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FERTILE SOIL FOR INTRAPRENEURSHIP: IMPARTIAL INSTITUTIONS AND HUMAN CAPITAL*

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Abstract

Intrapreneurs, entrepreneurial employees, constitute an important force behind innovations in the economy. Yet, what factors that promote intrapreneurship at the country level are an underdeveloped research area. This paper provides a seminal contribution regarding the methodological approach and the broad set of potential explanatory factors studied. Based on machine-learning techniques (LASSO and EBA methods), we investigate the influence of over 60 factors capturing institutional, demographic, cultural, and developmental factors. We find that the quality of government measured as impartiality, i.e., that the political institutions treat the citizens in a non-discriminatory fashion and do not favor some groups or individuals, and the level of human capital, measured as the average years of schooling, are the most important factors predicting the level of intrapreneurship across countries. Instrumental variable results support a causal interpretation. The findings emphasize the importance of policy to establish well-functioning and impartial institutions as well as to promote higher education.

JEL codes: L26, O30, E02, I2, O17
Keywords: intrapreneurship, impartial institutions, human capital, machine-learning

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1 Introduction

Innovation is at the core of economic growth. Entrepreneurship—the function of introducing new products or better processes for delivering them—is an essential part of innovation. Entrepreneurship research has received an increasing amount of attention, both within the management and economics literatures. As a result, distinct strands of entrepreneurship theory have evolved, often building on insights from Joseph Schumpeter, Israel Kirzner or Frank Knight (see Foss and Klein, 2015). For a long time, the literature equated entrepreneurship with (new) small or family firms or self-employment. However, the bulk of all small firms and self-employed persons are not innovative; most small firms are ordinary mom-and-pop stores or livelihood firms (Santarelli and Vivarelli, 2007; Shane, 2009; Delmar and Wennberg, 2010).

Seeing entrepreneurship as a function associated with innovation and not a specific organizational form or occupational choice makes it clear that entrepreneurship can be performed by employees within existing companies as well. These employees are called *intrapreneurs* and have until recently largely been overlooked by researchers within economics.[3] The exclusion of intrapreneurship from entrepreneurship may be one reason why it has been hard to establish a relationship between entrepreneurship and growth empirically (see, e.g., van Stel et al., 2005, Stam and van Stel, 2011, or Stam, 2013). Including intrapreneurs in the measure of entrepreneurship gives more adequate coverage of entrepreneurial behavior in society. It may also explain why countries with a low share of independent entrepreneurs, i.e., owner-managers of independent firms, score high on international innovation activity measures.

Studies analyzing the prevalence of independent entrepreneurship between countries, and what (institutional) factors that might explain these differences are plentiful (see, e.g., Bjørnskov and Foss, 2008, Thai and Turkina, 2014, Dheer, 2017, and Nikolaev et al., 2018). But what institutions that promote entrepreneurial employees, and if these factors are possible to influence through policy, are, on the other hand, a truly under-analyzed question.

A priori it may be reasonable to posit that entrepreneurial endeavors—independent of form—are affected by the same factors. The literature often, explicitly or implicitly, assumes that both independent entrepreneurs and intrapreneurs respond in the same way to the institutional framework. This need not be maintained as an assumption, however, but should be studied empirically.

[3] Within the business management literature, extensive research analyzes how to make established firms, including their employees, more entrepreneurial. Examples include both articles (e.g., Zahra, 1991; Carrier, 1994; Miles and Covin, 2002) and books (e.g., Burns, 2017; Morris *et al*., 2018). The importance of business culture and a well-developed corporate business strategy is often highlighted. However, this literature lacks an analysis from a societal perspective.

From a national policy perspective, promoting intrapreneurs can be as important as stimulating independent entrepreneurs which often is the main focus of current national policies. Research suggests that intrapreneurs can be as important as independent entrepreneurs when it comes to innovation activity as well as employment and economic growth (see Stam, 2013).

To analyze intrapreneurship using quantitative methods at the national level, one needs data on intrapreneurship that is comparable across countries. Until recently, no such measure was available, but from 2014 the intrapreneurship level has been measured coherently within the GEM-project, making a quantitative analysis possible. Intrapreneurship activity differs substantially between countries. The average share of intrapreneurs in the labor force between 2014 and 2017 was, e.g., 11 percent in Denmark, whereas it was 0.3 percent in Panama.

Studies of cross-national differences in intrapreneurship are scarce. The earlier research has *ex ante* restricted the analysis to a particular set of variables or areas that the scholars deem to be most important. Examples include human capital (Stam, 2013), employment protection legislation (Liebregts and Stam, 2019), trust (Elert *et al*., 2019), or a sub-set of institutional factors (Bosma *et al*., 2018). This approach makes strong assumptions about what does *not* matter without examining the evidence.

The purpose of this paper is to analyze in which environments intrapreneurship flourishes using a less restrictive approach than previous work. Instead of focusing on a small subset of potential explanatory factors, we impose much weaker *ex ante* assumptions on what matters. We study many national-level factors covering a wide set of different areas that the literature has linked to entrepreneurial activity. We extend the analysis using instrumental variables, which provide stronger causal evidence.

Our results suggest that intrapreneurship thrives predominantly in two environments. First, impartial institutions are crucial because they are the foundation for well-functioning and non-corrupt public institutions. The second factor is human capital. The higher the level of education, the greater is the rate of intrapreneurship. Both factors are squarely in the domain of public policy.[4]

The paper makes a seminal contribution by studying the intrapreneurship rate, a within economics sparsely studied yet important part of entrepreneurship, with novel methods applied to a wide set of factors. Methodologically we advance the literature by using machine-learning

[4] We include factors within and outside of the realm of public policy to examine whether the most important factors are part of the former category.

techniques to isolate the most important factors where intrapreneurship flourishes.[5] Cross-country analyses have, as described above, tended to focus on a handful of variables deemed important *ex ante*, where we consider around 60 factors.

