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Marshallian and Jacobian Externalities in Creative Industries

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Abstract

Does the growth of creative industries within a city yield both agglomeration effects (Marshallian externalities) as well as spillovers to the rest of the economy (Jacobian externalities, related to the novel combinations that can occur in cities with diversified economic activities)? Most of the quantitative literature on creative industries investigates one or the other of these effects. Exploring both under a common framework, I find significant evidence of Marshallian but not of Jacobian effects. This calls for caution in the elaboration of policies meant to encourage the growth of the creative sector.

The degree of specialisation in creative *sectors* is associated with higher sales and a higher number of firms in those sectors, albeit at a decreasing rate. A similar relationship is found for specialisation in creative *occupations* and the incomes of those workers. Though there is no evidence of spillovers from creative industries in general to the rest of the economy, analyses at a more disaggregated level could produce different results and useful insights for policy.

Keywords: Creative industries, creative economy, Marshallian externalities, agglomeration effects, Jacobian externalities.

JEL codes: R12, Z19, R58.

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1 Introduction

According to Benavente and Grazzi (2017), creative industries are 'the group of activities through which ideas are transformed into cultural and creative goods and services whose value is or could be protected by intellectual property rights'. There is a growing literature that can be traced back to Throsby (1994) and Florida (2002), pointing towards the importance of creative workers and creative firms for economic development. Subsequent work, particularly quantitative studies in the tradition of economic geography, has included analyses of the determinants of the creative agglomerations, their outcomes, and attempts to understand whether they generate spillovers to the rest of the economy.

I argue that most of that literature, including papers that do not frame themselves in that way, can be interpreted as asking questions about Marshallian or Jacobian externalities. Marshallian (sometimes called Marshall-Arrow-Romer) externalities are the benefits that a sector attains from its agglomeration in a geographical area: the pool of specialised labour and suppliers, together with intra-industry knowledge spillovers, results in effects that are external to the firms but internal to a sector. On the other hand, Jacobs (1969) argued that the interactions that occur within industrially diverse cities result in a higher potential for innovative combinations to arise. These positive effects of diversity are external both to firms and sectors.

The nature of creative industries makes them a sector with specially high potential to generate novel and innovative interactions with other activities, thus fostering innovation across the regions where they are located: this is precisely what lies behind Jacobian spillovers. Regardless of whether a region is more or less diversified, a strong creative sector should always be a source of creative goods and services that can interact with other sectors and generate innovative combinations, thus contributing to the Jacobian spillovers that are more generally associated with diversity.

For creative sectors, the issue is not whether Marshallian or Jacobian externalities are more important, rather if they are or are not a source of both: is a stronger creative sector associated with better outcomes for the creative sector itself and for the rest of the economy? The former would be Marshallian externalities (intra-industry effects), and the latter Jacobian externalities towards the rest of the economy, occurring through knowledge spillovers. The policy implications of Jacobian spillovers are much stronger. I study both questions under a common framework.

A distinction that could be important to uncover these effects is that between creative *sectors* and creative *occupations*. The definition of the 'creative class' by Florida (2002) has been highly influential, however, an important part of the literature studies creative sectors, rather than occupations. This is partly because there are economic arguments about the specificities of creative sectors, but also because of data availability. In this paper I will consider both creative sectors and occupations throughout the analyses.

This paper contributes to the literature in several ways. The first is studying under a unified framework whether creative industries are a source of Marshallian or Jacobian externalities. A second contribution is the specification used to study Marshallian effects, which shows that the relationship between creative agglomerations and their outcomes is nonlinear. Third, while studying these issues, the paper always compares the results for creative sectors and creative occupations. And fourth, studying a middle-income country is an important contribution. Most of the existing literature studies developed economies, and with policymakers in developing countries championing creative industries, particularly in Latin America, it is paramount to produce evidence in different contexts, as the case of Chile sudied here.

The econometric analysis suggests that creative sectors are associated to Marshallian externalities, although only when they are relatively small. Further specialisation in them is associated with more firms

and higher sales, consistent with the existence of Marshallian externalities. At high levels of specialisation however, these relationships seem to disappear. A higher specialisation in creative occupations is associated with higher incomes of those creative workers, also at a decreasing rate as specialisation increases.

There is no evidence that creative industries in general have positive economic effects on the wider economy in a Jacobian sense, but a preliminary look at different creative subsectors suggests that there is heterogeneity to be uncovered.

Section 2 briefly reviews the literature on Marshallian and Jacobian effects, summarises the evidence on creative industries from that perspective, and explains the research questions and contributions. Section 3 describes the data and some important definitions. Section 4 presents a brief descriptive analysis of creative industries in Chile. Section 5 shows the results of the econometric analyses of Marshallian and Jacobian effects. Section 6 summarises and discusses the results.

2 Literature Review and Research Questions

2.1 Knowledge Spillovers from Specialisation or Diversification?

There has been a long debate in economic geography on whether it is better for regions to be specialised or diversified. On the one hand, the argument first proposed by Marshall (1890) and then enriched by the contributions of Arrow (1962) and Romer (1986) states that regions benefit from specialising in an economic sector. This is, among other reasons, because of labour market pooling, specialised suppliers and intra-industry knowledge spillovers. On the other hand, Jacobs (1969) argued that cities flourish because the diversity of economic sectors produces inter-industry knowledge spillovers: innovation is generated by the recombination of ideas stemming from different sectors.

The broad corpus of quantitative evidence spearheaded by Glaeser et al. (1992) has not settled the debate. A broad ranging literature review by Beaudry and Schiffauerova (2009) concluded that the heterogeneous findings regarding Marshallian and Jacobian effects are not the result of fundamental differences across sectors or countries, but of methodological and measurement issues. The review by De Groot et al. (2009) concluded that the evidence is stronger for Jacobian effects, but also that the heterogeneity in the findings for both types of externalities may in part be explained by the different stages of development of regions and sectors. Neffke et al. (2011) showed that the role of Marshallian and Jacobian externalities changes across the life-cycle of industries.

Although both types of spillovers should ultimately result in higher productivity, the literature has taken a liberal approach and, given the lack of good data on productivity, has often looked at other outcomes, such as employment, wages, and number of plants when looking for evidence of Marshallian or Jacobian effects (see the review by Beaudry and Schiffauerova, 2009). The same approach will be followed here, by looking at a broad set of economic outcomes.

To capture the degree of specialisation, most of the literature uses measures based on employment in a sector. To capture diversity, concentration indices such as the Gini and the Hirschman–Herfindahl indices are the most common measures, followed by measures based on employment in other sectors. The latter will be used here.

2.2 Marshall and Jacobs: Agglomeration and Spillover Effects of Creative Industries

Although Jacobs' insight was about *diversity*, I argue that a stronger creative sector could be a direction of diversification that has a particularly high potential for spillovers towards other sectors. The underlying source of Jacobs' (1969) externalities—what makes diversity good for innovation—is the potential for novel ideas or novel uses for existing ideas that can occur when knowledge from different sources is recombined. Not all pairs of sectors have the same potential for innovation when they are put together, and creative sectors could be a particularly rich source of potential recombinations: as argued by Rutten et al. (2011, p.4), creative industries are 'characterized not only by a relatively high growth rate but also by extensive crosslinking with other sectors and branch industries'. This issue is explored by Chapain et al. (2010), who highlighted the importance of co-location for the materialisation of potential spillovers from creative industries to the rest of the economy. Jacobs gave examples of the importance of diversity using creative occupations: 'a playground designer is starting to make and sell equipment for playgrounds and nursery schools; a sculptor is starting a line of jewelry' (Jacobs 1969, pp. 53–4). Diversity in general may improve the likelihood of novelty. Creative industries in particular are especially likely to generate novelty when they interact with other activities.

The argument put forward here is that, sometimes implicitly, studies of creative industries have tried to determine whether the sector is associated with Marshallian or with Jacobian effects. Under the interpretation of creative industries as a source of Jacobian spillovers, creative sectors may be a source of both types of spillovers at the same time: as they agglomerate, they can improve outcomes for themselves (Marshallian, intra-industry agglomeration effects) and for the wider economy (Jacobian, inter-industry effects). The existence of Jacobian spillovers would have stronger policy implications: if a sector systematically improves the outcomes of the rest of the local economy, it would be desirable that the sector is strong in as many regions as possible.

Some contributions showing evidence consistent with the existence of Marshallian effects include Bakhshi et al. (2014), Lazzeretti et al. (2017), Simone (2015), and Yu (2018). Bakhshi et al. (2014) found evidence of higher wages for creative occupations in the regions of the United Kingdom with a higher cultural clustering. Lazzeretti et al. (2015) and Simone (2015) found that for Italy, industrial variety within creative sectors was a determinant of these sectors' employment growth.[1] Yu (2018) looked directly at the productivity of creative industries across Chinese provinces and found that it is determined by different measures of the specialisation and concentration of a province in creative sectors. A different result is observed by Tao et al. (2019), who worked with firm-level data from China and found that specialisation in creative sectors is *not* a determinant of the productivity of firms in creative sectors.

The existence of inter-industry spillovers associated with specialisation in creative industries is, as I argued above, implicitly evidence of Jacobian effects: specialisation in creative industries is likely to generate novel combinations with potential to increase productivity or to create new products or sectors. More generally, we can call these inter-industry effects of creative industries on the rest of the economy. These knowledge spillovers, as argued by Chapain et al. (2010), can occur not only through novel combinations, but also through labour flows, through sophisticated demand, or through the transmission of organisational models

[1] They do not look exactly at Marshallian agglomeration. In fact, they are looking at a measure of diversity, but their dependent and independent variables are both related to the development of the *creative sector*, thus study whether the development of the sector (its *within* diversity, following Frenken et al., 2007) is positive for itself. That corresponds to the Marshallian and not the Jacobian component as analysed here. The important distinction by Frenken et al. (2007) between related and unrelated variety is not particularly relevant to the discussion here, as it relates to diversity, which is not an aspect being considered directly in this paper.

(see Potts and Morrison, 2009). Following Chapain et al. (2010), creative spillovers to the wider economy could also take the form of product spillovers (e.g. demand for goods that are complementary to creative goods) and network spillovers (e.g. creative activity attracts people and fosters the tourism industry). But creative industries could also produce some *negative* spillovers: workers may be willing to accept lower wages in exchange for living in vibrant cities with a strong cultural scene (see Bakhshi et al., 2014).

There is evidence of a positive correlation between creative industries and a number of different outcomes in a region: evidence for employment is found by Marlet and Van Woerkens (2007), Stam et al. (2008), Boschma and Fritsch (2009), Rutten et al. (2011), Piergiovanni et al. (2012) and Lee (2014); for wages, by Lee (2014); and for a relationship with output or productivity by Rausell Köster et al. (2011), de Miguel-Molina et al. (2012), Marco-Serrano et al. (2014), Hong et al. (2014) and Boix-Domenech and Soler-Marco (2017). Bakhshi and McVittie (2009) found a relationship between innovation and purchases from and sales to creative industries, and Lee and Rodríguez-Pose (2014) found that small U.K. firms in cities with a higher share of creative employment innovated more. The influential work by Chapain et al. (2010) showed that creative industries tend to co-locate with some sectors, and interpreted that result as suggestive of the existence of spillovers between them.

2.2.1 Are There Really Positive Jacobian Effects?

Rausell Köster et al. (2011) and Marco-Serrano et al. (2014) found evidence of causality in both directions: from specialisation in creative sectors to GDP per capita, and from GDP per capita to creative specialisation. Yet other studies have found no evidence of inter-industry effects or even a negative relationship between specialisation in creative industries and regional outcomes. Bakhshi et al. (2014) found evidence of positive Marshallian effects, but when they looked at the wider economy, they found a negative relationship between creative activities and wages, which they interpreted as a compensating differential of living in a region with a 'vibrant cultural scene'. Lazzeretti et al. (2015) also found evidence of intra-industry effects but found no relationship between the variety of creative industries and employment growth in the wider economy. Campi et al. (2021) found no effect from creative industries to innovation in the wider economy, although there was some evidence of a positive effect on employment. The main conclusion from a report commissioned by severeal European agencies and NGOs with the objective of examining the existing evidence of spillovers from creative industries concluded that 'there are research gaps about causality and even more about commonly accepted methods of quantitative and qualitative evaluations' (TFCC, 2016, p.8). Fahmi and Koster (2017), working with Indonesian regions, concluded that creative industries 'are more likely to be an indicator than a driver of regional economic development' (Fahmi and Koster, 2017, p.1). Stojčić et al. (2016) found a negative relationship between the share of employment in creative industries and the annual growth rate of GDP per capita in Croatian regions. Innocenti and Lazzeretti (2019) found a positive relationship between employment growth and a measure of relatedness between the creative sectors and the other sectors (especially services), but a negative relationship between specialisation in creative sectors and employment growth in Italian provinces. They interpreted their results as evidence that creative industries promote growth in the wider economy only when they co-locate with related sectors. Boschma and Fritsch (2009) found evidence of a positive relationship between creative workers and employment growth across Dutch regions. But for Germany results are weaker, and for one of the creative class measures, negative.

