and pure collectivism, under which occupational choices are independent of social norms altogether or follow them slavishly. The range of σ values may reflect degrees of individualism, or the intensity of social interactions, or the degree of tolerance toward deviant behavior or a host of related sociological concepts, such as rationalism, secularism, self-expression, and "looseness" vs. "tightness" [Gelfand (2011a,b)].

2.2 Building blocks

To formalize the narrative of section 2.1, we suppose that the world economy is made up of many similar open economies, $j = 1, \ldots, J$, each with two overlapping generations of unit size, whose members' two-period lifecycle completes our demographic structure. Economic fundamentals (preferences, endowment, technology) are common to all countries. Free capital mobility ensures that a common world capital-labor ratio prevails independently of any nation's institutional choices. In each economy, the savings of the young finance their old-age consumption of a single physical good produced under constant returns to scale. What distinguishes our model from the standard one is preferences that exhibit consumption externalities, that is, national-economy wide social interactions between young and old households.

[13] It would be easy in our overlapping-generations model to introduce intergenerational dependence via the ε shocks. In such a case, moral scruples would be inherited and the intergenerational correlation pattern would produce an additional source of heterogeneity. We plan to address this in future work.

We assume that each generation consists of two types of people: type $i = 1$ agents, of unit mass, possess one efficiency unit of labor which they can apply to either production or enforcement; type $i = 2$, also of unit mass possess one efficiency unit of productive labor which they can deploy in production or rent-seeking. Type-1 agents who become enforcers are corruptible, as we specify in detail shortly. Rent-seekers ("predators") are matched randomly with their victims ("prey"), that is, with every other young person, including government employees; predators are in turn matched randomly with enforcers. Both matching technologies exhibit constant returns to scale. All agents are assumed to be risk-neutral, or equivalently to participate in complete financial markets against idiosyncratic risks which eliminate all uncertainty.

2.2.1 The State of the Economy

The state of the economy at time t is completely described by the following variables and parameters:

i. Capital per person, k_t, a state variable whose time path is determined through a no-arbitrage condition in the world-wide credit market.

ii. The mass of type $i = 2$ persons who choose rent-seeking is $\rho_t \in [0, 1]$. In many of our applications, its lagged value serves to define the norm ρ_t^n for time period t rent-seekers; the remaining mass of $1 - \rho_t$ of agents are employed as type-2 productive workers.

iii. D_t is the mass of type $i = 1$ persons who become enforcers; the remainder $1 - D_t$ is the mass of type-1 producers.

iv. The share $x_t \in [0, 1]$ of type $i = 1$ persons who are employed as enforcers but decide to engage in corruption in dereliction of their duties. Its lagged value also serves as the period$-t$ norm, x_t^n, of public-sector corruption for rogue enforcers.

v. An institutional policy variable, $\theta_t \in [0, 1]$, defined as the ratio of enforcement personnel to rent-seekers; it is a scalar decided by majority voting. Extreme values $\theta_t = 0$

and $\theta_t = 1$ denote no enforcement and maximum enforcement, respectively; maximum enforcement occurs when the government commits to a policy of one enforcer per thief. This variable proxies for the strength of property rights enforcement, and will be referred to as "institutions" for short.

vi. An invariant exogenous taste parameter $\sigma \in [0, 1]$ denoting "culture" in general, and the degree of "collectivism" or "conformism, in particular. It captures the impact of inherited norms or past history on lifetime utility, or, equivalently, on lifetime income. We associate pure individualism with the value $\sigma = 0$, when norms are irrelevant for individual decisions, and pure collectivism (or conformism) with the value $\sigma = 1$, when individual decisions respond strongly to norms.

vii. The probability π_t of detecting rogue enforcers may be exogenous, or endogenous, depending upon the equilibrium concept employed in occupational choice; see section 3.3. We choose this probability so that type-1 and type-2 households avail themselves of the same income options.

2.2.2 Demography, Preferences and Production

Both agent types $i = 1, 2$, have identical utility functions of the Cobb-Douglas type:

$$u_{i,j,t} = (1 - \delta_{i,j,t}) c_{i,j,t}^{1-\beta} c_{i,j,t+1}^{\beta}, \ \beta \in [0, 1], j = 1, \cdots, J, \tag{1}$$

where $(c_{i,j,t}, c_{i,j,t+1})$ denotes agent i's lifecycle consumption profile in cohort t and country j, and $\delta_{i,j,t}$ denotes an adjustment for social interactions between young and old that will be defined by combining culture and norms. $\delta_{i,j,t}$ is an implied "tax" on agents who deviate from social norms within their occupations, i.e. from the choices made by the preceding cohort.

Equation (1) leads to an indirect lifetime utility

$$v_{i,j,t} = (1 - \delta_{i,j,t}) y_{i,j,t} R_{t+1}^{\beta} =: \hat{y}_{i,j,t} R_{t+1}^{\beta}, \tag{2}$$

where $y_{i,j,t}$ is the (after-tax) cash income for type$-i$ agent in country j and period t, R_t is 1 plus the world rate of interest on assets held in period $t-1$, and $\hat{y}_{i,j,t}$ is income adjusted for social interactions via the implied "tax" imposed on the income of young households, as mentioned earlier. All agents share a common time-endowment profile $(1,0)$. Note that this specification of social interactions affects only utility and does not influence savings behavior.

Production technology is also common for all countries. The aggregate quantity, $Y_{j,t}$, of the single output that may be used for consumption and investment is given by

$$Y_{j,t} = K_{j,t}^{\alpha} N_{j,t}^{1-\alpha},\ j = 1, \ldots, J, \tag{3}$$

where $K_{j,t}$ denotes aggregate physical capital and $N_{j,t}$ describes aggregate physical (and efficiency) units of labor that are productively employed. Total factor productivity is a constant normalized to one.

2.3 The World Economy without Corruption

As our simplest example, we consider first a utopian benchmark of a world where $\delta_{i,j,t} = 0$: people are not corruptible nor prone to rent-seeking, and do not cause any externalities on others. With no resources allocated to enforcement, two aggregate units of productive labor are employed in each period in every nation, which saves a constant fraction β of its total wage bill. In a frictionless world equilibrium, world capital next period must equal world saving this period: $K_{t+1} = \beta w_t 2J$, where J denotes the world mass of workers, and the world-wide pre-tax wage w_t in every period equals the marginal product of labor. Consequently, world factor prices for capital and labor are taken as given in each national economy. They are determined at the general equilibrium of the world economy as functions of k_t. The law of motion in intensive form becomes

$$k_{t+1} = \beta(1-\alpha)k_t^{\alpha}, \tag{4}$$

where k_t denotes the world capital-labor ratio $k_t := K_t/2J$.

The law of motion for the world income per capita readily follows from (4) and looks exactly like the standard Solow model of economic growth. The world economy converges to a unique steady state with capital-labor ratio $\bar{k}$ and per capita income $\bar{y}$ common to all nations:

$$\bar{k} = [\beta(1-\alpha)]^{\frac{1}{1-\alpha}}, \ \bar{y} = [\beta(1-\alpha)]^{\frac{\alpha}{1-\alpha}}. \tag{5}$$

From now on we ignore the country index j unless it becomes necessary for clarity.

2.4 Economies with Corruption

2.4.1 Sequence of Events and Meetings

Rent-seeking and corruption lead to deadweight losses in output and welfare rooted in the occupational decisions of young households. Exactly how does society allocate its labor endowment among the activities of producing, rent-seeking and property-rights enforcement? Answers depend on outcomes in a variety of political and economic arenas. To analyze how those interact, we assume that collective and individual decisions emerge sequentially in several stages, and that subsequent decisions fully reflect the outcomes of earlier stages. In particular, we suppose that:

i. World capital markets move first and set factor rentals (w, R) for labor and capital, as well as the world capital-labor ratio k.

ii. Voters in each country choose the institutional parameter $\theta_t \in [0, 1]$, that is, the ratio of enforcers to rent-seekers, by majority vote.

iii. Young workers choose occupations. A mass $X_t = \rho_t$ of type-2 households become rent-seekers, while the remaining mass $(1 - \rho_t)$ opts for legitimate employment. Given θ_t, the government hires a mass of enforcers equal to

$$D_t = \theta_t X_t, \tag{6}$$

from among type-1 households, and that the remaining mass $1-D_t$ of those households will find work in the private sector.

iv. Type-2 workers who choose to become rent-seekers, with total efficiency labor units $X_t = \rho_t$, are randomly matched with their potential victims, that is, all non-rent seeking young workers whose mass adds up to $V_t = 2 - \rho_t$ efficiency units. Thus, the entire young generation (including enforcers) may be victimized by rent-seekers. For simplicity we assume that all bargaining power in matches resides with the aggressor, and that retirees and capital income are immune from rent-seeking.

v. As production takes place, individuals receive total pre-tax wage income, $(1-\alpha)k_t^{\alpha}$, and pay wage taxes at a given rate $\phi_t \in [0,1]$. The government uses all tax revenue to pay enforcers, making the tax rate endogenous.

vi. Matched victims surrender all wage income to rent-seekers. For simplicity of modeling we assume that idiosyncratic risks to rent-seekers and victims are removed by actuarially fair pre-match insurance. And, in a manner to be specified in detail further below, all private decisions depend on expected income adjusted for social interactions.

vii. After rent-seeking is complete, rent-seekers are randomly matched with enforcers. Successful matches again transfer all rent-seeking income to enforcers who may opt to retain it for their own use if they choose corruption, or turn it over to the Treasury if they prefer honesty.

viii. If enforcers go "rogue," they are exposed with probability $\pi_t \in [0,1]$ specified in equation (17); exposed rogues forfeit their government salaries and all looted income. Forfeited income is not collected by the Treasury; it becomes a deadweight loss.

2.4.2 Matching of Rent-Seekers with Producers

The model relies critically on how rent-seekers are matched with productive agents and how enforcers match with rent-seekers. Following the Diamond-Mortensen-Pissarides model we assume that rent-seekers with mass $X_t = \rho_t$ match randomly with all producers with mass

$V_t = 2 - \rho_t$, and loot victims of all after-tax income. Matching is defined in terms of a function $P(V_t, X_t)$ which denotes the number of meetings between rent seekers and their victims. We assume that $P(V, X)$ is increasing, concave, homogeneous of degree one in (V, X) and such that:

$$P(0, X) = P(V, 0) = 0, \quad P(V, X) \leq \min(V, X), \forall (X, V). \tag{7}$$

Under these assumptions, the probability that a victim meets a rent seeker is:

$$p(z_t) := \frac{P(V_t, X_t)}{V_t}, \tag{8}$$

where z_t, the intensity of rent seeking, is the predator-to-prey ratio X_t/V_t of the number of rent seekers divided by the total number of productive agents:

$$z_t = z(\rho_t) := \frac{\rho_t}{2 - \rho_t}, \ \rho_t \in [0, 1]. \tag{9}$$

The probability that a victim meets a rent-seeker is P/X or simply $p(z)/z$. It is easy to see that $p(z)$ is increasing in z and $p(z)/z$ is decreasing in z.

