

Industrial Inequality: a Non-Parametric Approach to the Colombian Case*

Desigualdad industrial:
una aproximación no-paramétrica
al caso colombiano

Andrés Camacho Murillo**

Recibido: 3 de Julio de 2013
Aprobado: 28 de Agosto de 2013

Abstract

From the last unforgettable economic downturn in Colombia in 1999, plenty of researchers have evidenced an astonishing recovery in the GDP's growth rate; however, the expectation of a healthy economy has not been yet reached by other indicators which, inevitably, raise doubts about an economic miracle. In this article, the unveiled reality of the industrial revenue concentration in the Colombian economy is explored. From

* Cómo citar este artículo: Camacho, A. (2013). Industrial Inequality: a Non-Parametric Approach to the Colombian Case. Revista CIFE, 15(23). pp. 107-122.

* Faculty of Economics, Universidad Santo Tomás. Member of the research group on Productivity and Competitiveness CIFE.

a total of six years over the period 2000 to 2010 (in alternate numbers) with more than nine thousand firms studied for each year, two non-parametric models are applied in discrete time: Gini index (G), and the Herfindahl-Hirshman Index for regions ($HHIR$). The outcome shows a high G of 0,73 for the whole industrial sections, and a $HHIR$ of 0,49.

Keywords: Industrial concentration, Gini index, Herfindalh-Hirshman index, industrial inequality.

Classification JEL: L11, R32

Resumen

Desde la última inolvidable caída de la economía Colombiana en 1999, un número importante de investigadores han evidenciado una asombrosa recuperación en la tasa de crecimiento del PIB; sin embargo, las expectativas de una economía saludable no han sido alcanzadas aun con otros indicadores que, inevitablemente, crean dudas sobre el milagro económico. En este artículo se explora la realidad no revelada de la concentración del ingreso industrial en la economía colombiana. Para un total de 6 años (desde el año 2000 hasta el 2010, números pares), y más de diez mil empresas estudiadas por año, dos modelos no paramétricos son estimados en tiempo discreto: el índice Gini (G), el índice de Disimilaridad (DI) y el índice Herfindalh-Hirshman para regiones ($HHIR$). El resultado muestra un alto G de 0,65 para todas las secciones industriales, un DI de 0,61, y un $HHIR$ de 0,49.

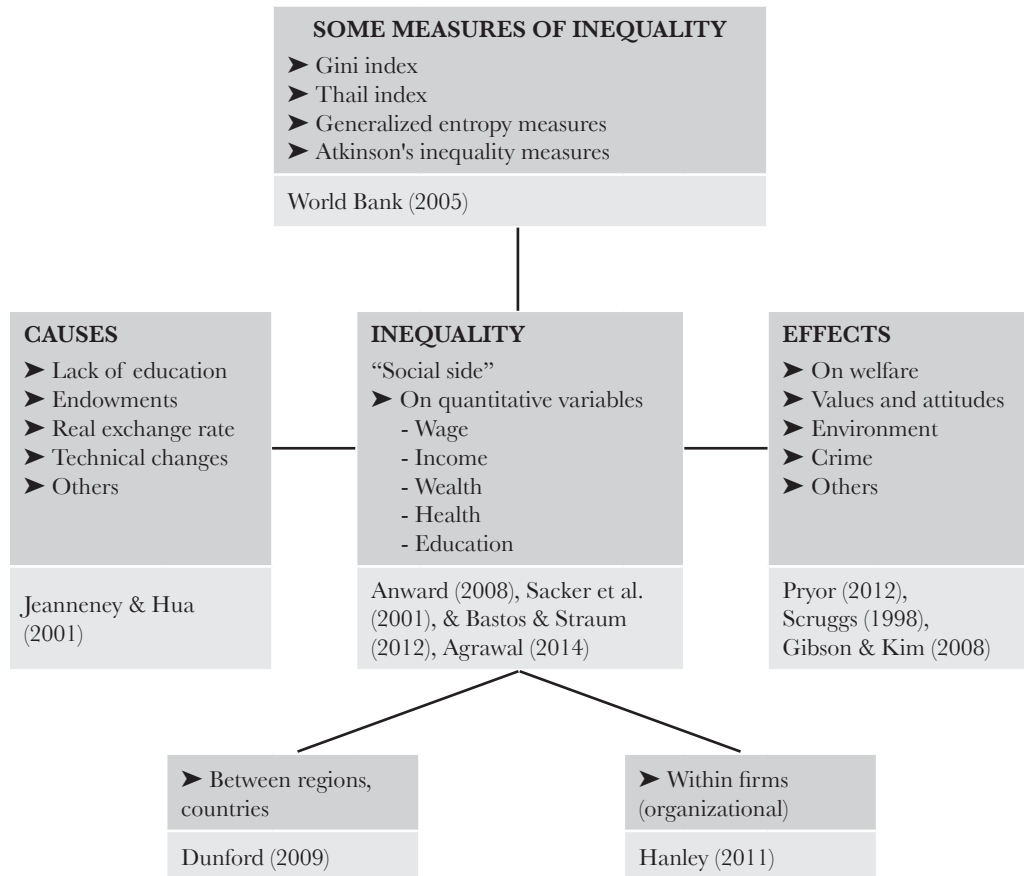
Palabras clave: Industrial concentration, Gini index, Herfindalh-Hirshman index, industrial inequality.

