COLOMBIAN REGIONS: COMPETITIVE OR COMPLEMENTARY?

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RESUMEN

Este trabajo analiza las características de la competitividad y complementariedad interregional en Colombia durante el periodo 1960-2000. Para llevar a cabo el análisis, se aplica el modelo Dendrinos-Sonis usando el estimador SUR. La evidencia muestra un país con bajo nivel de integración entre las diferentes regiones y un alto nivel de competitividad. Esto es consistente con la disparidad en el ingreso observado en el país. Las relaciones de competitividad interregional deben ser consideradas para formular unas adecuadas políticas regionales que permitan fortalecer la interacción e integración regional.

Palabras clave: competitividad, complementariedad, polarización, modelo Dendrinos-Sonis.
Clasificación JEL: R11, R12, R15.

ABSTRACT

This paper analyses the characteristics of interregional competition and complementarity in Colombia during the period 1960-2000. The analysis is based on an application of the Dendrinos-Sonis model which is calculated using the SUR estimator. The evidence shows a country with a low level of integration among the different regions and a high level of competition. These findings are consistent with the observed income polarization process. Policymakers must take into account the competitive regional relationships to propose adequate policies such as the adoption of regional redistribution strategies, or other interventions that might enhance regional interaction and integration.

Key words: competition, complementarity, convergence, polarizatation, Dendrinos-Sonis Model.
JEL Classification: R11, R12, R15.

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I. INTRODUCTION

At the beginning of the 1990´s, there were two important changes in Colombia's economic policy. First, the government implemented a trade liberalization process. Secondly, fiscal decentralization was increased by the new political constitution of 1991. During this decade, several papers (Cardenas et. al. (1993), Meisel (1993), Mora and Salazar (1994), Birchenall and Murcia (1997). Rocha and Vivas (1998), and Bonet and Meisel (1999), among others) that analyzed convergence process in Colombia found polarization in regional incomes for the post-war period[1] . Contrary to what had been expected, the regional imbalances in the levels of economic development were greater notwithstanding the new policies.

Bonet and Meisel (1999) considered three elements that seemed to have played an important role in the polarization process: the regional effects of policies associated with the promotion of import substituting industrialization (ISI), the consolidation of Bogotá as the Colombian metropolis, and the continuation of the relative economic decline of the Caribbean Coast region.

These factors imply the existence of spatial relations between the different regions in Colombia in which the relative growth or decline of a region will determine the aggregate behavior of the country and vice versa. At this point, it is important to examine the type of relationships in order to study the impacts of regional dynamics on the national economy. Given the heterogeneity of the regional economies, the findings from this analysis will provide important inputs into the design of the country's regional policies.

Through the use of the Dendrinos-Sonis Model, this paper analyzes the nature of interregional competition and complementarity in Colombia. A discussion of recent regional development in Colombia is presented in section II; section III elaborates the Dendrinos-Sonis model while section IV presents the results of estimations and their analysis. The conclusions and policy implications complete the paper.

This paper focuses on the horizontal relationship among regions in Colombia at a macro level. According to their geographical interaction, the 33 Colombian territorial entities are aggregated in seven regions: Bogotá, Caribbean, West-Central, North-Central, South-Central, Pacific, and New Departments (see Figure 1).

The Caribbean region includes only seven of the region´s eight departments since San Andrés was included in the New Departments.[2] The West-Central region is defined as Antioquia, Caldas, Quindío and Risaralda. The departments of Boyacá, Norte de

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[1]   An exception is the paper by Cárdenas *et. al.* (1993). They concluded that between 1950 and 1989 Colombia experienced a very rapid process of regional economic convergence.
[2]   Although San Andres is geographically part of the Caribbean Region, it has been included in the New Departments region since there are no available statistics for San Andres during the 1960-1980 period.

Santander and Santander comprise the North-Central region. The South-Central region corresponds to the departments Cundinamarca, Huila, and Tolima. The departments of Cauca, Chocó, Nariño, and Valle del Cauca constitute the Pacific region. The category of New Departments includes those created by the Constitution of 1991, plus Caquetá and Meta. Finally, Bogotá is defined as a region by itself since it contributes more than 20% of national GDP.

Figure 1
Colombian Regions

New Departments
West-Central Region
Pacific Region
South-Central Region
Bogotá
North-Central Region
Caribbean Region

For analysis of the 1960-2000 period, departmental GDP is used as departmental income. There are three different sources of data for this time period, which use different methodologies for constructing their data series. From 1960 to 1975, departmental GDP data were calculatedby a private firm (Inandes, 1977). For the period 1976 to 1979, there is an estimation made by Pontificia Universidad Javeriana (1992). Finally, from 1980 to 2000 the data comes from statistics by the National Statistical Agency (DANE). These sources were integrated expressing the GDP in 1975 pesos, and the data are reported in Appendix 1.

