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Looking Behind the Scenes: An Assessment of the Interdependence of Brazilian Cultural Industries

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Looking behind the scenes: an assessment of the interdependence of Brazilian cultural industries

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Abstract

How important is Brazil's cultural industries to its economy? We provide an answer to this question by evaluating the interdependence of the cultural activities in the Brazilian production structure and its evolution over the last few years (2005 – 2009). To accomplish this, we disaggregate 13 cultural economic industries in the Brazilian input-output table and calculate several indexes, such as, the production multiplier, linkage indexes, fields of influence and extraction analysis. Results show that the only cultural sector with high links to other sectors in the production structure is Telecommunication, edition and news agencies and that this sector provides the greatest loss in output when removed from the economy. Moreover, the sectors Jewelry, music instruments and toys, and Manufacture of telecommunication equipment have output multipliers higher than the average of the economy.

Keywords: Cultural Economics, Cultural industries, Input-output tables, Interdependence analysis.
JEL Classification: Z10, D57

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1 Introduction

Cultural economics is a broadly-defined term, and there has not been an agreement on its primary focus. As pointed out by Blaug (2001) and (Towse, 2003), studies of the arts was the main interest in the beginning (1960s); however, there is an increasing number of studies that deal with other aspects of cultural activities. The cultural topic has gained more attention in recent years, and we can observe supranational institutions such as UNESCO, OECD, Eurostat and the World Bank, for example, that have indicators or statistics on cultural activities.

Throsby (2004) stresses the importance of an impact analysis of cultural activities in the broader sectorial sense rather than the impact of a festival or a museum, for example, which are more common in studies of cultural economics. The author clearly states that analytical methods, such as, input-output, social accounting matrix and computable general equilibrium are extremely important but rare because of a lack of data.

Some of the pioneer works using input-output analysis to assess cultural activities are the works of Vaughan (1984) and for the Arts (1986). The first perform multiplier analysis for tourism activities in the United Kingdom using input-output data and a survey conducted in the country. The second is a report showing the cultural activities' numbers in the 1984 input-output data in the United States. More recently, we have the studies of DiNoto and Merk (1993) analyzing the impacts of arts activities in Idaho, Gazel and Schwer (1997) assessing the impact of the Grateful Dead performance in Las Vegas, Bryan et al. (2000) evaluating the economic impacts of cultural activities in the Welsh economy, and David and Guilhoto (2012) studying the economic importance of cultural activities in Brazil in 2006.

The Brazilian cultural industries sector is a fast-growing part of the country's economy. As per data from CEMPRE[1] and PNAD[2], IBGE reported some statistics on cultural industries for the years 2003 to 2005 and 2007 to 2010. For the first period, there was a 32% growth on gross output, 32.5% on value-added, 19% on the number of enterprises, and 32% on the government expenditure. As for the second period, there was a 31% growth on gross output, 38% on valued-added, 9% on the number of enterprises, and 64% on the government expenditure. Moreover, the number of workers grew 13% in both periods 2003-2005 and 2007-2010 according to CEMPRE (formal

[1] CEMPRE - Cadastro Central de Empresas by IBGE (Brazilian Institute of Geography and Statistics) is the Brazilian register of enterprises recorded by IBGE.

[2] PNAD – Pesquisa Nacional por Amostra de Domicílios - is the Brazilian Household Survey conducted by IBGE.

workers only), however, decreased by 11% according to PNAD (formal and informal workers).

Motivated by the increasing importance of the cultural industries in the Brazilian economy and the lack of studies using input-output analysis to assess the cultural industries, the objective of this paper is to evaluate the interdependence of the cultural activities in Brazilian production structure, therefore shedding more light on the cultural sectors feature in Brazil over time (2005 – 2009). In this sense, we contribute to the literature by providing an input-output framework with the cultural industries specified in the production structure and by analyzing the importance of such industries in the Brazilian production structure. To do this we disaggregate the cultural economic sectors Brazilian input-output tables for such years, calculate the production multiplier, linkage indexes, fields of influence and extraction analysis. It is important to stress that this work differentiates itself from David and Guilhoto (2012) by adding the time effect, using the extraction analysis and mainly by how we calculate the cultural sectors in the Brazilian production structure.

The remainder of the paper is as follows: section 2 presents a brief review of the cultural studies performed for the Brazilian economy, section 3 describes the data used and its manipulation, section 4 presents the several methodologies used and their results, and in section 5 we make our conclusions.

2 Cultural industry in Brazil

There are several studies analyzing the cultural economic aspects of the Brazilian economy. Section 2.1 provides a brief literature review of these studies to characterize the cultural industry in Brazil. Section 2.2 presents some descriptive analysis of the cultural industry in Brazil, focusing on regional differences.

2.1 Cultural studies in Brazil

Silva et al. (2007) used the RAIS[3] database to calculate the effects of economic cycles in the formal cultural labor market for the period 1995 to 2002. The authors concluded that the cultural labor market follows the same pattern as the GDP, however, it is more sensitive than sectors identified as more

[3]RAIS is an annual administrative survey that makes available information to identify workers eligible to receive social benefits and to monitor the labor market.

"traditional." Ferreira Neto et al. (2012) assessed the wage differential among the cultural sector workers and artists, and other workers, using a pseudo-panel analysis between 2002 and 2007 and found that cultural workers and artists are better paid in Brazil, per se. Machado et al. (2013b) studied the effects of public expenditure in cultural activities on creative workers' wages using data from PME[4] and FINBRA for the years 2002-2010.

Golgher (2011) used the Brazilian Census to describe the formation of creative and entertainment clusters based on where skilled workers in the creative industry are located by testing Florida's hypothesis that creative and skilled workers are attracted to places with more entertainment options and diverse people. Machado et al. (2013a) analyzed the potential of creativity of Brazilian regions and municipalities based on "cultural amenities" that might influence the decision of living and working in a specific city and found three well defined clusters. The first comprises São Paulo and Rio de Janeiro (the two largest metropolises in Brazil); the second comprises state capitals and the so-called university towns; and the third cluster, having 99 municipalities, is denominated centers of cultural and ecological tourism. Ferreira Neto and Perobelli (2013) created a comparable index to evaluate the cultural activity aspects of the Minas Gerais state micro-regions and performed some exploratory spatial analysis to find possible cultural clusters in the state. The authors found that most of the micro-regions had a low Development Potential of Cultural Activities (64 out of 66 regions) and that there were some clustering patterns.

