THE EFFECTS OF CULTURAL POLICY ON NASCENT CULTURAL ENTREPRENEURSHIP: A BAYESIAN NONPARAMETRIC APPROACH TO LONGITUDINAL MEDIATION

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Abstract

Despite the topic of nascent entrepreneurship receiving quite extent in coverage in the scientific literature there is very few, if any, knowledge on the characteristics of nascent firms in the cultural and creative sector. In this article we use Amadeus database for a sample of firms from 28 European Union countries in the period 2007-2016, to study the effects of cultural policy on nascent entrepreneurship. We model the effects as a mediation problem and show that while cultural policy has an effect on general performance of cultural firms it is mediated through its indirect effect on nascent cultural and creative firms and mediation happens with time delay. This finding is robust to numerous cultural policy variables, definitions of nascent entrepreneurship, performance indicators and model specifications. The article also implements and discusses a Bayesian nonparametric (BNP) approach to longitudinal mediation analysis (using Bayesian additive regression trees used on cross-lagged panel modelling of the Baron-Kenny approach to mediation) which is to our knowledge the first application of BNP in longitudinal mediation in statistical and econometric literature. We conclude by policy and research recommendations and reflections.

Keywords: nascent cultural entrepreneurship, cultural policy, longitudinal mediation, Baron-Kenny approach, BART, Amadeus.

Introduction

The cultural market has significantly changed during the last centuries as a consequence of political and economic changes, such as deregulation (Garnham, 2005) globalisation (Slavich and Montanari, 2005) and the financial crisis (Bonet and Donato, 2011). In this changing environment two new concepts, the “entrepreneurial individual” and the “enterprising society” (Fayolle and Redford, 2014), became relevant.

Although entrepreneurship has been extensively recognised as a driving force underlying economic performance and economic growth prosperity (Baumol, 1990; Dutta et al. 2009; Khajeheian, 2013), there is remarkably less of a consensus in the entrepreneurship literature on a definition of entrepreneurship and on what includes entrepreneurship. Entrepreneurship as a research field is characterised by different concepts and theories, belonging to different disciplines (psychology, sociology, economics, management as well). The review of the

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different definitions of entrepreneurship does not allow us to propose a single convincing definition, which can satisfy the specifics of each discipline without falling into a generic definition. Entrepreneurship is a multi-faceted phenomenon that can be viewed and approached from different angles. The same reasoning can be applied to cultural entrepreneurship (Vecco, 2018).

In this paper the focus will be on the nascent and early-stage concept of cultural entrepreneurship. Birch (1999) measures the number of ‘significant starters’ i.e., individuals who have started a business that after ten years employ at least five people and the number of young growers who have achieved his ‘growth index’ criteria. This measure of entrepreneurial vitality is based upon one definition of the entrepreneur. Both Birch and Reynolds use a process perspective, meaning they define entrepreneurs as people in the early phases of a business who exhibit certain growth-oriented behaviours. Sometimes, entrepreneurs in general are defined as people in the pre-start-up, start-up and early phases of business ownership. The main reason for this is that these are the targets for entrepreneurship policy measures and the authors propose that entrepreneurship policy measures are taken to stimulate individuals to behave more entrepreneurially. Some authors state that this can best be done by influencing motivation, opportunity and skill factors (Stevenson, 1996).

Despite the topic of early-stage and nascent (NE) entrepreneurship receiving quite extent in coverage in the scientific literature (see e.g. Reynolds & White, 1992; Reynolds & Miller, 1992; Gartner, 1988, 1993; Gartner & Carter, 2003; Davidsson, 2005, 2006, 2015; Davidsson et al., 2011), being led by Reynolds' orientation toward the empirical research programs in this area (Reynolds & White, 1992; Reynolds & Miller, 1992), Gartner’s (and collaborators’) calls for a re-orientation of entrepreneurship research from characteristics of individuals to behaviours in the process of emergence (Gartner, 1988, 1993; Gartner & Carter, 2003; Katz & Gartner, 1988), and, finally, other influential scholars’ early emphasis on the process nature of new venture creation (Bhave, 1994; Cooper & Gimeno-Gascon, 1992; van de Ven, Venkataraman, Polley, & Garud, 1989; Venkataraman, 1996), there is very few, if any, knowledge on the characteristics of those firms in the cultural sector. In particular, one would expect a strong connection of the creativity and innovation aspects of work in culture (see e.g. Castañer and Campos, 2002) and its non-institutional character, to the nascent aspects of cultural firms.

In two recent overviews of the field of cultural and creative entrepreneurship, Hausmann and Heinze (2016) and Chang and Wyszomirski (2015) find several main topics of the existing research in this area. Chang and Wyszomirski separate the literature into five components, namely, related to strategies, tactics, competencies and skills, mindset and context, while Hausmann and Heinze find four broad areas, represented in the literature, cultural entrepreneurship, influencing and success factors for cultural entrepreneurship, entrepreneurship education, and the concept of the “creative cities”. So far, there has not been any specific focus on systematic and comparative cross-country analysis of the effects of public policies on cultural and creative entrepreneurship.

Four firm performance measures (level of operating revenues; level of employment; firm capital; firm debt) are used to test empirically the specificities of the nascent cultural and creative firms across Europe in order to answer to the following research question: to what extent do cultural policy measures have an effect on nascent entrepreneurial activity in culture?
The empirical analysis relies on causal inference related to structural equation modelling, namely longitudinal mediation analysis.

The paper is structured as follows. Section 2 reviews the literature on NE and performance. Section 3 describes the database and the methodological approach adopted. Section 4 outlines the main results which have been tested for robustness while section 5 discusses the hypotheses with the support of results and concludes by providing some directions for future research.

