Culture, Pro-Market Institutions, and National Innovation

Daniel L. Bennett
Research Professor
Baugh Center for Entrepreneurship & Free Enterprise
Baylor University
One Bear Place #98011
Waco, TX 76798
bennettecon@gmail.com
(312) 835-9492

Boris Nikolaev
Assistant Professor
Department of Entrepreneurship
Baylor University
One Bear Place #98011
Waco, TX 76798
borisnikolaev@gmail.com
(813) 401-9756

Abstract
Previous research suggests that both formal institutions (e.g., pro-market institutions) and informal institutions (e.g., individualistic cultural values) are critical drivers of innovation. Most studies, however, consider the independent role of either formal or informal institutions. We contribute to this gap in the literature by exploring the potential interaction between informal institutions, measured by Hofstede's individualism-collectivism index, and formal institutions, measured by the Economic Freedom of the World index (i.e., pro-market institutions). Using cross-sectional data for a diverse sample of 84 countries, we find that both individualism and pro-market institutions are positively associated with innovation. However, the extent to which pro-market institutions promote innovation depends largely on how individualistic a country is and vice versa. For example, more individualistic countries tend to be more innovative, but even the most individualistic countries have below-average levels of innovation when their formal institutional environment lacks market support. At the same time, our findings suggest that the most innovative countries tend to have both strong pro-market institutions and individualistic cultural values.

Keywords: Culture; Economic Freedom; Individualism; Collectivism; Informal Institutions; Innovation; Pro-Market Institutions

Introduction

Innovation is increasingly viewed by policymakers, scholars, and practitioners as essential to sustaining the economic competitiveness and prosperity of nations (Acs et al., 2013; Colombelli et al., 2016; Wong et al., 2005). Previous research suggests that culture (i.e., informal institutions) is an important determinant of innovative activity. Most of this literature is focused on the role of individualistic cultural values, which emphasize individual freedom and recognize personal achievement (Hofstede, 1980), in fostering innovation (Bennett & Nikolaev, 2020; Rinne et al., 2012; Shane, 1992, 1993; Taylor & Wilson, 2012). A related body of literature suggests that pro-market institutions, which reduce transactions costs and uncertainty of market interactions and shape the relative rewards from productive and unproductive activities in the economy (Baumol, 1990; North, 1994), are also critical for innovative activity (Bennett & Nikolaev, 2019; Bjørnskov & Foss, 2013, 2012; Zhu & Zhu, 2017). While the national systems of innovation (NSI) framework suggests that the innovative performance of an economy depends on the interactions between formal and informal institutions (Acs, Audretsch, Lehmann, & Licht, 2017), previous research has largely focused on the role of either informal or formal institutions independently, leading to an incomplete understanding of the impact of institutions on innovation (Bruton et al., 2010). As Eesley et al. (2018, p. 393) note, "there is a scarcity of empirical research that explicitly examines the joint or interactive influence of formal versus informal institutions."

We contribute to this gap in the literature by examining the joint influence of pro-market institutions (formal institutions) and individualistic cultural values (informal institutions) on country-level innovation. We argue that, consistent with previous studies, both types of institutions are important determinants of innovation, but their impact depends on each other. In

other words, we argue that the positive effect of pro-market institutions on national innovation depends, to a great extent, on the level of individualistic cultural values in a country. Similarly, the effect of individualism on national innovation is conditional on the extent to which economic institutions support freedom of market exchange. In doing so, we contribute to the growing multi-disciplinary literature seeking to understand how formal and informal institutions jointly affect economic development (Alesina & Giuliano, 2015).

We analyze the joint effect of individualistic cultural values and pro-market institutions on innovation using cross-sectional data from a diverse sample of 84 countries. We use Hofstede's (1980) individualism-collectivism (I-C) cultural value dimension as our measure of informal institutions and the Economic Freedom of the World (EFW) index (Gwartney et al., 2018) as our measure of pro-market institutions. To measure innovation, we utilize the output innovation sub-index from the Global Innovation Index (GII) (Dutta et al., 2018). Controlling for a large number of confounding variables, our results suggest that both individualism and pro-market institutions are positively and significantly associated with innovation. However, these effects are contingent on each other—the effect of individualism on innovation is stronger in countries with more pro-market institutions, and the effect of pro-market institutions on innovation becomes stronger in countries with that are more individualistic. For example, more individualistic countries tend to be more innovative, but even the most individualistic countries have below-average levels of innovation when their formal institutional environment lacks market support. At the same time, our findings suggest that the most innovative countries tend to have both strong pro-market institutions and individualistic cultural values.

We further contribute to the literature by decomposing the GII innovation output index to explore the relationship between individualism, pro-market institutions, and a variety of

innovation measures. We also decompose the EFW index into its five main areas to explore the potential heterogeneous effects of pro-market institutions on innovation. Additionally, we explore the effects of individualism and pro-market institutions on different levels of innovation using quantile regression.

Literature Review & Theoretical Considerations

Institutions are defined as "the humanly devised constraints that structure political, economic, and social interactions (North, 1991, p. 97)." A society's institutions consist of both informal (i.e., cultural values, beliefs, and norms) and formal (e.g., economic, legal, and political) rules. Institutions "create order and reduce uncertainty in exchange," thereby lowering transactions costs and determining the incentive structure faced by agents in society (North, 1994). In this way, institutions influence the relative costs and benefits of entrepreneurial and innovative activities (Baumol, 1990). As such, institutions serve as the rules of the game governing entrepreneurial activity (North, 1990; Williamson, 2000) and may act in both a constraining and enabling capacity (Bennett, 2019a; Bruton & Ahlstrom, 2003; Davidsson, 2015).

Bjornskov and Foss (2016, p. 294) describe institutions as the "antecedents of the incidence and nature" of entrepreneurship and innovation. Indeed, a large body of empirical research suggests that institutions are important determinants of entrepreneurial and innovative activity; however, most of this work considers either the effect of formal or informal institutions in isolation (Eesley et al., 2018).[1] We address this important gap in the literature by examining not

[1] For exceptions, see: (1) Li and Zahra (2012), who find that venture capital activity is higher in countries with better governance institutions, as measured by the World Governance Index, but the effect is weaker in more uncertainty avoiding and collectivistic societies; and (2) Lehmann and Seitz (2017), who find that personal freedom, as proxied by the Gay Travel Index, is positively associated with innovation (i.e., per capita patents and trademarks), while controlling for measures of social capital and trust in some specifications.

only how formal and informal institutions impact national innovation independently of each other, but also, and more importantly, their joint effect on various innovative outputs (van Waarden, 2001).[2] More specifically, we pose the following research question: *To what extent is the effect of pro-market institutions (i.e., formal institutions) on innovation dependent on individualistic cultural values (i.e., informal institutions), and vice versa?*

Pro-market institutions & innovation

With respect to formal institutions, there is a large body of evidence that pro-market institutions – the laws, policies, and regulations that support market transactions and limit government intervention in the economy (Cuervo-Cazurra et al., 2019) – are positively associated with entrepreneurial and innovative activity. Many of these studies have used a multi-dimensional measure of economic freedom, a philosophically consistent concept based on the principles of "personal choice, voluntary exchange, freedom to compete, and protection of person and property," (Gwartney & Lawson, 2003, p. 406) as a proxy for pro-market institutions. Pro-market institutions provide entrepreneurs, innovators, and their investors with confidence that their investments of time, talent, and resources will be protected from "aggressors seeking to use violence, coercion, and fraud to seize things that do not belong to them (Gwartney & Lawson, 2003, p. 406)." This, in turn, reduces institutional uncertainty (Bylund & McCaffrey, 2017) and provides a powerful market incentive for productive entrepreneurial and innovative activity (Baumol, 1990).

[2] According to Coleman's (1990) "bathtub" model, macro-level factors such as formal institutions and culture create constraints on individual-level behavior. In turn, individuals make choices under those constraints, and individual-level actions accumulate at the macro-level. For example, higher levels of regulation at the macro-level can create constraints that prevent individuals from taking advantage of business opportunities (Boudreaux et al., 2019). In turn, fewer people will engage in entrepreneurial action, leading to overall lower levels of new start-ups at the macro-level. In this paper, we are interested in exploring macro-macro level linkages.

Entrepreneurs and innovators embedded in societies with strong pro-market institutions face lower transaction costs of "searching for, combining, adapting, and fitting heterogeneous resources in the pursuit of profit under uncertainty (Bjørnskov & Foss, 2012, p. 248)." Additionally, they face fewer institutional constraints on their ability to utilize their time, talents, and resources to recognize and capitalize on unexploited opportunities that they perceive may satisfy a market need (Bennett, 2019b), thereby encouraging a competitive environment that incentivizes entrepreneurship and innovation (Zhu & Zhu, 2017). In other words, countries with stronger pro-market institutions enable natural and spontaneous social orders (Hayek, 1988) that provide individuals with the freedom to engage in creative activity and pursue enterprising and innovative activities that have the potential to result in disruptive products, services, and processes that benefit society (Schumpeter, 1942; Von Mises, 1990).

Indeed, numerous cross-country studies have found a strong, positive correlation between economic freedom and various measures of entrepreneurial and innovative activity, including, e.g., self-employment (Gohmann, 2012; Nyström, 2008), opportunity-motivated entrepreneurship (Angulo-Guerrero et al., 2017; Bjørnskov & Foss, 2008; Boudreaux et al., 2019; McMullen et al., 2008; Nikolaev et al., 2018), formal entrepreneurship (Dau & Cuervo-Cazurra, 2014; Saunoris & Sajny, 2017), firm patents (Zhu & Zhu, 2017) and total factor productivity (Bjørnskov & Foss, 2012). Similarly, there is a growing body of evidence that subnational economic freedom is associated with entrepreneurial activity across U.S. states (Gohmann et al., 2008; Hall et al., 2013; Kreft & Sobel, 2005; Powell & Weber, 2013; Sobel, 2008) and cities (Bennett, 2019b, 2020; Bologna, 2014). While the preponderance of evidence from these studies, which use a variety of measures, methods, and samples, support the theory that pro-market institutions enable productive entrepreneurial activity, our focus is on a of

country-level innovation, which we conceptualize as a discovery-based process (Shane & Venkataraman, 2000) that leads to a broad set of incremental and radical innovative outputs (e.g., creative goods, intangible assets, online creativity, and knowledge creation, diffusion, and implementation), motivating the following hypothesis:

H1: Countries with stronger pro-market institutions are more innovative.

Individualism & innovation

With respect to informal institutions, the multifaceted value system of individualism-collectivism, which has been identified as the main dimension of cultural variation across societies (Heine, 2016; Thornhill & Fincher, 2014; Triandis, 1995), is a particularly salient cultural feature because, as Autio (2013, p. 337) highlights, entrepreneurial and innovative behavior is fundamentally an individual-level behavior that involves ”proactiveness, competitive orientation, innovativeness, and risk-taking.” According to Hofstede (1991, p. 51), individualistic societies are those “in which the ties between individuals are loose: everyone is expected to look after himself or herself and his or her immediate family.” Meanwhile, collectivistic societies are those “in which people from birth onwards are integrated into strong, cohesive in-groups, which throughout people’s lifetime continue to protect them in exchange for unquestioning loyalty.” As a such, individualistic societies tend to value individual freedom, opportunity, personal achievement, advancements, and recognition, while collectivistic cultures place a higher value on harmony, cooperation, and relations with superiors (Hofstede, 1980).

Because entrepreneurs often take substantial personal risks associated with market entry and innovation (Shane et al., 1995), they also expect to be rewarded individually if they succeed (Hayton et al., 2002).. Personal rewards and recognition of achievements are more culturally acceptable in individualistic societies (Shane, 1992).. Because individualistic cultures promote

self-expression and independent thinking, people are more likely to develop positive attitudes towards the creation and adoption of new innovations (Alesina & Giuliano, 2010). In addition, innovation requires individual characteristics such as creativity, risk-taking, intellectual autonomy, ambition, mastery, uncertainty tolerance, and breaking from traditional ways of doing things (Rogers, 1995). Many of these characteristics are explicitly associated with individualistic cultural values (Hofstede, 1980; Schwartz, 1994; Shane, 1992). Individualistic cultural beliefs also better facilitate anonymous exchange than collectivist cultural beliefs, leading to a larger market for goods and services, a greater division of labor and specialization (Smith, 1776), and hence, more productivity-enhancing innovations (Greif, 1994).