Porsse et al. (2009) evaluated the economic impacts of the Natal Luz festival in Brazil's Rio Grande do Sul state using surveys and input-output techniques. The authors concluded that the festival had high impact on the overall indexes and the main reason for this is the attraction of tourists. David and Guilhoto (2012) studied the cultural sectors in the Brazilian input-output table for 2006, and their main findings were that the Television Industry and Journal, Magazine and Discs sectors are key-sectors in the Brazilian economy and that the employment and wage multipliers for cultural sectors are above the Brazilian average.

With respect to consumption of cultural goods, most studies use the POF[5] survey conducted by the Brazilian Institute of Geography and Statis-

[4]PME – Pesquisa Mensal de Emprego (Labor Monthly Survey) is a survey by IBGE on labor force of six Brazilian metropolitan regions. FINBRA – Finanças do Brasil (Brazilian Finances) is a report by the Brazilian Treasure on revenue and expenditure of Brazilian municipalities.

[5]POF – Pesquisa de Orçamentos Familiares (Household Budget Survey) is a survey by IBGE on household expenditure.

tics (IBGE). Diniz and Machado (2011) focus on the determinants of consumption of artistic-cultural goods in the metropolitan regions of Brazil. Earp (2009), and Machado et al. (2010) focus on the demand for movies in Brazil. Other than those papers, we can highlight the work of Bertini (2009) , Reis (2002, 2006), Valiati and Florissi (2007), as well as the several reports generated by IBGE and the Ministry of Culture.

2.2 Cultural studies in Brazil

IBGE, the Brazilian Institute of Geography and Statistics, periodically releases reports on several Brazilian industries that comprise information on labor, government expenditure, and other data they annually gather. For the cultural industry, the most recent report is the Sistema de Informações e Indicadores Culturais 2007-2010.

Table 1 presents summary information on other accounts included in the input-output tables. In general, the numbers are almost constants and shows that the Gross Output of the cultural industry represents around 11% of the Brazilian GDP, 12% of the Value Added, with government expenditures around 0.3% for cultural activities.

Table 1 – Cultural industry in Brazil

Year	Gross Output*			Value Added*			Government Expense*		
	Total	Cultural	%	Total	Cultural	%	Total	Cultural	%
2007	2,219,537	250,897	11.30%	898,366	110,981	12.35%	1,760,998	4,416	0.25%
2008	2,607,912	281,297	10.79%	1,064,158	123,835	11.64%	1,906,212	5,581	0.29%
2009	2,596,215	287,742	11.08%	1,123,210	128,043	11.40%	2,115,535	6,190	0.29%
2010	3,048,519	328,878	10.79%	1,341,834	152,866	11.39%	2,303,791	7,251	0.31%

Source: IBGE: Sistema de Informações e Indicadores Culturais 2007-2010. *In R$1,000,000.00.

Table 2 illustrates the per capita expenditure on culture and the state government expenditure on culture by Brazilian macro-regions. At the national level, the per capita expenditure and the state expenditure both increased between 2007 and 2010, the former by 77.5% and the latter by 58.5%. For the per capita expenditure, the North region has the smallest increase (22.5%) while the Center-West has the largest increase (66.8%). However, in absolute terms, the South region is where people spend less on cultural goods, R$ 22.50 as of 2010, and the Center-West is where they spend more, R$ 90.74. As for the state expenditure, the Northeastern and the Center-West regions show levels of increases similar to the national level, 73.5% and 70.4% respectively. However, the Southeast region is still the one that spends the most on culture, representing 53.3% of the national expenditure.

Table 2 – Per capita expenditure on culture and State Government Expenditure by macro-region

Region	Per Capita Expenditure (R$)			State Expenditure*			
	2007	2010	% diff.	2007	2010	% diff.	% of 2010
Brazil	24.00	38.04	58.5	1,426,783	2,532,673	77.5	100%
North	21.96	26.90	22.5	204,180	257,940	26.3	10.2%
Northeast	17.34	27.63	59.3	299,708	519,932	73.5	20.5%
Southeast	25.95	43.20	66.5	642,102	1,351,046	10.4	53.3%
South	17.25	22.50	30.4	159,348	196,776	23.5	7.8%
Center-West	54.40	90.74	66.8	121,445	206,979	70.4	8.2%

Source: IBGE: Sistema de Informações e Indicadores Culturais 2007-2010. *In R$1,000,000.00.

Table 3 contains information by Brazilian macro-region about the labor force and their income. Tables 1 and 2 show that the cultural industry in Brazil is producing more (gross output and value-added) and the government is investing more (national and state expenditure), however, during 2007 and 2011 there is a decline in the number of workers in the cultural industry in almost every region; the exception is the North region. On the other hand, the average income both in total and in the cultural industries has increased during the period.

Table 3 – Number of Workers and Mean Income by macro-region

Region	Number of Workers*				Average Income (R$)			
	Total		Culture		Total		Culture	
	2007	2011	2007	2011	2007	2011	2007	2011
Brazil	89,928	93,493	4,177	3,718	1,213	1,375	1,258	1,463
North	6,808	7,393	188	201	994	1,123	975	1,028
Northeast	23,687	23,727	920	762	760	918	750	851
Southeast	38,178	40,298	2,105	1,873	1,400	1,562	1,518	1,739
South	14,470	14,749	675	641	1,353	1,492	1,187	1,438
Center-West	6,784	7,327	289	240	1,455	1,665	1,346	1,687

Source: IBGE: Sistema de Informações e Indicadores Culturais 2007-2010.

3 Data

To assess the interdependence of the Brazilian cultural industries, we use estimated input-output tables (Guilhoto and Sesso-Filho (2005, 2010))[6], with

[6] Available at http://www.usp.br/nereus/

56 industries (Appendix 1) and 110 commodities for 2005 and 2009. From the 56 industries, however, the Brazilian Institute of Geography and Statistics (IBGE) considers only 2 as cultural activities: Public and Private Education.