Literature review and theoretical framework

According to Davidsson (2006) the term ‘nascent entrepreneur’ first appeared in the research literature in a method orientated conference paper presented by Reynolds and Miller in 1992. In the same year, the related concept of ‘nascent venture’ first appeared in a journal article by Reynolds and White. According to Reynolds and White (1997) and Reynolds (2000), the creation of a new venture is a process comparable to biological creation as it implies four main stages (conception, gestation, infancy and adolescence) characterised by three transitions. NE happens in the first transition, when individuals or group of individuals decide to invest time and resources to start up a new, independent firm. These individuals are assumed to have some specific innate characteristics that distinguish them from other groups or individuals. What should be underlined in this definition is that nascent entrepreneurs are not young or novice entrepreneurs (see e.g. Reynolds & White, 1992; Reynolds & Miller, 1992; Gartner, 1988, 1993; Gartner & Carter, 2003; Davidsson, 2005, 2006). The adjective “nascent” refers to the process – the venture – not to the person. It follows that these entrepreneurs can have already relevant achievements behind them. Notably, ‘nascent entrepreneur’ is a temporary state. In comparison to early-stage entrepreneurship which encompasses all firms less than 3.5 years old, as defined by Reynolds et al. (2005), nascent entrepreneurship is mainly involved in setting up a business. In principle, both terms could be used for our research, but the authors have chosen to use nascent as they vary the definition of the concept in terms of age and other characteristics in the analysis and when performing the robustness checks. Furthermore, they follow other definitions of the concept and distinction, presented above.

Furthermore, following Reynolds and White (1997: 6) and Reynolds (2000: 158), being “nascent” as a process, analogous to biological creation, can be considered to have four stages (conception, gestation, infancy and adolescence), with three transitions. The first transition begins when one or more persons start to commit time and resources to founding a new firm. If they do so on their own and if the new venture can be considered an independent start-up, they are called nascent entrepreneurs. The second transition occurs when the gestation process is complete and when the new venture either starts as an operating business, or when the nascent entrepreneurs abandon their effort and a stillborn happens. The third transition is the passage from infancy to adolescence, namely the fledgling new firm’s successful shift to an established new firm (Wagner, 2007: 15). Following the definition used in the Panel Study of Entrepreneurial Dynamics (Reynolds, 2000; Shaver et al., 2001; Gartner and Carter, 2003; Gartner et al., 2004; Reynolds et al., 2004a) and in the Global Entrepreneurship Monitor (Reynolds et al., 1999, 2000, 2001, 2002a, 2004b; Acs et al., 2005), a nascent entrepreneur is defined as a person who is now trying to start a new business, who expects to be the owner or part owner of the new firm, who has been active in trying to start the new firm in the past 12 months and whose start-up did not yet have a positive monthly cash flow that covers expenses and the owner-manager salaries for more than three month.
The operationalisation and measuring of NE is anything but new. This concept has been conceptualised in different ways by scholars over time. For example, for Reynolds et al. (1999, 2000, 2001, 2002, 2004), Acs et al. (2005), a nascent entrepreneur is defined as a person who is now trying to start a new business, who expects to be the owner or part owner of the new firm, who has been active in trying to start the new firm in the past 12 months and whose start-up did not yet have a positive monthly cash flow that covers expenses and the owner-manager salaries for more than three months. Other scholars provide a less precise definition, focusing just on the duration of the gestation period of “within 12 months” (Edelman et al. 2010; Wagner, 2004; Delmar and Davidsson, 2000). Most recently, Chowdhury et al. (2015) provide a different operationalisation of nascent entrepreneurship/new firm ownership by referring to all firms involved in total early-stage entrepreneurial activities under 42 months.

Despite embracing one definition and approach of cultural entrepreneurship (see the overview proposed by Hausmann & Heinze, 2016), the authors strongly think that there is a clear need to investigate deeper whether, why and how cultural and creative entrepreneurship differs from other varieties of entrepreneurship. Reluctant to adopt a specific definition of cultural entrepreneur, which will weaker and make less generalizable the analysis of entrepreneur, the authors decided to use a more holistic approach, whose aim is not to create differences and categories rather than bring unity to the research field. To this purpose, within this paper we adopt Vecco’s framework (2018, forthcoming) which considers as entrepreneurship constituents: process, mind-set, behaviour and skills to develop a start-up. These core components are used and implemented by the entrepreneur to discover, to evaluate, and exploit business opportunities in different phases of the life cycle of the firm. What differs – which can explain the variety of entrepreneurship – is a three dimensional set-up: the environment, the goals and the values pursued by the entrepreneur. The core constituents are the same for all entrepreneurs but are differently declined and developed in this three dimensional set-up. Although there is an interrelationship between them, the most relevant dimension is the environment as it presumes specific values and specific goals to be implemented within it. In this context, the concept of environment does not have to be understood in its broad definition (institutional or social environment) but more as the area (culture, creativity, society, etc.) in which the entrepreneur decided to perform.

While, in entrepreneurship research, a large body of literature centres on the entrepreneur as a key economic actor, there has been a tendency for research to work outward from the entrepreneur to consider other factors and policies, what might be termed the supporting cast of policies which assist entrepreneurs achieve their various objectives (e.g. Shane and Venkataraman, 2000; Ardichvili et al., 2003; Storey, 2005; Audretsch et al., 2007; Henrekson and Stenkula, 2009; OECD, 2010; Dess et al., 2011; Shane, 2012). These related policies involve such activities as the provision of finance for entrepreneurship, and advice and financial assistance for the firm. They may also include to some extent policies that provide these forms of support in a bundle in either time or space (for example, incubators) or both. The attempt to designate areas of action as relevant has been extensively widened and, in some cases, the argument for support to entrepreneurship takes on the form of lobbying for action by government are very broad in scope (Kauffman Foundation, 2012).

