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## Efficient creativity in Mexican metropolitan areas

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## ABSTRACT

Human creativity is the most important economic resource. Yet, very few studies in the economic literature have attempted to evaluate the efficiency of creative sectors around the world. In that regard, this paper examines the efficiency of the production of creative goods in Mexico. The empirical examination is made covering 36 metropolitan areas at four different periods of time, using the quinquennial economic censuses taken by the government in 1998, 2003, 2008 and 2013. The paper first estimates the static performance of the creative industries by means of data envelopment analysis models. Subsequently, the Malmquist productivity index is used to estimate their dynamic efficiency. Using both analyses, it is shown that, contrary to a commonly held view in the literature, most of the efficient creative industries in Mexico are to be found in metropolitan areas that are not relatively large. Furthermore, it is also found that more than three fourths of the creative sectors in the metropolitan areas are inefficient. The paper then makes use of Florida's 3Ts model to explore some possible factors that could account for those inefficiencies. Two features that are not widespread in Mexico, good public infrastructure and culturally diverse cities, are found to be explanatory factors of best practices in the production of creative goods.

## 1. Introduction

As it has been stressed by, among others, [DCMS \(1998\)](#), [Caves \(2000\)](#), [Howkins \(2001\)](#), [Florida \(2002\)](#) and [Hartley \(2005\)](#), human creativity is the most important resource for a large number of economic activities. Moreover, creativity is not only an essential factor at the industry level, but also at the regional and national levels, since creative industries are an important driving force for the emergence of new markets ([Potts et al., 2008](#)). The recognition of their economic value has grown steadily over this century, specially after the reports on the creative sector made by three agencies of the United Nations: [UNCTAD and UNDP \(2008\)](#), [UNCTAD and UNDP \(2010\)](#) and [UNDP and UNESCO \(2013\)](#).

The creative sector, which includes industries as diverse as advertising, design or scientific research, is currently one of the few robust economic sectors worldwide. For instance, from 2002 to 2011, a period that includes the years of the Great Recession, the creative sector had an average annual growth rate of 8.8 per cent worldwide. In the case of the exports of creative goods from only developing countries, the growth rate was, in particular, even higher: about 12.1 per cent over the same period ([UNDP and UNESCO, 2013](#), p. 9). Furthermore, given the specific goal of this paper it is also worth to note that Mexico is

the biggest exporter of creative goods among Latin American countries ([UNCTAD and UNDP, 2010](#), p. 161).

Given the growing worldwide recognition of the importance of creative industries, some authors have tried to identify the key factors that may account for their dynamism. An obvious condition is the existence of appropriate cities that can nurture such industries. After all, to paraphrase [Glaeser \(2011\)](#), cities are among the greatest creative inventions. But, clearly, there have to be other relevant factors as well. A well-known theory on that regard, known as the 3Ts model, is due to [Florida \(2002\)](#). It posits that creative regions must have an abundance of three other elements: technology, talent, and tolerance. Needless to add, in order to make that model operational at the level of cities or countries, it is necessary to proxy each of those elements using variables that are not only closely related, but that are also readily available. To provide an example, in the construction of the Global Creativity Index ([Florida et al., 2015](#)) the authors end up estimating a country's technology using as proxies the country's share of GDP devoted to R&D, as well as its number of patents.

Macro analyses such as the one suggested by the 3Ts model are certainly quite useful for policy-makers and investors alike. Yet, it would also seem to be worth examining the production process of creative goods at the micro level. This paper illustrates this last approach by

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offering analyses of the static and dynamic efficiencies of the Mexican creative sectors. Having done so, the paper also offers a statistical exercise in which the 3Ts model is used to explore some possible factors that could account for the relative efficiency of each sector.

The study is done by focusing on the creative industries that are located in the Mexican metropolitan areas, where about 80 per cent of the urban population currently lives. As a first step, the static efficiency analysis considers the creative sector of each metropolitan area as a single unit. A data envelopment analysis (DEA) model is then used to compute, in relative terms, the efficiency of each unit. First proposed by [Charnes et al. \(1978\)](#), DEA is a non-parametric method that makes use of linear programming to calculate, for a group of decision-making units, the relative efficiencies in the production of one or more outputs by means of some inputs. It is a non-parametric method since it does not require the specification of a production function. This feature is particularly useful in the case of the production of creative goods, since an explicit functional form that relates inputs and outputs cannot be easily established.

DEA renders only static results: the relative efficiency of each unit with respect to the rest of them at a particular point in time. But the same estimation procedure can be repeated in different periods, in such a way that, by means of the Malmquist productivity index, a dynamic analysis is performed. As illustrated in this paper, that index can be used to compute, both, the efficiency change and the technological change in the production of creative goods for each metropolitan area.

It should be noted that the non-parametric methods mentioned above have been already used in, literally, a myriad of studies that attempt to measure the relative efficiency in the production of goods across industries and regions. Nonetheless, few of those studies are dedicated in particular to the case of creative industries, and only from a static perspective. This is not meant to say that there are no studies on the dynamic performance of the creative sector in the literature. Two interesting examples in that respect are [Stam et al. \(2008\)](#), for the case of the Netherlands, and [Hong et al. \(2014\)](#), for the case of China. But the methodologies used in those papers are quite different from the one stated in this work, which seems to be the first in using DEA and the Malmquist productivity index to examine the efficiency of creative industries. On the other hand, it should also be pointed out that there are several studies in the case of other knowledge-based industries that do use the same methods as the ones employed here (see, e.g., [Han et al., 2016](#)).