Besides the fact that there is also evidence of no relationship or a negative relationship between creative industries and outcomes of the broader economy, a deeper scrutiny of the literature shows important meth-

odological issues with most of the papers that found a positive Jacobian effect. All but one of the cited papers that found evidence of positive spillovers from creative industries to the broader economy shared at least one of two issues: they included R&D under their definition of creative industries or their data was limited to a cross section with sometimes as few as 30 observations. To the best of my knowledge, Lee (2014) is the only paper that uses fixed-effects models and does not include R&D within the definition of creative industries and that found econometric evidence of positive spillovers.[2] A further issue with many previous studies is that their dependent variables did not exclude creative sectors, so they may have been capturing the intra-industry effects of creative industries on their own outcomes, especially if creative activities were an important part of the economy of a region.

In sum, previous evidence on positive spillovers from creative industries to the rest of the economy is mixed, and the evidence on positive spillovers is not particularly strong. Table 1 presents a summary of the papers discussed above and their findings.

2.3 Research Questions and Contributions

Are creative industries associated with Marshallian or Jacobian spillovers? One of the main contributions of this paper is to study both questions under a common framework.

Marshallian effects refer to whether further specialisation in creative industries results in improved outcomes for those same industries (intra-industry spillovers). Jacobian effects occur when further specialisation in creative industries results in improved outcomes for the rest of the local economy (inter-industry spillovers). Similar specifications were used to study both questions, the key difference being whether the dependent variable measured an outcome (e.g. sales) for creative activities or for non-creative activities within a region.

Most previous empirical work on creative industries focused on a single dependent variable. To obtain a broader picture, I analysed labour income measures built from individual-level data and firm-based measures based on aggregate data from tax records, in line with the literature on Marshallian and Jacobian effects, which looks at a number of outcomes besides productivity.

The degree of specialisation in creative activities was measured using the location quotient (LQ), which has been one of the most popular measures in the literature of Marshallian agglomerations.

Loosely motivated by the conclusions of Neffke et al. (2011) and De Groot et al. (2009) mentioned above, a further contribution is consideration of the possibility that these intra-industry and inter-industry effects change as creative activities evolve. More specifically, I included a quadratic term for the measure of specialisation in creative activities to see if the Marshallian or Jacobian effects are different for different degrees of specialisation in creative activities.

Considering the distinction between creative sectors and occupations, I exploited the richness of the available individual-level data to look separately at specialisation in creative sectors and occupations to see whether there are differences in terms of the associated intra-industry or inter-industry effects. Rutten et al. (2011) found evidence consistent with positive spillovers from creative occupations, but not from creative sectors. Bakhshi et al. (2014) also arrived at different results from creative sectors and creative occupations.

[2] It also used shift-share instruments, which although appeared to be weak, seemed to confirm the results. Piergiovanni et al. (2012) used panel data, but only found significant coefficients when fixed effects were not included. Some other papers used instrumental variables, but either did not report the relevant specification tests for them or included R&D in their definition of creative sectors. Moreover, the instruments, when arguably exogenous, were limited to capturing cultural activities.

Table 1: Marshallian and Jacobian Effects, Summary of the Literature

Paper	**Geographic Region and Level of Analysis**	**Marshallian Effects**	**Jacobian Effects**
Marlet and Van Woerkens (2007)	Dutch cities		+
Stam et al. (2008)	Dutch cities		+
Boschma and Fritsch (2009)	German and Dutch regions		**x**/-/+
Bakhshi and McVittie (2009)	United Kingdom, firm-level data		+
Chapain et al. (2010)	United Kingdom, different geographical levels		+
Rutten et al. (2011)	Dutch cities		+
Rausell Köster et al. (2011)	Spanish regions		+
de Miguel-Molina et al. (2012)	European regions		+
Piergiovanni et al. (2012)	Italian provinces		+
Bakhshi et al. (2014)	United Kingdom travel to work areas, individual-level data	+	-
Hong et al. (2014)	Chinese provinces		+
Lee (2014)	United Kingdom travel to work areas		+
Lee and Rodríguez-Pose (2014)	United Kingdom, firm-level data		+
Marco-Serrano et al. (2014)	European regions		+
Simone (2015)	Italian provinces	+	
Stojčić et al. (2016)	Croatian regions		-
Boix-Domenech and Soler-Marco (2017)	European regions		+
Fahmi and Koster (2017)	Indonesian regions		+
Lazzeretti et al. (2017)	Italian provinces	+	**x**
Yu (2018)	Chinese provinces	+	
Innocenti and Lazzeretti (2019)	Italian provinces		-/+
Tao et al. (2019)	Chinese provinces, firm-level data	**x**	
Campi et al. (2021)	Colombian departments		**x**/+

Notes: For each paper, I indicate whether they found positive (+), negative (-), no effects (x), or a combination of these, for the hypotheses which they tested. The classification in Marshallian and Jacobian is based on my interpretation of their analyses.

Finally, this paper contributes to the small but growing evidence coming from developing countries, which includes Hong et al. (2014), Yu (2018) and Tao et al. (2019) using Chinese data, Fahmi and Koster (2017) studying Indonesia, and Campi et al. (2021) studying Colombian data.

3 Data and Definitions

As indicated by Chapain et al. (2010), disaggregated classifications of production are important to identify creative industries. The available data makes it possible to study income, number of firms, sales and labour productivity[3] at a very disaggregated level in terms of economic classification (six-digit ISIC or four-digit ISCO categories) and geographically (around 60 labour market areas). I worked with a panel of data at the level of labour market that was constructed from a panel of aggregated tax records data on firms and from different waves of an individual-level survey with information about occupations and incomes.

3.1 Databases

I used two main databases: the Casen survey and data from the tax authority.

The Casen survey (*Encuesta de Caracterización Socioeconómica Nacional*) is the National Socio-economic Characterization Survey. It is the cornerstone of social policies, and it has been conducted every two or three years continuously since 1990, with the latest available data at the moment of conducting this research being from 2017. For the purpose of this study, the most useful information was the classification of each worker's main activity, using the International Labour Organization's ISCO-88 codes, and of the sector of the firm where they work, classified using ISIC codes, which have been available at four digits since 1998.[4] The Casen survey is relatively large, having around 250,000 observation in the latest rounds, and close to 190,000 in 1998. This provides the geographical disaggregation required to understand creative economies, which are known to cluster in specific geographical areas.[5] An advantage of Casen relative to other data sources (like tax records or firm surveys) is that is does not under-represent informal workers or small or single-person firms (both frequent in the traditional cultural sectors).[6] Its main shortcoming is that it only records the interviewee's main activity and thus may under-represent creative activities so long as they can be a secondary source of income. I used this database to explore possible effects of creative industries on labour incomes (which includes wages and income from self-employment).

Tax data is available yearly for the 2005-2017 period from the SII (*Servicio de Impuestos Internos*). It is reported at the smallest administrative level of *comuna* and six-digit ISIC.CL (rev. 3) sector[7] and includes information on the number of firms, total sales, number of workers, and their total wages. The main value

[3] I did not consider employment measures because of their higher risk of simultaneity. See a critique of their use in the context of Marshallian and Jacobian effects in Almeida (2005). One possible way to consider employment as an outcome could be the local multipliers shift-share approach proposed by Moretti (2010) and as used by Campi et al. (2021) for creative industries in Colombia. There are still concerns about its use in this context.

[4] In Revision 2 for 1998, 2000, 2003, 2006 and 2009 and Revision 3 for 2011, 2013, 2015 and 2017. Appendix A.2 explores whether this change in the classification is problematic.

[5] The Casen survey was designed to be representative at the smallest administrative level of *comuna* for more than half of them in 1998, for over 90 percent in 2000, for all *comunas* included in the 2003, 2006 and 2009 surveys, and for the *comunas* that concentrate 80 percent of the population of each region in 2015. The 2011, 2013 and 2017 surveys did not consider the *comuna* level in their sampling methodologies, but expension factors for *comuna*-level estimation are provided for research purposes for all years for all *comunas* in the sample.

[6] Every individual aged 15 or more who declared that they worked or planned to work for at least one hour the week before the interview was asked about their main occupation.

[7] ISIC.CL is the Chilean adaptation, which adds two digits to the standard four-digit ISIC rev.3 classification.

of this dataset comes from the measure of aggregate sales and the possibility of building a measure of labour productivity at the level of sector-*comuna*. However, it has some shortcomings: sales are omitted for sectors with 10 or fewer informants; the main activity reported to the tax authority may not be the firm's actual main activity; and the geographical location is that of the firm's headquarters, which can differ from the region where the economic activities are conducted. The possible biases associated with this are in general the same for all *comunas*, except for a few of them (mostly within the capital Santiago), which are the legal base of many firms that operate at different locations.

3.2 Definitions

There are a number of different definitions of what creative industries are, including, but not limited to those given in DCMS (2009; 2013), UNDP and UNCTAD (2010) and WIPO (2003). This section explains the definitions of creative sectors and creative occupations. Creative sectors are those that produce cultural and creative goods and services (Benavente and Grazzi, 2017) and employ workers that conduct creative activities (e.g. architects) as well as other workers that are required for those sectors to operate, even though their occupations are not creative in themselves (e.g. office clerks). Creative occupations refer to the jobs that are inherently creative in their nature, regardless of the sector where the individual is working. For example, designers and photographers work for firms in many different economic sectors, not only within creative sectors. The job of a designer is still a creative occupation regardless of whether the person works in manufacturing, construction or retail.

From a practical standpoint, definitions need to be applicable to the available data, in which occupations were classified using ISCO-88 codes and sectors using ISIC codes (revisions 2 and 3).

3.2.1 Creative Sectors

The baseline list of which categories were considered to be creative was defined for the ISIC Rev.3 classification based on the international classifications mentioned above and can be seen in Table A1 in Appendix A.[8]

Starting from this definition, correspondences were constructed to obtain a classification for ISIC Rev.2 (Table A2) and for the 6-digit Chilean implementation of the Rev.3 used in the SII data (Table A3), which allows for a better classification than the international 4-digit classification and thus will be the baseline definition of creative sectors when using the SII database.[9]

The scope of the definition, in terms of what is included or excluded, is important. A definition could be too narrow and limited to artistic and cultural activities, or too broad, including activities whose creative nature could be questioned. The implications for eventual spillovers to other sectors are important: the narrower the definition is, the more certain we can be about finding a relationship between creativity and other activities, but modern creative sectors could be left out. As the definition broadens and more activities are included, the eventual spillovers could be associated with factors other than the creative nature of the activities. A broad definition also means more heterogeneous activities are lumped together.

[8] The list is based on the international classifications, but the details were agreed by the authors of the different papers participating in this IDB-funded project to increase comparability across studies.

[9] This classification was also informed by Chilean policy documents that include a list of creative categories for the 6-digit, Chilean adaptation of ISIC Rev.3 (CNCA, 2014; 2016).

3.2.2 Creative Occupations

For occupations, the baseline is the list of occupations considered to be creative in the official reports on Creative Industries produced by the Chilean government (Table A4). The first comprehensive analysis of creative industries was CNCA (2014), followed by an update in 2016 (CNCA, 2016).[10] This official classification was modified to be as consistent as possible with the baseline definition of creative sectors discussed above.

Besides the general definition of which occupations are creative, the availability of data on the sector and the occupation of each worker allowed for the construction of a series of alternative definitions used for robustness checks.

3.3 Local Labour Market Areas and Construction of the Panel

The smallest administrative geographical unit in Chile is the *comuna*, of which there are 346. But the administrative unit is often not the economically relevant unit of analysis, as in some cases several *comunas* work as a single economic area. The baseline level of geographical aggregation will be the 63 Local Labour Market Areas (LLMAs) defined by Casado-Díaz et al. (2017).[11]

To measure the degree of specialisation of geographic units in creative sectors, I used employment-based location quotients (LQs). These were calculated, for each year, as the quotient between the ratio of employees that a region (LLMA) has in a sector and the national ratio, akin to a measure of revealed comparative advantage. That is,

$$LQ_{r,t}^{creative\_occupations} = \frac{workers_{r,t}^{creative\_occupations}/workers_{r,t}^{total}}{workers_{t}^{creative\_occupations}/workers_{t}^{total}}$$

where $workers_{r,t}^{creative\_occupations}$ is the number of individuals working in creative occupations in region r at time t, the superscript *total* refers to all workers, and the variables without the region subscript are for the whole economy. Three location quotients were defined: (i) based on the shares of workers in creative occupations; (ii) on the shares of workers in creative sectors based on Casen data; and (iii) on the shares of workers in creative sectors based on SII records. $LQ_{r,t}^{creative\_sectors\_casen}$ and $LQ_{r,t}^{creative\_sectors\_sii}$ are defined analogously to $workers_{r,t}^{creative\_occupations}$ but for workers in creative sectors according to each data source. Alternative formulations can be used (see Lazzeretti et al., 2008).

Using the Casen and SII data, I constructed a panel of LLMA-level aggregate data (total sales, average labour income, etc.).[12] I used SII data for variables that cannot be obtained from the Casen survey, such as total sales and the number of firms. The regressions include controls from the Casen survey, so the sample is restricted to the years with Casen information.[13] For the purpose of the construction of the panel, the time dimension was redefined as the Casen waves.

[10] These definitions were motivated by DCMS (1998), and their definitions of creativity are based on UNESCO (2009). They take a broad approach at creative industries, considering not only activities with a high cultural intensity, but also others like architecture, design, computer programming and advertising.