Nonetheless, the cultural activities have a much larger participation in the production structure. To disaggregate such activities, we used information from the Annual Service Survey, Annual Industry Survey and the System of Information and Cultural Indexes[7] from IBGE. These surveys provide information to disaggregate some of the industries, enabling us to identify 13 cultural sectors.

We followed four steps to disaggregate and estimate the input-output tables with the cultural sectors[8]. First, we identified the cultural activities and their input-output corresponding sector. Secondly, we summed the gross output of cultural activities provided by the Survey and got the share of cultural activity in the corresponding I-O sector. Thirdly, from this share we disaggregated the I-O table and then used the RAS method to rebalance the Input-Output Table.

Table 4 presents this share of cultural activities in their respective input-output industry. From the 13 industries that contain some sort of cultural activities, the ratio for cultural – non-cultural is generally similar between 2005 and 2009. However, for 2 industries – 31 and 33 – this ratio changes from around 30% cultural in 2005 in both industries to 72% and 92.5% cultural in 2009, respectively. We believe that this change is due to the classification system used in Brazil. In 2005, the information provided for activity used CNAE[9] 1.0 and in 2009 CNAE 2.0. Although both classifications are compatible, issues like this are likely to happen and do not bias our results, hence we need some extra care to analyze the results for these sectors.

Appendices 2 and 3 present each cultural activity from the Annual Industry Survey used and their respective input-output industry for 2005 and 2009. Appendix 4 presents the activities from the Annual Service Survey used and their respective input-output industry as well.

Thus, the initial 56-industry input-output table becomes a 69-industry I-O table. Table 5 presents the disaggregated cultural industries.

[7]Pesquisa Anual de Serviços, Pesquisa Industrial Anual, e Sistema de Informação e Indicadores Culturais.

[8]For the Trade industry, we considered the share of cultural goods that is available at System of Information and Cultural Indexes, which they refer to as Cultural Trade.

[9]CNAE (Classificação Nacional de Atividades Econômicas) is the Brazilian code system for economic activities and follows the International Standard Industry Classification.

Table 4 – Share of cultural activities in each disaggregated Input-Output industry.

	Industry	2005		2009	
		Cultural	Non-Cultural	Cultural	Non-Cultural
13	Journal, magazines and disks	11.5%	88.5%	12.2%	87.8%
22	Other chemical products	0.0%	100.0%	0.5%	99.5%
31	Office and computing supplies	28.5%	71.5%	72.0%	28.0%
33	Elec. and communication equipment	29.2%	70.8%	92.5%	7.5%
34	Medical and optical equipment	6.0%	94.0%	2.5%	97.5%
39	Other products	8.0%	92.0%	3.9%	96.1%
42	Trade	3.3%	96.7%	5.3%	94.7%
44	Information service	78.6%	21.4%	78.3%	21.7%
47	Maintenance and repair	32.9%	67.1%	34.9%	65.1%
49	Enterprise service	2.8%	97.2%	2.4%	97.6%
50	Private Education	100.0%	0.0%	100.0%	0.0%
52	Community and person services	7.3%	92.7%	6.3%	93.7%
54	Public Education	100.0%	0.0%	100.0%	0.0%

Source: the authors.

Table 5 – Cultural Industries in the Input-Output tables

Code	Cultural industries
13C	Printing and Publishing
22C	Manufacture of tapes and disks
31C	Manufacture of computers and accessories
33C	Manufacture of telecommunication equipment
34C	Manufacture of optical, photographical and movie equipment
39C	Jewelry, music instruments and toys
42C	Cultural Trade
44C	Telecommunication, edition and news agencies
47C	Maintenance of computers and communication equipment
49C	Travel agencies and related services
50C	Private Education
52C	Recreational and cultural activities and education
54C	Public Education

Source: The authors

4 Input-output model

The input-output matrix describes the intersectoral flows in an economy used to analyze the industrial interdependence in an economy Miller and Blair (2009). Let the following equation represent an input-output matrix describing the monetary flows of an economy:

$$Z + f = x \tag{1}$$

where, Z is a matrix that represents intermediate consumption, f is the vector of final demand, and x is the vector of gross output.

$$A = Z(\hat{x})^{-1} \tag{2}$$

where each element of A is defined as $a_{ij} = z_{ij}/x_j$, which corresponds to the proportion of input that industry j needs from industry i to produce $1 of product; $\hat{x}$ is the diagonal matrix with the elements of vector x.

Solving (1), we have:

$$AX + f = x \tag{3}$$

after algebraic manipulations we get:

$$x = Lf \tag{4}$$

where L is the Leontief inverse matrix, defined as $L = (I - A)^{-1} = [l_i j]$, and its elements can be understood as the direct and indirect requirements of industry j for meeting a unit of output growth in i. Sections 4.1 to 4.4 each present one of the methodologies used to analyze the interdependence of the cultural industries in Brazil. Section 4.1 presents the production multiplier, section 4.2 the linkage indexes, section 4.3 the fields of influence and section 4.4 the extraction method.

4.1 Multipliers

Miller and Blair (2009) define the output multiplier (O_j) for sector j as the direct and indirect quantity of output required to satisfy a unity increase in the final demand of industry j. The higher the output multiplier, the higher the impact in the overall economy due to a shock in sector j. Formally, we have:

$$O_j = \sum_{i=1}^{n} l_{ij} \tag{5}$$

In order to evaluate the importance of the cultural industries, we compare its aggregate with respect to other central industries as well as the relative importance of each cultural industry. In this sense, table 5 presents the output multiplier for the years 2005 and 2009 for some aggregated sectors, while Figure 1 presents the output multiplier for each cultural industry.

As we can see in Table 6, the only two sectors with a higher output multiplier than the average (1.89 and 1.83) are Extractive (1.96 and 1.92) and Industry (2.11 and 2.02). Although the cultural sector multiplier is not above the mean, it is higher than the multiplier for Trade, Services and Public Administration. David and Guilhoto (2012) find similar results and point out that this is because of several problems in the production chain of cultural activities.

Table 6 –Average output multipliers for aggregated sectors, 2005 e 2009.

