www.cya.unam.mx/index.php/cya

Contaduría y Administración
Accounting & Management

Contaduría y Administración 70 (1), 2025, 269-294

Contribution of creative and cultural capital to Mexican economic growth

Contribución del capital creativo y cultural al crecimiento económico de México

Marcos Valdivia*, Rafael Borrayo

Universidad Nacional Autónoma de México,México

Received June 22, 2023; accepted February 9, 2024
Available online February 15, 2024

Abstract

This research aims to analyze the contribution of creative intangible capital to Mexican economic growth between 1991 and 2021. The study utilizes the growth accounting methodology, specifically the Corrado-Hulten-Sichel approach (CHS, 2005), which incorporates intangible capital. The research provides estimations for investment flows and capital stocks at the national and sector industry levels, focusing on the creative and cultural industries (CCIs) that produce intangibles. The main empirical finding indicates that intangible capital in Mexico contributes to growth at a similar magnitude as labor. The inclusion of intangible capital in Mexican growth accounting appears to have a positive impact on Total Factor Productivity (PTF). Notably, CCIs capital contribution represents approximately 75% of the total intangible capital contribution, highlighting its significant role as a driver of economic growth. [1]

JEL Code: E22, D24, Z1
Keywords: intangibles; growth accounting; total factor productivity; creative industries

*Corresponding author.
E-mail address: marcosv@crim.unam.mx (M. Valdivia).
This research was financially supported by UNAM DGAPA-PAPIIT IN302521
Peer Review under the responsibility of Universidad Nacional Autónoma de México.

http://dx.doi.org/10.22201/fca.24488410e.2025.5110

[1] An operational delimitation for CCI is assumed using NAICS, carried out by Valdivia et al (2023).

Resumen

Esta investigación realiza un análisis de la contribución del capital creativo intangible sobre el crecimiento económico de México entre 1991 y 2021. El estudio emplea la metodología de contabilidad del crecimiento, específicamente el enfoque de Corrado-Hulten-Sichel (CHS, 2005), que incorpora el capital intangible. La investigación genera estimaciones para flujos de invesión y acervos de capital a nivel nacional y sectorial, en particular, en las industrias creativas y culturales (ICC) que producen activos intangibles. El hallazgo principal destaca que el capital intangible contribuye al crecimiento en un monto similar al factor trabajo. La inclusión del capital intangible en la contabilidad del crecimiento de México se expresa en un impacto positivo sobre la productividad total de los factores. En particular, la contribución de las ICC representa aproximadamente el 75% de la contribución total del capital intangible, destacando su papel relevante como determinante del crecimiento económico.

Código JEL: E22, D24, Z1
Palabras clave: intangibles; contabilidad del crecimiento; productividad total de los factores; industrias creativas

---

Introduction

This study provides insights, from an accounting growth perspective, into fundamental research questions that connect the discussion of cultural and creative industries (CCI) with cultural economics. These questions include the following: How significant is the economy of culture, particularly the core activities within CCI, compared to the activities typically considered in GDP measurement? What are the interrelationships between CCI and other economic sectors? Given that CCI produces goods and services with economic value, it should influence economic growth and overall productivity. How substantial are its contributions compared to other countries, regions, and sectors within an economy? Which indicators can be used to describe the evolution of CCI? How can the economic effort of CCI be quantified?

These are typical questions that arise when a new discipline is approached from an economic analysis perspective. Similar inquiries have been raised by disciplines such as cultural economics and ecological economics since the 1990s. For example, Throsby's (1999) contribution to understanding cultural capital exemplifies how the measurement problem of cultural capital in economics should be theoretically addressed. In line with this spirit, this paper suggests that bridging CCI and intangible capital is a suitable approach to incorporating cultural economics into the field of growth economics.

In this study, the flows of Goods and Services (G&S) within CCI are measured by using an estimate of the flows of intangibles as a "mirror." This assumption is based on the fact that intangible G&S are pervasive across the entire economy, as they are produced, consumed, and distributed in all sectors. Consequently, CCI essentially represents a sector that produces intangible G&S. Hence, the primary objective of this paper is to establish a connection between the activities conducted by CCI and their relationships with the broader economy, employing an accounting growth perspective. To achieve

this, the study relies on the CHS (2005; 2009) methodology, an international standard for estimating intangible G&S flows, which treats intangible flows as investment since their monetary values are capitalized. However, it is important to clarify that the economic values generated in this research do not necessarily reflect the existence of markets for G&S. It is known that many intangible and cultural G&S lack markets and the institutions to appropriately express their "intrinsic" economic values.

Therefore, this study mainly adopts an economic analysis perspective where the expenditures made by economic units on intangible G&S are treated as investment. Mas et al. (2022) refer to this approach as the investment perspective and develop it specifically for the case of CCI. An important strength of this approach is that the results align with the categories used in the System of National Accounts (SNA).

Following the literature review in section 1, the complete methodological procedure, starting with the identification of official sources of information, is sequentially presented in section 2. Section 3 focuses on estimating intangible G&S flows for the entire Mexican economy, which are capitalized as an investment in a manner compatible with the System of National Accounts (SNA). Using this data, a general description of the intangible economy in Mexico is provided. The methodology for identifying the ICC-sector is based on Valdivia et al (2023). In section 4, a growth accounting exercise is conducted to obtain an initial approximation of the contribution of capital associated with CCI to growth during the period 1992-2020. The results are disaggregated by sector, offering an initial approach to understanding the state of the cultural economy in Mexico from our perspective. Finally, the paper concludes with a section of final remarks.

Brief literature review on intangible capital

The work of Nakamura (1999, 2001) was the first study to develop expenditure-based measures for a wide range of intangible assets in the US economy, but it is the work of Corrado et al. (2005, 2009, 2018) that triggered a chain of studies on the measurement of intangibles in various countries, providing empirical evidence of their importance for labor productivity growth in Canada (Muntean, 2014), Japan (Fukao et al., 2009), Australia (Barnes and McClure, 2009), Spain (Mas, M. y J. Quesada, 2014), and Europe (Corrado et al., 2018; Dal Borgo et al., 2013; Roth and Thum, 2013). The central idea of the standard measurement approach (Corrado et al., 2005) is derived from the intertemporal capital theory, using the concept that any resource use (expenditure) that reduces present consumption to increase future consumption should qualify as investment (Weitzman, 1976; Hulten, 1979) and be considered an asset. Therefore, just as traditional tangible fixed assets are recorded, expenditure on an intangible asset that will not disappear during the course of an activity, but will at least partially remain available for use in subsequent periods, should be considered as a flow of investment. This criterion of symmetric treatment

for all expenditures on intangible assets not captured by official statistical agencies has the significant advantage of being compatible with the framework used to compile the national accounts system (SCN), facilitating its acceptance among accounting experts and the academic community. This allows intangible assets to be considered as another source or determinant of economic growth.