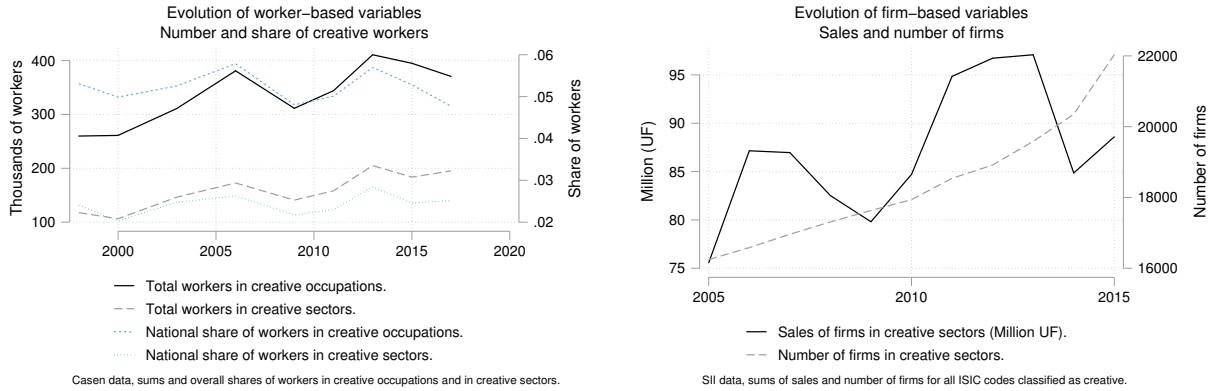
[11] Casado-Díaz et al. (2017) defined the LLMAs using an evolutionary approach that compares favourably with the alternative of travel-to-work areas.

[12] For Casen variables, the *comuna* level expansion factors are always used to weight observations when aggregate measures are calculated.

[13] 1998, 2000, 2003, 2006, 2009, 2011, 2013, 2015 and 2017.

4 Descriptive Analysis

This section briefly describes creative sectors and occupations and compares them to non-creative activities. Figure 1 shows the evolution of some key variables at the national level. Figure 1(a) shows the total number and the share of workers in sectors and in occupations classified as creative, obtained from the individual-level Casen data. While the absolute numbers have been increasing, their shares over the workforce have remained stable. The number of workers in creative occupations is approximately twice the number of workers in creative sectors. This is because creative workers are present across all the sectors of the economy, while creative sectors, although intensive in creative workers, are a relatively small sector in aggregate terms. Figure 1(b) shows the firm-based variables from the SII dataset. They show a steady rise in the number of firms in creative sectors, but a bumpy growth in sales, which comove with employment during the period. Figure B1 in the appendices shows the distribution of creative intensity across the country.



(a) Workers in creative sectors and occupations

(b) Sales and firms in creative sectors

Figure 1: Evolution of Creative Industries in Chile

Table 2 provides some basic descriptive statistics for creative and non-creative sectors, and creative and non-creative occupations. Creative workers have higher average incomes than non-creative workers, and the difference is higher for workers in creative sectors than for those in creative occupations. Weekly hours worked are lower on average for creative sectors and occupations, but the difference is more than compensated by higher hourly incomes on average. Years of education are higher for creative than for non-creative occupations and the difference is higher between creative and non-creative sectors, mimicking the situation with incomes.

In the second part of the table, the firm-based variables show that creative sectors represent a fairly small share of the total number of firms and of total sales. Sales per worker, which will be used as a proxy for productivity, are lower for creative than for non-creative firms. This apparent inconsistency with the individual-based statistics for hourly incomes could be explained by differences in intermediate input usage and capital intensity. If non-creative sectors have a higher capital intensity, they may have higher sales per worker, but an important part of those sales may end up as return on capital and not wages.[14] Creative industries may use fewer intermediate inputs on average than sectors like manufacturing or natural resource-based industries. This could also explain why the higher sales per worker of non-creative sectors are not

[14] Djulius et al. (2020) estimated the production function for creative industries in Indonesia and found that capital does not play a relevant role and value added is explained mostly by labour.

Table 2: Descriptive Statistics for 2015

	Sectors		Occupations	
Casen data	Creative sectors	Non-creative sectors	Creative occupations	Non-creative occupations
Percentage of total workers	2.6	97.4	5.88	94.12
Average income (CLP)	835,075	449,693	671,990	446,483
Average weekly hours worked	40.96	42.88	39.85	43.02
Average hourly income (CLP)	5,208.84	2,683.34	4,327.26	2,650.58
Average schooling (years)	15.05	11.82	14.02	11.77
SII data	Creative sectors	Non-creative sectors		
Total number of firms	22,032	943,187		
Total sales (1,000s of UF)	88,600	15,800,000		
Sales per worker (weighted average)	2,251	10,329		

Notes. Results reported for 2015, the last year with data from both datasets available. Casen averages are calculated for the whole economy, using expansion factors. UF stands for *Unidad de Fomento*, a constant currency unit. Sales per worker is a weighted average using LLMA population as weights.

translated into higher wages. In general, sales per worker are not a very good proxy for productivity, but no better measure is available. Finally, there are some concerns with the tax records data.[15]

5 Econometric Analysis of Marshallian and Jacobian Effects

The questions related to the Marshallian (intra-industry) and Jacobian (inter-industry) effects of creative industries are analysed with the linear models described below. A broad set of dependent variables are considered, including labour market and firm outcomes, all of them aggregated at the LLMA level. The labour market measures, based on Casen data, are the incomes per hour of workers in creative sectors and of workers in creative occupations; the firm-based measures, based on SII's administrative records are number of firms, sales, and sales per worker as a rough proxy for productivity.

5.1 Marshallian Effects

To explore the relationship between specialisation and the outcomes of creative sectors, I estimated the following panel model:

$$ln\left(y_{r,t}^{creative}\right) = \beta' \mathbf{x}_{r,t} + \gamma Specialisation_{r,t} + \delta Specialisation_{r,t}^2 + \lambda_r + \lambda_t + u_{r,t} \quad (1)$$

[15] Firms could produce creative output and be registered as operating in a non-creative sector, but the opposite can happen, so the direction of this bias is not self-evident. Informality is also an issue, but again it affects both creative and non-creative firms. Moreover, sales (and thus productivity) are under-reported as the result of censoring for confidentiality reasons. When a *comuna*-sector has between one and 10 firms, sales are not reported, but employees are. Around 20 percent of the *comuna*-sector observations fall under this category. If sales are censored for all of the ISIC codes that are considered creative (or non-creative), sales and productivity are missing. When only some ISIC codes are censored, sales and productivity are reported but underestimated. Whether this creates a sample selection problem or not depends on whether the probability of censoring is randomly distributed across ISIC codes, or creative activities are more or less likely to be censored. An analysis of censoring suggests that it is slightly more likely across non-creative activities, so that the underestimation of sales and productivity could be stronger for non-creative sectors. In other words, the productivity differential in favour of non-creative sectors could be higher than reported.

The r subscript indexes regions (here LLMAs) and t indexes the time periods. The dependent variables are measures of labour market outcomes and firm outcomes (number of firms, sales and labour productivity) for creative sectors or occupations at the LLMA level, in natural logarithms.

I included a quadratic term to explore whether the relationships change with the degree of specialisation.[16]

The estimated coefficients for the LQ measures (γ and δ) show how creative sectors or activities change as they agglomerate. For example, when an LLMA increases its specialisation in creative activities, do these activities become more productive? Incorporating the quadratic term allows us to understand if those relationship are the same for different levels of specialisation or not. For example, it could be that at low levels of specialisation there is no relationship between specialisation and productivity, but after a certain threshold, a higher concentration of creative activities translates into higher levels of productivity. Or the opposite: as creative activities become more important for a region, they become more productive, but up to a certain productivity ceiling.

The set of controls $\mathbf{x}_{r,t}$, all defined at the LLMA-year level, includes the total income of all residents (as a proxy for the economic size of the geographical unit), the share of people living in urban areas, the log of population, average age, average education across the LLMA, and average education in the creative sectors of the LLMA. Most of these are the standard controls used in the literature. Alternative specifications without some of these controls, and adding others (such as higher education enrolment in creative disciplines and the share of workers in manufacturing) were also considered and produced similar results.[17] The models also controlled for LLMA and year fixed-effects.

Table 3 is split in three parts. The first shows results for hourly incomes in creative occupations, where the location quotient used is the share of workers in creative occupations in an LLMA over the national share of workers in creative occupations. The question being asked is whether higher specialisation in creative occupations, improves hourly incomes *for those occupations*. The second part is for hourly incomes of individuals working in creative sectors, where the location quotient is calculated for this group (the share of workers in creative sectors in an LLMA, over the national share of workers in creative sectors). The third group of columns shows results for the outcomes of firms operating in creative sectors. Here the location quotient is also based on the share of workers in firms in creative sectors, but it is calculated using the employment data from the SII for consistency in the way the dependent variables and specialisation are measured.

[16] Alternative specifications were tested, for example, excluding the quadratic term and using growth rates as dependent variables. The results are consistent with those presented here.

[17] Measures of innovation, R&D, or patent or trademark applications are not available at a disaggregated geographical level for the period.

Table 3: Effects of Agglomeration

	Individuals in creative occupations	Individuals in creative sectors	Firms in creative sectors		
	Hourly income	Hourly income	Number of firms	Sales	Labour productivity
LQ occupations	0.617**				
	(0.014)				
LQ occupations squared	-0.319***				
	(0.006)				
LQ sectors (Casen)		0.240			
		(0.433)			
LQ sectors (Casen) squared		-0.110			
		(0.340)			
LQ sectors (SII)			0.205***	2.456**	-1.549
			(0.001)	(0.045)	(0.105)
LQ sectors (SII) squared			-0.0259*	-0.942	0.364
			(0.056)	(0.180)	(0.436)
ln(Total income)	0.0370	0.604***	-0.0794	0.946	0.251
	(0.807)	(0.003)	(0.200)	(0.152)	(0.433)
Share in urban areas	-0.966	0.194	-0.217	5.294	0.595
	(0.116)	(0.796)	(0.345)	(0.216)	(0.793)
ln(Population)	-0.200	-1.002**	-0.161	1.341	0.409
	(0.352)	(0.014)	(0.520)	(0.582)	(0.826)
Age	-0.0297	-0.0526	-0.00104	-0.192	0.0549
	(0.186)	(0.322)	(0.927)	(0.115)	(0.454)
Avg. schooling	0.122*	-0.0889	0.0123	-0.330	0.126
	(0.059)	(0.413)	(0.687)	(0.325)	(0.406)
Avg. schooling creative sec.	0.0119	0.103***	0.00148	0.0413	0.0956***
	(0.417)	(0.000)	(0.775)	(0.392)	(0.003)
Year and LLMA fixed effects	✓	✓	✓	✓	✓
Sample size	486	293	278	100	100

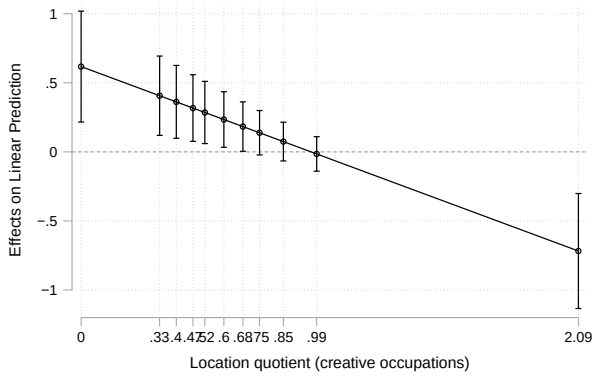
Notes. Casen data for individuals and SII data for firms. Panel regressions using all the years with data available for the controls and each dependent variable. Only LLMA-years where the dependent variable is calculated with 5 or more observations. Dependent variables are in natural logarithms. Standard errors clustered at the LLMA level for Casen (individual-based) data and robust standard errors for SII (firm-based) data. p-values in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5.1.1 Results for Labour Market Outcomes

Results for individuals show that hourly incomes are significantly higher as workers in creative occupations agglomerate, but not when workers in creative sectors agglomerate. Hourly incomes of creative workers grow but at a decreasing rate as specialisation increases.[18]

To check the significance of the effects at different degrees of specialisation, Figure 2 shows the partial effects of the LQ measure on hourly incomes of workers in creative occupations, together with their 90 percent confidence bands for LQ equal to zero and for each LQ decile.

The partial effect of specialisation on hourly incomes is significant for the 60 percent of lower LQs, then it becomes insignificant. More specifically, for LLMAs with an LQ close to zero, increasing to an LQ of 0.33 (30 percent of the country-wide share of employment, equivalent to the first decile of LQ) is associated with an increase in hourly incomes of around 20 percent.[19] For LQs at the median of 0.6, an increase to 0.68 (about a decile) is associated with an increase of hourly incomes of around 2 percent.[20] This suggests that Marshallian effects may be relevant when creative industries begin to grow, but not after a certain level of specialisation is reached. To a degree, this means that these are not exactly agglomeration effects in the way they are traditionally understood: they are not stronger the stronger the sector is, instead, results suggest that a certain degree of agglomeration is needed so that the sector can achieve its potential.



(a) Hourly income in creative occupations

Figure 2: Average Marginal Effects and 90% Confidence Bands for Different Values of the LQ (0 and All Deciles). Workers in Creative Occupations.

[18] Outcomes for workers in creative sectors or occupations are only calculated when there were at least five observations in the LLMA-year. It must be noted that one thing is the sample size for an LLMA, and another, the number of creative individuals within each LLMA sub-sample. As creative workers are a small fraction of total workers, for small LLMAs there can be very few creative individuals sampled, so the estimates for variables such as the wage of creative workers can be very imprecise. For consistency, a similar condition was imposed for firm-based variables (at least five firms in the LLMA-year). The robustness checks included using a higher threshold.