Sector	2005	2009	Sector	2005	2009
Agriculture	1.76	1.67	Service	1.54	1.53
Extractive	1.96	1.92	Public Administration	1.64	1.58
Industries	2.11	2.02	Cultural Sector	1.67	1.66
Trade	1.44	1.48	Average of economy	1.90	1.84

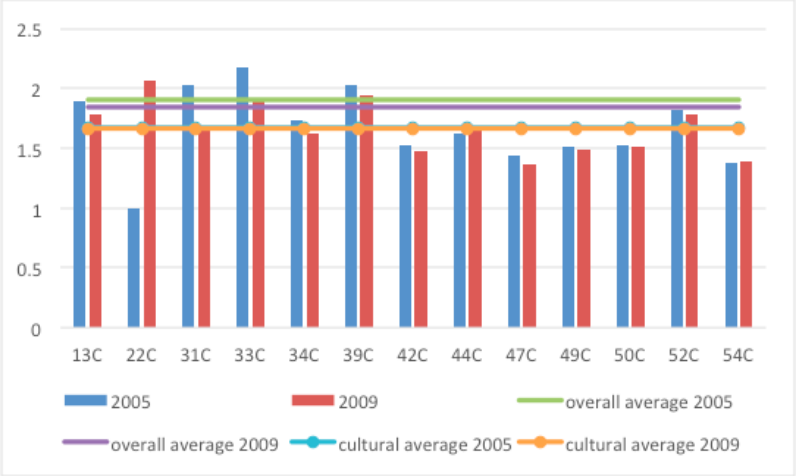
Source: The authors.

We can see from Figure 1 that the cultural activities average in 2005 is low and that most of the other sectors, 8 of them, are above this average. Conversely, in 2009 this average is higher, being near the overall average of 2009 with only 3 cultural sectors above it. Manufacture of telecommunication equipment (33C) and Jewelry, music instruments and toys (39C) are the sectors that present the higher output multipliers in both years. Sectors Manufacture of computers and accessories (31C) in 2005 and Manufacture of tapes and disks (22C) in 2009 are also worth mentioning.

4.2 Linkage Indexes

The key-sector analysis is one of the most traditional measures to determine if a sector, or group of sectors, is important in the production structure of a country. The idea is to find out which sectors have more linkages within an economy. The most traditional manner to do so is through the Hirschman-Rasmussen indexes (HRI). According to Miller and Blair (2009), the backward linkage (U_j) provides the dependence of sector j from all the others sectors of the economy, while the forward linkage (U_i) provides the depen-

Figure 1 – Output Multipliers for cultural industries, economy mean and cultural sector mean, 2005, 2009



Source: The authors

dence of all the other sectors of the economy from sector j. Values higher than one for the indexes is evidence that the sector is above the national mean. Mathematically,

$$U_j = \frac{\sum_{i=1}^{n} l_{ij}}{\sum_{i=1}^{n}\sum_{j=1}^{n} l_{ij}} \tag{6}$$

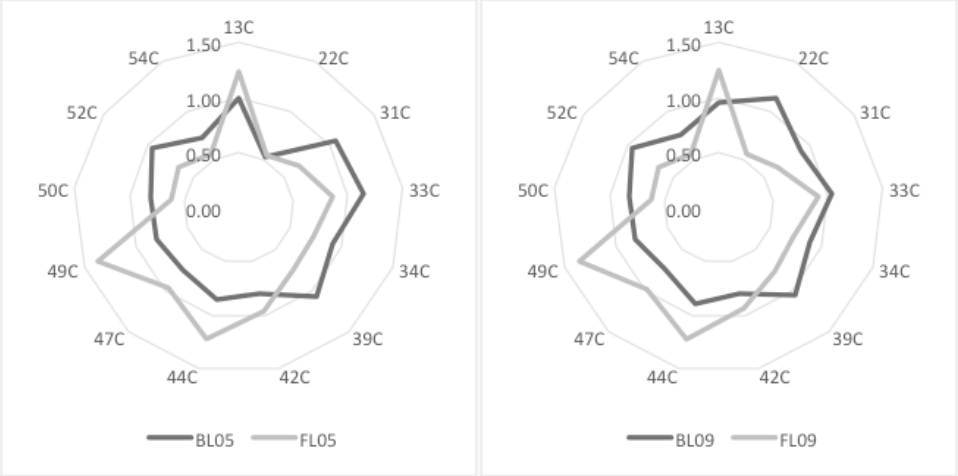
$$U_j = \frac{\sum_{i=1}^{n} g_{ij}}{\sum_{i=1}^{n}\sum_{j=1}^{n} g_{ij}} \tag{7}$$

where $[g_{ij}] = G = (I - K)^{-1}$, is the element of the Ghosh (G) matrix, such that $K = [k_{ij}]$ is the technical coefficient matrix defined by $k_{ij} = z_{ij}/x_i$.

Figure 2 shows the results for the Hirschman-Rasmussen indexes. Sectors with values above unit are considered more important to the production structure, and if both Backward Linkage (BL) and Forward Linkage (FL) are

above unit, it is considered a key sector. The only cultural industry considered a key-sector is the Printing and Publishing (13C) in 2005. Another sector that appears relevant is the 49C – Travel Agencies and related services – with a high forward linkage in both years.

Figure 2 – Backward and Forward Indexes for the cultural industries, 2005 and 2009



Source: The authors

As the HRI does not take into account the size of the sector in the economy, Guilhoto et al. (2005) devised a new methodology to calculate the linkage indexes using the decomposition of the Leontief inverse matrix creating the so-called Pure Linkage Indexes (PLI). Thus, the Pure Backward Linkage (PBL) yields the pure impact on the economy of the value of the total production in sector j, i.e, the impact that is free from demand for inputs from sector j and feedback from the economy to sector j and vice-versa. The Pure Forward Linkage (PFL) yields the pure impact on sector j of the total production in the rest of the economy. Another advantage of the PLI is the possibility of obtaining the total index (Pure Total Linkage – PTL) through the sum of PBL and PFL. In order to make it easier to compare PLI and HRI, we can standardize the PLI, dividing the pure index of each sector by the mean of pure index in the economy.