This work is an initial approach to measuring investment flows in intangibles of Mexico's creative economy following the standard methodology of Corrado, Hulten, and Sichel (2005; 2009), complementing a previous study by Valdivia et al (2023) that analyzes the interactions between CCI and the rest of the economic activities at the metropolitan area level. There are very few studies that examine the links between CCIs and investment in intangible assets. However, one work from which a stylized fact can be derived on this matter is that of Scheffel and Thomas (2011), which suggests that "there is a positive association between the proportion of creative employment and the concentration of spending on intangibles (across many categories) within the CCIs." Similarly, Mas et al. (2022) present perhaps the first measurement of intangible investment in CCIs for different countries in the European community and the United States.

In the literature on the creative economy, the view that concepts such as "creativity," "investment in intangibles," and "innovation" are intrinsically linked to each other is increasingly accepted. In this interactive complexity, intangibles have at least three properties: they act as mediators, can be easily converted into other forms of intangibles, and are highly complementary to tangible investments and other intangible assets depending on the economic activity in which they are located. Since intangibles predominantly consist of knowledge capital, we can expect links between a creative workforce (with expertise) and innovation indicators.

Theory and methodology

CHS approach

This research follows the methodology proposed by CHS (2005) to calculate the flows of intangible investment and stocks. The basic idea of this approach is treating spending on intangibles (design, marketing, R&D, etc.) as investment. Traditionally, such spending is treated as an intermediate good. CHS (2005) provides a theoretical framework to incorporate intangible assets by extending conventional capital theory. This approach allows to incorporate intangibles in a framework of growth accounting and, consequently, makes estimations of intangible capital compatible with the capital categories used in the System of National Accounts.

There are three goods under this canonical model: a consumption good with volume product C_t and price P_t^C, an intangible investment good I_t with price P_t^I, where subindex t denotes time. When an

intangible good is treated as investment, the product of such intangible good N_t is incorporated into the production functions of sectors as capital, which has the property of accumulation and therefore it cannot be treated as an intermediate good that is completely consumed in one period of time. Therefore, in the same way, tangible capital is accumulated, the accumulation of intangible asset R_t is calculated as: $R_t = N_t + (1 - \delta_R)R_{t-1}$ (perpetual inventory method). Where R has a depreciation rate δ_R. Under these conditions, it is possible to represent a production function for each sector, its monetary flows and account identities as follows:

Intangible sector:

$$N_t = F^N(L_{N,t}, K_{N,t}, R_{N,t}, t) \qquad P_t^N N_t = P_t^L L_{N,t} + P_t^K K_{N,t} + P_t^R R_{N,t} \tag{1}$$

Tangible sector:

$$I_t = F^I(L_{I,t}, K_{I,t}, R_{I,t}, t) \qquad P_t^I I_t = P_t^L L_{I,t} + P_t^K K_{I,t} + P_t^R R_{I,t} \tag{2}$$

Consumption sector:

$$C_t = F^C(L_{C,t}, K_{C,t}, R_{c,t}, t) \qquad P_t^C C_t = P_t^L L_{C,t} + P_t^K K_{C,t} + P_t^R R_{C,t} \tag{3}$$

These identities respond to the newt balance conditions: : $L = L_N + L_I + L_C$, $K = K_N + K_I + K_C$, $R = R_N + R_I + R_C$.

Note that intangible capital stock R_t is incorporated in the production function as input but the service costs, $P_t^R R_t t$, are not payments for intermediate goods. The corresponding GDP identity incorporates the product value of the intangible good by the production side –flow $P_t^N N_t$ –, the payments for the intangible stock services –which is also a flow–, a payment for the capital use $(P_t^R R_t)$ by the income side in where P_t^R is called user cost:

$$P_t^Q Q_t = P_t^C C_t + P_t^I I_t + P_t^N N_t = P_t^L L_t + P_t^K K_t + P_t^R R_t \tag{4}$$

If $P_t^{Q'} Q'_t$ is the economic output without taking into account intangible investment, GDP would be larger than in the case when those intangible assets are not capitalized. Consequently: i) output increases from $P_t^{Q'} Q'_t$ to $P_t^Q Q_t$, ii) the intangible investment share increases from $P_t^I I_t / P_t^{Q'} Q'_t$ to $(P_t^I I_t + P_t^N N_t)/P_t^Q Q_t$ and ii) labor share drops from $P_t^L L_t / P_t^{Q'} Q'_t$ to $P_t^L L_t / P_t^Q Q_t$ in where labor share is the proportion of income that goes to labor.

The following step is to explain how factors (tangible capital, intangible capital and labor) contribute to output or productivity growth. This can be done by relying on the standard growth accounting approach. We omit this technical discussion and remit the reader to the appropriate literature for a review.

Implementation

The basis for the implementation of the CHS methodology (2005) follows the accounting identity of equation 4, which indicates that in the calculation of GDP, the expenditure side must be equal to the income side. Therefore, the real value of intangible asset investment flows $P_t^N N_t$ is estimated and subsequently used to estimate the corresponding stocks (perpetual inventory method). Finally, with these series, the cost of using intangible capital services $P_t^R R_t$ is estimated. As is usual in studies of countries that have constructed a series of investment and intangible assets, they are accompanied by an exercise of decomposing the sources of economic growth, according to standard growth accounting equations. This requires having information on investment in intangibles in real values and subsequently estimating endowments or stocks. CHS uses the deflator of GNP corresponding to the non-agricultural private sector to obtain real investment series from nominal ones for all assets except software. The calculations in this study focus on the Mexican economy, aiming to analyze the longest possible period from 1990 to 2020, employing relevant and suitable information for this purpose.[2] The KLEMS project database from INEGI stands out as a primary data source in our research, facilitating the examination of an extensive time span, specifically from 1990 to 2020.

This research uses two strategies to estimate intangible flows. The first strategy is called the surplus approach and consists of using the total income of the industries that produce investment in intangible goods. The second strategy is called the expenditure approach and consists of using the expenses incurred by economic units in some intangible goods. Various estimation criteria are generated from these strategies by taking into account the KLEMS database of INEGI. These criteria are based on a classification of creative and cultural industries (CCI), which is described in Table 1 and it uses the NAICS classification for identification.

[2] The KLEMS project database from INEGI stands out as a primary data source in our research, facilitating the examination of an extensive time span, specifically from 1990 to 2020.

Table 1
Classification of CCIs and their identification in the industrial catalog of NAICS

CREATIVE SEGMENT	Economic activity in NAICS	Disponibilidad en Base KLEMS/INEGI
R&D	5411, 5412, 5413, 5416, 5417, 5419	541
ADVERTISING / DESIGN	5414, 5418, 54191	541
ARTS / ENTERTAINMENT	71	71
MASS MEDIA / FILM	51911, 512, 515	512, 515-519
PUBLISHING INDUSTRY	511	511
SOFTWARE	518, 51913, 5415	517-518, 515-519, 541

Source: Author´s own elaboration based on NAICS (INEGI, 2018)

Likewise, the ICC are associated with the three fundamental categories of CHS (2005): Innovative Property, Economic Competencies, and Computerized Information. Table 2 summarizes the different criteria used for estimation based on INEGI KLEMS database. Each row of Table 2 indicates a criterion used in the estimation of investment flows. Each cell indicates the estimation strategy used: surplus approach or expenditure approach. Hybrid criteria consider both calculation strategies (surplus and expenditure) in their estimations, and in these cases, only the criterion indicated by the cell is considered. In general, Table 2 reflects the adaptation of various recommendations that have been derived from the seminal publication of CHS (2005). Additionally, this work establishes a link between ICCs and CHS categories. To our knowledge, only Mas et al. (2022) have done something similar applied to the case of Spain.