The paper proceeds in section 2 with a background related to the main factors we consider in the analysis grouped into four areas. We proceed to describe the data used in the analysis in section 3 and section 4 describes the econometric method used. Section 5 presents the main results, and Section 6 concludes.

2 Literature review

2.1 *Independent entrepreneurs versus intrapreneurs*

Most of the entrepreneurial research within economics do not explicitly discuss intrapreneurship, but entrepreneurship that excludes, explicitly or implicitly, intrapreneurs. They may also discuss innovation in general terms. Factors that affect incentives, regulation of employment, and attitudes toward entrepreneurial aspiration could all influence not only potential independent entrepreneurs but also intrapreneurs. For example, the rule of law may make it possible to write enforceable contracts. This may secure material payoffs for innovators, both those who are independent and those employed by existing firms. The absence of rule of law could expose both kinds of innovator to theft or coercion, which may not bolster innovation. High trust may also make it easier for innovators to benefit from their work, and low trust may decrease the desire to innovate if innovators believe they will be taken advantage of.

A priori, it seems reasonable that the same factors might affect the presence of entrepreneurial endeavors, independently of functional form (as an owner-manager in an independent business or as an employee in an established firm). But this need not be the case, factors could have differential effects on independent and employed entrepreneurs. Rule of law could, for example, be more important for independent entrepreneurs as they may need to engage in numerous contracts with agents outside the firm to bring the innovation to market. For intrapreneurs, it could be more important with trust, as the innovation is embedded in an existing firm where the innovative process is characterized more by relational contracts in the firm rather than formal contracting. Furthermore, some factors might influence the entrepreneurial activities in opposite ways. Generous social security systems and strict employment protection laws may discourage people from working as self-employed and instead

[5] Machine-learning techniques have until now rarely been used within entrepreneurship research but it is highlighted as an emerging topic (Obschonka and Audretsch, 2020). New papers using this method to analyze entrepreneurship related questions include Prüfer and Prüfer (2020), Obschonka *et al*. (2020), and Coad and Srhoj (2020).

encourage individuals to work as intrapreneurs. It is an empirical question to determine what factors influence the intrapreneurship level in a country.

2.2 *Institutions and other factors*

The entrepreneurship literature has examined a wide range of factors that might influence entrepreneurial activity and potentially explain cross-national differences. We consider both formal and informal institution, including cultural measures, as well as developmental and geographical factors. The section reviews all variables used in the analysis summed up under the four headings *formal institutional*, *labor market & demographic, cultural & attitudinal* and, finally, *developmental and geographical* factors. The areas are partly overlapping but give an overview of earlier studies.

Formal institutional factors

North (1990) highlights the role of institutions as vital for shaping the incentive structure in society. Boettke and Coyne (2009), inspired by Baumol (1990, 1993), conclude that the institutional framework influences the profitability of opportunities and willingness of individuals to become independent entrepreneurs. Elert *et al*. (2017) and Elert and Henrekson (2020) give an overview of how institutions may influence entrepreneurial activity and how politicians can spur entrepreneurship through institutional reforms. Harper (2018) gives an overview of innovation and institutions. The literature has stressed several aspects of the institutional framework in a country that might affect entrepreneurial activity.

Well-functioning public institutions, e.g., absence of corruption, political stability, and high regulatory quality, are often highlighted as important for a well-functioning economy and productive entrepreneurship. Examples include Estrin *et al*. (2013), Dau and Cuervo-Cazurra (2014), Olthaar *et al*. (2017), Chowdhury *et al.* (2018), Urbano *et al.* (2019), and Boudreaux and Nikolaev (2019) who all emphasize the importance of good institutions. Nistotskaya *et al.* (2015) have highlighted the importance of quality of governance in terms of impartial political institutions that are free from corruption. In the same vein, the importance of economic freedom has been stressed several times in the entrepreneurship literature. Bjørnskov and Foss (2008, 2013), McMullen *et al.* (2008), Nyström (2008), Gohman (2012), Boudreaux (2014) and Murtazashvili (2017) have all in different aspects found that institutions supporting economic freedom, including well-defined and stable property rights, spur entrepreneurial

experimentation and activity. An historical example from Ancient Greece includes Bitros and Karayiannis (2008).[6]

Labor market and demographic factors

The organization of labor markets is an important topic in the entrepreneurship literature. Van Stel *et al.* (2007) find, e.g., that extensive labor market regulation resulting in rigidity of employment influences entrepreneurial activity negatively. The extent and design of the social insurance system may make it less rewarding to change employer or start a new business (see, e.g., Koellinger and Minitti, 2009). The design of the social security system may also benefit employment relative to self-employment, causing entrepreneurial individuals to be intrapreneurs (Elert *et al.*, 2019). Employment protections can have the same effect (Liebregts and Stam, 2019).

Demographic factors include the total or female labor force participation rates as well as age and life expectancy (see, e.g., Bosma, 2012a or Liang *et al.*, 2018). The literature also points to the effects of ethnicity, diversity, immigration, and fractionalization of the labor force. Entrepreneurship might, e.g., be more pronounced among some ethnic groups (see, e.g., Smallbone, 2010). Ethnic diversity might, further, stimulate or dampen innovations as a result of increased or decreased interaction (see Greve and Salaff, 2003, Sobel *et al*., 2010, or Awaworyi Churchill, 2017).