Mathematically[10], the Pure Linkage indexes are:

[10] Rewriting the matrix of Technical Coefficients as $A = \begin{bmatrix} A_{jj} & A_{jr} \\ A_{rj} & A_{rr} \end{bmatrix} = \begin{bmatrix} A_{jj} & A_{jr} \\ A_{rj} & 0 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & A_{rr} \end{bmatrix}$ we can calculate $L = (I - A)^{-1} = \begin{bmatrix} B_{jj} & B_{jr} \\ B_{rj} & B_{rr} \end{bmatrix} =$

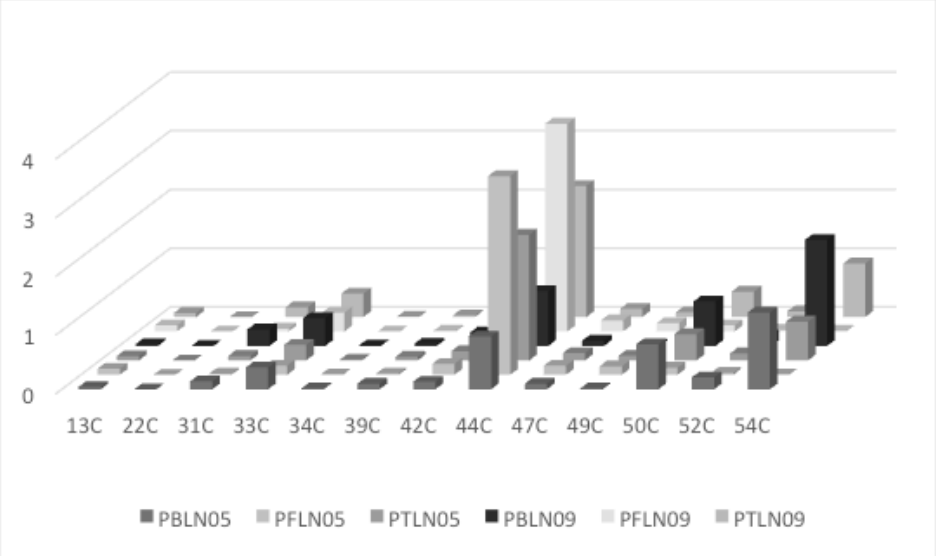
$$PBL = \Delta_r A_{rj} \Delta_j Y_j \tag{8}$$

$$PBL = \Delta_j A_{jr} \Delta_r Y_r \tag{9}$$

where $\Delta_j = (I - A_{jj})^{-1}$ and $\Delta_r = (I - A_{rr})^{-1}$.

Figure 3 presents the results for the Pure Linkage Index. Different from the H-R index, if the Pure Total Linkage Normalized (PTLN) is above unit, we define it as a key sector. For the cultural industries, we have the Telecommunication (44C) sector as a key-sector in both years. The difference in the results is due to the importance of this industry in the production structure that now is being taken into account. The industries Private Education (50C) and Public Education (54C) show themselves to be important as well, especially with respect to backward effects, i.e., they demand more from the economy to meet a final demand shock than other cultural sectors.

Figure 3 – Pure Linkage Indexes for cultural industries, 2005 and 2009.



Source: The authors

$$\begin{pmatrix} \Delta_{jj} & 0 \\ 0 & \Delta_{rr} \end{pmatrix} \begin{pmatrix} \Delta_j & 0 \\ 0 & \Delta_r \end{pmatrix} \begin{pmatrix} I & A_{jr}\Delta_r \\ A_{rj}\Delta_j & I \end{pmatrix}$$

4.3 Fields of Influence

The fields of influence analysis is complementary to the linkage indexes as it describes the distribution in changes in the technical direct coefficients in the economic system, enabling us to determine which are the most important relations in the production structure (Guilhoto (2009)).

The approximation of the fields of influence from a small change in a_{ij} is $F(\epsilon_{ij})$ such that

$$F(\epsilon_{ij}) = \frac{[L(\epsilon_{ij}) - L]}{\epsilon_{ij}} \tag{10}$$

where ϵ_{ij} is the small change in coefficient a_{ij}. To evaluate which coefficients have higher fields of influence we must define S_{ij}:

$$S_{ij} = \sum_{t=1}^{n}\sum_{p=1}^{n}[f_{tp}(\epsilon_{ij}) \tag{11}$$

where S_ij is the associated value to each $F(\epsilon_{ij})$ matrix, i.e., the higher S_{ij}, the higher the field of influence of that relation in the economy.

Figures 5 and 6 present the results for the field of influence for the years 2005 and 2009, respectively. The darker the link, the more important it is to the production structure. We can see that from 2005 to 2009 there is a gain in importance in the cultural industries links to the production structure, especially for sectors Manufacture of telecommunication equipment (33C), Jewelry, music instruments and toys (39C) mainly as suppliers, and Telecommunication, edition and news agencies (44C) mainly as a consumer. Figure 4 presents the key for figures 5 and 6.

Figure 4 – Key for Figures 5 and 6

	Below the Average
	Between Average and 1 Standard Deviation
	Between 1 and 2 Standard Deviations
	Between 2 and 3 Standard Deviations
	Above 3 Standard Deviations