Clasificación JEL: L11, R32

1. Introduction

The word inequality has been studied from a variety of perspectives all over the world, especially linked to human beings' associated variables (see figure 1). The most common indices of inequality such as Gini, Thail, generalized entropy, and Atkinson's inequality (World Bank, 2005) have been widely used to capture the relative poverty among people, or what is called income inequality. It has also been used to compute inequality in wages, wealth, health, education, (Anward, 2008; Sacker, et al., 2001; Bastos & Straum, 2012; Agrawal, 2014), regional asymmetry (Dunford, 2009), and within-firm organizational structures (Hanley, 2011). Causes of inequality have often been hypothesized to lie mainly on personal endowment, exchange rate, technical changes, lack of education and so forth (see Jeanneney & Hua (2001), Weil, 2009), and its effects are deemed to be held on welfare, values, crime, the environment, among others. (Pryor, 2012; Scruggs, 1998; Gibson & Kim, 2008).

Figure 1. Main research angles of studies in inequality.



In spite of this variety of research on social inequality, there are a few studies done on inequality between companies and industries using these tools. The exceptions found in the literature review compute the traditional concentration indices such as Herfindalh-Hirshman index (HHI), Lerner index¹, and sales-concentration index, together with the Gini/Thail index, e.g. Coelho, De Rezende & De Oliveira (2013) for exports of forest products at international level, Kaminski (2012) for the Polish sector of power generation, Liao (2010) for the Chinese construction industry, and Papatheodorou & Arvanitis (2009) for airport concentration in Greece are some of them.

Notwithstanding, most of the studies done globally take into account specific industries for the research purpose, but none of them analyze the whole economy to capture intra-industry asymmetries, to thereafter do inter-industry comparisons. Moreover, none of them includes regional asymmetries between firms at national level using the Herfindalh-Hirshman index; an important matter to be highlighted in industrial inequality studies.

Nowadays, computations about industrial inequality may be regarded as another tool for understanding social inequality in developing countries, since small firms, mainly owned by unskilled businessmen (or with few level of innovation) can hardly compete against medium and large companies, where multinational corporations (MNC) are part of the game. This matter may be the Colombian case, where some do not understand why the social Gini index still remains high (about 0,55 according to the World Bank's statistics, or even close to 0,59 according to Londoño y Alvarado, cited by Galindo, 2014) in spite of having a GDP growth averaging 4 % in the last 12 years; perhaps the problem can also be explained from the supply side: the industrial inequality².