Numerous studies provide empirical support that societies with more individualistic cultural values exhibit higher levels of entrepreneurship (del Junco & Brás-dos-Santos, 2009; Hayton et al., 2002; Nikolaev et al., 2018; Steensma et al., 2000; Stephan & Uhlaner, 2010) and innovation (Bennett & Nikolaev, 2020; Rinne et al., 2012; Shane, 1992, 1993; Taylor & Wilson, 2012). We, therefore, propose the following hypothesis:

H2: *Countries with more individualistic cultural values are more innovative.*

Pro-market institutions, individualism, and innovation

Previous research suggests that both pro-market institutions and individualism cultural values are important enablers of innovative activity. While insightful, these studies have largely emerged as two distinct strands of literature – we are unaware of any study that simultaneously considers the effect of both pro-market institutions and individualistic cultural values, much less their potential interdependence. Yet, institutional scholars largely agree that there is an important complementarity between informal and formal institutions (Alesina & Giuliano, 2015; Aoki, 2001; Platteau, 2000). North (2005, pp. 49–50), for instance, argues that informal institutions

"embody the internal representation of the human landscape" and formal institutions provide the "structure that humans impose on the landscape" such that the former serve as the internal representation and the latter the external manifestation of that representation. Similarly, Li and Zahra (2012, p. 98) state that "formal institutions are embedded in different cultural settings." Mokyr (2017, p. 10) adds that formal and informal institutions "coevolve and provide stability to the economic system when aligned."

It is clear, therefore, that there is an interdependence between formal and informal institutions, and economic performance depends on both (Alesina & Giuliano, 2015). According to North (2005, p. 79), "the key to improved performance is some combination of formal rules and informal constraints and the task we face is to achieve an understanding of exactly what combination will produce the desired results." Mokyr (2017, p. 11) adds that good institutions "interact with a culture that enforces them, whereas bad institutions may reinforce a culture that perpetuates them." In the context of innovation, the national systems of innovation (NSI) literature suggests that "knowledge is produced and accumulates through an interactive and cumulative process of innovation that is embedded in a national institutional context," which consists of both formal and informal institutions (Acs et al., 2017, p. 1002). Together, formal and informal institutions influence the development, diffusion, and use of innovation that powers the engine of economic performance (Lundvall, 2010; Nelson, 1993).

As such, innovative behavior is influenced by the fit between a nation's formal institutional environment and its citizen's cultural values (van Waarden, 2001). We contend that individualistic cultural values and pro-market institutions are complementary in shaping an environment conducive to innovation. The structure of a market economy, as represented by the degree to which its formal institutions support market activity, therefore reflects the beliefs and

values of those in a position to shape the rules of the game (North, 2005). Using game theory, Grief (1994) shows that individualistic cultures foster the development of formal enforcement institutions that support anonymous market exchange.

According to Hayek (1948, p. 21), two conditions must be satisfied for a workable individualistic order that encourages innovation. First, the expected remunerations that an individual can expect to receive from the "different uses of his abilities and resources correspond to the relative utility of the result of his effort to others." Second, these "remunerations correspond to the objective results of his efforts rather than to their subjective merits." In other words, an individualistic society that provides rewards on the basis of value created for others rather than on the basis of the goodness of intentions will encourage individuals to utilize their unique skills and knowledge to pursue innovative activity. Hayek argues that these conditions are satisfied when embodied in a system of private property rights and long-run economic policies supportive of a competitive market that provides individuals the freedom to choose how to utilize their time, talents, and resources. Individualistic societies rely on market-supporting economic institutions to enforce contracts, minimize transactions costs, expand market opportunities, and provide economic incentives for entrepreneurial and innovative activity (Li & Zahra, 2012). They are also reluctant to accept and support burdensome regulation of the economy (Holmes et al., 2013).

The above logic suggests that pro-market institutions and individualism are complementary to encouraging innovation. Indeed, the top decile of the most innovative countries in our sample (i.e., Finland, Germany, Ireland, Luxembourg, Sweden, Switzerland, United Kingdom, and the United States) all have relatively high levels of both individualistic cultural values and economic freedom. Meanwhile, the bottom decile of countries (i.e., Bangladesh, Burkino Faso, El

Salvador, Honduras, Malawi, Mozambique, Nepal, Nigeria, and Zambia) all have relatively low levels of both individualism and economic freedom. We, therefore, propose the following two hypotheses:

H3a: *The effect of pro-market institutions on innovation is higher in countries with more individualistic cultural values.*

H3b: *The effect of individualistic cultural values on innovation is higher in countries with stronger pro-market institutions.*

Data & Methods

In this section, we describe the main variables used in our analysis. Table 1 provides descriptions, sources, and summary statistics for all variables.

Innovation outputs

We follow Bennett and Nikolaev (2020) in using the output score from the Global Innovation Index (GII) as our measure of innovation (Dutta et al., 2018). The GII was originally developed in 2007 to better capture the richness of innovation in society than traditional singular measures of innovation used by researchers (e.g., level of R&D expenditures; the number of research articles published; patents filed/granted). The GII has been updated annually since its inception, and it attempts to account for the innovative contributions of a wide spectrum of innovative actors such as scientists, manufacturing and service sector firms, and public entities. GII thus captures a large variety of incremental and radical innovations.

The innovative outputs sub-index is comprised of two main pillars that capture various outputs of innovative activities within an economy. First is the *knowledge and technology outputs* pillar that is comprised of three sub-pillars: knowledge creation, knowledge impact, and knowledge diffusion. Second is the *creative outputs* sub-pillar that is composed of three sub-

pillars: intangible assets; goods & services, and online creativity. Each sub-pillar is derived from multiple innovation indicators, compiled using data from a large number of international public bodies and private organizations. In total, 27 individual indicators were used to create the innovation outputs index. Most of the indicators are normalized by either population or GDP as a means to enable cross-country comparability. Because the GII is comprised of a large number of indicators from various sources, data is not available for all indicators for all countries. The latest GII provides data for 126 economies, covering more than 90.8 percent of the global population and 96.3 percent of global economic output. Table A1 in the Appendix describes the composition of the innovation outputs index.

Individualistic cultural values

Following a large literature in cross-cultural entrepreneurship and innovation, we use the I-C index created by Hofstede (1980) as our measure of cultural values. It is available for more than 100 countries and ranges from 0 (most collectivistic) to 100 (most individualistic). We use the most recent version of the international values survey module, which consists of twenty-four values questions rated on a scale of 1 (most important) to 5 (least important). The data were originally collected through a global survey of 100,000 IBM employees in 1967 and 1973. Subsequent waves of the survey and replication studies have included, in addition to IBM employees, a number of additional sub-groups, including airline pilots, students, civil service managers, and "up-market" consumers and elites (Hofstede, 2010).

Economic freedom

Following a growing body of entrepreneurship (e.g., Bennett & Nikolaev, 2019) and international business studies (e.g., Cuervo-Cazurra et al., 2019), we utilize the Fraser Institute's EFW index as our measure of pro-market institutions. EFW incorporates 42 distinct variables

derived from publicly available sources (e.g., World Bank, International Monetary Fund, and the Global Competitiveness Report). The original data are transformed to a zero to 10 scale, with higher values reflecting more economic freedom. The components are used to derive both a summary rating for each country and ratings in five areas: the size of government; legal system and property rights; sound money; international trade freedom; and regulatory freedom (Gwartney et al., 2018). Countries that achieve a high economic freedom score provide secure protection of privately owned property, even-handed enforcement of contracts, and a stable monetary environment. They also maintain low tax rates, refrain from creating barriers that restrict domestic and international exchange, and rely primarily on markets (as opposed to the political process) to allocate resources (Bennett et al., 2017a).

Control variables

We control for a large set of country-level characteristics that may influence cross-national differences in innovation, cultural values, and/or formal institutions (e.g., Nikolaev et al., 2018). First, because there is considerable evidence that the origins of a country's legal system and regulatory processes may influence a wide range of developmental outcomes such as innovation and institutional development (La Porta et al., 2008), we include a set of legal origins dummies (French, UK, Socialist, and Scandinavian, omitting German as a baseline for comparison) (La Porta et al., 1999). Next, geographic conditions may influence access to resources and global markets, constraining a country's capacity to engage in innovative activity. A substantial literature, for example, suggests that poorer and less innovative countries tend to be concentrated around the tropics. This could be partly explained by two ecological impediments—low agricultural productivity due to soil erosion as a result of heavy rainfall and the prevalence of infectious diseases, which is strongly correlated with animal and human mortality and morbidity

(Bennett & Nikolaev, 2020; Nikolaev & Salahodjaev, 2017; Sachs, 2003). We, therefore, control for two geographic factors—latitude and share of the population living in the tropics (Bennett et al., 2017b; Easterly & Levine, 2003; Sachs et al., 2001).

We also control for the shares of a nation's population belonging to the major world religions—Catholic, Muslim, and Protestant. Religious values define how people handle in-group interactions, work, and contract enforcement. Thus, religion is related to both cultural values and formal institutions, and, in turn, may influence innovative activity (Barro & McCleary, 2003). In his influential work, for example, Weber (1988) argued that capitalism, which is characterized by strong pro-market institutions, evolved out of the Protestant ethic, which encouraged people to dedicate themselves to work in the secular world by starting their own ventures, engaging in free trade, and acquiring wealth.

Additionally, we control for income inequality using the Gini coefficient, which provides a measure of the distribution of income across a population (Solt, 2016), and ethnolinguistic fractionalization, which shows the probability that two people selected at random from a country's population belong to the same ethnic group (Alesina et al., 2003). Both inequality and ethnolinguistic fractionalization have been previously linked to underdevelopment (Alesina & Ferrara, 2005; Easterly, 2007). Tselios (2011), however, suggests that higher inequality may encourage innovation. Higher levels of individualism and pro-market institutions have also been correlated with lower levels of income inequality (Bennett & Nikolaev, 2016; Nikolaev et al., 2017).

Finally, we control for a set of regional fixed effects (Africa, Asia, Europe, Oceania, and South America, omitting North America as baseline region for comparison) to account for the

potential impact of unobserved factors that are common across the countries of a region that may influence innovative activity.

Methods

We use ordinary least squares (OLS) regression (Wooldridge, 2010) to estimate the effects of culture and pro-market institutions on innovation using the following equation, where $Innov_i$, $Culture_i$, and $Institutions_i$ represent innovation outputs, individualism, and economic freedom in country i; X_i denotes a matrix of control variables, and ϵ_i is an idiosyncratic error term. For statistical inference, we cluster standard errors at the country such that they are robust to heteroskedasticity (White, 1980). To test hypotheses H1 and H2, we assess parameters α_1 and α_2, which capture the marginal effects of EFW and individualism, respectively. We anticipate both α_1 and α_2 to be positive.

$$Innov_i = \alpha_0 + \alpha_1 EFW + \alpha_2 Individualism + \gamma X_i' + \nu_i$$

To assess H3a and H3b, which suggest that EFW and individualism are complementary institutions such that the effect of EFW [individualism] on innovation is increasing in the level of individualism [EFW], we assess the marginal effects of EFW and individualism from estimates of the below non-linear equation. The marginal effect of EFW on innovation is conditional on the level of individualism ($\frac{\partial Innov}{\partial EFW} = \beta_1 + \beta_3 Individualism$). Similarly, the marginal effect of individualism on innovation is conditional on the level of EFW ($\frac{\partial Innov}{\partial Individualism} = \beta_1 + \beta_3 EFW$). We anticipate that $\beta_3 > 0$.

$$Innov_i = \beta_0 + \beta_1 EFW_i + \beta_2 Individualism + \beta_3 EFW_i \times Individualism_i + \gamma X_i' + \epsilon_i$$

Our final sample consists of 84 countries. Appendix Table A2 provides a list of the countries in our sample as well as each country's innovation output, individualism, and EFW measures. We use the Stata 15 software for all statistical analyses.