2.4.3 Matching Enforcers with Rent-Seekers

To deter rent-seeking the government employs enforcers who receive the same wage as type $i = 1$ producers. Matching a mass D_t of enforcers with X_t rent-seekers determines probabilities that a rent seeker meet an enforcer, and vice versa, which depend on the policy parameter defined in (6), $\theta_t := \frac{D_t}{X_t}$. We define the number of matches between rent seekers and enforcers by analogy with those of producers-to-rent seekers. Let $Q(X_t, D_t)$, be a concave and homogeneous-of-degree-one function of its arguments, satisfying the same properties as the function $P(\cdot)$, given in equation (7). Thus the probability that a rent seeker meets an enforcer, $q(\theta_t)$, follows immediately:

$$q(\theta_t) := \frac{Q(X_t, D_t)}{X_t}, \ \theta \in [0, 1]. \tag{10}$$

No rent-seekers can be apprehended if there are no enforcers, that is, $q(0) = 0$. Enforcer employment reflects both individual and policy choices; see equation (6).

3 Incomes and Occupational Choice

3.1 Production versus Rent-Seeking

Job choice in this paper boils down to a comparison of after-tax incomes in alternative occupations, adjusted for social interactions and personal morality. Type-2 households select between rent-seeking and productive work in the private sector. Type-1 households may choose between employment in the private sector for a competitive wage rate, which we normalize to one, or in the public sector for a salary also equal to one.

We define adjusted period$-t$ incomes $\left(y_t^{HE}, y_t^P\right)$ for legitimate work by types 1 and 2, where HE denotes "honest enforcement" and P "production." Arbitrage in the labor market will equalize those two incomes, in cash value as well as adjusted value. We also define by $\left(y_t^{RE}(\varepsilon), y_t^{RS}(\varepsilon)\right)$ adjusted gross incomes for rogue enforcers (RE) and rent-seekers (RS) with moral code ε. Households take those incomes as exogenous and beyond their control. We assume that the moral code is a privately known, non-manipulable inverse index of social morality: the greater the value the weaker the scruples from engaging in anti-social behavior in the form of either rent seeking or rogue enforcement. This index is a random draw, revealed at the beginning of each agent's life cycle, from a known distribution function $G(\cdot)$ defined over the non-negative reals. Individual moral codes affect payoffs from anti-social activity alone.

Given the adjusted income array $\left(y_t^P, y_t^{HE}, y_t^{RE}(\varepsilon), y_t^{RS}(\varepsilon)\right)$ honest behavior prevails at equilibrium, if and only if

$$y_t^P = y_t^{HE} \geq y_t^{RE}, \text{ type } i = 1; \tag{11a}$$

$$y_t^{HE} \geq y_t^{RS}, \text{ type } i = 2. \tag{11b}$$

That is, young individuals are honest if such behavior pays off better than either going rogue or rent seeking. As we discover below conditions (11a,b) translate to threshold values of ε :

$$\varepsilon \leq \hat{\varepsilon}_t^1, \ \varepsilon \leq \hat{\varepsilon}_t^2. \tag{12}$$

The likelihood that individuals in each sector engage in honest behavior depends on their drawing sufficiently high moral codes relative to "morality bars" $(\hat{\varepsilon}_t^1, \hat{\varepsilon}_t^2)$, which are determined endogenously and themselves depend on prevailing institutions and culture.

Unscrupulous individuals with weak moral codes, that is, high draws of ε, will engage in anti-social activity. We recall the definitions in 2.4.1 of ρ_t as the fraction of rent-seekers among type-2 households, and of x_t as the fraction of rogue enforcers among all enforcement personnel. Then, by (12) we have:

$$1 - \rho_t = G(\hat{\varepsilon}_t^2); \ \ 1 - x_t = G(\hat{\varepsilon}_t^1). \tag{13}$$

We delve next into the determination of adjusted incomes and the critical values of the moral code.

3.2 Income Adjustments

Occupational choice in our environment depends on individual earnings, social interactions and each person's moral code. The code adjusts multiplicatively, or "corrects" the cash receipts rent seekers and rogue enforcers collect from anti-social activity. Social interactions generate a negative consumption externality arising from the disapproval felt by individuals who deviate from social norms, either because they are more honest or less honest than the norms dictate. To simplify the exposition, we assume that social norms (ρ_t^n, x_t^n) in the private and public sector are identical and equal to the lagged value of public sector corruption, that is

$$\rho_t^n = x_t^n := x_{t-1} \in [0, 1]. \tag{14}$$

We also assume that the negative consumption externality is equivalent to a tax rate proportional to each person's deviation from the social norm, i.e. to σx_t^n for honest workers choosing $x_t^i = 0$, and $\sigma(1 - x_t^n)$ for corrupt enforcers or rent-seekers choosing $x_t^i = 1$. Cash incomes, adjusted for culture and morality, yield equivalent lifetime expected incomes as follows:

$$y_t^{HE} = y_t^P = (1 - \phi_t)[1 - p(z_t)](1 - \sigma x_{t-1}); \tag{15a}$$

$$y_t^{RS}(\varepsilon) = (1 - \phi_t)\,\frac{p(z_t)}{z_t}[1 - q(\theta_t)][1 - \sigma(1 - x_{t-1})]\varepsilon; \tag{15b}$$

$$y_t^{RE}(\varepsilon) = (1 - \phi_t)(1 - \pi_t)\left[1 - p(z_t) + \frac{p(z_t)}{z_t}\frac{q(\theta_t)}{\theta_t}(1 - \sigma(1 - x_{t-1}))\right]\varepsilon; \tag{15c}$$

where z_t is defined in (9) and π_t, the probability of detecting rogue enforcers, is defined further below in equation (17). We note that equations (15a, b, c) underscore the asymmetric effect of social interactions: honest producers incur a loss of utility relative to their cash income while rogue enforcers and rent-seekers enjoy a potential gain if ε is large enough.

In these expressions $(\phi, 1 - p, p/z, 1 - q, q/\theta)$ denote respectively, the wage tax rate collected by the government; the probability that an honest worker evades rent-seekers; the probability that a rent-seeker finds a victim; the probability that a rent-seeker evades law enforcement; and the probability that an enforcer catches a rent-seeker. Also, as we discussed earlier, $(\sigma x_{t-1}, \sigma(1 - x_{t-1}))$ are implied tax rates on honest and anti-social agents, respectively, who deviate from the prevailing social norm $x \in [0, 1]$ when they choose levels of honesty $(x_i, \rho_i) = (0, 0)$, or corruption, $(x_i, \rho_i) = (1, 1)$, which differ from the average choice of their elders. Thus, corrupt norms in this setting penalize honest individuals and favor antisocial ones.[14]

In particular, equation (15a) summarizes several assumptions from section 2 and asserts that the adjusted income of honest workers per labor unit is the product of three terms: the after-tax cash wage, the probability of escaping rent seekers, and an adjustment for deviating

[14] In the terminology of the social interactions literature, the moral code ε denotes an individual social effect, z_t, the rent-seeking intensity, captures a contemporaneous endogenous social effect (via its dependence on ρ_t, the share of type-2 agents who become rent-seekers), and σx_{t-1} describes a lagged-endogenous social effect. In addition, equations (15a – 15d) capture contextual effects through the probability functions $p(z_t)$ and $q(\theta_t)$.

from social norms. A similar interpretation applies to equation (15b) which reflects the probability of a rent seeker's finding a victim, the probability of escaping law enforcement, and the personal morality code. Lastly, equation (15c) combines its predecessor equations (15a) and (15b) to express the expected life cycle payoff of a rogue enforcer. The first term within the first bracket on the right-hand side is the honest-enforcer payoff; the second term within the same bracket is the expected amount of loot each enforcer recovers from captured rent-seekers, adjusted by the morality code. The second bracket adjusts for social interactions and personal morality; and the entire right-hand side is adjusted downwards by the exogenous probability π of a rogue's being exposed.[15]

3.3 Occupational Choice in the Main Example

We return to equations (14) and (15a, b, c) to derive closed-form expressions for aggregate rent-seeking and corruption in a smaller parameter space. To shrink that space, we assume in what follows that:

A.1 The individual moral code has a uniform distribution with support $[0, 2]$.

A.2 The random matching technologies (P, Q) feature constant elasticities of substitution of $\frac{1}{2}$ over (V, X) with a unit common distribution parameter, that is (in intensive form):

$$p(z) := \frac{z}{1+z}; q(\theta) := \frac{\theta}{1+\theta}, \quad \forall (z, \theta) \in [0, 1] \times [0, 1]. \tag{16}$$

A.3 A probability π_t of detecting rogue enforcers in period t is implied, and is therefore partly endogenous,[16] by the assumption that agents o types $i = 1$ and $i = 2$ face the

[15] It is a classic feature of the DMP model, which underlies our matching of rent-seekers with enforcers, that the division of the "spoils" could reflect relative power of those two groups in a Nash equilibrium setting. We eschew this possibility here, but do thank participants at a seminar in Cleveland Fed for this important point.

[16] This step follows Becker and Stigler (1974). An exogenous value of π_t would imply considerably different dynamics but could be considered as a policy option.

same options. Setting $y_t^{RS}(\varepsilon) = y_t^{RE}(\varepsilon)$, for any ε in equations (15b,c) yields:

$$\pi_t = \frac{1+\theta_t}{2+\theta_t}. \tag{17}$$

It follows from (17) that the probability of detecting rogue enforcers is increasing and concave in the quality of institutions, which accords with intuition.

These assumptions, which we partly relax in the Technical Appendix, imply that the median voter is a "morally" neutral person with $\varepsilon = 1$; that the probability of exposing rogue enforcers improves when institutions firmly defend property rights; producers are victimized, and thieves apprehended, with probabilities that vary in the interval $[0, 0.5]$; and that predators meet prey with probability between 0.5 and 1, depending on the quality of institutions, as proxied by θ_t.

Under assumptions A.2 and in view of (17), adjusted incomes for an agent of type $(1, \varepsilon)$ or $(2, \varepsilon)$, as defined in (15a, b, c), simplify to

$$y_t^{HE} = \frac{1-\phi_t}{1+z_t}(1-\sigma x_{t-1}); \tag{18a}$$

$$y_t^{RS}(\varepsilon) = y_t^{RE}(\varepsilon) = \frac{1-\phi_t}{1+z_t}\frac{1}{1+\theta_t}[1-\sigma(1-x_{t-1})]\varepsilon, \forall\varepsilon. \tag{18b}$$

Occupational choice is now readily described from equations (12), (13), and (18a,b), which lead to the following

<u>Result 1</u>: If matching technologies and moral codes satisfy assumptions A1–A2 and adjusted incomes satisfy (18), we have:

a. The auxiliary function $m(x;\sigma) := \frac{1-\sigma x}{1-\sigma(1-x)}$, measuring the relative social interactions effect, is decreasing and convex in x; increasing (decreasing) in σ if $x <$ $(>)$ 0.5.

b. Critical codes ("morality bars") are increasing functions of institutional quality and decreasing functions of social norms. They are defined from

$$\hat{\varepsilon}_t^1 = \hat{\varepsilon}_t^2 = \min\left\{2, (1+\theta_t)m(x_{t-1};\sigma)\right\}. \tag{19}$$

c. Equilibrium values for corruption intensities satisfy the following law of motion

$$\rho_t = x_t = \mathcal{J}(x_{t-1}; \theta, \sigma), \text{ where } \mathcal{J} := \max\left\{0, 1 - \frac{1+\theta}{2} m(x;\sigma)\right\}, \forall (x, \theta, \sigma) \in [0,1]^3. \tag{20}$$

We note that the map $\mathcal{J}$ is weakly increasing and locally concave in corruption intensity x and also depends on (σ, θ_t), as illustrated in Figure 2. Better institutions in the form of higher θ, will shift the map downward; greater collectivism, in the form of higher σ, will rotate the map counterclockwise about the point $(0.5, \mathcal{J}(0.5, \theta, \sigma))$.