II. REGIONAL ECONOMIC DEVELOPMENT IN COLOMBIA

One of the salient features of regional economic development in Colombia during the last four decades has been the increasing importance of Bogotá in the country's urban network. What had been singular in Colombia until the 1960s was that urban growth was quite uniform among the four main cities. However, beginning in that decade, urban growth in Colombia became more like the typical Latin American pattern of one dominant city. At the end of the 1960-1996 period, Bogotá had the largest participation in the national GDP; in 1960, this region contributed 15% of the national GDP, whereas by 2000, this share increased to 20% (see Figure 2).

Figure 2
Regional Share in the National GDP
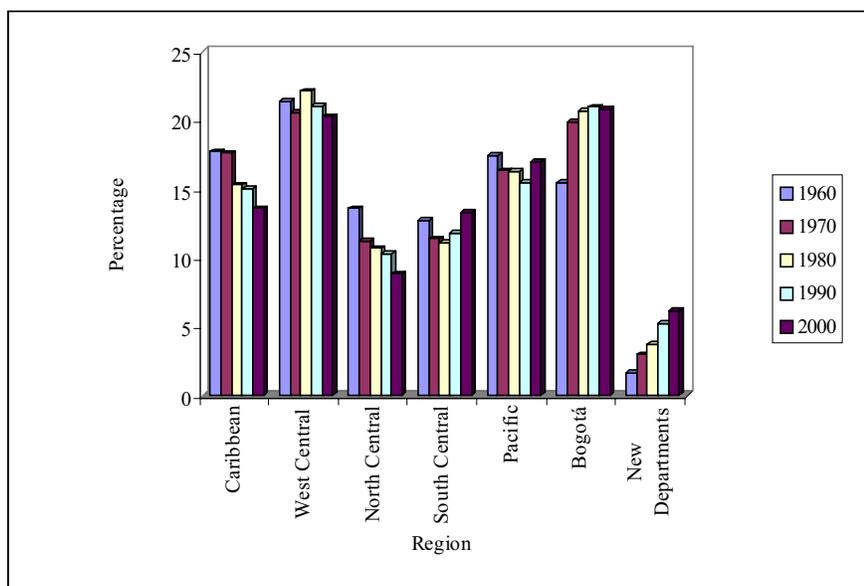
The growth of Bogotá was stimulated by the import substituting industrialization (ISI) policies actively pursued in Latin America since the 1950's under the intellectual stimulus of the Economic Commission for Latin America and the Caribbean (ECLA). In the Colombian case, Garcia (1999) has argued that ISI policies discriminated against the poorest regions

in the country. Tariff protection favored some activities and consequently, this protection privileged the regions in which the favored sectors were located.

This policy was biased in favor of the industrial areas because this sector was highly protected from foreign competition. Since the triangle defined by the cities of Bogotá, Cali and Medellin made up a large share of the Colombian industrial sector, these cities enjoyed the benefits associated with high tariffs on imported industrial goods. For instance, 59 percent of industrial value added in 1995 was generated by these three cities. Therefore, the high tariff on industrial imports worked as a subsidy for the industrial areas and as a tax on the other zones (Bonet and Meisel, 1999).

As is pointed out by Baer (1984), industrialization programs have tended to accentuate regional concentration of income due to the importance of market size in firm location decision. New firms tended to locate in the large cities where they could benefit from economies of large-scale production. The localization factor has played the most important role in the increasing economic importance of Bogotá. It is clear that companies want to be located in or close to the location of the primary market, in this case, Bogotá. Since it is not only the largest city but has the smallest concentration of among all the Colombian cities (Goueset ,1998).

According to Goueset (1998), Bogotá has one third of the total population of the 13 cities inspected by the National Household Survey and more than half of household income. The average household income in Bogotá is twice the income in the other cities considered in this survey. This spatial concentration in household income has naturally generated a spatial concentration in consumption.

The impact of ISI policies in the growth of developing country metropolitan areas has been analyzed by Krugman and Livas (1996). They argue that a major reason for the concentration of manufacturing in the metropolitan areas was the powerful backward and forward linkages these sites offer. These linkages played a major role in overcoming the disadvantages of high rents, wages, congestion and pollution. In an application of this model to the Colombian economy, Fernández (1998) found that forward and backward linkages induce agglomeration in Bogotá. Also, this author concludes that there is a strong influence of internal freight charge over the agglomeration process.