Empirical Results

Our theory suggests that both individualistic cultural values and pro-market institutions will have a positive effect on innovative outputs. However, and more importantly, it also suggests that the extent to which pro-market institutions affect national innovation levels will largely depend on how individualistic a country is and vice versa. Specifically, the positive effect of pro-market institutions on innovation will be much stronger in more individualistic societies, and, similarly, more individualistic societies will have greater levels of innovation when there is greater support for pro-market institutions. Below, we test the predictions of our theoretical developments.

Baseline results

We present estimates from our linear OLS regressions of innovation output on individualism and EFW in Table 2. Heteroskedastic-robust standard errors are given in parentheses and standardized coefficients in brackets. Model 1 is a parsimonious specification that does not include any control variables. Both individualism and EFW enter positively and are highly statistically significant. Together, they explain nearly 58 percent ($R^2 = 0.576$) of the variation in innovation among the countries in our sample. Subsequent models introduce additional variables to hold constant other potential determinants of innovation. We constrain the sample to a common set of countries throughout Table 2 so that the results are comparable across models because it has been demonstrated that cross-country empirical research results can be quite sensitive to the sample of countries used (Bennett & Nikolaev, 2017). We report the adjusted R^2 value so that we can assess the additional explanatory power of the supplementary regressors in each model.

Model 2 introduces a set of legal origins dummy variables, omitting German legal origins as the baseline for comparison. Model 3 introduces two measures of geography – latitude and the share of the population living in the tropics. Several measures of religion are added to model 4. Model 5 controls for income inequality and ethnolinguistic fractionalization. Finally, model 6 controls for regional fixed effects. Throughout Table 2, both individualism and EFW remain positively and highly significantly associated with innovation output, although the magnitude of the estimated effects is reduced when controlling for additional factors.

The independent and control variables in model 6, which we consider to be our baseline model, explain 70 percent of the variation in innovation output for our sample of countries. The estimates in this model suggest that unit increases in individualism and EFW are associated with 2.1 and 5.9 unit increases in the innovation output index. Economically, the magnitude of our two institutional variables on innovation are similar, as standard deviation increases in individualism and EFW are associated with 0.34 and 0.36 standard deviation increase in innovation outputs, respectively. Overall, the results from Table 2 strongly support both H1 and H2, suggesting that pro-market institutions and individualistic cultural values are both positive determinants of innovation. With the exception of the legal origins variables, none of the other controls are robustly associated with innovation.

[TABLE 2 HERE]

Results by innovation type

Next, we decompose the innovation output index into its two main pillars and six sub-pillars to examine if formal and informal institutions have differential effects by innovation type. We report linear model estimates of OLS regressions of innovation on individualism and EFW by innovation type in Table 3. Each row represents a different model using the measure of

innovation denoted as the DV. All models hold constant the baseline set of control variables (Table 2, model 6), but for space, we only report the results for individualism and EFW. Model 1 uses innovation outputs as the DV and is reproduced from Table 2 for ease of comparison. Model 2 uses the creative output pillar as the DV, while models 3-5 use its sub-pillars (i.e., intangible assets, creative goods & services, and online creativity). Model 6 uses the knowledge & technology output pillar as the DV, while models 7-9 use its sub-pillars (knowledge creation, knowledge impact, and knowledge diffusion). EFW is positively and highly significantly associated with both pillars, creative output and knowledge and technology output, as well as the following sub-pillars: creative goods & services, online creativity, knowledge impact, and knowledge diffusion. The standardized confident estimates, reported in brackets, range from 0.286 (knowledge & technology output) to 0.51 (creative goods & services) for these measures of innovation. EFW is also positively associated with intangible assets, but the standardized coefficient estimate of 0.213 is only significant at the 10 percent level. EFW is not, however, significantly associated with knowledge creation. Similarly, individualism is positively and significantly associated (at the 5 percent level or better) with the two pillars and 5 of the 6 sub-pillars (all but intangible assets). The standardized coefficient estimates for these measures of innovation range from 0.235 (creative output) to 1.184 (knowledge creation).

[TABLE 3 HERE]

Interaction model results

We present the results from the interaction model estimates in Table 4. For space, we only present the estimates for the two main effects (individualism and EFW) and the interaction effect, but all models include the set of baseline control variables and regional fixed effects. We are interested in the marginal effect of EFW [individualism], which is conditional on the level of

individualism [EFW]. We, therefore, perform a joint test of significance of the EFW [individualism] main effect and the interaction terms for statistical inference (Brambor et al., 2006), and report the results of this test as p(Economic Freedom) [p(individualism)].

The conditional marginal effect of individualism is significant at the 5 percent level or better in all but one of the models (intangible assets is the exception). Interestingly, the main effect term for individualism is negative in all of the models. As anticipated, the interaction between individualism and EFW enters positively in all but model 3 (intangible assets). That the main effect is negative and the interaction effect positive suggests that there may be a level of EFW for which the conditional marginal effect of individualism on innovation changes from negative to positive. We estimate this threshold from the conditional marginal effect of individualism and report it as MET(Individualism).[3]

In model 1, which uses our primary measure of innovation (innovation output) as the DV, MET(Individualism)=5.6, suggesting that the marginal effect of individualism is negative for countries with a EFW<5.6. Only two countries (Argentina and Mozambique) in our sample of 84 nations have an EFW score below this threshold. As such, the conditional marginal effect of individualism on innovation output is positive and increasing in the level of EFW for nearly our entire sample. Figure 1 shows the estimated conditional marginal effects of individualism on innovation output by EFW percentile, along with 95 percent confidence bands. The value of EFW at each percentile is given in brackets. As illustrated, the marginal effect of individualism is increasing in the level of EFW, but the marginal effect is not statistically significant at the 5 percent level in countries below the 30th percentile of EFW values. Countries around the

[3] Specifically, the marginal effect is given by: $\frac{\partial Innov}{\partial Individualism} = \beta_1 + \beta_3 EFW$. Setting the marginal effect equal to zero, we solve for the threshold level of EFW at which the marginal effect of individualism on innovation changes from negative ($\beta_1 < 0$) to positive ($\beta_3 > 0$). In other words, $EFW = -\frac{\beta_2}{\beta_3}$.

threshold value of EFW for which the marginal effect of individualism on innovation output is positive and statistically significant include India, Trinidad and Tobago, and Zambia. The marginal effect of individualism on innovation output increases from 1.4 at the 30th percentile of EFW to 3.0 at the 90th percentile. This suggests that the marginal effect of individualism on innovation output in the countries with the strongest pro-market institutions most economically is more than double that of those with the weakest. This provides strong support for H3b.

[TABLE 4 HERE]

The estimated threshold is 3.8 and 4.6 in models 2 (DV=creative output) and 4 (DV=creative goods & services), and the minimum EFW value in our sample is 4.8, suggesting that the marginal effect of individualism on these two measures of innovation is positive and increasing in the level of EFW for our entire sample. In model 9 (DV=knowledge diffusion), the threshold is 5.4, and only Mozambique has an EFW score below this level, suggesting that the marginal effect of individualism on knowledge diffusion is positive and increasing in the level of EFW for nearly our entire sample. The threshold ranges from 6.0 to 6.2 in models 5-8. There are 6 countries in our sample with an EFW<6 and another 4 countries with EFW scores between 6.0 and 6.1, suggesting that the marginal effect of individualism on these measures of innovation is positive for most of the countries in our sample, but negative for the around 10 percent of the sample of countries with the weakest pro-market institutions. Figures depicting the marginal effects of individualism on the two innovation pillars by EFW percentile are presented in Appendix B.

[FIGURE 1]

Next, we examine the conditional marginal effect of EFW on innovation output. The main effect and interaction effect terms both enter positively in model 1 of Table 4, and are jointly

significant at the 1 percent level. This suggests that the marginal effect of EFW on innovation output is positive for our sample of countries, irrespective of the level of individualism. Figure 2 shows the estimated conditional marginal effects of EFW on innovation output by individualism percentile, along with 95 percent confidence bands. The value of individualism at each percentile is given in brackets. The figure indicates that the marginal effect of EFW, which is statistically significant at the 5 percent level above the 10th percentile of individualism values, is increasing in the level of individualism. Countries around the threshold of individualism for which the marginal effect of EFW is significant include Albania, Bangladesh, China, El Salvador, Honduras, Singapore South Korea, Thailand, and Vietnam. Among these countries with relatively low levels of individualistic cultural values, the mean EFW value is 7.1, and the mean innovation output value is 30.8. The mean EFW and innovation output values for this sub-sample of countries with relatively low levels of individualism are approximately equivalent to the means of these variables for the entire country sample. The estimated conditional marginal effect of EFW on innovation output increases from 4.2 at the 20th percentile of individualism to 11.2 at the 90th percentile, suggesting that the marginal effect of EFW on innovation output in the most individualistic countries in our sample is more than 2.5 times that of the least individualistic nations. This provides strong support for H3a.

We also perform analogous analyses of the conditional marginal effects of EFW on innovation for the other two innovation pillars and six innovation sub-pillars. These results are presented in models 2-7 of Table 4. The results using creative output, creative goods & services, online creativity, and knowledge diffusion as the DV are qualitatively similar to our primary results that use innovation output as the DV. That is, the main effect and interaction effects terms are both positive and jointly significant at the 5 percent level or better, suggesting that the

marginal effect of EFW on innovation is positive for our sample of countries and increasing in the level of individualism. However, the main effect term enters negatively when using knowledge & technology output, knowledge creation, and knowledge impact as the DV. These latter results suggest that there may be a level of individualism for which the marginal effect of EFW on these measures of innovation is negative. The estimated individualism threshold is 0.8 and 0.6 in models 6 (knowledge & technology output) and 8 (knowledge impact), respectively. Within our sample, only Ecuador and Guatemala have individualism values below 0.8, suggesting that the marginal effect of EFW on these two measures of knowledge innovation is positive for nearly our entire sample. The estimated threshold is 2.6 in model 7 (knowledge creation). Thirty countries in our sample have an individualism value below this threshold, suggest that the marginal effect of EFW on knowledge creation is negative for more than one-third of our sample. Countries with individualism values near this threshold include Malaysia, Portugal, and Slovenia. Meanwhile, the conditional marginal effect of EFW on intangible assets is not statistically significant. Figures depicting the marginal effects of EFW on the two innovation pillars by individualism percentile are presented in Appendix B.

[FIGURE 2]

Additional results

We perform a number of additional analyses that we briefly discuss here. First, we control for several additional variables that potentially matter for innovation. This includes the level of economic development (Anokhin & Wincent, 2012), the historical disease prevalence (Bennett & Nikolaev, 2020), and a measure of civic and political freedoms (Lehmann & Seitz, 2017). Controlling for these additional factors results in a small reduction in sample size and the magnitude of the effect sizes for our independent variables of interest, but it does not

qualitatively affect our main conclusions. These results are provided in Appendix Table A3. Note that we re-estimate the baseline linear and non-linear models using the country sample for which data is available for the additional three control variables and report these results in models 1 and 5. Subsequent models introduce the additional control variables iteratively.

