

Economic Impact of Creative Industries in Mexico City: An Input-Output Analysis

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ABSTRACT

The literature on Cultural and Creative Industries (CCIs) indicates that these sectors play a crucial role in boosting competitiveness, productivity, growth, employment, and export potential within the economy. However, no efforts have been made in Mexico to assess their contribution relative to other traditional sectors. This paper aims to analyze the economic impact of CCIs on Mexico City's economy, which is known to have the highest concentration of CCIs in the country. The results reveal that CCIs represent only 19% of the impact on sales and 33% on purchases compared to traditional sectors in the city's economy.

Keywords: economic assessment, creativity, input-output, production chains, hypothetical extraction model.

JEL Classification: C67, L80, R12, R15, Z1.

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RESUMEN

Efectos multiplicadores de las industrias creativas en la Ciudad de México: un análisis de insumo-producto

La literatura sobre las industrias culturales y creativas (ICC) indica que estos sectores desempeñan un papel crucial en el impulso de la competitividad, la productividad, el crecimiento, el empleo y el potencial de exportación dentro de la economía. Sin embargo, en México no se han hecho esfuerzos para evaluar su contribución en relación con otros sectores tradicionales. Este trabajo tiene como objetivo analizar el impacto económico de las ICC en la economía de la Ciudad de México, que se sabe que tiene la mayor concentración de ICC en el país. Los resultados revelan que las ICC representan solo el 19% del impacto en las ventas y el 33% en las compras en comparación con los sectores tradicionales de la economía de la ciudad.

Palabras clave: evaluación económica, creatividad, insumo-producto, cadenas productivas, modelo de extracción hipotética

Clasificación JEL: C67, L80, R12, R15, Z1.

INTRODUCTION

The term cultural and creative industries (CCI) refers to a broad range of economic sectors, including architecture, museums, crafts, audiovisual media, design, literature, visual and performing arts, software, and both the tangible and intangible cultural heritage of a country. However, despite the widespread acceptance of the term, there is no single, definitive, universally accepted definition. Terms such as creative sectors, digital industries, creative economy, and even the orange industry are used interchangeably with CCI in Latin America. It is widely recognized that the term originated in 1994 with the Creative Nation initiative promoted by the Australian government, based on the idea that culture creates wealth (Department of Communications and the Arts [DCA], 1994). However, since the 1940s, concepts like the cultural industry have been used by Horkheimer *et al.* (1998) to critique capitalism, pointing to the standardization of consumption and the mass production of culture for non-creative, profit-driven purposes. The core idea of the cultural industries weakens when it is redefined as the creative industries, which focus solely on the production and marketing of goods and

services that include creative content. To clarify different perspectives on creative industries, we have tried to categorize them into a broader view (Moore, 2014) that sees creative industries as just another type of industry and as a form of occupation (creative class).

The challenge in defining this activity type has also led to a lack of clarity on how to measure it, as there is no well-established consensus on which industries and/or services should be considered part of the creative sector. Classifications vary widely; for example, in 1998, the DCM initially identified thirteen sectors within the creative industries, including traditional cultural activities such as radio, television, photography, music, and visual and performing arts. Different classifications exist; for instance, the World Intellectual Property Organization (WIPO, 2022) proposed eighty sectors related to copyright protection, the United Nations Conference on Trade and Development (UNCTAD, 2010) suggested seventy-one industries, the Orange Economy has forty-five sectors, the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2013) identified thirty-seven sectors, and the European Union outlined twenty-five sectors within a classification focused on the cultural and creative industries most related to the digital economy (UNCTAD, 2024). The accumulation of inaccuracies in understanding what CCIs are and how they are measured also hampers identifying these sectors' roles in the economy. UNCTAD (2024) regularly assesses the economic contribution of CCIs; its latest 2024 report shows they account for between 0.5% and 7.3% of GDP, 0.5% to 12.5% of employment, and export a substantial amount of goods and services. Despite this assessment effort, these reports are highly aggregated and cannot capture the impacts that, at least in theory, are attributed to these industries. For example, it has been recognized that their macro impacts are more significant than those of traditional sectors; they foster innovation and have substantial direct and indirect effects on the economy (Boix-Domènech *et al.*, 2018).

The main goal of this work is to estimate the direct and indirect effects of CCIs in Mexico City using an input-output method called hypothetical extraction, which assumes a complete reduction in the operations of the Cultural and Creative Industries to measure their impact on GDP and overall employment in the city. The work is organized as follows: Section 1 reviews impact studies of CCIs across various economies worldwide, discussing the effects of cultural and

creative industries on the global economy based on the latest reports. It also includes the classification of the Cultural and Creative Industries and their adaptation to Mexico City. Sections 2 and 3 outline the methodology used and present the results of the measurements. Finally, highlights the most important conclusions.