Another element that has contributed to Bogotá's rapid growth in recent decades has been the enormous growth of the national government. While total government expenditures as a percent of GDP were 8.8% in 1950, by 1997 they had increased to 37.2% (García and Jayasuriya, 1997). Given that Bogotá is the capital of the country, not surprisingly, it received a large share of the increase in public sector jobs and investment.

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[3] $HHI = \sum_i \left(\frac{y_i}{y} * 100 \right)^2$ Where y_i is the departmental GDP and y is the national GDP.

By taking a look of the evolution of the Herfindahl-Hirschman index -HHI[3]-, we can have a more comprehensible idea about the Colombian concentration process and the impact of Bogotá in this process. The HHI increased from 800 in 1960 to 988 in 2000. However, when the national capital was excluded from the estimation of this index, growth turns into decline, with the HHI decreasing in value from 560 in 1960 and to 556 in 2000, implying that there was a small reduction in the degree of concentration when Bogotá was excluded. Therefore, the importance of this city in the determination of the spatial production concentration in Colombia is clearly evident (see Figure 3).

Figure 3
Evolution of HHI
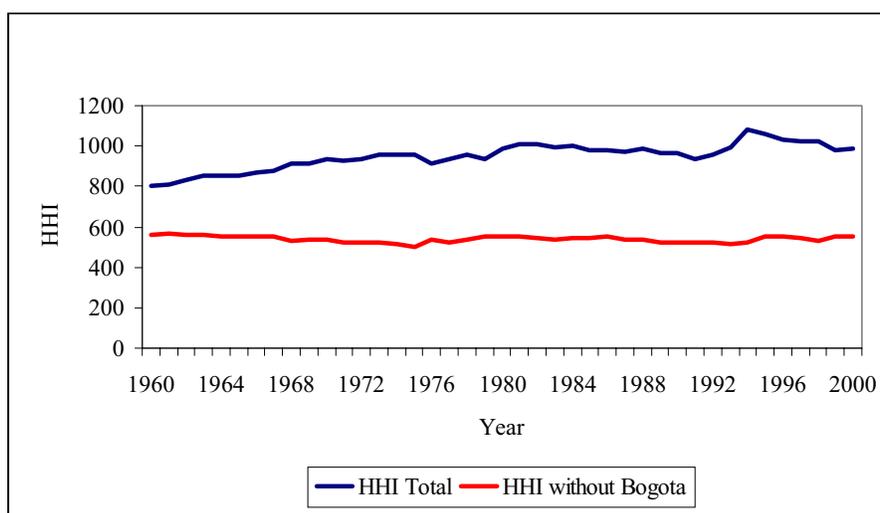
Another relevant characteristic of Colombia's regional economic development is the relative economic decline of the Caribbean Coast and North-Central regions. While the West-Central, South-Central and Pacific regions exhibited rather stable shares at 20%, 13%, and 16%, respectively, the Caribbean region share decreased from 18% in 1960 to 13% in 1996 and the North-Central from 14% to 9%.

Concurrently, while ISI policies helped the industrial areas, it discriminated against non-industrial sections of the country; these latter areas received little protection from foreign competition. This was one of the factors that contributed to the Caribbean's economic decline because of the limited development of its industrial sector and high share of the agricultural sector in this region.

Further, agricultural policies were not a priority during the period in which ISI policies operated. Garcia and Jayasuriya (1997) consider that the government fixed the exchange rate attempting to stabilize prices and imposed trade restrictions to maintain external balance. These actions resulted in an appreciation of the peso and discriminated against agriculture. Government food policies favored consumers and thus imposed quotas and others exports restrictions on products such as beef and rice, set price controls on products like milk, and sold imported wheat at a loss.

Another factor mentioned by Meisel (1999) was the collapse of the Caribbean exports as a consequence of the macroeconomic impact of coffee exports. Meisel considers that Colombia suffered a Dutch disease that was detrimental to exports apart from coffee. Since the Caribbean Coast was not a coffee-producing area, its products were negatively affected by the macroeconomic conditions.

Finally, it is important to note that the New Departments registered a low but increasing participation in the national GDP, from 1.7% in 1960 to 6.1% in 1996. This performance is a result of the exploitation of oil fields in some of these departments during the last two decades.