Next, we re-estimate our baseline linear model using quantile regression (Chamberlain, 1994). Our baseline OLS regressions provide estimates of the effects of individualism and EFW on the mean value of innovation output, but it is possible that culture and institutions exert differential effects across the distribution of innovation. Quantile regression allows us to estimate the effects on specific innovation quantiles. Using the Stata program *sqreg*, we estimate the effects of individualism and EFW on the following innovation percentiles using simultaneous quantile regression, which produces bootstrapped standard errors that contain between-quantile blocks in the variance-covariance matrix: 5^{th}, 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th}, and 95^{th}.[4] For example, the median (i.e., 50^{th} percentile) regression of innovation output on individualism and EFW specifies the changes in innovation output as a function of individualism, EFW, and the baseline set of control variables and regional fixed effects. Our results suggest the effect of EFW on innovation in the 5^{th}, $10^{th,}$ and 25^{th} percentile regressions is positive but not statistically significant. Meanwhile, the magnitude of the coefficients are much larger and enter significantly in the higher quantiles. This seems to suggest that the effects of EFW on innovation are larger for higher levels of innovation; however, pairwise equality of coefficient tests suggest that the estimates across quantiles are not significantly different from one another. Individualism enters positively and is statistically significant in all 7 quantile regressions, and equality of coefficient

[4] We use 100 bootstrap replications to obtain the variance-covariance matrix and set the random number generating seed at 5.

tests similarly suggest that the individualism coefficients are not significantly different from one another across regressions. We present these results in Appendix Table A4.

Finally, previous research suggests that the various areas of economic freedom may exert differential impacts on entrepreneurship (Angulo-Guerrero et al., 2017; Bjørnskov & Foss, 2008; McMullen et al., 2008; Nyström, 2008). Similarly, the different areas of economic freedom may exert differential impacts on innovation. We, therefore, decompose the EFW index into its five major areas and re-estimate the effects of economic freedom on innovation output using each of the five areas. In the linear specification, the legal institutions and property rights, international trade freedom, and regulatory freedom areas enter as positive and significant correlates of innovation output. The government size and sound money areas are not statistically significant at conventionally accepted levels. In the interaction model, the marginal effects of four of the five areas (government size is the exception) are statistically significant at the 5 percent level or better, suggesting that the positive effect of economic freedom for these areas on innovation is increasing in the level of individualism for our sample of countries. Individualism enters positively and is statistically significant in all of the specifications. These results are presented in Appendix Table A5.

Discussion

A large number of studies have identified individualistic cultural values and pro-market institutions as critical drivers of entrepreneurship and innovation. However, most of these comparative studies examine the effect of these factors independently of each other (Bruton et al., 2010). Yet, the NSI literature suggests that innovation is a function of the institutional context that includes both formal and informal institutions. Most analyses also focus on a singular measure of innovation (e.g., R&D expenditures, patents, scientific articles), potentially

omitting important sources of innovation that are also important for economic advancement. We contribute to these important gaps in the literature in several ways. First, we utilize a broad measure of innovation output—the innovation output sub-index from the GII, which accounts for a large variety of incremental and radical innovations from numerous actors and better captures the richness of innovation in society than any singular measure.

Second, we consider the joint effects of both pro-market institutions (i.e., formal institutions) and individualistic cultural values (i.e., informal institutions) on innovation. Our results from OLS regressions for a cross-sectional sample of 84 countries suggest that, controlling for a large number of potential confounding variables and regional fixed effects, both individualism and pro-market institutions are positively and significantly associated with innovation output.

Lastly, we consider the interdependence formal and informal institutions for innovation (Eesley et al., 2018). Our results from regressions that include an interaction term between individualism and pro-market institutions suggest that the effect of individualism on innovation is higher for countries with stronger pro-market institutions. Similarly, the effect of pro-market institutions on innovation is higher for countries with higher levels of individualism.

Policy Implications

Our study suggests that both individualistic cultural values and pro-market institutions are important enablers of innovation. Similar to results obtained by Li and Zahra (2012), who find that individualism and formal governance institutions are complementary in stimulating venture capital investments, our results indicate that formal and informal institutions complement one another in facilitating high levels of innovation. Figure 3 reveals this complementary relationship, plotting the predicted level of innovation output (color scale) by level of

individualism (x-axis) and EFW (y-axis), holding the set of baseline controls and regional effects constant.[5]

[FIGURE 3]

This contour graph suggests that innovation is predicted to be highest in countries with high levels of both individualism and EFW, an indication of the importance of having complementary informal and formal institutions that provide individuals with the freedom and economic incentives to engage in innovative activity. Indeed, the top decile of innovative countries in our sample all have high levels of both individualism and EFW. The graph also suggests that innovation is predicted to be very low in countries with low levels of EFW and individualism. The least innovative nations in our sample all have relatively low levels of individualism and EFW.

Interestingly, figure 3 also suggests that countries with high levels of EFW but low levels of individualism can still achieve moderately high levels of innovation, but the same is not true of countries with high levels of individualism but low levels of EFW. Hong Kong and Singapore, for instance, are the two most economically free countries in the world, and both have relatively low levels of individualism. They both are also in the upper quartile of the most innovative countries in our sample. Meanwhile, South Africa has an individualism rating in the top quintile of our sample, but it ranks among the bottom quintile on EFW. Its innovation output score is around the 35th percentile of our sample. Argentina and Morocco also have relatively high levels of individualism (both rank in the top 35 percent of our sample), but Argentina is the least

[5] We provide analogous contour graphs for the two innovation output pillars in Appendix C.

economically free country in our sample, and Morocco is in the bottom 15 percent. Both countries rank in the bottom two-thirds of our sample in terms of innovation output.

Most countries in our sample, however, have intermediate levels of both individualism and EFW, and the graph suggests that innovation is predicted to be increasing as the levels of both individualism and EFW rise. The median values of individualism and EFW in our sample are 3.4 and 7.2. Countries such as Dominican Republican and the Philippines have individualism and EFW values very close to the sample medians, and their innovation output scores are in line with the predicted values –both rank around the 35 percentile. Interestingly, Bulgaria has an individualism score very close to the median, but an EFW score around the 60th percentile. Meanwhile, Jamaica has an EFW score very close to the median, but an individualism score around the 60th percentile. Bulgaria's innovation score is around the 60th percentile, while Jamaica is around the 25th percentile.

While there are certainly other factors that contribute to national innovation, the anecdotal comparison between Bulgaria and Jamaica suggests that incremental increases in pro-market institutions may be more valuable for encouraging innovation than incremental increases in individualism for countries with intermediate levels of both. This seems to also be supported by the above discussion that countries with relatively high levels of EFW and low levels of individualism are more innovative than countries for which the opposite is true. This insight is valuable for policymakers seeking to encourage innovation, as formal institutions are more malleable through the political process than informal institutions (Roland, 2004). As North (2005, p. 50) describes, "While formal institutions can be changed by fiat, informal institutions evolve in ways that are still far from completely understood and therefore are not typically amenable to deliberate human manipulation."

Therefore, policymakers are better positioned to implement pro-market institutional reforms than to influence culture, which is "one of the most important and stable contexts for economic activity in a society (Li & Zahra, 2012, p. 108)." Doing so will help establish the formal institutional framework that supports and encourages innovative and entrepreneurial activity (Audretsch & Belitski, 2017); however, policymakers should adopt market-based rules and policies that align with the cultural values, norms, and beliefs of their population, rather than simply importing institutional blueprints from other successful countries (Boettke et al., 2008; Rodrik, 2008).

Limitations & future research directions

As with all empirical studies, ours has several limitations that can be addressed in future research. First, although our sample represents countries at various stages of development located in every major region of the world, it is constrained by data availability. For example, Greene (1997) recommends using N>50+8 x m (m is the number of IVs) per independent variable to obtain sufficient statistical power. Unfortunately, in the context of our study, we are limited by the number of countries for which data is available (e.g., there are simply not enough countries in the world to satisfy this condition). As additional data become available for a larger number of countries, it would be worthwhile to re-examine the relationship between culture, institutions, and innovation.

Second, our analysis is based on cross-sectional data, limiting our ability to draw causal inferences or to analyze the innovation effects of cultural and institutional change. Thus, our results should be interpreted as suggestive rather than causal. Future research that uses panel data could improve our understanding of these processes and their importance for innovation and economic development more generally (Alesina & Giuliano, 2015). Two challenges to doing so

are immediately evident. First is devising metrics that capture the richness of innovation in society that are comparable across both countries and time. Although the GII index that we use is available annually, its methodology and variable coverage have changed over time. Second, there is some evidence that cultural values along the I-C cleavage have changed in recent decades for many countries (Taras et al., 2012). However, Hofstede's (1980) cultural value dimensions were designed to capture relative differences across countries, and much of the measured cultural shift in recent decades represents absolute rather than relative changes such that differences between country pairs have remained relatively stable over time (Beugelsdijk et al., 2015).

Next, we follow numerous entrepreneurship and innovation studies in using Hofstede's individualism index to capture cultural variation across countries. However, the relationship between individualism and innovation is likely more nuanced than what our conceptualization and measurement enable us to assess (Gorodnichenko & Roland, 2017; Stephan & Uhlaner, 2010). Shane (1995), for instance, suggests that individualism influences the type of innovation strategy and not necessarily the sheer volume of innovation activity. Taylor and Wilson (2012) argue that certain types of collectivism (e.g., patriotism and nationalism) can promote innovation at the national level while other forms of collectivism (e.g., familism and localism) can harm innovation rates as well as slow progress in science and technology. Others have suggested that the relationship between individualism and innovation may be curvilinear (Efrat, 2014; Morris et al., 1993) or depend on a country's level of development (Zhao et al., 2012). Still, others suggest using alternative cultural measures (Schwartz, 1994). Future research that examines some of these nuances could deepen our understanding of the relationship between culture, institutions, and innovation.

Additionally, our analysis points to the complementary role of formal and informal institutions for national innovation. This presents an opportunity for two research extensions. First, future research could examine their interaction in the context of firm-level innovation (Zhu & Zhu, 2017). In other words, while we focus on macro-macro linkages, it would be fruitful to examine the relationship between formal and informal institutions at the macro-level and individual-level behavior (Boudreaux et al., 2019). Second, there exists cultural (Tung, 2008; Vedula & Fitza, 2019), institutional (Arregle et al., 2013; Audretsch & Belitski, 2017; Bennett, 2020), and innovative heterogeneity (Fritsch & Wyrwich, 2018; González-Pernía et al., 2012) across regions within a country. Future research that explores a similar framework at the subnational level would shine additional light on the importance of the interdependent institutional environment for innovation.

References

Acs, Z. J., Audretsch, D. B., Lehmann, E. E., & Licht, G. (2017). National systems of innovation. *The Journal of Technology Transfer*, *42*(5), 997–1008. https://doi.org/10.1007/s10961-016-9481-8

Acs, Z. J., Audretsch, D., & Lehmann, E. E. (2013). The knowledge spillover theory of entrepreneurship. *Small Business Economics*, *41*, 757–774. http://dx.doi.org/10.1007/s11187-013-9505-9

Alesina, A., Devleeschauwer, A., Easterly, W., Kurlat, S., & Wacziarg, R. (2003). Fractionalization. *Journal of Economic Growth*, *8*, 155–194. https://doi.org/10.1023/A:1024471506938

Alesina, A., & Ferrara, E. L. (2005). Ethnic Diversity and Economic Performance. *Journal of Economic Literature*, *43*(3), 762–800. https://doi.org/10.1257/002205105774431243

Alesina, A., & Giuliano, P. (2010). The power of the family. *Journal of Economic Growth*, *15*(2), 93–125. https://doi.org/10.1007/s10887-010-9052-z

Alesina, A., & Giuliano, P. (2015). Culture and Institutions. *Journal of Economic Literature*, *53*, 898–944. https://doi.org/doi: 10.1257/jel.53.4.898

Angulo-Guerrero, M. J., Pérez-Moreno, S., & Abad-Guerrero, I. M. (2017). How economic freedom affects opportunity and necessity entrepreneurship in the OECD countries. *Journal of Business Research*, *73*, 30–37. https://doi.org/10.1016/j.jbusres.2016.11.017

Anokhin, S., & Wincent, J. (2012). Start-up rates and innovation: A cross-country examination. *Journal of International Business Studies*, *43*(1), 41–60. https://doi.org/10.1057/jibs.2011.47

Aoki, M. (2001). *Toward a Comparative Institutional Analysis*. MIT Press. https://mitpress.mit.edu/books/toward-comparative-institutional-analysis

Arregle, J.-L., Miller, T. L., Hitt, M. A., & Beamish, P. W. (2013). Do regions matter? An integrated institutional and semiglobalization perspective on the internationalization of MNEs. *Strategic Management Journal*, *34*(8), 910–934. https://doi.org/10.1002/smj.2051

Audretsch, D. B., & Belitski, M. (2017). Entrepreneurial ecosystems in cities: Establishing the framework conditions. *The Journal of Technology Transfer*, *42*(5), 1030–1051. https://doi.org/10.1007/s10961-016-9473-8

Autio, E., Pathak, S., & Wennberg, K. (2013). Consequences of cultural practices for entrepreneurial behaviors. *Journal of International Business Studies*, *44*(4), 334–362. https://doi.org/10.1057/jibs.2013.15

Barro, R. J., & McCleary, R. M. (2003). Religion and Economic Growth across Countries. *American Sociological Review*, *68*, 760–781. https://doi.org/10.2307/1519761

Baumol, W. J. (1990). Entrepreneurship: Productive, Unproductive, and Destructive. *Journal of Political Economy*, *98*, 893–921.