[19] This is approximated as $\partial hourly\_income/\partial LQ \times \Delta LQ|_{LQ=0} = 0.617 \times 0.33$.

[20] $\partial hourly\_income/\partial LQ \times \Delta LQ|_{LQ=0.6} = (0.617 - 2 \times 0.319 \times 0.6) \times (0.68 - 0.6)$.

5.1.2 Results for Firm Outcomes

The number of firms and sales also seem to increase with specialisation, but not productivity.[21]

The effect on the number of firms is significant for all but the LLMAs with the highest concentration of creative workers (see Figure 3). However, the effects are small in magnitude. A move from the fifth to the sixth decile is associated with an increase in the number of firms of 1.5 percent. The effect on sales is significantly positive up to the seventh decile of creative specialisation and large in magnitude. A move from the fifth to the sixth decile is associated with an increase in sales of 15 percent.

5.1.3 Rounding Up

It appears that while creative industries are relatively small in a region, further specialisation of a geographical area in creative activities is associated to slightly more firms, higher incomes, and higher sales, consistent with the existence of Marshallian externalities. At high levels of specialisation, however, these relationships seem to disappear, as if the outcomes reach a plateau.

There are reasons to doubt the direction of the causality. Time-varying region-specific factors may be omitted, and specialisation and outcomes are simultaneously determined. The possibility of causality from incomes to specialisation in creative occupations is especially likely considering labour can move with relative ease. An unreported analysis using difference and system GMM estimators[22] (see Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998) was not conclusive, but suggested that at least for incomes in creative sectors, the causality may actually run from incomes to the concentration of creative activities, a possibility that has not received much attention in the literature.[23]

5.2 Jacobian Effects

Do creative industries have an impact on other sectors of the economy? To explore this I used the following specification:

$$ln\left(y_{r,t}^{non-creative}\right) = \beta'\mathbf{x}_{r,t} + \gamma Specialisation_{r,t} + \delta Specialisation_{r,t}^2 + \lambda_r + \lambda_t + u_{r,t} \tag{2}$$

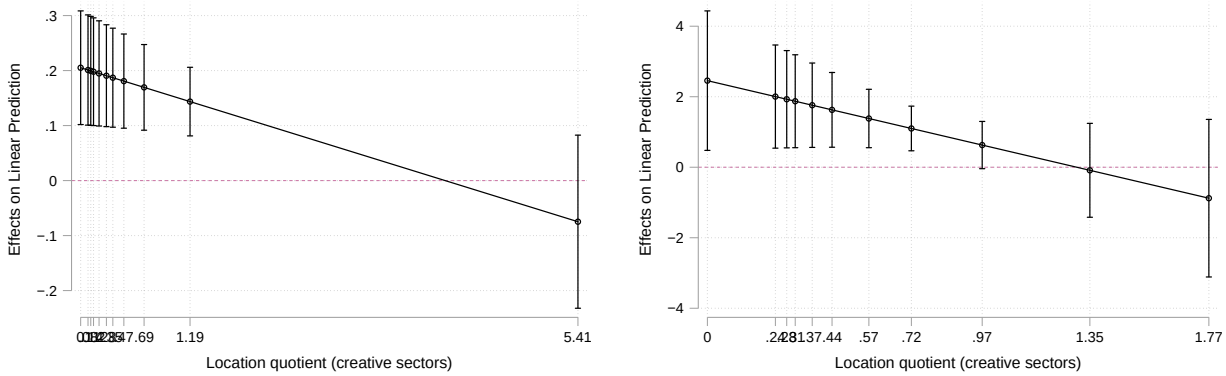
The dependent variables $y_{r,t}^{non-creative}$ are similar to those of the previous question, but now for non-creative sectors or occupations to capture exclusively the relationship between creative activities and *the rest* of the economy. This is a departure from most of the literature, which has looked for spillovers using measures of aggregate outcomes at the regional level.[24] The controls are the same as those explained in the previous section, and the key independent variables of interest are again LQs capturing the degree of specialisation in creative industries, also including a quadratic term to capture if there are differences in the relationships across specialisation levels.

[21] The sample size is relatively small for firm-based variables for two reasons: First, the time dimension is shorter for SII data. Second, for some LLMAs, either there is no activity in these sectors or the number of firms in the corresponding *comunas* is too small and thus sales are omitted in the original data for all the creative activities in that particular LLMA. For the difference in sample sizes for creative sectors and occupations see footnote 18.

[22] These exercises did not include the quadratic term for LQ to avoid problems with the number and the strength of the internal instruments.

[23] Exceptions are Rausell Köster et al. (2011) and Marco-Serrano et al., 2014, who found evidence of simultaneous causation. There has been use of instrumental variables in the literature (e.g. Lazzeretti et al., 2009; de Miguel-Molina et al., 2012; Boix-Domenech and Soler-Marco, 2017), but looking for effects of creative agglomerations, the opposite direction of causality has not been explored much.

[24] Some exceptions are Rutten et al. (2011), Lee (2014) and Bakhshi et al. (2014), who built dependent variables excluding creative activities.



(a) Number of firms in creative sectors

(b) Sales in creative sectors

Figure 3: Average Marginal Effects and 90% Confidence Bands for Different Values of the LQ (0 and All Deciles), Firms-Based Variables for Creative Sectors

The coefficients for the LQs capture whether there is a relationship between the degree of specialisation in creative sectors and occupations, and the outcomes of non-creative activities in a certain geographic area–they are certainly not testing the causality of these potential relationships.

The results are presented in Table 4. They show that the only variable for which the LQ measures are significant is the number of firms in other sectors. Figure 4 shows that the marginal effect is significant for all deciles but the last two, but it is economically irrelevant. Going up from zero to the first decile (the largest partial effect) is associated with an increase in the number of firms in non-creative sectors of less than 0.2 percent. It could be argued that inter-industry spillovers take time to manifest themselves, so it would be appropriate to include lags of the LQ measures instead of their contemporaneous values. Doing this (without the quadratic term) results in insignificant coefficients for the LQ measures.

Considering that very different activities are lumped together under the umbrella of creative industries, could it be that some of the activities commonly considered creative have spillovers and others do not? Few papers have considered dimension across which the relationships between creative industries and regional economic outcomes may be heterogeneous. Lazzeretti et al. (2008) mapped creative clusters in Italy and Spain, distinguishing between 'traditional cultural industries' and 'technology-related creative industries', although only as part of a descriptive exercise. Lee (2014) and Stam et al. (2008) found differences for creative industries in rural and urban areas. Bakhshi et al. (2014), studying English cities, distinguished between 'arts and cultural' and 'commercial creative' activities and found evidence of negative spillovers from the former and positive from the latter.

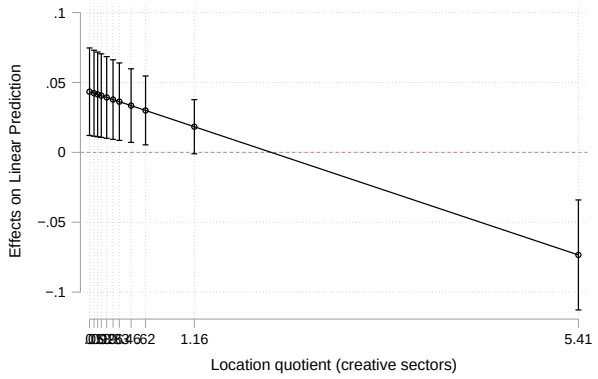
A preliminary look at opening up creative industries suggests that there is a high degree of heterogeneity across them (see Table B1 in the appendices). If the estimation of Jacobian spillovers is done separately for subsectors (see Table C8), most coefficients for the LQ measures are insignificant, but there is evidence consistent with both positive and negative spillovers from different subsectors, including significant coefficients for productivity for the arts and for publishing, and negative coefficients for income for the arts, consistent with previous findings by Bakhshi et al. (2014). However, the data is not as reliable when working with these narrowly defined subsectors, and these are only exploratory results to suggest directions for future research,

ideally using firm-level and individual-level panel data, as well as data on innovation and better measures of productivity.

Table 4: Spillovers of Creative Agglomerations

	Individuals in non-creative occupations	Individuals in non-creative sectors	Firms in non-creative sectors		
	Hourly income	Hourly income	Number of firms	Sales	Labour productivity
LQ occupations	0.00435				
	(0.959)				
LQ occupations squared	0.0124				
	(0.780)				
LQ sectors (Casen)		0.0128			
		(0.816)			
LQ sectors (Casen) squared		-0.0320			
		(0.204)			
LQ sectors (SII)			0.0434**	0.0318	0.0581
			(0.026)	(0.812)	(0.735)
LQ sectors (SII) squared			-0.0108***	-0.0137	-0.0103
			(0.005)	(0.487)	(0.722)
ln(Total income)	0.446***	0.435***	0.00368	0.202	0.239
	(0.000)	(0.000)	(0.818)	(0.370)	(0.310)
Share in urban areas	0.00225	-0.0242	0.0340	-0.556	-0.944*
	(0.991)	(0.904)	(0.659)	(0.304)	(0.061)
ln(Population)	-0.286***	-0.293***	0.315***	0.491	0.0333
	(0.000)	(0.000)	(0.001)	(0.263)	(0.941)
Age	0.0233**	0.0232**	-0.00159	0.00293	-0.00358
	(0.015)	(0.013)	(0.492)	(0.917)	(0.900)
Avg. schooling	0.0978***	0.107***	0.00252	0.0708	0.0261
	(0.000)	(0.000)	(0.692)	(0.231)	(0.675)
Avg. schooling creative sec.	-0.00221	-0.00298	0.000305	-0.0144	-0.00797
	(0.530)	(0.398)	(0.807)	(0.240)	(0.543)
Year and LLMA fixed effects	✓	✓	✓	✓	✓
Sample size	504	504	290	290	290

Notes. Casen data for individuals and SII data for firms. Panel regressions using all the years with data available for the controls and each dependent variable. Dependent variables are in natural logarithms. Standard errors clustered at the LLMA level for Casen (individual-based) data and robust standard errors for SII (firm-based) data. p-values in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.



(a) Number of firms in non-creative sectors

Figure 4: Average Marginal Effects and 90% Confidence Bands for Different Values of the LQ (0 and All Deciles)

5.3 Robustness Checks

I tested alternative ways of defining what is a creative sector. One risk with the standard definition of creative sectors is that it may include activities with a very small share of workers that are actually creative. An alternative, data-driven way to define which sectors are creative is to define a cutoff share of creative workers, as in Bakhshi et al. (2013). Following their findings, I considered sectors with 30 percent or more of workers in creative occupations to be creative sectors (see details in A.3). Although this definition still needs an arbitrary list of occupations considered to be creative, the quality of creativity can arguably be ascertained with more certainty for occupations than for sectors. The results (tables C1 and C2 in Appendix C) are similar to the baseline for the Marshallian effects but without the nonlinearity. Some coefficients are significant for Jacobian effects, but marginal effects are insignificant for all LQ levels.

There are other ways to exploit the information about sector and occupation for each worker to produce alternative definitions. For example, *core* creative workers can be considered those performing creative occupations in firms within creative sectors, whereas *broad* creative workers are those in either creative occupations or sectors considered to be creative. The broader definition corresponds to what some policies attempt to target. Results for the core and broad definitions (in tables C3 and C4 in Appendix C) show that all marginal effects are insignificant, showing the importance of what is actually included under the definitions of creative industries for determining the findings.

It might be possible that the sort of intra-industry effects observed would be observed for any sector or combination of sectors or occupations as they agglomerate, and that these effects are not something particular to creative industries. To check this, I randomly selected a group of occupations and sectors (the same numbers of categories observed under the baseline definitions of creative sectors and occupations). Results in tables C5 and C6 show no evidence of Marshallian effects on income levels. There is, however, a puzzling significantly negative coefficient for labour productivity. Some coefficients appear significant for Jacobian effects, but only at the 10 percent level.

As some LLMAs are relatively small, and thus have small sample sizes, the baseline results for Marshallian

effects included only LLMA-years where there were at least five surveyed individuals classified as working in a creative sector or creative occupation, depending on the dependent variable that was being calculated. This number was chosen to avoid a large impact on the sample size, but results are robust to increasing it. Table C7 shows that results hold when increasing the threshold to 30 individuals.

6 Summary and Discussion

Most previous quantitative work on creative industries has tried to answer whether further specialisation in creative activities is good for the sector itself or for the rest of the economy. This paper argues that those questions are closely related to the ideas of Marshallian externalities (intra-industry effects) and Jacobian externalities (inter-industry effects). The latter, in the sense that diversification towards creative sectors is likely to generate innovation opportunities in other sectors. The paper studied both questions under a common framework.