In practical terms, these properties help explain three features of corruption data:

i. if we control for institutions and culture, then corruption is positively autocorrelated;

ii. if we control for culture, then stronger institutions reduce corruption in both the short and the long run; and

iii. if we ignore higher-frequency movements due to business cycle factors, then greater collectivism will rotate the map $\mathcal{J}$ counterclockwise, accelerating convergence to a low-corruption/high-income steady state while slowing convergence to a high-corruption/low-income steady state.

We take some of these predictions to scatter plots of the international data in section 6 below.

Equation (20) provides a complete description of corruption dynamics for a fixed quality of institutions: aggregate corruption at any time $t = 0, 1, \ldots,$ is simply a quadratic function of corruption intensity for any given $\theta_t = \theta$, that is:

$$C_t(\theta_t) = X_t + x_t D_t = x_t(1 + \theta_t x_t) = x_t + x_t^2 \theta_t. \tag{21}$$

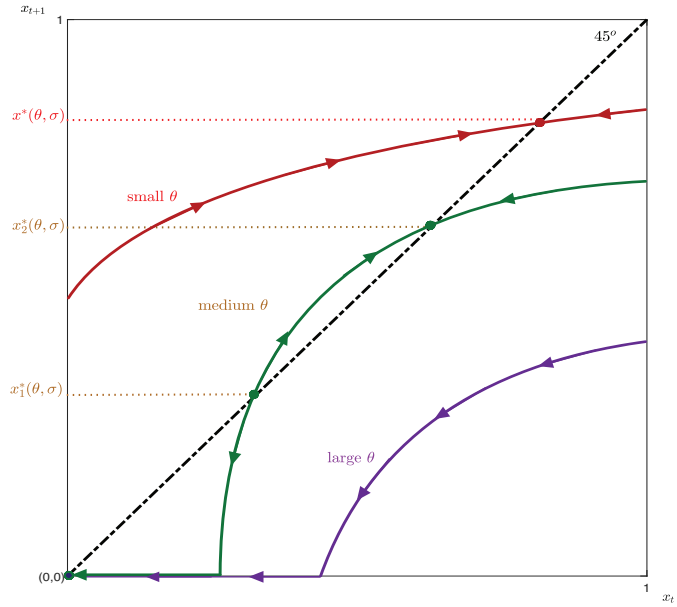

Figure 2: Corruption Dynamics for θ : small, medium, large

4 Equilibrium Dynamics for Exogenous Institutions

4.1 The Evolution of Corruption

This section explores the properties of the laws of motion, defined by equation (20), for a society in equilibrium when institutions are fixed at an exogenous and constant value $\theta \in [0,1]$ while the social interactions parameter is assumed to be time-invariant, $\sigma \in [0,1]$, and other parameters are defined by Assumptions A.1 – A.3. With the full complement of individual and social effects being present (see fn. 11), we derive laws of motion for the vector (x_t, ρ_t), that is, the fraction of corrupt enforcers in the total police force and of rent-seekers in the total type-2 population. If social norms equal the lagged value of of the share of corrupt enforcers, x_{t-1}, then the equilibrium time map is determinate and monotone, converging to a unique steady state that reflects institutional quality, the degree of collectivism and initial conditions for corruption (σ, x_0). Section 5 describes what happens when institutions are endogenous.

We start with two extreme cases, $\sigma = 0$ and $\sigma = 1$, which correspond to simple equilibria,

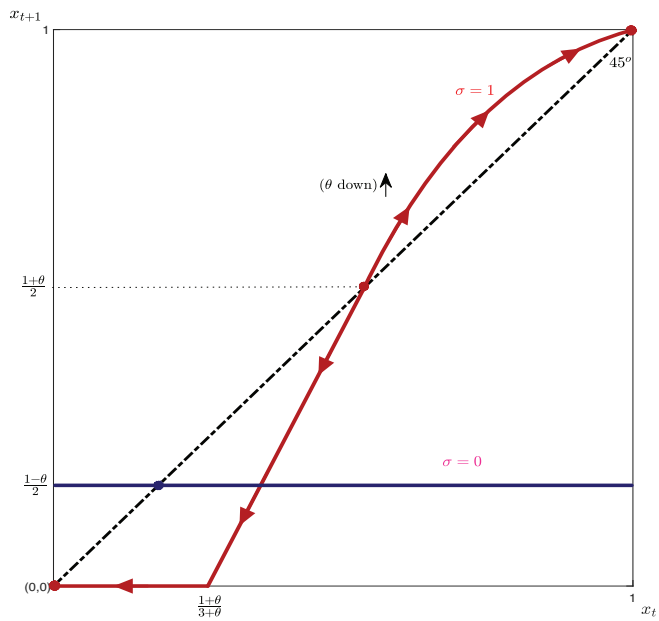

Figure 3: Corruption Dynamics for $\sigma = 0, 1$

that is, to situations in which institutions matter a lot or very little, respectively. These are described by the two maps

$$\mathcal{J}(x;\theta,0) = \frac{1-\theta}{2}, \tag{22}$$

for the purely individualistic case, and

$$\mathcal{J}(x;\theta,1) = \max\left\{0, 1 - \frac{1+\theta}{2}\frac{1-x}{x}\right\}, \tag{23}$$

for the purely collectivist one, illustrated in Figure 3.

Inherited norms do not matter in the fully individualistic case, $\sigma = 0$, where equilibrium corruption at $\frac{1-\theta}{2}$ depends on institutional quality alone; see equation (22). Corruption dynamics become more complex in a fully collectivist environment, $\sigma = 1$, where norms are paramount; see equation (23). Here we have three steady states for the incidence of corruption, $x = \{0, (1+\theta)/2, 1\}$; both extreme ones are asymptotically stable while the

middle one is not. Long-run states do not depend on institutional quality, but the barriers that must be overcome to achieve good economic performance do: they are lower when institutions are strong. Specifically, the barrier $\frac{1+\theta}{2}$ in Figure 3 rises with θ, and any initial norm $x_0 < (1+\theta)/2$ will steer the economy towards the best economic outcome $x = 0$.

Institutions do generally matter when the collectivism index is below one. In that case, long-run states depend on the triple (σ, x_0, θ). Outcomes are proved in the Technical Appendix and summed up in

<u>Result 2.</u>

a. If θ is small, that is, if $\theta + 2\sigma \leq 1$, then equilibrium is ergodic, as shown in the upper most chart of Figure 2, converging monotonically to a unique attractor $x^*(\theta, \sigma) \in \left[0, \frac{1}{2}\right]$. The attractor is a weakly decreasing function of (θ, σ) such that $x^*(0, \sigma) = \frac{1}{2}, \forall \sigma \in \left[0, \frac{1}{2}\right]$.

b. If θ is neither small nor large, that is, if $\theta \in (1 - 2\sigma, \hat{\theta}_1(\sigma))$, where $\hat{\theta}_1(\sigma)$ is defined as

$$\hat{\theta}_1(\sigma)) := [6 - 5\sigma - 4(2 - 3\sigma + \sigma^2)^{0.5}]\sigma^{-1},$$

then the time map $\mathcal{J}$ is sigmoid and the law of motion has two attractors, $x = 0$ and $x = x_2^*(\theta, \sigma)$, separated by an unstable fixed point, $x_1^*(\theta, \sigma)$. The unstable fixed point is the barrier, illustrated in Figure 2, which separates nations into two groups of economies (or convergence clubs) moving towards $x = 0$ and $x = x_2^*(\theta, \sigma)$.

Figure 2 demonstrates that $\frac{1}{2} \leq x_1^*(\theta, \sigma) \leq x_2^*(\theta, \sigma) \leq 1$, with $x_1^*(\theta, \sigma)$ increasing and $x_2^*(\theta, \sigma)$ decreasing in θ.

c. If (θ, σ) are sufficiently large, that is, $\theta > 1 - 2\sigma$ and $\sigma \in (0.2, 1)$, then a saddle node bifurcation occurs at at $\theta = \hat{\theta}_1(\sigma)$ when the two non-zero fixed points from Figure 2 merge into one at $x = \frac{5+\hat{\theta}_1(\sigma)}{4} - \frac{1}{2\sigma}$, with the time map becoming tangent to the 45-degree line. A single attractor appears at $x = 0$.

d. If $\sigma \in [.2, 1]$ and $\theta \in [\hat{\theta}_1(\sigma), 1]$ then equilibrium is again ergodic, converging monotonically to s unique attractor $x = 0$, as shown in Figure 2.

4.2 Discussion

Before we proceed with the choice of institutional quality by means of a political mechanism, we wish to broach a property that permeates our model, especially the maps for medium θ in Figures 2, 3 as well as in 5 and 6 further below. These maps are typically sigmoid, which in turn is critical for equilibrium multiplicity, because of a complementarity between the individual morality code and the social interaction effect emanating from the norm. Larger values of ε amplify the impact of social interactions, increasing the wedge between honest agents, who draw lower values, and corrupt agents, who draw larger ones. This complementarity matters for both low and high values of the norms [*c.f.* Verbrugge (2006)].

Below we explore two further aspects of our results so far. One discusses refinements of our model. The other derives an equation for the evolution of aggregate GDP.

4.2.1 Refinements

First, we elaborate on an important property of the model, namely that it is the asymmetric nature of the social interactions that matter for our results. Were they to be symmetric, that is, if the relative interaction effect were defined so as $m := 1$, then (20) would lead to $\rho_t = x_t = \frac{1-\theta_t}{2}$. That is, rent seeking and corruption would be entirely dependent on the intensity of fiscal enforcement and not on the current value of corruption.[17]

We emphasize that, while our assumption about the distribution of ε does simplify the derivation of the law of motion (20), equation (19) on which the law of motion is based, allows for much more general assumptions about the distribution of ε. However, the particular derivations in Result 2 would be complicated without much gain in generality. This is especially important in view of our aim of endogenizing the choice of institutions, which we pursue further in section 5 below.

Returning to the original framework with asymmetric social interactions, we underscore that the protection of institutions, which we take as a policy variable instead of a socially de-

[17] This is, in fact, consistent with the finding of Arrow and Dasgupta (2009) that proportionality between individual and global relative consumption effects across all goods eliminates social interaction effects.

termined parameter, heeds the dictum that the "guardians [of institutions] must be guarded" [Hurwicz (2007)]]. We can strengthen the deterrent structure facing enforcers who may be tempted to go rogue by introducing a feature that resembles *ostracism:* we assume that the consequences of rogue enforcers being caught include in addition a lump sum cost, which intuitively may be thought as the income equivalent of ostracism. Exposed rogue enforcers are not only deprived of their own wages and of their share of the recovered loot but, in addition, are liable to a lump sum penalty equivalent to an amount ω_t of cash income. Thus, a term $-(1-\phi_t)(1-\pi_t)\omega_t[1-\sigma(1-x_{t-1})]\varepsilon$ enters the right hand side of (15c). It follows then that setting $y_t^{RS}(\varepsilon) = y_t^{RE}(\varepsilon)$, yields instead of (17) the following expression

$$\pi_t = \frac{(1+\theta_t)[1-(1+z_t)\omega_t]}{2+\theta_t-(1+\theta_t)(1+z_t)\omega_t}. \tag{24}$$

Equation (24) amounts to a tradeoff between the income equivalent of ostracism and the probability of being caught: the larger the former the smaller the latter can be. Equation (24) reduces to (17) if $\omega_t = 0$. This variation of the model is interesting, but unfortunately complicates the analytics of the dynamics enormously and is not being pursued further.