Based on the above literature, we test the following three main hypotheses:

**H1:** Cultural policy, proxied by the level of public cultural funding, positively affects the performance of cultural firms.
H2: The effect in H1 is mediated\(^3\) by the effect of cultural policy on nascent entrepreneurship. H3: The total (i.e. direct and indirect) effect of cultural policy on the performance of cultural firms differs depending on the performance indicators.

We define the direct and indirect effect following Chen and Hung (2016). Figure 1 shows the typical mediation model; path coefficient \(c\) is termed as the direct effect of the independent variable \((X)\) on the dependent variable \((Y)\), also known as the effect of the control mediator variable \((M)\) of independent variable \((X)\) on dependent variable \((Y)\), or the residual effect. Path coefficient \(a\) is the effect of independent variable \((X)\) on mediator variable \((M)\), also known as the first stage effect. Path coefficient \(b\) is the effect of the mediator variable \((M)\) on the dependent variable \((Y)\), also known as the second stage effect. The multiplication of the first stage effect and second stage effect \(ab\) is known as the indirect effect. If the direct effect of independent variable \((X)\) on the dependent variable \((Y)\) after the addition of the mediator variable \((M)\) is insignificant (namely, path coefficient \(c\) is significant), it is known as the full mediation.

![Figure 1: Basic mediator model.](source: Chen and Hung, 2016.)

**Data and method**

The analysis is based on the dataset of Amadeus, which is a database of comparable financial information for public and private companies covering 43 countries. It presents comprehensive information on Europe's largest 500,000 public and private companies by total assets. There are of course drawbacks to this choice. Firstly, the literature often finds Amadeus data as of weak quality, despite being the predominant source on information on European firms in all sectors. Secondly, the drawbacks are related to overrepresentation of large firms in the analysis (clearly visible from the descriptive statistics). Probably, it is legit to say that this article findings are valid for nascent firms in culture, being of larger size, but this goes in line with previous considerations of heterogeneity of nascent firms being one of the predominant challenges for future research in nascent entrepreneurship. On the other hand, the size of the sample of nascent cultural firms (compared to the full sample) nevertheless allows to make the generalisation at least in terms of larger nascent firms, both in general and in culture.

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\(^3\) In simpler terms, this means that cultural policy has a direct effect on performance of cultural firms and an indirect effect on nascent cultural entrepreneurship, the latter having an own and separate effect on the performance of cultural firms. Cultural policy, therefore, has both a direct and indirect/mediated effect on performance of cultural firms.
To discern the firms, working in cultural and creative occupations the authors use a detailed NACE II classification, using the activity codes in Table 1.

### Table 1: Cultural sectors by NACE II classification

<table>
<thead>
<tr>
<th>Activity Code</th>
<th>Activity Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>C18.1.1</td>
<td>Printing of newspapers</td>
</tr>
<tr>
<td>C18.1.2</td>
<td>Other printing</td>
</tr>
<tr>
<td>C18.1.3</td>
<td>Pre-press and pre-media services</td>
</tr>
<tr>
<td>C18.1.4</td>
<td>Binding and related services</td>
</tr>
<tr>
<td>C18.2.0</td>
<td>Reproduction of recorded media</td>
</tr>
<tr>
<td>C32.2.6</td>
<td>Manufacture of musical instruments</td>
</tr>
<tr>
<td>G47.6.1</td>
<td>Retail sale of books in specialised stores</td>
</tr>
<tr>
<td>G47.6.2</td>
<td>Retail sale of newspapers and stationery in stores</td>
</tr>
<tr>
<td>G47.6.3</td>
<td>Retail sale of music and video recordings in stores</td>
</tr>
<tr>
<td>G47.6.4</td>
<td>Retail sale of sporting equipment in specialised stores</td>
</tr>
<tr>
<td>F58.1.1</td>
<td>Book publishing</td>
</tr>
<tr>
<td>F58.1.2</td>
<td>Publishing of directories and mailing lists</td>
</tr>
<tr>
<td>F58.1.3</td>
<td>Publishing of newspapers</td>
</tr>
<tr>
<td>F58.1.4</td>
<td>Publishing of journals and periodicals</td>
</tr>
<tr>
<td>F58.1.9</td>
<td>Other publishing activities</td>
</tr>
<tr>
<td>F58.2.1</td>
<td>Publishing of computer games</td>
</tr>
<tr>
<td>F58.2.9</td>
<td>Other software publishing</td>
</tr>
<tr>
<td>F59.1.1</td>
<td>Motion picture, video and television programme production activities</td>
</tr>
<tr>
<td>F59.1.2</td>
<td>Motion picture, video and television programme post-production activities</td>
</tr>
<tr>
<td>F59.1.3</td>
<td>Motion picture, video and television programme distribution activities</td>
</tr>
<tr>
<td>F59.1.4</td>
<td>Motion picture production activities</td>
</tr>
<tr>
<td>F59.2</td>
<td>Sound recording and music publishing activities</td>
</tr>
<tr>
<td>F59.2.0</td>
<td>Sound recording and music publishing activities</td>
</tr>
<tr>
<td>B01.0.0</td>
<td>Radio broadcasting</td>
</tr>
<tr>
<td>B01.0.0</td>
<td>Radio broadcasting</td>
</tr>
<tr>
<td>B01.0.0</td>
<td>Television programming and broadcasting activities</td>
</tr>
<tr>
<td>B01.0.0</td>
<td>Wireless telecommunications activities</td>
</tr>
<tr>
<td>B01.0.0</td>
<td>Satellite telecommunications activities</td>
</tr>
</tbody>
</table>

### Source: Eurostat (2016).

The period between 2006 and 2015 was analysed with the support of a sample of 39,052 firms, from 28 European Union countries. 2,820 firms – representing 7.22% of the total of firms – are cultural firms. Moreover, the authors identify 105 nascent cultural firms (being of 3 years or younger age), which represents 0.27% of total sample and 3.72% of all cultural firms in the sample.