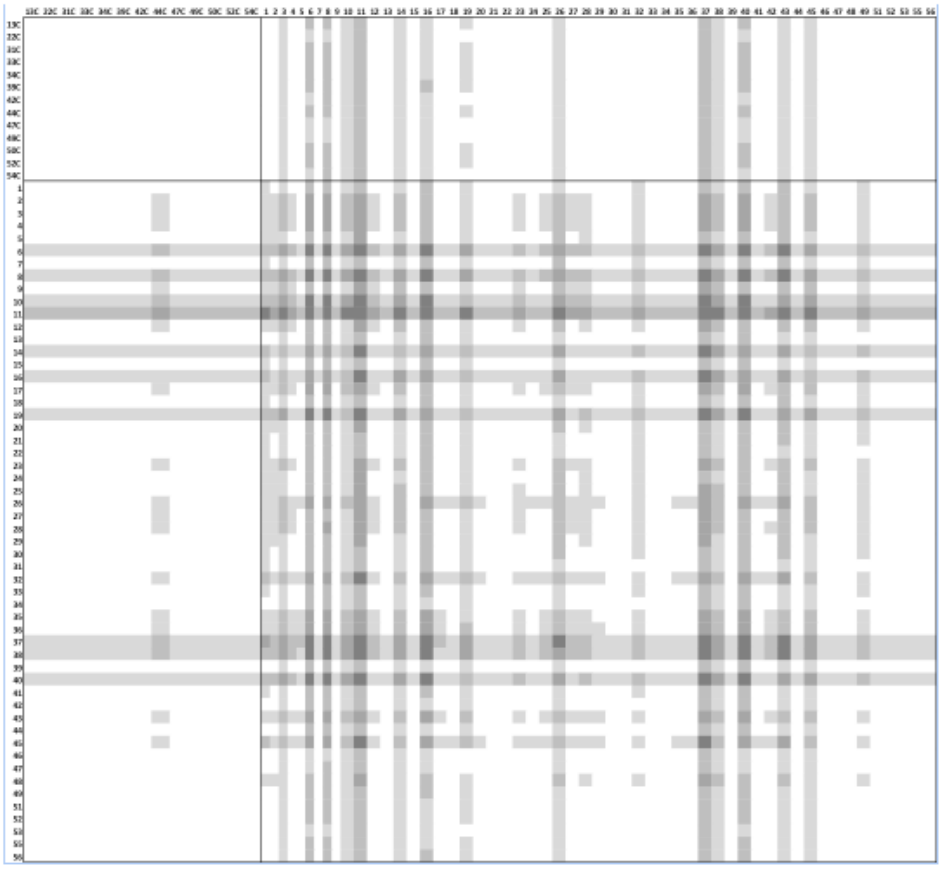
Source: The authors

4.4 Extraction Method

[11].

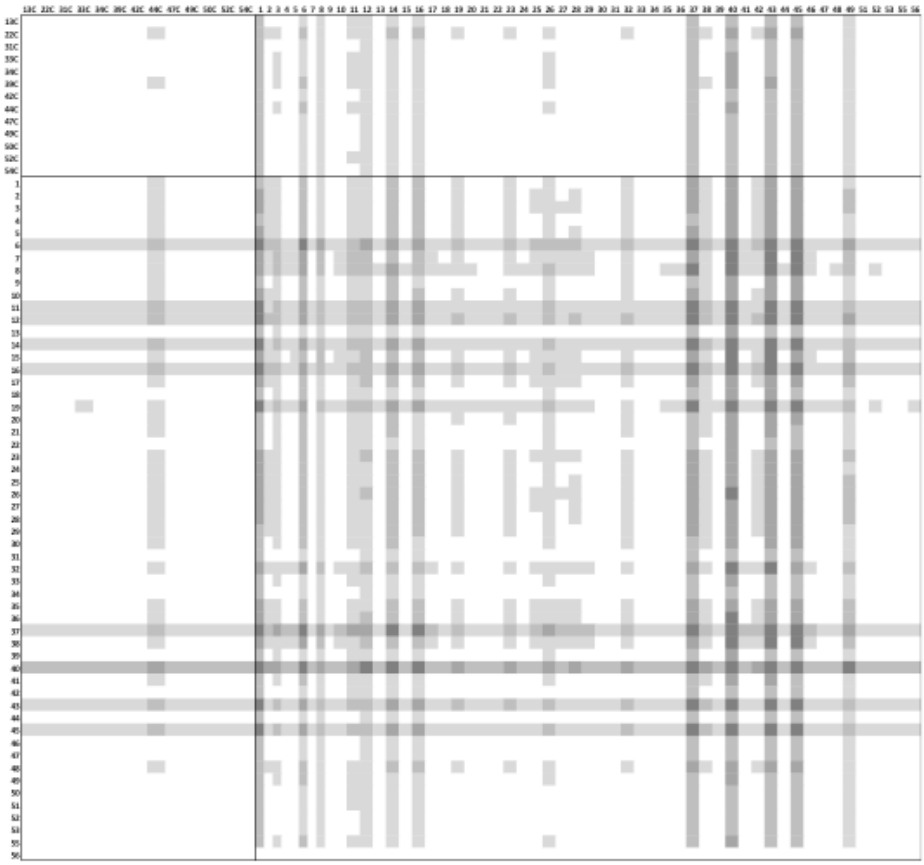
[11] For more derails see Dietzenbacher et al. (1993)

Figure 5 – Field of Influence for 2005



Source: The authors. Obs: The 13th first rows and columns are the Cultural sectors.

Figure 6 – Field of Influence for 2009



Source: The authors. Obs: The 13th first rows and columns are the Cultural sectors.

The extraction method evaluates the impact of a hypothetical isolation of one region (or industry) on the rest of the economy. Therefore, this is another measurement of the linkages in the economy, complementing the previous indexes.

Mathematically, the impact vectors are

$$x^1 - \bar{x}^1 = (I - A^{11})^{-1} A^{1R} L^{RR} [f^R + A^{R1}(I - A^{11})^{-1} f^1] \tag{12}$$

and

$$x^R - \bar{x}^R = (I - A^{RR})^{-1} A^{R1} L^{11} [f^1 + A^{1R}(I - A^{RR})^{-1} f^R] \tag{13}$$

where A is the matrix of technical coefficient, L is the Leontief inverse, f is the final demand, superscript 1 represents one sector (or region), superscript R represents the rest of the economy (sectors or regions), and $\bar{x}$ is output of the rest of the economy with the extraction of the sector (or region).

Tables 7 and 8 show the result for the extraction method for the years of 2005 and 2009, respectively. Comparing the results from both tables, it is clear that the cultural industries gain in importance in 2009 compared to 2005. This can be verified in two ways: a higher impact on itself and on the other cultural industries.

5 Conclusions

In this paper, we examine the importance of the cultural industries in the Brazilian economy by evaluating the interdependence of the cultural activities in Brazilian production structure and its evolution over the last few years (2005 – 2009) using input-output analysis. This analysis fits well with our question as the indicators calculated map several aspects of the sectorial interdependence, such as multipliers and linkages. The novelty of this approach is twofold: the disaggregated treatment of the cultural sector and the application for the Brazilian economy.