Table 2
Estimation procedure for intangible flows

CHS classification	INNOVATIVE PROPERTY					ECONOMIC COMPETENCIES		COMPUTARIZED INFORMATION
Creative segment	R&D	Mass media	Publishing	Arts Entertainment	Finance	Advertising/ Design	Human capital	Software
Scenario A	Surplus	Surplus	Surplus	Surplus		Surplus		Surplus
Scenario B	Surplus	Surplus	Surplus	Surplus		Surplus	Expenditure	Surplus
Scenario C	Surplus	Surplus	Surplus	Surplus	Surplus	Surplus		Surplus
Scenario D	Surplus	Surplus	Surplus	Surplus	Surplus	Surplus	Expenditure	Surplus

Source: Author´s own elaboration

For the surplus approach strategy, the gross operating surplus (GOS) of the industries generating intangible goods is considered, and the technical coefficients $\alpha_{i,j}$ from the input-output matrix (I-O) are used to distribute the intangible investment flows among all sectors of the economy according to $X_i = EBP_j \cdot \alpha_{i,j}$. In particular, the distribution structure provided by $\alpha_{i,j}$ in the input-output tables is used to distribute the intangible goods and services generated (X_i) by their producing sectors in the entire economy.[3]

Regarding the expenditure approach strategy, this is used to approximate economic competencies considering that 25% of the remuneration of highly educated employees is intangible investment. Such spending for economic competencies can be in the form of advertising/design, operating models, platforms, distribution networks, supply chains or employer-provided training.

The nominal investment estimated series must be deflated to obtain real values using different deflators from the National Accounts. Once the nominal series is deflated and the real values N(t) are obtained, the perpetual inventory method is used to estimate the stock (OECD, 2009; Harberger, 1978). Thus, the stocks of each intangible asset j, R_{jt} similar to the accumulation of tangible capital, are estimated according to the equation of accumulation:

$$R_{jt} = N_{jt} + (1 - \delta_{Rj})R_{j,t-1} \tag{5}$$

This equation requires an investment flow of asset j at time t, N_{jt} a depreciation rate δ_{Rj} (constant over time), and an initial capital for each of the assets considered, R_{j0}.

A tangible asset depreciates for at least two reasons: i) normal wear and aging from use, and ii) obsolescence, where new capital becomes less valuable than old capital. An intangible asset may have negligible wear and aging but high obsolescence if new ideas, such as knowledge, replace old ones or when workers leave a company. Additionally, difficulties in appropriating the benefits of generated knowledge, such as leakage to competitors or patent expiration, can contribute to obsolescence. Although the depreciation rate is critical for estimating the stock of tangible and intangible capital, it is currently extremely difficult to obtain information on intangible assets.

After evaluating various criteria proposed for the depreciation of intangible capital, this research adopts specific depreciation rates for each creative segment. Specifically, $\delta = 0.2$ is applied to R&D, mass media, publishing, arts, and economic competencies, while $\delta = 0.33$ is assigned to software. To

[3] When using GOS_j not only the intermediate consumption expenses are deducted, but also the payment or cost of using factors. In this sense, it reflects the profits of industry j, and it is assumed that only a fraction $\alpha_{i,j}$ of the GOS is converted into intangible investment in sector i.

ensure international comparability, these values align with those utilized in CHS (2005) to the extent possible.

To calculate the stock from investment flows, it is necessary to determine the initial endowments from which the investment flows begin to accumulate (see equation 6). This equation requires the estimation of intangible capital stocks from investment flows in volume, depreciation rates, and the initial stock value. The selection of the procedure for an initial capital stock is relevant, and the usual practice for tangible assets is applied, which is the steady-state relationship of the Solow model.

$$R_{j0} = \frac{N_{j0}}{g + \delta_{j0}}$$

(6)

The initial capital stock R_0 for each asset is related to the investment in the initial year N_0, the steady-state investment growth rates g and the depreciation rate δ_{j0} for each asset, and similarly for the set of intangible assets considered. This requires that the entire economy grows at the steady-state rate in the first year of the available data series, in our case, it was the year 1990.

For the analysis of growth accounting, the flow of capital services generated by the capital stock in each period is required. In the absence of directly observable flows for capital services, they are approximated as a proportion of the productive capital stock (OECD, 2009, p. 60). These capital services have a cost known as the user cost. Theoretically, this cost could be observed in a market through the price-rental of capital. However, such markets are very scarce or non-existent, and in the extreme case, this applies to intangible assets where markets are either few or non-existent. Therefore, the user cost must be approximated by an implicit rental price as payment for the capital services.

In the specific calculation of the user cost, it was estimated as follows:

$$u_{i,t} = r * IPC_t + (\delta_{it} * \left(1 + \left(\frac{IP_{i,t}}{100}\right) * IPC\right) - \left(\frac{IP_{i,t}}{100} * IPC_t\right)$$

(7)

Where i represents the type of capital asset, r is the assumed rate of return with a value of 0.03, IPC is the consumer price index with a base year of 2013, δ is the depreciation rate, and IPi is the price index associated with the asset. The FBKF price index, services, and ICTs price indexes were used.

Finally, the calculation of capital services was done as follows:

$$sc_{i,t} = u_{i,t} * K_{i,t}$$

(8)

Where i represents the capital asset and K represents the capital stock.

It is important to note that the estimates for tangible capital assume a homogeneous depreciation rate of 0.1. The heterogenization of tangible capital is a task that requires more information and will be carried out in future work. However, the estimates for tangible capital are generally consistent with those estimated by INEGI-KLEMS.

Section 3

In this section, we present the results of investment flows for intangibles in the Mexican economy, specifically focusing on estimates related to CCIs. Table 3 displays the share of investment flows attributed to intangibles in relation to the total new investment (NTI), which combines both intangible and tangible investments. These shares are calculated based on the scenarios presented in Table 2 from the previous section, utilizing data from the PTF-KLEMS database provided by INEGI.

Table 3
Intangible investment share in new total investment

	Scenario A	Scenario B	Scenario C	Scenario D
2003	9.98%	18.26%	16.12%	23.35%
2008	8.50%	14.93%	15.88%	21.34%
2013	8.65%	15.96%	17.70%	23.68%
2018	7.86%	14.46%	18.09%	23.35%

Source: Author´s own elaboration

Scenario A primarily represents investment in which intangible capital goods are produced by ICCs. Scenario B encompasses Scenario A and includes spending on human capital as a proxy for economic competencies. [4] Scenarios C and D incorporate both intangible investment produced by the financial sector. On average, the share of intangible investment in Scenario A was 8.8% during the period 2003-2018, and it increases to 23% in Scenario D, which includes investment in financial goods and human capital. The share of investment in NTI decreases from 10% in 2003 to 7.9% in 2018 in Scenario A, and a similar trend is observed in Scenario B, where the share changes from 18% in 2003 to 14.5% in 2018.

