The impact of cultural spending

An analytical survey of 47 cities across the world

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Any omissions or mistakes, therefore, found in this document are the sole responsibility of the authors.

The Forum d'Avignon aims at strengthening the links between culture and the economy, suggesting subjects for reflection at global, European and local levels. The Forum d'Avignon was created after the ratification of the UNESCO convention on cultural diversity, and since its beginning, has been backed by the French Ministry of Culture and Communication. Each year the Forum organizes, with its partners, international meetings which provide opportunities for unique discussions and exchanges between actors from the worlds of culture, the creative industries, the economy and the media.

A think tank dedicated to culture

Each year the Forumd'Avignon publishes new studies highlighting the essential links between culture and the economy, on themes suggested by its Advisory Board. Throughout the year these themes are examined and proposals put forward by working groups that are organized by the Forum d'Avignon with experts, international consulting firms and its public and private partners. The Forum's think tank tackles subjects such as culture, financing and economic models; culture and attractiveness of the territories; culture and digital ; culture and innovation. For its third edition in 2010, six publications have been produced for the Forum d'Avignon, following the three studies presented in 2009.

The international meetings of culture, the economy and the media

An international and cross-sectoral event associating debates and performances by artists, the Forum d'Avignon is a field for reflection in which the economic dimension of culture and the roles of social cohesion and job creation in cultural areas are being, explored. The Forum d'Avignon is where concrete proposals, unique networking opportunities, heritage and innovations discoveries are brought together. The directions explored each year are disseminated among national and international authorities. Over 400 committed people come together: artists, chairmen,writers, professors, filmdirectors, philosophers, students from international universities, representatives of the creative and cultural industries. The diversity of the points of view is also symbolized by the cosmopolitan diversity of the speakers, coming from all over the world.

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Synthesis

In the framework of the Forum d'Avignon, consultancy Kurt Salmon built a database in 2009 and 2010, comprising 47 cities across 21 countries and 5 continents (28 cities in Europe, 12 in America, 3 in Asia, 2 in Oceania, 1 in Africa). Eleven indicators were used to characterize these cities: 4 indicators rounded out the *economic performance* category, with the 7 other indicators in the *cultural intensity* heading. The study included a statistical and econometric study of this sample, which was carried out by TERA Consultants in 2011 in the scope of their partnership with the Forum d'Avignon. The study's objective was to identify possible significant relations between the cities' economic performance indicators and culture-based indicators.

Two types of quantitative analyses using different methodologies were carried out. These analyses yielded the following two key messages.

1. ***The first analysis suggests that culture in cities is an individual and collective bonus, providing means for an active and appealing social life.***
2. ***The second analysis shows that cultural expenses in a city are a very good means to track the city's economic development, and provide cities with a means for further development. Cities can monitor their cultural policies for each indicator, ensuring that their policies are not behind in their economic dynamics, helping to either create or consolidate the strong tie linking investment in culture in the economic dynamics.***

To further these analyses, the sample data was first restated. This restatement was carried out first of all to ensure a better comparison between the cities presenting a strong heterogeneity in terms of life style, with all monetary data converted on the basis of an exchange rate to be expressed in purchasing power parity. Second, to exploit all of the base indicators for the sample's 47 cities, estimations for data which was not provided, due to either a reliable source of data or data availability, were provided for. These estimations were approximated using neighboring data.

Once the data was restated, the first analysis, called descriptive statistics, positioned the cities on a map based on the eleven indicators. This step and the statistical position yielded few aggregates, with the cities generally close to one another. ***The first analysis, pointed to the cities' homogeneity, despite their differences in size, life style, geography, etc. This means that economic indicators interact without any specific discontinuity regarding the sample's cities.***

Looking beyond the overall cultural homogeneity, a few differences do stand out. First, three cities (London, Paris and Berlin) are stellar examples due to the number and quality of their cultural venues and the universities that they host. Five other cities are close to the three leaders: New-York, Madrid, Rio, Buenos-Aires and Rome. Four other

cities (Venice, Cracow, Vancouver and Avignon) share the same population characteristics (number of visitors, migratory flow, etc.) and therefore, differentiate themselves from the rest of the sample.

This first approach was then furthered by replacing the GDP/inhabitant monetary indicator by a more qualitative indicator: the HDI (Human Development Index), which is unfortunately measured at a national level and does not have the granularity of city size. By substituting the HDI for the GDP, however, we find a greater differentiation among the cities. This leads us to believe that there is a stronger bond between «qualitative» wealth (HDI) and the base's other indicators, especially for the cultural indicators. ***Additional data enriching the database with « lifestyle quality » indicators would be very helpful. This data would ensure that culture and life style can be correlated, as suggested by the HDI analysis.***

A second, econometric, analysis was carried out to see if there was a statistical link between culture and economy. In this second phase, multiple regressions between sample indicators were tested to more specifically identify the relations between cultural and economic indicators.

The study shows that the most significant relation is the correlation between a city's GDP/ inhabitant and its public cultural spending per capita (investment and general expenses). This relation states that the share of the cities' cultural spending represents an average, ***0.7% of the GDP per capita, whereas the expenses alone account for nearly 9% of the GDP per capita***. So, the cultural expenses of the sample, average out to an annual 186 € PPP/inhabitant for an average GDP/ inhabitant of 31 330€ PPP. Using this average as a starting point, we obtain a linear regression[1], which shows ***an additional 10%, or 18.6 €, since cultural spending per capita is tied to the GDP per capita of 1.7%, or 625.4 €.***

[1] The regression is: GDP/Inhab. = 31 330 + [(33,665) x (city cultural spending/Inhab.)]. This right axis to adjust the linear regression between the two variables entails a major constant. The constant logically means that a very large part of a city's GDP per capita cannot be explained by the city's cultural expenses. Nevertheless, looking beyond this constant, all cultural spending paid for by the city points to a positive and significant relationship with the GDP per capita.

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1 Introduction

Culture bears the semantic stigma of *spending* its appropriated budgets. This stigma insidiously ranks cultural activities in an unproductive category, presenting the spending as a superfluous, even ostentatious, nature. Seeking to put an end to this stigma, the Forum d'Avignon has initiated studies to reveal and decipher the relations between cultural expenses and the economy. Seminal works and debates have yielded a powerful conclusion: culture should be apprehended as a growth stream contributing to economic dynamics and not as a sterile and useless expense.

As the terminology evolves, the term *cultural investments* is replacing *cultural expense*. Case-studies and experiences, namely that of cities, showcase that culture is: « a highly significant factor in the competitive wars waged by territories to recruit companies and consequently provide jobs[2] ».

Moving from casuistic studies to more general laws requires a database with a quantifiable and homogenous base to identify and measure stable and significant relations. To our knowledge, this database did not exist, pushing the Forum d'Avignon to create, from the beginning, interest in this area, and create a database comprising vast international data including cities worldwide, regardless of size, geography, economic and cultural characteristics.

Kurt Salmon, (formerly Ineum Consulting) undertook this painstaking yet key task, collecting data in cities across the world, and finding enough common denominators to yield comparisons. Kurt Salmon then reviewed and analysed the collected data to identify and define a typology of economic development strategies and policies for the sample's 50 cities.

A statistic and econometric exploitation of the database was undertaken to identify the stable and general relation tying culture to economics. TERA Consultants was given the opportunity to study the database and implemented statistical tools to identify pertinent information to underline the significance between the eleven indicators describing the database cities.

A question underlying the Forum d'Avignon debates focuses on the relationship between city economics and their cultural « activity ».

Given this approach, a preliminary step entailed assessing available data, to review and homogenise the data, ensuring that the data could be used for statistics (§ 2).

[2] Synthesis of the Forum d'Avignon 2010, Hervé Digne, Vice-President of the Forum d'Avignon, November 6, 2010

A first analytical step, termed « descriptive », or technically, used primary component analysis, was undertaken to understand the interactions between base indicators and their respective weight in the relative position of cities (§ 3). This first analysis helps identify the indicators which have the opposite effect. When positioned on a map, these indicators are far from one another. Complementary indicators, those which do influence one another, appear close to one another on the map. The study shows that cities with neighboring characteristics are grouped close to one another on the map, while cities with different data show distance between the points. Using the eleven indicators, we mapped the cities to provide a visual guide to help establish a city typology.