This research attempts to measure the inequality between firms in each industrial section, taking account of their operational revenues. The studied period covers a decade between 2000 and 2010 (in alternate numbers). Roughly, 15 000 firms per annum were included in the research. Data was collected from "Superintendencia de Sociedades", a Colombian institution in charge of overseeing the real economic sector performance, and also from the National Administrative Department of Statistics (DANE). Two non-parametric models are applied in discrete time, in order to observe the industrial revenue distribution between them (by total and by regions): the Gini index, and the Herfindalh-Hirschman index for regions.

-
- 1 Although Lerner index works when measuring monopoly power, it is also available to estimate market power and industrial concentration through some changes and assumptions.
 - 2 Abaker & Salih (2011) found for the Sudan case, that the Gini index among industrial employees is roughly 55%, and that the majority of poor workers are based on growing industries such as water, buildings and manufacturing industries

The work is organized as follows, being the introduction the first part. The second part provides an explanation of data sources, and also an overview of data behavior in the studied period. The third part shows a description of the non-parametric models to be estimated for the industrial inequality outcomes. The last part sums up the results of the study, and give some remarks for future research.

2. Estimates of Industrial Revenue Inequality

Data source

In order to estimate the level of revenue inequality between firms among different industries, the study uses data from Superintendencia de Sociedades de Colombia (SS), institution in charge of supervision of the real economic sector performance. The study period is between 2000 and 2010 –just alternate years– for a total of 6 years. The number of firms to be accounted on the study is as follow: 9 382 firms in 2000, 8 778 firms in 2002, 9.180 firms in 2004, 21 999 firms in 2006, 20. 657 firms in 2008, and 20 865 in 2010. The number of per annum observations was got after cleaning the database (to avoid data inconsistency); that is, after dropping firms without reported revenues and/or fixed assets, or with values close to zero.

A total of 15 industrial sections were studied (see table 1). They are standardized by the Department of Statistics in Colombia, based on the International Standard Industrial Classification of All Economic Activities (ISIC Rev. 3 A.C). Both extra-territorial organizations & bodies (letter Q), and Public administration, defense & compulsory social security (letter L) were taken out of the study, as there is no enough available data. Furthermore, all Colombian regions were analyzed for each industrial section; however, data input varies as some industrial activities do not exist or are not reported in certain regions.

Table 1. ISIC Rev. 3 A.C at section level

	Section		Section
A	Agriculture, hunting and forestry	J	Financial intermediation
B	Fishing	K	Real estate, renting and business activities
C	Mining and quarrying	M	Education
D	Manufacturing	N	Health and social work
E	Electricity, gas and water supply	O	Other community, social and personal service activities
F	Construction	P	Private households with employed persons

	Section		Section
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	Q*	Extra-territorial organizations & bodies
H	Hotels and restaurants	L*	Public administration, defence & compulsory social security
I	Transport, storage and communications		

Source: United Nations Statistics Division (ISIC Rev 3.), and Superintendencia de Sociedades de Colombia

* They were taken out from the study, as there is no enough available data

Data analysis: an introductory image

Since 2000, a year after the Colombian economic downturn, the country has demonstrated an outstanding economic growth rate averaging 4 %. According to the World Bank's figures, the period 2005-2007 can be placed at the forefront, as the real GDP growth reached the most remarkable rates Colombians had ever seen: 5,2 %, 6,2 %, and 8,2 %, respectively. The results were accompanied with an increase in the number of firms in the country (from roughly 9 to 21 thousand, according to the figures released by Superintendencia de Sociedades, SS), with an astonishing growth in value added that ended at COP \$384 billion (after being at COP\$261 billion in 2000), and also with an undeniable surge of the firms' operational revenues which reached COP \$272 billion in 2010 (in constant price of 2005).

In regards to some sectorial figures (see table 2), according to DANE (stands for the National Administrative Department of Statistics) the value added was mainly concentrated on financial establishments, insurance companies, real estate and enterprise services (21,06 %), followed by the social and personal services sector (17,50 %), the manufacturing sector (15,04 % average), retail, wholesale trade, reparation, restaurants and hotel sector (12,99 %). Moreover, the number of establishments was found to be higher in the last two sectors.