1. CCIS AND THEIR INPUT-OUTPUT IMPACTS

Few input-output studies try to measure how CCIs affect specific regions within an economy. This is partly because creative activities are not clearly included in the input-output tables. As a result, more work is needed to identify these industries (Boix-Domènech *et al.*, 2018). Additionally, this is due to the limited availability of subnational input-output matrices; while most countries have domestic input-output matrices, they often lack matrices at the subnational level. The advantage of input-output accounts is that they enable analysis of the direct effects CCIs may have on an economy, such as changes in production, employment, and capital. They also consider indirect effects on other sectors involved in inter-industry relations or consumption chains, as well as non-quantifiable impacts like innovation, improved quality of life in cities, and motivation of people, among others (UNESCO, 2009). Since the COVID-19 pandemic, research on the impacts of CCIs on the economy has increased, as these sectors were among the most affected. Many studies describe the connection between the pandemic and the economic situation as an external economic shock that is transmitted and amplified depending on the conditions of the affected economies (Peckham, 2013; Calvo y Reinhart, 1996; Rigbon, 2003). The uniqueness of the pandemic is that, unlike more traditional external shocks such as earthquakes, floods, or hurricanes with short-term and often localized effects, COVID-19 is considered to have a long-term global economic impact. Therefore, the input-output methodology was especially suitable for its assessment because its transmission operated as an external shock via trade linkages, financial linkages, or simply through herd behavior (Cheung *et al.*, 2009). This created a conflict across three potential dimensions: on the demand side, it affects the spending power of the population; on the supply side, it leads to business closures and job losses; and finally, it impacts financial flows (Baqaei *et al.*, 2020; Bodenstein *et al.*, 2020). During the COVID-19 pandemic, major cities

worldwide were the primary sites of infection and experienced the largest economic impacts from the virus. The hardest-hit sectors were those in the service industry, especially the cultural and creative industries (CCIs) of various economies (Khlystova *et al.*, 2022). This is because creative activities, unlike other economic pursuits, require physical presence and social interaction, both of which were minimized by the mitigation measures implemented to contain the pandemic. However, a key advantage of creative sectors is their high resilience, arising from their innovative, diversified, and adaptable nature (Khlystovaa, *et al.*, 2022). This resilience was demonstrated by their remarkable ability to adapt to new digital formats and online delivery during and after the pandemic.

According to UNESCO (2021), the pandemic caused a \$750 billion loss and affected at least 10 million jobs in the global creative sectors. This report highlights that the Cultural and Creative Industries (CCI) were the first to shut down due to the pandemic and the last to reopen, demonstrating how much these industries were impacted by mitigation measures, as many rely on open spaces or operate with high job insecurity. In OECD countries, job losses in the sector are estimated to range from 0.8% to 5.5% of total employment. Additionally, this crisis has exposed the high vulnerability of micro-enterprises and self-employment within the creative sector (Organization for Economic Co-operation and Development (OECD, 2020). CCIs will experience long-term effects from the pandemic as it changes consumer habits. It has been shown that consumers are hesitant to spend on cultural services or are shifting to online delivery or streaming options (Khlystova *et al.*, 2022). A WIPO study (2022) stresses that the pandemic's impacts on CCIs are uneven, both across different sectors and within each sector. The report points out sectors that gained from the pandemic, such as telecommunications and audiovisual industries, which successfully adapted to new online formats. However, even within these sectors, the situation varies. For instance, in the audiovisual industry, the film and advertising sectors faced more challenges than radio and television; meanwhile, online download platforms became dominant, a trend known as "platformization." It has been suggested that after the pandemic, the creative sectors have no option but to move forward; returning to the old normal is no longer possible. These sectors will need to adjust to new conditions, replacing outdated practices of job insecurity with more

sustainable ones that can offer greater resilience (WIPO, 2022). In fact, the pandemic worsened the already precarious working conditions in the CCIs. Within the industry, creatives can have various employment statuses: they may be salaried, self-employed, freelancers, unemployed, or experience unemployment at different times. Mercosur-UNESCO (2021) provides a detailed account of the pandemic's impact on CCIs in Latin America, noting that 2,564 cinema complexes, 6,908 theaters, 7,516 museums, 7,844 bookstores, and 2,309 art galleries and exhibition halls had to close in the region. In Mexico, the data show 825 closed movie theaters, 713 active theaters, 1,395 museums, 1,643 bookstores, and 933 galleries. This resulted in 80% of creative spaces being affected by activity cancellations during the peak of the pandemic.

The application of input-output analysis to assess CCIs before the pandemic showed a wide range of evidence regarding their effects. Boix-Domènech *et al.*, (2018) suggests that, for the European Union, their impacts range from 2.6% to 7.8% on production and employment. In the Czech Republic, Šlehoferová (2014) estimated that the average consumption multiplier was only 0.473, much lower than the construction sector's multiplier of approximately 0.908. However, its primary impact was on the product multiplier, which averaged 1.9, with advertising services being the most important sector within the creative industries. Lyons (2023) conducted a regional analysis of Wales's 2018 national output-input matrix for the Cardiff urban area, examining nine sub-sectors of creative industries that contribute 3% of value added and 2.6% of local employment. Through changes in final demand, Lyons (2023) modeled the impacts of the nine creative sub-sectors on the economy; his results show that the sectors most affected by Covid were those requiring face-to-face interaction, such as music, visual and performing arts, and design. Sukma *et al.* (2018) applied the same product and found that in Indonesia, fashion exports increased national value added by 0.06% and employment by 0.11%. Additionally, artisanal exports increased national value added by 0.05% and employment by 0.11%, showing that their main effects are in creating jobs. Zuhdi *et al.* (2013) use Japan's 2005 input-output tables to analyze the impact of CCIs divided into seven sectors. Their results show that the rise in exports and consumption of goods from CCIs boosts the Japanese economy, while the increase in imports of these goods has a negative effect. Heng *et al.* (2003) used input-pipeline analysis to