Research has also highlighted the relevance of human capital for successful entrepreneurship (e.g., Unger *et al*., 2011; Marvel *et al*., 2016). Stam (2013) has shown that intrapreneurship at the country level is positively related to human capital investments. Many entrepreneurial endeavors, within or outside established companies, are facilitated by a high level of individual human capital.

Cultural and attitudinal factors

Customs, traditions, and norms are often stressed as important examples of *informal institutions* influencing behavior. How these factors affect individual behavior have been discussed widely in the economic literature (see, e.g., Mulligan, 1997).

Hofstede (1991) and Hofstede *et al.* (2010) have identified five cultural dimensions across nations, and in Hofstede *et al.* (2004), the authors elaborate on how these cultural traits may affect entrepreneurship. The importance of cultural traits as drivers of innovation and

[6] Another branch of research analyzes institutional entrepreneurship, i.e., when entrepreneurs influence the institutional framework (see, e.g., Henrekson and Sanandaji, 2011, Elert and Henrekson, 2017).

entrepreneurship has been analyzed extensively in the literature (see, e.g., Mueller and Thomas, 2000, Hechavarria and Reynolds, 2009, Taylor and Wilson, 2012, or Dheer, 2017).

Many studies, including Colombier and Masclet (2008) and Lindquist *et al*. (2015), have found that having a parent who is (or have been) an entrepreneur strongly correlates with the probability of being an entrepreneur of your own. The preference and priorities of your parents and their values passed on to their children might hence be important determinants for one's potential entrepreneurial career.

General trust for other individuals is highlighted in the entrepreneurship literature. High trust facilitates the flow of information (across groups) in society and increases the perception of entrepreneurial opportunities (Kwon and Arenius, 2010; Mickiewicz and Rebmann, 2020). Empirical support for the importance of trust has been found in, e.g., Kodila-Tedika and Agbor (2016). Later research has also stressed the importance of trust for intrapreneurship (Elert *et al.*, 2019). The possible influence of religion and religious beliefs is debated (see, e.g., Dana, 2010, and Henley, 2017).

Developmental and geographical factors

Some characteristics of a country that might influence the entrepreneurial activity include economic development and geographical factors together with historical traits. The entrepreneurial and intrapreneurial activities differs substantially across countries depending on economic development. Many rich countries have, e.g., a much higher share of intrapreneurs compared to developing countries (Bosma, 2012a).

The communist regimes have a lingering suppressive effect on entrepreneurial activities. According to Wyrwich (2012) and Fritsch and Wyrwich (2016), the communist regime in GDR triggered, e.g., a mentality at odds with entrepreneurship.

Geographical and historical traits of a country might be deeper and more fundamental causes explaining economic development and entrepreneurial activities (Spolaore and Wacziarg, 2013). Several articles have documented a strong link between various aspects of geography and historical traits on the one hand, and how the economy is organized and progress on the other (see, e.g., Hibbs and Olsson, 2004, and Olsson and Hibbs, 2005).

3 Data

3.1 Intrapreneurship

Intrapreneurs are entrepreneurship carried out by employees. The formal definition of intrapreneurship has varied considerably over time and there are still distinct terminology differences in the literature across academic disciplines.[7] In order to work with intrapreneurship from an empirical perspective, an operational definition must be used.

In 1999, a consortium denoted GEM (Global Entrepreneurship Monitoring) started to collect data consistently about independent entrepreneurship. In 2011, they collected survey data about intrapreneurship for the first time and from 2014 and onwards they have collected annual data on intrapreneurship in a consistent manner.[8]

GEM counts a person as an intrapreneur if (s)he during the last three years with a leading role has been involved in the development of new activities for the main employer. We measure the intrapreneurship level as the proportion of intrapreneurs in the working-age (18–64 years) population. It is GEM's so-called broad definition of intrapreneurship that we use in our analysis.[9] We compute country averages across the GEM waves in 2014, 2015, 2016, and 2017. Time averaging reduces measurement errors in any given year and provides a better measure of the persistent level of intrapreneurship. There are 87 countries from across the world in the sample (although not all countries have data on all the institutional measures).[10] Figure 1 illustrates the variation across countries. Intrapreneurship is highest in Denmark, Norway, and Australia. It is lowest in Panama, South Africa, and Georgia.

3.2 Explanatory and instrumental variables

This section contains an overview of the explanatory and instrumental variables used, and Table 1 presents common summary statistics and a correlation matrix among the variables our variable selection methods select as "strong factors." In total, we study about 60 potential influences, encompassing both formal and informal institutions, on intrapreneurship. Online Appendix 1 describes the sources used and the data in more detail.[11]

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[7] See Sharma and Chrisman (1999) for an extensive list of different definitions and Antoncic and Hisrich (2003) for a topical discussion from a management perspective.

[8] In 2008, a smaller pilot study with eleven countries was also conducted (see Bosma *et al*., 2010).

[9] The narrow definition requires that the intrapreneur must be currently involved in an intrapreneurship activity and is a subset of the intrapreneurs defined according to the broad definition. See Bosma *et al*. (2012a) for a further discussion about how GEM measures intrapreneurship. The correlation between the different intrapreneurship measures is high (see Stam and Stenkula, 2017).

[10] The data is available at http://gemconsortium.org/data.

[11] The online appendix is available at: https://1drv.ms/b/s!Aj3kGVvDCC7ngY9Rr3GfKGHza8IgUw?e=uYUMRf.

Formal institutional factors

To account for the influence of public institutional factors, we include the functioning of the public sector, the rule of law, government involvement in markets, as well as the stability and openness of political institutions. We measure the level of democracy as well as the constraints on the decision-making power of the executive branch.

