



Entrepreneurship, culture, and the epigenetic revolution: a research note

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Abstract We show how the type of alcohol consumed is related to the type of entrepreneurship present for economies in Europe. We differentiate between beer-, wine-, and spirit-drinking countries and distinguish between productive, unproductive, and destructive entrepreneurship. The underlying links do not emerge from drinking per se but rather the drinking habits and taste for beverage types capture deep cultural features and cultural similarities amongst the countries. Societies that prefer to drink beer are closer to each other culturally than those which prefer drinking wine or spirits. Therefore, the taste for alcohol type is merely an instrument in explaining cultural and institutional differences across entrepreneurship. Broadly speaking, beer-drinking countries are characterized by higher shares of productive entrepreneurship, wine-drinking countries with unproductive entrepreneurship, and spirit-drinking countries with destructive entrepreneurship. We discuss mechanisms in which the results are found and highlight a new research agenda, emphasizing the potential role of epigenetics.

Keywords Entrepreneurship · Informal institutions · Culture · Europe · Epigenetics

JEL classification E02 · E14 · L26 · O52 · Z10

1 Introduction

Baumol (1990) contributed to the body of entrepreneurship literature by differentiating between three entrepreneurship types; productive, unproductive, and destructive entrepreneurship. The productive entrepreneurship includes activities that are wealth creating, unproductive covers activities that merely re-distribute existing rents, and destructive one destroys economic rents and wealth. His thesis largely is a product of Schumpeter's (1934) idea that the long-run growth of an economy is dependent on its ability to exploit innovations. Baumol theorized that across countries, the total supply of entrepreneurs can vary but the productive contribution of the various types of entrepreneurial activities varies even

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more, and it is the rules of the game created by institutions that influence the distribution of those activities in a society. The institutions refer to the quality of prevailing economic, political, and legal institutions which incentivize individuals to choose where to allocate their efforts. The prevailing economic environment also comprises of the cultural climate which takes part in determining the distribution of the individuals' efforts and thus the type of entrepreneurship present in an economy, and this is where our paper provides a contribution.

What we know up to this day about entrepreneurship is plenty. We have research showing that entrepreneurship is linked to economic growth through innovations, employment, and productivity (Hopenhayn 1992; Wennekers and Thurik 1999). It has also been proposed that the relative stability of the differences in entrepreneurial activity across countries suggests that other factors, such as culture, drive the difference (Grilo and Thurik 2005; Blanchflower 2000). Much of the earlier research focuses on determining the economy-wide differences in the *level* of entrepreneurship instead of, in line with our interest, differences in the *type* of entrepreneurship. The emergence of, for example, the Global Entrepreneurship Monitor (GEM) data (Acs et al. 2004), has recently made possible to distinguish between opportunity and necessity entrepreneurship which is positive progress in accounting for the diverse types of entrepreneurship, but much is still to be known on what determines the allocative efficiency of different entrepreneurial activities.

Baumol himself noted, the rules of the game change slowly, and he circumvented this by providing historical cases on the matter. We do not use different cases across historical points in time rather than link the types of entrepreneurship with a measurement that approximates the rules of the game, or cultural similarity. What we argue is that a country's culture can be approximated by the alcohol type they consume the most, i.e., their taste for the alcohol type, and link this to the type of entrepreneurship found most in that economy. We group the countries based on whether they consume the most in per capita terms beer, wine, or spirits as well as further group them according to also their second choice of beverage. The idea of this paper is not to provide evidence using advanced econometric methods to squeeze out convincing causal links, since we are not arguing that drinking beer will make you a productive entrepreneur. What we argue is that what we measure is something more fundamental; measuring culture in broad

terms as the taste for specific alcohol types is deeply rooted in the culture and history of a given society. So, at its core, what we are measuring is not alcohol consumption, but rather we more fundamentally measure how informal institutions, i.e., culture or cultural similarity, is related to the productivity of entrepreneurship. By doing so, we also capture potentially other common features the countries have, such as regulatory, development, or other institutional similarities.

Our paper provides a contribution in focusing on a direct channel in which culture is important for economic outcomes, such as entrepreneurship. This suggests that culture—in a broad sense—is related to the distribution of entrepreneurial efforts in an economy. What our results show is that in countries where the main type of alcohol consumed is beer, there is more productive entrepreneurship present than in other countries. On a similar note, economies where individuals mostly consume wine are dominated with unproductive entrepreneurship, and countries that mostly consume spirits have a larger share of destructive entrepreneurship. This entails that all activities are found in each country groups, but they are most predominant in countries according to the prevalent culture. The relationships hold in general when we expand our groupings of countries to differentiate between first and second choices of the beverage types which is more refined grouping of countries and of cultural and other institutional similarities and in addition when we look at countries across the globe.

The link between culture and economic outcomes has not been historically clear. Culture, for example, is difficult to quantify and does not have a uniform definition across fields or researchers together with culture being slow to change. There is evidence of culture affecting economic outcomes such as risk-taking (Mihet 2013) and economic growth and development (Dieckmann 1996; Weber 1965). Europe emerges as a good geographic area to study as countries located there trade and share both goods and labor intensively across borders and share some common historical events such as war, but yet have some divergent patterns of economic, cultural, and historical outcomes. Tabellini (2010) proposes that trust as a cultural value has in part determined the European regional development. Our data shows that the three groups of countries are mainly distributed approximately so that the beer-drinking countries are in North, wine-drinking countries in South,

and the spirit-drinking countries in East Europe (see Fig. 1 in Section 3). This entails a geographical concentration of cultural proximity for Europe.

Finally, we provide a discussion in which we provide alternative micro-mechanisms which might be driving our results and provide a fruitful research agenda where research is scant and future research effort should put emphasis on. We discuss the relationship between institutions and culture, then go into the genome-wide evidence on entrepreneurship and lastly introduce albeit not directly test that epigenetics being the underlying mechanism in how culture affects entrepreneurship. We propose that institutions, culture, and genetics are all linked through epigenetics, a scientific field which has gained increasing attention by biologists, medicine, and the likes in the recent decade, and suggest that we need more evidence on how the environment changes how the genes are expressed which has implications for entrepreneurship and growth (Carey 2012).¹

2 Background and literature

Baumol (1990) theorizes that entrepreneurship is present, in one form or another, at all times, and it always plays a role in an economy. He defines productive entrepreneurship as a set of entrepreneurial activities that create economic value such as innovative actions. On the other hand, unproductive entrepreneurship includes activities which merely redistribute already existing rents, such as tax evasion and other redistributive activities, and destructive entrepreneurship as “discovery of a previously unused legal gambit that is effective in diverting rents to those who are first in exploiting it.” (Baumol 1990, p. 897). Those include activities which destroy economic value, such as crime and terrorism. One plausible way for an entrepreneur to destroy inputs is through gaining political power and therefore influencing institutions (Desai et al. 2013). Ever recently, in line with our interest, there has been a growing interest in explaining and investigating the allocation of entrepreneurship (Bowen and De Clercq 2008; Sobel 2008; Weitzel et al. 2010). However, many have concentrated on the differentiation between productive and unproductive entrepreneurship and neglect the destructive one, with exceptions such as, e.g., Desai

et al. (2013), who propose a theoretical model on destructive entrepreneurship.

It is important and interesting to look at Baumol’s distinction of the three types of entrepreneurship as entrepreneurship is a complex phenomenon. Productive entrepreneurship is mostly predominant in the countries closest to the technological frontier, and thus, if only looking at these countries, it might be sufficient to focus solely on this type of entrepreneurship. However, for questions interested in explaining the development gap of countries and understanding why countries grow, the distinction of the entrepreneurship types is vastly important as the different entrepreneurship types can possibly be attributed at least partly to explain growth, or the lack of it; for example, Huggins and Thompson (2014) propose that the link between culture and development is mediated by entrepreneurship. This is also the reason fundamentally why understanding the allocation of productive activities in a society and possible reasons for them, such as culture, is valuable.