identify the multipliers of the creative sectors in Singapore, showing that by 2000, CCIs contributed 3.2% of GDP and 2.2% of employment in the country. When measuring their indirect effects, they estimated impact multipliers of 1.8 for output and 0.8 for value added, both higher than those estimated for the United Kingdom, which has one of the most developed CCIs. An intriguing finding is that CCIs are strongly connected to construction and education, which receive 10% of their inputs from creative sectors. In Australia, the Creative Industries Innovation Centre (2013) studied seven creative sectors and used a national input-output matrix, showing that the total impact multiplier of creative and cultural industries (CCIs) is 3.76, with advertising, marketing, and architecture having the largest multiplier effects on the economy. In 2019, the Creative UK Group (2021) estimated that CCIs had a total impact of 10.7% on employment and 9% on gross value added, based on input-output matrices. Its direct impact made up 6.4% of employment and 5.9% of the UK's gross value added. The estimated multipliers for France, Germany, and the UK range from 1.7 to 1.9, according to a study by Deloitte (2021). In contrast, research on productive linkages and the impacts of CCIs in Mexico is nearly nonexistent, apart from one study by Valdivia *et al.* (2022). These researchers use the input-output method to calculate the backward and forward multipliers of CCIs in Mexico City, based on a 2008 state matrix. Their main results show that CCIs generally have low impact multipliers; however, certain key activities in the services and software sectors display significant forward multipliers, along with the creative services sector, newspaper publishing, and especially advertising agencies. An important aspect of all the input-output impact analyses reviewed above was identifying the sectors that make up the CCIs, since the official tables do not specify this type of activity. As a result, there is considerable diversity in the kinds and number of sectors used, which makes the results largely incomparable across different studies on the subject. In our case, it was also necessary to adapt the existing methodologies for identifying sectors within CCIs. To this end, we adopt the proposal of Valdivia *et al.* (2020), which suggests a broader classification of the creative sectors by incorporating R&D to revive innovation processes. This classification aligns more closely with the Orange Economy classifications developed for Latin America, as shown in Table 1 and Table 2.

TABLE 1
SECTOR CLASSIFICATION IN MEXICO CITY'S CULTURAL AND CREATIVE INDUSTRIES: SHARE
OF MEXICO CITY'S TOTAL ECONOMY, 2013

Category	Production	GDP	Employment
CCI	4.46	4.97	5.56
Art	0.61	0.73	0.27
Entertainment	0.44	0.36	0.65
R&D	0.28	0.37	0.06
Services	3.13	3.52	4.58
Non-creative sectors	95.54	95.03	94.44
Total	100.00	100.00	100.00

Source: authors' elaboration based on data from the CDMX Input-Output Matrix of the Center for Sustainable Regional and Urban Development (CEDRUS, 2013).

As shown in Table 1, CCIs in Mexico City account for 5% of the city's GDP and about 6% of employment. Although their share is small compared to other sectors in the city, their importance is still notable because, within other non-creative sectors, their contribution to GDP is similar to that of banking services, and their employment share is comparable to that of the second-largest sector, which is public administration (see Annex 1). Creative services are the most significant, contributing over 70% of GDP and more than 80% of employment within the city's CCIs (see table 2).

The importance of creative services within Mexico City's CCIs lies in the fact that it is the most service-oriented city in the country, with services being its main economic activity. Among these creative services, those classified as "Other professional, scientific, and technical services" are the most significant because they include a variety of activities that closely interact with real estate, financial, and technological sectors operating in the city. This broad sector includes architectural and engineering services, administrative, scientific, and technical consulting, market research, photography, and translation services.

2. METHODOLOGY

The methodological strategy used in this study is based on a uni-regional input-output analysis. Mexico has a longstanding history of research using this approach to explore different parts of the country (Albornoz

et al., 2012; Mendoza-Sánchez, 2019). The uni-regional nature of the model shows that it functions as a matrix tracking transactions between sectors within the same region.