We summarize the main findings as follows: a) the output multiplier – the cultural activities are below the average but above the important sectors, such as, Trade, Services and Public Administration; b) linkages – Printing and Publishing (13C) in 2005 is classified as a key-sector and Travel Agencies and related services (49C) present the highest forward linkage in both years; c) spread effects (fields of influence) – we verify only a slight interaction between cultural activities and non-cultural activities; however, this interaction shows a slight increase in the 2009 year; and d) impact effects – the

Table 7 - Extraction method for the year of 2005

	13C	22C	31C	33C	34C	39C	42C	44C	47C	49C	50C	52C
Primary	13%	-	17%	16%	29%	19%	12%	8%	12%	7%	23%	16%
Secondary	34%	-	56%	45%	34%	50%	33%	31%	28%	23%	34%	56%
Tertiary	8%	-	14%	15%	13%	12%	9%	8%	9%	7%	19%	13%
Cultural	1%	-	2%	2%	2%	2%	1%	0%	1%	1%	11%	2%
Removed Sector	44%	-	11%	22%	21%	17%	45%	53%	49%	62%	13%	12%

Source: The authors. The percentage was calculated by summing the impacts in all sectors ($x^R - \bar{x}^R$) and the impact in the removed sector itself ($x^1 - \bar{x}^1$), and then calculating share of the sum of sector with respect to this total. Removed sector is the sector in the column, which was hypothetically extracted.

Table 8 - Extraction method for the year of 2009

	13C	22C	31C	33C	34C	39C	42C	44C	47C	49C	50C	52C
Primary	15%	5%	20%	17%	38%	26%	13%	9%	12%	9%	14%	15%
Secondary	25%	56%	45%	33%	20%	34%	28%	28%	22%	20%	55%	52%
Tertiary	10%	14%	18%	18%	15%	16%	11%	10%	10%	7%	16%	18%
Cultural	2%	26%	3%	3%	5%	5%	2%	0%	2%	1%	3%	3%
Removed Sector	48%	0%	14%	29%	22%	19%	46%	53%	55%	62%	12%	12%

Source: The authors. The percentage was calculated by summing the impacts in all sectors ($x^R - \bar{x}^R$) and the impact in the removed sector itself ($x^1 - \bar{x}^1$), and then calculating share of the sum of sector with respect to this total. Removed sector is the sector in the column, which was hypothetically extracted.

hypothetical extraction tell us that the intrasectorial impact is small; and for the majority of the cultural sectors, the impact on the GDP is highest when the secondary sector is hypothetically extracted.

It is important to emphasize that the results enable us to provide policymakers and private agents with a global picture of the cultural sector for the Brazilian economy, but there is space to better understand the most important links between the cultural sector and the non-cultural sector in the Brazilian economy. Possible extensions include a higher disaggregation of the cultural activities and the use of an inter-regional input-output model for the Brazilian economy in order to estimate the impact in the different Brazilian regions.

References

Bertini, A. (2009). *Eonomia da cultura: a indústria do entretenimento e o audiovisual no Brasil.* Saraiva.

Blaug, M. (2001). Where are we on cultural economics? *Journal of Economic Surveys*, 15(2):123–143.

Bryan, J., Hill, S., Munday, M., and Roberts, A. (2000). Assessing the role of the artsand cultural industries in a local economy. *Environment and Planning*, 32(2):1391–1408.

David, L. and Guilhoto, J. J. M. (2012). O potencial da economia da cultura no brasil. In *X Encontro Nacional da Associaćão Brasileira de Estudos Regionais e Urbanos*.

Dietzenbacher, E., van der Linden, J., and Steenge, A. E. (1993). The regional extraction method: Ec input-output comparisons. *Economic Systems Research*, 5(2):185–206.

Diniz, S. and Machado, A. (2011). Analysis of the consumption of artistic-cultural goods and services in brazil. *Journal of Cultural Economics*, 35(1):1–18.

DiNoto, M. and Merk, L. (1993). Small economy estimates of the impact of the arts. *Journal of Cultural Economics*, 17(2):41–53.

Earp, F. S. S. (2009). .o espectador eventual: notas sobre a demanda por cinema no brasil. *Políticas Culturais em Revista*, 2:77–87.

Ferreira Neto, A. B., Freguglia, R. D. S., and Fajardo, B. D. A. G. (2012). Diferenciais salariais para o setor cultural e ocupações artísticas no brasil. *Economia Aplicada (Impresso)*, 16:49–76.

Ferreira Neto, A. B. and Perobelli, F. S. (2013). Spatial analysis of cultural activities in the microregions of minas gerais. *EconomiA*, 14:139–157.

for the Arts, N. E. (1986). The arts in the gnp. *Journal of Cultural Economics*, 10:77–82.

Gazel, R. C. and Schwer, K. R. (1997). Beyond rock and roll: The economic impact of the grateful dead on a local economy. *Journal of Cultural Economics*, 21:41–55.

Golgher, A. B. (2011). A distribuićão de indivíduos qualificados nas regiões metropolitanas brasileiras: A influência do entretenimento e da diversidade populacional. *Nova Economia*, 21:109–134.

Guilhoto, J. (2009). Análise de insumo-produto: Teoria e fundamentos. mimeo.

Guilhoto, J. and Sesso-Filho, U. (2005). Estimaćão da matriz insumo-produto a partir de dados preliminares das contas nacionais. *Economia Aplicada*, 9:277–299.

Guilhoto, J. and Sesso-Filho, U. (2010). Estimaćão da matriz insumo-produto utilizando dados preliminares das contas nacionais: Aplicaćão e análise de indicadores econômicos para o brasil em 2005. *Economia & Tecnologia. UFPR-TECPAR*, 23.

Guilhoto, J., Sonis, M., and Hewings, G. (2005). Linkages and multipliers in a multiregional framework: Integration of alternative approaches. *Australasian Journal of Regional Studies*, 11(1):75–89.

IBGE (2013). Sistema de informaćões e indicadores culturais 2007-2010. Technical report, IBGE. Available at www.ibge.gov.br.

Machado, A. F., Diniz, S. C., and Menezes, T. (2010). Perfil dos consumidores decinema no brasil metropolitano. In *VII Encontro Nacional da Associaćão Brasileira de Estudos Regionais*.

Machado, A. F., Diniz, S. C., and Simoes, R. F. (2013a). Urban amenities and thedevelopment of creative clusters: the case of brazil. *Current Urban Studies*, 1:92–101.