2.1 Informal institutions and entrepreneurship

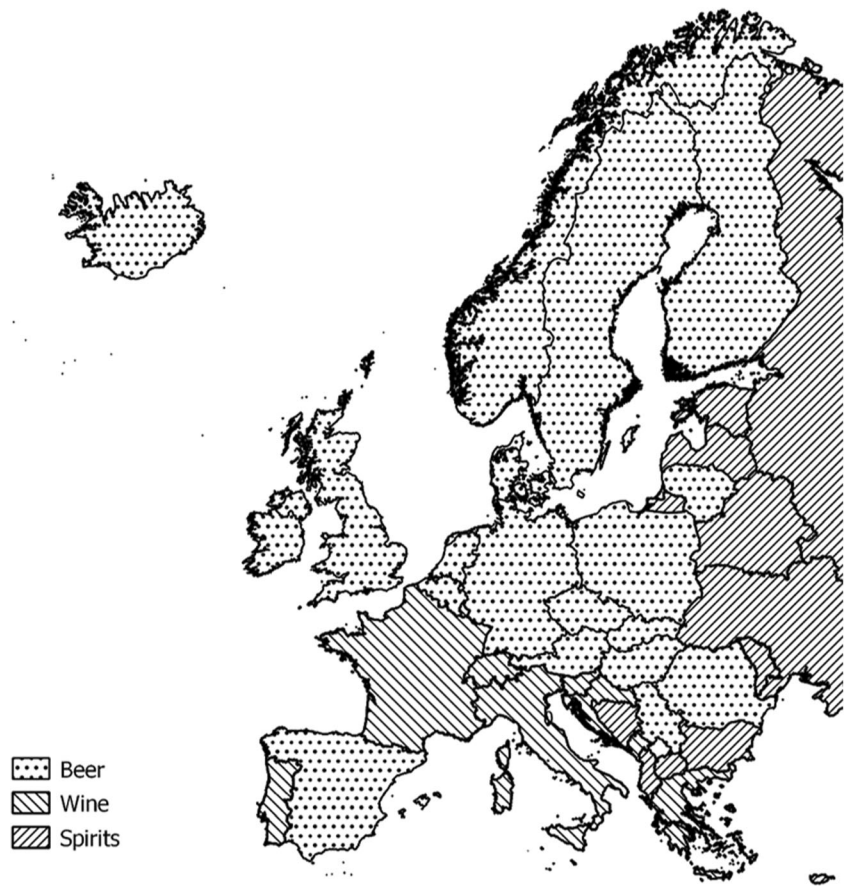
The notion that institutions incentivize and support human behavior has been widely researched in the past (Acemoglu and Robinson 2012; North 1990; Hall and Jones 1999). The rules of the game change both across time and differ across countries. The rules of the game present in a society comprise both of formal and informal institutions in which we focus on the informal institutions, namely, culture.² However, culture as a term does not have a universal definition. Inglehart (1997) defines culture as the set of basic common values which contributes to shaping people’s behavior in a society. A complementary definition by Guiso et al. (2006) states that culture includes those customary beliefs and values that ethnic, religious, and social groups transmit fairly unchanged from generation to generation. This implies that culture is slow to change (Roland 2004).³ Economists (and other researchers) have measured culture largely by utilizing survey data, looking at second-generation immigrants, and collecting experimental evidence (Alesina and Giuliano 2015).

² This is given we take North (1990) definition of formal and informal institutions. As written previously, we also however possibly also capture some similarities in the formal institutions.

³ See Alesina and Giuliano (2015) for a deep discussion on theoretical and empirical definitions of culture.

¹ <https://www.youtube.com/watch?v=kp1bZEUgqVI>

Fig. 1 Map of distribution of countries based on the taste for alcohol



In general, institutions impacting entrepreneurship has been recognized by quite some time now (Parker 2009; Davidsson and Henrekson 2002; Blau 1987). Much of this line of research focuses on tax incentives or different labor market policies and their relation to entrepreneurship. However, Wennekers et al. (2002) argue that the cross-country variations in the level of entrepreneurship are the result of differences in institutional and that of cultural components. On the other hand, Elert and Henrekson (2017) and Henrekson and Sanandaji (2010) argue that entrepreneurship is also a driver for institutional change, and therefore, the relationship between institutions and entrepreneurship is bilateral.

There has been work explicitly focusing on the impact of culture to entrepreneurship and entrepreneurial outcomes for quite some time now; see Hayton et al. (2002) and Cacciotti and Hayton (2017) for reviews of the literature. Therefore, it is not a new idea that culture affects entrepreneurship. For example, Chakraborty et al. (2016) present a formal model of the evolution of culture

and entrepreneurship. Frederking (2004) shows that it is the organization of culture that is relevant for entrepreneurs and their business activities. Complementarily, Huggins and Thompson (2015) find that local social values play an important role in fostering entrepreneurial resilience. Davidsson (1995) defines two ways in which culture can affect entrepreneurship: (i) a supportive culture would lead to social legitimation, which makes the entrepreneurial career more valued and socially recognized, and (ii) a culture sharing more pro-entrepreneurial values and patterns of thinking can lead to more individuals showing psychological traits and attitudes consistent with entrepreneurship.

Culture and entrepreneurship have gained attention at the regional level (e.g., Krueger et al. 2013; Davidsson 1995), and there also exists cross-country evidence linking national culture and entrepreneurship. For example, Freytag and Thurik (2007) show that individuals in post-communist countries are less likely to prefer being self-employed. Wennekers et al. (2007) provide evidence for a large set of OECD countries and find

positive correlations with uncertainty avoidance and business ownership. Similarly, Dheer (2017) finds that culture is related to entrepreneurship across nations through its moderating effect of political freedom, corruption, and education. Pinillos and Reyes (2011) are two of many to link an individualistic-collectivistic orientation to entrepreneurship. Therefore, much of previous macro-level evidence would support entrepreneurship to being related to national culture.

As described previously, the availability of new data has embarked exceptions to fill in the gap on the role of institutions, such as culture, and the type of entrepreneurship present. For example, Bowen and De Clercq (2008) find that institutions matter for the allocation of entrepreneurial effort, and Hechavarría and Reynolds (2009) focus on the opportunity and necessity entrepreneurship division and the role of culture in determining the type of entrepreneurship present in an economy. Harms and Groen (2017) find national culture being related to new business ownership but not to high-growth or social entrepreneurship in a cross-country setting. Liñán and Fernández-Serrano (2014) study the European Union countries and their divergent entrepreneurship patterns and their relationship with culture. The most directly and closely related to our intentions, Sobel (2008) tests Baumol's theory empirically. However, he tests only the productive and unproductive entrepreneurship and uses one country in his analysis. So even though there is previous empirical evidence on the relationship between national culture and entrepreneurship in general, we contribute by bringing new evidence on culture and the different productive types of entrepreneurship for a large group of countries together with measuring culture in a new innovative manner. The clear shortcoming of this line of research is that all measure the effects of institutions on the quantity of entrepreneurship and usually on productive entrepreneurship while not considering that the effects might differ for the distribution of entrepreneurship types.

3 Data and method

We provide a new proxy for measuring cultural similarities if not of culture explicitly by the use of the taste for a specific alcohol type derived from data on national alcohol consumption. Mandelbaum (1965) notes that drinking behavior is considered important for the whole social order in many economies which

leads to drinking being defined from the fundamental motifs of the culture. Lintonen and Konu (2003) show that the beverage choice type reflects the substance use patterns and attitudes. We also know that individual drinking behavior is influenced by the surrounding society or "cultural position on drinking" (MacAndrew and Edgerton 1969; Room and Mäkelä 2000). Aizenman and Brooks (2008) study specifically the cultural consumption patterns for wine and beer and show that wine for example does have a cultural side to its consumption. Consequently, the aggregate consumption of alcohol can be both a measurement of the prevailing culture (direct effect) and an outcome of the culture (indirect effect). There is evidence that drinking habits are different across European countries (Kuntsche et al. 2004) even though some have found convergence for the preference of beverages type (Leifman 2001). But changes in drinking patterns alter slowly, taking up to a generation to change (Simpura and Karlsson 2001).

Country-level data on alcohol consumption on beer, wine, and spirits are readily available across European economies and provided by the World Health Organization (WHO). The WHO defines alcohol consumption as the recorded amount of alcohol consumed per capita for population above 15 years over a calendar year in a country in liters of pure alcohol.⁴ As alcohol is heavily taxed and many public authorities put much concern on alcohol consumption, there exists historical data for large sample of countries. Our data does under-report some alcohol use as it excludes stockpiling, waste and spillage, cross-border shopping, tax-free alcohol, surrogate alcohol, and variations in beverage strength. Even though the data is by no means perfect, it suits our purposes as it does differentiate between the consumption of the three alcohol types.

We can measure some permanent component for taste for alcohol type and therefore a cultural aspect that is attached, especially because we measure aggregate consumption of the type of beverage per capita as an average across 1990 to 2014 for each of the included European economy. As we are not

⁴ There are some discrepancies amongst the reports of countries. Italy reports consumption for the population above 14 years, and Sweden for over 16 years. In some countries (e.g., Luxembourg), the national sales do not accurately reflect actual consumption by residents, since purchases by non-residents may create a significant gap between national sales and consumption.

interested in the short-run variation in the consumption of different types of alcohol, rather than seek to capture the more permanent component of the taste for beverage, we are interested in smoothening out the temporal and cyclical variation in the consumption as there is evidence showing that macroeconomic shocks in general can affect alcohol consumption (de Goeij et al. 2015; Ruhm and Black 2002). We list countries based on their taste for beer, wine, and spirits using the mean value of the consumption of each type. A country is defined as beer drinking if it consumes beer the most out of the three categories nationally with similar rationale for the other two groups. This allows us not to be concerned about the differences in the volumes rather than measure the taste for alcohol type. The mean values of consumption per capita are presented in the [electronic supplementary material](#).