TABLE 2
SECTORAL DISTRIBUTION OF PRODUCTION, GDP, AND EMPLOYMENT OF MEXICO CITY'S
CCIS, 2013

Sector	Production	GPD	Employment
Art	13.8	14.6	4.8
5112 - Software Editing	2	2.7	0.6
5121 - Film and video industry	4.7	3.2	2.7
5122 - Sound industry	0.6	0.5	0.6
7111 - Companies and groups of artistic and cultural shows	0.3	0.3	0.3
7115 - Freelance artists, writers and technicians	5	7	0.1
7121 - Museums, historical sites, zoos and the like	1.1	0.8	0.4
Entertainment	9.8	7.1	11.7
7114 - Agents and representatives of artists, athletes	0.1	0	0.1
7131 - Parks with recreational facilities and arcade houses	1.1	0.7	2.1
7132 - Casinos, lotteries, and other games of chance	5.2	3.7	2.1
7139 - Other recreational services	3.4	2.7	7.4
R&D	6.2	7.5	1.1
5417 - Scientific Research and Development Services	6.2	7.5	1.1
Services	70.2	70.7	82.5
5111 - Publication of newspapers, magazines, books and the like, and publication of these publications integrated with printing	6.1	4.9	7.1
515 - Radio and televisión	13.6	9.2	2.1
5191 - Other information services	0.7	0.7	1
5413, 5416, 5419 - Other professional, scientific and technical services	27.4	32.7	33.4
5414 - Specialized design	0.6	0.7	1.3
5415 - Computer System Design Services and Related Services	6.5	6.1	11.4
5418 - Advertising services and related activities	11.7	13.2	24.9
7112 - Professional athletes and sports teams	2	1.6	0.5
7113 - Promoters of artistic, cultural, sports and similar events	1.5	1.7	0.7
Total CCI	100	100	100

Source: author's elaboration based on data from the CDMX Input-Output Matrix of the Center for Sustainable Regional and Urban Development (CEDRUS, 2013).

The impact of a complete shutdown of Mexico City's cultural and creative industries on the city's GDP and overall employment is analyzed using an input-output approach with the hypothetical extraction method (Dietzenbacher and van Der Linden, 1997; Miller and Lahr, 2001). This study uses the input-output table of Mexico City from 2013, prepared by the Center for Regional and Sustainable Urban Development Studies (CEDRUS) at the Faculty of Economics at UNAM. This matrix's construction process and characteristics are detailed in Asuad *et al.*, (2023). Its main advantages include that a bottom-up approach was used in its development and that it features a wide range of sectoral disaggregation (184 productive branches). The matrix is from the year 2013; however, the productive structure is believed to experience minimal changes over time.

Although multi-state input-output matrices are available for Mexico, this study uses a single-region model instead of a multiregional one, because the CEDRUS matrix for Mexico City provides a high level of sectoral detail, allowing for a more in-depth analysis of the creative industries. Additionally, the CEDRUS matrix includes an employment satellite vector, which makes it possible to evaluate the creative industry's impact not only in terms of output but also in terms of employment creation. Out of 184 industrial sectors, 20 were identified as part of the cultural and creative industry in Mexico City. The CCI classification proposed by Valdivia *et al.*, (2020) served as the basis for this process. Table 3 shows the classification used in this research.

2.1. Unirregional Input-Output Model

In matrix terms, Mexico City's uni-regional model can be shown as follows:

$$\mathbf{X} = \begin{bmatrix} X_1 \\ \vdots \\ X_{184} \end{bmatrix} \quad \mathbf{Z} = \begin{bmatrix} Z_{11} & \cdots & Z_{1184} \\ \vdots & \ddots & \vdots \\ Z_{1841} & \cdots & Z_{184184} \end{bmatrix} \quad \mathbf{Y} = \begin{bmatrix} Y_1 \\ \vdots \\ Y_{184} \end{bmatrix} \quad \mathbf{V} = [V_1 \quad \cdots \quad V_{184}]$$

Where $\mathbf{X}$ is a gross output value vector of order 184x1, $\mathbf{Z}$ is the cross-sectoral transaction matrix of order 184x184, $\mathbf{Y}$ is the final demand vector of order 184x1, and $\mathbf{V}$ is the value-added (VA) vector of order 1x184.¹

¹ Since it is a uni-regional model, imports are included as part of the VA since they are part of the primary costs.

TABLE 3
CLASSIFICATION OF CULTURAL AND CREATIVE INDUSTRIES

Art	5112 - Software editing and software editing integrated with playback
	5121 - Film and video industry
	5122 - Sound industry
	7111 - Companies and groups of artistic and cultural shows
	7115 - Freelance artists, writers and technicians
	7121 - Museums, historical sites, zoos and the like
Entertainment	7114 - Agents and representatives of artists, athletes and the like
	7131 - Parks with recreational facilities and arcade houses
	7132 - Casinos, lotteries, and other games of chance
	7139 - Other recreational services
R&D	5417 - Scientific Research and Development Services
Services	5111 - Publication of newspapers, magazines, books and the like, and publication of these publications Integrated with printing
	515 - Radio and television
	5191 - Other information services
	5413, 5416, 5419 - Other professional, scientific and technical services
	5414 - Specialized design
	5415 - Computer System Design Services and Related Services
	5418 - Advertising services and related activities
	7112 - Professional athletes and sports teams
	7113 - Promoters of artistic, cultural, sports and similar events

Source: Authors’ elaboration based on Valdivia *et al.* (2020).
Note: Codes refer to classes from Mexico’s 2013 North American Industrial Classification System (NAICS 2013).