Machado, A. F., Rabelo, A., and Moreira, A. G. (2013b). Specificities of the artistic cultural labor market in brazilian metropolitan regions between 2002 and 2010. *Journal of Cultural Economics*, 38:237–251.

Miller, R. and Blair, P. (2009). *Input-output Analysis: Foundations and Extensions*. Cambrigde University Press, second edition.

Porsse, A., Palermo, P., and Portugal, M. (2009). Projeção dos impactos econômicos do natal luz no rio grande do sul: Uma avaliação a partir do modelo de matriz de insumo-produto. In *VII Encontro Nacional da Associaćão Brasileira de Estudos Regionai*.

Reis, A. C. F. (2002). *Marketing Cultural e Financiamento da Cultura*. Thomson Learning.

Reis, A. C. F. (2006). *Economia da Cultura e Desenvolvimento Sustentável – o Caleidoscópio da cultura*. Manole.

Silva, F. B., Araujo, H. E., and Souza, A. L. (2007). Emprego formal no setor cultural. Technical report, IPEA.

Throsby, D. (2004). Assessing the impacts of a cultural industry. *Journal of Arts Management, Law Society*, 34(3):188–204.

Towse, R. (2003). *A Handbook of Cultural Economics*. Edward-Elgar.

Valiati, L. and Florissi, S. (2007). *Economia da cultura: Bem-estar econômico evolućão cultural*. Editora da UFRGS.

Vaughan, D. (1984). The cultural heritage: an approach to analyzing income and employment effects. *Journal of Cultural Economics*, 8(2):1–36.

Appendix

Appendix 1 – Original 56 input-output sectors in the Brazilian table.

Code	Sector	I-O Code
101	Agriculture, hunting, forestry	1
102	Livestock and fishing	2
201	Oil and natural gas	3
202	Iron ore	4
203	Other extractive industries	5
301	Food and beverages	6
302	Tobacco products	7
303	Textiles	8
304	textile products	9
305	leather and footwear	10
306	Wood - excludedfurnitures	11
307	Cellulose, paper products	12
308	Journal, Magazines and disks	13
309	Coke, refined Oil product	14
310	Alcohol	15
311	Chemical products	16
312	Manufacture of resin and elastomers	17
313	Pharmaceutical products	18
314	Agrochemicals	19
315	Perfumery and Hygiene products	20
316	Paints, varnishes, lacquers and enamels	21
317	Other chemical products	22
318	Rubber and plastic products	23
319	Cement	24
320	Other non-metallic mineral products	25
321	Steel and steel products	26
322	Non-ferrous metals	27
323	Metallic products, except machines and equipment	28
324	Machines and equipment, including maintenance and repair	29
325	Electrodomestics	30
326	Office, accounting and computing supplies	31
327	Electric machines and devices	32
328	Eletronic and comunication equipment	33
329	Medical and precision optical equipment	34
330	Automotive vehicles	35
331	Trucks and bus	36
332	Parts and accessories for motor vehicles	37
333	Other transport equipment	38
334	Furniture and other products	39
401	Electricity, gas, water, sewage and urban sanitation	40
501	Construction	41
601	Trade	42
701	Transportation, storage and mail	43
801	Information service	44
901	Finance and insurance	45
1001	Real Estate	46
1101	Maintenance and repair services	47
1102	Accommodation and food services	48
1103	Enterprise services	49
1104	Private Education	50
1105	Private Health	51
1106	Community, social and person services	52
1107	Households with employed people	53
1201	Public Education	54
1202	Public Health	55
1203	Public Administration and defense	56

Source: Nereus

Table 2 – Cultural Industry-activities for 2005 (CNAE 1.0)

CNAE Code	Name	I-O Code
22.21	Journal, Magazines and books printing	13
22.29	Other graphical services	13
22.3	Reproduction of recorded material	13
24.96	Manufacture of disks and tapes.	22
30.21	Manufacture of computers	31
30.22	Manufacture of equipments for eletronic devices for information treatment	31
32.10	Manufacture of basic electronic material	33
32.21	Manufacture of equipment for radio and television broadcast and radio and telephone transmitters.	33
32.22	Manufacture of telephone devices, intercommunication systems and similar.	33
32.30	Manufacture of radio and television receivers and reproduction, recording or amplification of sound and video.	33
33.40	Manufacturing of optical devices, instruments and material, and photographic and cinematographic material.	34
36.91	Stoning of precious and semi-precious stones, manufacture of jewelery and jewelery artifacts.	39
36.92	Manufacture of musical instruments	39
36.94	Manufacture of toys and recreational games	39
36.99	Manufacture of diverse products	39

Source: IBGE. Note: translation by the authors.

Table 3 – Cultural Industry-activities for 2009 (CNAE 2.0)

CNAE Code	Name	I-O Code
18.11	Journals, Magazines, books and other periodical publication's printing	13
18.21	Pre-printing servicer	13
18.22	Graphic finishing services	13
18.30	Reproduction of recorded material	13
26.10	Manufacture of electronic components	33
26.21	Manufacture of computer equipment	31
26.22	Manufacture of peripheral computer equipment.	31
26.31	Manufacture of communication transmitters devices.	33
26.32	Manufacture of telephone equipment and other communication devices	33
26.40	Manufacture of reception, reproduction, recording, audio, and video amplification devices.	33
26.70	Manufacture of optical, fotographic and cinematographic equipments.	34
26.80	Manufacture of magnetic, optical and new media.	22
32.11	Stoning of gems, manufacturing of jewelery and jewelry artifacts.	39
32.12	Manufacture of imitation jewelery and similar items.	39
32.20	Manufacture of musical instruments.	39
32.40	Manufacture of toys and recreational games.	39

Source: IBGE. Note: translation by the authors.

Appendix 4 - Cultural Service-activities for 2005 and 2009

Services to enterprises
Travel agency, tour operators and other tourism services
Services to households
Recreational and cultural activities
Continued teaching activities
Information services
Telecommunication
Audio and visual services
Editing and editing integrated to printing
News agencies and other information services
Maintenance and repair services
Maintenance and repair of computer and communication equipment.

Source: IBGE. Note: translation by the authors. In 2005 "Editing and editing integrated to printing" was not disaggregated.