We have not discussed where social norms come from; we just identified them with lagged values of endogenous variables, like the incidence of rent-seeking and corruption. This is not just a matter of convenience. The lagged values of endogenous variables serve to carry forward the integrated impact of the full complement of past social and economic forces affecting our model economy. We would be remiss if we were to ignore the extensive literature on the evolution of social norms. Young (2015), in surveying this literature, emphasizes the importance of modeling social norms as patterns of behavior that are self-enforcing at the group level. Endogenous norms reflect individuals' desire to conform to group behavior and are sustained through a multitude of mechanisms including a desire to coordinate, fear of being sanctioned, signaling membership in the group, or simply following the lead of others. The evolution of endogenous norm dynamics, however, is also beyond the scope of the present paper.

4.2.2 The Evolution of Aggregate GDP

There is a notable similarity between the evolution of ρ_t and x_t, which are handled similarly by virtue of our having set the respective norms to be equal to one another in equation (14). Both types of anti-social behavior depend on the matching functions $(p(z), q(\theta))$, and on social norms through the relative social interactions function m. Greater enforcement deters both corruption and rent-seeking in the steady state, but not necessarily the aggregate amount of corruption. From an empirical vantage point, the behavioral similarity of rent-seeking to corruption is welcome because typically unobservable rent-seeking tracks observable corruption. This simplification depends crucially on assumption (14), which eases considerably the complicated dynamic interdependence of x_t and ρ_t.

In addition, we have club convergence for combined low values of individualism and institutional quality. In that situation, there is a critical value $x_1^*(\theta, \sigma)$ for social norms with the property that long-run equilibria converge to low corruption if social norms begin below x_1^*, and to high corruption if norms lie above x_1^*. The basin of attraction to high public corruption is larger for nations with weaker institutions and stronger collectivist values.

Another corrolary of Result 2 is that, in our main example, the dynamics of aggregate GDP mirrors those of corruption:

$$Y_t = (2 - \rho_t) f(k_t) = (2 - x_t) f(k_t), \tag{25}$$

where output per efficiency labor unit $f(k_t)$ is set in the world market; and labor input is the entire labor force less the mass of rent seekers which also equals the fraction of rogue enforcers in any equilibrium. If we normalize $f(k) = 1$, then we may use the law of motion for corruption to rewrite (25) for any interior equilibrium, where $\theta < \hat{\theta}_1(\sigma)$, in the form

$$Y_t = F(Y_{t-1}; \theta, \sigma), \text{ where } F(Y; \theta, \sigma) := 1 + \frac{1+\theta}{2} \frac{1 - 2\sigma + \sigma Y}{1 + \sigma - \sigma Y}. \tag{26}$$

Here GDP per capita is increasing in the quality of institutions and in its own lagged value; the time map (26) is monotonically increasing in Y_{t-1} and convex. Figure 6 shows this map

when institutions are endogenous.

Before we turn to the determination of institutional quality, we may summarize our results when the ratio of enforcers to potential victims is exogenous. In individualist societies with relatively weak social interactions, current corruption depends strongly on institutions and weakly on norms; the reverse is true in collectivist societies with intense social interactions. This is so because the presence of institutions bolsters cash incomes and thus provides incentives that are decisive in individualist environments; but their influence is attenuated in conformist environments because social approbation can be significant for lifecycle utility. In either type of society, stronger property rights reduce corruption and rent seeking in both the short and long runs; GDP improves.

We have ignored here an aspect of corruption which has been referred to by Shleifer and Vishny (1993) as the industrial organization of corruption. Engaging in corrupt practices with public officials who may act as monopolists might allow private agents to bypass costly visas, licenses and permits which are necessary to comply with regulations and laws. In this sense, corruption might allow agents to bypass inefficient red tape and the like and "grease" trade. It is conceptually possible in our setting that, when institutions are weak, additional enforcement may have higher costs than benefits thus reducing GDP. We do not pursue this possibility and refer instead to empirical research, reviewed by Olken and Pande (2012), which concludes that in spite of robust evidence that corruption responds to standard economic incentives, "the effects of anticorruption policies in developing countries often attenuate as officials find alternate strategies to pursue rents."

5 Choosing Institutions by Majority

We have studied the impact of institutions on the evolution and steady-state outcomes of corruption and national income when households take them as exogenous. Long-run outcomes depend strongly on social norms when collectivism is strong (σ is high), and they do so through two distinct channels. One is that norms directly determine how fast each society approaches the steady state $x^*(\theta, \sigma)$ that corresponds to a particular combination

of institutions and culture. A second channel operates through politics when institutions are endogenous. As we will see shortly, conformist societies tend to tailor their institutional choices to inherited habits: poor initial norms create majorities favoring weak property rights; strong norms lead in the opposite direction.

We explore below the choice of institutions through majority voting over the one-dimensional agenda $\theta_t \in [0, 1]$, which ranges between no enforcement and "strong" enforcement. In the case of no enforcement, the government hires nobody. In the case of some enforcement, $\theta > 0$, the government levies taxes on all wage income to pay for the cost of hiring public-sector enforcers. We note at the outset that only young households are affected by institutional quality because the accumulated savings of old households are, by assumption, exempt from rent-seeking or corruption.

Majority voting, as we know from Hotelling (1929) and Downs (1957), implements the wishes of the median voter — the agent with $\varepsilon = 1$ in our case. This outcome duplicates the decision of a myopic Millsian central planner who takes norms and factor prices as given, and chooses institutional quality so as to maximize each period the sum of lifecycle utilities for all young households, using the population mass of each type as a welfare weight.

One downside of the median voter concept, emphasized in the survey by Duggan and Martinelli (2017), is that it ignores the influence of political parties or citizen candidates whose policy tastes differ from the median voter's. Another limitation, pointed out by Tsebelis (2004), is that interest groups or organized minorities are often able to frustrate the will of modest majorities, especially when the median voter wishes to deviate substantially from the status quo. Section 7 discusses some of these limitations.

To describe political equilibrium by majority voting we derive first the government budget constraint and solve it by expressing the rate $\phi \in [0, 1]$ of a proportional tax on the labor income of all honest workers, V_t, as a function of the institutional variable θ and of culture (x^n, σ). Budget balance at a unit wage rate requires that tax revenue, $\phi_t V_t$, should equal spending on enforcement, $D_t = \theta_t X_t$. That is:

$$\phi(\theta_t, x^n, \sigma) = \frac{\theta X_t}{V_t} = \theta_t z_t = \theta_t \frac{x(\theta_t, x^n, \sigma)}{2 - x(\theta_t, x^n, \sigma)}, \tag{27}$$

where (9) is used in the last step and $x_t = x(\theta_t, x^n, \sigma)$ is given from the law of motion and is, from (20), equal to $\mathcal{J}(x^n; \theta_t, \sigma)$. This allows us to rewrite the terms $(1-\phi_t)(1-p(z_t))$ that influence lifecycle utilities as

$$(1-\phi_t)(1-p(z_t)) = \frac{1-\theta_t z_t}{1+z_t} = 1 - \frac{1+\theta_t}{2} x_t.$$

We may now express lifecycle utilities for all agent types ($i = 1, 2$ and $\varepsilon \in [0, 2]$) as functions of the vector $(\theta_t, \varepsilon, x^n)$. From equations (15a, b, c) for agent types $(1, \varepsilon)$ and $(2, \varepsilon)$, plus equation (17), lifecycle utilities are equal to the payoff from honest enforcement or productive employment, y^{HE}, or rent-seeking, $y^{RS}(\varepsilon)$, whichever is larger. That is:

$$W(\theta_t, \varepsilon, x^n) := [1 - \sigma(1 - x_n)] \left[1 - \frac{1+\theta_t}{2} x_t\right] \max\left\{m(x^n; \sigma), \frac{\varepsilon}{1+\theta_t}\right\}. \tag{28}$$

Political equilibrium does not depend on the common scale factor $[1 - \sigma(1 - x^n)]$, which is independent of θ_t, and is thus suppressed from now on. Using (20) to eliminate x_t from (28) and focusing on the median voter $\varepsilon = 1$ from now on, we have a lifecycle payoff

$$W(\theta_t, 1, x^n) := \left[\frac{1-\theta_t}{2} + \left(\frac{1+\theta_t}{2}\right)^2 m(x^n; \sigma)\right] \max\left\{m(x^n; \sigma), \frac{1}{1+\theta_t}\right\}, \tag{29}$$

which the median voter maximizes over $\theta_t \in [0, 1]$.

Next we show that lifecycle utilities of all agents, and thus median ones in each group as well, are $U-$shaped functions of institutional quality θ_t, if norms are neither high nor low; strictly increasing if norms are good enough (low x^n); strictly decreasing if norms are bad enough (high x^n). Specifically, for any $m = m(x^n; \sigma)$, $W(\theta_t, 1, x^n)$ is decreasing in θ_t if $1+\theta_t < m^{-1}$; increasing in θ_t if $1+\theta_t \in (m^{-1}, 2m^{-1})$; and independent of θ_t if $1+\theta_t > 2m^{-1}$. This is so because improvements in institutional quality must reallocate productive workers into enforcement employment and displace rent seekers into production. The ratio of these opposing flows is below 1 when θ is small relative to social norms, and above 1 when θ is

large. Specifically, we have from (29) for any $m = m(x^n; \sigma)$,

$$W(\theta, 1, x^n) = \frac{1-\theta}{2(1+\theta)} + \frac{1+\theta}{4} m, \text{ if } 1+\theta \in (1, m^{-1});$$
$$W(\theta, 1, x^n) = \left[\frac{1-\theta}{2} + \left(\frac{1+\theta}{2}\right)^2 m\right] m, \text{ if } 1+\theta \in (m^{-1}, 2m^{-1}); \tag{30}$$
$$W(\theta, 1, x^n) = m, \text{ if } 1+\theta \in (2m^{-1}, 2).$$

5.1 A Single-Peakedness Result

We show next that, if the median voter in either group prefers θ_2 to θ_1, then so does a majority in each group. We have, in particular (see Technical Appendix):

Result 3. Suppose that (θ_1, θ_2) are two institutional choices such that $0 \leq \theta_1 \leq \theta_2 \leq 1$. Then

a. If the median voter in each group prefers θ_2 to θ_1, so will all voters with $\varepsilon \leq 1$, that is, all those who are disposed towards honest behavior.

b. If the median voter in each group prefers θ_1 to θ_2, so will all voters with $\varepsilon \geq 1$, that is, all those disposed towards anti-social behavior.