Among the countries, the largest percentage of cultural firms come from United Kingdom (952; 33.76%), Germany (651; 23.09%) and France (565; 20.04%). Among the nascent cultural firms, 35 (33.33%) come from United Kingdom, 33 (31.43%) from Germany, 15 (14.29%) from France and 11 (10.48%) from Italy.

Table 2 presents some basic descriptive statistics of the main variables. On average, the non-cultural firms operating revenues are slightly above 9 million EUR, with cultural firms significantly behind. A non-cultural firm has an average of 4,700 employees, with cultural firms even more behind. Average non-cultural firm’s capital amounts to approximately 570,000 EUR, where cultural firms even with a slightly higher average amount. Finally, cultural firms are on average approximately 2 years younger (of an average age of approximately 26 years) than non-cultural firms.
Table 2: Descriptive statistics of the dataset

<table>
<thead>
<tr>
<th>Non-cultural firms</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
<th>Observat.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>7346955</td>
<td>152000000</td>
<td>0</td>
<td>682000000</td>
<td>N = 227005</td>
</tr>
<tr>
<td>Operating revenues</td>
<td>between</td>
<td>66100000</td>
<td>1</td>
<td>762000000</td>
<td>n = 35012</td>
</tr>
<tr>
<td></td>
<td>within</td>
<td>136000000</td>
<td>-76000000</td>
<td>606000000</td>
<td>T-bar = 6.48</td>
</tr>
<tr>
<td></td>
<td>overall</td>
<td>4742.6</td>
<td>1</td>
<td>652000000</td>
<td>N = 216816</td>
</tr>
<tr>
<td>Employees</td>
<td>between</td>
<td>342574.4</td>
<td>10</td>
<td>65200000</td>
<td>n = 36200</td>
</tr>
<tr>
<td></td>
<td>within</td>
<td>1327550</td>
<td>-65200000</td>
<td>586000000</td>
<td>T-bar = 5.99</td>
</tr>
<tr>
<td></td>
<td>overall</td>
<td>567742.7</td>
<td>-3762100</td>
<td>1170000000</td>
<td>N = 222664</td>
</tr>
<tr>
<td>Firm capital</td>
<td>between</td>
<td>10100000</td>
<td>-901332.6</td>
<td>1180000000</td>
<td>n = 33690</td>
</tr>
<tr>
<td></td>
<td>within</td>
<td>23700000</td>
<td>-117000000</td>
<td>1050000000</td>
<td>T-bar = 6.61</td>
</tr>
<tr>
<td></td>
<td>overall</td>
<td>28.26588</td>
<td>0</td>
<td>1989</td>
<td>N = 353770</td>
</tr>
<tr>
<td>Firm age</td>
<td>between</td>
<td>39.80548</td>
<td>0</td>
<td>1989</td>
<td>n = 35377</td>
</tr>
<tr>
<td></td>
<td>within</td>
<td>0</td>
<td>28.26588</td>
<td>28.26588</td>
<td>T = 10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cultural firms</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
<th>Observat.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>6269250</td>
<td>38500000</td>
<td>1</td>
<td>88100000</td>
<td>N = 18819</td>
</tr>
<tr>
<td>Operating revenues</td>
<td>between</td>
<td>45600000</td>
<td>221</td>
<td>88100000</td>
<td>n = 2731</td>
</tr>
<tr>
<td></td>
<td>within</td>
<td>8791084</td>
<td>-22800000</td>
<td>24200000</td>
<td>T-bar = 6.89</td>
</tr>
<tr>
<td></td>
<td>overall</td>
<td>1549.909</td>
<td>8773.532</td>
<td>255896</td>
<td>N = 17984</td>
</tr>
<tr>
<td>Employees</td>
<td>between</td>
<td>7365.088</td>
<td>33.6667</td>
<td>237295.3</td>
<td>n = 2819</td>
</tr>
<tr>
<td></td>
<td>within</td>
<td>1589.567</td>
<td>-6994.66</td>
<td>5004.31</td>
<td>T-bar = 6.38</td>
</tr>
<tr>
<td></td>
<td>overall</td>
<td>570363.9</td>
<td>11200000</td>
<td>65300000</td>
<td>N = 18417</td>
</tr>
<tr>
<td>Firm capital</td>
<td>between</td>
<td>13100000</td>
<td>-494196.5</td>
<td>51800000</td>
<td>n = 2629</td>
</tr>
<tr>
<td></td>
<td>within</td>
<td>1779351</td>
<td>-11800000</td>
<td>13500000</td>
<td>T-bar = 7.01</td>
</tr>
<tr>
<td></td>
<td>overall</td>
<td>25.97832</td>
<td>29.92554</td>
<td>767</td>
<td>N = 27680</td>
</tr>
<tr>
<td>Firm age</td>
<td>between</td>
<td>29.9304</td>
<td>1</td>
<td>767</td>
<td>n = 2768</td>
</tr>
<tr>
<td></td>
<td>within</td>
<td>0</td>
<td>25.97832</td>
<td>25.97832</td>
<td>T = 10</td>
</tr>
</tbody>
</table>

Source: Own calculations.