Figure 1 shows that beer-drinking countries in general reside in the northern part of Europe with some countries in the Eastern and Balkan parts, such as Romania and Serbia, and Spain in the south. The wine-drinking countries include Mediterranean countries together with France and Luxemburg which are categorized more of northern/middle European countries. The spirit-drinking countries are located mainly in the Eastern part of Europe together with some Balkan countries. Clearly, the beer-drinking group is the largest out of the three with 20 economies included which forms half of the countries in our sample. The 9 wine-drinking countries total 22.5% and the 11 spirit-drinking countries the rest 27.5%.

We compare our grouping of countries to traditionally used cultural measures, such as general trust and Hofstede's 6 cultural dimensions together with a development indicator expressed as gross domestic product (GDP) per capita across the country groups.⁵ We present these in Table 1 for both mean and median values.

Table 1 shows that majority of the traditional cultural measures differ across our grouping of countries. This further validates our cultural measure to include certain

cultural aspects in the European countries included. In some cases, for example, masculinity vs femininity, the difference between beer- and wine-drinking countries does not seem vastly different. This implies that our division of culture might not capture cultural differences exhaustively, but this should be seen as a rough proxy for the cultural similarities.

A natural concern arises from the fact that if a country mainly consumes beer instead of wine or spirits, there is still much heterogeneity amongst countries grouped in these broad categories. Therefore, we further group countries based on their first and second choices of the beverage consumed which results in 6 broad country groups presented in Table 2.

Table 2 shows that the largest group is the one that consumes most beer and secondly wine with 14 countries listed which equalates to 35% of the total sample. Countries with beer as a first choice and spirits as a second and those with wine as a first choice and beer as a second both have 6 countries (15%) in their respective groups. There are 3 countries that prefer wine as a first option and spirit as a second, namely, France, Greece, and Montenegro, amounting to 7.5%. Countries that prefer spirits as a first choice and beer secondly form the second largest group with 25% with 10 countries. Moldova is the only country in Europe to prefer firstly spirits and secondly wine. We map the countries to show their geographical distribution.

When mapping the countries based on their first and second choices, we see that some differences appear in comparison with Figs. 1 and 2. Countries with beer as a first choice and wine as second are largely found in the northern part, with Spain as an exception in Southern Europe. Countries that prefer beer as a first choice and spirits second are located close to the eastern border, excluding Ireland, somewhat further away geographically from the rest of the countries. The countries that consume firstly wine and secondly beer are located south with Luxembourg in the middle of Europe. France is further away from Greece and Montenegro, all which are wine-drinking countries who secondly consume spirits. The spirit-drinking countries are the same as in Fig. 1, but now with Moldova as the only country that prefers wine secondly.

As Sobel (2008) notes, one of the issues in testing Baumol's theory is that the three entrepreneurship variables are in actuality unobserved. To construct our measures of the types of entrepreneurship, we use a set of variables that are crude approximations while

⁵ Trust measure is derived from Values Surveys EVS/WVS Waves 1–4 (1981–2004) and retrieved from <http://www.jdsurvey.net/jds/jdsurvey/Maps.jsp?Idioma=l&SeccionTexto=04&NOID=104>. Hofstede's 6 cultural dimensions, power distance, individualism vs collectivism, masculinity vs femininity, uncertainty avoidance, and long-term orientation, are collected from <https://geerthofstede.com/research-and-vsm/dimension-data-matrix/>. GDP per capita is measured as average value from 2000 to 2014 and taken from the World Bank.

Table 1 Grouping of countries and traditional cultural measures

	Beer	Wine	Spirits
Trust	71.7 [62.35]	53.6 [53.9]	46.1 [48.4]
Power distance ^{1a}	49.0 [42.0]	57.4 [61.5]	61.8 [57.0]
Individualism vs collectivism ^a	62.6 [63.0]	49.6 [47.5]	49.8 [49.5]
Masculinity vs femininity ^a	48.1 [47.0]	47.5 [46.5]	28.8 [33.0]
Uncertainty avoidance ^a	65.4 [65.0]	84.1 [83.0]	75.8 [74.0]
Long-term orientation	54.0 [52.0]	57.4 [61.0]	73.2 [70.5]
Indulgence	49.0 [56.0]	42.7 [48.0]	25.2 [16.0]
GDP per capita	31203[38225]	33257[22387]	7362 [4483]

Values presented as averages and values in closed brackets are medians

¹Data are not available for all of our included European countries. Nineteen countries in beer category, 8 in wine category, and 4 in spirits category

optimizing the country coverage as many commonly used data sources cover mostly the beer-drinking economies. The three measures of entrepreneurship are all calculated by using their average value of each type for 2000 to 2014 nationally but there are differences in the data coverage across the countries. We use average

Table 2 Grouping of countries according to first and second choice

1st choice beer, 2nd wine (beer-wine)		
Austria	Iceland	Serbia
Belgium	Malta	Spain
Denmark	Netherlands	Sweden
Germany	Norway	United Kingdom
Hungary	Romania	
1st choice beer, 2nd spirits (beer-spirits)		
Czech Republic	Ireland	Poland
Finland	Lithuania	Slovakia
1st choice wine, 2nd beer (wine-beer)		
Croatia	Luxembourg	Slovenia
Italy	Portugal	Switzerland
1st choice wine, 2nd spirit (wine-spirits)		
France	Greece	Montenegro
1st choice spirits, 2nd beer (spirits-beer)		
Albania	Cyprus	Former Republic of Macedonia
Belarus	Estonia	
Bosnia and Herzegovina	Latvia	Ukraine
Bulgaria	Russian	
1st choice spirits, 2nd sine (spirits-beer)		
	Republic of Moldova	

Based on average of per capita consumption for 1990–2015

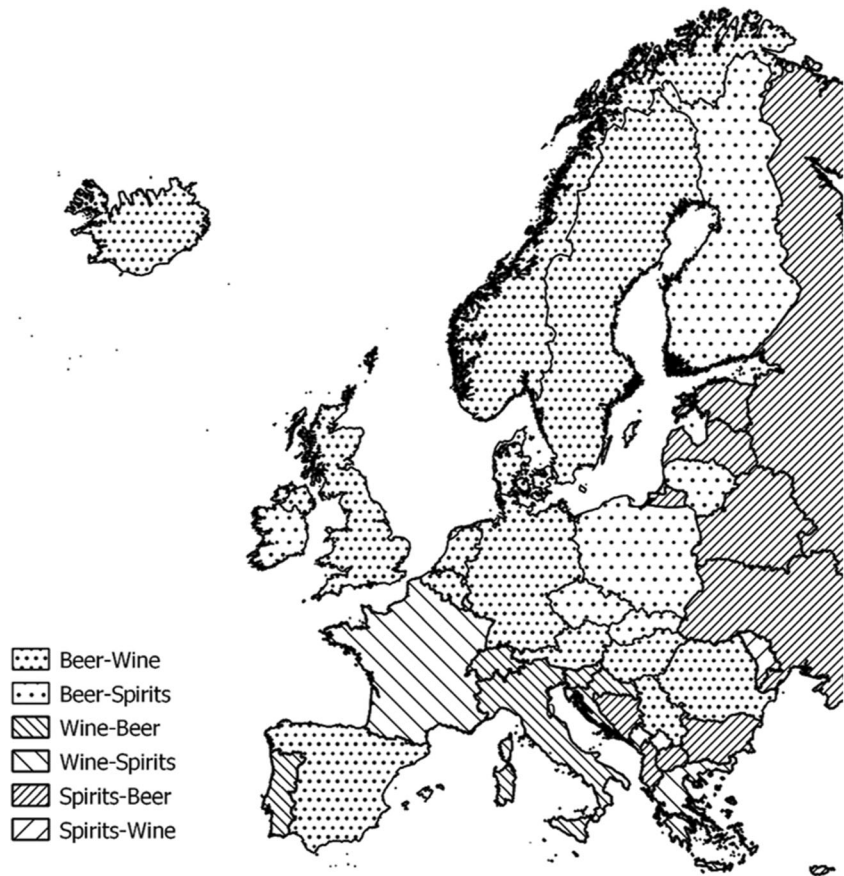
values because we do not wish to identify how changes in culture affect the changes in our entrepreneurship measures as culture changes slowly. We wish to compare values across countries, and thus, the time period is selected as data for most countries is available during the time period, and it is long enough to cover fluctuations in the business cycle. We also run alternative estimations with other possible proxies for the entrepreneurship variables, and the alternative measures are aligned with Sobel (2008).