The next step leads us to « explanatory » methods, used to show the correlation between the indicators describing the sample's 50 cities (§ 4). This step seeks to identify the significant statistical relationships between the indicators, called variables. More specifically, we sought to ensure that with the sample's 50 cities, statistical relationships could bring out cultural variables on one hand and economic variables on the other hand. Based on significant correlations on a statistical level, we will then seek to understand if we can infer plausible links of causality.

2 Building the database and indicators

In 2009, Ineum Consulting, (today's Kurt Salmon), partnered with the Forum d'Avignon, and created a panel of international cities, with indicators that were either tied to economic or cultural performance and university-level institutions[3]. Drawing on these bases, Kurt Salmon built a barometer to define a typology of strategic policies to integrate culture in a city's economic development. This analysis studied the links between the cultural and economic sets of indicators, to assess current strategic policies and determine how to leverage and anchor culture.

The barometer's first version was enriched by Kurt Salmon for the 2010 edition of the Forum d'Avignon. More specifically, the barometer integrated new cities and further detailed collected data.

The 2010 database provides a statistical and analytical base for TERA Consultants. The objective is to use a new statistical approach to enrich the database contents. The assessment explains the correlation between the analysis and the dynamics of the indicators.

2.1 The 2010 database

In the 2010 database, each city is characterised by 11 indicators (cf. Table 1): **6 indicators encompass the cultural and university level institutions**, complemented by five **economic performance indicators.**

[3] *Culture at stake: economic or symbolic development of territories?* "*La culture, enjeu économique ou symbolique pour le développement des territoires ?* « Ineum Consulting, 2009, p.1 and 2

Table 1: The indicators in the 2010 database[4]

6 indicators to reflect cultural intensity and universities	Unit
Number of key tourism sites	Number
Number of museums	Number
Number of theatres and operas	Number
The city's public cultural spending per capita	In current €
Number of students in the university in relation to the population	%
Number of universities	Number

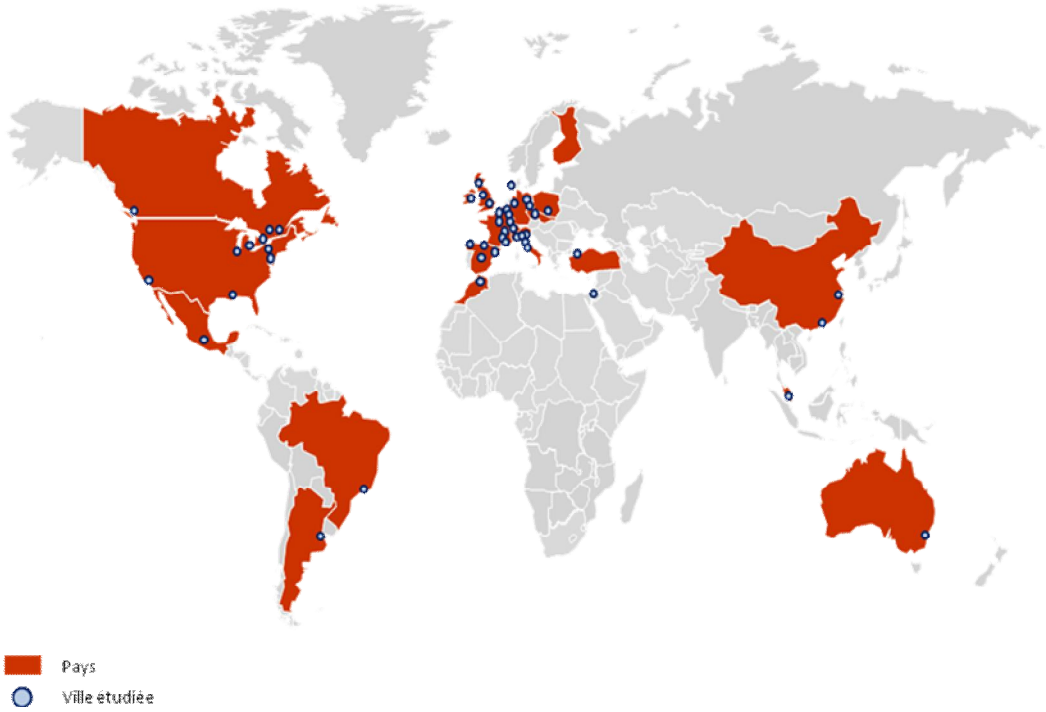
5 economic performance indicators	Unit
GDP per capita	In current €
Share of the city's active population in the overall population	%
City's migratory flows	Number
Number of tourists per year/ overall city population	%
City's unemployment rate	Net rate per 1,000 inhabitants

Source: Ineum Consulting

Further, the cities selected underline the will to build a global sample representing all types of countries (developed, emerging, developing). As such, the panel includes 47 cities, spanning 21 countries (cf. Diagram 1 and Table 2), and provides international comparisons, to offer general and global lessons. More, since Kurt Salmon did not systematically choose the capitals of the sample's 21 countries, capitals are not over-represented in the database.

[4] « *La culture, enjeu économique ou symbolique pour le développement des territoires ?* » Ineum Consulting, 2009, p.7

Diagram 1: Panel geography



Source: Ineum Consulting data

Table 2: Panel of the cities studied

Continent	Country	City
Europe	Czech Republic	Prague
	Belgium	Brussels
	France	Paris, Lyon, Marseille, Avignon, Nancy et Lille
	Germany	Dresde, Berlin et Essen
	Italy	Rome, Florence, Venise, Bologne et Gène
	Luxemburg	Luxemburg
	Spain	Madrid, Barcelona, Bilbao et St. James Way
	Poland	Cracow
	United Kingdom	Londres, Liverpool, Dublin et Glasgow
	Switzerland	Geneva
	Turkey	Istanbul
North America	United States	New-York, Chicago, Philadelphie, Detroit et Los Angeles
	Canada	Toronto, Montréal, Vancouver et Ottawa
Central America	Mexico	Mexico City
South America	Argentina	Buenos Aires
	Brazil	Rio
Africa	Morocco	Fez
Asia	China	Hong Kong and Shanghai
	Israël	Tel-Aviv
Oceania	Republic of Singapore	Singapore
	Australia	Sydney

Source: Kurt Salmon data

2.2 Adjusting monetary indicators via purchasing power parity

To ensure monetary compatibility between cities with heterogenous development and wealth (Fez versus London for example), TERA Consultants adjusted data by introducing exchange rates integrating purchasing power parity. The database's initial rates used September 2009 current rates.

Purchasing power parity (PPP) is a monetary conversion providing a common unit for various currencies and integrating respective national purchasing power, making it easy to compare prices for goods and services between monetary zones. This conversion rate generally differs from the exchange rate: comparing monetary exchange rates for example, reflects reciprocal values across international financial markets and not the values at the consumer's intrinsic level.

Equation 1: Rule to adjust monetary variables of the purchasing power parity in local currency[5]

Restated variable in USD PPP
=
[Non restated variable in EUR] x [USD/EUR exchange rate]
x [Purchasing power in local currency/USD]
÷ [Country exchange rate in country currency/USD]

Source: TERA Consultants analysis

On the basis of this new conversion, the study refers to two monetary indicators, GDP and public cultural spending, which correspond to initial database values.

To show the impact of this change, we compared the values between the former non-adjusted monetary indicators and the new indicators adjusted for purchasing power parity (cf. Table 3).

The reference value for a given monetary indicator is the US dollar, the exception here being American cities for which there was no PPP adjustment. Argentina's cities were the most negatively impacted: the monetary indicator's value dropped 49% when

[5] The USD – euro exchange rate (used in the Ineum study) : 1 € = 1,4522 USD

The purchasing power parity for each country studied (source : http://data.un.org/Data.aspx?d=MDG&f=seriesRowID:699) : for example, in the United Kingdom, 1 USD, buys £ 0,667

The country exchange rate - USD for each of the countries studied (sources: http://data.un.org/Data.aspx?q=exchange+rate&d=IFS&f=SeriesCode%3a.. And an OECD site): for example, in the United Kingdom, 1 USD buys £ 0,592

purchasing power parity is factored in. At the other extreme, Switzerland's cities, gained the most: with monetary indicators up 32%, pushed by the purchasing power parity.