Mediation analysis is used where NE serves as a mediating variable for the effects of cultural policy measures (proxied by the percent of ministry budget for culture in GDP\(^4\)) on the performance of the firm. Mediation analysis is a statistical approach used to understand how a predictor (generically, \(X\)) produces an indirect effect on an outcome (\(Y\)) through an intervening variable (mediator, \(M\)). For example, diet programme might be hypothesised to reduce food intake, which, in turn, is hypothesised to reduce the participant’s body mass index. This analysis, therefore, aims to uncover causal pathways along which changes are transmitted from causes to effects. There are two essential ingredients of modern mediation analysis. First, the indirect effect is not merely a modelling artefact formed by suggestive combinations of parameters but an intrinsic property of reality that has tangible policy implications. Second, the

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\(^4\) To proxy for cultural policy measures we use only level (or percentage) of government budget for culture. In general, this is among the most commonly used measures of cultural policy in empirical analysis (see e.g. UNESCO, 2015). For future work, the analysis would benefit in extending the empirical work with modelling also the effects of other policy measures (treaties and agreements; specific budgetary items; support for cultural diversity, etc.).
policy decisions concern the enabling and disabling of processes (hiring vs. education) rather than lowering or raising values of specific variables. These two considerations lead to the analysis of natural direct and indirect effects (Pearl, 2014: 459).

For the estimation of mediating effects, the simple and most commonly used algorithm of Baron and Kenny (1986) has been advanced using longitudinal mediation analysis. Baron-Kenny algorithm proposes a four step approach in which several regression analyses are conducted and significance of the coefficients is examined at each step (Y is the response, in our case performance of the firm; X is the predictor, in our case government budget for culture; and M is the mediator variable, in our case nascent cultural and creative entrepreneurship). The detailed scheme of the approach is provided in Figure 2.

**Figure 2: Basic diagram of Baron and Kenny's approach**

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Conduct a simple regression analysis with X predicting Y to test for path c alone, $Y = \beta_0 + \beta_1 X + e$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2</td>
<td>Conduct a simple regression analysis with X predicting M to test for path a, $M = \beta_0 + \beta_1 X + e$</td>
</tr>
<tr>
<td>Step 3</td>
<td>Conduct a simple regression analysis with M predicting Y to test the significance of path b alone, $Y = \beta_0 + \beta_2 M + e$</td>
</tr>
<tr>
<td>Step 4</td>
<td>Conduct a multiple regression analysis with X and M predicting Y, $Y = \beta_0 + \beta_1 X + \beta_2 M + e$</td>
</tr>
</tbody>
</table>

Visual Depiction


There are a number of fundamental problems with the application of traditional mediation models to cross-sectional data (Gollob and Reichardt, 1987). Firstly, the causal relationships implied by the paths in the mediation model take time to unfold. The use of cross-sectional data implies that the effects are instantaneous. Secondly, it is well known that conclusions based on a causal model that omits a key predictor can be seriously in error, yet a model based on cross-sectional data leaves out several key predictors—namely the variables measured at previous times. When previous levels of the variables are not controlled for, the paths in the mediation model may be over- or underestimated relative to their true values. Third, effects unfold over time, and we would not expect the magnitude of a causal effect to remain the same for all possible intervals.

Selig and Preacher (2009) consider three mediation models for longitudinal data: a cross-lagged panel model (CLPM), a latent growth curve model, and a latent difference score model. In our analysis, we focus on the first one. The CLPM is a multivariate extension of the univariate simplex model, one of the most commonly used structural models for the analysis of longitudinal data (Jöreskog, 1970, 1979). The CLPM allows time for causes to have their effects, supports stronger inference about the direction of causation in comparison to models using cross-sectional data, and reduces the probable parameter bias that arises when using cross-sectional data. Extensive overviews of the use of this model for mediation analyses were given by Cole and Maxwell (2003), MacKinnon (2008) and Bernal Turnes and Ernst (2016). Figure 3 depicts such a model.

**Figure 3: A cross-lagged panel mediation model**
In Figure 3, three constructs \(X, M\) and \(Y\) – are each measured at four times. The CLPM can be used with more or fewer waves of measurement, but at least three are needed to achieve a fully longitudinal mediation model. The constructs \(X, M\) and \(Y\) are often latent variables with multiple indicators, although the model can be used with observed variables. Using latent variables has the advantage of addressing the problem of measurement error, thus disattenuating relationships among the constructs. The CLPM for \(X, M\) and \(Y\) can be expressed by the following three equations,

\[
X_{[t]} = \beta_{X,[t-1]}X_{[t-1]} + \zeta_{X,[t]} \quad (1)
\]

\[
M_{[t]} = \beta_{M,[t-1]}M_{[t-1]} + \beta_{X,[t-1]}X_{[t-1]} + \zeta_{M,[t]} \quad (2)
\]

\[
Y_{[t]} = \beta_{Y,[t-1]}Y_{[t-1]} + \beta_{M,[t-1]}M_{[t-1]} + \beta_{X,[t-2]}X_{[t-2]} + \zeta_{Y,[t]} \quad (3)
\]

where \(X_{[t]}\) is the value of \(X\) at time \(t\), \(\beta_{X,[t-1]}\) expresses the relationship between the construct \(X\) at time \(t\) and the same construct measured at the previous time \(t - 1\), and \(\zeta_{X,[t]}\) is a random disturbance that is different for each time. Similar interpretations can be given to corresponding terms in the equations for \(M_{[t]}\) and \(Y_{[t]}\). The mediated, i.e. indirect effect of \(X\) on \(Y\) can therefore be expressed in terms of the product of \(\beta_{X,[t-1]}\) and \(\beta_{M,[t-1]}\).