For economic freedom, we use a total aggregate index as well as its five components (measured in 1995): (1) the size of government, (2) legal structure and security of property rights, (3) access to sound money, (4) freedom to trade internationally, and (5) regulation of credit, labor, and business.

Finally, we consider impartiality and professionalism. Impartiality measures if government officials treat everybody in the same situation in a similar manner. A high value of this measure indicates that those executing political power do not favor some groups or individuals. Professionalism captures that people get public positions by competence, not due to personal contacts.

Labor market and demographic factors

We include labor force participation (total and female) and rigidity of employment measures. Additional aspects include the mandatory minimum wage, and indices over employment laws, unemployment benefits, social security laws, and labor union power.

To cover human capital aspects and the quality of the labor force, we use the average years of schooling from 1985 to 1995, data on IQ, and life expectancy. Also, we consider four dimensions of diversity: income, ethnic, religious, and genetic.

Cultural and attitudinal factors

As empirical measures of cultural influences, we use the five cultural dimensions in Hofstede *et al.* (2010), namely, uncertainty avoidance, individualism, long-term orientation, masculinity, and power distance.

To measure trust, we use the standard formulation about generalized trust. Further, we use five questions on economic attitudes and the government's role in the economy included in the European Values Study and World Values Survey (EVS/WVS).

We cover potential influences from parents. The EVS/WVS survey asks individuals their opinion on which values parents ought to encourage children to learn. The ten priorities span a wide range of values (including "hard work" and "imagination"). We also include the share of non-religious in the year 1970.

Developmental and geographical factors

Our measure of economic development is GDP per capita. To measure the influence of communism, we use a variable, which takes the value one if the country's regime was communist in 1970.

More long-term historical variables measure the years since the Neolithic revolution (in logs), the percent at risk of malaria, population density in the year 1500, and state history (experience with an organized authority) in the year 1500. Geographical attributes of the countries included are the distance from the equator, latitude (measured from the North Pole), average temperature, and average precipitation. There is an indicator of the country being landlocked.

Instrumental variables

To strengthen a causal interpretation of our result, we complement our analysis by using instrumental variables (see section 5.4 for motivation and discussion of the instrument). The main instrumental variable is historical pathogens. We use historical constraints on the executive (an average across the years 1600–1850) as an additional instrument.

4 Method

Our main specifications are ordinary least squares regressions of the following form:

$$Intrapreneurship_i = \beta_0 + \beta_1 X_i + \varepsilon_i \qquad (1)$$

$Intrapreneurship_i$ captures the intrapreneurship rate in country *i*. A vector of independent variables is captured by X_i. We use robust standard errors to account for heteroscedasticity.

As we study a wide array of potential influences, model selection is crucial. The number of factors is too large to estimate the complete model meaningfully. It is in part because of issues with degrees of freedom, and also due to the difficulty of interpreting the estimates in a model with many conditioning variables. We apply two mechanical model selection methods: first, a LASSO model and second an Extreme Bounds Analysis. The first approach is global; it examines which factors are most important for explaining intrapreneurship while considering all influences. The second approach examines many limited or local models as it examines all possible combinations of up to four factors.

We use the two methods to rank the variables. The highest ranked variables are included in OLS models, one set of estimates for each method. The significant factors in those models are our strongest and most robust predictors of intrapreneurship.

4.1 LASSO

The first approach is a machine-learning method called the Least Absolute Shrinkage and Selection Operator (LASSO). It adds a term to the usual sum of squared deviations objective in ordinary least squares. The added penalty term is the sum of the absolute values of the estimated coefficients (betas). The parameter λ gives the weight of the penalty term.

The LASSO problem is to choose coefficients β such that

$$min_{\{\beta\}} \sum_{i=1}^{N} \left(y_i - \beta_0 - \sum_{j=1}^{p} x_{ij}\beta_j \right)^2 + \lambda \sum_{j=1}^{p} |\beta_j|$$

where *i* denotes observations and *j* the explanatory variables. *N* is the sample size and *p* the number of variables in the model, and $|\beta_j|$ denotes the absolute value of β_j.

The absolute values in the penalty term introduce corners in the optimization problem. Given a sufficiently high λ, only one coefficient will be assigned a non-zero value. By assigning zero to some coefficients, the LASSO shrinks the model.[12] The first non-zero value is assigned to the factor that most contributes to explaining the outcome. When reducing λ the model will select more factors. The added factors are those that most contribute to explain the outcome. LASSO ranks variables by the order they are selected (assigned a non-zero coefficient) when λ is changed from high to low values. For a thorough discussion of the method consult for example Hastie *et al*. (2009).

4.2 EBA

The second approach, Extreme Bounds Analysis (EBA), differs from the first model as it examines lots of partial models. For each variable, all combinations of up to three of the other factors are estimated in an OLS model. The share of such combinations in which the variable is significant at the 5% level is the basis of our ranking. We give the highest rank to the variable that most frequently is significant in all combinations of up to three additional variables. For each variable, there are over 41,000 such combinations. In total, we examined over 2.6 million combinations.

[12] OLS usually assigns non-zero coefficients to all factors.

The partial approach in EBA may assign a high rank to several variables that are strongly correlated, while LASSO's global approach would tend to pick one variable (the most important for explaining the outcome) among several highly correlated candidates.

5 Results

5.1 LASSO

Table 2 presents the results from the LASSO selection. Models starting with the most important variable in the first specification, and we add the other high ranked variables in subsequent specifications.[13] The five most important factors, in the order selected by LASSO, are Impartiality, Power distance, Control of corruption, Years of schooling, and Property rights (EFI component 2).