Mas et al. (2022) is one of the few studies that provides estimates of intangible investment associated with ICCs for a significant number of European countries, including the USA. Based on their

[4] According to the CHS classification, economic competencies include marketing and design which are part of the CCIs. Therefore, it is reliable to assume that most of the investment estimated in scenario B corresponds also to CCIs.

findings, we compare our estimates A* and B with those estimated in other countries, as presented in Table 4. A* is estimated using Economic Census information instead of the PTF-KLEMS database. It is worth noting that Mexico's estimates fall within the lower range of the distribution and are quite similar to the figures observed in Spain, Greece, and Poland.

Table 4
Shares of intangible investment across countries

	2008-2013	1995-2016
Sweden	34.6	34.9
USA	35.4	31.8
United Kingdom	29.7	28.3
Finland	30	28.1
Denmark	31.7	27.1
Ireland	34.8	26.6
France	26.1	26
Japan	26.5	24.7
Netherlands	26	24.2
Belgium	22.7	21.7
Austria	24.2	21.4
Italy	21.5	21.1
Germany	22	20.8
taiwan	21.8	19.8
Mexico A*	16.6	19.2
Czech Republic	21.1	18.5
South Korea	20.7	18.4
Portugal	22	17.1
Luxembourg	16.8	15.9
Mexico B	15.3	15.8
Hungary	17.3	15.3
Spain	17.4	14.5
Poland	13.6	14.1
Greece	15.3	13.1

Source: Author's own elaboration based on Mas (2020)
Notes: The estimation for Mexico A* is based on data from Economic Censuses, while for Mexico B it relies on data from PTF-KLEMS

Figure 1 illustrates the composition of intangible investment for each scenario considered in 2018. Firstly, R&D stands out as the dominant segment across all scenarios, accounting for nearly 50% of the total intangible investment in scenario A. In scenario B, investment in human capital takes a 50% share, with the assumption that a significant portion of this investment is allocated to economic competencies. It is worth noting that marketing and design are also included in this category, although the exact proportions are unknown. Nonetheless, if we were to redistribute human capital investment specifically for marketing/design, their share (4.3%) would increase accordingly.

Furthermore, it is important to highlight that Arts/Entertainment, as shown in Figure 1, consistently holds the second highest concentration among the creative segments in all scenarios, closely

followed by Media/Information and Software. While marketing/design accounts for 8.6% in scenario A, as mentioned earlier, its share would be much higher than 4.3% if human capital were redistributed among specific economic competencies. In that case, marketing/design is likely to have the second highest concentration among the creative segments, or perhaps even claim the first position.

Based on data from Mas et al. (2022) for the Spanish case (average 1995-2016), the distribution of intangible investment for ICCs is as follows: R&D (27%), Software (27%), Arts (6%), and Design/Marketing (40%). Comparing this distribution to scenario B, we find that R&D (23%) and Arts/Entertainment (7.6%) in Mexico are close to the Spanish figures. However, software (6.1%) appears to be significantly smaller in Mexico. Nonetheless, considering the 40% concentration of Design/Marketing in Spain, it could serve as an appropriate benchmark for Mexico once human capital (50%) is redistributed among economic competencies.

Lastly, Figure 1 clearly demonstrates that once intangible investment from the financial sector (i.e., financial innovations) is included in scenarios C and D, it becomes the predominant concentrator. However, it's important to note that the financial sector is not part of the CCIs. If we consider scenario D as the estimation for the total investment in intangibles, ICCs may concentrate around 50% of such investment.

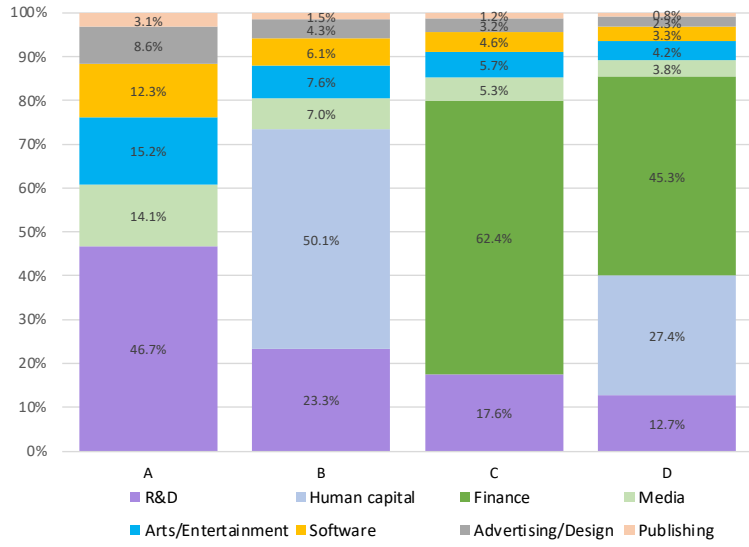

Figure 1. Composition of intangible investment by scenarios (2019)
Source: Author's own elaboration

Figure 2 presents a panel of series depicting the shares of intangible investment in each of the creative segments during the period 1990-2020. The panel includes estimated shares for scenarios A, B, and D. The key observations from the series are as follows: a) R&D, software, and marketing/design exhibit an increasing trend in their share of investment in scenarios A and B from 1990 to 2008. b) Arts/Entertainment, publishing, and spending on human capital (economic competencies) show a decreasing trend in their share of investment in scenarios A and B between 1990 and 2008. c) The decline in Arts/Entertainment in scenarios A and B during 1990-2008 is negatively correlated with the increasing series of R&D. d) Media and, to a lesser extent, software are the only creative segments that experience an increase in their shares during the period 2008-2020. e) Arts/Entertainment, R&D, and economic competencies demonstrate relatively stable shares since the financial crisis of 2008-2009. These observations highlight the changing dynamics and trends in the allocation of intangible investment across different creative segments over the analyzed period.