The models in (1)-(3) are estimated under strong parametric assumptions, which can impose statistical problems (see Bernal Turnes and Ernst, 2016, which refer to Judd & Kenny, 1981; Gollob & Reichardt, 1987; Sobel, 1990; Kraemer et al., 2002; Cole & Maxwell, 2003; Selig & Preacher, 2009). It is, therefore, recommended to use semi- or nonparametric approaches (for example, Bernal Turnes and Ernst, 2016 suggest bootstrapping).

For final verification purposes, it is therefore recommendable using a different modelling approach. We decided to use Bayesian nonparametric modelling, which is subject to many discussions and research in statistics and econometrics in recent years. A Bayesian nonparametric model is a Bayesian model on an infinite-dimensional parameter space (Orbanz and Teh, 2010). The parameter space is typically chosen as the set of all possible solutions for a given learning problem. A Bayesian nonparametric model uses only a finite subset of the available parameter dimensions to explain a finite sample of observations, with the set of dimensions chosen depending on the sample, such that the effective complexity of the model (as measured by the number of dimensions used) adapts to the data. Classical adaptive
problems, such as nonparametric estimation and model selection, can thus be formulated as Bayesian inference problems. Popular examples of Bayesian nonparametric models include Gaussian process regression, in which the correlation structure is refined with growing sample size, and Dirichlet process mixture models for clustering.

In our analysis we use Bayesian adaptive regression trees (BART) which is implemented in the program package R. BART method has been developed in a contribution of Chipman, George and McCulloch (2008; 2010). They develop a Bayesian “sum-of-trees” model where each tree is constrained by a regularization prior to be a weak learner\(^5\), and fitting and inference are accomplished via an iterative Bayesian backfitting Markov chain Monte Carlo (MCMC) algorithm that generates samples from a posterior. BART modelling has been specifically suggested for its usage in causal inference in previous literature in statistics (Hill and McCulloch, 2007; Hill, 2011).

The BART model consists of two parts: a sum-of-trees model and a regularization prior on the parameters of that model. Let \( T \) denote a binary tree consisting of a set of interior node decision rules and a set of terminal nodes, and let \( M = \{\mu_1, \mu_2, \ldots, \mu_k\} \) denote a set of parameter values associated with each of the \( b \) terminal nodes of \( T \). The decision rules are binary splits of the predictor space of the form \( \{x \in A\} \) vs \( \{x \notin A\} \) where \( A \) is a subset of the range of \( x \). These are typically based on the single components of \( x = (x_1, x_2, \ldots, x_p) \) and are of the form \( \{x_i < c\} \) vs \( \{x_i > c\} \) for continuous \( x_i \). Each \( x \) value is associated with a single terminal node of \( T \) by the sequence of decision rules from top to bottom, and is then assigned the \( \mu_i \) value associated with this terminal node. For a given \( T \) and \( M \), we use \( g(x; T, M) \) to denote the function which assigns a \( \mu_i \in M \) to \( x \). Thus,

\[
Y = g(x; T, M) + \epsilon, \quad \epsilon \sim N(0, \sigma^2) \tag{4}
\]

is a single tree model of the form considered by Chipman, George and McCulloch (1998).

With this notation, the sum-of-trees model can be expressed as

\[
Y = \sum_{j=1}^{m} g(x; T_j, M_j) + \epsilon, \quad \epsilon \sim N(0, \sigma^2) \tag{5}
\]

where for each binary regression tree \( T_j \) and its associated terminal node parameters \( M_j \), \( g(x; T_j, M_j) \) is the function which assigns \( \mu_i \in M \) to \( x \). Each \( \mu_{ij} \) will represent a main effect when \( g(x; T_j, M_j) \) depends on only one component of \( x \) (i.e., a single variable), and will represent an interaction effect when \( g(x; T_j, M_j) \) depends on more than one component of \( x \) (i.e., more than one variable). Thus, the sum-of-trees model can incorporate both main effects

---

\(^5\) According to Schapire (1990), a class of concepts is learnable (or strongly learnable) if there exists a polynomial-time algorithm that achieves low error with high confidence for all concepts in the class. A weaker model of learnability, called weak learnability, drops the requirement that the learner be able to achieve arbitrarily high accuracy; a weak learning algorithm need only output an hypothesis that performs slightly better (by an inverse polynomial) than random guessing. The notion of weak learnability was introduced by Kearns and Valiant (1988; 1989) who left open the question of whether the notions of strong and weak learnability are equivalent. This question was termed the hypothesis boosting problem since showing the notions are equivalent requires a method for boosting the low accuracy of a weak learning algorithm's hypotheses.
and interaction effects. And because (5) may be based on trees of varying sizes, the interaction effects may be of varying orders.

With a large number of trees, a sum-of-trees model gains increased representation flexibility which endows BART with excellent predictive capabilities. This representational flexibility is obtained by rapidly increasing the number of parameters. The BART model specification is completed by imposing a prior over all the parameters of the sum-of-trees model, namely, \((T_1, M_1), \ldots, (T_m, M_m)\) and \(\sigma\).

The variables, included in our main model, are listed in Table 3. In the models, we also include number of additional controls, including time and year fixed effects.