The content of this paper unfolds as follows. Section 2 presents the metropolitan areas to be studied, as well as a list of the industries that constitute the creative sectors in each city. The selection of those specific industries is not as straightforward as it would seem at first sight, since there are in the literature contrasting views about what constitutes a creative good. As is also detailed in Section 2, the study uses data from the last four quinquennial economic censuses taken by the Mexican federal government. Afterwards, Section 3 reviews the two non-parametric methods used to evaluate the static and dynamic efficiencies of the Mexican creative industries. Section 4 then presents an empirical implementation of those methods, as well as a thorough discussion of the results. It also presents statistical evidence that relates the findings with the 3Ts model. The conclusions are drawn in Section 5.

## 2. Creative industries in metropolitan areas

The Mexican federal government established the existence of 59 metropolitan areas (MAs) in 2010 ([SEDESOL et al., 2012](#)). Although those areas are the result of aggregating only 367 municipalities, about 15 per cent of the total number of Mexican municipalities, their contribution to the national employment is around 73 per cent, and their production accounts for about 77 per cent of total gross product ([INEGI, 2014](#)). That group of MAs is, nevertheless, quite heterogeneous. In

terms of population, the MA officially named as Valle de México is by far the largest city in the country, with a population of more than 20 million people. This area includes Mexico City's 16 circumscriptions, as well as 60 municipalities from two neighboring states. The next two largest MAs are Guadalajara and Monterrey, with a population of about 5 million people each. On the other hand, eight of the 59 metropolitan areas have populations smaller than 200,000 people.

The population growth rate of the Mexican MAs as a whole was 17.5 per cent from 2000 to 2010, but there were a dozen of them with population growth rates of at least 30 per cent during that decade. They are, listed in decreasing order, Cancún, Puerto Vallarta, Reynosa-Río Bravo, Pachuca, Querétaro, Tuxtla Gutiérrez, Tijuana, Saltillo, Aguascalientes, Zacatecas-Guadalupe, León, and Villahermosa. It is also interesting to note that seven of all MAs are located south of the US border, and, somewhat atypically for international standards, only 13 of the 59 metropolitan areas are located on the coast.

Needless to add, the heterogeneity among the MAs manifests itself not only in terms of their population or location, but also in terms of their creative sectors. For instance, a study made by the Ministry of Economy ([SE, 2008](#)) identifies as interactive media hubs in Mexico only the following eight metropolitan areas: Aguascalientes, Guadalajara, Mérida, Mexicali, Monterrey, Querétaro, Tijuana and Valle de México (Mexico City). Furthermore, a more recent study made by the government, based on cluster analysis ([SE, 2016](#)), identifies 30 information technology clusters that are constituted by about 1500 companies. But the report only labels four MAs as information technology hubs: Guadalajara, Monterrey, Querétaro and Valle de México. This is not meant to imply that the rest of the MAs do not produce enough creative goods since, as is noted next, there are creative industries of different nature.

### 2.1. Classification of creative industries

At the end of the last century, the UK's Department for Culture, Media and Sport singled out 13 industries that might constitute the creative sector ([DCMS, 1998](#)): advertising, antiques, architecture, crafts, design, fashion, film, leisure software, music, performing arts, publishing, software, and TV and radio. Other classifications were later offered by, among others, [Howkins \(2001\)](#), [Florida \(2002\)](#), and [Hartley \(2005\)](#). However, the most commonly cited classification was offered by [UNCTAD and UNDP \(2008\)](#). In their influential report, those two UN agencies proposed that creative industries should be classified into four broad groups (subdivided into nine subgroups): heritage (traditional cultural expression and cultural sites), arts (performing and visual arts), media (audiovisuals and publishing, and printed media), and functional creation (design, creative services, and new media).

The list suggested by [UNCTAD and UNDP \(2008\)](#) is comprehensive and well-balanced. However, it is too large for the purposes of this paper, since the empirical models described later require specific data on inputs and outputs for the creative industries. In that regard, the only available data at a sufficient level of detail come from the economic censuses taken by the government in 1998, 2003, 2008 and 2013 ([INEGI, 1999, 2004, 2009, 2014](#)). Some of the industries in the UN list mentioned before, such as the heritage group, do not have their counterparts in the economic census. Thus, taking as a guide the available information, as well as the specific lists proposed for Mexico by [NEA \(2013\)](#) and [SE \(2013a\)](#), [Table 1](#) presents the creative industries to be studied in this work.

It is worth noting that the classification given in that table conforms to the North American Industry Classification System (NAICS). More precisely, the 1997 and 2002 versions of NAICS were employed for, respectively, the censuses taken in 1998 and 2003. The latest version of NAICS, published in 2007, was used in the 2008 and 2013 censuses. Another point to keep in mind is that each census provides information only at the municipality level, in such a way that data for each

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