Table 3: How monetary indicators vary per country, with purchasing power parity

Country Change in monetary indicators due to PPP (in%)

Pays	Taux de variation des indicateurs monétaires causé par l'intégration de la PPA
Argentina	-49%
China (Shangaï)	-40%
Marocco	-29%
Mexico	-13%
Brazil	-11%
China (Hong Kong)	-8%
Czech Republic	-1%
US	0%
Republic of Singapore	3%
Turkey	4%
France	4%
Canada	5%
Belgium	6%
Germany	7%
Poland	10%
Luxemboug	10%
Australia	11%
Spain	11%
Italy	12%
Isreal	12%
UK	13%
Switzerland	32%

Source: TERA Consultants analysis

Ranking the cities per their GDP/per capita and cultural spending per capita are consequently impacted (cf. Table 4 and 5).

The ranking changes reflect the integration changes in monetary indicators when purchasing power parity is factored in, as well as the initial difference between city rankings.

Buenos Aires (Argentina), for example, loses the most rungs in the GDP ranking (-6), while Geneva (Switzerland) posts top GDP gains (+3).

Once again, Buenos Aires (Argentina) loses the most rungs in the ranking per public cultural spending by cities (-5). Inversely, Geneva (Switzerland) gains a notch in the same category.

Table 4: How city rankings based on the GDP indicator/per capita change after adjusting for purchasing power parity

City	GDP per Capita (€)	GDP per capita rank	PIB per capita - USD adjusted for PPP (USD PPP)	GDP rank adjusted for PPP	New Rank after data is adjusted for PPP
Glasgow	29 051	13	47 555	10	3
Dublin	35 877	4	58 729	4	-
Liverpool	19 280	38	31 561	34	4
London	35 758	5	58 534	5	-
Venice	22 163	30	36 124	28	2
Bologna	25 937	21	42 276	18	3
Genoa	20 090	35	32 746	32	3
Florence	23 537	25	38 365	23	2
Rome	26 362	19	42 969	16	3
Madrid	23 452	27	37 824	25	2
St James Way	24 381	22	39 322	22	-
Bilbao	26 300	20	42 417	17	3
Barcelona	21 127	33	34 074	31	2
Essen	33 295	7	51 691	6	1
Berlin	23 458	26	36 419	26	-
Dresden	31 169	8	48 390	9	- 1
Lille	20 191	34	30 630	35	- 1
Paris	28 656	15	43 471	15	-
Lyon	28 960	14	43 932	13	1
Marseille	22 809	28	34 601	29	- 1
Nancy	16 898	40	25 634	39	1
Avignon	21 314	31	32 333	33	- 2
Cracow	13 911	43	22 157	41	2
Prague	21 131	32	30 331	36	- 4
Brussels	42 520	2	65 730	2	-
Geneva	52 214	1	100 309	1	-
Luxemburg	37 700	3	60 310	3	-
Philadelphia	31 103	9	45 168	11	- 2
Detroit	28 470	16	41 344	19	- 3
Chicago	30 439	10	44 203	12	- 2
New Orleans	27 452	17	39 866	21	- 4
NewYork	34 386	6	49 936	7	- 1
Los-Angeles	30 131	12	43 756	14	- 2
Vancouver	19 798	36	30 231	37	- 1
Montreal	22 576	29	34 474	30	- 1
Toronto	23 761	23	36 283	27	- 4
Ottawa	26 521	18	40 498	20	- 2
Mexico city	14 048	42	17 841	42	-
Buenos-Aires	19 281	37	14 320	43	- 6
Rio	7 263	44	9 352	45	- 1
Fez	1 058	47	1 084	47	-
Istanbul	6 708	45	10 109	44	1
Tel Aviv-Yafo	23 550	24	38 232	24	-
Singapore	18 124	39	27 196	38	1
Sydney	30 176	11	48 427	8	3
Hong-Kong	16 804	41	22 332	40	1
Shanghai	3 890	46	3 391	46	-

Source: TERA Consultants analysis

Table 5: How city rankings for cultural spending change after PPP adjustment

City	Overall cultural spending / population (€)	Cultural spending rank	Overall cultural spending / population USD adjusted for PPP (USD PPP)	Overall Cultural spending adjusted for PPP	New Rank after data is adjusted for PPP
Glasgow	152	10	249	9	1
Dublin	152	9	250	8	1
Liverpool	601	3	983	3	-
Londres	10	38	17	36	2
Venice	99	18	162	18	-
Bologna	61	23	100	22	1
Genoa	45	27	73	26	1
Florence	60	24	98	23	1
Rome	33	31	53	30	1
Madrid	45	26	73	27	- 1
Santiago de C	117	16	189	16	-
Bilbao	105	17	170	17	-
Barcelona	98	19	159	19	-
Essen	142	13	221	12	1
Berlin	166	7	257	7	-
Dresden	126	15	196	15	-
Lille	143	12	217	13	- 1
Paris	52	25	79	25	-
Lyon	248	5	376	5	-
Marseille	153	8	232	10	- 2
Nancy	36	30	54	29	1
Avignon	136	14	207	14	-
Krakow	27	33	43	31	2
Prague	0	47	0	47	-
Bruxelles	351	4	543	4	-
Genève	745	2	1 431	1	1
Luxembourg	748	1	1 196	2	- 1
Philadelphia	81	20	118	20	-
Detroit	29	32	42	32	-
Chicago	5	41	7	41	-
New Orleans	10	40	14	40	-
NewYork	13	36	18	35	1
Los-Angeles	3	43	4	43	-
Vancouver	16	35	25	34	1
Montreal	199	6	304	6	-
Toronto	10	39	15	38	1
Ottawa	151	11	231	11	-
Mexico	4	42	5	42	-
Buenos-Aires	42	28	31	33	- 5
Rio	12	37	15	39	- 2
Fès	0	46	0	46	-
Istanbul	3	44	4	44	-
Tel Aviv-Yafo	65	21	106	21	-
Singapore	40	29	60	28	1
Sydney	1	45	1	45	-
Hong-Kong	63	22	84	24	- 2
Shangai	18	34	16	37	- 3

Source: TERA Consultants analysis

2.3 How we estimated missing data for the migratory flow indicator

Data relative to the migratory flow indicator was entered into the database, provided that a source was both available and reliable. Entering a zero as a value for cities whose migratory flow remains unknown, impacts all data entries for this indicator.

To ensure that all cities would have data entrances, even for the 14 cities with no available data, we estimated the missing data and approximated figures with the closest neighbors using a digital method. Given the missing migratory flow, this method sought to find the data for city « v », to determine which cities most closely resemble the characteristics of city « v », in short their digital neighbors. The average of the migratory flow of the « digital neighbors » is then attributed to city « v ». As such, this system maintains a general standard for the migratory flow indicator for all the cities.

Approximating these values depends on other characteristics which have been accounted for. By accounting for 9 other indicators, the following values are estimated (cf. table 6).

Table 6: Estimating missing data for the migratory flow indicator (for 1,000 inhabitants)

City	Estimated migratory flows
Genoa	0,85
Florence	6,78
Essen	0,85
Dresden	0,95
Lille	6,48
Paris	-3,97
Philadelphia	-8,64
Detroit	0,85
Chicago	-8,64
NewYork	9,39
Buenos-Aires	-34,40
Istanbul	22,00
Singapore	-6,99
Sydney	-8,64

Source: Ineum Consulting, TERA Consultants analysis

3 Studying the relationships between indicators and city mapping

In this phase of the analysis we carried out a qualitative analysis or in statistical terms, a primary component analysis. We mapped the cities on a two-dimensional space retaining the maximum amount of information contained in the restated database which represents each city with eleven indicators. This analysis shows the joint influence of the indicators on one another and serves as a base for dual mapping: one for indicators, and one for cities.