For simplicity, the components of final demand and those of value-added are aggregated. In the input-output model for Mexico City, the final external demand represents demand from outside sources and other states within Mexico. Equation (1) solves the model based on this demand side:

$$X = Zi + Y \tag{1}$$

In the input-output model, cross-sectoral flows|—such as from sector “i” to sector “j”—|during a specific period depend solely on the total output of the receiving sector (sector “j”) in that same period. This assumption is

mathematically represented by equation (2), which shows the technical input coefficients.

$$A_{ij} = \frac{z_{ij}}{x_j} \quad (2)$$

The input-output model can be developed from the perspectives of demand (Leontief, 1936) and supply (Ghosh, 1958). In this paper, we analyze the impact of CCIs using the Leontief model. Equation (3) mathematically represents this model, which is used to determine the amount of production needed to meet changes in final demand. This equation is derived from solving vector $\mathbf{X}$ as a function of vector $\mathbf{Y}$ in equation (1):

$$\mathbf{X} = (\mathbf{I} - \mathbf{A})^{-1} * \mathbf{Y} \quad (3)$$

2.2. The hypothetical extraction method

In input-output analysis, different methods are used to assess a sector's significance within a country's or region's productive structure. One of these is the Hypothetical Extraction Method (HEM), which can be applied to both single-region and multiregional input-output models. It has mainly been used to develop indicators of productive linkages (Morales-López, 2023) or to evaluate the impact of various internal or external shocks (Murillo-Villanueva *et al.* 2020). This study employs the Hypothetical Extraction Method (HEM) because it provides an intuitively understandable measure of sectoral economic importance. Furthermore, the HEM enables the assessment of sectoral importance not only from the perspective of intermediate transactions but also regarding final demand, while also allowing the estimation of both intra- and intersectoral effects. Recently, Morales-López and Quintana-Romero (2024) used it to determine the sectors that most contribute to product output and employment in Mexico City's economy. In this study, the HEM is also applied to the input-output matrix of Mexico City prepared by CEDRUS; however, it is used to evaluate the impact of cultural and creative sectors on value-added and employment in Mexico City.

Miller and Lahr (2001) argue that HEM can be generalized using seven cases. In Morales-López and Quintana-Romero (2024), cases three and four were used; however, this work applies case one. The main difference is that case one considers the extraction of sales made

by sectors to final demand to estimate the total impact of the sector. In contrast, cases three and four only extract intermediate transactions to estimate the backward and forward production chains. Case 1 was chosen for this study because it allows for assessing the overall importance of the sector, both from the perspective of intermediate demand and final demand. The method enables the “hypothetical extraction” of input purchases made by CCIs from other sectors, inputs purchased by other sectors from CCIs, and final CCI product purchases by the government, households, and the private sector of Mexico City, as well as final CCI purchases made by other Mexican states and foreign countries.

This results in a decrease in GDP and overall employment in Mexico City compared to its original levels. The extent of this decline highlights the importance of the CCI sectors within Mexico City’s productive and labor structure, both in terms of GDP and employment. The method is mathematically based on the matrix solution of Leontief’s model.

$$\begin{bmatrix} X_i \\ X_r \end{bmatrix} = \begin{bmatrix} A_{ii} & A_{ir} \\ A_{ri} & A_{rr} \end{bmatrix} \begin{bmatrix} X_i \\ X_r \end{bmatrix} + \begin{bmatrix} Y_i \\ Y_r \end{bmatrix} \quad (4)$$

Where X_i is a scalar that indicates the gross value of production of the sector “i”, X_r is a column vector of order 183×1 that contains the gross value of the production of the rest of the sectors “r”. A_{ii} is a scalar that represents the technical input coefficient of sector “i” with respect to itself. A_{ri} is a vector of order 183×1 that contains the technical input coefficients of sector “i” with respect to the rest of the sectors “r”. A_{ir} is a row vector of order 1×183 with the corresponding technical input coefficients. A_{rr} is a square submatrix of A of order 183×183 . Y_i is a scalar that indicates the final demand of “i” -including exports to other entities and countries-. Finally, Y_r is a 183×1 column vector that contains the final demands of the rest of the sectors “r”.

The method assumes a total closure of the “i” sector; that is, it ceases to carry out intermediate operations and provide products to households, the government, the private sector, and external demand. The above is expressed as follows:

$$\begin{bmatrix} X_i^{(-i)} \\ X_r^{(-i)} \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & A_{rr} \end{bmatrix} \begin{bmatrix} X_i^{(-i)} \\ X_r^{(-i)} \end{bmatrix} + \begin{bmatrix} 0 \\ Y_r \end{bmatrix} \quad (5)$$

Where, $X_i^{(-i)}$ it is a scalar that represents the hypothetical production of sector "i" by extracting its intermediate purchases and sales. $X_r^{(-i)}$ is a column vector of order 183x1 that contains the hypothetical production of the rest of the sectors of CDMX by assuming the total closure of sector "i". The resolution of the Leontief model proposed in equation (5) allows us to find a new value for the gross production of the 184 sectors, considering the impact of the total closure of sector "i". To see the impact on GDP and employment of the productive sectors of Mexico City, it is enough to pre-multiply the left side of the equation by diagonalized matrices that contain the value-added and employment coefficients:

$$VA^{(-i)} = VA^d * (I - A^{(-i)})^{-1} * Y \quad (6)$$

$$E^{(-i)} = E^d * (I - A^{(-i)})^{-1} * Y \quad (7)$$

Where $VA^{(-i)}$ is the vector of the hypothetical GDP of order 184x1 after considering the total closure of sector "i". VA^d is a matrix of order 184x184 that contains on its main diagonal the coefficients of added value (value added per unit of gross production), while the rest of the elements are zero. $E^{(-i)}$ is the vector of the hypothetical use of order 184x1 after considering the total closure of sector "i". E^d is a matrix of order 184x184 that contains on its main diagonal the employment coefficients (number of employed people per unit of gross production), while the rest of the elements are zero.