We measure productive entrepreneurship by the research and development (R&D) expenditure both in the private and public sectors. The very idea of spending on R&D is to invest resources in innovative activities which in the future will provide a return. Even though some of the investments of R&D do not result in being successful, the intention to begin with is to create something new (wealth). The R&D expenditure is measured as a share of gross domestic product and provided by the World Bank’s World Development Indicators database. To validate our measure of productive entrepreneurship, we instead use patents per capita and opportunity-driven total early stage entrepreneurship, and comparative results are presented in Appendix Tables 7 and 8.⁶

As a measure of a county’s unproductive entrepreneurship, we add the percentage of personnel in the armed forces from the total labor force. The variable captures the overall military activity of an economy and the higher the total employment in the armed forces, the more resources in terms of

⁶The number of patent applications is from the World Bank and opportunity-driven total early stage entrepreneurship from Global Entrepreneurship Monitor (GEM).

Fig. 2 Map of distribution of countries based on the wider taste for alcohol



labor are allocated in unproductive activities which can be entrepreneurial by nature.⁷ The armed forces personnel are defined as active duty military personnel, including paramilitary forces if the training, organization, equipment, and control suggest they may be used to support or replace regular military forces. The data is provided by the World Bank's World Development Indicators database. To verify our unproductive entrepreneurship measure, we add a measure of foreign lobbyist spending in the USA for the year 2017, and it is measured as non-government spending in lobbying activities per 100,000 inhabitants, and in addition, we also include the total number of registered in-house lobbyists and trade/business/professional associations aimed at influencing EU policy making per

⁷ However, there has been recent discussion in the role of the government and military in the creation of innovation and even for obtaining human capital for the individuals employed in armed forces. On the other hand, one might argue that large military might even be destructive for the economy, for example, in some cases with war.

100,000 inhabitants.⁸ The comparative results are presented in Appendix Tables 7 and 8.

Our measure of destructive entrepreneurship needs to account entrepreneurial activity that in general destroys economic value. Crime rates would be ideal, but they have a problem with inconsistencies in the reporting as the wealthier and more developed countries report crimes more often since their justice and legal systems work more efficiently than countries where crime might be more common but is largely under reported. Therefore, we

⁸ The foreign lobby watch uses the semi-annual reports; foreign agents are required to file with the US Department of Justice under the Foreign Agents Registration Act (FARA) to measure the different registrants acting on behalf of foreign interests, i.e., spending which is aimed at influencing US policy or public opinion. The data is from the Center for Responsive Politics, and for a few countries, only government spending is available instead of non-government spending. The number of lobbyist organizations in Europe is provided by the Transparency Register. Neither one of these measures are perfect as in both cases, it is non-random which countries have incentives to lobby for their interest specifically in the USA or in EU. As far as the authors are aware, within-country lobbying activities for the 40 European countries are not available.

approximate destructive entrepreneurship by corruption. Corruption can not only be seen as an institution but corruption also is a destructive action itself. Broadly, this measures the possibility for actions that are destructive but corruption itself is a form of destructive entrepreneurship as political corruption is entrepreneurial. The data come from Transparency International who publishes a yearly index for perceived corruption called the Corruption Perceptions Index (CPI). The index is constructed by using surveys on corruption from various sources and aggregating them to a single index. We subtract the index from 100 to make the values more easily interpretable. These results indicate that a higher value of the index indicates more corruption.

We summarize each of the three entrepreneurship types for the included European countries in our sample.

As Table 3 shows, the share of R&D is the largest in Sweden (3.40%), Finland (3.39%), Denmark (2.70%), and Germany (2.59%) and the smallest in Bosnia and Herzegovina (0.099%), Albania (0.121%), the former Yugoslav Republic of Macedonia (0.276%), and Cyprus (0.374%). The average value for R&D investments for our whole data set is 1.29% implying that there is variation across the European countries in their investment in productive entrepreneurship. For the share of labor in armed forces, we see that the highest shares arise from Montenegro (5.33%), Belarus (3.53%), Greece (3.24%), and Bulgaria (2.19%). On the other hand, the smallest are in Iceland (0.076%), Ireland (0.486%), Netherlands (0.562%), Germany (0.590%), and the UK (0.593%). One explanation to these differences can also be accounted to their relative position, i.e., presence of American military bases, NATO, as well as historical reasons such as civil war. Some of these countries, Belarus, Cyprus, and Greece, are amongst the few in Europe with mandatory military service.⁹ On average, for the whole dataset, 1.35% of the labor is employed in armed forces implying yet again variation across European countries. Countries that have the highest corruption (highest CPI score) are Montenegro, Ukraine, Russia, and Albania implying that countries with the most corruption in Europe seem to be in East Europe and the Balkan area. Meanwhile, the least corrupt (lowest CPI score) countries are Finland, Denmark, Sweden, Iceland, and Switzerland.

We show the distribution of these three different entrepreneurship measures is grouped over our culture distinctions by using box-and-whisker plots or so called

box plots which originate from the work of Tukey (1977). The box plots are a non-parametric way to describe the distribution of the underlying data by the use of quartiles. The boxes are presented so that the spacings between the different parts show the spread and skewness of the data at the same time indicating possible outliers that exist using dots. The band within the box shows the median of the data. We also run ordinary least squares (OLS) estimates of the form:

$$y_i = \alpha + \gamma_1 W_i + \gamma_2 S_i + \varepsilon_i \tag{1}$$

where outcome variables y_i are the three entrepreneurship types and are run in separate estimations. W_i and S_i denote whether county i is a wine- or spirit-drinking country, respectively. As the variables are dichotomous, the base is defined as the beer-drinking countries, i.e., the estimated coefficients are with respect to the base group. ε_i is the conventional error term. All the variables are measured as averages across a time horizon, as described earlier, and thus, the estimations provide correlations across the averages. When we look at first and second preferences, the equation then becomes:

$$y_i = \beta + \delta_1 BS_i + \delta_2 WB_i + \delta_3 WS_i + \delta_4 SB_i + \delta_5 SW_i + \varepsilon_i \tag{2}$$

where now the base is beer-drinking economies that secondly prefer wine. The variables are denoted as B indicating for beer, W for wine, and S for spirit, and the order of the letter denoting first and second preferences.

4 Results

We firstly present evidence dividing the countries based on first preferences alone for the three entrepreneurship measures using box-plots to show the distribution of the entrepreneurship variables respectively.

Figure 3a shows that countries that drink beer have higher productive entrepreneurship when looking at the median. Wine-drinking countries come in second and the countries that prefer spirits have the lowest activity. The distribution of R&D within the three country groups is in line with what we argue. As seen in Fig. 3b, the beer-drinking country group has the lowest median value of share of armed forces (less than 1%) out of the three country groups. There is one outlier for the beer-drinking groups, i.e., Serbia, with a value slightly higher than 2%.

⁹ Bulgaria had until it was abolished in 2007.

Table 3 Summary of productive, unproductive, and destructive entrepreneurship

Country	R&D (%)	Armed forces (%)	CPI
Albania	0.121	1.643	70.7
Austria	2.472	0.766	21.5
Belarus	0.682	3.525	70.3
Belgium	2.019	0.806	27.8
Bosnia and Herzegovina	0.099	1.271	66.3
Bulgaria	0.516	2.195	61.1
Croatia	0.858	1.745	59.8
Cyprus	0.374	2.105	39.3
Czech Republic	1.362	0.682	54.6
Denmark	2.697	0.747	6.1
Estonia	1.239	0.974	37.2
Finland	3.393	1.107	6.1
France	2.134	1.209	30.3
Germany	2.587	0.590	21.6
Greece	0.635	3.243	58.3
Hungary	1.055	0.996	49.2
Iceland	2.565	0.076	11.0
Ireland	1.326	0.486	25.6
Italy	1.153	1.710	53.2
Latvia	0.537	0.702	56.2
Lithuania	0.790	1.569	51.0
Luxembourg	1.538	0.688	15.6
Malta	0.562	1.234	41.3
Montenegro	0.773	5.328	61.3
Netherlands	1.805	0.562	12.6
Norway	1.605	1.022	13.3
Poland	0.667	0.937	54.1
Portugal	1.100	1.645	37.1
Republic of Moldova	0.422	0.651	70.7
Romania	0.434	1.698	65.5
Russian Federation	1.121	1.868	75.4
Serbia	0.659	2.117	66.6
Slovakia	0.602	0.798	57.0
Slovenia	1.782	1.216	39.4
Spain	1.161	1.033	34.0
Sweden	3.399	0.751	8.5
Switzerland	2.675	0.667	12.1
The former Yugoslav Republic of Macedonia	0.276	1.722	64.7
Ukraine	0.897	1.158	76.2
UK	1.635	0.593	18.5

All variables are measured as mean values for 2000 to 2014

For the wine-drinking group, there appear two outliers: Montenegro with 5.3% and Greece with 3.2% of employment in armed forces. The wine- and spirit-drinking countries have approximately the same median value of the share of labor in armed forces even though the rest of the distribution diverges. On the other hand, Fig. 3c shows that the countries that consume spirits have a median value that is well above the other two groups, i.e., are more corrupt. The differences between the groups seem relatively pronounced with beer-drinking countries having the median value clearly below the others. The distribution of the beer-drinking countries and their values of CPI is however widespread.