Table 2. Number of establishments by industries
(at section level) and % share of revenues

ISIC Rev 3	SECTION	Value added (% share)	# of firms (Average) 00 - 10	# of firms (Abs Change) 00 - 10	Revenue (% share)
A	Agriculture, hunting and forestry	8,21 %	1040	540	2,85 %
B	Fishing		32	7	0,14 %
C	Mining and quarrying	7,24 %	233	158	7,09 %

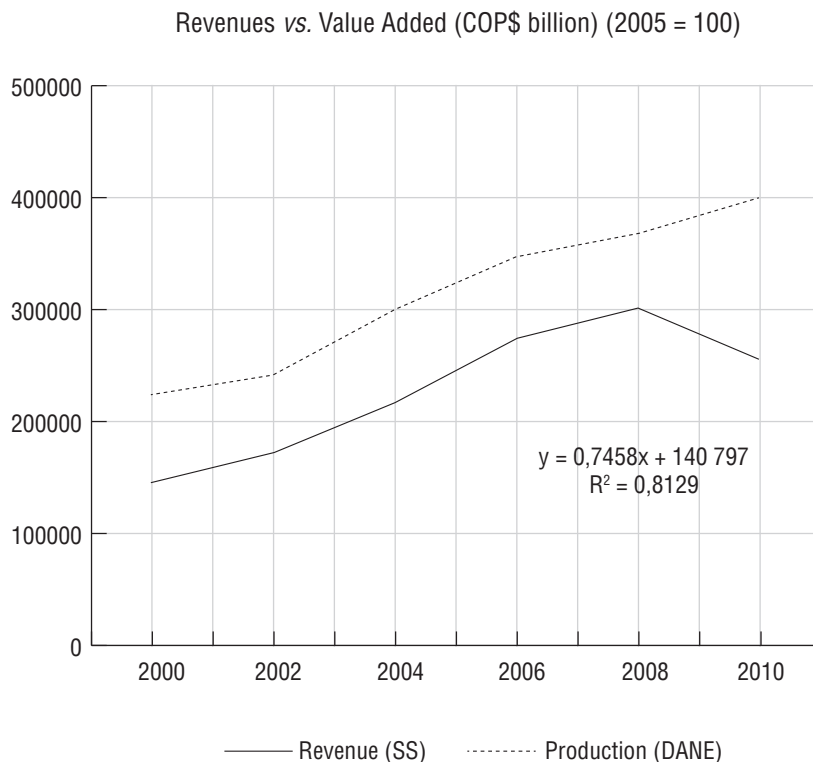
ISIC Rev 3	SECTION	Value added (% share)	# of firms (Average) 00 – 10	# of firms (Abs Change) 00 – 10	Revenue (% share)
D	Manufacturing	15,04 %	3392	2018	36,03 %
E	Electricity, gas and water supply	4,34 %	54	98	0,14 %
F	Construction	6,05 %	1211	816	4,04 %
G	Wholesale and retail trade; repair of motor vehicles,...	12,99 %	4721	4748	37,66 %
H	Hotels and restaurants		297	250	0,81 %
I	Transport, storage and communications	7,56 %	657	261	4,00 %
J	Financial intermediation		791	61	2,16 %
K	Real estate, renting and business activities	21,06 %	2271	2185	3,36 %
M	Education		75	104	0,09 %
N	Health and social work		60	48	0,57 %
O	Other community, social and personal service activities	17,50 %	304	180	1,05 %
P	Private households with employed persons		7	9	0,03 %

Data Sources: Superintendencia de Sociedades de Colombia, and DANE

The revenues reported by the SS seems to be concentrated, overall, in the manufacturing industries, as well as retail and wholesale trade (37 % for each one, approximately); however, doing some approaches in per-firm terms (average revenues over average number of establishments), the revenue concentration holds on the extractive sector (33 % of the total average revenue per-firm). It is worthy of saying that SS requests income statements from a range of supervised and controlled establishments every year, according to some national laws.