By solving equations (6) and (7) we find the hypothetical GDP and employment vectors. The next step is to compare the hypothetical values of GDP and employment with the real ones. Equation (8) expresses the impact of a total closure of sector "i" on GDP, while equation (9) shows the effect of a total closure of sector "i" on employment:

$$I_VA^{(-i)} = [(VA - VA^{(-i)}) \ominus VA] * 100 \quad (8)$$

$$I_E^{(-i)} = [E - E^{(-i)}) \ominus E] * 100 \quad (9)$$

Where $I_VA^{(-i)}$ is a vector of order 184x1 whose values represent the share of the reduction in GDP with respect to the real value of the 184 sectors in the face of a total closure of sector "i". $I_E^{(-i)}$ It is a vector

of order 184×1 whose values represent the share of the reduction in employment with respect to the real value of the 184 sectors in the face of a total closure of sector "i". The magnitude of these percentages is an indicator of the importance of sector "i" in the economy's GDP and employment. The original value-added weighted average of the vector elements $I_VA^{(-i)}$ is an indicator of the sector's importance in terms of GDP generation. In contrast, the weighted average by the original use of the vector elements $I_E^{(-i)}$ is an indicator of the sector's importance in terms of job creation.

To estimate the importance of the CCI, a total closure of each of the 20 sectors that comprise the classification will be assumed (see Table 3). In this way, the exercise estimates the magnitude of the impact that a total closure of operations in these sectors would have on Mexico City's GDP and employment. Many of these sectors experienced this situation during the beginning of the Covid-19 crisis.

An advantage of the methodological approach used is its ability to estimate the impact on the GDP and employment of the sector of interest (intrasectoral effect) and on the GDP and employment of the sectors that provide inputs for the industry's production process (intersectoral effect). To this end, vectors are used $I_VA^{(-i)}$ and $I_E^{(-i)}$ which contain the effects on each of the 184 sectors. The method enables the hypothetical extraction of input purchases made by CCIs from other sectors, inputs purchased by other sectors from CCIs, and final CCI product purchases by the government, households, and the private sector in Mexico City, as well as final CCI purchases made by other Mexican states and foreign countries.

3. RESULTS

Table 4 shows the impact on CDMX's total GDP assuming the hypothetical complete closure of operations in each sector of the CCIs. This impact is divided into intersectoral effects (the impact on the GDP of the sector itself) and effects on other sectors (the impact on the GDP of the rest of the economy). Additionally, the sectors of the ICC are listed in the sectoral ranking based on the impact on GDP caused by the total shutdown of each of the 184 sectors included in Mexico City's Input-Output Matrix.

As shown in Table 4, a hypothetical complete shutdown of operations in the Other Professional, Scientific, and Technical Services sector would lead to a 1.9% decline in the City's GDP. Of this decrease, 1.63% would result from a decline within the same sector, while the remaining 0.27% would originate from drops in the GDP of other related activities. This GDP reduction occurs because of the "extraction" of input purchases made by the Other Professional, Scientific, and Technical Services sector and the "extraction" of input purchases that other economic activities make to that sector.

As shown in Table 4, a hypothetical complete shutdown of operations in the Other Professional, Scientific, and Technical Services sector would lead to a 1.9% decline in the City's GDP. Of this decrease, 1.63% would result from a decline within the same sector, while the remaining 0.27% would originate from drops in the GDP of other related activities. This GDP reduction occurs because of the "extraction" of input purchases made by the Other Professional, Scientific, and Technical Services sector and the "extraction" of input purchases that other economic activities make to that sector.

Among the 20 creative and cultural sectors, the complete shutdown of the Other Professional, Scientific, and Technical Services sector would have the most significant impact on CDMX's GDP. Other creative activities likely to cause the largest GDP decline include Radio and Television (0.9%) and Advertising Services and Related Activities (0.79%). Similar to Other Professional, Scientific, and Technical Services, their impact on GDP from the loss of operations is more focused on their own sector than on other sectors. In general, the impact of the hypothetical closure of operations of most sectors of the CCI on the GDP of the CDMX is low. This is evidenced by the fact that only 8 of the 20 sectors are located within the top 75 positions of the sectoral ranking, based on the impact on GDP from the total closure of operations in each of the 184 sectors of Mexico City's input-output matrix. Notably, among the sectors in the top 75, 5 belong to the Services segment, 1 to Research and Development, 1 to the Arts, and 1 to Entertainment.

Table 5 shows the impact on total employment in CDMX by considering the complete shutdown of each sector within the CCIs. This impact is divided into intra-sectoral (impact on employment within the specific sector) and intersectoral (impact on employment in other sectors of the economy). Additionally, the ranking position of ICC

sectors is provided based on the employment impact caused by the full closure of each of the 184 sectors in Mexico, according to the City's Input-Output Matrix.