Instead of looking at the distribution of the entrepreneurship types based on box plots, we estimate Eq. 1 by the use of ordinary least squares.

From Table 4, it is rather clear that especially the spirit-drinking country groups are largely and significantly different from the beer-drinking group for all of the entrepreneurship variables. In addition, they are also statistically different from the wine-drinking country group all except for the unproductive entrepreneurship variable, share of labor in armed forces. The wine-drinking group however is statistically significantly different from the beer-drinking group only when looking at the share of labor in armed forces.¹⁰ For the productive entrepreneurship, the coefficient is negative implying that there is less research and development in the wine-drinking country on average. For the corruption perception index, the wine-drinking country group does have a higher value than the beer-drinking group.

4.1 Second preferences

However, one could argue that it is too crude to divide the countries based on only their first preferred beverage. We therefore further divide the countries based on their first and second choices of alcohol type and provide similar box plots as above.

The pattern that appears is qualitatively rather similar than shown in Fig. 3a–c. The beer-wine group has the highest share devoted to R&D when looking at the median value with high variance. Finland presents as an outlier for beer-drinking countries with spirits as a second choice that has a substantial share of its GDP devoted to R&D (3.39%). Ignoring Finland, the beer-

¹⁰ It should be kept in mind that we have 40 observations; thus, the results and the statistical significance should be cautiously interpreted.

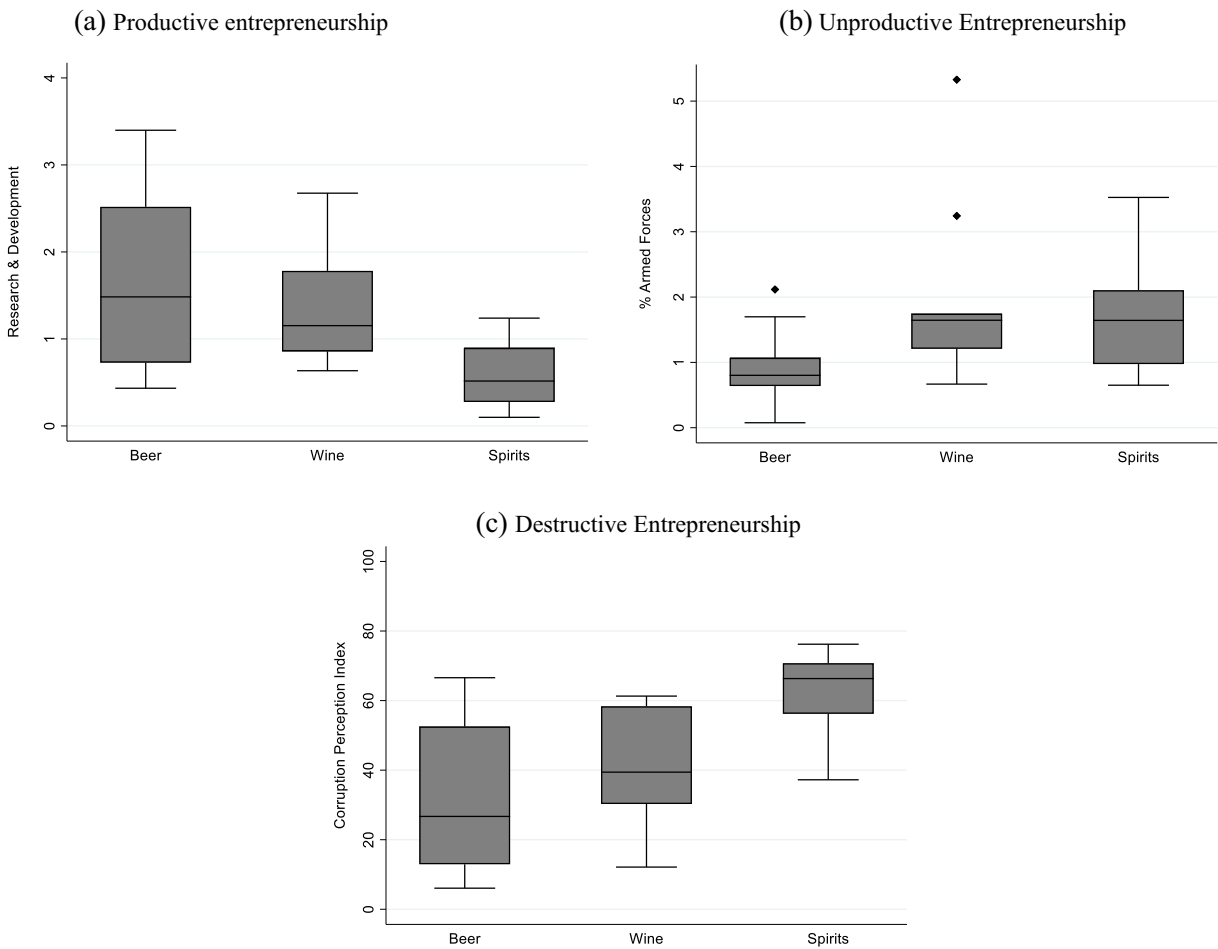


Fig. 3 a Productive entrepreneurship. b Unproductive entrepreneurship. c Destructive entrepreneurship

spirit country group has a median which is lower than both the beer-wine and wine-beer countries. Both spirit-drinking groups have clearly lower shares of R&D; with a median close to 0.5%. Figure 4 b teases out the two outliers that belong to the wine-spirit group as the median value of the share of armed forces from the labor force is now highest for that group. The median value for the wine-beer group now is slightly lower than that of the spirit-beer group. Belarus stands out as an outlier amongst the spirit-beer countries with 3.5% of the labor force employed in armed forces. Both the beer-drinking groups have low median values as well as the whole distribution compared with other groups apart from Serbia (2.1%) and Romania (1.7%) having extreme values for the beer-wine group. For the destructive entrepreneurship in Fig. 4c, the beer-drinking countries preferring secondly wine have clearly the lowest CPI value while countries secondly preferring spirits have a

higher value than wine-beer countries. Both wine-drinking groups have higher median values than the beer-wine group implying that they score on average higher on the CPI. Both spirit-drinking country groups have the highest values of the CPI and score the highest in CPI than the other country groups.

We run an ordinary least squares estimate as described by Eq. 2 with the different entrepreneurship variables separately (Table 5).

The results convey a similar story as the figures previously. For the R&D, all the groups exhibit a coefficient that is less than the reference group with smaller estimates for wine-drinking countries and even smaller for spirit-drinking countries. The *R*-square suggests that the grouping of countries explains 30% of the cross-country variation, and this naturally means that culture does not exhaustively explain the variation in the entrepreneurship levels but is suggested to be a large

Table 4 OLS—Europe

Dependent variable	R&D	Armed forces (%)	CPI
Wine	-0.2345 (0.3107)	1.011*** (0.3519)	8.513 (7.471)
Spirits	-1.068*** (0.2906)	0.6909** (0.3291)	30.28*** (6.987)
Constant	1.640*** (0.1731)	0.9284*** (0.1960)	-67.72*** (4.162)
R^2	0.271	0.208	0.338
No. of countries	40	40	40
$F(1,37)$ (H_0 , wine = spirits)	5.75**	0.66	6.77**

Base is beer. Standard error in parentheses. ***1%, **5%, and *10% level of significance. CPI values reversed which means a higher value indicated more corruption

component. For the share of labor in armed forces, the wine-drinking countries with spirits as their second choice has the largest coefficients as expected. The two beer-drinking country groups do not seem to have any major differences between them as the beer-spirit coefficient is close to 0. The spirit-wine group, i.e.,

Moldova, even has a lower coefficient than the base group does. The fit of the simple model is 0.456 which implies that the cross-country variation in the unproductive entrepreneurship is captured by a sizable proportion when grouping the countries. The estimations pronounce numerically what the box plots show; all