Continuing this argument, we solve $m = m(x; \sigma)$ in terms of x and obtain:

$$x = \tilde{x}(m, \sigma) := \frac{m}{1+m} + \frac{1-m}{1+m}\frac{1}{\sigma}. \tag{31}$$

From (30) we observe that the median voter's lifecycle utility is decreasing in θ for all θ if $x^n \in [\tilde{x}(\frac{1}{2}, \sigma), 1]$; increasing in θ for all θ if $x^n \in (\tilde{x}(1/2, \sigma), 1)$; independent of θ if $x^n \in (0, \tilde{x}(2, \sigma))$; and $U-$ shaped in θ otherwise.

From this observation we arrive at the following

Result 4: The median voter will be indifferent about institutions if social norms are very strong; will vote for no enforcement if social norms are very weak; and will favor strong enforcement if social norms are intermediate. Specifically, equilibria with endogenous institutions satisfy

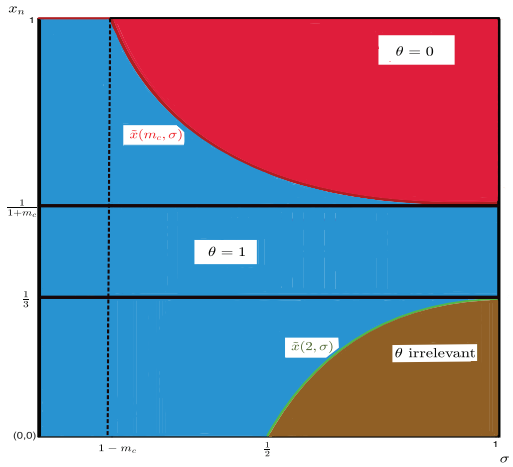

Figure 4: Voting at Given Norms

a. θ_t indeterminate and $x_t = 0$, if $x_{t-1} \in [0, \tilde{x}(2, \sigma)]$;

b. $\theta_t = 1$, and $x_t = \mathcal{J}(x_{t-1}; 1, \sigma)$ if $x_{t-1} \in [\tilde{x}(2, \sigma), \tilde{x}(m_c, \sigma)]$;

c. $\theta_t = 0$, and $x_t = \mathcal{J}(x_{t-1}; 0, \sigma)$ if $x_{t-1} \in [\tilde{x}(m_c, \sigma), 1]$;

where $m_c = (1 + \sqrt{33})/8$.

Figure 4 illustrates voting outcomes for given norms.

5.2 Corruption and GDP under Majority Voting

Letting the median voter dictate institutional quality does not change appreciably the dynamic behavior of our economy, captured in Figure 2 and in equation (26), except in one detail. Median voters tend to make extreme choices of institutions, either $\theta = 0$ or $\theta = 1$, because their lifecycle utility indices are typically $U-$shaped functions of institutional quality. Such bang-bang choices "punch" a gap in the laws of motion for both corruption and GDP, equivalent to a discontinuity in the time maps for output $F(Y; \sigma)$, defined in (26) above, and $T(x; \sigma)$, defined in (32) below, which connect past with present GDP and past

with present corruption, respectively. These maps, drawn in Figures 5 and 6, resemble the earlier ones in Figure 2. The Technical Appendix proves

Result 5:

a. Under majority voting, the law of motion for corruption is:

$$\begin{gathered} x_t = T(x_{t-1};\sigma), \\ \text{where } T(x;\sigma) = 0, \text{ if } x \in [0, 0.5]; \\ T(x;\sigma) = 1 - m(x;\sigma), \text{ if } x \in [0.5, \tilde{x}(m_c;\sigma)]; \\ T(x;\sigma) = 1 - \frac{1}{2}m(x;\sigma), \text{ if } x \in [\tilde{x}(m_c;\sigma), 1] \end{gathered} \tag{32}$$

b. T is weakly increasing and locally concave in x, as shown in Figure 5, with a discontinuity at $\tilde{x}(m_c;\sigma)$, as defined in (31).

c. For all $\sigma \in [0, 1]$ we have

$$T(0.5;\sigma) = 0 < T(1;\sigma) = \frac{1+\sigma}{2}.$$

d. There are at most two steady states:

the good attractor $x = 0$ is an asymptotically stable one for any $\sigma \in [0, 1]$; and

the bad attractor $x = 2 - \sigma^{-1}$ is also an asymptotically stable steady state for $\sigma \in \left[\frac{2}{2+m_c}, 1\right]$. Both attractors are illustrated in the bifurcation diagram of Figure 8.

e. From equations (25), (26) and (32), it is easy to verify that long run GDP is equal to $2f(k)$ at the good attractor and $\frac{1}{\sigma}f(k)$ at the bad one.

Medium term output dynamics also follow from equations (25), (26) and (32) with the law of motion

$$y_t = H(y_{t-1};\sigma), \tag{33}$$

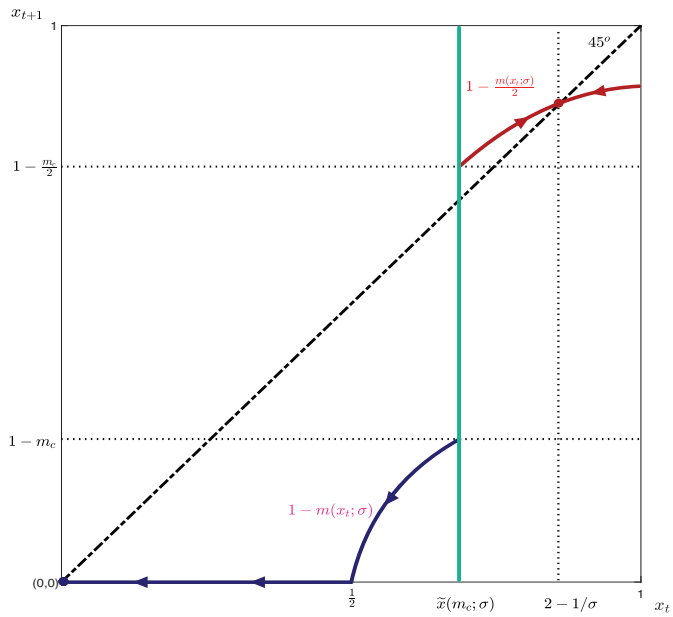

Figure 5: Corruption Dynamics: Endogenous Institutions, High σ

expressed in terms of efficiency labor units per person,

$$y_t = \frac{Y_t}{f(k)}, \tag{34}$$

and depicted in Figure 6. The map H is weakly increasing in y and locally convex:

$$\begin{aligned} H(y;\sigma) &= \frac{3-\sigma y}{2(1+\sigma-\sigma y)}, \text{ if } y \in [1, \tilde{y}]; \\ H(y;\sigma) &= \frac{2-\sigma}{1+\sigma-\sigma y}, \text{ if } y \in [\tilde{y}, 1.5]; \\ H(y;\sigma) &= 2, \text{ if } y \in [1.5, 2], \end{aligned} \tag{35}$$

where $\tilde{y} := 2 - \tilde{x}(m_c;\sigma)$. The evolution of GDP has again at most two attractors: a good one at $y = 2$, for any σ, and a bad one, at $y = \sigma^{-1}$ for high $\sigma \in [2(2+m_c)^{-1}, 1]$ only.

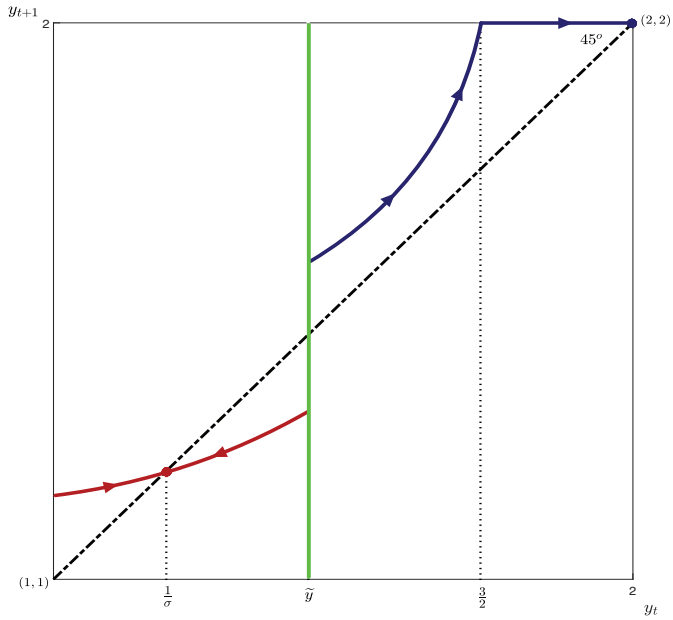

Figure 6: GDP Dynamics: Club Convergence with Endogenous Institutions and High σ

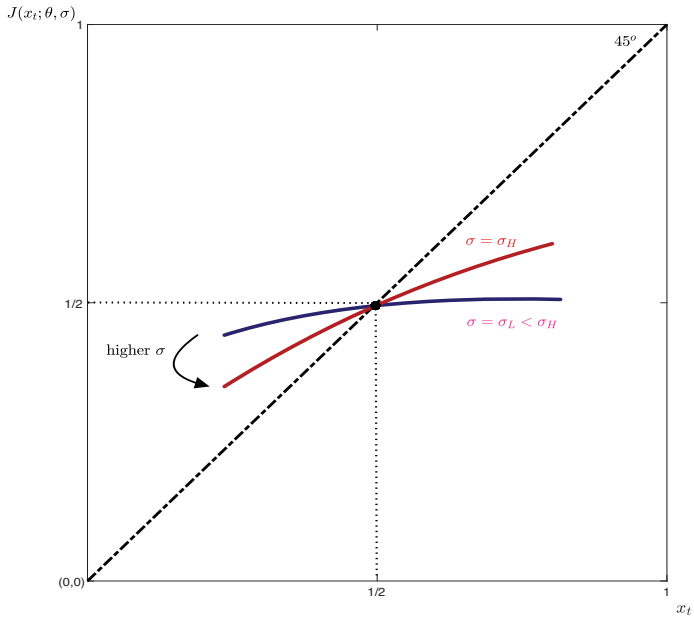

Figure 7: Speed of Club Convergence

Figure 7 illustrates why the combination of high collectivism and weak property rights slows down convergence to the steady state along the bad attractor. A shift from $\theta = 1$ to $\theta = 0$ translates upwards the locally concave law of motion $\mathcal{J}$; a rise in the collectivism index σ rotates $\mathcal{J}$ counterclockwise about the point $x = 0.5$, which controls whether the auxiliary function $m(x; \sigma)$ is increasing in σ if $x \leq 0.5$, or decreasing in σ if $x \geq 0.5$. Each of these changes raises the slope of $\mathcal{J}$ at values of x above 0.5 slowing down convergence in the interval $x \in [0.5, 1]$, as shown in Figure 7. We conclude that when club convergence prevails, detrended GDP per capita in "rich" nations should be less autocorrelated in the medium and low frequencies that we normally associate with economic growth; and less dependent on past values, than that of "poor" nations.[18]

A corollary of that argument is that autocorrelations of endogenous state variables should be highest when the parameter vector (σ, x_0) is large enough to trigger a political equilibrium with weak property rights, that is, with $\theta = 0$.