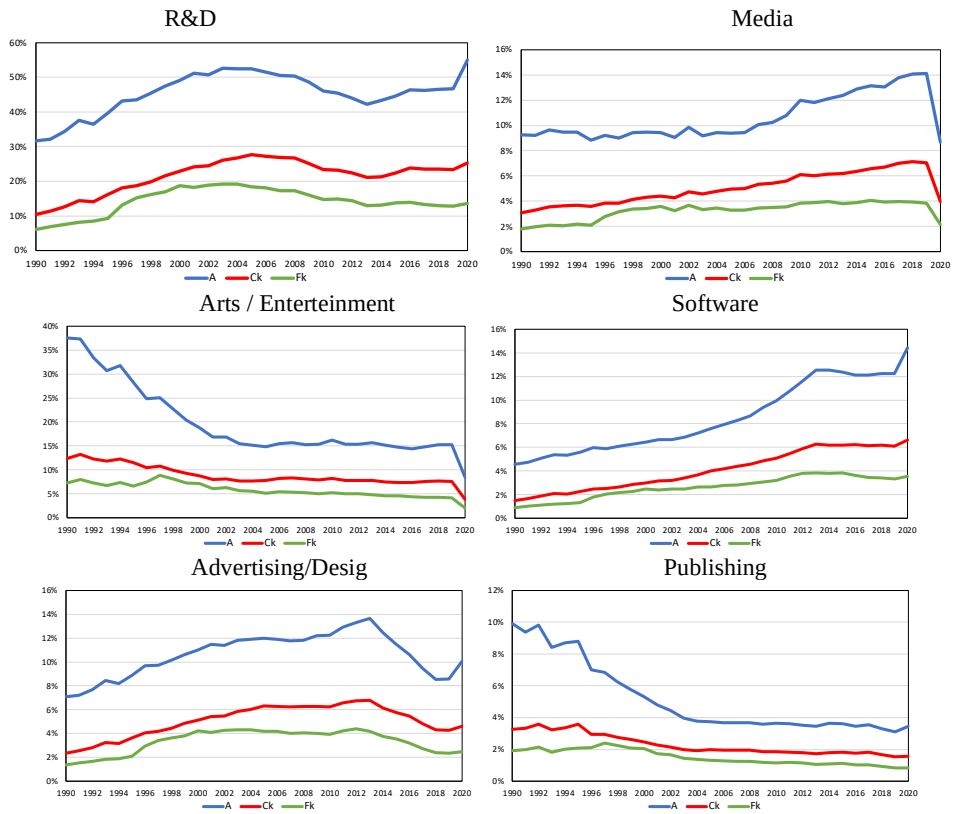

Figure 2. Panel of series of intangible investment in each of the creative segments during the period 1990-2020
Source: Author's own elaboration

The table 5 provides the average annual growth rate of tangible investment (AVGTI) in each of the creative segments for different time periods, as well as the corresponding tangible investment figures. The table also highlights the association between CHS and the creative segments. Firstly, it is noteworthy that the average growth rate of intangible investment (3.4%) is more than twice the rate observed for tangible investment (1.6%) during the long run period from 1991 to 2020. With the exception of Arts/Entertainment and Publishing, all creative segments exhibited higher average annual growth rates than tangible investment.

In the long run (1991-2020), the creative segments with the highest AVGTI are Software (9.8%), R&D (6.3%), and Marketing/Design (5.6%). On the other hand, Arts/Entertainment shows a negative AVGTI of -0.51% during the same period, followed by Publishing with a small positive AVGT of 0.94%. During the post-financial crisis period (2009-2018), all creative segments experienced a loss of dynamism, except for Media/Information, which recorded a growth rate of 4.15%. This trend aligns with the share time series observed in panel figure 2.

These findings highlight the varying growth patterns and dynamics within different creative segments, with some segments outperforming tangible investment in terms of average annual growth rates while others exhibit slower or negative growth

Table 5
Average annual growth rate in intangible investment

CHS classification	INTANGIBLE													TANGIBLE
	INNOVATIVE PROPERTY							ECONOMIC COMPETENCIES			COMPUTARIZED INFORMATION	Total intangible in scenario B	Total intangible in scenario D	
Creative segment	R&D	Media	Publishing	Arts / Entertainment	Finance	Total IP without finance	Total IP with finance	Advertising /Design	Human capital	Total EC	Software			
Criterion	Surplus	Surplus	Surplus	Surplus	Surplus			Surplus	Exp. (25%)		Surplus			
1991-1995	12.95%	7.60%	6.12%	2.80%	4.90%	7.82%	5.80%	12.95%	1.90%	2.39%	11.15%	4.23%	4.51%	-3.00%
1996-2001	15.22%	11.36%	0.83%	2.37%	-5.26%	10.24%	1.44%	15.22%	6.44%	7.09%	20.50%	8.48%	3.93%	7.46%
2002-2009	2.55%	5.38%	-0.44%	2.02%	9.34%	2.64%	6.12%	3.93%	1.02%	1.33%	10.22%	2.14%	4.32%	2.52%
2009-2018	0.17%	4.15%	-0.11%	0.99%	5.28%	0.92%	3.61%	-2.32%	1.95%	1.53%	3.38%	1.37%	2.93%	0.91%
1991-2007	10.94%	8.70%	2.39%	3.08%	3.92%	7.61%	5.25%	11.16%	3.30%	3.84%	15.28%	5.43%	4.85%	3.29%
2002-2018	1.93%	5.09%	0.29%	1.91%	7.48%	2.29%	5.21%	0.75%	1.75%	1.66%	7.19%	2.12%	3.95%	2.45%
2019-2020	0.02%	-32.72%	-6.18%	-37.93%	0.02%	-10.69%	-3.30%	0.02%	0.89%	0.82%	-3.40%	-3.75%	4.85%	-12.24%
1991-2020	6.30%	4.24%	0.94%	-0.51%	4.01%	3.94%	3.99%	5.63%	2.66%	2.81%	9.81%	3.35%	3.64%	1.57%

Source: Author´s own elaboration

One interesting aspect to note from table 5 is the response of intangible investment to the economic shock caused by COVID-19. The table reveals that aggregate ICCs exhibited resilience during the pandemic, with a decline of -3.8% in annual growth rate for intangible investment compared to a larger decline of -12% in tangible investment. However, within the creative sectors, Media/Information and Arts/Entertainment were significantly affected, experiencing sharp drops of -32.7% and -37.9% respectively during the period of 2019-2020. This indicates that COVID-19 had a pronounced impact on creative sectors that heavily rely on physical social interactions, such as Arts/Entertainment. The restrictions and limitations on gatherings and social activities during the pandemic had a substantial negative effect on these sectors, leading to a significant decline in their investment levels. In contrast, other creative sectors that are less dependent on physical interactions, such as Media/Information, demonstrated a comparatively smaller decline in investment.

It is crucial to analyze how intangible investment is distributed across sectors. Figure 3 illustrates the time series of the intangible share for the top five sectors with the highest concentration of intangible investment in scenario B from 2000 to 2020. These sectors account for approximately 50% of the total intangible investment, and this figure remains relatively constant over the analyzed period, as indicated by the dashed curve with reference on the right x-axis. However, the composition of these sectors has undergone significant changes. In 2000, manufacturing was the leading sector, accounting for 17% of the total intangible investment, followed by administrative-support services (10%), public administration (10%), educational services (8.3%), and real estate/rental-leasing (6.2%). Over time, manufacturing experienced a decreasing trend, reaching approximately 10% in 2008. In contrast, administrative-support services exhibited an increasing trend between 2004 and 2008, reaching around 15% in 2008, and have remained stable at that level of concentration since then. Real estate/rental-leasing increased its share from 6% in 2008 to 8.5% in 2012, and it has remained relatively stable at that concentration level.

The main observation from Figure 3 is the decline of the manufacturing sector in terms of its investment in intangible goods. One possible explanation for this is that there is an increasing demand for imported intangible capital by the manufacturing sector, which is not captured by the System of National Accounts (SNA) measurement.