The results show that as local labour markets specialise in creative sectors, there are increases in the number of firms and in the sales of those sectors, but not in the wages they pay. These intra-industry effects decrease as specialisation increases, until they eventually disappear. Specialisation in creative occupations shows the same relationship with the incomes for those occupations. Going from close to zero up to the first decile of specialisation in creative occupations corresponds to an increase of around 20 percent in hourly incomes, while going from the fifth to the sixth decile is associated with an increase of only 2 percent. For specialisation in creative sectors, moving from the median to the sixth decile is associated with an increase in the number of firms of 1.5 percent, and 15 percent higher sales. These result are consistent with the existence of Marshallian externalities and with previous empirical findings, although they cannot be interpreted as causal effects from specialisation. More likely, there is a process of simultaneous causation between the agglomeration of creative industries and local economic outcomes, as found by Rausell Köster et al. (2011) and Marco-Serrano et al. (2014), including possibly an effect from incomes to specialisation. The observed nonlinearity is a new result in describing the dynamics of creative industries and their evolution. The incomes of workers in creative occupations may have important increases as creative workers gain relative importance, especially when they are still relatively few in a region. When a relevant creative cluster is already established, incomes and sales are not expected to keep increasing as much. Marshallian effects may play a role in the takeoff of creative industries in a region, as some degree of specialisation is required for the sector to mature and reach its potential. In terms of individuals, it is the creative workers (those in creative occupations) and not the rest of the workers in the sector that gain from agglomerating. A similar finding was described by Bakhshi et al. (2014), who found that in the United Kingdom wages for creative occupations are higher where there is higher specialisation in creative sectors.

There is no evidence consistent with spillovers from creative industries in general towards the rest of the economy. There are several possible explanations for this result. If creative industries *are* a potential source of positive spillovers to the rest of the economy, they may not be observed here for at least three reasons. First, in Chile, creative sectors, particularly modern, technology-related ones, may not be mature enough, or may not have developed the necessary connections with the rest of the economy (see Chapain et al., 2010). Second, the estimates could be biased due to endogeneity. For example, measurement error on the LQs would bias estimates towards zero. And third, the data may not be good enough to capture some of those activities and potential spillovers. The ISIC categories are a rather crude way to identify creative firms. Moreover, it

would be ideal to observe firm-worker linkages and firm-to-firm linkages and knowledge flows to pin down potential spillovers more precisely (and ideally, having exogenous variation in them).

A second scenario is that in fact, there are no positive spillovers from creative industries towards the rest of the economy, and that this is not a result particular of Chile or developing countries, but a general truth for creative industries the way they are commonly defined. As discussed in the literature review, there is evidence of positive spillovers, but also of simultaneous causation, of no relationship between creative industries and the rest of the economy, and even evidence of a negative relationship. Moreover, the evidence of positive spillovers is relatively weak. The preliminary look at sectorial heterogeneity discussed above suggests that an important line for further research is opening up the broad definition of creative industries that is commonly used. The heterogeneity across creative subsectors in terms of observed characteristics and of cultural and economic value may result in a different potential for spillovers to the rest of the economy.

Most creative subsectors and occupations seem to produce relatively high incomes (Table B1). Also, because of their nature they are occupations that are more likely to avoid automation at least for some time, making them a sector that could be promoted for its potential to create good jobs, however, differences in job quality across subsectors should be considered. The existence of Marshallian effects that seem to be particular to creative activities may justify supporting their development, especially in their early stages, but more research is needed to confirm the direction of causality between creative employment and the sector's outcomes.

Analysing all of the creative industries as one category may be misleading for policy advice. Policies supporting these sectors should take into account the differences between creative sectors and creative occupations, as well as between subsectors, especially in terms of potential for inter-industry effects, something we do not know much about yet.

Other direction to improve our understanding of Jacobian effects from creative industries is along the lines of Chapain et al. (2010) and Innocenti and Lazzeretti (2019) on colocation and relatedness, or Cerisola (2018) on the complementarity between different dimensions of creativity. The potential for spillovers may only materialise under certain conditions in relation to the other activities that are present in a region.

The mechanisms behind Marshallian and Jacobian effects are another area where knowledge is lacking. Are the intra-industry effects related to knowledge spillovers? Do othey occur through labour mobility or through informal sharing as in Allen's (1983) collective invention? Do inter-industry effects occur chiefly through value chain interactions (see Bakhshi and McVittie, 2009) or in other contexts too? Are they relevant for services and for manufacturing?

Creative industries are likely to have an increasingly important role in the economy, but there are still many questions to be answered to fully understand them and to design policies to maximise their economic impact.

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Appendices

A Definitions of Creative Sectors and Creative Occupations

A.1 Baseline Definition and Creative Subsectors

Tables A1 through A4 show which sectors or occupations are considered creative.

Most definitions of creative industries, including those used here, lump together activities that are very heterogeneous, particularly in terms of their cultural content and economic valuation. Both the outer and the inner circles of Throsby's (2008) concentric circles model are included, making it difficult to translate empirical findings into policy recommendations.

Moreover, the potential for spillovers to the rest of the economy is likely to differ for different types of industries. To explore this, creative activities, both sectors and occupations, can be classified in subsectors based in the categories used in Chilean policy documents on creative industries (CNCA 2014; 2016). The subsectors in which creative activities were classified are new media, architecture, publishing, creative sites, advertising, audiovisual, arts, and crafts. These will be used for some preliminary exploratory analyses (see Appendix C.4), as the data is not really well suited for an analysis in such detail.

As the name says, these are *sub*sectors, but it is possible to define, for each subsector, a set of relevant occupations, which are the core creative workers that characterise each subsector. The detail of how each of the creative sectors (ISIC) and occupations (ISCO) are classified is available in Tables A1 through A4.

Table A1: Baseline List of Creative ISIC Rev.3 Categories and Creative Subsectors

ISIC Rev.3 Code	Creative Subsector	Description
7430	Advertising	Advertising
7421	Architecture	Architectural and engineering activities and related technical consultancy
9214	Arts	Dramatic arts, music and other arts activities
7494	Audio-visuals	Photographic activities
9211	Audio-visuals	Motion picture and video production and distribution
9212	Audio-visuals	Motion picture projection
9213	Audio-visuals	Radio and television activities
9220	Audio-visuals	News agency activities
3691	Crafts	Manufacture of jewellery and related articles
3692	Crafts	Manufacture of musical instruments
3694	Crafts	Manufacture of games and toys
9219	Creative sites	Other entertainment activities n.e.c.
9231	Creative sites	Library and archives activities
9232	Creative sites	Museums activities and preservation of historical sites and buildings
9233	Creative sites	Botanical and zoological gardens and nature reserves activities
7220	New media	Software consultancy and supply
2213	Publishing	Publishing of recorded media
2212	Publishing	Publishing of newspapers, journals and periodicals
2211	Publishing	Publishing of books, brochures, musical books and other publications
2219	Publishing	Other publishing

Table A2: Baseline List of Creative ISIC Rev.2 Categories and Creative Subsectors (Adapted from Rev.3)

ISIC Rev.2 Code	Creative Subsector	Description
8325	Advertising	Advertising services
8324	Architecture	Engineering, architectural and technical services
9414	Arts	Theatrical producers and entertainment services
9415	Arts	Authors, music composers and other independent artists not elsewhere classified
9411	Audio-visuals	Motion picture production
9412	Audio-visuals	Motion picture distribution and projection
9413	Audio-visuals	Radio and television broadcasting
9592	Audio-visuals	Photographic studios, including commercial photography
3902	Crafts	Manufacture of musical instruments
3901	Crafts	Manufacture of jewellery and related articles
9420	Creative sites	Libraries, museums, botanical and zoological gardens, and other cultural services not elsewhere classified
3420	Publishing	Printing, publishing and allied industries

Table A3: Definition of Creative Sectors Adapted for ISIC-CL (Rev.3) at Six Digits

ISIC.CL Rev.3 Code	Creative Subsector	Description (Original Label in Spanish)
743001	Advertising	Empresas de publicidad
743002	Advertising	Servicios personales en publicidad
742110	Architecture	Servicios de arquitectura y técnico relacionado
749921	Architecture	Diseñadores de vestuario
749922	Architecture	Diseñadores de interiores
749929	Architecture	Otros diseñadores n.c.p.
749961	Arts	Galerías de arte
921419	Arts	Servicios de producción teatral y otros n.c.p.
921911	Arts	Instructores de danza
921411	Arts	Servicios de producción de recitales y otros eventos musicales masivos
921490	Arts	Agencias de venta de billetes de salas de concierto y de teatro
921420	Arts	Actividades empresariales de artistas
921430	Arts	Actividades artísticas; funciones de artistas, actores, músicos, conferencistas, otros
749401	Audio-visuals	Servicios de revelado, impresión, ampliación de fotografías
749402	Audio-visuals	Actividades de fotografía publicitaria
749409	Audio-visuals	Otras actividades de fotografía
221300	Audio-visuals	Edición de grabaciones
921110	Audio-visuals	Producción de películas cinematográficas
921120	Audio-visuals	Distribuidora cinematográfica
921200	Audio-visuals	Exhibición de filmes y videocintas
921320	Audio-visuals	Actividades de radio
921310	Audio-visuals	Actividades de televisión
749940	Audio-visuals	Agencias de contratación de actores
922001	Audio-visuals	Agencias de noticias
924940	Audio-visuals	Contratación de actores para cine, televisión, y teatro
369200	Crafts	Fabricación de instrumentos de música
369100	Crafts	Fabricación de joyas y productos conexos
369400	Crafts	Manufacture of games and toys
921930	Creative sites	Espectáculos circenses, de títeres u otros similares
923100	Creative sites	Actividades de bibliotecas y archivos
923200	Creative sites	Actividades de museos y preservación de lugares y edificios históricos
923300	Creative sites	Actividades de jardines botánicos y zoológicos y de parques nacionales
722000	New media	Asesores y consultores en informática (software)
221101	Publishing	Edición principalmente de libros
222101	Publishing	Impresión principalmente de libros
221109	Publishing	Edición de folletos, partituras y otras publicaciones
221900	Publishing	Otras actividades de edición
221200	Publishing	Edición de periódicos, revistas y publicaciones periódicas

Table A4: Baseline List of Creative Occupations (ISCO-88)

ISCO-88 Code	Creative Subsector	Description (Original Label in Spanish)
1234	Advertising	Directores de departamentos de publicidad y de relaciones públicas
5210	Advertising	Modelos de moda, arte y publicidad
2149	Architecture	Arquitectos, ingenieros y afines, no clasificados bajo otros
2141	Architecture	Arquitectos, urbanistas e ingenieros de tránsito
3118	Architecture	Delineantes y dibujantes técnicos
3471	Architecture	Decoradores y diseñadores
2452	Arts	Escultores, pintores y afines
3474	Arts	Payasos, prestidigitadores, acróbatas y afines
2454	Arts	Coreógrafos y bailarines
2453	Arts	Compositores, músicos y cantantes
3473	Arts	Músicos, cantantes y bailarines callejeros, de cabaret y afines
3131	Audio-visuals	Fotógrafos y operadores de equipos de grabación de imagen
2455	Audio-visuals	Actores y directores de cine, radio, teatro, televisión y afines
3472	Audio-visuals	Locutores de radio y televisión y afines
3132	Audio-visuals	Operadores de equipos de radiodifusión, televisión y telecomunicaciones
7321	Crafts	Alfareros y afines (barro, arcilla y abrasivos)
7331	Crafts	Artesanos de la madera y materiales similares
7330	Crafts	Artesanos de la madera, tejidos, cuero y materiales similares
7332	Crafts	Artesanos de los tejidos, cuero y materiales similares
7422	Crafts	Ebanistas y afines
7323	Crafts	Grabadores de vidrio
7313	Crafts	Joyeros, orfebres y plateros
7324	Crafts	Pintores decoradores de vidrio, cerámica y otros materiales
7322	Crafts	Sopladores, modeladores, laminadores, cortadores y pulidores
7432	Crafts	Tejedores con telares o de tejidos de punto y afines
7436	Crafts	Costureros, bordadores y afines
7346	Crafts	Impresores de serigrafía y estampadores a la plancha
7435	Crafts	Patronistas y cortadores de tela, cuero y afines
7433	Crafts	Sastres, modistos y sombrereros
7437	Crafts	Tapiceros, colchoneros y afines
7442	Crafts	Zapateros y afines
7441	Crafts	Apelambradores, pellejeros y curtidores
7312	Crafts	Constructores y afinadores de instrumentos musicales
2431	Creative sites	Archiveros y conservadores de museos
2432	Creative sites	Bibliotecarios, documentalistas y afines
4141	Creative sites	Empleados de bibliotecas y archivos
2131	New-media	Creadores y analistas de sistemas informáticos
1236	New-media	Directores de departamentos de servicios de informática
2132	New-media	Programadores informáticos
2139	New-media	Profesionales de la informática, no clasificados bajos otros epígrafes
3121	New-media	Técnicos en programación informática
2451	Publishing	Autores, periodistas y otros escritores
2444	Publishing	Filólogos, traductores e intérpretes
1237	Unclassified	Directores de departamentos de investigaciones y desarrollo

A.2 Change in Classification

Between 2009 and 2011, the Casen classification of the firms where the respondents worked changed from ISIC revision 2 to revision 3. As shown in the tables in the previous appendix, under rev.2 there are fewer sectors identified as creative. To study how much of a problem this change is, below I show the average value of the main Casen-based variables.

For most of the variables, the trend does not change at break. But as expected, because of the broader scope of the definition using rev.3, the gross number and especially the share of creative workers appear to jump to a higher level in 2011, although the difference is not dramatic. Average wages of creative workers are much higher under the rev.3 period, but this seems to be the result of a trend that started in 2000.

Nevertheless, the regression analyses were repeated restricting the sample to the period starting in 2011 and results hold.