3.1 Statistical analysis of the database

This first analysis helps statistically determine the weight of each indicator in relation to one another regardless of weighting and ranking, yet optimizes the quantity of information retained. The method used is PCA.

3.1.1 Describing the methodology

This analysis method is generally defined as « descriptive ». It is based on indicators linked to one another, and entails, building independent variables to describe the information using a limited number of components. The goal is to position the cities two dimensionally, positioning them on a map, where each axis is the result of an objective statistical analysis.

The approach has to be both geometric and statistics-based. The approach is geometric, because the cities are represented in a geometric space reflecting well-defined directions, and uses statistics since the axes are the result of the statistical analyses of the associated indicators.

This first approach describes the relationship between a city's overall public cultural spending per capita and the GDP per capita for the given city, in light of the influence of all other indicators. The city's GDP per capita is, therefore, identified as an « additional variable », in this Primary Component analysis. This variable is not used to build axes, since it is the very variable that we are seeking to explain by all indicators. Nevertheless, this variable has been added in the data representation.

3.1.2 Presenting the results

The Primary Component Analysis process, described in Appendix 1, allows for 10 axes (or factors) to be created, each defined as a weighted sum of the initial ten indicators. These factors are successively determined by calculating weighted coefficients, so that the first factor retains the maximum amount of information, the second factor retains the maximum amount of remaining information, and so forth. These factors are ranked in decreasing order based on the pertinence in retaining the information.

Choosing the number of factors to represent each city provides the dimension of the representation of the city samples. If we want to map the cities in a two-dimensional map, the two most representational factors need to be selected. On a practical level, two objectives guide how to choose the retained factors:

- factors representing key cumulative variables, meaning factors which translate into a broad diversity and thus retain more information;
- factors which best separate the indicators, or which help to separately interpret several distinct groups of factors.

Analysing how the indicators contributed to the database helps identify which factors which be the most influential in creating axes (cf. Table 7).

Table 7: How the indicators contributed to building the F1, F2 and F3 axes

	F1	F2	F3
Variability (%)	27,98	13,75	13,61
% cumulated	27,98	41,73	55,33
Share of active population	0,154	**39,867**	5,907
Unempoyment rate	0,421	0,182	**11,037**
Net migratory rate (for 1000 inhabitants)	2,812	**20,247**	**24,398**
Number of visitors / population	1,661	0,531	**33,591**
Number of key tourism sites	**17,199**	7,350	2,575
Number of museums	**31,493**	0,022	0,345
Number de theatres and operas	**22,643**	1,243	0,670
Overall cultural spending/Population adjusted for PPP	4,023	5,097	**16,337**
Number of students in universities / population	3,806	**25,417**	1,563
Number of universities	**15,788**	0,043	3,577

Source: Tera Consultants analysis

The F1 axis points to high variability (28.0%), while the F2 and F3 axes present a similar variability (13.8% for the F2 axis and 13.6% for the F3 axis). The F3 axis complements the F1 axis, and shows how indicators contribute to building axes. Indicators which influence the construction of the F3 axis (unemployment, migratory flow rate, number of visitors, cultural spending), also complement the F1 axis (number of key tourism sites, number of museums, number of theatres and opera houses, number of universities). More, the F3 axis accounts for the influence of cultural spending indicators. In short, the F1 and F3 axes are retained as the most pertinent for the remainder of the analysis.

We can see that, for the most part, the F1 axis was built using indicators linked to tourism activity and universities, while the F3 axis is linked to economic indicators and the population's wealth. We also note that the university student population over total population has little impact on the axes.

Analysing the table for correlations between the indicators and the retained factors serves as a guide on interpreting the axes (cf. table 8). For a given axis, a positive correlation (respectively negative) with an indicator means that the higher the indicator the higher the associated value on the axis (respectively weak). As such, two indicators with the same correlations influence the position on the axis concurrently (as seen in the unemployment rate in table 8). Conversely, when there are two indicators with correlations with different signs they influence the axis position in opposite ways (shown in the example of the number of universities in table 8).

Table 8: Correlation between the indicators and the two retained factors

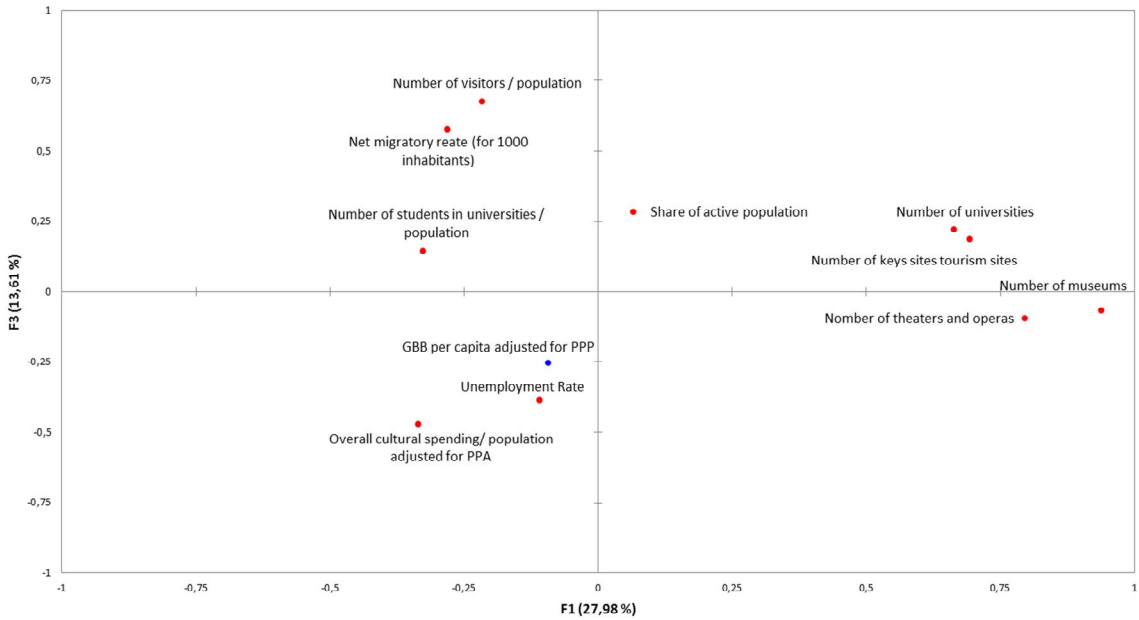
	F1	F3
Share of active population	0,066	0,284
Unempoyment rate	- 0,108	**- 0,388**
Net migratory rate (for 1000 inhabitants)	- 0,280	**0,576**
Number of visitors / population	- 0,216	**0,676**
Number of key tourism sites	**0,694**	0,187
Number of museums	**0,939**	- 0,069
Number de theatres and operas	**0,796**	- 0,096
Overall cultural spending/Population adjusted for PPP	- 0,335	**- 0,471**
Number of students in universities / population	- 0,326	0,146
Number of universities	**0,665**	0,221
GDB per capita adjusted for PPP	- 0,093	- 0,256

Source: Tera Consultants analysis

Overall, the F1 axis opposes cities boasting a number of museums, theatres, opera houses, tourism sites and universities with cities which have relatively few of these venues. The F3 axis points to « population-based » indicators: the number of visitors, percent of working population and rate of migratory flows, which cannot be compared to overall public cultural spending per capita and the unemployment rate.

We can, therefore, note that public cultural spending and the unemployment rate oppose the F3 indicators. The position of each of the indicators and the variable explained in a space comprised of two F1 and F3 axes help visualise how the indicators influence one another (cf. Diagram 1).

Diagram 2: Positioning database indicators for the two axes retained for the analysis



Source: Tera Consultants analysis

The central position of the city GDP per capita shows that this indicator is not linked to other indicator(s). We then plotted the cities on the map (cf. Diagram 2).