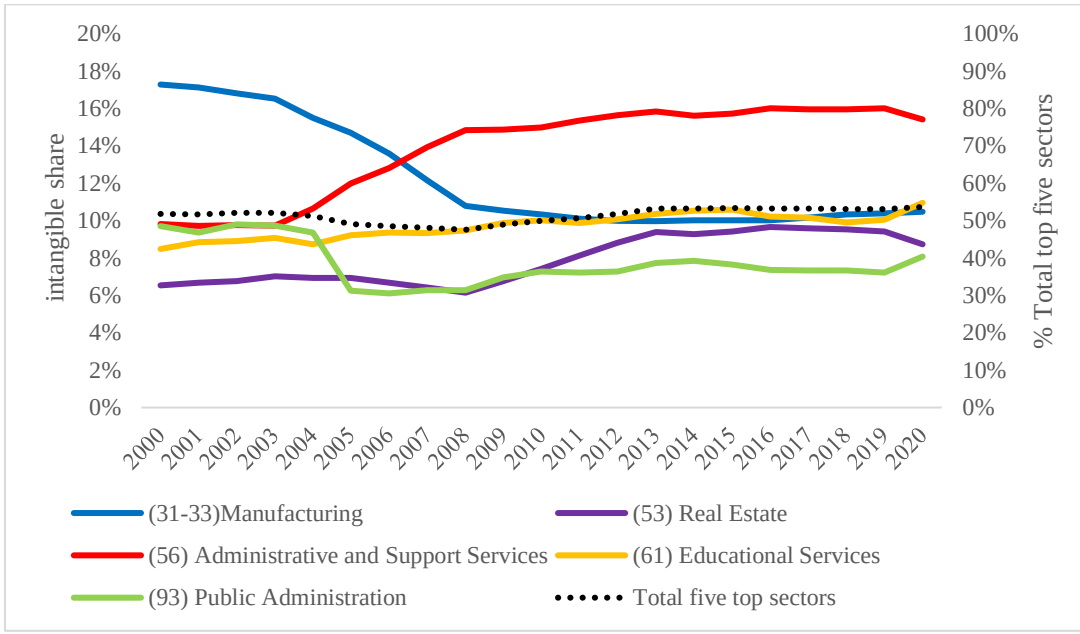

Figure 3. Time series of the intangible share of the top five sectors
Source: Author´s own elaboration

Table 6 provides the distribution of intangible investment by creative segments at the sector level in 2018, considering scenario B. The last row of the table represents the aggregate distribution, where economic competencies have the highest concentration at 50%, followed by R&D (24%), Arts/Entertainment (8%), Media/Information (7%), Software (6%), Marketing/Design (4%), and Publishing (2%). It should be noted that economic competencies include Marketing/Design, but the specific proportion is not specified.

Table 6
Distribution of intangible investment by creative segments at the sector level 2018

	R&D	Media	Arts	Software	Advertising/Design	Publishing	Human capital	Total intangible
(11) Agriculture, Forestry, Fishing and Hunting	0%	0%	1%	0%	0%	0%	99%	100%
(21) Mining, Quarrying, and Oil and Gas Extraction	0%	0%	0%	0%	0%	0%	100%	100%
(22) Utilities	44%	3%	8%	10%	8%	1%	27%	100%
(23) Construction	8%	0%	2%	2%	1%	0%	87%	100%
(31-33) Manufacturing	27%	3%	4%	6%	5%	1%	54%	100%
(43) Wholesale Trade	27%	5%	6%	7%	5%	2%	48%	100%

(46) Retail Trade	11%	2%	2%	3%	2%	1%	80%	100%
(48-49) Transportation and Warehousing	22%	3%	2%	6%	4%	1%	61%	100%
(51) Information	49%	11%	3%	15%	9%	5%	8%	100%
(52) Finance and Insurance	23%	4%	4%	6%	4%	2%	56%	100%
(53) Real Estate and Rental and Leasing	54%	8%	8%	14%	10%	3%	2%	100%
(54) Professional, Scientific, and Technical Services	43%	8%	9%	12%	8%	3%	17%	100%
(55) Management of Companies and Enterprises	17%	17%	4%	12%	3%	7%	41%	100%
(56) Administrative and Support Services	38%	5%	7%	9%	7%	2%	32%	100%
(61) Educational services	0%	0%	0%	0%	0%	0%	100%	100%
(62) Health care	0%	0%	0%	0%	0%	0%	100%	100%
(71) Arts, Entertainment, and Recreation	0%	17%	19 %	8%	0%	7%	48%	100%
(72) Accommodation and Food Services	47%	8%	3%	12%	9%	3%	19%	100%
(81) Other Services (except Public Administration)	42%	4%	5%	10%	8%	2%	29%	100%
(93) Public Administration	0%	0%	0%	0%	0%	0%	100%	100%
Total	25%	4%	4%	7%	5%	2%	54%	100%

Source: Author´s own elaboration

When comparing from table 6 the distribution of creative segments in each sector to the marginal information (last row), several noteworthy features emerge: a) Economic competencies dominate in sectors such as agriculture, mining, construction, education, and health services. b) Creative segments are generally more prominent in the services sector. c) Sectors involved in the production of intangible goods also have a high concentration of intangible investment associated with their activities. For example, professional services (54) allocate 34% to R&D, Arts/Entertainment (71) allocate 28% to Arts, Information (51) allocate 13% to software, Information (51) allocate 5% to publishing, and professional services (54) allocate 7% to marketing/design. d) The manufacturing sector mirrors the aggregate distribution, indicating that it does not exhibit a particular bias toward a specific creative segment. e) R&D investment is significant in real estate (46%), media/information (43%), accommodation and food services (41%), and utilities (39%). f) Arts investment plays a relevant role in the Information sector (13%), real estate (15%), and professional services (17%).

Section 4

In this section, we present the growth accounting estimates for the Mexican economy, incorporating creative and cultural capital. The results are based on the empirical implementation of the methodological issues discussed in the previous section.

Table 7 displays the growth accounting results for different sub-periods, considering the average annual growth rate of new gross value added (NGVA) that includes intangible investment. The results are presented with the inclusion of intangible capital under criterion A and B, as well as without including it. It is worth noting that the inclusion of creative capital increases the average growth rate of gross value added (AGRVA) from 2.4 to 2.5 and 2.6 in criteria A and B, respectively, during the long-run period of 1992-2019. However, if we consider the year 2020, the AGRVA decreases to 2, 2.1, and 2.2 in each criterion, reflecting the impact of the COVID-19 pandemic on the economy.[5]

[5] The Mexican economy faced a significant decline in GDP during the COVID-19 crisis, experiencing one of the largest drops globally. In 2020, the GDP contraction reached -9%, indicating a severe economic downturn.