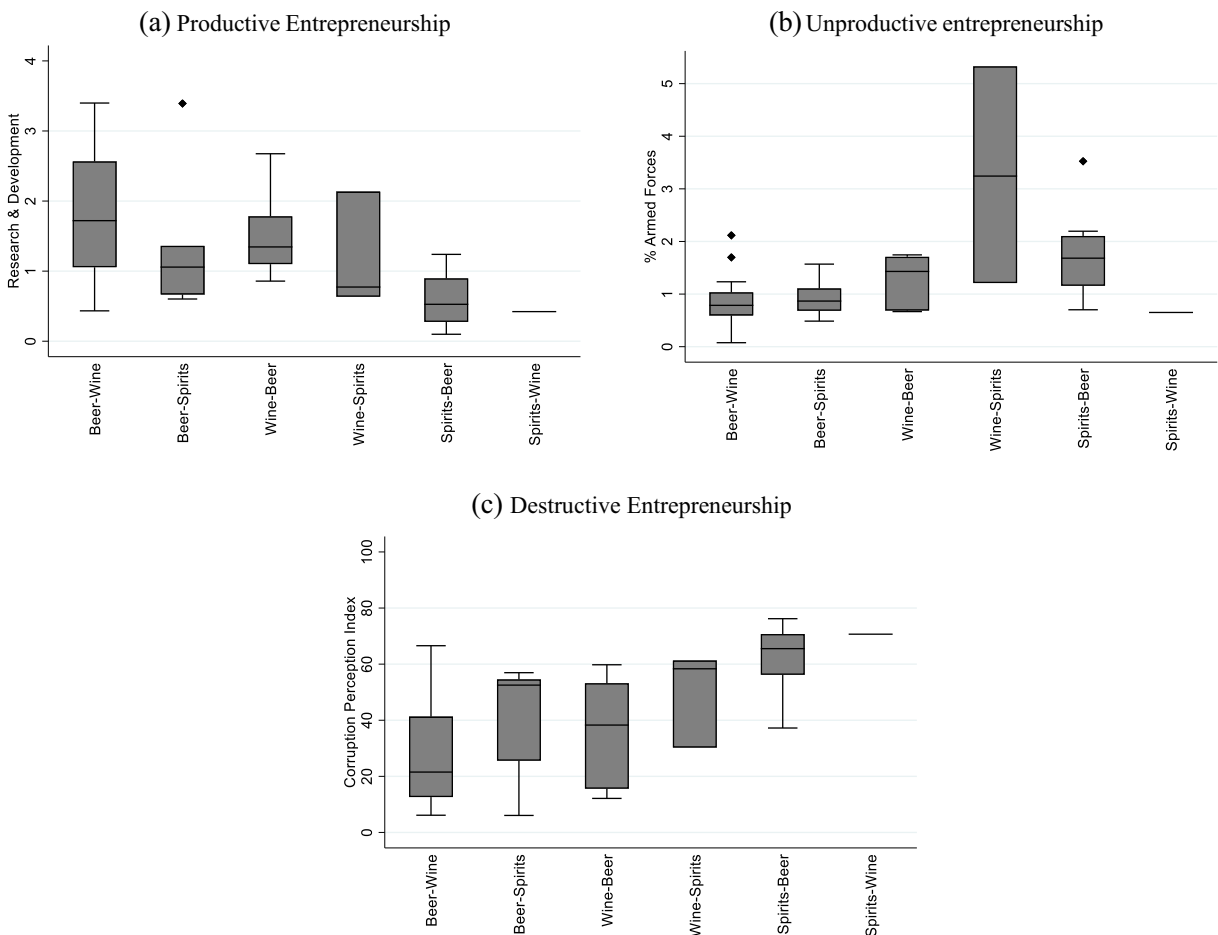


Fig. 4 a Productive entrepreneurship. b Unproductive entrepreneurship. c Destructive entrepreneurship

Table 5 OLS

Dependent variable	R&D	Armed forces (%)	CPI
Beer-spirits	-0.4045 (0.3856)	0.0019 (0.3700)	12.98 (9.036)
Wine-beer	-0.2435 (0.3856)	0.3506 (0.3700)	7.822 (9.036)
Wine-spirits	-0.5804 (0.5028)	2.332*** (0.4825)	21.58* (11.78)
Spirits-beer	-1.175*** (0.3272)	0.7884** (0.3140)	33.36*** (7.667)
Spirits-wine	-1.339 (0.8180)	-0.2771 (0.7850)	42.29** (19.17)
Constant	1.761*** (0.2112)	0.9279*** (0.2027)	-71.61*** (4.949)
R ²	0.302	0.456	0.398
No. of countries	40	40	40

Base is beer-wine. Standard error in parentheses. ***1%, **5%, and *10% level of significance. CPI values reversed which means a higher value indicated more corruption

countries have more corruption on average than the baseline, beer-wine. Moldova has the largest positive coefficient with spirit-beer and wine-spirits following.

Here the *R*-square is nearly 0.40 which would imply that cultural differences are important in explaining differences in also destructive entrepreneurship.

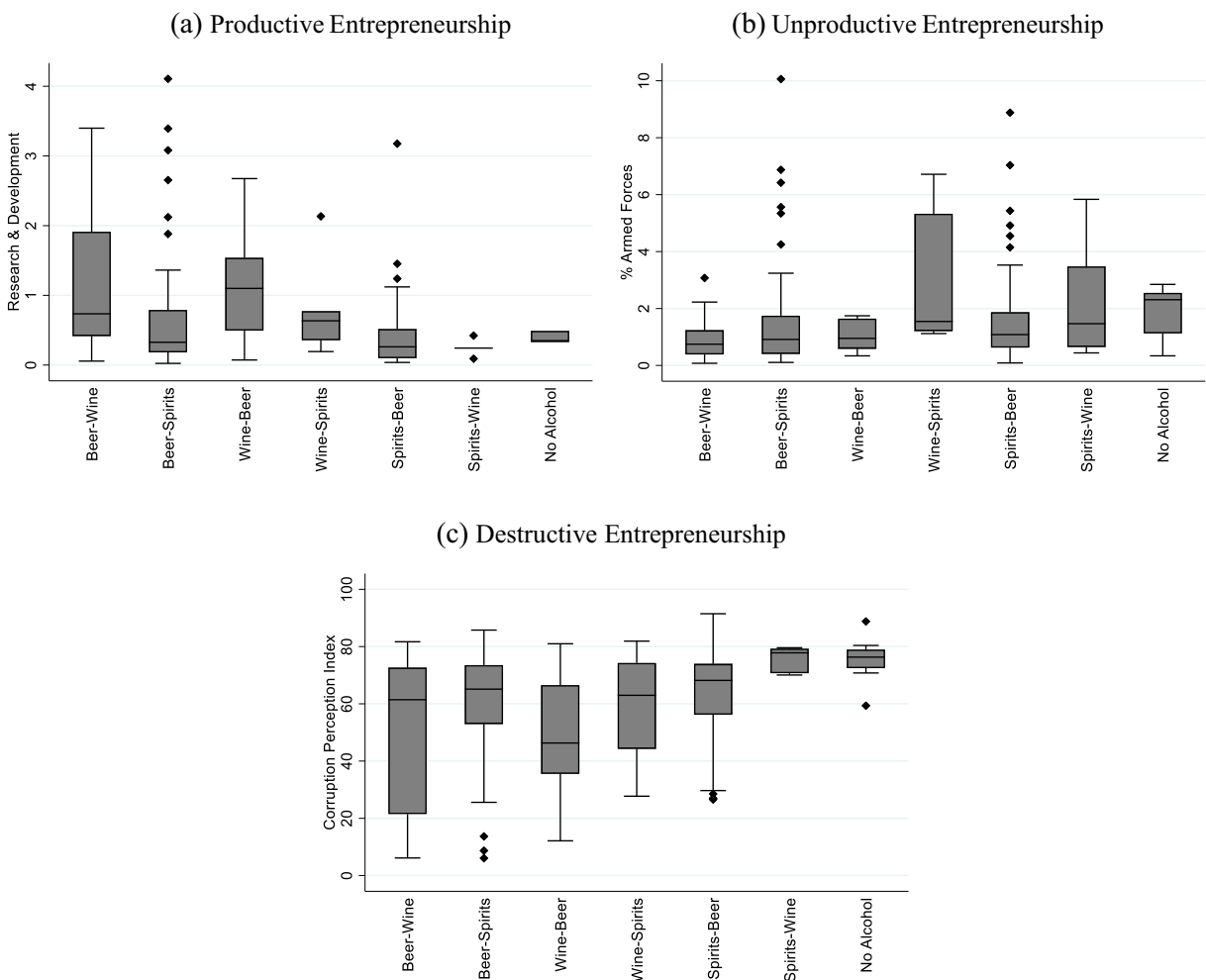


Fig. 5 a Productive entrepreneurship. b Unproductive entrepreneurship. c Destructive entrepreneurship