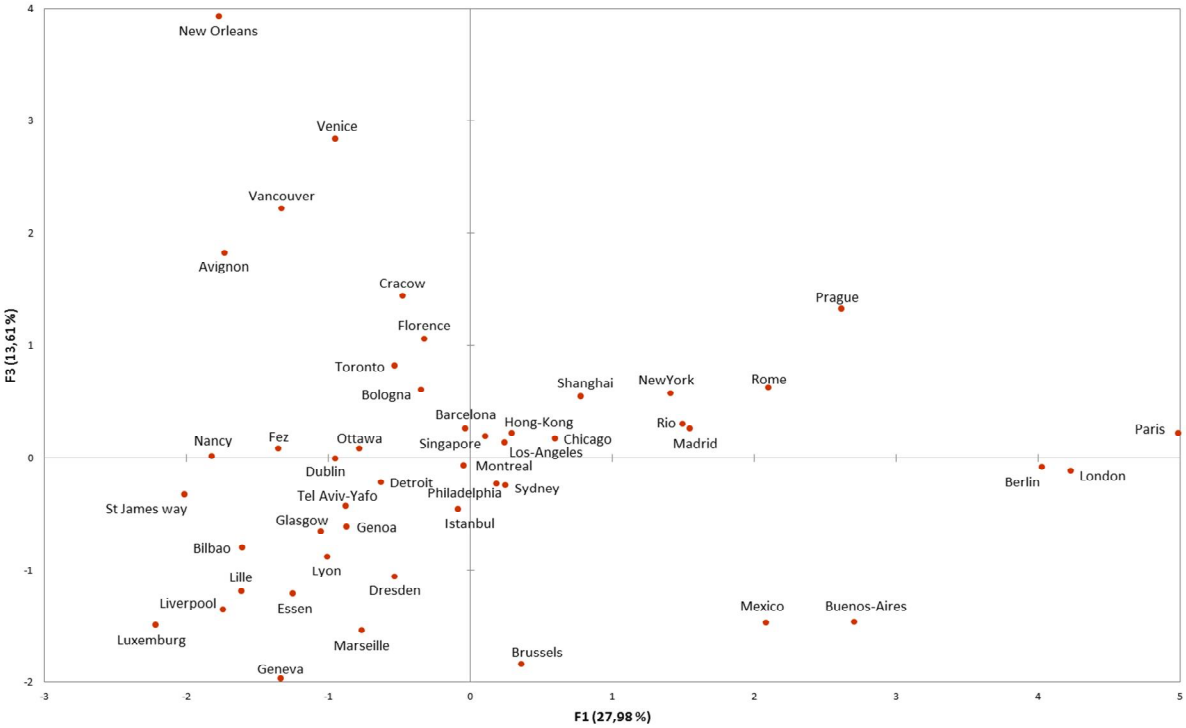
Data analysis shows that three key European capitals, are both close to one another and are clearly detached from the cloud of points on the map's east. These capitals are Berlin, London and Paris, and single themselves out due to the number of venues they offer (museums, theatres, opera houses, universities).

Other cities, located in the north-west of the map, namely, Avignon, New Orleans, Vancouver, and Venice, share similar values for population-based indicators, but we cannot as such, infer general statements about the cities' homogeneity.

While a few cities stand out, such as Mexico City and Buenos Aires (South West corner), the distance between the points and their scarcity are not enough to single out a specific city typology.

The majority of the cities are grouped in a cloud which has no real specificity. The proximity of these cities with the central F1 and F2 axes, may stem from the compensation of opposing indicator values. To yield a statistically valid typology we need to include other indicators to offset this compensation-neutralisation effect, which would differentiate the sample's cities from one another.

Diagram 3: Positioning the sample's cities on the map and representing the 11 database indicators



Source: Tera Consultants analysis

3.1.3 Conclusions of this first statistical analysis

Although, academically speaking the Primary Component Analysis may be disappointing as it does not provide a statistics-based city typology for the sample, the results are, in reality, very rewarding. The analysis shows that the differences between the cities comprising the sample and described by the economic and cultural indicators are not sufficient enough to differentiate the cities even though the economic standards (GDP, unemployment, etc) are very different.

We cannot distinguish the wealthy cities, which as such, have major cultural potential driven by a high GDP and which can be opposed to "poor" cities, be they financially or culturally poor.

This analysis also incites us to do the following:

- In the future include one or more additional indicators in the database to offset the compensation phenomenon between the indicators as a means to be able to differentiate the cities. This differentiation could be the basis for a statistical typology between cities;
- Broaden the database with more cities;
- Further explain a point which seems illogical: overall cultural spending per capita is negatively correlated with the migratory indicators and the number of visitors.

3.2 Mapping indicators and cities with HDI

The wealth indicator for cities pertaining to the database is the GDP per capita: a monetary indicator. Yet Culture also translates a wealth dimension which is not merely monetary. Practicing and consuming culture echo a certain « quality of life » which cannot be diminshed to monetary values or values which are too quantitative. As such, given the conclusion of the first analysis, Tera Consultants has decided to add a new indicator to the database. This indicator will translate life « quality » rather than the quantity of money or financial wealth. We consequently decided to use the United Nation's HDI development as this indicator.

The HDI is a composite indicator based on life expectancy, average years of schooling, expected years of schooling, as well as a schooling index combined with revenue per capita and adjusted for PPP[6]. This index's values, however, are available for countries but not for cities. Yet, as an initial analysis, we believe that inter-country differentiation of cities using the HDI indicator can help relay phenomena which GDP alone cannot do, even if it accounts for PPP.

The HDI analysis also palliates potential effects of indicators' compensation among one another. To check that the HDI introduced a city dispersion which is distinct from the dispersion observed with GDP, we categorized the cities based on their GDP and HDI separately and then ranked the cities per GDP and HDI (cf. Appendix 2).

Twenty-one cities, or 46% of the sample, pointed to an HDI ranking that was lower than the GDP rank. For these cities, this meant that the monetary revenue was more important than the « quality of life » measured by the HDI. For 22 cities, or 48% of the sample, life quality was preferred over monetary revenue. And finally, three cities (Fez, Cracow and Shanghai), or 6%, shared the same score for HDI and GDP. This breakdown points to a balance between the sample's cities, underlining that the HDI indicator brings a new position to cities which is worth noting.

As an indicator, the HDI provides a more qualitative aspect, overriding the quantitative monetary aspect and provides a new diversity to offset the effects of indicator compensation and thus yield a city typology. The same analysis as a primary component was reiterated by substituting HDI for the PPP adjusted GDP indicator.

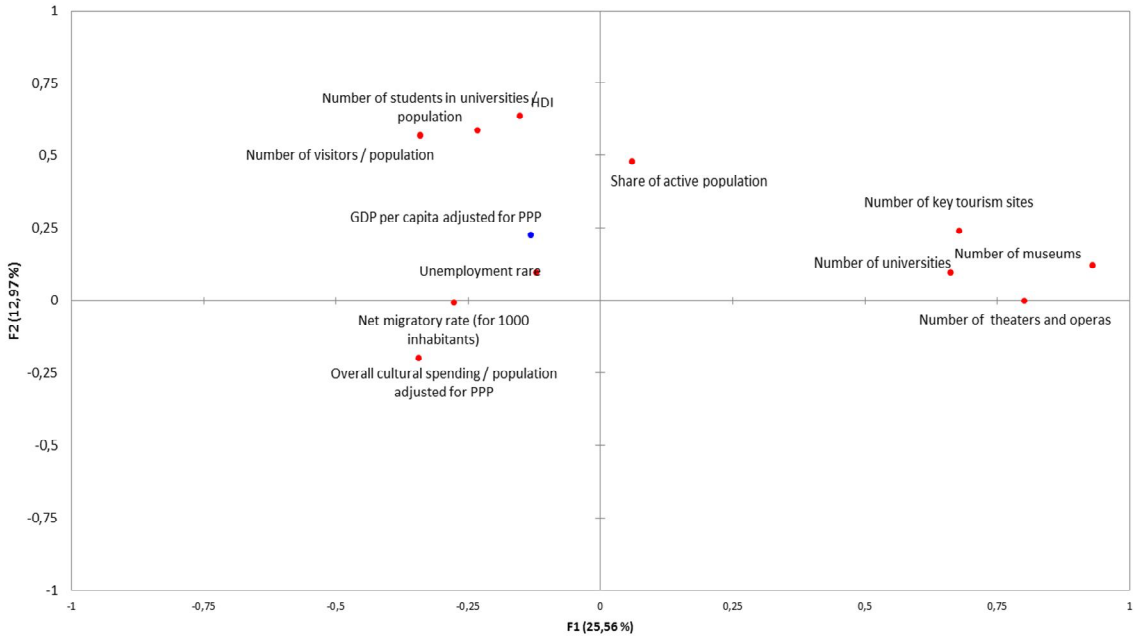
3.3 Carrying out a Primary Component Analysis for the HDI database

The descriptive analysis shows that public cultural spending per capita is opposed to HDI, the number of visitors and students, that quantity of work and unemployment rate. More, the number of key tourist sites, museums, universities, opera houses and theatres stave off the migratory flow. We see that the impact of public cultural spending

[6] All data comes from the « United Nations Development Programme » website.

remains negative, but to a lesser degree than before, with differences evening out. (cf. Diagram 4).