Table 7
Growth accounting and capital CCI contributions

	1992-2020			1992-2019			1992-2007			2008-2019		
	Without intangibles	Scenario A	Scenario B	Without intangibles	Scenario A	Scenario B	Without intangibles	Scenario A	Scenario B	Without intangibles	Scenario A	Scenario B
Gross Value Added (extended)	2.028	2.106	2.191	2.396	2.481	2.560	2.850	2.949	3.026	1.789	1.857	1.939
Intangible Capital		0.272	0.359		0.287	0.375		0.389	0.464		0.151	0.256
Innovative property		0.194	0.157		0.205	0.166		0.263	0.202		0.128	0.118
R&D		0.138	0.110		0.142	0.113		0.199	0.153		0.065	0.060
Arts		0.019	0.016		0.023	0.020		0.025	0.020		0.021	0.020
Mass media		0.032	0.026		0.035	0.030		0.033	0.025		0.038	0.035
Publishing		0.005	0.004		0.005	0.004		0.006	0.005		0.003	0.003
Computarized information		0.043	0.035		0.046	0.037		0.058	0.044		0.029	0.027
Economic competencies		0.035	0.167		0.036	0.172		0.068	0.217		-0.006	0.111
Advertising/ Design		0.035	0.022		0.036	0.023		0.068	0.044		-0.006	-0.005
Expenditure in human capital			0.146			0.149			0.173			0.116
Tangible Capital	1.882	1.742	1.645	1.937	1.809	1.708	2.126	2.001	1.905	1.684	1.553	1.445
Labor	0.403	0.397	0.393	0.466	0.463	0.457	0.538	0.536	0.531	0.370	0.366	0.358
TPF	-0.257	-0.306	-0.206	-0.007	-0.077	0.020	0.186	0.024	0.126	-0.264	-0.213	-0.120

Source: Author´s own elaboration

The inclusion of creative capital in the growth accounting analysis for the Mexican economy has significant implications. Under criterion A, which focuses on investment from CCIs, creative capital contributes 0.29 percentage points to the NAGRVA (Net Average Growth Rate of Value Added) during the period 1992-2019. Tangible capital contributes 1.81 percentage points, and labor contributes 0.46 percentage points. Among the creative segments, R&D has the largest impact (0.14), followed by software (0.05), marketing/design (0.04), media (0.04), arts (0.02), and publishing (0.005).

If we consider criterion B, which includes other intangibles in addition to CCIs, the contribution of intangible capital increases to 0.38 percentage points. Economic competencies (proxied by spending on human capital) contribute 0.15 percentage points, while capital from CCIs contributes 0.23 percentage points. This indicates that creative capital remains a significant contributor to growth even when other intangibles are taken into account.

When comparing the two subperiods, it is observed that creative capital has a stronger contribution in the first period (1992-2007) with 0.39 percentage points, compared to the second period (2008-2019) with a contribution of 0.15 percentage points. This is primarily due to the lower NAGRVA in the second period, which remained below 2% in any of the used criteria.

The behavior of total factor productivity (TFP) is also noteworthy. In the period of higher NAGRVA (1992-2007), TFP decreases when creative capital is included in the analysis, which aligns with expectations from the literature. In contrast, TFP is negative during the period 2008-2019, but the inclusion of creative capital mitigates the adverse effect. TFP becomes less negative when creative capital is included, indicating that creative capital has a positive influence on TFP. This effect is even more pronounced under criterion B, where TFP is less negative compared to the other criteria.

Figure 4 illustrates the time series of the annual contribution to growth for each of the segments that make up creative capital. It shows a common pattern observed in many developed countries, including Mexico. After 2000, there is a general slowdown in the contribution of creative capital to growth, which is further intensified by the financial crisis of 2008. This slowdown is a stylized fact that has been documented in the literature.

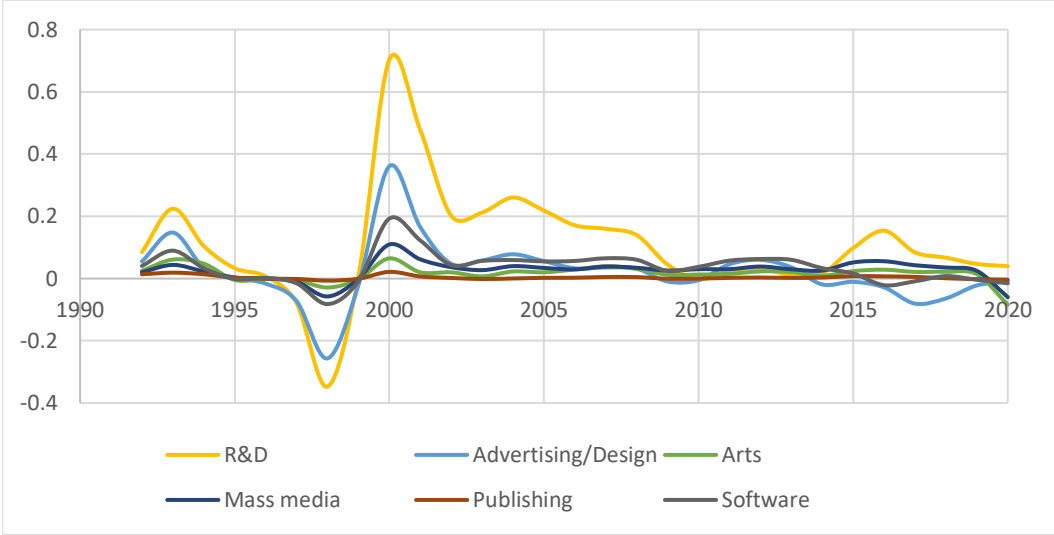

Figure 4. Time series of the annual contribution to growth for each of the creative segments
Source: Author´s own elaboration

One interesting observation from Figure 4 is the significant decrease in creative capital during and especially after the tequila crisis in 1995, where gross value added (GVA) experienced an 8% drop. This behavior is considered "atypical" because tangible capital and labor, which are not shown in the figure, both rebounded strongly after the 1995 crisis. The lack of response from creative capital during the 1990s crisis can be attributed to several factors. Firstly, intangibles were in a phase of maturation in Mexico during that period. Additionally, the crisis led to a significant devaluation of the exchange rate, making inputs for the creative sector more expensive. This particularly affected the R&D and marketing/design segments, which experienced the most substantial decline after the 1995 crisis. It is worth noting that this lack of response from creative capital during the 1990s crisis was not observed in the financial crisis of 2008, except for R&D. This suggests that intangibles in Mexico have aligned with the typical resilient behavior exhibited by the creative capital phenomenon in response to economic shocks. The same resilience is expected during the COVID-19 crisis, although the specific impact on different creative segments may vary.

R&D indeed dominates the contribution of creative capital by a significant margin, but it has exhibited a diminishing trend since 2000. Marketing/Design, on the other hand, was the second-largest contributor during the 1990s but has become the weakest creative segment since 2003. The marketing/design segment displays negative contribution numbers after 2014. Media/Information has been a relatively stable creative segment in the 21st century and has emerged as the second-largest contributor in the years leading up to the COVID crisis. Software, meanwhile, demonstrated a

relatively strong performance between 2001 and 2014, during which it became the second-largest contributor to growth. In fact, it was the main contributor during 2010-2014 when R&D experienced a significant decline. This reflects the emerging and influential role of software in the knowledge economy. However, software has shown a declining trend in recent years, although it has proven resilient to the COVID-19 crisis, possibly due to increased telework. It remains to be seen how the COVID-19 pandemic will affect intangible capital in the coming years, but the contribution of software to growth will likely remain strong.

Turning to the Arts and Publishing segments of creative capital in Figure 4, it is evident that publishing has had virtually no contribution to growth throughout the entire period under study, with a contribution of only 0.005 during 1992-2020. This can be attributed, among other factors, to the significant process of digitalization that the publishing sector has undergone in recent decades. It is possible that digital publishing is being accounted for in other creative sectors, such as software, which may partially explain the minimal contribution observed in the publishing segment. It would be interesting to discuss the new trends and demands in the book industry and how they may impact the publishing segment in the future.