TABLE 4
IMPACT ON THE TOTAL GDP OF MEXICO CITY (%)*

Ranking	Sector	Segment	Total	Intrasectorial	Intersectorial
18	Other professional, scientific, technical services	Services	1.90	1.63	0.27
37	Radio and Television	Services	0.90	0.46	0.44
47	Advertising services and related activities	Services	0.79	0.66	0.13
58	Computer System Design Services and related services	Services	0.44	0.31	0.14
61	Scientific research and development services	R&D	0.43	0.37	0.06
66	Editing of newspapers, magazines, books, software, and other materials integrated with printing	Services	0.41	0.24	0.16
73	Freelance artists, writers, and technicians	Art	0.35	0.35	0.00
74	Casinos, lotteries, and other gambling activities	Entertainment	0.35	0.18	0.16
79	Film and video industry	Art	0.29	0.16	0.13
84	Other recreational services	Entertainment	0.23	0.13	0.10
103	Software editing and software editing integrated with playback	Services	0.14	0.14	0.01
105	Athletes and professional sports teams	Services	0.14	0.08	0.05
113	Promoters of artistic, cultural, sports, and similar shows	Services	0.10	0.08	0.02
125	Amusement parks and arcades	Entertainment	0.08	0.03	0.04
126	Museums, historical sites, zoos, and similar activities	Art	0.07	0.04	0.03
139	Other information services	Services	0.05	0.03	0.02
145	Specialized Design services	Services	0.04	0.03	0.01
160	Sound industry	Art	0.03	0.03	0.00
162	Companies and groups of artistic and cultural shows	Art	0.02	0.02	0.01
178	Agents and Managers of artists, athletes, and similar professionals	Entertainment	0.00	0.00	0.00

*Values are expressed as percentage points of GDP.

Source: Own elaboration based on the Input-Output Matrix of Mexico City prepared by CEDRUS (2013).

TABLE 5
IMPACT ON OVERALL EMPLOYMENT IN MEXICO CITY (%)

Ranking	Sector	Segment	Total	Intrasectorial	Intersectional
14	Other professional, scientific, and technical services	Services	2.27	1.86	0.42
22	Advertising services and related activities	Services	1.56	1.38	0.18
45	Radio and television	Services	0.87	0.12	0.75
46	Computer System Design Services and related services	Services	0.87	0.63	0.23
57	Editing of newspapers, magazines, books, and the like, and editing of these publications integrated with printing	Services	0.67	0.40	0.27
60	Other recreational services	Entertainment	0.57	0.41	0.16
87	Casinos, lotteries, and other gambling activities	Entertainment	0.33	0.12	0.21
90	Film and Video industry	Art	0.31	0.15	0.16
117	Amusement parks and arcades	Entertainment	0.18	0.12	0.07
122	Athletes and professional sports teams	Services	0.14	0.03	0.11
125	Scientific research and development services	R&D	0.13	0.06	0.07
139	Other information services	Services	0.09	0.06	0.03
140	Specialized Design	Services	0.09	0.07	0.01
145	Museums, historical sites, zoos, and similar activities	Art	0.08	0.02	0.06
151	Promoters of artistic, cultural, sports, and similar shows	Services	0.06	0.04	0.02
158	Software editing and software editing integrated with playback	Services	0.05	0.04	0.01
161	Sound industry	Art	0.04	0.03	0.00
167	Companies and groups of artistic and cultural shows	Art	0.03	0.02	0.01
177	Freelance artists, writers, and technicians	Art	0.01	0.01	0.00
181	Agents and Managers of artists, athletes, and similar professionals	Services	0.01	0.00	0.00

Source: Own elaboration based on the Input-Output Matrix of Mexico City prepared by CEDRUS (2013).

As shown in Table 5, a hypothetical total shutdown of the Other Professional, Scientific, and Technical Services sector would lead to a 2.27% decrease in employment in Mexico City. Of this decline, 1.86% would

come from reduced employment within that sector, while 0.42% is linked to declines across other industries. The activities most likely to cause the largest decrease in GDP are Advertising Services and Related Activities (1.56%) and Radio and Television (0.87%). The employment impact from shutting down the Advertising Sector and Related Activities is more concentrated within that sector (1.38%) than on other sectors (0.18%). Interestingly, job losses from the closure of Radio and Television would impact other sectors more (0.75%) than the sector itself (0.12%). Overall, shutting down most sectors of the CCI has a low impact on employment in Mexico City. This is shown by the fact that only 6 out of 20 sectors rank within the top 75 positions based on the impact of total closure across the 184 sectors in the Mexico Input-Output Matrix. Similarly, it's notable that of these six CCIs in the top 75, the first five are in the services segment, while the remaining one belongs to the entertainment segment.

At first glance, the sectors that, when shutting down their operations, have the greatest impact on Mexico City's GDP are the same ones that cause a more significant negative effect on employment (see Tables 3 and 4). However, the impact tends to vary. Table 6 shows the overall effect on GDP and employment in Mexico City by "removing" the operations of the sectors in the CCI, highlighting the differences in both effects.