Table 6 OLS

Dependent variable	R&D	Armed forces (%)	CPI
Beer-spirits	-0.4185** (0.2027)	0.7171* (0.3675)	10.61** (4.142)
Wine-beer	-0.0546 (0.3168)	0.1925 (0.5982)	-3.038 (6.939)
Wine-spirits	-0.3483 (0.4014)	2.064*** (0.6896)	9.052 (7.583)
Spirits-beer	-0.7311*** (0.2059)	0.8245** (0.3717)	13.16*** (4.199)
Spirits-wine	-0.9176** (0.4014)	1.207* (0.6895)	25.34*** (8.012)
No alcohol	-0.7764 (0.5022)	1.016 (0.6530)	25.40*** (7.583)
Constant	1.167*** (0.1562)	0.8782*** (0.2884)	-49.96*** (3.271)
R^2	0.121	0.073	0.126
No. of countries	129	168	180

Base is beer-wine. Standard error in parentheses. ***1%, ** 5%, and *10% level of significance

4.2 The whole world

A natural question arising after our evidence is that how generalizable are our findings? Are the results arising because of the specific European context? What does this mean for countries where alcohol is banned altogether or simply individuals do not consume alcohol? We conduct the same exercise for all countries that have available data from the used data sources across the world. We include countries that have data on alcohol consumption and at least one entrepreneurship variable. This means that we have maximum of 180 countries, and a list of the countries included and data availability and associated numerical values of the entrepreneurship variables are provided in the electronic supplementary material. The countries that report zero sales on at least two of the alcohol types are coded as countries without alcohol sales.

Figure 5 a, b, and c show comparable results as when only looking at the European countries. In contrast, now we see more outliers in all three entrepreneurship variables. Some caution should be taken when looking at the results since now we are including countries with very diverse backgrounds, levels of development, size, level of alcohol consumption, and location. We run OLS estimates for the entire sample of countries for reference which is again based on Eq. 2 (Table 6). We provide evidence in Appendix Table 9 for estimations where we look at first choices only.

The results for all the entrepreneurship types are fairly in line with what we find for the European case. For the productive entrepreneurship, all the coefficients are negative with the spirit-drinking countries the lowest. For the unproductive entrepreneurship, the largest

coefficient is for wine-drinking countries that prefer spirits as a second choice followed by the spirit-drinking countries. For destructive entrepreneurship, the same as previously is found except for the negative coefficient for wine-beer countries. The countries that have no alcohol consumption seem to behave in a comparable manner as those countries that prefer spirits, i.e., have a high share of destructive entrepreneurship and higher share of labor in armed forces and lower investments in R&D than those of beer-wine. The grouping of the countries seems to do worse for explaining the cross-country variation on the level of the type of entrepreneurship with lower R -squares which can be expected but in general still provides similar results than that of countries located in Europe.

What our paper does not account for are within-country variations in culture and the type of entrepreneurial activity. There is a vast research agenda in estimating how individuals with diverse cultural backgrounds have different economic and behavioral outcomes (Oosterbeek et al. 2004; Fern et al. 2009). There are micro-level differences in culture even within a country but there is no compelling reason the relationship would not be the same in a more micro-level setting. The empirical exercise of conducting the same analysis for more micro-detailed level of aggregation is left for future research. In addition, one limitation of the study is that we do not provide causal impact of culture to entrepreneurship rather than provide evidence that the two are related. Therefore, more evidence on how and why culture affects entrepreneurship and in specific different types of entrepreneurship is highly advised and further elaborated below.

5 Discussion

Our results find evidence of the grouping of countries based on their culture being associated with the presence of different entrepreneurship types. Our paper confirms in line with existing literature that culture matters for entrepreneurship and contributes by providing evidence that culture matters for the productivity of entrepreneurship. Together with the before-mentioned limitations, our study phases which should be addressed in future research, why culture affects entrepreneurship, should be further discussed and tested in a micro-level. We discuss the relationship between institutions and culture, then go into the genome-wide evidence on entrepreneurship and lastly introduce albeit not directly test that epigenetics being the underlying mechanism how culture can affect entrepreneurship. We propose that institutions, culture, and genetics are all linked through epigenetics and suggest that we need more evidence on how the environment changes how the genes are read which has implications for entrepreneurship and growth.

The quality of institutions being crucial for economic growth in a society is well established (e.g., Acemoglu et al. 2001; Rodrik et al. 2004). Also, the link between institutions and entrepreneurship has gained attention previously (Baumol and Strom 2007; Bosma et al. 2018). It has been proposed that countries with weak institutions actually could incentivize unproductive or destructive entrepreneurship while not incentivizing productive entrepreneurship (Murphy et al. 1993; Parker 2009). However, Alesina and Giuliano (2015) point out: “Culture and institutions are endogenous variables determined, possibly, by geography, technology, epidemics, wars, and other historical shocks.” They stress that institutions and culture have a two-way causal relationship instead of one only affecting the other. Therefore, we acknowledge that our results might also pick up some institutional similarities and not only cultural similarities. However, it is the formal and the informal institutions in combination with the physical nature that comprise the environment in which the individuals interact. This implies that the environment impacts the behavior of individuals through several means, for example, providing incentives, access to education or capital, or health, which on the other hand impact entrepreneurship. This suggests that in

institutions, culture and genetics are all linked through epigenetics (Selye 1955).¹¹

Instead of looking for explanations from the external environment affecting entrepreneurship, recent studies have linked the genetics of individuals and entrepreneurial tendencies (Nicolaou et al. 2008a, 2008b). More specifically, they find certain genes being associated with the tendency for being an entrepreneur largely argued coming from genetic variations in the dopamine receptors (Nicolaou et al. 2008a, 2008b). Some have also found that attention deficit hyperactivity disorder (ADHD) and the associated genes are linked to being an entrepreneur (Mannuzza et al. 1993; Nicolaou et al. 2011) while others have focused especially on the testosterone levels of individuals and entrepreneurship (e.g. Nicolaou et al. 2018; Greene et al. 2014; White et al. 2006). This strain of literature emphasizes (directly or indirectly) that the entrepreneurial tendency is therefore largely heritable and by nature fixed. But rather than genes being fixed and thus possibly solely a determinant of an individual being an entrepreneur, the field of epigenetics would propose that the environmental factors moderate the expression of the genes which then can be linked to entrepreneurship. Also, epigenetics implies that the changes in the gene expression can also be heritable, and thus, the epigenetic markers can be inherited for multiple of generations. Therefore, as there is evidence showing that genetics and entrepreneurship do appear to have a relationship, the interplay with external factors and genetics which in turn affects entrepreneurship should be further examined especially in examining across-country entrepreneurship outcomes. In a recent review, Nofal et al. (2018) also shortly propose epigenetics as a useful future research agenda.

Epigenetics is an emerging field of genetical biology which combines developmental biology and genetics. Even though having roots in the 1970s, the field of research has only in the recent decade gained momentum amongst researchers, and some have even proposed that we have an epigenetic revolution ongoing or refer to an epigenetic hype which by and large claims victory of epigenetics over genes (Maderspacher 2010).¹² There is no real census on the exact definition of epigenetics. It has

¹¹ Hans Selye identified the role of environmental factors that led to the term he coined, stress (https://en.wikipedia.org/wiki/Hans_Selye).

¹² There has also been reservations about the scientific basis of the epigenome project (Madhani et al. 2008)

been defined as how genotypes give rise to phenotypes during development (Waddington 1957), the study of mitotically and/or meiotically heritable changes in gene function that cannot be explained by changes in DNA sequence (Russo and Martienssen 1996), and as the structural adaptation of chromosomal regions so as to register, signal, or perpetuate altered activity states.¹³ There is no consensus amongst the biological geneticist on the exact mechanism in which epigenetics functions, but the evidence seems to point out that epigenetics exists, e.g., see evidence for plants (Henderson and Jacobsen 2007), lab rats (Weaver et al. 2004), and humans (Wong et al. 2005; Fraga et al. 2005). Rather importantly, Holliday (2006) discusses the difference between genetic and epigenetic heritability. Plainly, genetics is based on cell lineages and the organism starts as a single cell and ends up as a clone of cells. On the other hand, epigenetic changes often occur in groups of cells because of a specific signal which impinges on a group of cells with the same receptor. The genetic changes are stable and rarely reversed, whereas epigenetic changes are often reversible (Holliday 2006). Thus, the epigenetic inheritance implies that information can be inherited without altering the structure of the DNA.