Diagram 4: Indicator changes based on retained axes



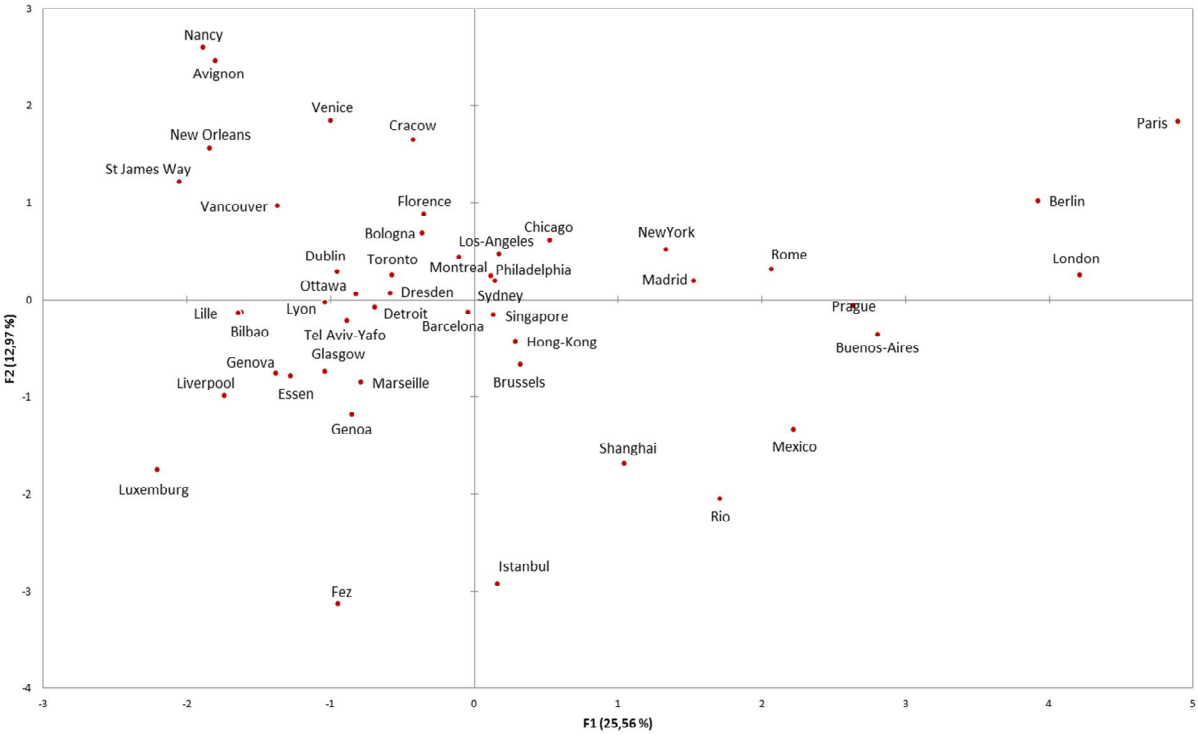
Source: Tera Consultants analysis

As a result, the sample's cities can be mapped into a new two-dimensional space where the axes are composed of factors providing a more diversified breakdown, and with a minimal loss of information (cf. Diagram 5).

Once again, Europe's key capitals can be found to the eastern side of the map (cf. Diagram 4). Latin American capitals and Asian cities are now more clearly based in the positive part of the F1 axis. Large North American cities are grouped in the center, while the smaller cities are in the negative part of the F1 axis. Using the HDI accentuates the differences observed with the GDP per capita indicator, and yet does not yield to a clear typology which can be applied to the entire sample.

The final analysis based on the HDI will further help city differentiation grouped in the map center. This confirms the need to enrich the database with new indicators to provide a clear statistical typology. First, it could be very useful to link each city with a well-defined HDI, much like the national HDI. Second, as stated previously, it is important to find one or more pertinent quantitative or qualitative indicators characterizing Culture and/or the economy and/or city sociology to detect a typology. Third, the database needs to add new cities.

Diagram 5: New city positions of the sample



Source: Tera Consultants analysis

4 Quantifying the impact of public cultural spending for GDP per capita

In the previous part, we used the Primary Component Analysis to describe the database. After applying the descriptive method to understand the city sample, we needed to better understand the interdependency of the eleven indicators. We therefore turned to an explanatory method using a linear regression. With this method, the objective is to find the significant statistic relationships between the database indicators, and not to list city typology.

So, we will focus on studying the relationship between a city's public cultural spending per capita and the GDP per capita/per city indicator as a means to generalize the casuistic observations to determine if an interrelation between these two indicators exists.

4.1 The methodology of the econometric analysis employed

To analyse the relation between GDP/inhabitant adjusted for PPP and the other indicators, we used the multivariate linear regression. The objective being to estimate a variable (the explained variable) using one or more variables (the explanatory). To do so, we sought to reproduce as best as possible, the variations being studied; meaning the variations which best represented the point clouds. The multivariate linear regression helps build more flexible models to explain the dependent variables.

The variable that we are seeking to explain here is the GDP per capita adjusted to purchasing power parity. It is best to correlate this indicator with the explanatory indicators characterising culture (the 6 cultural-intensity indicators included in this database).

The process of the linear regression used is both iterative and heuristic. When validating or using the model, backtracking is often required, based on the results obtained to check the solidity.

Generally speaking, if a sole indicator is retained as an explanatory variable, the GDP per capita, the explained variable, will be expressed as: «Constant + y_1 x (indicator 1) + an unknown given by other table columns». (cf. table 9 above).

Table 9 appears as follows: for indicator 1, there is a 90% chance that its value y_1 will be found in the interval [y_4 , y_5]. The percentage given by Pr > |t| means that there is P% of a chance that the sign of value y_1 is contrary to the result indicated. If this percentage is too high, the associated variable is not significant. If it is weak, the indicator is significant. The same holds true for the constant.

Table 9: Presenting the linear regression

Source	Value	Mean	t	Pr > |t|	Lower limit	Upper limit (90%)
Constant	x_1	x_2	x_3	< 0,01%	x_4	x_5
Indicator 1	y_1	y_2	y_3	P%	y_4	y_5

Source: Tera Consultants analysis

4.2 Analysing regressions of different GDP types on the variables characterising culture

We will start by reminding the reader what we are searching for. The variable explained is GDP per capita restated for Purchasing Power Parity which we are seeking to correlate with explanatory variables which are database indicators characterising culture. The four explanatory variables retained are: net migration rate, the number of visitors per capita, the number of cultural sites of all sorts (including universities) and overall public cultural spending per capita. Table 10 below presents the results for GDP linear regression for the four explanatory variables.