Comparing the figures released by both institutions; that is, the sectorial value added published by DANE against the figures of firm revenues published by SS, it gives the idea that they are highly correlated after being deflated (the correlation coefficient is 0,82), and also that the gap between both data sets is getting lower through the time (see chart 1). This previous data review is very important for the sake of the outcomes, as it will give signals of the whole economy in a more accurate way (see chart 4).

Chart 1. Data comparison (Sectorial value added Vs firm revenues)



Source: DANE (Sectorial value added), Superintendencia de Sociedades de Colombia

3. Modelling

The study follows two non-parametric techniques in discrete time to obtain the outcomes: the traditional Gini index, and the Herfindalh-Hirshman index for regional-industry revenues. The first one captures revenue asymmetry between firms at industry-section level for the whole country, and the second one shows industry revenue asymmetry from regional approaches.

3.1 Gini index

Gini index is one of the most used methods to capture inequality; in words of the World Bank (2005):

“It is based on the Lorenz curve, a cumulative frequency curve that compares the distribution of a specific variable (e.g. income) with the uniform distribution that represents equality” (p.97)

The following Gini equation will be the baseline to shows a discrete measure of revenue concentration in the Colombian industries.

$$G_j = 1 - \sum_{i=1}^n (\theta y_i + \theta y_{i-1}) (\theta x_i - \theta x_{i-1})$$

Where:

G_j : Gini index for industrial section j . The results are held between 0 and 1 ($1 \geq G_j \geq 0$). If the outcome is close to 1, the revenue distribution between firms is highly asymmetric.

$$\theta y_i = \frac{y_i}{\sum_{i=1}^n y_i} \text{ where } \mathcal{Y}_i \text{ is the cumulative firm revenues}$$

$$y_i = \sum_{i=1}^1 \sum_{n=1}^{10} s_n$$

Therefore, s_n stands for the firm revenues in each i th decile. Each industrial section was split into 10 groups of equal frequency. Thus $i = 1, 2, \dots, 10$

For the X axis the cumulative number of firms is presented:

$$\theta x_i = \frac{x_i}{\sum_{i=1}^n x_i}$$

$$x_i = \sum_{i=1}^1 \sum_{n=1}^{10} f_n$$

Thus f_n stands for firms in each i th decile.

In order to approach the outcomes to a more accurate estimation, the Gini index computed for the whole economy \bar{G} is the weighted Gini index from each industrial section. The weight was given based on the number of firms in each industrial section. Therefore:

$$\bar{G} = \sum_{j=1}^M \left(G_j \cdot \frac{f_j}{\sum_{j=1}^M f_j} \right)$$

Where:

\mathcal{J} : industrial sections

F_j : Number of firms in the j -th industrial section of the economy

G_j : Estimated Gini Index for each industrial section j

3.2 Herfindahl-Hirshman index for regional concentration

The Herfindahl-Hirshman index applied for industrial-revenue concentration at regional level (R^j), is similar in structure to the traditional HHI; nonetheless, the R index accounts for sale concentration of the i -th industry in each Colombian region r . Thus:

$$R^j = \sum_{r=1}^M (x^{rj})^2 = (x^{1j})^2 + (x^{2j})^2 + \dots + (x^{Mj})^2$$

Where:

$$x^{rj} = \sum_{i=1}^n \varnothing_i^{rj}$$

$$\varnothing_i^{rj} = \frac{S_i}{\sum_{i=1}^n S_i} \forall i \in j, r; j = j_1, \dots, j_J; r = r_1, \dots, R$$

$j = 1, 2, \dots, J$ Industrial sections

$r = 1, 2, \dots, R$ Regions (Departments in Colombia)

$i = 1, 2, \dots, N$ Firms that belong to the analyzed industry

Therefore, X^{rj} is the sum of shares \varnothing_i^{rj} , which is in turn the sale share of the i -th firm on the total industry sales j in the region r . The result stands on between 0 and 1 ($1 \geq R_j \geq 0$), and the higher the index is, the higher the sale concentration is at regional level.