**Table 3: Main variables in the analysis**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>LogOpRe</td>
<td>Operating Revenue / Turnover, in logarithm form</td>
<td>Amadeus</td>
</tr>
<tr>
<td>LogEmpl</td>
<td>Number of Employees, in logarithm form</td>
<td>Amadeus</td>
</tr>
<tr>
<td>LogCapi</td>
<td>Capital, in logarithm form</td>
<td>Amadeus</td>
</tr>
<tr>
<td>LogDebt</td>
<td>Debtors, in logarithm form</td>
<td>Amadeus</td>
</tr>
<tr>
<td>NascCult</td>
<td>Dummy variable, having value of 1 if the firm is of 42 months or less age at the year of the survey, and 0 otherwise</td>
<td>Amadeus, own elaboration</td>
</tr>
<tr>
<td>GovCultB</td>
<td>Percent of ministry budget for culture in GDP</td>
<td>Eurostat (COFOG)</td>
</tr>
<tr>
<td>AgeOrg</td>
<td>Age of the firm at the year of the survey, included also with a quadratic term</td>
<td>Amadeus</td>
</tr>
<tr>
<td>LogTotAss</td>
<td>Total Assets, in logarithm form</td>
<td>Amadeus</td>
</tr>
<tr>
<td>LogStocks</td>
<td>Stocks, in logarithm form</td>
<td>Amadeus</td>
</tr>
<tr>
<td>LogCurrLia</td>
<td>Current Liabilities, in logarithm form</td>
<td>Amadeus</td>
</tr>
<tr>
<td>LogLTDebt</td>
<td>Long Term Debt, in logarithm form</td>
<td>Amadeus</td>
</tr>
<tr>
<td>LogEntVal</td>
<td>Enterprise Value, in logarithm form</td>
<td>Amadeus</td>
</tr>
</tbody>
</table>

Source: own elaboration.

**Results**

Table 4 presents the results of modelling the direct and indirect (i.e. mediated through the effect on nascent entrepreneurship) effects of cultural policy on operating revenues, employment, capital and debt, using basic Baron and Kenny's approach with bias-corrected bootstrap method. The variables included have been tested for multicollinearity to avoid the overlap. As it can be seen, as expected, government budget for culture has a positive and (weakly) significant effect on the level of operating revenues, which persists in both regressions where it is used (reduced and full model). Government budget for culture has a negative effect on the level of employment, strongly positive effect on the level of capital and no effect on debt. None of those effects is mediated – all of the coefficients on cultural budget in the mediator model are clearly insignificant.

On the other hand, being a nascent cultural firm has a negative effect on the operating revenues, positive on employment and negative on the level of capital, which is in accordance with expectations and previous studies (Vecco and Srakar, 2017).

**Table 4: Results of mediation analysis, basic mediation**

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Reduced model, dep.var.: LogOpRe</th>
<th>Mediator model, dep.var. NascCult</th>
<th>Mediator to Response model, dep.var.: LogOpRe</th>
<th>Full model, dep.var.: LogOpRe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coef.   t stat   Sig.</td>
<td>Coef.   t stat   Sig.</td>
<td>Coef.   t stat   Sig.</td>
<td>Coef.   t stat   Sig.</td>
</tr>
</tbody>
</table>

11
Table 5 presents the results of mediation modelling using cross-lagged panel models, based on equations (1)-(3). The results are significantly different than in Table 4. Namely, the coefficient on cultural budget in the second regression (the mediator model) is positive and statistically significant, and the coefficients on nascent cultural entrepreneurship (the mediating variable) in the final full model regressions are statistically significant for operating revenues, employment and level of capital. As the indirect effect can be expressed in terms of product of the two coefficients (coefficient on cultural budget in the second regression and coefficient on nascent entrepreneurship in the full model regression), we can claim that cultural budget has a direct effect on the performance of cultural firms, but largely only in terms of capital and debt (it causes cultural firms to have less capital and more debt, in accordance with the pecking order theory, see e.g. Myers and Mayluf, 1984), and a separate, indirect effect through its effect on the prevalence of nascent cultural entrepreneurship, on the level of operating revenues, employment and capital.

Source: Own calculations.

It is possible that the effects carry a large degree of heterogeneity. Therefore, we separate the regressions by welfare regimes, following the commonly used Esping-Andersen's classification (Esping-Andersen, 1990) into five broad regimes:

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6 Other possible classifications, for example the classification of entrepreneurial regimes in Dilli and Elert (2016) which features more heterogeneity in the continental group, could be tested in future research. Our robustness check did not find much difference when using the Dilli and Elert classification.
Results, presented in Table 6 confirm the heterogeneity between regimes. Indirect effects can be observed in Continental countries (as related to operating revenues) and Social Democratic countries (as related to employment and level of capital). They seem very strong in level and significance in Social Democratic countries. No indirect effects whatsoever can be observed in Liberal, Mediterranean and Eastern European countries. This shows that cultural policies are best targeted to nascent firms in culture in Western Europe (excluding United Kingdom and Ireland); countries like France, the Benelux countries Germany, Austria, Sweden and Denmark seem the most oriented towards positively stimulating nascent firms in culture in our causal scheme.

Several robustness tests have been performed, most of them not presented here due to article’s length. As noted in the methods section, the authors performed the models with several different estimators, to take into account the dynamic nature of the dataset, and multilevel modelling. Moreover, quite a few different measures of public budgets for culture (percent of GDP, of total budget, different types of budgets, etc.) were included. Finally, the findings for different definitions of NE, including the firms of 2 or 5 years of age, were tested. None of the robustness checks has shown any significantly different observations in the verification of our main hypotheses.

In Figures 4 and 5, we visually present the results of Bayesian nonparametric BART models. The visualization follows a common approach to estimate marginal effects from nonparametric models, developed in Friedman (2001) and labelled as partial dependence functions/plots. In descriptive terms, partial dependence is an approximation to the target function which maps independent on dependent variables and minimizes the expected value of some specified loss function $L(y, F(x))$ over the joint distribution of all $(y, x)$ values.
Largely, the results of this verification confirm previous results from Table 5 with additional nonlinear effects visible. The effects of the three studied variables in Models 1 and 2 are positive, as suggested in Table 5, with the effect of government spending being of weaker significance. Additionally, we can observe significant effects of nascent cultural entrepreneurship in Models 3, 4 and 6, i.e. on operating revenues, employment and level of debt. The only difference is that in this modelling, the effect on capital is insignificant, while the effect on debt becomes of higher importance.