Table 10: Linear regression for GDP per capita applied to variables characterising culture: the correlation coefficient is 0.321

	Valeur	Ecart-type	t	Pr > |t|	Borne inf. (90%)	Borne sup. (90%)
Constant	31 226,49	5 404,88	5,78	< 0,0001	22 135,74	40 317,24
Net migratory rate (per 1000 inhabitants)	- 41,55	139,17	- 0,30	0,77	- 275,62	192,53
Number of visitors / population	166,72	246,47	0,68	0,50	- 247,83	581,27
Number of key turism sites de sites	12,99	27,97	0,46	0,64	- 34,05	60,03
Overall cultural spending/GDB PPP	920 150,00	##########	1,98	0,05	137 075,55	1 703 224,45

Source: Tera Consultants analysis

The indicators' lower values compared to the constant are normal, meaning that cultural indicators can explain only a small part of the GDP per capita in cities, since this variable is explained by other indicators which are not accounted for in this study and not present in the database. This first step is key since it indicates that statistically, only the variable linked to a city's public cultural spending per capita presents a significant correlation with the GDP per capita in PPP. The GDP regression with this sole explanatory variable is therefore justified and helps confirm this result (cf. table 11 below).

Table 11: Linear regression of the GDP per capita for overall public cultural expenses per capita – the correlation coefficient is 0.334

	Valeur	Ecart-type	t	Pr > |t|	Borne inf. (90%)	Borne sup. (90%)
Constant	33 960,84	3 030,10	11,21	< 0,0001	28 872,01	39 049,67
Overall cultural spending/GDB PPP	849 959,88	##########	1,95	0,06	117 135,95	1 582 783,81

Source: Tera Consultants analysis

This regression validates the previous result. Nevertheless, the relatively high correlation coefficient leads us to believe that the public cultural spending variable per capita could be correlated with a hidden variable which seems very probably in explaining GDP per city inhabitant.

To avoid this correlation with a hidden variable, the public cultural spending per capita may be replaced with another variable built for this purpose, namely the share of the city's public cultural spending per city-based GDP. The explanatory variables for the regression become the net migration rate, the number of visitors/inhabitants, the number of cultural sites of all types (including universities) and the share of cultural expenses in the GDP.

Table 12: Linear regression of the GDP per capita for the modified variables which characterise culture – the correlation coefficient is 0.006

Source	Valeur	Ecart-type	t	Pr > |t|	Borne inf. (90%)	Borne sup. (90%)
Constante	31 226,49	5 404,88	5,78	< 0,0001	22 135,74	40 317,24
Taux de migration net (pour 1000 habitants)	(41,55)	139,17	(0,30)	77%	(275,62)	192,53
Nombre de visiteurs / population	166,72	246,47	0,68	50%	(247,83)	581,27
Nombre total de sites	12,99	27,97	0,46	64%	(34,05)	60,03
Dépenses culturelles totales / PIB PPA	920 150,00	465 574,69	1,98	5%	137 075,55	1 703 224,45

Source: Tera Consultants analysis

This linear regression (cf. table 12) shows that only the overall public cultural spending variable per total GDP presents a significant correlation with a positive impact on GDP per capita. The regression between the GDP per capita and overall public cultural spending for total GDP helps confirm the previous result.

Table 13: Linear regression of the GDP per capita for overall public cultural spending / total GDP – the correlation coefficient is 0.057

Source	Valeur	Ecart-type	t	Pr > |t|	Borne inf. (90%)	Borne sup. (90%)
Constante	33 960,84	3 030,10	11,21	< 0,0001	28 872,01	39 049,67
Dépenses culturelles totales / PIB PPA	849 959,88	436 353,44	1,95	6%	117 135,95	1 582 783,81

Source: Tera Consultants analysis

Given the correlation coefficients and the error rates, the most precise linear regression is presented in Table 11.

The cultural expenses per capita for the sample's cities average to an annual 186 € PPP for an average GDP per inhabitant of 31 330€ PPP. Moving from this average, we see that the linear regression[7], pushes 10% cultural spending per capita of cities up 10%, or 18.6 €, is associated with a GDP value per capita which is greater than 1.7%, or 625.4 €.

In otherwards, this relation shows that across the sample of cities, the share of cultural expenses spent by the cities totals, on average, only 0.7% of the GDP per capita, yet these expenses are statistically correlated with about 9% of the GDP level per capita. The cultural spending consented by cities are, therefore, not only relevant to individual well-being and collectiveness, but to social welfare and appeal, they are also key markers for a city's economic dynamics. Cities committed to leading active cultural policies need to provide the appropriate budgets.

[7] The regression is: PIB/Hab. = 31 330 + [(33,665) x (a city's cultural spending/person.)]

5 Conclusion

These first statistical analyses using the Kurt Salmon database have furthered the knowledge of interdependence between the data. The iterative process of linear regression has shown the influence of total public cultural spending per capita for GDP per capita. A 10% rise in cultural spending per city inhabitant, or 18.6 €, is tied to a greater GDP value per capita of 1.7%, or 625.4 €.

This value, however, should be considered with much caution. The descriptive analysis put to light that to render the database more significant, and thus provide a study with a more precise impact, we needed to estimate missing data, as well as add more indicators, to show that cultural spending can logically drive a number of other indicators upwards. As stated in this study, the other indicators include professional and migratory factors and the number of visitors. We also need to add indicators revealing the very access to culture to offset the potential effects of compensation of indicators and which would blur the comparison between the cities. We nevertheless know that a rise in cultural spending per capita in a city has a positive leverage effect on GDP – we are, therefore, talking about an investment for economic development.

In short, these figures and values merely outline the interactions between Culture and Economy. The real difficulty lies in conceiving a precise model which will be our reality. At this stage, however, explaining reality is not entirely possible, and we need more information to understand the interactions and to set up public policies around Culture.

6 Appendix 1: Primary Component Analysis

The Primary Component Analysis projects a cloud of points of more than two dimensions on an optimized two-dimensional plan. The projection plan is optimal because, by construction, it retains the most information. The project helps visualise very simply the similarities and the difference of a population described by a large number of elementary characteristics.

To determine the projection of the cloud of points, the method correlates the indicators between one another and then ranks them in a table of ten columns and ten rows.

Table 14: Correspondances

	Indicators
Ind. 1	Labour forde/Population
Ind. 2	Unemployment rate
Ind. 3	Migration rate
Ind. 4	Number of tourists/population
Ind. 5	Number of major tourism sites
Ind. 6	Number of museums
Ind. 7	Number of theatres and operas
Ind. 8	Total public cultural spending/population PPPadjusted in USD
Ind. 9	Number of university students/population
Ind. 10	Number of universities
Ind. 11	GDP per capita PPP adjusted in USD

Table 15: The matrix correlating the indicators between one another

Variables	Ind. 1	Ind. 2	Ind. 3	Ind. 4	Ind. 5	Ind. 6	Ind. 7	Ind. 8	Ind. 9	Ind. 10	Ind. 11
Ind. 1	1	-0.081	0.002	0.074	-0.157	0.043	0.108	-0.126	0.216	0.158	-0.131
Ind. 2	-0.081	1	-0.139	-0.034	0.001	-0.040	-0.063	0.116	0.079	-0.094	0.167
Ind. 3	0.002	-0.139	1	0.273	-0.025	-0.238	-0.102	-0.023	-0.071	0.012	-0.046
Ind. 4	0.074	-0.034	0.273	1	0.091	-0.160	-0.145	-0.053	0.142	-0.136	0.069
Ind. 5	-0.157	0.001	-0.025	0.091	1	0.656	0.419	-0.140	-0.140	0.361	0.117
Ind. 6	0.043	-0.040	-0.238	-0.160	0.656	1	0.753	-0.201	-0.228	0.547	0.078
Ind. 7	0.108	-0.063	-0.102	-0.145	0.419	0.753	1	-0.199	-0.178	0.295	-0.133
Ind. 8	-0.126	0.116	-0.023	-0.053	-0.140	-0.201	-0.199	1	-0.039	-0.247	0.598
Ind. 9	0.216	0.079	-0.071	0.142	-0.140	-0.228	-0.178	-0.039	1	-0.221	0.008
Ind. 10	0.158	-0.094	0.012	-0.136	0.361	0.547	0.295	-0.247	-0.221	1	-0.118
Ind. 11	-0.131	0.167	-0.046	0.069	0.117	0.078	-0.133	0.598	0.008	-0.118	1