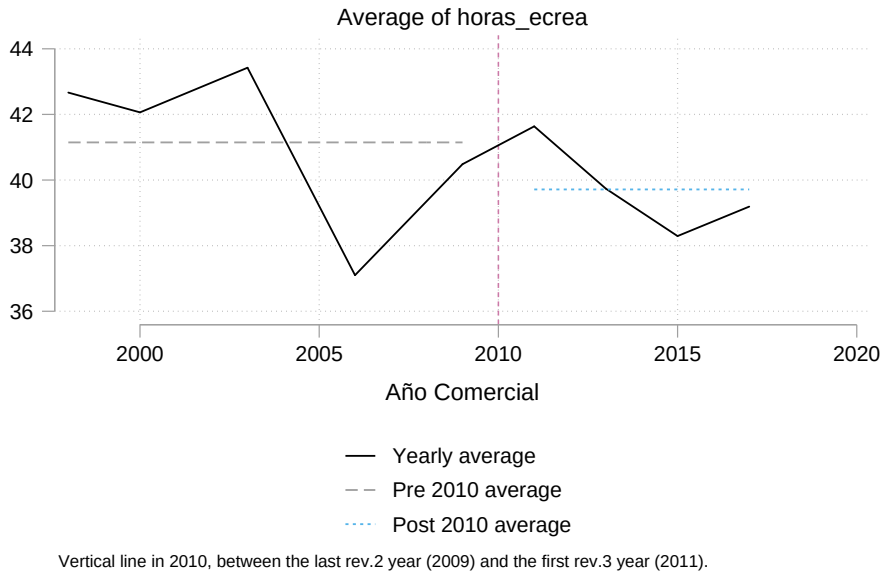
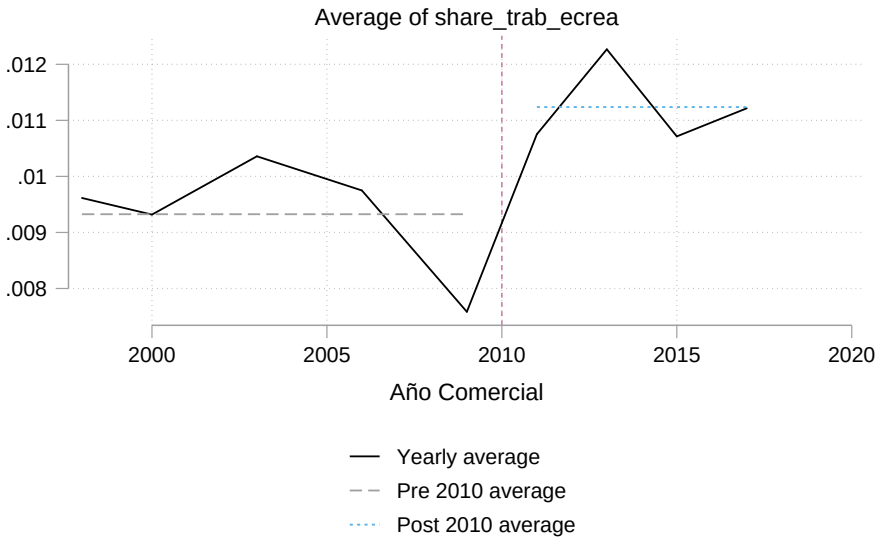
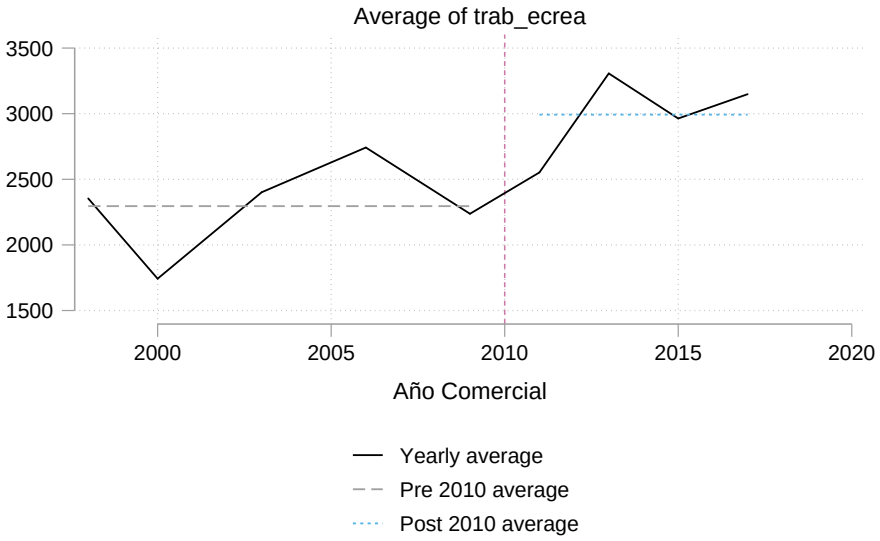


Figure A1: Average Hours Worked in Creative Sectors



Vertical line in 2010, between the last rev.2 year (2009) and the first rev.3 year (2011).

Figure A2: Share of Workers in Creative Sectors



Vertical line in 2010, between the last rev.2 year (2009) and the first rev.3 year (2011).

Figure A3: Number of Workers in Creative Sectors

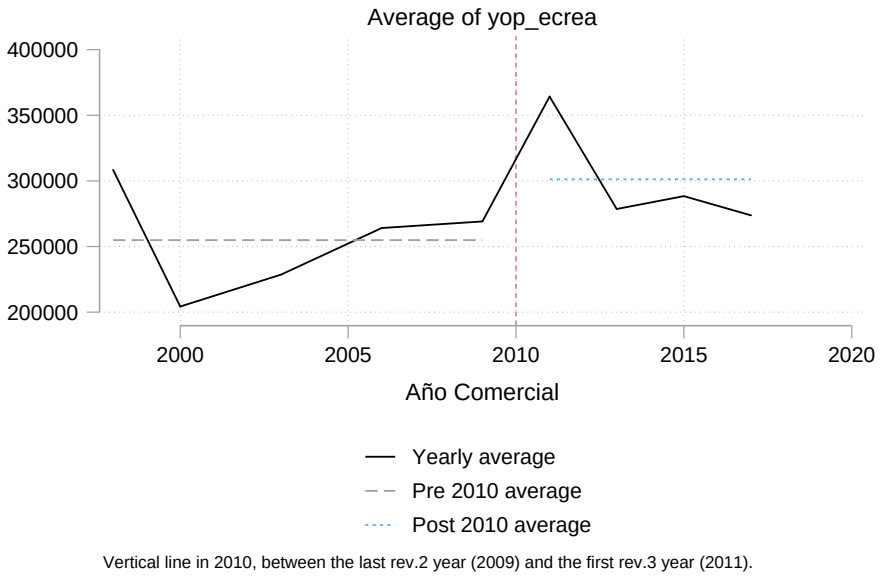


Figure A4: Average Income of Workers in Creative Sectors

A.3 Alternative Definition

A first alternative approach to identify creative sectors is to follow Bakhshi et al. (2013), who considered a sector creative if the share of creative workers was above a certain threshold. The problem with this approach is that it still requires an arbitrary definition of which occupations are creative. Tables A5 and A6 show the sectors that are considered creative under this definition (using a threshold of 30 percent of workers in creative occupations to consider a sector to be creative).

Table A5: Percentage of Creative Workers for Sectors with 30 Percent or More of Creative Workers Defined as Creative, ISIC Rev.2

Label	**ISIC Rev.2 Code**	**% of Creative Workers**
Authors, music composers and other independent artists nec	9415	86.84
Repair of footwear and other leather goods	9511	85.51
Manufacture of jewellery and related articles	3901	85.32
Manuf. of products of leather and leather substitutes, except footwear and wearing	3233	73.2
Manufacture of musical instruments	3902	72.97
Manufacture of wearing apparel, except footwear	3220	69.59
Motion picture production	9411	65.7
Manufacture of furniture and fixtures, except primarily of metal	3320	63.21
Photographic studios, including commercial photography	9592	59.89
Radio and television broadcasting	9413	59.46
Manufacture of carpets and rugs	3214	53.81
Theatrical producers and entertainment services	9414	53.15
Manufacture of wood and cork products not elsewhere classified	3319	52.01
Manufacture of made-up textile goods except wearing apparel	3212	51.51
Manufacture of pottery, china and earthenware	3610	51.44
Engineering, architectural and technical services	8324	50.24
Knitting mills	3213	46.02
Tanneries and leather finishing	3231	44.62
Laundries, laundry services, and cleaning and dyeing plants	9520	43.94
Cordage, rope and twine industries	3215	42.34
Watch, clock and jewellery repair	9514	41.52
Fur dressing and dyeing industries	3232	40.9
Libraries, museums, botanical and zoological gardens, and other cultural services nec	9420	40.71
Spinning, weaving and finishing textiles	3211	40.42
Manufacture of footwear, except vulcanized or moulded rubber or plastic footwear	3240	39.29
Data processing and tabulating services	8323	37.64
Manufacture of structural clay products	3691	36.43
Manufacture of wooden and cane containers and small cane ware	3312	35.35
Advertising services	8325	35.29

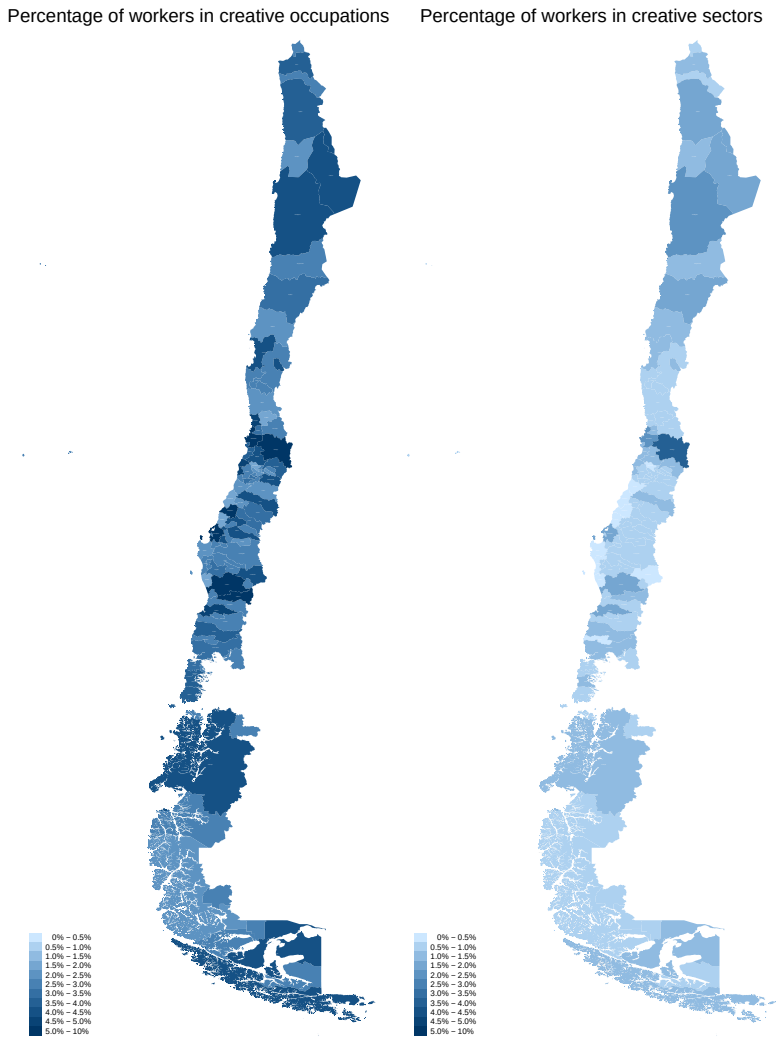
Table A6: Percentage of Creative Workers for Sectors with 30 Percent or More of Creative Workers Defined as Areative, ISIC rev.3

Label	**ISIC Rev.3 Code**	**% of Creative Workers**
Publishing of recorded media	2213	100
Manufacture of knitted and crocheted fabrics and articles	1730	91.2
Manufacture of jewellery and related articles	3691	82.26
News agency activities	9220	80.98
Manufacture of carpets and rugs	1722	79.47
Dressing and dyeing of fur; manufacture of articles of fur	1820	76.08
Photographic activities	7494	74.86
Dramatic arts, music and other arts activities	9214	74.52
Manufacture of sports goods	3693	73.75
Manufacture of luggage, handbags and the like, saddlery and harness	1912	71.52
Library and archives activities	9231	71.28
Manufacture of wearing apparel, except fur apparel	1810	70.81
Manuf. of other products of wood; of cork, straw and plaiting materials	2029	68.64
Radio and television activities	9213	66.25
Software consultancy and supply	7220	66.07
Repair of personal and household goods	5260	65.73
Manufacture of motorcycles	3591	64.5
Manufacture of furniture	3610	64.15
Motion picture and video production and distribution	9211	61.25
Other computer related activities	7290	60.03
Manufacture of footwear	1920	58.43
Manufacture of made-up textile articles, except apparel	1721	57.48
Hardware consultancy	7210	56.93
Other manufacturing n.e.c.	3699	49.64
Activities of professional organizations	9112	49.02
Manufacture of musical instruments	3692	48.98
Manufacture of non-structural non-refractory ceramic ware	2691	46.14
Publishing of newspapers, journals and periodicals	2212	44.92
Manufacture of other textiles n.e.c.	1729	44.79
Finishing of textiles	1712	42.24
Data base activities	7240	41.9
Financial leasing	6591	40.95
Tanning and dressing of leather	1911	38.33
Manufacture of man-made fibres	2430	38.19
Preparation and spinning of textile fibres; weaving of textiles	1711	38.09
Publishing of books, brochures, musical books and other publications	2211	38.04
Architectural and engineering activities and related technical consultancy	7421	37.68
Manufacture of industrial process control equipment	3313	36.85
Manufacture of structural non-refractory clay and ceramic products	2693	36.73
Advertising	7430	36.71
Manufacture of office, accounting and computing machinery	3000	32.49
Manufacture of cordage, rope, twine and netting	1723	32.48
Data processing	7230	32.15

B Descriptive Analysis Appendices

B.1 Creative Intensity Across the Country

Figure B1 shows maps of Chile classifying all LLMAs according to their creative intensity, measured by the percentage of workers in creative occupations (a) and in creative sectors (b) over the period.[25]



(a) Percentage of workers in creative occupations

(b) Percentage of workers in creative sectors

Figure B1: Percentage of Workers in Creative Occupations and Sectors, all LLMAs, Average Over the 1998-2017 Period

[25]The percentage of creative workers, for a particular period, has a one to one relationship with the respective location quotients.