5.2.1 Summary of Main Results for Endogenous Institutions

The outcome of the joint political/economic process strikes a balance between two fundamental cultural forces, collectivism, denoted by σ, and social norms, denoted by x_0. Collectivism raises the importance of inherited norms in occupational choice by "taxing" the utility of those who deviate from acceptable behavior. When collectivism is sufficiently high, it can form a lethal cultural mix with corruption-tolerant norms; that mix promotes unproductive occupational choices, lends political support to weak institutions, and guides unfortunate societies to undesirably high levels of corruption and poverty. For each value of collectivism σ above some critical value σ_c there exists a critical value $\tilde{x}(\sigma)$ of inherited norms that turns any combination (σ, x_0) above $(\sigma_c, \tilde{x})$ into a development barrier.

Figure 8 shows this barrier as a downward-sloping curve $x = x_c(\sigma)$, a tipping line, which

[18] This follows under the assumptions of no stochastic shocks but we conjecture that it could be generalized. We thank Marios Angeletos for a clarification here.

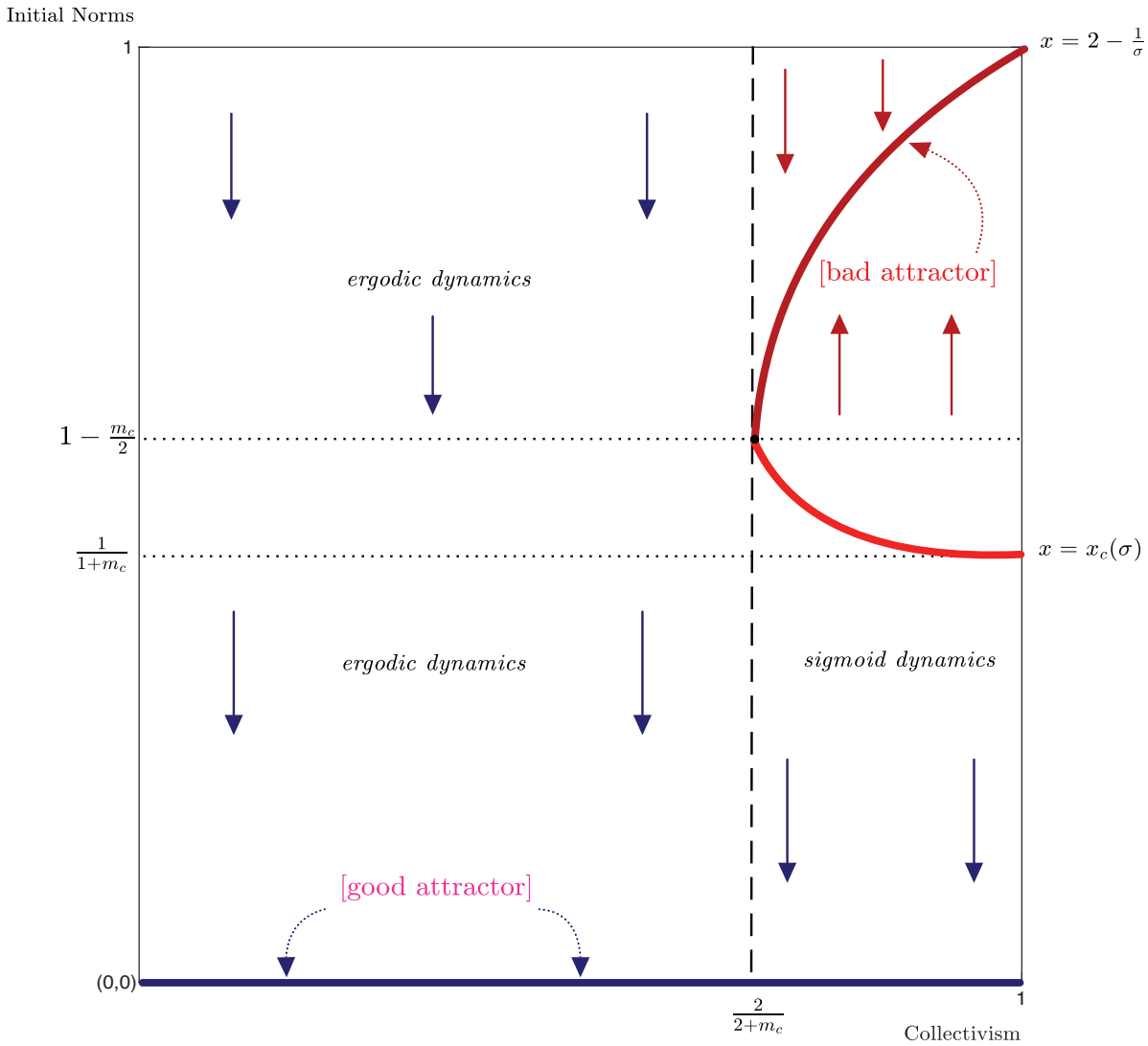

Figure 8: Long Run States under Endogenous Institutions

joins two points in the same space as Figure 1 above: $(\sigma, x_0) = \left(\frac{2}{2+m_c}, 1 - \frac{m_c}{2}\right)$ with $(\sigma, x_0) = \left(1, \frac{1}{1+m_c}\right)$ where $m_c \in (0,1)$ is an endogenous threshold that equals about 0.84 in our main example. The curve $x = \tilde{x}(\sigma)$ corresponds to unstable steady states like $x_1^*(\sigma, \theta)$ in Figure 2; it slopes down to indicate that, at high initial norms, collectivist societies are more prone to poor outcomes than their individualist counterparts. Long-run behavior changes radically when the parameter vector (σ, x_0) crosses the bifurcation line into high values. That event separates nations into "cultural convergence clubs" which depend on initial conditions and culture. Initial norms above that curve describe conformist and corruption-tolerant economies that opt for weak institutions and end up in steady state equilibria of high corruption and low incomes. Conversely, initial conditions below, or to the left, of the bifurcation curve lead to strong institutions, low corruption and high incomes.

6 From Theory to Data

What empirical support can we hope to marshal in favor of our main conjectures? In a nutshell, these are:

i. If economic fundamentals are common to all countries, then a downward-sloped barrier exists in the "culture-space" defined jointly by the indices of collectivism and initial social norms $(\sigma, x_0) \in [0,1] \times [0,1]$. Societies on different sides of the barrier form distinct convergence clubs of asymptotically "rich" and "poor" nations, with strong and weak institutions, respectively.

ii. Highly collectivist societies can belong to either convergence club which implies that their economic and institutional performance will show greater dispersion than that of individualistic societies.

iii. Nations that find themselves on the underdevelopment side of the development barrier will converge to their long-run steady states, or balanced growth paths, more slowly than others, thus exhibiting higher autocorrelations in their corruption and GDP per capita statistics at medium and low frequencies.

A detailed empirical investigation of these conjectures is beyond the scope of this introductory treatment which does not allow for heterogeneity in economic fundamentals. Still, it may be useful to speculate about the chances that our main results will survive formal statistical tests. Given that GDP data are generally available, testing requires appropriate measures of culture, corruption and institutions. The literature provides numerous proxies for corruption and for institutional quality, but does not offer any specific measures on the fiscal cost of institutional quality. Similarly, the literature proposes numerous proxies for multidimensional measures of culture, which have been developed by social scientists other than economists, with the sole exception of Falk *et al.* (2018). From among this multitude of measures, Hofstede's scalar measure of individualism vs. collectivism[19] fits our theory very well. It is for this reason that we have chosen it for the demonstration, given in Figure 1, of patterns in international data on countries' positions in the space of culture and initial state of corruption. The Hofstede Index figures prominently in additional figures to be discussed shortly below.

To complement Figure 1, we add a few more three-dimensional scatter plots of our two-dimensional culture space, with the third dimension being tertiles or quartiles of autocorrelations in institutional quality and in filtered per capita GDP. Specifically, we focus on data patterns that appear to support the "cultural convergence hypothesis" and, more precisely, the conjecture that the evolution of GDP, corruption and institutional quality is considerably less "neoclassical" among nations in the northeastern quadrant of the culture space $[0, 1] \times [0, 1]$, defined by collectivism and initial social norms, than it is for societies in the remaining three quadrants.

If we measure initial social norms by the earliest national data available through the Corruption Perception Index then Figure 1 highlights how cultural differences correlate with the long run behavior of per capita GDP.

Figures 9 and 10 report correlation patterns between culture and two alternative measures of institutional quality. Specifically, in Figure 9 the institutional quality is proxied by $\texttt{WMO}_{ex}$, which measures expropriation risk. It is a component of the World Bank's measure of

[19] Hofstede (1980; 1984). See also https://tinyurl.com/ydfqwxyy

rule of law,[20] and proxies for the risk that the state or other sovereign political authority will deprive, expropriate, nationalize, or confiscate the assets of private businesses, whether domestic or foreign. Higher values imply lower risk of expropriation and the correlation with GDP per capita is positive. In Figure 10, institutional quality is proxied by $\texttt{ICRG}_{lo}$, which measures the strength and impartiality of law and order. This one is available from the PRS Group [various years] and is positively correlated with GDP per capita.[21] We note that both measures give similar pictures, although $\texttt{WMO}_{ex}$ is a narrower measure of institutional quality than $\texttt{ICRG}_{lo}$. Each measure broadly conforms to the predictions of Results 4 and 5 above as shown in Figure 8. Countries associated with better institutions, by either measure, cluster in the southwestern quadrant of the "culture space" (σ, x_0). Those with poor institutions cluster in the northeastern quadrant.

Figures 11 and 12 connect culture with autocorrelations of per capita GDP and of institutional quality, proxied by $\texttt{WMO}_{ex}$, which measures the quality of institutions by economic risk affecting property owners. This is also available from the PRS Group [various years] and is positively correlated with GDP per capita. Both, GDP per capita and $\texttt{WMO}_{ex}$ are treated by the Christiano and Fitzgerald (2003) (CF) filter to scrub out dynamics at business cycle frequencies.[22] Both Figures 11 and 12 conform to the predictions made in Results 4 and 5 and illustrated in Figure 8. Not surprisingly, per capita GDP is very highly autocorrelated; the median autocorrelation coefficient is 0.91 and the interquartile range is 0.04.

[20] http://info.worldbank.org/governance/wgi/pdf/rl.pdf, downloadable from
info.worldbank.org/governance/wgi/pdf/WMO.xlsx
and comes from Global Insight Business Conditions and Risk Indicators.

[21] For details, see https://www.prsgroup.com/wp-content/uploads/2014/08/icrgmethodology.pdf. The "Law" part assesses the strength and impartiality of the legal system; the "Order" part assesses a country's popular observance of the law.

[22] In making use of the band-pass filter of Christiano and Fitzgerald (2003), we choose parameter values such that the decomposition filters out stochastic cycles at periods shorter than 7 years — a typical upper bound on the duration of business cycles — and periods longer than 30 years, which correspond to long-run developments materializing approximately once every generation.