Source: Tera Consultants Analysis

Since the GDP restated per capita is the variable we are seeking to explain, it has been removed from the matrix. The diagonal nature of this matrix helps identify the characteriscs, deemed « primary » or the « factors » which are combinations of elementary characteristics. In our study, the elementary characteristics are the indicators. For example, a key characteristic 1 or « $\vec{F}1$ »expresses itself based on indicators 1, 2, 3, etc., or, $\vec{Ind}1$, $\vec{Ind}2$, $\vec{Ind}3$, etc. as:

$$\vec{F}1 = 2,3 \times \vec{Ind}1 - 0,7 \times \vec{Ind}2 + 3,5 \times \vec{Ind}3 + \ldots$$

The key characteristic $\vec{F}1$ can also be expressed in the base of the vectors of elementary characteristics:

$$\vec{CP}1 = \begin{pmatrix} 2,3 \\ -0,7 \\ 3,5 \\ \ldots \end{pmatrix}$$

In this case, two vectors of the key characteristics are built by analysis as the main correspondence to handle more than 42% of the information on differences amongst the cities[8]. The 2 vectors of the key characteristics can be expressed in the database of the ten elementary characteristics. The most structured characteristics, called F1, points to 28% of the differences. The second vector of principal characteristics, called F2, helps improve this percentage by 14%, and therefore brings total handled information to 42% for the information included in the database.

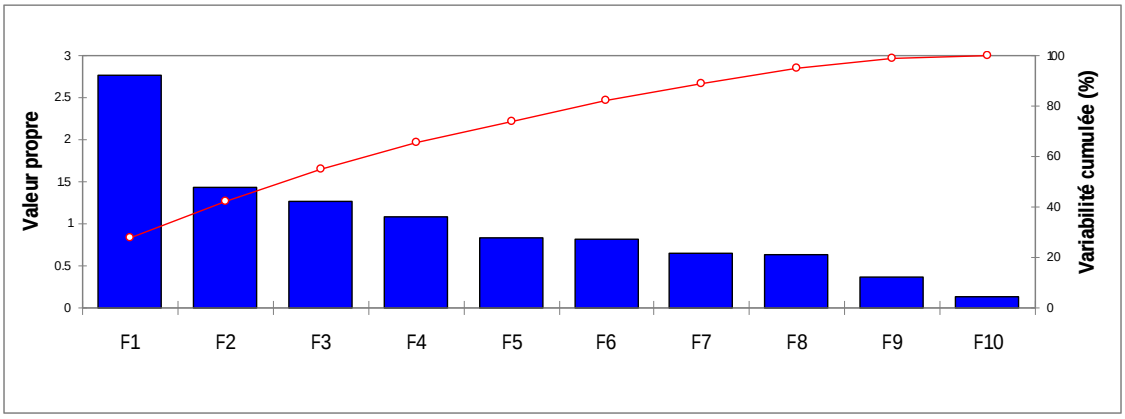
Table 16: Real values and percentages regarding the intertia of real vectors

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Real value	2,772	1,428	1,273	1,089	0,836	0,821	0,658	0,626	0,367	0,129
Variability (%)	27,717	14,283	12,729	10,894	8,359	8,213	6,580	6,262	3,673	1,290
Cumulated %	27,717	42,000	54,729	65,623	73,983	82,195	88,775	95,037	98,710	100,000

Source: TERA Consultants analysis

[8] The synthetic indicator which represents conserving information to define vectors of principal characteristics is adjusted inertia.

Diagram 6: Cumulated variability for each factor



Source: Tera Consultants analysis

Building the vectors of principal characteristics was for the most part influenced by certain elementary characteristics. The table below shows the contributions to build these vectors and their elementary characteristics.

Table 17: How the indicators contribute to building the axes

Variables	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Ind. 1	0.078	18.247	30.278	3.117	26.878	0.421	0.800	3.992	16.188	0.000
Ind. 2	0.404	13.22	2.743	30.783	13.300	35.753	3.783	0.001	0.012	0.004
Ind. 3	1.187	20.750	25.37	0.314	9.638	3.861	5.105	31.056	0.222	2.498
Ind. 4	1.521	24.395	5.694	27.6	0.297	2.816	0.069	27.847	9.755	0.010
Ind. 5	18.242	0.045	5.327	18.146	0.457	1.731	6.824	1.375	39.857	7.997
Ind. 6	31.507	0.346	0.339	1.202	0.273	2.037	0.050	0.024	0.841	63.382
Ind. 7	22.172	0.000	0.909	0.192	0.577	6.512	34.87	2.174	11.911	20.681
Ind. 8	4.141	15.873	2.804	0.107	38.773	30.400	5.679	0.97	1.188	0.066
Ind. 9	4.173	4.790	26.531	14.645	3.750	3.555	6.101	32.510	3.897	0.047
Ind. 10	16.574	2.337	0.005	3.897	6.058	12.914	36.718	0.051	16.128	5.3159

Source : Analyse Tera Consultants

Table 18: Coordinates of real vectors associated with the indicators

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Ind. 1	0.0279	0.427	0.550	-0.177	0.518	-0.065	-0.089	-0.200	0.402	-0.002
Ind. 2	-0.064	-0.364	0.166	0.555	0.365	0.598	-0.195	-0.003	-0.011	0.006
Ind. 3	-0.109	0.456	-0.5	-0.056	0.310	0.196	-0.226	0.557	0.047	0.158
Ind. 4	-0.123	0.494	-0.239	0.525	0.054	-0.168	0.026	-0.528	-0.312	0.010
Ind. 5	0.427	0.021	-0.231	0.426	-0.068	-0.132	0.261	0.117	0.631	-0.283
Ind. 6	0.561	-0.059	0.058	0.110	0.052	-0.143	-0.022	0.016	-0.092	0.796
Ind. 7	0.471	0.002	0.095	0.044	0.076	-0.255	-0.59	0.147	-0.345	-0.455
Ind. 8	-0.203	-0.398	-0.167	0.033	0.623	-0.551	0.238	0.098	-0.109	-0.026
Ind. 9	-0.204	0.219	0.515	0.383	-0.194	-0.189	0.247	0.570	-0.197	0.022
Ind. 10	0.407	0.153	0.007	-0.197	0.246	0.359	0.606	0.023	-0.402	-0.231

Source: Tera Consultants analyses

Each indicator's weight is calculated based on how the axes are built in the space as vectors associated with indicator F. Based on the selected indicators, the indicators' coefficient vary. This explains the importance of choosing the best variables, since the more diversified the field, the better the diversity. Coefficients are weights associated with each indicator for a given indicator integrated with the GDP.

7 Appendix 2: City rankings per GDP and HDI

Ville	Rang par rapport au PIB	Rang par rapport à l'IDH	Différence entre le rang du PIB et rang de l'IDH
Dublin	4	34	-30
Luxembourg	3	33	-30
Londres	5	34	-29
Glasgow	10	34	-24
Bruxelles	2	22	-20
Genève	1	14	-13
Rome	15	28	-13
Bologna	17	28	-11
Bilbao	16	23	-7
Florence	22	28	-6
Essen	6	11	-5
Prague	35	39	-4
Dresden	9	11	-2
Lyon	13	15	-2
Santiago de	21	23	-2
Istanbul	43	44	-1
Liverpool	33	34	-1
Mexico	41	42	-1
Paris	14	15	-1
Singapore	37	38	-1
Venice	27	28	-1
Fès	46	46	0
Krakow	40	40	0
Shangai	45	45	0
Buenos-Aire	42	41	1
Madrid	24	23	1
Rio	44	43	1
Genoa	31	28	3
NewYork	7	2	5
Barcelona	30	23	7
Sydney	8	1	7
Tel Aviv-Yaf	23	15	8
Philadelphia	11	2	9
Chicago	12	2	10
Hong-Kong	39	27	12
Ottawa	19	7	12
Marseille	28	15	13
Berlin	25	11	14
Detroit	18	2	16
Avignon	32	15	17
New Orlean	20	2	18
Lille	34	15	19
Toronto	26	7	19
Montreal	29	7	22
Nancy	38	15	23
Vancouver	36	7	29