As we discussed in the last section, Arts/Entertainment is the only segment that has experienced a negative annual growth rate in intangible investment, with a rate of -0.51%, contrasting with the strong growth rates observed in the rest of the creative segments (as seen in Table 7). Despite its sluggish investment growth, Arts/Entertainment has made a relatively significant contribution to growth, particularly in the early 1990s when it reached around 0.05 in 1993. Since 2001, Arts/Entertainment has exhibited a stable contribution to growth, sometimes even matching the contribution of the Media/Information segment. On average, Arts/Entertainment has contributed around 0.025 to growth, which is close to the contribution registered by the Media/Information segment during the period 1992-2019.

However, the COVID-19 pandemic significantly negatively impacted the Arts/Entertainment segment, leading to a decline of -0.08 in its contribution to growth. This aligns with the overall observation that Arts/Entertainment was among the creative sectors most affected by the pandemic due to the restrictions on social interactions and the impact on cultural and entertainment activities.

Final remarks

The paper presents empirical research focused on the Mexican case, aiming to explore the interplay between growth accounting and cultural economics. Specifically, it provides estimates of investment flows and capital stocks related to CCI. These estimates are then incorporated into a growth accounting framework to assess the capital contribution of CCI to Mexican growth from 1992 to 2020.

The main empirical finding suggests that intangible capital in Mexico contributes to growth at a similar magnitude as labor. The inclusion of intangible capital in Mexican growth accounting appears to have a positive impact on Total Factor Productivity (PTF). Notably, ICC's capital contribution represents approximately 75% of the total intangible capital contribution, highlighting its significant role as a driver of economic growth.

Furthermore, the paper sheds light on the distribution of intangible investment across sectors, emphasizing the sectors where specific creative segments are particularly prominent. It provides valuable insights into the allocation of intangible investment within the economy. Notably, the manufacturing sector in Mexico emerges as one of the primary purchasers of intangible goods from ICC. However, it has experienced a decline in dynamism, possibly due to an increasing demand for imported intangible capital.

Moreover, the data suggests that the impact of the COVID-19 pandemic on creative sectors was not evenly distributed. Some sectors demonstrated resilience, while others faced substantial challenges due to their reliance on physical social interactions, such as Arts/Entertainment.

This study serves as an initial step in bridging the fields of cultural and growth economics, addressing essential research questions regarding the significance of CCI, its interrelationships with other sectors, and its contribution to economic growth and overall productivity.

References

Barnes, Paula, and Andrew McClure. (2009). Investments in Intangible Assets and Australia's Productivity Growth. Productivity Commission. Staff Working Paper, March 26. Available online: https://www.pc.gov.au/research/supporting/intangible-investment (accessed on 14 June 2023)

Corrado, Carol, Charles Hulten, y Daniel Sichel. (2005). Measuring Capital and Technology: An Expanded Framework. In Measuring Capital in the New Economy, edited by Corrado Carol, Haltiwanger John, and Sichel Daniel. Chicago: The University of Chicago Press, pp. 11–45. https://doi.org/10.7208/chicago/9780226116174.003.0002

Corrado C, Hulten C, y Sichel D. (2009). Intangible capital and U.S. economic growth. Review of Income and Wealth, 55(3), 661-685. https://doi.org/10.1111/j.1475-4991.2009.00343.x

Corrado, Carol, Jonathan Haskel, Cecilia Jona-Lasinio, y Massimiliano Iommi. (2018). Intangible investment in the EU and US before and since the Great Recession and its contribution to productivity growth. Journal of Infrastructure, Policy and Development, 2, 11. https://doi.org/10.24294/jipd.v2i1.205

Dal Borgo M., Goodridge, P., Haskel, J. y Pesole, A. (2013). Productivity and Growth in UK Industries: An Intangible Investment Approach. Oxford Bulletin of Economics and Statistics, Department of

Economics, University of Oxford, vol. 75(6), 806-834. https://doi.org/10.1111/j.1468-0084.2012.00718.x

Fukao, Kyoji, Tsutomu Miyagawa, Kentaro Mukai, Yukio Shinoda, y Konomi Tonogi. (2009). Intangible Investment in Japan: Measurement and Contribution to Economic Growth. Review of Income and Wealth, 55, 717–36. https://doi.org/10.1111/j.1475-4991.2009.00345.x

Harberger, A. C., 1978, "Perspectives on Capital and Technology in Less Developed Countries". In: M. J. Artis and A. R. Nobay (Eds.): Contemporary Economic Analysis, London, 42–72

Hulten, C. (1979). On the 'importance' of productivity change. The American Economic Review, 69(1),126-136. http://www.jstor.org/stable/1802503

Mas, M., Fernández de Guevara, J. y Robledo D. J. C. (2022). La dimensión de las actividades culturales, creativas y TIC en España. Primera edición, Fundación BBVA.

Mas, M. (2020). El crecimiento de la productividad y los activos intangibles. Papeles de Economía Española, N.º 164.

Mas, M. y J. Quesada. (2014). Activos intangibles. Una inversión necesaria para el crecimiento económico en España. Colección Fundación Telefónica. Barcelona:

Muntean, Tatiana. (2014). Intangible Assets and Their Contribution to Labour Productivity Growth in Ontario. International Productivity Monitor, 27, 22–40. http://www.csls.ca/ipm/27/27-tm.pdf. (accessed on 14 June 2023)

Nakamura, Leonard. (1999). Intangibles: What put the new in the new economy? Business Review, 3–16. https://www.philadelphiafed.org/-/media/frbp/assets/economy/articles/business-review/1999/july-august/brja99ln.pdf. (accessed on 1 May 2020).

Nakamura, Leonard. (2001). What Is the US Gross Investment in Intangibles? (At Least) One Trillion Dollars a Year. Federal Reserve Bank of Philadelphia Working Paper 01-15. Philadelphia: Economic Research Division, Federal Reserve Bank of Philadelphia. https://doi.org/10.21799/frbp.wp.2001.15

OECD, (2009). Measuring Capital: A Manual measurement of capital stocks, consumption of fixed capital and capital services. https://www.oecd.org/sdd/productivity-stats/43734711.pdf

Roth, Felix, and Anna-Elisabeth Thum. (2013). Intangible capital and labor productivity growth: Panel evidence for the EU from 1998–2005. Review of Income and Wealth 59, 486–508. https://doi.org/10.1111/roiw.12009

Scheffel, E., and Thomas, A. (2011). Employment and intangible spending in the UK's creative industries -A view from the microdata. Economic and Labour Market Review 5, 79–104. https://doi.org/10.1057/elmr.2011.8

Throsby D. (1999). Cultural Capital, Journal of Cultural Economics, 23, 3–12. https://doi.org/10.1023/a:1007543313370

Valdivia, M., Quintana L. y Mendoza, M.A. (2023). The creative economy and its linkages in the metropolitan areas of Mexico. Area Development and Policy, 8(1), 84-102. https://doi.org/10.1080/23792949.2022.2041059

Weitzmann M. L. (1976). On the welfare significance of national product in a dynamic Economy, Quarterly Journal of Economics, 90(364), 156-62. https://doi.org/10.2307/1886092