4. Results

The outcomes shown in table 3 summarize both the results for the whole economy and for each industrial section. Overall, it is possible to say that the industrial Gini index in Colombia is average 0,7396. The three most revenue-asymmetric industries are, in order: Financial Intermediation, Mining and Quarrying, and Health and Social Work; the less asymmetric (but still highly asymmetric) are Private Households with Employed Persons and Education.

Moreover, the chart displays a dramatic regional concentration for the whole industrial sections that reaches the value of 0,4917. The most regionally concentrated industries are Mining and Quarrying; and Transport, Storage and Communication.

Table 3. Average Gini index, Dissimilarity index and regional HHI

	Section	Average # Establish	% share Establish	Gini	Dissimi	HHI Region
A	Agriculture, hunting and forestry	1 040	0,07	0,7234	0,5837	0,2754
B	Fishing	32	0,00	0,7417	0,6442	0,6264
C	Mining and quarrying	233	0,02	0,8269	0,7097	0,7676
D	Manufacturing	3 392	0,22	0,7703	0,6433	0,2529
E	Electricity, gas and water supply	54	0,00	0,6211	0,4801	0,4560
F	Construction	1 211	0,08	0,7093	0,5751	0,3149
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	4 721	0,31	0,7706	0,6419	0,3785
H	Hotels and restaurants	297	0,02	0,6904	0,5492	0,3809
I	Transport, storage and communications	657	0,04	0,8088	0,6222	0,6848
J	Financial intermediation	791	0,05	0,8509	0,7460	0,5006
K	Real estate, renting and business activities	2 271	0,15	0,7850	0,6681	0,5203
M	Education	75	0,00	0,6449	0,5508	0,4928
N	Health and social work	60	0,00	0,8135	0,7525	0,5197
O	Other community, social and personal service activities	304	0,02	0,7670	0,6301	0,6093
P	Private households with employed persons	7	0,00	0,5704	0,4400	0,5947
	Average 00-10	15 144	1,00	0,7396	0,6158	0,4917

Source: the author based on data from Superintendencia de Sociedades de Colombia

The reasons why industrial inequality exists may be found in Industrial Organization theories, as well as administrative theories targeting competitiveness. For example, Lall & Chakravorty (2005) found that one reason of revenue inequality in India is the existence of spatial inequality (location). In their view, the main caveat is when new private industrial investments are usually thought to be placed on existing industrial areas due to beneficial cost structures.

Other scholars have focused on the determinants of regional inequality. They have suggested that socio economic factors such as inward FDI, trade flows, decentralization,

urbanization, education levels, human capital, public investment, factorial productivity, and population growth are among the explanatory variables. They have also affirmed that geographic factors such as location and topography are part of the determinants (Li & Fang, 2013).

On the other hand, when reviewing the Gini index through the period (table 4), it is possible to see that the industrial revenue asymmetry has been growing slightly, moving from 0,74 in 2000 to 0,79 in 2010. These results may demonstrate that in spite of having a growing number of firms in the country (as was shown previously), the market power of some firms in each industrial section is getting higher. An exception is held on the revenues of the education sector, where Gini index has plummeted from 0,76 to 0,57.

Table 4. Industrial revenue concentration 2000-2010 (Total)