Bennett, D. L. (2019a). Infrastructure Investments and Entrepreneurial Dynamism in the U.S. *Journal of Business Venturing*, *34*(5), 28. https://doi.org/10.1016/j.jbusvent.2018.10.005

Bennett, D. L. (2019b). Local Economic Freedom and Creative Destruction in America. *Small Business Economics*. https://doi.org/10.1007/s11187-019-00222-0

Bennett, D. L. (2020). Local institutional heterogeneity & firm dynamism: Decomposing the metropolitan economic freedom index. *Small Business Economics*. https://doi.org/10.1007/s11187-020-00322-2

Bennett, D. L., Faria, H. J., Gwartney, J. D., & Morales, D. R. (2017a). Economic Institutions and Comparative Economic Development: A Post-Colonial Perspective. *World Development*, *96*, 503–519. https://doi.org/10.1016/j.worlddev.2017.03.032

Bennett, D. L., Faria, H. J., Gwartney, J. D., & Morales, D. R. (2017b). Economic Institutions and Comparative Economic Development: A Post-Colonial Perspective. *World Development*, *96*, 503–519. http://dx.doi.org/10.1016/j.worlddev.2017.03.032

Bennett, D. L., & Nikolaev, B. (2016). Factor endowments, the rule of law and structural inequality. *Journal of Institutional Economics*, *12*(04), 773–795. https://doi.org/10.1017/S1744137416000084

Bennett, D. L., & Nikolaev, B. (2017). On the ambiguous economic freedom–inequality relationship. *Empirical Economics*, *53*, 717–754. https://doi.org/10.1007/s00181-016-1131-3

Bennett, D. L., & Nikolaev, B. (2019). Economic Freedom, Public Policy, and Entrepreneurship. In J. Gwartney, R. Lawson, J. Hall, & R. Murphy (Eds.), *Economic Freedom of the World: 2019 Edition* (pp. 199–224). Fraser Institute.

Bennett, D. L., & Nikolaev, B. (2020). Historical Disease Prevalence, Cultural Values, and Global Innovation. *Entrepreneurship Theory and Practice*, *In Press*.

Beugelsdijk, S., Maseland, R., & Van Hoorn, A. (2015). Are Scores on Hofstede's Dimensions of National Culture Stable over Time? A Cohort Analysis. *Global Strategy Journal*, *5*(3), 223–240.

Bjørnskov, C., & Foss, N. (2013). How Strategic Entrepreneurship and The Institutional Context Drive Economic Growth. *Strategic Entrepreneurship Journal*, *7*(1), 50–69. https://doi.org/10.1002/sej.1148

Bjørnskov, C., & Foss, N. J. (2008). Economic freedom and entrepreneurial activity: Some cross-country evidence. *Public Choice*, *134*(3–4), 307–328. https://doi.org/10.1007/s11127-007-9229-y

Bjørnskov, C., & Foss, N. J. (2012). How Institutions of Liberty Promote Entrepreneurship and Growth. In *Economic Freedom of the World: 2012 Annual Report* (pp. 247–270). Fraser Institute.

Bjornskov, C., & Foss, N. J. (2016). Institutions, Entrepreneurship, and Economic Growth: What Do We Know and What Do We Still Need to Know? *Academy of Management Perspectives*, *30*, 292–315. https://doi.org/10.5465/amp.2015.0135

Boettke, P. J., Coyne, C. J., & Leeson, P. T. (2008). Institutional Stickiness and the New Development Economics. *The American Journal of Economics and Sociology*, *67*, 331–358.

Bologna, J. (2014). A Spatial Analysis of Entrepreneurship and Institutional Quality: Evidence from U.S. Metropolitan Areas. *Journal of Regional Analysis and Policy*, *44*(2), 109–131.

Boudreaux, C. J., Nikolaev, B., & Klein, P. (2019). Socio-cognitive traits and entrepreneurship: The moderating role of economic institutions. *Journal of Business Venturing*, *34*(1), 178–196. https://doi.org/10.1016/j.jbusvent.2018.08.003

Brambor, T., Clark, W. R., & Golder, M. (2006). Understanding Interaction Models: Improving Empirical Analyses. *Political Analysis*, *14*, 63–82. https://doi.org/10.1093/pan/mpi014

Bruton, G. D., & Ahlstrom, D. (2003). An institutional view of China's venture capital industry. *Journal of Business Venturing*, *18*(2), 233–259. https://doi.org/10.1016/S0883-9026(02)00079-4

Bruton, G. D., Ahlstrom, D., & Li, H. (2010). Institutional Theory and Entrepreneurship: Where Are We Now and Where Do We Need to Move in the Future? *Entrepreneurship Theory and Practice*, *34*(3), 421–440. https://doi.org/10.1111/j.1540-6520.2010.00390.x

Bylund, P. L., & McCaffrey, M. (2017). A theory of entrepreneurship and institutional uncertainty. *Journal of Business Venturing*, *32*(5), 461–475. https://doi.org/10.1016/j.jbusvent.2017.05.006

Chamberlain, G. (1994). Quantile regression, censoring, and the structure of wages. In C. A. Sims (Ed.), *Advances in Econometrics: Sixth World Congress* (Vol. 1, pp. 171–210). Cambridge University Press; Cambridge Core. https://doi.org/10.1017/CCOL0521444594.005

Coleman, J. S. (1990). *Foundations of Social Theory. Cambridge, MA: Belknap Press of Harvard University Press*.

Colombelli, A., Krafft, J., & Vivarelli, M. (2016). To be born is not enough: The key role of innovative start-ups. *Small Business Economics*, *47*(2), 277–291. https://doi.org/10.1007/s11187-016-9716-y

Cuervo-Cazurra, A., Gaur, A., & Singh, D. (2019). Pro-market institutions and global strategy: The pendulum of pro-market reforms and reversals. *Journal of International Business Studies*, *50*(4), 598–632. https://doi.org/10.1057/s41267-019-00221-z

Dau, L. A., & Cuervo-Cazurra, A. (2014). To formalize or not to formalize: Entrepreneurship and pro-market institutions. *Journal of Business Venturing*, *29*, 668–686. https://doi.org/10.1016/j.jbusvent.2014.05.002

Davidsson, P. (2015). Entrepreneurial opportunities and the entrepreneurship nexus: A re-conceptualization. *Journal of Business Venturing*, *30*(5), 674–695. https://doi.org/10.1016/j.jbusvent.2015.01.002

del Junco, J. G., & Brás-dos-Santos, J. M. (2009). How different are the entrepreneurs in the European Union internal market?—An exploratory cross-cultural analysis of German, Italian and Spanish entrepreneurs. *Journal of International Entrepreneurship*, *7*(2), 135–162. https://doi.org/10.1007/s10843-009-0037-y

Dutta, S., Lanvin, B., & Wunsch-Vincent, S. (2018). *Global Innovation Index 2018: Energizing the World with Innovation, 11th Edition*. Cornell University, INSEAD, and WIPO.

Easterly, W. (2007). Inequality does cause underdevelopment: Insights from a new instrument. *Journal of Development Economics*, *84*, 755–776. http://dx.doi.org/10.1016/j.jdeveco.2006.11.002

Easterly, W., & Levine, R. (2003). Tropics, germs, and crops: How endowments influence economic development. *Journal of Monetary Economics*, *50*, 3–39. http://dx.doi.org/10.1016/S0304-3932(02)00200-3

Eesley, C. E., Eberhart, R. N., Skousen, B. R., & Cheng, J. L. C. (2018). Institutions and Entrepreneurial Activity: The Interactive Influence of Misaligned Formal and Informal Institutions. *Strategy Science*, *3*(2), 393–407. https://doi.org/10.1287/stsc.2018.0060

Efrat, K. (2014). The direct and indirect impact of culture on innovation. *Technovation*, *34*(1), 12–20. https://doi.org/10.1016/j.technovation.2013.08.003

Fritsch, M., & Wyrwich, M. (2018). Regional knowledge, entrepreneurial culture, and innovative start-ups over time and space—an empirical investigation. *Small Business Economics*, *51*(2), 337–353. https://doi.org/10.1007/s11187-018-0016-6

Gohmann, S. F. (2012). Institutions, Latent Entrepreneurship, and Self-Employment: An International Comparison. *Entrepreneurship Theory and Practice*, *36*(2), 295–321. https://doi.org/10.1111/j.1540-6520.2010.00406.x

Gohmann, S. F., Hobbs, B. K., & McCrickard, M. (2008). Economic Freedom and Service Industry Growth in the United States. *Entrepreneurship Theory and Practice*, *32*, 855–874. https://doi.org/10.1111/j.1540-6520.2008.00259.x

González-Pernía, J. L., Peña-Legazkue, I., & Vendrell-Herrero, F. (2012). Innovation, entrepreneurial activity and competitiveness at a sub-national level. *Small Business Economics*, *39*(3), 561–574. https://doi.org/10.1007/s11187-011-9330-y

Gorodnichenko, Y., & Roland, G. (2017). Culture, Institutions, and the Wealth of Nations. *The Review of Economics and Statistics*, *99*, 402–416. https://doi.org/10.1162/REST_a_00599

Greene, W. H. (1997). *Econometric Analysis*. Prentice-Hall International.

Greif, A. (1994). Cultural Beliefs and the Organization of Society: A Historical and Theoretical Reflection on Collectivist and Individualist Societies. *Journal of Political Economy*, *102*, 912–950.

Gwartney, J., & Lawson, R. (2003). The concept and measurement of economic freedom. *European Journal of Political Economy*, *19*, 405–430. https://doi.org/10.1016/S0176-2680(03)00007-7

Gwartney, J., Lawson, R., Hall, J., & Murphy, R. (2018). *Economic Freedom of the World: 2018 Annual Report*. http://www.deslibris.ca/ID/10097993

Hall, J. C., Nikolaev, B., Pulito, J. M., & VanMetre, B. J. (2013). The Effect of Personal and Economic Freedom on Entrepreneurial Activity: Evidence from a New State Level Freedom Index. *American Journal of Entrepreneurship*, *6*(1).

Hayek, F. A. (1948). *Individualism and Economic Order*. The University of Chicago Press.

Hayek, F. A. von. (1988). *The collected works of Friedrich August Hayek* (W. W. Bartley, Ed.). Routledge.

Hayton, J. C., George, G., & Zahra, S. A. (2002, Summer). National culture and entrepreneurship: A review of behavioral research. *Entrepreneurship: Theory and Practice*, *26*, 33–52.

Heine, S. J. (2016). *Cultural Psychology*. W.W. Norton.

Hofstede, G. (1980). Culture's consequences: National differences in thinking and organizing. *Beverly Hills, Calif.: Sage*.

Hofstede, G. (1991). Organizations and cultures: Software of the mind. *McGrawHill, New York*.