B.2 Description of Creative Subsectors

The numbers shown in Table 2 in the main text are averages considering all creative sectors or occupations and could be hiding an important degree of heterogeneity. Table B1 shows measures of the size and some descriptive statistics for eight subcategories of creative activities (details in Tables A1 and A2). These results however (and those in C.4) should be interpreted carefully, as the data may not be good enough to characterise these narrowly defined subsectors.

Publishing, architecture and advertising appear to be the largest subsectors, although the ranking of subsectors is different if we look at size as number of workers, number of firms or total sales. Some striking numbers, like the large share of creative sales attributed to a relatively small number of workers in publishing, and the opposite for architecture, may be related to the differences in capital intensity and input usage. Within creative sectors, some subsectors, like publishing, may be intensive in the use of capital and intermediate inputs, while others, like the arts, *create* value chiefly out of *creativity*. Although how that creativity translates into income also depends on whether a sector is strong in economic value creation or not: for instance, the arts may be culturally intensive but do not have such a high economic valuation, thus explaining the relatively low incomes even if they could translate most of sales into labour income.

There is a strictly monotonic relationship between average schooling and average incomes, with the extremes being crafts and architecture. Crafts and creative sites are the only subsectors that have, on average, lower incomes than non-creative sectors. However, their education levels are on average higher than those of non-creative sectors.

There is an important degree of heterogeneity in average weekly hours worked. Workers in sectors like publishing, new media, architecture and advertising work over forty hours a week (some even above the average for non-creative sectors). Workers in others, like crafts, creative sites, and most notably the arts, work a much smaller number of hours, suggesting important differences in job quality that may be related to the economic value of the sectors.

The last column of the table shows what percentage of the workers in each subsector work in creative occupations, a measure of the creative density of each subsector. As could be expected, arts and crafts have very high figures.[26]

Overall, the important differences observed in incomes, education levels, and hours worked are related to underlying differences in the types of activities conducted and goods and services produced by the subsectors, as well as in the way in which they interact with the rest of the economy. It is not clear whether the fact that creativity is at their core is enough to put all of them together under the same concept. In particular, one could expect that the potential for generating spillovers to the rest of the economy is different for these different subsectors.

[26] These numbers are calculated considering *all* creative occupations, regardless of which subsector they are associated to. For example, artists within advertising are considered as working in a creative occupation.

Table B1: Characteristics of Creative Subsectors in 2015

Subsectors	Percentage of total workers in creative sectors	Percentage of total creative firms	Percentage of total sales of creative firms	Average schooling (years)	Average income (CLP)	Average weekly hours worked	Within the subsector, percentage of workers in creative occupations
Crafts	3.52	3.18	0.54	11.92	345,032	35.72	77.91
Publishing	*3.71*	*21.74*	*37.26*	*14.6*	*685,327*	*44.03*	*42.89*
Audiovisual	11.46	10.1	10.32	14.18	535,509	39.65	58.1
New media	*14.07*	*8.13*	*16.6*	*16.02*	*980,765*	*43.74*	*68.47*
Architecture	28.29	14.2	7.93	16.52	1,294,707	44.47	41.39
Advertising	*17.82*	*32.98*	*23.71*	*14.83*	*773,842*	*42.47*	*45.19*
Arts	9.78	9.05	3.64	14.08	454,791	31.13	77.49
Creative sites	*11.35*	*0.63*	*0*	*13.25*	*421,025*	*36.55*	*25.51*
Average creative sectors				15.05	835,075	40.96	
Average non-creative sectors				11.82	449,693	42.88	

Notes. Casen and SII data, subsectors defined in the tables in Appendix A. *Percentage of total workers in creative sectors* indicates the percentage of total workers in creative sectors in the country that work in the corresponding subsector. *Within the subsector, percentage of workers in creative occupations* indicates which percentage of the workers in each subsector work in occupations that are considered creative.

C Additional Econometric Results

C.1 Results with Alternative Definitions

C.1.1 Sectors with 30% of Creative Workers Defined as Creative

Table C1: Effects of agglomeration. Creative sectors are those with 30% or higher intensity of creative occupations.

*

	Individuals in creative sectors			Firms in creative sectors		
	Income	Hours	Hourly income	Number of firms	Sales	Labour productivity
LQ sectors (Casen)	0.201	0.0820	0.264			
	(0.171)	(0.395)	(0.157)			
LQ sectors (Casen) squared	-0.0435	-0.0228	-0.0645			
	(0.502)	(0.468)	(0.354)			
LQ sectors (SII)				0.139*	1.384**	-0.951
				(0.097)	(0.034)	(0.119)
LQ sectors (SII) squared				-0.0530	-0.601	-0.0538
				(0.428)	(0.135)	(0.866)
ln(Total income)	0.112	0.0191	-0.0410	-0.0405	0.446	0.275
	(0.387)	(0.740)	(0.765)	(0.403)	(0.257)	(0.351)
Share in urban areas	0.329	0.0309	0.539	0.177	-1.436	0.585
	(0.480)	(0.912)	(0.337)	(0.214)	(0.221)	(0.513)
ln(Population)	0.0933	-0.00138	0.0529	-0.0368	2.552*	1.758**
	(0.727)	(0.983)	(0.871)	(0.868)	(0.072)	(0.030)
Age	-0.00902	0.000584	-0.0118	-0.000279	-0.0445	0.0476
	(0.703)	(0.964)	(0.661)	(0.965)	(0.401)	(0.335)
Avg. schooling	-0.0773	-0.0449	-0.0286	0.0246	0.0431	0.0675
	(0.145)	(0.177)	(0.653)	(0.202)	(0.775)	(0.629)
Avg. schooling creative sec.	0.110***	0.0367***	0.0778***	-0.00122	-0.0239	-0.0518*
	(0.000)	(0.000)	(0.000)	(0.775)	(0.432)	(0.080)
N	537	537	537	307	222	216

Notes. Casen data for individuals and SII data for firms. Panel regressions using all the years with data available for the controls and each dependent variable. Dependent variables are in natural logarithms. All regressions include year and LLMA fixed-effects. Standard errors clustered at the llma level for individual-based variables and robust standard errors for firm-based variables. Results for occupations are omitted as the definition here only changes for sectors. p-values in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C2: Spillovers of creative agglomerations. Creative sectors are those with 30% or higher intensity of creative occupations.
*

	Individuals in non-creative sectors			Firms in non-creative sectors		
	Income	Hours	Hourly income	Number of firms	Sales	Labour productivity
LQ sectors (Casen)	-0.0345	0.0226*	-0.0682			
	(0.385)	(0.081)	(0.233)			
LQ sectors (Casen) squared	0.0140	-0.0156***	0.0418**			
	(0.261)	(0.001)	(0.029)			
LQ sectors (SII)				0.0123	-0.190	-0.286
				(0.720)	(0.527)	(0.374)
LQ sectors (SII) squared				0.00166	0.0163	0.0808
				(0.944)	(0.931)	(0.699)
ln(Total income)	0.424***	0.00249	0.442***	-0.0120	0.185	0.213
	(0.000)	(0.882)	(0.000)	(0.586)	(0.274)	(0.241)
Share in urban areas	-0.0102	0.0225	-0.0124	0.0419	-0.0996	-0.511
	(0.934)	(0.527)	(0.944)	(0.498)	(0.868)	(0.401)
ln(Population)	-0.278***	0.00726	-0.292***	0.289***	0.590*	0.155
	(0.003)	(0.800)	(0.000)	(0.000)	(0.091)	(0.672)
Age	0.0181***	0.0000156	0.0216**	0.0000685	0.00664	0.00315
	(0.003)	(0.993)	(0.016)	(0.978)	(0.780)	(0.894)
Avg. schooling	0.117***	0.00295	0.0955***	0.0151	0.0468	0.0198
	(0.000)	(0.703)	(0.000)	(0.245)	(0.424)	(0.765)
Avg. schooling creative sec.	-0.00117	-0.000732	0.00294	-0.000527	0.00726	0.00982
	(0.698)	(0.603)	(0.466)	(0.722)	(0.538)	(0.458)
N	537	537	537	307	307	307

Notes. Casen data for individuals and SII data for firms. Panel regressions using all the years with data available for the controls and each dependent variable. Dependent variables are in natural logarithms. All regressions include year and LLMA fixed-effects. Standard errors clustered at the llma level for individual-based variables and robust standard errors for firm-based variables. Results for occupations are omitted as the definition here only changes for sectors. p-values in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.1.2 Core and Broad Definitions

Table C3: Effects of agglomeration. 'Core' and 'Broad' definitions of creative sectors.

*

	Creative occupation in creative firm			Creative occupation or creative firm		
	Income	Hours	Hourly income	Income	Hours	Hourly income
LQ core	0.492	0.322*	0.279			
	(0.105)	(0.060)	(0.437)			
LQ core squared	-0.183	-0.167*	-0.0485			
	(0.248)	(0.068)	(0.807)			
LQ broad				0.0638	-0.189	0.423
				(0.867)	(0.387)	(0.201)
LQ broad squared				-0.0603	0.125	-0.250
				(0.777)	(0.331)	(0.191)
ln(Total income)	0.0543	-0.0488	0.303	0.0204	-0.0262	0.0306
	(0.807)	(0.745)	(0.148)	(0.857)	(0.610)	(0.796)
Share in urban areas	-3.489***	-2.649***	-0.500	0.274	0.201	-0.0351
	(0.000)	(0.004)	(0.595)	(0.639)	(0.546)	(0.951)
ln(Population)	-0.913***	-0.0876	-0.900**	0.300*	0.0188	0.128
	(0.004)	(0.609)	(0.016)	(0.080)	(0.711)	(0.513)
Age	-0.0744*	-0.00814	-0.0838*	-0.0447**	-0.0132	-0.0227
	(0.070)	(0.780)	(0.074)	(0.041)	(0.310)	(0.359)
Avg. schooling	0.0812	-0.0406	0.102	0.0771	-0.00599	0.0639
	(0.471)	(0.597)	(0.379)	(0.226)	(0.865)	(0.300)
Avg. schooling creative sec.	0.113***	0.0204	0.0817***	0.0490***	0.0110	0.0314**
	(0.000)	(0.222)	(0.000)	(0.000)	(0.124)	(0.016)
N	426	429	424	504	504	504

Notes. Casen data. Panel regressions using all the years with data available for the controls and each dependent variable. Dependent variables are in natural logarithms. All regressions include year and LLMA fixed-effects. Standard errors clustered at the llma level. LQ core is the location quotient for workers in creative occupations working in firms in creative sectors. LQ broad is the location quotient for creative workers, considering to be creative both workers in creative occupations and those in firms in creative sectors. p-values in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C4: Spillovers of creative agglomerations. 'Core' and 'Broad' definitions of creative sectors.