Figure 4: Partial dependence plots for the variables in Table 5.

Note: From left to the right: the effect of GovCultB_L1 on GovCultB in Model 1; the effect of NascCult_L1 on NascCult in Model 2; the effect of GovCultB_L1 on NascCult in Model 2.
Source: Own calculations.

Figure 5: Partial dependence plots for the variables in Table 5.

Note: From left to the right: the effect of NascCult_L1 on LogOpRev in Model 3; the effect of GovCultB_L2 on LogOpRev in Model 3; the effect of NascCult_L1 on LogEmpl in Model 4; the effect of GovCultB_L2 on LogEmpl in Model 4; the effect of NascCult_L1 on LogCapi in Model 5; the effect of GovCultB_L2 on LogCapi in Model 5; the effect of NascCult_L1 on LogDebt in Model 6; the effect of GovCultB_L2 on LogDebt in Model 6.
Source: Own calculations.

Conclusion
In the article, as set of three hypotheses has been tested. Hypothesis H1 (*Cultural policy has an effect on entrepreneurial performance of cultural firms*) has been confirmed. In most of the models in tables 4, 5 and 6, cultural budgets as a proxy for cultural policy had a significant direct effect on performance, in particular for operating revenues and employment. This effect has been found highly specific for welfare regimes, as shown in Table 6.

Hypothesis H2 (*This effect is mediated by the effect of cultural policy on nascent entrepreneurship*) has also been confirmed, but only when taking into account the time varying structure of the causal relationship. In the models of basic mediation, (Table 4) it can be observed that there is no mediating relationships. On the other hand, in longitudinal mediation, performed by cross-lagged panel models, we were able to observe quite strong indirect effects of cultural policy on firm performance through the mediating effect of nascent cultural entrepreneurship.

Hypothesis H3 (*The total effect of cultural policy on entrepreneurial performance differs depending on the performance indicators*) has also been confirmed. We found significantly different effects specifically related to the levels of capital and debt, with the latter largely insignificant in most models. Moreover, the effects on operating revenues and employment are clearly different in Table 4, using basic mediation models, which concurs with the findings of Vecco and Srakar (2017).

The authors are aware of some limitations and paths for future research. One clear limitation concerns the sample used within this study. Many artistic sectors (in particular the more “core” ones such as theatre, classical and jazz music, and fine arts) are underrepresented in the sample under study. It would be interesting to compare the results using any other existing database (e.g. Global Entrepreneurship Monitor – GEM, or the World Bank Group Entrepreneurship Database). Furthermore, other performance measures should be included in the analysis and tested to get better insight into the performance of this sector. More attention might be paid to legal status of the firms, to the institutional settings, which regulate their performances, and to the market and competitive conditions: how does the structure of that industry (e.g. concentration) affect these cultural firms? What is the main relevant set of formal and informal institutions affecting their performance? How do these formal and informal national level institutions concur and interact with each other? What kinds of types of cultural firms are more successful across the different sectors of the cultural industries? Are these cultural firms generating collective benefits for the society as well? Who benefits from the externalities associated with NEC?

In addition to the directions stemming from limitations, qualitative analysis and/or mixed methods could be used to get better insight into the reasons for possible drawbacks and failures of nascent cultural firms. This will allow us to develop more focused policies to bolster the cultural sector and fully exploit its potential.

Nevertheless, the study is among the first empirical/econometric studies on nascent cultural firms. Using similar methodological tools as in this article, we would be able to get significantly better insight into an ever more spreading and economically propulsive and important sector. By this, the usual stereotypes of cultural firms being more or less of marginal importance could be changed which would benefit the field of culture and entrepreneurship in general.
Furthermore, methodological advance of the paper is clear. The article is to our knowledge the first using Bayesian nonparametric methods for longitudinal mediation in statistics and econometrics in general, and the first usage of both longitudinal mediation and Bayesian nonparametrics in cultural economics. The advancements and discussions in contemporary statistics and econometrics are only slowly getting ground in cultural economics and many methods remain unused. In particular, Bayesian modelling should find a more common place in cultural economic usages in future.

The present findings have both policy and managerial implications. In general, nascent cultural firms are more exposed to performance problems than both the cultural firms in general and nascent cultural firms in other sectors, respectively. This should come as no surprise, as cultural firms are niche market oriented as in general face smaller markets (this can assume as characteristic of the cultural sector in general), in particular in the early years of their take-off. It would therefore be strongly recommendable to enhance the condition of those firms by targeting specific policy measures to stimulate the sector growth. This is particularly important for the cultural sector also for the reason of its essence, being related to riskier and innovative projects, which implicitly have the dimension of “nascent” in its very nature. For example, specific interventions to promote networking activities may be relevant to overcome the problem that many small firms lack resources to implement growth strategies. Mostly, the costs associated to starting and establishing a business, by respecting all regulatory procedures and administrative burden (this is a feature characterizing all businesses not just the cultural sector) may represent an obstacle for the nascent firms. Undoubtedly, there is a gap in the economic development agent’s ability to reach out to the majority of the smallest firms. The authors would suggest that there is a clear need for specific strategies and tools to deploy the potential of the cultural sector, considering the cultural firms as relevant economic development agents whose contributions may substantially support the sustainability of the economic system.

References