Impartiality is positive and strongly significant in all specifications. The large explanatory power of Impartiality reflects the high correlation noticed in Table 1.[14] Power distance, a cultural value towards accepting hierarchies, is negative and significant in the second specification but loses significance when we include the next set of factors. Control of corruption, an institutional measure closely related to impartiality, is significant and positive in the third model, yet loses significance as we include additional factors. Human capital, as captured by the average years of schooling, is positive and strongly significant in all specifications. Property rights, as measured by the second component of the Economic Freedom Index, are positive but insignificant in the last specification.[15] Results are similar when accounting for log GDP per capita, the labor force participation rate, the population share aged 65 and over, and the industry's share of GDP (see online Appendix 2, Table A1). All the added controls are insignificant.

Impartiality is a quantitatively significant factor. Increasing impartiality by one standard deviation corresponds to increasing intrapreneurship by 2.1 percentage points in the univariate model, compared to the average intrapreneurship rate of 3.1 percent. The effect also amounts to 0.85 of a standard deviation of intrapreneurship. The effect size is 0.36 in the richer

[13] The models are estimated on the same set of countries. Results are similar if each model is estimated on the full sample with available data.

[14] Not only Impartiality but also Control of corruption, Property rights (EFI component 2), Rule of law, Government effectiveness, and Regulatory quality explain over half the Intrapreneurship variation in a univariate model. Impartiality's high R-squared is shared with several other institution measures, further supporting the importance of good institutions for flourishing intrapreneurship.

[15] Variance inflation factors (VIF) do not raise concerns of multicollinearity as they are below the usual threshold of 10.

models.[16] The point estimate of human capital indicates that if the average years of schooling in a country increase with one year, the average intrapreneurship level will increase by about 0.3 percentage point. The effect size of human capital is 0.25 in the richer model (column 5 of Table 2) and 0.67 in a univariate model.[17] Both of the strongest predictors have quantitatively significant estimates, which make the results policy relevant.

5.2 EBA

Table 3 presents the estimates with the EBA selected variables. The most frequently significant variables are Impartiality, years of schooling, Power distance, Control of corruption, and the Rule of law. Of these variables, three capture institutional quality: Impartiality, Control of corruption, and the Rule of law.[18] The LASSO model selected two of these variables: Impartiality and Control of corruption. The other variables selected by both approaches are Human capital and Power distance.

The results are similar to the previous table: Impartiality and Human capital are the strongest predictors of intrapreneurship, and the effect size is about the same as in the previous table. Power distance and Control of corruption lose significance as we include more factors. The last column reports that Impartiality and human capital are significant at the 5% level in 99.6% and 98.4%, respectively, of all model combination indicating a very high stability. Sign stability of the estimated coefficients is higher still, as seen in column 7. When accounting for log GDP per capita, the labor force participation rate, the population share aged 65 and over, and the industry's share of GDP, the estimates on the added controls are insignificant, while the estimates on Impartiality and years of education do not change much (see online Appendix 2, Table A2).

5.3 Discussion

Both methods select impartial institutions as one of the strongest predictors, but it is strongly related to several other institutional measures. Although impartial institutions are the stronger influence, it is hard to distinguish it from the control of corruption measure.[19]

[16] The effect size is sometimes referred to as beta coefficients. It is computed as the estimate multiplied by the standard deviation of that variable as a fraction of the standard deviation of the dependent variable.

[17] The univariate model with years of schooling yields a point estimate of 0.768.

[18] Variance inflation factors are all below the threshold 10 in models 1 through 4 in Table 3. In model 5 the VIFs for Control of Corruption and Rule of Law increase above 10, raising concerns of multicollinearity between these variables. However, the point estimates in model 4 and 5 are very similar for Impartiality, Years of schooling, and Power Distance indicating that the collinearity does not affect those results.

[19] Impartiality and control of corruption are highly correlated with a correlation coefficient of 0.87. Yet, when both are included in the model Impartiality is the strongly significant predictor of intrapreneurship.

This point also comes back when we use the Elastic Net method as an additional robustness check. It is adjacent to the LASSO method that adds the penalty from ridge regression to the model, that is, it adds the sum of the squared coefficients (betas) to the objective function (and the parameter α assigns the weight to the LASSO penalty and 1-α is the weight of the ridge regression penalty). The LASSO tends to pick one factor among several highly correlated factors, while the Elastic Net may include several of the highly correlated factors. The Elastic Net selects Impartial institutions as the most important factor but also includes Control of corruption among the most important influences (using *α=0.9*), indicating that both institutional factors are important.

Besides impartial institutions, both LASSO and EBA select human capital (average years of schooling) as an important predictor of the intrapreneurship rate in a country. The importance of human capital supports the view in Stam (2013) that intrapreneurship at the country level is positively related to human capital investments, albeit based on a very limited dataset. Our analysis substantiates its importance with newer data and another method. It is also well in line with microdata research analyzing the willingness or probability of a person to become an intrapreneur (e.g., Bosma *et al.*, 2010, 2011, 2012b; Bager and Schøtt, 2011, Parker, 2011, and Nyström, 2012). A high level of individual human capital facilitates the recognition of entrepreneurial opportunities.

Power distance is a third factor that both methods rank high. It is also significant when first included indicating a certain level of robustness, although not as robust as impartiality and human capital. The findings indicate that cultural differences may also contribute to intrapreneurship and innovation more generally.

Power distance expresses the degree to which the less powerful members of a society accept and expect an unequal distribution of power. The fundamental issue here is how a society handles inequalities among people. People in societies exhibiting a large degree of power distance accept a hierarchical order where everybody has a place and which needs no further justification. In societies with low power distance, people strive to equalize the distribution of power and demand justification for inequalities of power. This factor might capture the idea that a low power distance in the society might spur job autonomy among employees in the firms, which enhances intrapreneurship (see Elert *et al.*, 2019, and Stam and Stenkula, 2017).