Holmes, R. M., Miller, T., Hitt, M. A., & Salmador, M. P. (2013). The Interrelationships Among Informal Institutions, Formal Institutions, and Inward Foreign Direct Investment. *Journal of Management*, *39*(2), 531–566. https://doi.org/10.1177/0149206310393503

Kreft, S. F., & Sobel, R. S. (2005). Public Policy, Entrepreneurship, and Economic Freedom. *CATO JOURNAL*, *25*(3), 595–616.

La Porta, R., Florencio, L.-S., Shleifer, A., & Vishny, R. (1999). The Quality of Government. *Journal of Law, Economics, & Organization*, *15*, 222–279.

La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2008). The economic consequences of legal origins. *Journal of Economic Literature*, *46*, 285–332. https://doi.org/10.1257/jel.46.2.285

Lehmann, E. E., & Seitz, N. (2017). Freedom and innovation: A country and state level analysis. *The Journal of Technology Transfer*, *42*(5), 1009–1029. https://doi.org/10.1007/s10961-016-9478-3

Li, Y., & Zahra, S. A. (2012). Formal institutions, culture, and venture capital activity: A cross-country analysis. *Journal of Business Venturing*, *27*(1), 95–111. https://doi.org/10.1016/j.jbusvent.2010.06.003

Lundvall, B.-Å. (2010). *National Systems of Innovation: Toward a Theory of Innovation and Interactive Learning*. Anthem Press; JSTOR. https://www.jstor.org/stable/j.ctt1gxp7cs
McMullen, J. S., Bagby, D. R., & Palich, L. E. (2008). Economic Freedom and the Motivation to Engage in Entrepreneurial Action. *Entrepreneurship Theory and Practice*, *32*, 875–895. https://doi.org/10.1111/j.1540-6520.2008.00260.x
Mokyr, J. (2017). *A Culture of Growth: The Origins of the Modern Economy*. Princeton University Press.
Morris, M. H., Avila, R. A., & Allen, J. (1993). Individualism and the Modern Corporation: Implications for Innovation and Entrepreneurship. *Journal of Management*, *19*(3), 595–612. https://doi.org/10.1177/014920639301900305
Nelson, R. R. (1993). *National innovation systems: A comparative analysis*. Oxford University Press on Demand.
Nikolaev, B., Boudreaux, C. J., & Palich, L. (2018). Cross-Country Determinants of Early-Stage Necessity and Opportunity-Motivated Entrepreneurship: Accounting for Model Uncertainty. *Journal of Small Business Management*, *56*(S1), 243–280. https://doi.org/10.1111/jsbm.12400
Nikolaev, B., Boudreaux, C., & Salahodjaev, R. (2017). Are individualistic societies less equal? Evidence from the parasite stress theory of values. *Journal of Economic Behavior & Organization*, *138*, 30–49. https://doi.org/10.1016/j.jebo.2017.04.001
Nikolaev, B., & Salahodjaev, R. (2017). Historical Prevalence of Infectious Diseases, Cultural Values, and the Origins of Economic Institutions. *Kyklos*, *70*, 97–128.
North, D. C. (1990). *Institutions, institutional change, and economic performance*. Cambridge University Press.
North, D. C. (1994). Economic Performance Through Time. *The American Economic Review*, *84*, 359–368.
North, D. C. (2005). *Understanding the Process of Economic Change*. Princeton University Press.
Nyström, K. (2008). The institutions of economic freedom and entrepreneurship: Evidence from panel data. *Public Choice*, *136*, 269–282. http://dx.doi.org/10.1007/s11127-008-9295-9
Platteau, J.-P. (2000). *Institutions, Social Norms, and Economic Development*. Routledge.
Powell, B., & Weber, R. (2013). Economic freedom and entrepreneurship: A panel study of the United States. *American Journal of Entrepreneurship*, *6*, 67+.
Rinne, T., Steel, G. D., & Fairweather, J. (2012). Hofstede and Shane Revisited: The Role of Power Distance and Individualism in National-Level Innovation Success. *Cross-Cultural Research*, *46*(2), 91–108. https://doi.org/10.1177/1069397111423898
Rodrik, D. (2008). *One economics, many recipes: Globalization, institutions, and economic growth*. Princeton University Press.
Rogers, E. M. (1995). *Diffusion of innovations* (4th ed). Free Press.
Roland, G. (2004). Understanding institutional change: Fast-moving and slow-moving institutions. *Studies in Comparative International Development*, *38*, 109–131. https://doi.org/10.1007/BF02686330
Sachs, J. D. (2003). Institutions Don't Rule: Direct Effects of Geography on Per Capita Income. *National Bureau of Economic Research Working Paper Series*, *No. 9490*.
Sachs, J. D., Mellinger, A. D., & Gallup, J. L. (2001). The Geography of Poverty and Wealth. *Scientific American*, *284*, 70–75.

Saunoris, J. W., & Sajny, A. (2017). Entrepreneurship and economic freedom: Cross-country evidence from formal and informal sectors. *Entrepreneurship & Regional Development*, *29*(3–4), 292–316. https://doi.org/10.1080/08985626.2016.1267806
Schumpeter, J. A. (1942). *Capitalism, socialism, and democracy*. Harper.
Schwartz, S. H. (1994). Beyond individualism/collectivism: New cultural dimensions of values. In Ŭ. Kim, H. C. Triandis, C. Kagitcibasi, S.-C. Choi, & G. Yoon (Eds.), *Individualism and Collectivism: Theory, Method, and Applications* (pp. 85–122). Sage Publications.
Shane, S. (1992). Why do some societies invent more than others? *Journal of Business Venturing*, *7*(1), 29–46. https://doi.org/10.1016/0883-9026(92)90033-N
Shane, S. (1993). Cultural influences on national rates of innovation. *Journal of Business Venturing*, *8*(1), 59–73.
Shane, S. (1995). Cultural Differences in lnnovation Championing Strategies. *Journal of Management*, *21*(5), 22.
Shane, S., & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *The Academy of Management Review*, *25*, 217–226.
Shane, S., Venkataraman, S., & MacMillan, I. (1995). Uncertainty Avoidance and the Preference for Innovation Championing Roles. *Journal of International Business Studies*, *26*(1), 47–68. JSTOR.
Smith, A. (1776). *An Inquiry into the Nature and Causes of the Wealth of Nations* (Edwin Cannan, Ed.). Library of Economics and Liberty.
Sobel, R. S. (2008). Testing Baumol: Institutional quality and the productivity of entrepreneurship. *Journal of Business Venturing*, *23*, 641–655. https://doi.org/10.1016/j.jbusvent.2008.01.004
Solt, F. (2016). The Standardized World Income Inequality Database*. *Social Science Quarterly*, *97*(5), 1267–1281. https://doi.org/10.1111/ssqu.12295
Steensma, H. K., Marino, L., Weaver, K. M., & Dickson, P. H. (2000). The Influence of National Culture on the Formation of Technology Alliances by Entrepreneurial Firms. *Academy of Management Journal*, *43*(5), 951–973. https://doi.org/10.5465/1556421
Stephan, U., & Uhlaner, L. M. (2010). Performance-based vs socially supportive culture: A cross-national study of descriptive norms and entrepreneurship. *Journal of International Business Studies*, *41*(8), 1347–1364. https://doi.org/10.1057/jibs.2010.14
Taras, V., Steel, P., & Kirkman, B. L. (2012). Improving national cultural indices using a longitudinal meta-analysis of Hofstede's dimensions. *Journal of World Business*, *47*(3), 329–341. https://doi.org/10.1016/j.jwb.2011.05.001
Taylor, M. Z., & Wilson, S. (2012). Does culture still matter?: The effects of individualism on national innovation rates. *Journal of Business Venturing*, *27*(2), 234–247. https://doi.org/10.1016/j.jbusvent.2010.10.001
Thornhill, R., & Fincher, C. L. (2014). *The parasite-stress theory of values and sociality: Infectious disease, history and human values worldwide*. Springer.
Triandis, H. C. (1995). *Individualism & collectivism*. Westview Press.
Tselios, V. (2011). Is Inequality Good for Innovation? *International Regional Science Review*, *34*(1), 75–101. https://doi.org/10.1177/0160017610383278
Tung, R. L. (2008). The cross-cultural research imperative: The need to balance cross-national and intra-national diversity. *Journal of International Business Studies*, *39*(1), 41–46. https://doi.org/10.1057/palgrave.jibs.8400331

van Waarden, F. (2001). Institutions and Innovation: The Legal Environment of Innovating Firms. *Organization Studies*, *22*(5), 765–795.
Vedula, S., & Fitza, M. (2019). Regional Recipes: A Configurational Analysis of the Regional Entrepreneurial Ecosystem for U.S. Venture Capital-Backed Startups. *Strategy Science*, *4*(1), 4–24. https://doi.org/10.1287/stsc.2019.0076
Von Mises, L. (1990). *Economic freedom and interventionism: An anthology of articles and essays* (B. B. Greaves, Ed.). Foundation for Economic Education.
Weber, M. (1988). *The Protestant ethic and the spirit of capitalism*. P. Smith.
White, H. (1980). A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity. *Econometrica*, *48*, 817–838.
Williamson, O. E. (2000). The New Institutional Economics: Taking Stock, Looking Ahead. *Journal of Economic Literature*, *38*(3), 595–613.
Wong, P. K., Ho, Y. P., & Autio, E. (2005). Entrepreneurship, Innovation and Economic Growth: Evidence from GEM data. *Small Business Economics*, *24*(3), 335–350. https://doi.org/10.1007/s11187-005-2000-1
Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data*. MIT Press.
Zhao, X., Li, H., & Rauch, A. (2012). *Cross-Country Differences in Entrepreneurial Activity: The Role of Cultural Practice and National Wealth*. 29.
Zhu, H., & Zhu, S. X. (2017). Corporate innovation and economic freedom: Cross-country comparisons. *The Quarterly Review of Economics and Finance*, *63*, 50–65. https://doi.org/10.1016/j.qref.2016.04.003