	Section	2000	2002	2004	2006	2008	2010	Average
A	Agriculture, hunting and forestry	0,6938	0,6938	0,7118	0,7297	0,7466	0,7646	0,7234
B	Fishing	0,7433	0,7044	0,7280	0,7828	0,7263	0,7655	0,7417
C	Mining and quarrying	0,8201	0,7925	0,8122	0,7433	0,9090	0,8844	0,8269
D	Manufacturing	0,7414	0,7390	0,7259	0,7942	0,7967	0,8243	0,7703
E	Electricity, gas and water supply	0,5288	0,5880	0,4924	0,6393	0,7262	0,7519	0,6211
F	Construction	0,7305	0,6800	0,7575	0,7002	0,6887	0,6989	0,7093
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	0,7286	0,7252	0,8047	0,7747	0,7829	0,8076	0,7706
H	Hotels and restaurants	0,6307	0,6225	0,6646	0,7189	0,7288	0,7770	0,6904
I	Transport, storage and communications	0,7948	0,7846	0,7423	0,8304	0,8390	0,8619	0,8088
J	Financial intermediation	0,8397	0,8995	0,8345	0,8497	0,8536	0,8287	0,8509
K	Real estate, rental and business activities	0,7900	0,7908	0,8003	0,7719	0,7832	0,7738	0,7850
M	Education	0,7653	0,7343	0,5057	0,6815	0,6045	0,5782	0,6449
N	Health and social work	0,8462	0,8553	0,6152	0,8647	0,8474	0,8521	0,8135
O	Other community, social and personal service activities	0,7320	0,7549	0,6995	0,7920	0,8027	0,8212	0,7670
P	Private households with employed persons	0,4077	0,2307	0,6034	0,6251	0,6792	0,8765	0,5704
	weighted average	0,7497	0,7524	0,7659	0,7728	0,7808	0,7969	0,7396

Source: author's estimations based on data from Superintendencia de Sociedades de Colombia

Furthermore, the industrial concentration at regional levels –from 2000 to 2010– has fluctuated around 0,50 (table 5). Some industrial sections have increased the size of inequality; among them: Mining and Quarrying; Electricity, Gas and Water Supply; Transport, Storage and communications. Again, the Education sector is the only one that gives signals of improvement.

Table 5. Industrial revenue concentration 2000-2010 at regional levels

	Section	2000	2002	2004	2006	2008	2010	Average
A	Agriculture, hunting and forestry	0,2800	0,2647	0,2990	0,2895	0,2517	0,2674	0,2754
B	Fishing	0,5580	0,6968	0,6878	0,5725	0,6179	0,6253	0,6264
C	Mining and quarrying	0,7105	0,6277	0,6183	0,8742	0,8672	0,9075	0,7676
D	Manufacturing	0,2868	0,2550	0,2715	0,2512	0,2294	0,2232	0,2529
E	Electricity, gas and water supply	0,2728	0,5317	0,4735	0,4804	0,4472	0,5303	0,4560
F	Construction	0,3736	0,3891	0,2825	0,3080	0,2857	0,2507	0,3149
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	0,3530	0,3410	0,5135	0,3571	0,3336	0,3728	0,3785
H	Hotels and restaurants	0,3557	0,3579	0,3935	0,3630	0,4074	0,4081	0,3809
I	Transport, storage and communications	0,5388	0,6622	0,6105	0,7375	0,7505	0,8094	0,6848
K	Real estate, rental and business activities	0,5419	0,5405	0,5369	0,5143	0,4969	0,4913	0,5203
M	Education	0,6939	0,6004	0,5415	0,3671	0,4444	0,3098	0,4928
O	Other community, social and personal service activities	0,5559	0,6423	0,5025	0,6047	0,6857	0,6648	0,6093
P	Private households with employed persons	0,5204	0,6064	0,8414	0,5514	0,4853	0,5634	0,5947
	Average	0,4734	0,5009	0,5176	0,4815	0,4842	0,4922	0,4917

Source: author's estimations based on data from Superintendencia de Sociedades de Colombia

5. Conclusion

The study of the industrial concentration among all Colombian economic sectors has unveiled two main real issues to be addressed in future. Firstly, the astonishing revenue inequality observed in the whole economy from 2000 to 2010 –reaching an average Gini index value of 0,73– in spite of the permanent economic growth, which for many it is the pride of a healthy economy; secondly, the undebatable regionally industrial concentration, that stopped on 0,49 average.