As a point of comparison to intrapreneurship, Nikolaev et. al. (2018) study entrepreneurship using an EBA-like approach. They find that some aspects of economic freedom

The correlations of Impartiality with two other institutional factors selected by LASSO or EBA, property rights (0.77) and rule of law (0.85), are also high but Impartiality turns out to be the strong predictor also relative these institutional measures.

such as stable monetary policy and low corruption, and less income inequality, is associated with higher levels of entrepreneurship. They find no evidence of effects from cultural values or human capital, underscoring that several pertinent factors that affect entrepreneurship may differ from intrapreneurship.

5.3.1 Causality

To interpret the estimates causally, one must believe the relationships estimated are not due to endogeneity. Such guarantees can never be made. Yet, our approach can relieve some concerns. First, the explanatory variables predate the intrapreneurship measure used. Second, by considering a wide set of factors as well as many facets of related factors, such as dozen measures of formal institutions, we reduce the concern that we do not include important factors in the analysis. Third, the explanatory factors examined are all taken from sources that have collected them for different reasons than to explain intra- or entrepreneurship. The factors are not constructed to explain intrapreneurship, which could introduce endogeneity. The next section offers further evidence on causality.

5.4 Instrumental variables

What have shaped institutions across the world? The growth literature has found geography and, in particular, the microbiota (germs like bacteria, viruses, fungi, etc.) in different locations, an important factor (see, e.g., Diamond, 1997). Locations more hospitable to people, with fewer pathogens, shape better institutions in the sense that the institutions promote economic development. More pathogens tend to make societies more insular and to decrease the economic and social interaction between groups, which does not promote development. The effect of geography on development works only through institutions (see Easterly and Levine, 2003, Rodrik *et al*., 2004, as well as Acemoglu *et al*., 2001).

Historical pathogens are a plausible instrument for Impartiality, our measure of institutional quality. Historical pathogens are strongly related to current institutional quality, as verified in the analysis below. The growth literature, referenced in the previous paragraph, finds that pathogens only affects development through institutions, supporting the exclusion restriction. Instrumental variable estimates could provide more convincing evidence of a causal effect of Impartiality on intrapreneurship.[20]

[20] Two studies that relate pathogens to innovation and inequality are Nikolaev et al. (2017) and Bennett and Nikolaev (2020).

Table 4 presents the second stage estimates of an instrumental variable (two-stage least squares) model. The first stage is strong, as indicated by the F-statistic of 66 for the exclusion of the instrument in the first stage.[21] The point estimate on Impartiality is 2.3 and strongly significant. The point estimate does not change noticeably as geographical and historical controls are added to the model in columns 2 through 4.[22] The first stage is not as strong, as pathogens correlate strongly with geographical variables, in particular distance to the equator, but stay above the frequent threshold for the F-statistic of 10.

To further examine the evidence against the exclusion restriction, we add historical constraints on the executive as an instrument (in addition to historical pathogens). Online Appendix 2, Table A4, presents the second stage results. The point estimate on Impartiality in column 1 is here very similar to the estimate in Table 4. With two instruments, we test the overidentifying restriction. The p-value on the Hansen J-test does not present any evidence against the exclusion restriction. Neither does the models 2 through 4, providing further evidence in favor of a causal effect of Impartiality on intrapreneurship.

6 Conclusion

This paper has analyzed a wide range of factors, based on earlier literature, that might influence the level of *intrapreneurship* at the country level using machine-learning technique. We find that impartial institutions and human capital are the two strongest and most robust predictors of intrapreneurship based on LASSO and EBA methods. By examining a broad set of potential determinants, we provide robustness in terms of allowing many facets of society to influence intrapreneurship. The LASSO approach considers the full set of influences and selects the most influential factors. The EBA method is a brute force method as it considers all combinations of smaller sets of influences. As both approaches yield the same strongest factors, it alleviates concerns that the results are due to one particular method. We use an instrumental variable approach to strengthen a causal interpretation of the results.

Impartiality could capture the quality of government more broadly as an important factor determining the level of intrapreneurship in a country.[23] The importance of impartiality for entrepreneurial activity has been found in earlier empirical work by political scientists in

[21] The first stage estimates are presented in online Appendix 2, Table A3.
[22] We include controls that are pre-determined as potentially endogenous controls could bias the results.
[23] Six different institutional measures explain over half the variation in intrapreneurship when considered individually. The six measures are highly correlated, and all indicate that good institutions promote intrapreneurship. Among these measures, Impartiality stands out as the most important factor. This is not due to a lack of closely related alternatives, there are five highly correlated alternative measures, but because Impartiality has the strongest relationship with intrapreneurship.

Nistotskaya *et al.* (2015). Specifically, they argue that entrepreneurial activities often require costly asset specific investments and complex transactions. This idea may also apply to intrapreneurship, although they do not consider it in their analysis.

Treating citizens in a non-discriminatory fashion encourages entrepreneurial activity as it facilitates the estimation of expected return on investments and reduces the uncertainty in economic activities. Impartiality may also promote a market for innovations. This market could involve services to help with commercializing innovations or other inputs in the innovative process, and a market for trading innovations at different stages of development. Thicker markets for inputs into innovation and commercialization, as well as markets for trading innovations, may in turn raise the expected value of innovations, further fueling a virtuous cycle of innovation and market thickness.

From a policy perspective, our paper stresses the importance of supporting both a high quality of the government, with an emphasis on impartiality, and a high level of human capital to promote intrapreneurship. It may indeed be one channel through which institutions affect economic growth, i.e., impartial institutions promote intrapreneurship that generates growth.