Figures

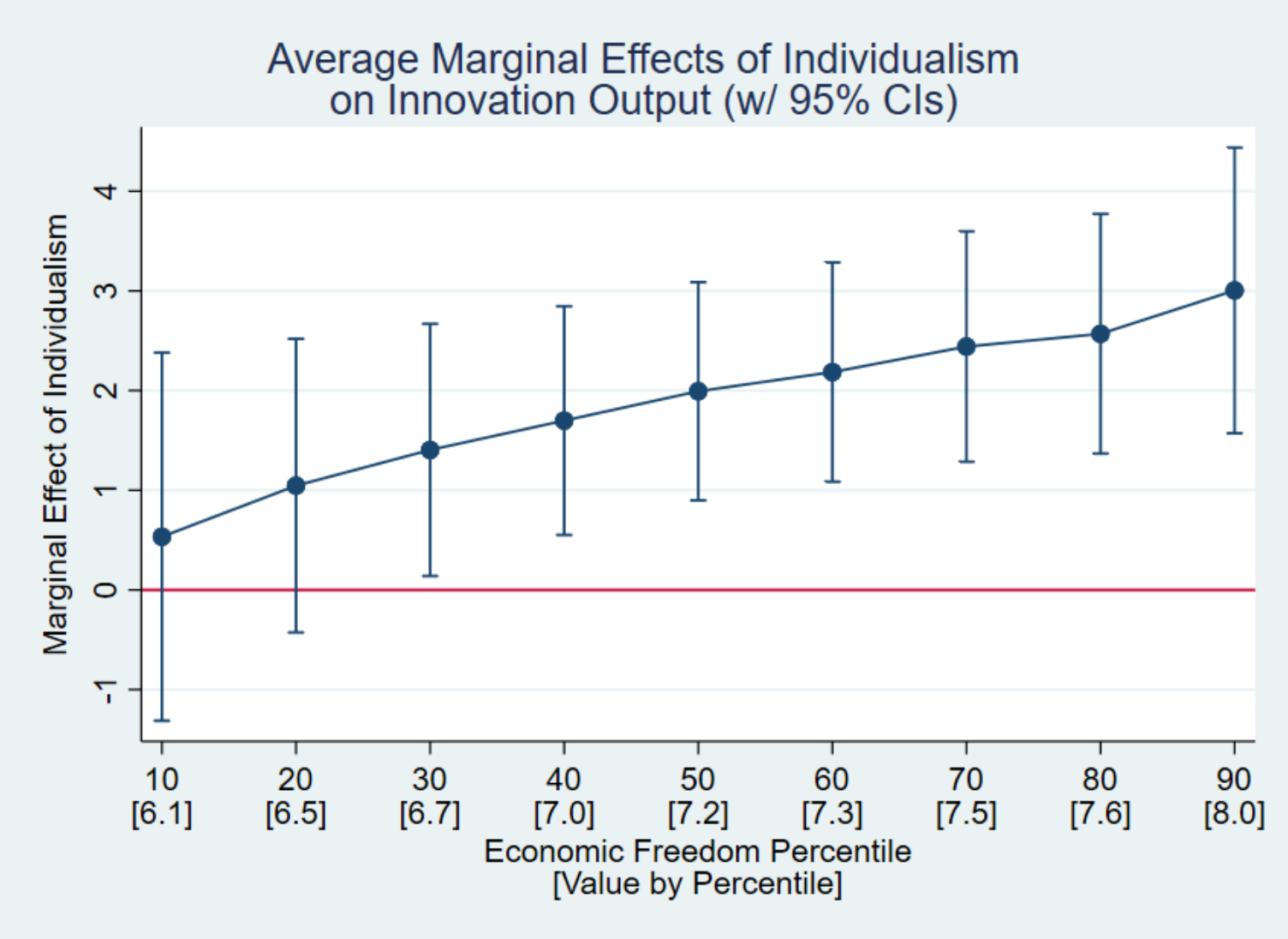

Figure 1: Average Marginal Effects of Individualism on Innovation Output by Level of Economic Freedom

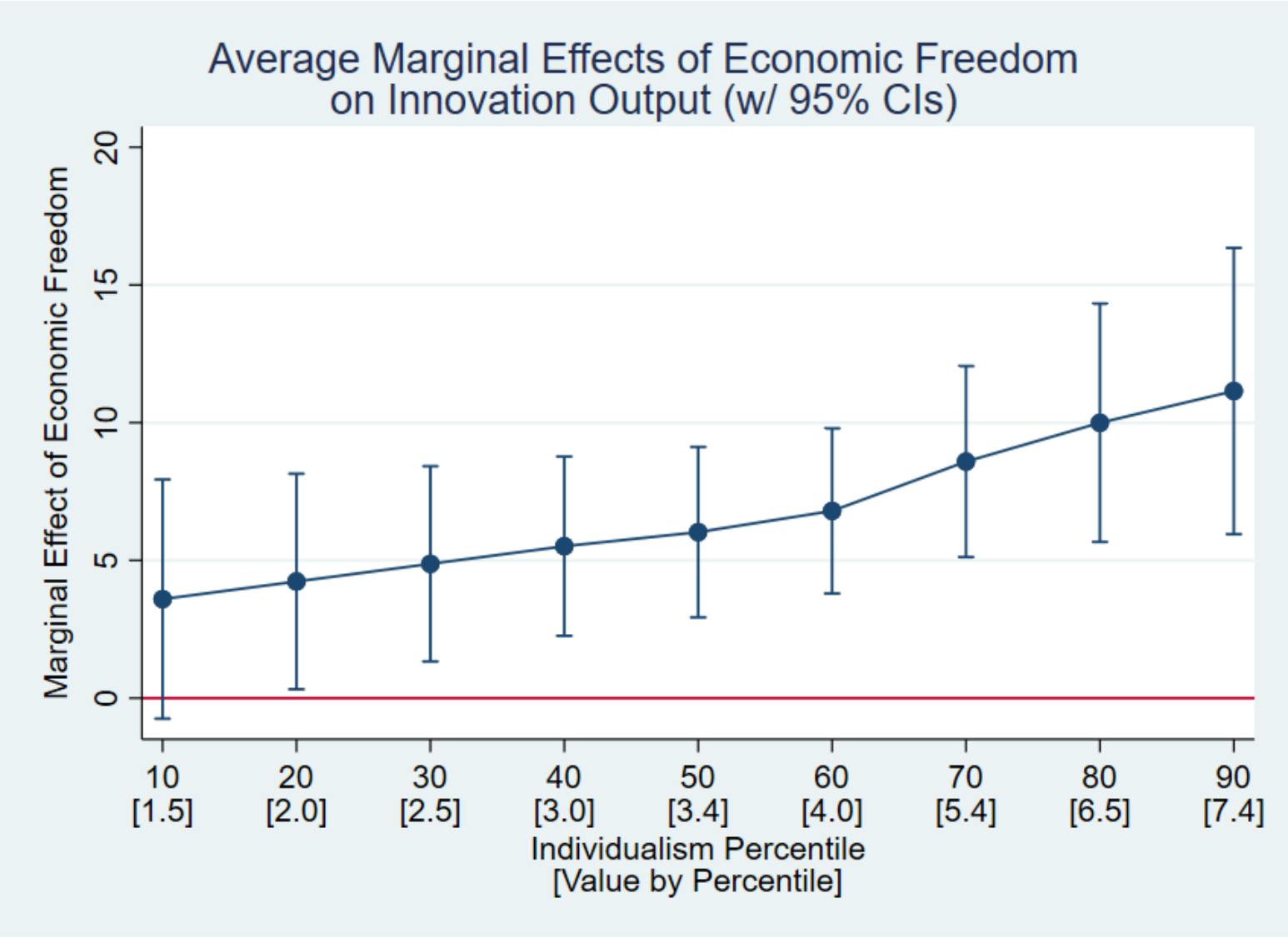

Figure 2: Average Marginal Effects of Economic Freedom on Innovation Output by Level of Individualism

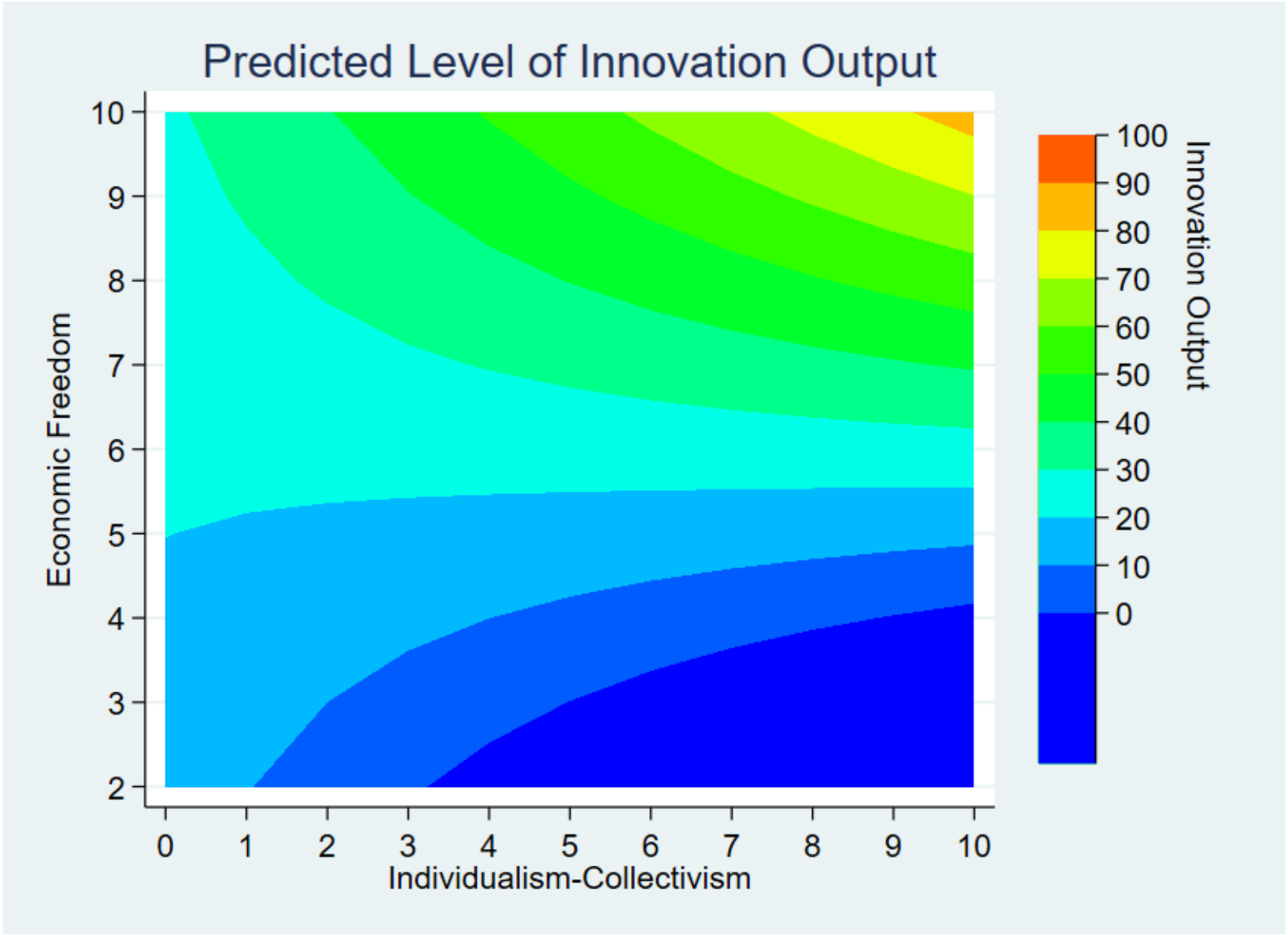

Figure 3: Predicted Innovation Output by Level of Individualism & Economic Freedom

Tables

Table 1: Variable Descriptions & Summary Statistics

Variable	Description	Mean	SD	Min	Max	N	Source
Innovation Output Index	Index measuring innovative outputs in two pillars: (1) knowledge & technology outputs, and (2) creative outputs. Each pillar is comprised of three sub-pillars, derived from numerous variables. The index ranges from 0 (least innovative) to 100 (most innovative). See Appendix Table A1 for details on its components.	32.05	12.87	8.30	67.13	84	Dutta et al. (2018)
Creative Outputs	Creative output pillar. See Appendix Table A1 for additional details.	34.04	12.58	0.56	59.38	84	Dutta et al. (2018)
Intangible Assets	Intangible assets sub-pillar. See Appendix Table A1 for additional details.	45.62	11.77	0.68	71.87	84	Dutta et al. (2018)
Creative Goods & Services	Creative goods & services sub-pillar. See Appendix Table A1 for additional details.	25.88	15.30	0.87	61.28	84	Dutta et al. (2018)
Online Creativity	Online creativity sub-pillar. See Appendix Table A1 for additional details.	19.03	18.95	0.02	63.97	84	Dutta et al. (2018)
Knowledge & Technology Output	Knowledge & technology output pillar. See Appendix Table A1 for additional details.	30.06	14.34	6.97	74.88	84	Dutta et al. (2018)
Knowledge Creation	Knowledge creation sub-pillar. See Appendix Table A1 for additional details.	23.91	21.09	0.90	89.89	84	Dutta et al. (2018)
Knowledge Impact	Knowledge impact sub-pillar. See Appendix Table A1 for additional details.	39.13	13.47	3.60	67.04	84	Dutta et al. (2018)
Knowledge Diffusion	Knowledge diffusion sub-pillar. See Appendix Table A1 for additional details.	27.15	15.95	7.11	86.03	84	Dutta et al. (2018)