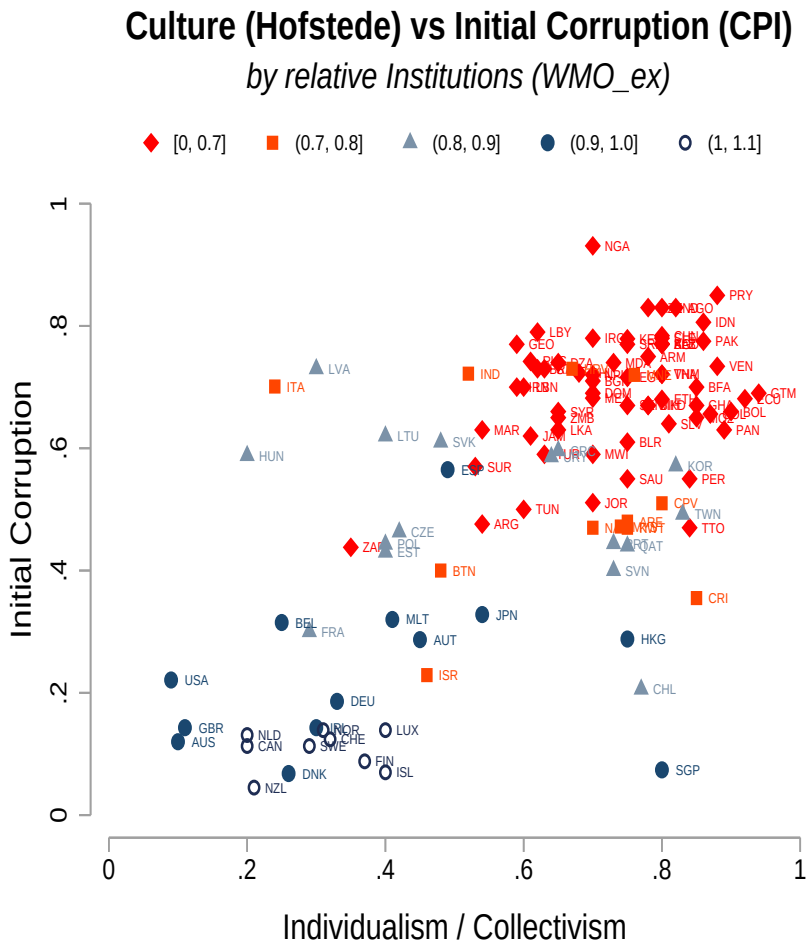

Figure 9: Culture (Hofstede) and Initial Corruption Index (CPI) by Institutions (WMO_ex) Relative to the US. Higher values imply lower risk of expropriation.

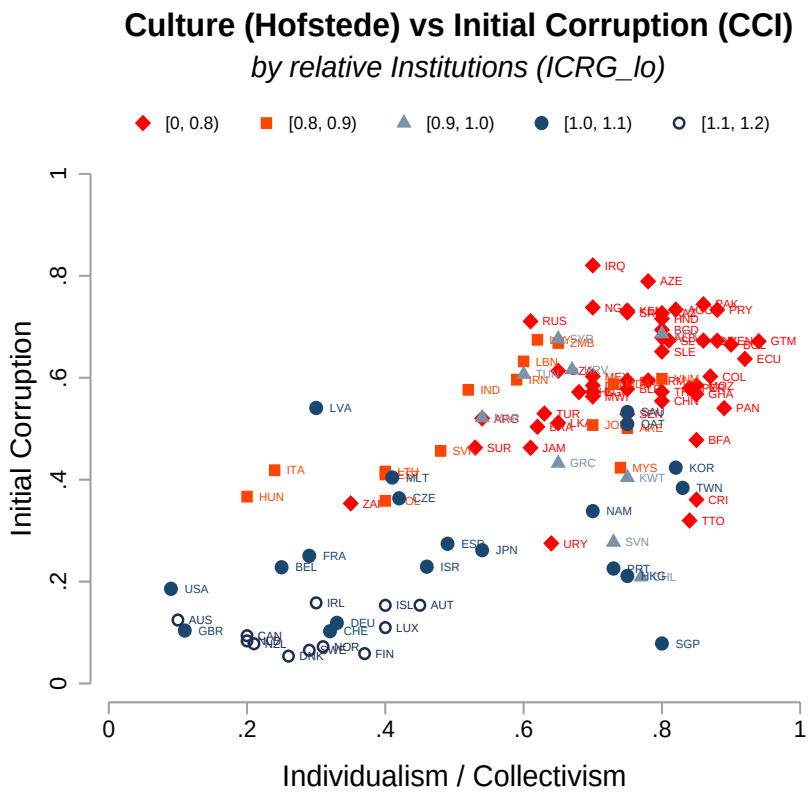

Figure 10: Culture (Hofstede) and Initial Corruption Index (CPI) by Institutions (ICRG_lo) Relative to the US. Higher values imply better law and order.

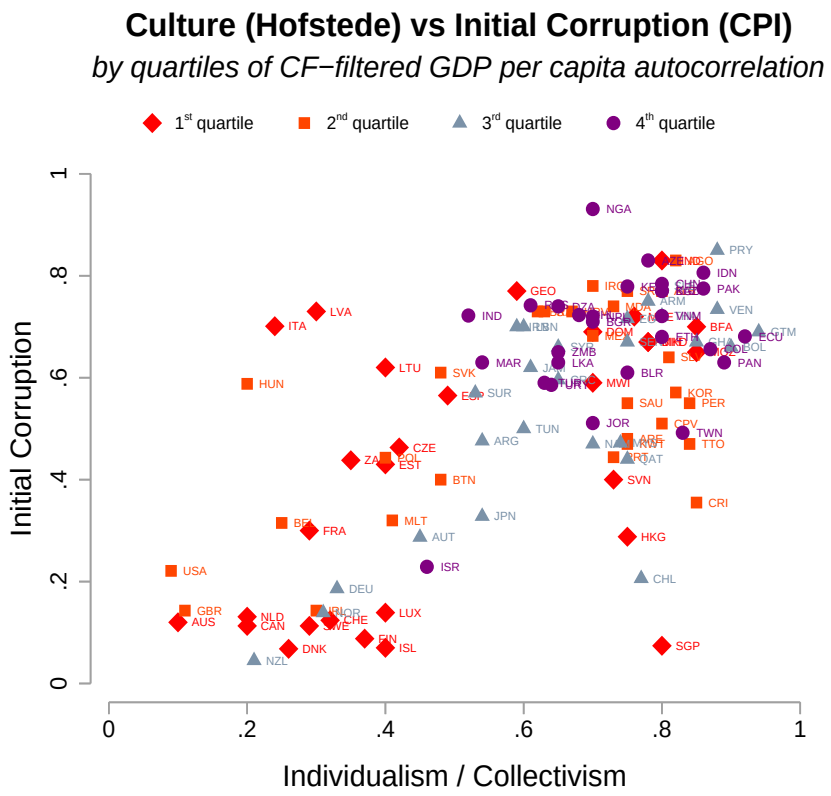

Figure 11: Culture (Hofstede) and Initial Corruption Index (CPI) by Quartiles of CF-filtered GDP per capita autocorrelation: Rhombus first quartile – • fourth quartile

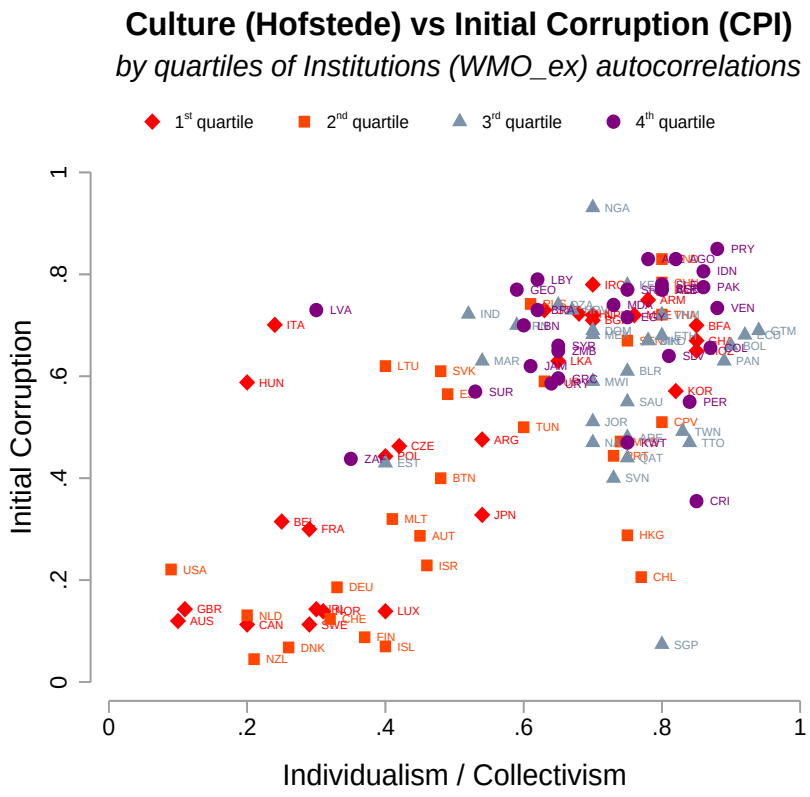

Figure 12: Culture (Hofstede) and Initial Corruption Index (CPI) by Quartiles of Institutions (WMO_ex) autocorrelation: Higher values imply better institutional quality.

Informal scatter plots seem to suggest that the northeastern quadrant of the world "culture space" is densely populated by countries whose development experience is not the linear progress of the neoclassical growth paradigm. That paradigm emphasizes the role of "growth engines" such as human capital and R&D. A richer model than ours may throw further light on the broader question of where material progress comes from: economics or culture?

With the notable exception of Falk *et al.* (2018), the literature treats culture as a country-specific attribute. While many countries have pronounced multiethnic characteristics, this type of heterogeneity has not had much influence on policy design. Policy design should

in principle be sensitive to pronounced within-country differences in cultural characteristics exhibited by population groups that differ in location or ethnicity.

Our demonstration of a paramount role for culture as an engine for development leads naturally to the question of how effective policy tools are at regulating the impact of culture on corruption in heterogeneous societies. This bears on the emergence and determinants of culture. Culture, as reflected in the parameter σ, may be treated as a long-ingrained feature of each nation or ethnolinguistic group. While given at any point in time, evidence suggests that cultural characteristics develop over long periods of time and are instilled in populations that go through different experiences. A recent strand of the literature that includes, in particular, Ashraf and Galor (2013), Becker *et al.* (2020), Enke (2019) and Falk *et al.* (2018), has emphasized the ancient origins of value systems, including negative and positive reciprocity and a range of emotions. Their evidence shows that societies with a historically tightly knit kinship structure regulate behavior through a variety of socially mediated tools. In loose kinship societies, cooperation appears to be enforced through universal moral values, internalized guilt, altruistic punishment, leaving also a role for moralizing religions. According to Ashraf and Galor (2013), such differences have solidified over the ages as population groups separated temporally and spatially when they migrated out of Africa. Giuliano and Nunn (2020) emphasize, in broadly related research, the importance of environmental features for cultural persistence. They find that populations with ancestors who lived in environments with more cross-generational instability place less importance in maintaining tradition today and exhibit less cultural persistence. Clearly, our reliance on a single country-wide index may only serve as a benchmark.

7 Conclusions and Extensions

In revisiting the question of why the whole world is not developed, we add private rent-seeking and official corruption as occupational choices in an open economy model of macroeconomic activity in which institutions are chosen by a citizen majority. Working with a simple parametric example we conjecture that the road to prosperity can be blocked by poor social

norms in collectivist societies. Poor norms allow the past to dominate the present: they raise the importance of history, diminish chances for meaningful institutional reform and perpetuate underdevelopment through political choices that favor weak institutions.