Public policy may be important to develop the market for innovations. Measures may include setting up dispute and arbitration mechanisms to settle conflicts between innovators on the one hand, and service providers and innovation buyers, on the other hand, such that they can impartially settle disputes. Theses mechanisms could be run by or monitored by the government. The government could also help with reducing information asymmetries, for example, by setting up hubs informing about the actors in the innovations market, facilitating reputation building (by rating or certifying actors in the market), and possibly by matching innovators with service providers. Many of these policy measures would not only be helpful for intrapreneurs but also entrepreneurs.

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Tables

Table 1. Summary statistics and correlations of the main variables.

			Correlations			
Variable	Mean	Std. Dev.	Intrapreneur.	Impartiality	Schooling	Power dist.
Intrapreneurship	3,09	2,51	1,00			
Impartiality	4,35	1,13	0,85	1,00		
Years of schooling (1985-95 average)	7,55	2,18	0,67	0,62	1,00	
Power distance (Hofstede)	0,61	0,21	-0,72	-0,63	-0,54	1,00
GDP per capita (log), 1995	8,84	0,90	0,70	0,74	0,64	-0,64
Life expectancy (at birth)	71,8	8,08	0,62	0,74	0,53	-0,47
IQ	90,5	10,2	0,50	0,60	0,56	-0,31
Non-religious fraction (in 1970)	0,08	0,15	-0,10	-0,05	0,13	0,17
Female labor force participation	43,3	13,2	0,38	0,28	0,35	-0,20
Labor force participation (working age)	55,2	10,3	0,19	0,08	0,00	0,01
Rigidity of employment (WDI)	29,5	18,0	-0,40	-0,26	-0,35	0,27
Mandatory minimum wage	0,75	0,43	-0,50	-0,46	-0,28	0,63
Employment laws index	0,50	0,18	0,02	0,16	0,09	-0,01
Unemployment benefits index	0,55	0,37	0,36	0,41	0,55	-0,38
Social security laws index	0,61	0,20	0,44	0,44	0,56	-0,43
Old age, disability, and death benefit index	0,60	0,12	0,39	0,36	0,23	-0,28
Labor union power index	0,45	0,18	-0,06	-0,05	0,19	0,01
Democracy (polity2)	6,08	5,83	0,36	0,33	0,55	-0,42
Communist regime (in 1970)	0,20	0,40	-0,16	-0,20	0,14	0,25
Constraints on the executive	4,79	1,90	0,64	0,58	0,54	-0,74
Professionalism	4,16	0,98	0,68	0,77	0,38	-0,46
Control of corruption (WBGI)	0,43	1,03	0,81	0,87	0,58	-0,72
Government efficiency (WBGI)	0,52	0,96	0,79	0,85	0,63	-0,72
Rule of law (WBGI)	0,36	0,93	0,79	0,85	0,58	-0,73
Regulatory quality (WBGI)	0,48	0,86	0,74	0,80	0,62	-0,69
Political stability (WBGI)	0,21	0,91	0,70	0,77	0,59	-0,60
Voice and accountability (WBGI)	0,37	0,89	0,68	0,71	0,67	-0,70
Economic Freedom Index (EFI), 1995	6,61	1,16	0,55	0,56	0,35	-0,54
EFI component 1 (size of government)	5,74	1,80	-0,39	-0,40	-0,30	0,38
EFI component 2 (property rights)	6,55	1,68	0,76	0,77	0,51	-0,74
EFI component 3 (access to sound money)	7,11	2,64	0,45	0,47	0,21	-0,45
EFI component 4 (freedom to trade)	7,47	1,52	0,66	0,72	0,63	-0,65
EFI component 5 (regulation)	6,14	1,18	0,46	0,39	0,27	-0,43
Luck (vs. effort) determines outcomes	4,40	0,76	0,32	0,34	0,25	-0,25
Competition is harmful (vs. good)	3,68	0,55	0,14	0,27	0,19	-0,004
Gov't ownership over firms (more vs. less)	5,12	0,84	-0,62	-0,57	-0,54	0,69
Government should take more responsibility	5,86	0,94	-0,61	-0,53	-0,42	0,53
Zero-sum wealth views	4,61	0,65	0,17	0,23	0,23	-0,02
Trust	1,71	0,17	-0,53	-0,43	-0,27	0,48
Individualism (Hofstede)	0,43	0,23	0,59	0,54	0,59	-0,68
Masculinity (Hofstede)	0,48	0,19	-0,33	-0,34	-0,17	0,14
Uncertainty avoidance (Hofstede)	0,66	0,23	-0,39	-0,26	-0,07	0,33
Long term orientation (Hofstede)	0,47	0,24	0,03	0,18	0,24	0,02
Gini of income	40,3	10,0	-0,51	-0,48	-0,45	0,40
Ethnic fractionalization	0,39	0,25	-0,36	-0,37	-0,34	0,25
Religious fractionalization	0,60	0,25	0,00	-0,05	-0,27	-0,06
Genetic diversity	0,72	0,03	0,27	0,25	0,23	-0,35
Independence	0,49	0,15	0,35	0,22	0,12	-0,32
Hard work	0,49	0,23	-0,55	-0,48	-0,25	0,58
Feeling of responsibility	0,70	0,12	0,19	0,34	0,17	-0,16
Imagination	0,19	0,08	0,43	0,40	0,19	-0,34
Tolerance and respect	0,67	0,11	0,50	0,63	0,32	-0,44
Thrift	0,35	0,13	-0,34	-0,26	-0,20	0,42
Determination and perseverance	0,34	0,11	0,08	0,22	0,22	0,00
Religious faith	0,36	0,24	-0,40	-0,44	-0,53	0,41
Unselfishness	0,31	0,12	0,00	-0,02	-0,15	0,09
Obedience	0,36	0,16	-0,46	-0,43	-0,63	0,42
Distance to equator	0,35	0,19	0,57	0,56	0,64	-0,58
Latitude	23,7	26,9	0,46	0,41	0,45	-0,35
Average temperature	16,0	8,6	-0,53	-0,55	-0,74	0,48
Average precipitation	90,1	58,0	-0,13	-0,10	-0,26	0,26
Landlocked	0,13	0,34	0,14	0,12	0,17	-0,37
Years since Neolithic revolution (log)	8,42	0,59	-0,04	-0,06	-0,08	0,16
Percent risk of malaria	0,12	0,28	-0,32	-0,41	-0,39	0,41
State history year 1500	0,50	0,24	0,04	0,08	-0,16	-0,06
Population density year 1500	1,94	1,18	0,32	0,37	0,11	-0,27