*

	Not creative occupation in creative firm			Not creative occupation or creative firm		
	Income	Hours	Hourly income	Income	Hours	Hourly income
LQ core	0.0102	-0.0607	0.172			
	(0.955)	(0.585)	(0.218)			
LQ core squared	-0.0442	0.0225	-0.116			
	(0.701)	(0.738)	(0.212)			
LQ broad				0.0185	-0.00607	-0.0193
				(0.807)	(0.836)	(0.861)
LQ broad squared				-0.0162	0.000592	0.0175
				(0.730)	(0.976)	(0.792)
ln(Total income)	-0.0948	-0.111*	-0.0178	0.427***	0.000998	0.445***
	(0.502)	(0.077)	(0.902)	(0.000)	(0.954)	(0.000)
Share in urban areas	0.674	0.491	-0.216	0.0229	0.0678*	-0.00771
	(0.410)	(0.352)	(0.726)	(0.867)	(0.081)	(0.969)
ln(Population)	0.476**	0.130*	0.228	-0.276***	0.00709	-0.285***
	(0.032)	(0.079)	(0.299)	(0.003)	(0.788)	(0.000)
Age	-0.0605**	-0.0285	-0.0265	0.0204***	-0.00108	0.0234**
	(0.039)	(0.173)	(0.301)	(0.004)	(0.598)	(0.015)
Avg. schooling	0.0711	-0.0201	0.0741	0.112***	0.00405	0.101***
	(0.433)	(0.743)	(0.332)	(0.000)	(0.614)	(0.000)
Avg. schooling creative sec.	0.0239	0.0176	0.0000558	-0.00347	-0.00112	-0.00276
	(0.163)	(0.192)	(0.997)	(0.109)	(0.248)	(0.428)
N	504	504	504	504	504	504

Notes. Casen data. Panel regressions using all the years with data available for the controls and each dependent variable. Dependent variables are in natural logarithms. All regressions include year and LLMA fixed-effects. Standard errors clustered at the llma level. LQ core is the location quotient for workers in creative occupations working in firms in creative sectors. LQ broad is the location quotient for creative workers, considering to be creative both workers in creative occupations and those in firms in creative sectors. p-values in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.2 Random Set of Sectors

Table C5: Effects of Agglomeration

*

	Individuals in random group of occupations			Individuals in random group of sectors			Firms in random group of sectors		
	Income	Hours	Hourly income	Income	Hours	Hourly income	Number of firms	Sales	Labour productivity
LQ occupations	0.243	-0.0855	0.405						
	(0.237)	(0.284)	(0.182)						
LQ occupations squared	-0.130	0.0356	-0.205						
	(0.147)	(0.332)	(0.117)						
LQ sectors (Casen)				0.126	0.00982	0.179			
				(0.328)	(0.891)	(0.334)			
LQ sectors (Casen) squared				-0.0244	-0.00371	-0.0528			
				(0.556)	(0.883)	(0.424)			
LQ sectors (SII)							0.0597	0.609	-0.916***
							(0.219)	(0.200)	(0.004)
LQ sectors (SII) squared							0.00796	-0.107	0.0282
							(0.476)	(0.388)	(0.761)
ln(Total income)	0.353***	0.0297	0.328***	0.214**	0.0482	0.124	-0.0771**	-0.0634	0.310
	(0.000)	(0.259)	(0.001)	(0.034)	(0.298)	(0.359)	(0.019)	(0.866)	(0.251)
Share in urban areas	0.234	0.00518	0.0615	0.410	0.190	0.195	0.153	0.472	-1.637**
	(0.386)	(0.951)	(0.864)	(0.372)	(0.191)	(0.727)	(0.240)	(0.720)	(0.037)
ln(Population)	-0.302***	-0.0364	-0.259**	-0.161	-0.109*	0.0723	0.202	-1.264	-1.289*
	(0.004)	(0.429)	(0.037)	(0.309)	(0.064)	(0.671)	(0.163)	(0.205)	(0.074)
Age	0.00761	-0.00634	0.0244	0.0392***	0.00356	0.0395**	0.000826	-0.0637	-0.0326
	(0.557)	(0.106)	(0.139)	(0.007)	(0.538)	(0.046)	(0.894)	(0.287)	(0.518)
Avg. schooling	0.0845**	0.00570	0.0518	-0.0163	-0.0258	0.0367	0.0313**	-0.289*	-0.297**
	(0.011)	(0.639)	(0.230)	(0.723)	(0.136)	(0.435)	(0.034)	(0.088)	(0.026)
Avg. schooling creative sec.	-0.0124	0.000534	-0.0144	0.0752***	0.00406	0.0560***	-0.00621	0.0788*	0.0417
	(0.190)	(0.893)	(0.293)	(0.000)	(0.549)	(0.009)	(0.214)	(0.085)	(0.217)
Year and LLMA fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sample size	537	537	537	537	537	537	307	282	278

Notes. Casen data for individuals and SII data for firms. Panel regressions using all the years with data available for the controls and each dependent variable. Dependent variables are in natural logarithms. Standard errors clustered at the LLMA level for Casen (individual-based) data and robust standard errors for SII (firm-based) data. p-values in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C6: Spillovers of Creative Agglomerations

*

	Individuals not in random group of occupations			Individuals not in random group of sectors			Firms not in random group of sectors		
	Income	Hours	Hourly income	Income	Hours	Hourly income	Number of firms	Sales	Labour productivity
LQ occupations	0.116	-0.0311	0.201						
	(0.309)	(0.546)	(0.182)						
LQ occupations squared	-0.0631	0.0149	-0.108						
	(0.212)	(0.488)	(0.147)						
LQ sectors (Casen)				0.0154	0.00612	0.0670			
				(0.629)	(0.673)	(0.218)			
LQ sectors (Casen) squared				-0.00709	-0.00337	-0.0145			
				(0.516)	(0.544)	(0.429)			
LQ sectors (SII)							-0.0511*	-0.210*	-0.0594
							(0.099)	(0.094)	(0.682)
LQ sectors (SII) squared							0.0142**	0.0575*	0.0494
							(0.048)	(0.074)	(0.251)
ln(Total income)	0.417***	-0.000712	0.435***	0.426***	0.00242	0.445***	-0.0124	0.221	0.224
	(0.000)	(0.965)	(0.000)	(0.000)	(0.879)	(0.000)	(0.639)	(0.258)	(0.250)
Share in urban areas	-0.0215	0.0297	-0.0264	-0.0274	0.0209	-0.0484	0.0511	0.101	-0.292
	(0.851)	(0.381)	(0.870)	(0.826)	(0.573)	(0.794)	(0.473)	(0.865)	(0.625)
ln(Population)	-0.287***	0.0188	-0.338***	-0.280***	0.0111	-0.314***	0.297***	0.596	0.158
	(0.000)	(0.540)	(0.000)	(0.002)	(0.665)	(0.000)	(0.007)	(0.144)	(0.677)
Age	0.0167***	0.000464	0.0170**	0.0145**	-0.000789	0.0179**	0.000155	0.0189	0.0116
	(0.010)	(0.789)	(0.047)	(0.023)	(0.654)	(0.035)	(0.959)	(0.269)	(0.499)
Avg. schooling	0.111***	0.00451	0.0961***	0.122***	0.00371	0.0968***	0.0146	0.0738	0.0483
	(0.000)	(0.507)	(0.000)	(0.000)	(0.610)	(0.000)	(0.278)	(0.181)	(0.357)
Avg. schooling creative sec.	0.00165	-0.00180	0.00513	-0.00431	-0.00168	0.00133	-0.000856	-0.00703	-0.0104
	(0.681)	(0.192)	(0.541)	(0.286)	(0.299)	(0.886)	(0.781)	(0.670)	(0.556)
Year and LLMA fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sample size	537	537	537	537	537	537	307	307	307

Notes. Casen data for individuals and SII data for firms. Panel regressions using all the years with data available for the controls and each dependent variable. Dependent variables are in natural logarithms. Standard errors clustered at the LLMA level for Casen (individual-based) data and robust standard errors for SII (firm-based) data. p-values in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.3 At Least 30 Observations per LLMA-Year

Table C7: Effects of Agglomeration, Only LLMA-Years Where the Dependent Variable is Calculated with 30 or More Observations *

	Individuals in creative occupations			Individuals in creative sectors			Firms in creative sectors		
	Income	Hours	Hourly income	Income	Hours	Hourly income	Number of firms	Sales	Labour productivity
LQ occupations	1.053***	-0.218	1.341***						
	(0.005)	(0.213)	(0.001)						
LQ occupations squared	-0.500***	0.101	-0.641***						
	(0.007)	(0.187)	(0.001)						
LQ sectors (Casen)				-1.036	0.0427	-0.437			
				(0.263)	(0.915)	(0.730)			
LQ sectors (Casen) squared				0.650	0.0272	0.319			
				(0.172)	(0.894)	(0.620)			
LQ sectors (SII)							0.276***	2.456**	-1.549
							(0.007)	(0.045)	(0.105)
LQ sectors (SII) squared							-0.108	-0.942	0.364
							(0.131)	(0.180)	(0.436)
ln(Total income)	0.0725	-0.0231	0.0609	0.675*	-0.0173	0.480	0.0431	0.946	0.251
	(0.605)	(0.706)	(0.675)	(0.076)	(0.921)	(0.412)	(0.378)	(0.152)	(0.433)
Share in urban areas	0.484	0.559	0.0621	-2.557	-1.429	0.696	-0.335	5.294	0.595
	(0.557)	(0.151)	(0.954)	(0.370)	(0.334)	(0.879)	(0.110)	(0.216)	(0.793)
ln(Population)	-0.0872	0.176	-0.383	-0.751	0.231	1.085	0.238**	1.341	0.409
	(0.781)	(0.286)	(0.335)	(0.637)	(0.843)	(0.771)	(0.041)	(0.582)	(0.826)
Age	-0.0117	-0.0163	0.00837	-0.178**	-0.0431	0.0281	0.0140*	-0.192	0.0549
	(0.735)	(0.352)	(0.831)	(0.034)	(0.306)	(0.869)	(0.086)	(0.115)	(0.454)
Avg. schooling	0.212*	0.0309	0.148	-0.0519	-0.0578	0.167	0.0366	-0.330	0.126
	(0.054)	(0.567)	(0.250)	(0.851)	(0.626)	(0.626)	(0.177)	(0.325)	(0.406)
Avg. schooling creative sec.	0.00746	0.00171	-0.0166	0.270***	0.0379	0.128	0.00164	0.0413	0.0956***
	(0.690)	(0.852)	(0.479)	(0.001)	(0.283)	(0.122)	(0.679)	(0.392)	(0.003)
Year and LLMA fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sample size	206	206	206	62	62	62	177	100	100

Notes. Casen data for individuals and SII data for firms. Panel regressions using all the years with data available for the controls and each dependent variable. Only LLMA-years where the dependent variable is calculated with 30 or more observations. Dependent variables are in natural logarithms. Standard errors clustered at the LLMA level for Casen (individual-based) data and robust standard errors for SII (firm-based) data. p-values in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.4 Subsectors and Jacobian Effects

One natural avenue to explore after observing that there is no relationship between specialisation in creative industries and outcomes in the broader economy is looking whether the same holds true for specialisation in specific categories of creative industries. Table C8 summarises the results of replicating Table 4 but defining the LQ measures for each of the eight subsectors defined in Section A.1.[27,28] Results are only presented as a first look at the issue and should be interpreted with care.

While most LQ measures are insignificant, some interesting results do arise. Crafts are associated with better labour market outcomes for other sectors: this is consistent with the network spillovers described by Chapain et al. (2010), but in this case they could be stemming from a strong tourism sector that drives the results for labour markets and crafts.

New media is rather surprisingly not associated to Jacobian effects. This could be the result of problems in the measurement of the sector with the ISIC rev.3 and ISCO-88 categories, or it could be that the sector is relatively underdeveloped in the country. Architecture, audiovisual and creative sites have none or few significant coefficients, but only at the 10 percent level.

The arts produce the most interesting results: they are associated with worse labour market outcomes in other sectors but with higher labour productivity. The former is consistent with the idea of the compensating differential of living in a culturally stimulating city, as argued by Bakhshi et al. (2014), who found similar results. Arts and publishing have positive coefficients for productivity, suggesting Jacobian spillovers across sectors. No obvious grouping of the eight subsectors seemed to produce meaningful results.

This is only a first attempt at exploring what we might be missing when looking at all creative industries together as something homogeneous, and more work should be done in different economic realities and with more detailed data.

One issue to keep in mind if the questions asked here are explored at the level of creative subsectors is the boundary between Marshallian and Jacobian effects: a Marshallian effect observed at the aggregate level of creative industries might in fact be the result of Jacobian effects across different creative subsectors.

[27] For simplicity, I did not include the quadratic term for specialisation.

[28] This analysis cannot be conducted for intra-industry effects because it is unreliable to estimate the dependent variables for narrowly defined subsectors in many LLMAs with a very small number of surveyed workers in each subsector.

Table C8: Spillovers of Creative Agglomerations, Estimates for the LQ Measures, All Creative Subsectors

	Individuals in creative occupations	Individuals in creative sectors	Firms in creative sectors		
	Hourly income	Hourly income	Number of firms	Sales	Labour productivity
Crafts	-0.0361	0.00646	0.0149	0.106	0.120
	(0.501)	(0.524)	(0.388)	(0.272)	(0.192)
New media	0.0323	0.0117	-0.00377	-0.0233	-0.00944
	(0.454)	(0.564)	(0.340)	(0.314)	(0.656)
Architecture	0.0371*	-0.00655	-0.00670	-0.00142	0.0756
	(0.065)	(0.590)	(0.536)	(0.974)	(0.223)
Audiovisual	-0.00400	-0.00601	0.00741	0.0527	0.0305
	(0.656)	(0.473)	(0.189)	(0.185)	(0.412)
Creative sites	0.00947	-0.00456	-0.00430*	-0.000614	0.00899
	(0.193)	(0.306)	(0.092)	(0.946)	(0.390)
Arts	-0.00140	-0.0270**	-0.00209***	0.00145	0.00314**
	(0.913)	(0.034)	(0.000)	(0.461)	(0.048)
Publishing	-0.00808	-0.00291	0.0223	0.172	0.331***
	(0.253)	(0.767)	(0.338)	(0.180)	(0.009)

Notes. Casen data for individuals and SII data for firms. Panel regressions using all the years with data available for the controls and each dependent variable. Dependent variables are in natural logarithms. Standard errors clustered at the LLMA level for Casen (individual-based) data and robust standard errors for SII (firm-based) data. p-values in parentheses. For simplicity, the estimates corresponding to different LQ measures are all displayed in the same row. The model specification is the same as in the previous tables. Each row represents a creative subsector, as defined in A.1. Estimates without the quadratic terms, discussion with alternative specifications in the text. Advertising is excluded because of its small sample size. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.