Strictly speaking, our model looks at a world consisting of many symmetric, and small, national economies with identical economic fundamentals, perfect capital mobility, and different cultural characteristics, operating under a common vector of worldwide factor prices. However, economic fundamentals do vary across nations and institutional choice does affect factor prices (that is, wage and interest rates) in closed economies as well as in large open economies like the United States and China. From a theory standpoint, it would be also interesting to find out how anti-social activity reacts to additional types of penalties, such as incarceration or exclusion from asset markets.

Another extension would come to grips with the strong positive autocorrelation in the quality of institutions which our theory predicts primarily for collectivist economies with high tolerance for corruption, but is known to hold for most modern economies. One way to understand strong institutional autocorrelations for most countries is to replace our majority voting assumption with a supermajority one through interest groups as in Acemoglu and Robinson (2000a), or by bringing in veto power as in Tsebelis (2004). This change would impede large and rapid reforms, tying once more current institutions to past ones and opening a window on populist politics.

Anthropologists and sociologists may be interested in a more granular version of our model, in which nations are replaced by smaller units, like provinces, cities, or even neighborhoods. The findings of Enke (2019) and Becker *et al.* (2020) suggest that much may done in this area.

Perhaps the most vexing issue this paper can raise is one for economic policy: how does one deal with ingrained corruption in collectivist societies? How does a community on the underdevelopment side of the development barrier climb over it? If the distance from the barrier is not very large, in the sense of Figure 1, then a temporary improvement in fundamentals (raising saving, controlling population growth, attracting foreign investment for a single generation) may be enough. Otherwise, policy can attempt to change the culture:

initiatives like long-run propaganda campaigns via schools, churches and the media may be effective in changing preferences and moral codes by helping citizens identify public but also private corruption. Lessons may also be sought from countries like Singapore, which uprooted government corruption in the 1960s, and South Korea, which has made leaps and bounds in identifying and prosecuting corruption. Other policy tools may be a free and unfettered press, the draconian punishment of perpetrators, and higher pay for civil servants.

Costas Azariadis, Department of Economics, Washington University in St. Louis, St. Louis, MO 63130-4899, USA

and

Yannis M. Ioannides, Department of Economics, Tufts University, Medford, MA 02155, USA

Technical Appendix

A Properties of Auxiliary Functions

For $(x, \theta, \sigma) \in [0,1]^3$, we define $m(x, \sigma)$ and $\mathcal{J}(x; \theta, \sigma)$ from equations (**??**) and (20), respectively, and consider a quadratic in x with parameters $(\theta, \sigma) \in [0,1]^2$:

$$\psi(x; \theta, \sigma) := 2\sigma x^2 - [(5+\theta)\sigma - 2]x + \theta + 2\sigma - 1. \tag{36}$$

The discriminant of this quadratic,

$$\Delta(\theta; \sigma) := \sigma^2\theta^2 - 2\sigma(6 - 5\sigma))\theta + (2 - 3\sigma)^2, \tag{37}$$

is itself a quadratic polynomial in $\theta \in [0,1]$ for each σ. Here we note that:

a. The relative social interaction function m, defined in section 3.3, Result 1 (a), is decreasing and convex in x; it satisfies

$$m(0, \sigma) = \frac{1}{1-\sigma} > 1 - \sigma = m(1, \sigma);$$

it is increasing in σ for $x \in [0, .5]$; decreasing in σ for $x \in [0.5, 1]$.

b. The map $\mathcal{J}$, defined in (20), is increasing and locally concave in x, decreasing in θ whenever $\mathcal{J} > 0$.

c. $\mathcal{J}(x; \theta, \sigma) = 0$ if $x < \hat{x}(\theta, \sigma) := \frac{\theta + 2\sigma - 1}{\sigma(3+\theta)}$; or $\theta > \hat{\theta}(\theta, \sigma) := \frac{2}{m(x,\sigma)} - 1$;

$\mathcal{J}(x; \theta, \sigma) = 1 - \frac{1+\theta}{2} m(x, \sigma)$, otherwise.

$\mathcal{J}(x; \theta, \sigma)$ is decreasing (increasing) in x if $x <$ $(>)$ $\frac{1}{2}$;

d. $\psi(x; \theta, \sigma)$ is convex in x, increasing in (θ, σ) $\forall(\theta, \sigma) \in [0,1]^2$.

e. If $\theta + 2\sigma > 1$, then $\Delta(\theta; \sigma)$ has two positive roots, $(\hat{\theta}_1(\sigma), \hat{\theta}_2(\sigma))$ such that $\hat{\theta}_2 \geq 1, \forall\sigma$ and $\hat{\theta}_1(\sigma) \in [0,1]$ iff $\sigma \in [0.2, 1]$.

f. If $\theta + 2\sigma > 1$ and $\sigma \in (0.2, 1)$, then

$$\hat{\theta}_1(\sigma) := \frac{6 - 5\sigma - 4(2 - 3\sigma + \sigma^2)^{0.5}}{\sigma} \in [0, 1];$$

$\hat{\theta}_1(0.2) = (\hat{\theta}_1(1) = 1;$

$\hat{\theta}_1(2/3)$ achieves its minimum value of 0 at $\sigma = \frac{2}{3}$;

$(\hat{\theta}_1(\sigma) > 1 - 2\sigma, \forall \sigma \in [0, 0.5]$.

B A Robustness Check for Sigmoid Dynamics

Suppose now that we replace assumptions (A.1) – (A.3) in section 3 with less restrictive ones, that is:

B1. $p(z) = \frac{z}{z+A}$ for $A \geq 1; q(0) = 0;$ and $\sigma = 1$.

B2. ε has full support on R_+ with a smooth density function g and a smooth cumulative distribution G such that

$$\lim_{\varepsilon \to 0} g(\varepsilon) = \lim_{\varepsilon \to \infty} g(\varepsilon) = 0, \text{ with } \lim_{x \to 0} \left[\frac{g'\left(B\frac{1-x}{x}\right)}{x^3} \right] = 0, \forall B > 0.$$

B3. The equilibrium value of the probability of rogue enforcers' being caught, defined in (17), changes to $\pi(\theta, x^n) = \frac{A(1+\theta)m(x)}{1+A(1+\theta)m(x)} \in (0, 1)$.

Now the critical value of ε from (15a – 15c) is $\frac{A}{1-q(\theta)} \frac{1-x^n}{x^n}$. From this we conclude that, at $\sigma = 1$, corruption intensity obeys the following equation

$$x_t = \mathcal{J}(x_{t-1}; \theta, 1) = 1 - G\left(\frac{A}{1 - q(\theta)} \frac{1 - x_{t-1}}{x_{t-1}} \right).$$

From assumption B.2 it is easy to check that both $x = 0$ and $x = 1$ are asymptotically stable steady states and, hence, must be separated by an unstable intermediate state, as in Figures

2 and 3. Strictly speaking, this result holds at $\sigma = 1$ only, and by continuity, for smaller values of σ, for many reasonable distributions of ε and many matching technologies.

C Proof of the Single-Peakedness Result 3

We first prove the payoff equation (29) starting with the definition of the tax rate ϕ in equation (27). Then we calculate adjusted incomes for producers

$$v^P(\theta, x_n, \sigma) = (1-\phi)(1-p)(1-\sigma x^n) = \frac{1-\theta z}{1+z}(1-\sigma+\sigma x^n)m(x^n, \sigma)) \tag{38}$$

and for type-ε rent-seekers or rogue-enforcers

$$v^{RS}(\theta, \varepsilon, x_n, \sigma) = \frac{1-\phi}{1+z}(1-\sigma+\sigma x_n)\frac{\varepsilon}{1+\theta}, \tag{39}$$

because of the symmetry assumption (A.2) made in equation (17). Then, the payoff for any agent of type $\varepsilon \in [0, 2]$, under an optimal occupational choice, is

$$W(\theta, \varepsilon, x^n, \sigma) = \max\left\{v^P(\theta, x^n, \sigma), v^{RS}(\theta, \varepsilon, x^n, \sigma)\right\}, \tag{40}$$

which proves equation (29).

Continuing we note that part (a) of Result 3 is equivalent to the inequality

$$1 \leq \frac{W(\theta_2, 1, x^n)}{W(\theta_1, 1, x^n)} \leq \frac{W(\theta_2, \varepsilon, x^n)}{V(\theta_1, \varepsilon, x^n)}, \text{ for } \varepsilon \in [0, 1]; \tag{41}$$

part (b) is equivalent to

$$1 \leq \frac{W(\theta_1, 1, x^n)}{W(\theta_2, 1, x^n)} \leq \frac{W(\theta_1, \varepsilon, x^n)}{W(\theta_2, \varepsilon, x^n)}, \text{ for } \varepsilon \in [1, 2]. \tag{42}$$

Next we define the function

$$T(\theta, \varepsilon, x^n) := \frac{\max\left\{m(x^n, \sigma), \frac{1}{1+\theta}\right\}}{\max\left\{m(x^n, \sigma), \frac{\varepsilon}{1+\theta}\right\}}, \tag{43}$$

and rewrite inequalities (41) and (42) in the form

$$T(\theta_2, \varepsilon, x^n) \leq T(\theta_1, \varepsilon, x^n), \text{ if } \varepsilon \in [0, 1]; \tag{44}$$

$$T(\theta_2, \varepsilon, x^n) \geq T(\theta_1, \varepsilon, x^n), \text{ if } \varepsilon \in [1, 2]; \tag{45}$$

Both (44) and (45) hold true because T is clearly weakly decreasing in θ, for $\varepsilon \in [0, 1]$, and weakly increasing in θ, for $\varepsilon \in [1, 2]$. This completes the proof.

D Proof of Result 5

Parts (b), (c) and (e) are straightforward. For part (a) we easily check that equation (32) follows directly from Result 4. For part (d), we need to show that no positive steady state $x > 0$ exists if $\sigma < \frac{2}{2+m_c}$; one positive steady state exists if $\sigma > \frac{2}{2+m_c}$.

Positive states are solutions to $x = T(x; \sigma)$, that is, roots of the polynomial

$$h_1(x) := \sigma x^2 - (3\sigma - 1)x + \sigma, \quad \text{for } x \in \left[\frac{1}{2}, \tilde{x}(m_c; \sigma)\right] \text{ and } \sigma \in \left[\frac{1}{2}, \frac{2}{2 + m_c}\right],$$

and of the polynomial

$$h_2(x) := 2\sigma x^2 - (5\sigma - 2)x + 2\sigma - 1, \text{ for } x \in [\tilde{x}(m_c, \sigma), 1] \text{ if } \sigma \in \left[\frac{2}{2 + m_c}, 1\right].$$

It is easy to show that $h_1(x)$, which is not shown in Figure 8, has no real roots for $\sigma \geq 0.5$. $h_2(x)$ has two positive roots $(x_1, x_2) = (0.5, 2 - \sigma^{-1})$ for $\sigma \geq 0.5$. Of these, x_2 lies inside the interval $\left[\frac{2}{2+m_c}, 1\right]$ if and only if $\sigma \geq \frac{2}{2+m_c}$. Figure 6 illustrates and completes the proof.

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