Notes: Variables and sources are described in the electronic supplementary material.

Table 2. Determinants of Intrapreneurship: LASSO selected variables.

Dependent variable: Entrepreneurial Employee Activity

	(1)	(2)	(3)	(4)	(5)
Impartiality	1.885	1.482	0.978	0.785	0.798
	(0.205)***	(0.228)***	(0.350)***	(0.333)**	(0.353)**
Power distance (Hofstede)		-3.222	-2.433	-2.116	-2.107
		(1.489)**	(1.518)	(1.323)	(1.346)
Control of corruption			0.737	0.611	0.484
			(0.359)**	(0.332)*	(0.551)
Years of schooling (1985-95 avg)				0.273	0.267
				(0.096)***	(0.093)***
Property rights (EFI component 2)					0.081
					(0.247)
Constant	-5.091	-1.384	-0.009	-1.366	-1.842
	(0.870)***	(1.722)	(1.904)	(1.895)	(2.999)
R-squared	0.603	0.645	0.665	0.697	0.698
Observations	58	58	58	58	58

Notes: The dependent variable is Entrepreneurial Employee Activity, averaged across the 2014, 2015, 2016, and 2017 survey waves of the Global Entrepreneurship Monitor.
Robust standard errors in parenthesis. Significance stars, * p<0.1, ** p<0.05, *** p<0.01.

Table 3. Determinants of Intrapreneurship: EBA selected variables.

Dependent variable: Entrepreneurial Employee Activity						Across all EBA combinations	
						Significance rate	Sign stability
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Impartiality	1.858	1.443	1.154	0.758	0.775	99.6%	99.9%
	(0.196)***	(0.223)***	(0.217)***	(0.319)**	(0.316)**		
Years of schooling (1985-95 avg)		0.332	0.292	0.269	0.284	98.4%	99.8%
		(0.102)***	(0.100)***	(0.095)***	(0.096)***		
Power distance (Hofstede)			-2.802	-2.159	-2.215	96.3%	99.6%
			(1.325)**	(1.314)	(1.345)		
Control of corruption				0.622	1.094	96.0%	99.7%
				(0.329)*	(0.723)		
Rule of law					-0.604	89.7%	97.8%
					(0.789)		
Constant	-4.953	-5.651	-2.402	-1.189	-1.297		
	(0.820)***	(0.848)***	(1.591)	(1.799)	(1.785)		
R-squared	0.609	0.658	0.690	0.703	0.706		
Observations	59	59	59	59	59		

Notes: The dependent variable is Entrepreneurial Employee Activity, averaged across the 2014, 2015, 2016, and 2017 survey waves of the Global Entrepreneurship Monitor. Robust standard errors in parenthesis. Significance stars, * p<0.1, ** p<0.05, *** p<0.0 1. Column 6 reports the share of all model combinations of the EBA in which the variable is significant at the 5% level. Column 7 reports the share of all model combinations in the EBA in which the sign is the same as displayed in the table. The EBA examines over 2.6 million comb inations.

Table 4. Instrumenting for Impartiality: historical pathogens.

Dependent variable: Entrepreneurial Employee Activity

	(1)	(2)	(3)	(4)
Impartiality	2.333	2.283	2.197	2.266
	(0.272)***	(0.544)***	(0.492)***	(0.517)***
Latitude		0.003	0.001	-0.001
		(0.010)	(0.010)	(0.011)
Distance to the equator		0.910	1.641	2.734
		(2.195)	(2.270)	(2.193)
State history (year 1500)		1.168	1.108	1.355
		(1.116)	(1.003)	(1.098)
Population density (year 1500)		-0.067	-0.066	-0.070
		(0.031)**	(0.026)**	(0.027)***
Years since Neolithic revolution (log)		0.053	0.308	0.216
		(0.712)	(0.648)	(0.645)
UK legal origin			1.127	1.184
			(0.699)	(0.691)*
French legal origin			-0.062	0.107
			(0.536)	(0.508)
Malaria risk				2.018
				(1.333)
Constant	-7.103	-7.665	-9.836	-10.034
	(1.236)***	(6.615)	(5.864)*	(5.659)*
F-stat for exclusion of instrument	66,06	11,26	10,62	10,88
R-squared	0.625	0.671	0.707	0.710
Observations	54	54	54	54

Notes: The dependent variable is Entrepreneurial Employee Activity, averaged across the 2014, 2015, 2016, and 2017 survey waves of the Global Entrepreneurship Monitor. Impartiality is instrumented with historical pathogens. Second stage estimates from the two-stage least squares model presented. Robust standard errors in parenthesis. Significance stars, * p<0.1, ** p<0.05, *** p<0.01.

Figure 1. Intrapreneurship rates across the world.