An important feature of Mexico City's CCI is that it tends to generate more jobs than added value. This is demonstrated by the fact that 14 out of 20 creative and cultural sectors would experience a more significant negative impact on employment than on GDP if they ceased operations completely, as shown in Table 6. For example, in the case of Other Professional, Scientific, and Technical Services, shutting down their operations would lead to a larger decrease in employment (2.27%) than in the City's GDP (1.90%).

The sectors that show the most notable differences between their impact on GDP and employment can be divided into two groups: those with a greater effect on GDP and those with a larger impact on employment. Among those with a significantly greater impact on GDP than on employment are Scientific Research and Development Services, with a difference of 0.30%, and Independent Artists, Writers, and Technicians, with a difference of 0.34%.

TABLE 6
CCI BASED ON ITS MAIN EFFECT ON GDP OR EMPLOYMENT (%)

Sector	Segment	Total GDP	Total Employment	Difference
Other professional, scientific, and technical services	Services	1.90	2.27	0.38
Radio and television	Services	0.90	0.87	-0.03
Advertising services and related activities	Services	0.79	1.56	0.78
Computer System Design Services and Related Services	Services	0.44	0.87	0.42
Scientific Research and Development services	R&D	0.43	0.13	-0.30
Editing of newspapers, magazines, books, and the like, and editing of these publications integrated with printing	Services	0.41	0.67	0.26
Freelance artists, writers, and technicians	Art	0.35	0.01	-0.34
Casinos, lotteries, and other gambling activities	Entertainment	0.35	0.33	-0.02
Film and video industry	Art	0.29	0.31	0.02
Other recreational services	Entertainment	0.23	0.57	0.34
Software editing and software editing integrated with playback	Services	0.14	0.05	-0.10
Athletes and professional sports teams	Services	0.14	0.14	0.00
Promoters of artistic, cultural, sports, and similar shows	Services	0.10	0.06	-0.04
Amusement parks and arcades	Entertainment	0.08	0.18	0.11
Museums, historical sites, zoos, and similar activities	Art	0.07	0.08	0.00
Other information services	Services	0.05	0.09	0.04
Specialized Design	Services	0.04	0.09	0.04
Sound Industry	Art	0.03	0.04	0.01
Companies and groups of artistic and cultural shows	Art	0.02	0.03	0.00
Agents and Managers of artists, athletes, and similar professionals	Entertainment	0.00	0.01	0.00

Source: Own elaboration based on the Input-Output Matrix of Mexico City prepared by CEDRUS (2013).

While sectors that have a greater impact on employment than on GDP include Advertising Services and related activities, with a difference of 0.78%, Computer Systems Design Services and related services, with a difference of 0.42%, Other Professional, Scientific, and Technical

Services at 0.38%, and Other Recreational Services at 0.34%. Examining the differences among CCI sectors based on their influence on GDP and employment is crucial because it helps us predict whether internal or external shocks, like the recent Covid-19 crisis, might cause more losses in value added or employment. This information is valuable for developing contingency plans for the impacts of future crises, whatever they may be.

CONCLUSIONS

The methodological approach used to estimate the impact of the Cultural and Creative Industries on GDP and employment in Mexico City confirms that the closure of most CCI sectors has a low overall effect on GDP and employment in CDMX. However, the impact on employment is significantly larger than that on GDP. This indicates that the CCI in Mexico City tends to generate more jobs than value-added, as evidenced by the fact that closing 14 of the 20 creative and cultural sectors would lead to a more substantial negative effect on employment than on GDP when their operations are fully shut down. This information is valuable for developing contingency plans for potential job loss effects in Mexico City due to future crises. The stronger impact of the creative sectors on employment can be used to promote job creation in less dynamic regions. This would also bring a significant technological boost and improve local living conditions, as creative jobs attract more innovative individuals. In many parts of the world, cities that focus on creative activities also drive major urban renewal. Therefore, creating creative jobs, along with their multiplier effect on the economy, would help improve urban amenities in cities.

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ANEX 1

THE KEY SECTORS BY CONTRIBUTION TO MEXICO CITY'S GDP, 2013

Sector	Share of GDP
Wholesale trade	9.36%
Retail trade	8.79%
Rental without brokerage of real estate	8.37%
Employment Services	8.34%
Other Transportation	6.03%
Multiple banking	5.08%
Wireless telecommunications service operators	3.41%
Higher education schools	2.88%
Operators of wireline telecommunications services	2.66%
Delivery of justice and maintenance of security and public order	2.61%

Source: Own elaboration based on the Input-Output Matrix of Mexico City prepared by CEDRUS UNAM.

THE KEY SECTORS BY CONTRIBUTION TO MEXICO CITY'S EMPLOYMENT, 2013

Sector	Share of employment
Employment Services	21.10%
Public administration in general	6.31%
Delivery of justice and maintenance of security and public order	5.73%
Food preparation services and alcoholic and non-alcoholic beverages	4.33%
Multiple banking	3.87%
Elementary, middle and special needs schools	2.64%
Other Transportation	2.53%
Business administration services and secretarial support	2.46%
Investigation, Safety and Security Services	2.02%

Source: Own elaboration based on the Input-Output Matrix of Mexico City prepared by CEDRUS UNAM.