No matter what precise definition of epigenetics one has to follow, the underlying message is clear: the environment can change how the genes are expressed, contradicting the argument that the genetic makeup of an individual is fixed and thus predetermined at birth solely by the disposition of the genetic heritability of the parents. Instead of completely disagreeing with the genetic determinism, epigenetics shines light on the possibility that acquired marks can be passed through generations which simply means that genes might have a memory. This could imply that the reason why we have not seen convergence of development across countries even though we have improved the formal institutions in some countries in the world is that the new generation of individuals can still carry the information of their past generation not only by their genetic predisposition but also by due information stored through epigenetic marks. This would mean that it takes even longer time than

necessarily anticipated for the environment, i.e., formal or informal institutions, to impact human behavior. In contrast to our results, this means that the reason why we see different cultures and the productivity of entrepreneurship differing can be that the epigenetic marks of the past generations are passed on influencing culture, entrepreneurship, and the interaction of the two.

Therefore, we call and suggest an important future research agenda in which the importance of environmental factors and the interplay with genes are examined with respect to entrepreneurship research. There have been two contradicting views on the entrepreneur, either he is a complete blank and through the environment and learning will become an entrepreneur or there is something inherently different about those who are entrepreneurs and they are born as entrepreneurs. Much of the literature on the environmental factors that make the entrepreneur focuses on the set of opportunities that are available. Environmental factors here imply, for example, the cultural milieu which can influence the degree of entrepreneurship and especially the types of entrepreneurship present in an economy which naturally arises from the individuals, or entrepreneurs. Our discussion is suggestive by nature as we do not provide direct evidence of epigenetics playing a role but nevertheless, we argue this to be an integral new discovery to the entrepreneurship literature and one possible mechanism in which our cultural proxies are mediated to the entrepreneurship outcomes in an aggregate manner. Our results point out that countries can be divided into groups based on their informal institutions which correlate to the productivity of entrepreneurship across Europe and the world. The epigenetics can be one source of these differences in cultures and entrepreneurship outcomes across countries.

An important question arising from this possible future research agenda is that how do different environments change the genome expressions and how are they related to being an entrepreneur? Are the environmental factors working through the genetic expression outweighing the institutional setting put in place? This is if we assume epigenetics influences the genome expressions which in turn solely determine whether you become an entrepreneur or not. In addition, is epigenetics one of the reasons why we see strong intergenerational links between entrepreneurs? Or are certain

¹³ See Deichmann (2016) for a recent survey of the three epigenetic mechanisms .

genetics associated with different types of entrepreneurship, and if so, how does epigenetics play a role there? If it is the case that epigenetics is at work in either one of the scenarios, the environment of up to four previous generations has imprinted memory on the genes and thus are still at play today.

What makes this line of research challenging is how to measure and identify the impact epigenetics has on entrepreneurship. We have just started to gain evidence on the static nature of the genes that are associated with tendencies of being an entrepreneur, and even this seems to be a challenging task. As Koellinger et al. (2010) note, the genome-wide association studies require at least 30,000 observations for statistically sound evidence with just using the genomes. This should also hold for applications investigating the role of epigenetics and thus is data intensive. Additionally, to properly research cultural differences, future research should obtain genome-level data across countries which can impose an additional challenge. With the increase with big data, computing in general, and improvements in detailed DNA management and collection, epigenetics can potentially have a role in the play in entrepreneurship research also.

6 Conclusions

Why economies grow has been in the forefront of questions for economists at least ever since Adam Smith's celebrated thesis. Entrepreneurship has been proposed as one of the driving forces for growth, e.g., through creative destruction and innovation (Acs et al. 2018). However, there has recently been some discussion on the impact of entrepreneurship to growth which might not be as straightforward or unidirectional as though. Baumol (1990) however already discussed how entrepreneurship can manifest itself through different forms as individuals react to incentives laid out by formal and informal institutions. Therefore, as entrepreneurship type can vary, so can its impact on economic growth. This results in that our paper brings about implications for growth even though not directly measured.

This paper stresses in line with Alesina and Giuliano (2015) the importance of understanding a two-way relationship of culture and economic outcomes, in our case entrepreneurship and the mutual feedback effects. We make available simple correlations and do not argue

that culture is unidirectionally causing the productive capacity of economy's entrepreneurship. Culture does not develop in a vacuum nor does the several types of entrepreneurship as they simultaneously evolve together with other factors such as formal institutions, creating a dynamic ecosystem. This is what makes culture and its implications a difficult field of study. What our paper brings forward is a new proxy for culture, or cultural similarity, as well as highlighting the importance of the relationship between culture and the productivity of an economy's entrepreneurship. It is important to incorporate the informal institutions when differentiating between the several types of entrepreneurship as they are shaping the incentives and actions of individuals and as we show aggregate productive activities.

What is important to note is again what Baumol stated in his article that rather than influencing the total supply of entrepreneurs, public policy can more effectively influence the allocation of entrepreneurial activities. As the different entrepreneurial activities are a response to the underlying incentive structure, policy can more effectively try to influence the institutions that support these incentives. Attempts to directly change the culture present in a society seem to be a more challenging task for the policy makers. This also implies that there is also still much to be researched in the realm of cultural and other institutional similarities and its implications to individuals, policy makers, and societies as a whole.

In addition, we shed light to a promising new research agenda. The role of epigenetics in entrepreneurship should be further investigated to try to seek out to answer the underpinnings of what determines entrepreneurship. Individuals are constantly in contact with their surroundings and even though genetics can be fixed at birth, the environment still has a say in the regulation of those genes with implications across generations. How these two interplay can have at an aggregate level deterring or growth-enhancing implications. In summary, is it farfetched that we propose to link epigenetics to culture and thus entrepreneurship? Given genetics and genetic expression make up human beings and can define the behavior of individuals through physical and personality traits, it would seem not. Epigenetics has been in the fore front of research in many disciplines recently, and we in economics and entrepreneurship research should follow alike.

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Appendix

Table 7 Alternative entrepreneurship measures

Dependent variable	Ln (patents per capita)	Opportunity TEA	US lobbying	Europe lobbying
Wine	−0.3423 (0.8448)	−0.0371 (0.0328)	0.1357 (0.1512)	0.0285 (0.6672)
Spirits	−1.068** (0.7901)	−0.0251 (0.0344)	0.1734 (0.1414)	−1.159* (0.6239)
Constant	6.857*** (0.4707)	0.9415 (0.0186)	0.1003 (0.0842)	1.485*** (0.3717)
R^2	0.133	0.047	0.045	0.096
No. of countries	40	32	40	40
H_0 , wine = spirits	2.55** $F(1,37)$	0.09 $F(1,29)$	0.05 $F(1,37)$	2.53 $F(1,37)$

Base is beer. Standard error in parentheses. ***1%, **5%, and *10% level of significance

Table 8 Alternative entrepreneurship measures

Dependent variable	Ln (patents per capita)	Opportunity TEA	US lobbying	Europe lobbying
Beer-spirits	−0.6352 (1.063)	0.0121 (0.0401)	−0.1105 (0.1863)	−0.4842 (0.8255)
Wine-beer	−0.7176 (1.063)	−0.0287 (0.0401)	0.2195 (0.1863)	0.3436 (0.8255)
Wine-spirits	−0.1635 (1.386)	−0.0455 (0.0608)	−0.1313 (0.2429)	−1.037 (1.076)
Spirits-beer	−2.086** (0.9022)	−0.0208 (0.0382)	0.1430 (0.1581)	−1.275* (0.7005)
Spirits-wine	−1.627 (2.255)	−	0.1123 (0.3951)	−1.602 (1.751)
Constant	7.047*** (0.5823)	0.9372 (0.0238)	0.1334 (0.1020)	1.630 (0.4522)
R^2	0.302	0.053	0.100	0.140
No. of countries	40	32	40	40

Base is beer-wine. Standard error in parentheses. ***1%, **5%, and *10% level of significance

Table 9 OLS—entire world, first choice

Dependent variable	R&D	Armed forces (%)	CPI
Wine	0.089 (0.244)	0.521 (0.448)	−4.28 (5.09)
Spirits	−0.504*** (0.162)	0.430 (0.288)	7.94** (3.26)
No alcohol	−0.528 (0.491)	0.574 (0.624)	18.8** (7.29)
Constant	0.918*** (0.100)	1.32*** (0.182)	−43.3*** (2.05)
R^2	0.086	0.019	0.071
No. of countries	129	168	180

Base is beer. Standard error in parentheses. ***1%, **5%, and *10% level of significance

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