The main reasons of industrial inequality given by the theory –to be tested for the Colombian case in forthcoming researches– lie on Industrial Organization thesis, as well as managerial statements; among them, the existence spatial inequality, lack of factorial productivity, concentration of investment (and trade) in certain industries and regions, high-regionally unequal population growth, governmental preferential policies, Special Economic Zones, and so forth.

Certainly, some questions for future researches arise. For instance, from an industrial organization point of view, what could be the main economic determinants of this industrial asymmetry in Colombia? Might industrial inequality be one of the reasons for the social inequality existence in Colombia (and even in high-Gini index countries)? What kind of industrial public policies should be set up to minimize this inequality?

6. Bibliography

- Abaker & Salih (2011). Poverty and inequality in industrial sector of Sudan, *Scholarly Journal of Business Administration*, Vol. 1(4) pp. 83-88.
- Agrawal, T. (2014). Educational inequality in rural and urban India. *International Journal of Educational Development*, 34, 11-19.
- Anward, S. (2008). Factor mobility, wage inequality and welfare. *International review of economics & Finance*, volume 17, issue 4, October, p.495-506
- Bastos, P., & Straume, O. R. (2012). Globalization, product differentiation, and wage inequality. *Canadian Journal of Economics/Revue canadienne d'économique*, 45(3), 857-878.
- Coelho, De Rezende & De Oliveira (2013). Concentration of world exports of forest products [concentração das exportações mundiais de produtos florestais], *Ciencia Florestal*, 23 (4), pp. 691-701.
- Dunford, M (2009). Regional inequalities. *International Encyclopedia of Human Geography*, p.236-245
- Galindo, M. (2014, May 17). La Desigualdad no es como la pintan...es peor. *El Tiempo*. Retrieved from <http://www.eltiempo.com>
- Gibson, J & Kim, B. (2008). The effect of reporting errors on the cross-country relationship between inequality and crime. *Journal of Development economics*, volume 87, issue 2, October, p. 247-254
- Hanley, C. (2011). Investigating the organizational sources of high-wage earnings growth and rising inequality. *Social science research*, volume 40, issue 3, may, p. 902-916
- Jeanneney, S. & Hua, P. (2001). How does real exchange rate influence income inequality between urban and rural areas in China? *Journal of development Economics*, volume 64, issue 2, april, p.529-545
- Pryor, F. (2012). The impact of income inequality on values and attitudes. *The journal of socio-Economics*. Doi: 10.1016/j.socec.2012.04.022
- Kaminski, J. (2012). The development of market power in the Polish power generation sector: A 10-year perspective, *Energy Policy*, 42, pp. 136-147
- Lall & Chakravorty (2005). Industrial Location and Spatial Inequality: Theory and Evidence from India. *Review of Development Economics*, 9(1), 47-68, 2005

- Li, G. & Fang, C. (2013). Analyzing the multi mechanism of regional inequality in China. Berlin, Germany: Springer-Verlag Berlin Heidelberg
- Liao, Y. (2010). The concentration ratio of China construction industry market, 2010 International Conference on Management and Service Science, MASS 2010, art. no. 5577404.
- Papathodorou, A., & Arvanitis, P. (2009). Spatial evolution of airport traffic and air transport liberalisation: the case of Greece. *Journal of Transport Geography*, 17(5), 402-412.
- Sacker A. et al. (2001). Dimensions of social inequality in the health of women in England: Occupational, material and behavioral pathways, *Social sciences and medicine*, volume 52, issue 5, march, p.763-781
- Scruggs, L. (1998) Political and economic inequality and the environment. *Ecological economics*, volume 26, issue 3, September, p. 259-275
- Weil, D. (2009). *Economic growth* (2nd ed.). Boston, MA: Pearson education, Inc.
- World Bank (2005). *Introduction to poverty analysis*. The World Bank Institute. Retrieved <http://siteresources.worldbank.org/PGLP/Resources/PovertyManual.pdf>

7. Acknowledgement

The author wants to acknowledge the support given by some research assistants from Universidad Santo Tomás, as well as by Solangy Melo Torres, independent researcher. Thanks to Dr. Leo Roche for his useful suggestions.