Table 1: Variable Descriptions & Summary Statistics

Variable	Description	Mean	SD	Min	Max	N	Source
Economic Freedom	Index measuring the degree to which a country's institutions and policies are consistent with the principles of economic freedom: personal choice, voluntary exchange, open markets, and protection of persons and their property from aggressors. Comprised of five areas: size of government; legal institutions & property rights; sound money; international trade freedom; and regulatory freedom. Each area is comprised of numerous components. Raw data for each component is transformed to a 0-10 scale that is increasing in economic freedom. Area scores are the average of the components. Index score is the average of the areas.	7.09	0.75	4.84	8.97	84	Gwartney et al. (2018)
Individualism	Index measuring the relative degree to which a society accepts and reinforces individualist or collectivist values. The index ranges from 0 (most collectivistic) to 100 (most individualistic). Data was originally collected in 1967 and 1973. The dataset was updated in 2013, partly based on replications and extensions of the original study.	4.04	2.25	0.60	9.10	84	Hofstede et al. (2010)
Legal Origins - Socialist	Dummy variable = 1 if legal origin Socialist; 0 otherwise.	0.19	0.40	0.00	1.00	84	La Porta et al. (1999)
Legal Origins - French	Dummy variable = 1 if legal origin French; 0 otherwise.	0.38	0.49	0.00	1.00	84	La Porta et al. (1999)
Legal Origins - British	Dummy variable = 1 if legal origin British; 0 otherwise.	0.31	0.47	0.00	1.00	84	La Porta et al. (1999)
Legal Origins - Scandinavian	Dummy variable = 1 if legal origin Scandinavian; 0 otherwise.	0.06	0.24	0.00	1.00	84	La Porta et al. (1999)
Latitude	Value of the latitude of a country's approximate geodesic centroid (distance from equator).	24.76	27.31	-41.81	64.99	84	La Porta et al. (1999)
Tropical	Share of population living in tropical area.	28.76	40.56	0.00	100.00	84	La Porta et al. (1999)
Muslim % Population	Share of population Muslim in 1980.	13.11	26.81	0.00	99.40	84	La Porta et al. (1999)

Table 1: Variable Descriptions & Summary Statistics

Variable	Description	Mean	SD	Min	Max	N	Source
Catholic % Population	Share of population Catholic in 1980.	37.51	38.38	0.00	97.30	84	La Porta et al. (1999)
Protestant % Population	Share of population Protestant in 1980.	14.53	24.69	0.00	97.80	84	La Porta et al. (1999)
Gini Coefficient (Inequality)	Measure of inequality in the distribution of income. Values bounded between 0 (completely equal distribution) and 1 (one person controls all income). Values	37.97	8.88	22.90	59.70	84	Solt (2016)
Ethnolinguistic Fractionalization	Index that captures the probability that two individuals, selected at random from a country's population, will belong to different ethnic groups. Data collected from various years over the period 1979-2001.	0.38	0.24	0.00	0.86	84	Alesina et al. (2003)
Economic Development	Natural log of per capita GDP.	9.65	1.01	6.66	11.42	83	World Bank World Development Indicators
Disease Pathogens	Index measuring the historical prevalence of infectious diseases. Based on the severity of nine diseases that are destructive to human survival and reproductive health (leishmania, trypanosomes, leprosy, schistosomes, filariae, tuberculosis, malaria, dengue, and typhus). Derived from historical epidemiological atlases of infectious diseases and other epidemiological information dating back to the early 20th century. The pathogen scores for each one of these diseases (coded on either three- or four-point scales) were then standardized by converting them to z-scores. The composite pathogen prevalence index was estimated as the average of the individual disease z-scores. Positive values for each country indicate above average disease prevalence while negative values denote that pathogen prevalence is below the mean.	-0.03	0.67	-1.31	1.16	82	Murray & Schaller (2010)
Democracy	Index measuring the quality of democratic political institutions. Reflects the average of measures: civil rights and political liberties.	4.61	1.46	0.50	6.00	83	Abramowitz (2018)

Table 2: Culture, Institutions & Innovation

	(1)	(2)	(3)	(4)	(5)	(6)
Economic Freedom	7.406***	6.371***	6.138***	5.887***	5.825***	5.882***
	(1.169)	(1.148)	(1.170)	(1.291)	(1.394)	(1.457)
	[0.431]	[0.371]	[0.357]	[0.343]	[0.339]	[0.343]
Individualism	2.711***	2.406***	1.791***	2.095***	2.039***	2.068***
	(0.419)	(0.400)	(0.459)	(0.457)	(0.504)	(0.552)
	[0.475]	[0.421]	[0.314]	[0.367]	[0.357]	[0.362]
Legal Origins: Socialist		-8.851**	-9.713**	-11.361**	-11.112**	-8.728*
		(4.104)	(4.088)	(4.608)	(4.817)	(5.092)
		[-0.272]	[-0.298]	[-0.349]	[-0.341]	[-0.268]
Legal Origins: French		-14.168***	-11.783***	-12.365**	-11.906**	-9.308*
		(3.774)	(3.799)	(5.009)	(5.383)	(5.429)
		[-0.538]	[-0.447]	[-0.470]	[-0.452]	[-0.353]
Legal Origins: UK		-15.672***	-12.166***	-12.653***	-12.146**	-10.199**
		(3.794)	(3.983)	(4.577)	(4.963)	(4.828)
		[-0.566]	[-0.440]	[-0.457]	[-0.439]	[-0.369]
Legal Origins: Scandinavian		-4.999	-5.600	1.323	0.455	-3.171
		(4.281)	(4.362)	(5.812)	(6.136)	(5.933)
		[-0.092]	[-0.104]	[0.024]	[0.008]	[-0.059]
Latitude			0.084***	0.076**	0.072**	0.079
			(0.028)	(0.031)	(0.036)	(0.076)
			[0.179]	[0.160]	[0.154]	[0.168]
Tropics			-0.034	-0.030	-0.029	-0.021
			(0.025)	(0.026)	(0.026)	(0.030)
			[-0.106]	[-0.096]	[-0.090]	[-0.068]
Muslim % Population				-0.053	-0.053	-0.051
				(0.041)	(0.041)	(0.052)
				[-0.111]	[-0.111]	[-0.106]
Catholic % Population				-0.031	-0.032	-0.005
				(0.032)	(0.032)	(0.034)

Table 2: Culture, Institutions & Innovation

	(1)	(2)	(3)	(4)	(5)	(6)
				[-0.093]	[-0.094]	[-0.014]
Protestant % Population				-0.123**	-0.113*	-0.024
				(0.058)	(0.067)	(0.063)
				[-0.237]	[-0.216]	[-0.046]
Gini Coefficient (Inequality)					-0.031	-0.041
					(0.192)	(0.207)
					[-0.021]	[-0.028]
Ethnolinguistic Fractionalization					-1.139	0.399
					(4.359)	(4.662)
					[-0.022]	[0.008]
Regional Fixed Effects	No	No	No	No	No	Yes
Countries	84	84	84	84	84	84
Adj. R2	0.576	0.671	0.691	0.698	0.690	0.701

*OLS regressions of innovation output (DV) on economic freedom and individualism (IVs). Model 1 does not include any control variables. Model 2 controls for a country's legal origins (Germany is omitted category). Model 3 controls for two measures of geography (latitude, share of population located in the tropics). Model 4 control for religious affiliation of a nation's population. Model 5 controls for economic inequality (Gini Coefficient) and population heterogeneity (ethnolinguistic fractionalization). Model 6 controls for regional fixed effects using a set of continent dummies (i.e., Africa, Asia, Europe, Oceania, South America, with North America as omitted category). A common country sample employed across models. Standard errors, clustered at the country level, in parentheses. Standardized (beta) coefficients in brackets. Constant term included but results omitted for space. *** p<0.01, ** p<0.05, * p<0.1.*

Table 3: Culture, Institutions & Innovation - by Innovation Type

		Economic Freedom			Individualism					
	Innovation Measure	Coff	SE	Beta	Coff	SE	Beta	Controls	Countries	Adj. R2
(1)	Innovation Output	5.882***	(1.457)	[0.343]	2.068***	(0.552)	[0.362]	Yes	84	0.701
(2)	Creative Output	6.287***	(1.287)	[0.374]	1.314**	(0.548)	[0.235]	Yes	84	0.751
(3)	Intangible Assets	3.342*	(1.870)	[0.213]	0.208	(0.686)	[0.040]	Yes	84	0.494
(4)	Creative Goods & Services	10.411***	(1.815)	[0.510]	2.804***	(0.876)	[0.413]	Yes	84	0.642
(5)	Online Creativity	8.054***	(1.980)	[0.318]	2.035***	(0.752)	[0.242]	Yes	84	0.834
(6)	Knowledge & Technology Output	5.477***	(2.034)	[0.286]	2.821***	(0.750)	[0.443]	Yes	84	0.704
(7)	Knowledge Creation	1.840	(2.915)	[0.065]	2.813**	(1.184)	[0.301]	Yes	84	0.735
(8)	Knowledge Impact	5.771***	(1.835)	[0.321]	2.538***	(0.932)	[0.425]	Yes	84	0.463
(9)	Knowledge Diffusion	8.816***	(2.628)	[0.414]	3.113***	(0.948)	[0.440]	Yes	84	0.563

*OLS regressions of innovation (DVs) on economic freedom and individualism (IVs). Each row represents a different model using the innovation measure indicated as the DV. Results for Innovation Output (row 1) reproduced from Table 2 (model 6) for comparison. All models include the full set of control variables and regional fixed effects, but these results omitted for space. Standard errors, clustered at the country level, in parentheses. Standardized (beta) coefficients in brackets. *** p<0.01, ** p<0.05, * p<0.1.*

Table 4: Culture, Institutions & Innovation -- Interaction Results by Innovation Type

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Innovation Output	Creative Output	Intangible Assets	Creative Goods & Services	Online Creativity	Knowledge & Technology Output	Knowledge Creation	Knowledge Impact	Knowledge Diffusion
Economic Freedom	1.674	5.019*	5.151	6.975*	2.794	-1.667	-7.068	-1.218	3.284
	(2.938)	(2.752)	(4.359)	(3.530)	(3.469)	(4.061)	(5.940)	(3.630)	(5.568)
Individualism	-7.211	-1.483	4.197	-4.772	-9.563*	-12.931**	-16.829*	-12.875**	-9.086
	(4.588)	(4.791)	(7.335)	(6.873)	(5.567)	(6.191)	(9.150)	(6.393)	(10.499)
Economic Freedom X Individualism	1.280**	0.386	-0.550	1.045	1.600**	2.173**	2.710**	2.126**	1.683
	(0.629)	(0.655)	(0.986)	(0.977)	(0.785)	(0.857)	(1.270)	(0.879)	(1.441)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries	84	84	84	84	84	84	84	84	84
R-squared	0.777	0.752	0.496	0.647	0.842	0.730	0.754	0.491	0.576
p(Economic Freedom)	0.00	0.00	0.21	0.00	0.00	0.00	0.04	0.00	0.00
p(Individualism)	0.00	0.05	0.84	0.01	0.01	0.00	0.01	0.00	0.00
MET(Economic Freedom)						0.8	2.6	0.6	
MET(Individualism)	5.6	3.8		4.6	6.0	6.0	6.2	6.1	5.4

*OLS regressions of innovation (DV) on economic freedom, individualism, and the interaction between economic freedom and individualism (IVs). Innovation measure (DV) indicated in column header. All models include the full set of control variables and regional fixed effects, but these results omitted for space. Standard errors, clustered at the country level, in parentheses. p(Economic Freedom) and p(Individualism) denote the p-value of the marginal effect of economic freedom and individualism, respectively, derived from a joint test of significance of the respective main effect and interaction effect terms. MET(i) is the marginal effect threshold for variable i, or the level of the conditional variable for which the sign of the average marginal effect of i changes. For example, MET(Individualism)=5.6 in model 1 suggests that the marginal effect of individualism on innovation output is negative [positive] for countries an economic freedom score below [above] 5.6. MET(i) omitted if either the sign of the main and interaction effects are the same or the marginal effect is not statistically significant (e.g., model 3). *** p<0.01, ** p<0.05, * p<0.1.*