By estimating the standard deviation of the logarithm of GDP per-capita of the departments, it is possible to draw some initial conclusion about the convergence process in Colombia. This estimator was relatively constant from 1960 to 1975. Starting in 1981 it began to increase reaching 0.47 in 2000, compared to 0.33 in 1981. The descent of the indicator between 1975 and 1980 could be reflecting different methodologies used by data sources instead of a real decline. In spite of this possible limitation, it is quite evident that rather than convergence there was polarization in the period 1980-2000 (see Figure 4).

Figure 4
Sigma Convergence Among the Departments, 1960-2000
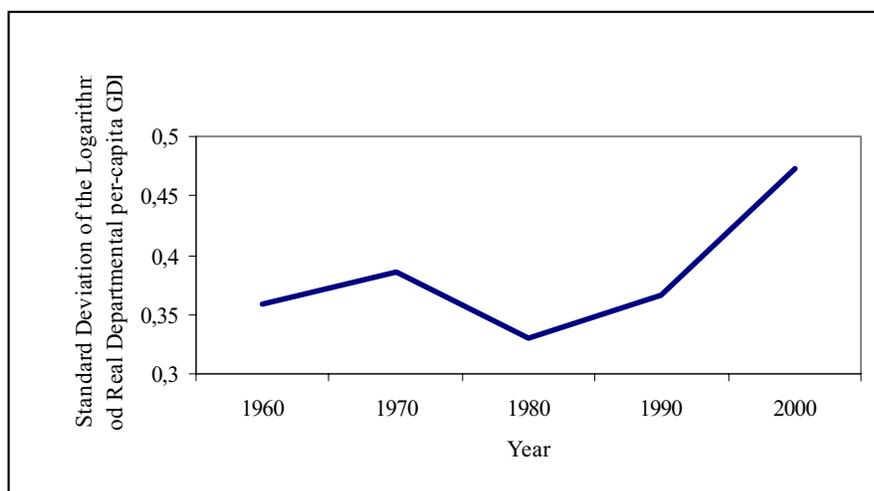
In order to have a complete panorama of Colombian regional economic development, we can also analyze the evolution of per-capita regional GDP as a percentage of per-capita national GDP. Although the per-capita GDP of Bogotá decreased during the 1960-2000 period, it was still the highest in the country. By the end of this period, it was 137% of the national per-capita GDP (see Figure 5).

Because of the relative decline of the Caribbean region's economy, the proportion of its per-capita GDP in the national per-capita GDP reveals a dramatic fall. While in 1960

the Caribbean per-capita GDP was close to the national level (99%), by 1996 it was only 64%. This dramatic change did not happen in the other declining region: North-Central. This latter region maintained a reasonably stable proportion of its per capita GDP in the national per capita GDP during this period.

Similarly to the evolution of national GDP distribution in the West-Central and Pacific regions, the percentage of their GDP per-capita compared to the national level were moderately stable during the period 1960-2000. The South Central Region had a significant increase in its proportion from 87% in 1960 to 129% in 2000.

Figure 5

Regional GDP as a Proportion of National GDP Per-Capita
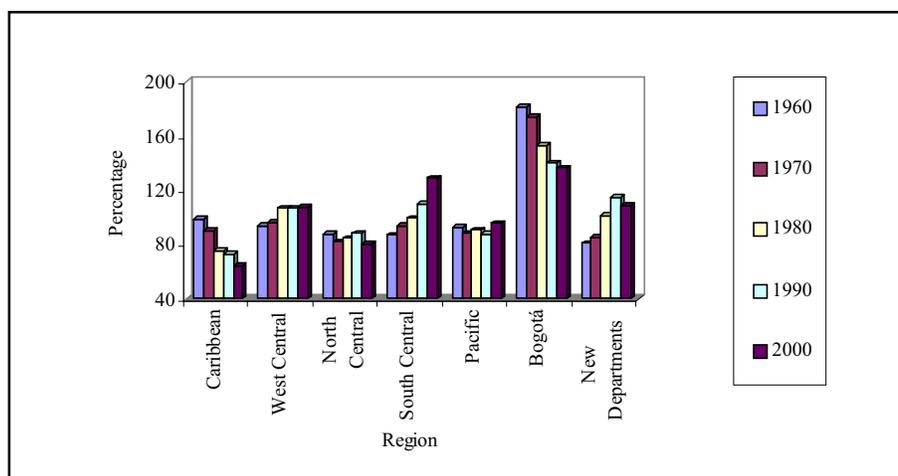
The percentage of GDP per-capita of the New Departments vis-a-vis the national level rose significantly, increasing from 53% in 1960 to 115% in 1996. The GDP growth rate in this region was higher than its population growth rate. While the average of the first rate (GDP) was 1.6% per year, the second one (population) was 1.2% annually.

III. THE DENDRINOS-SONIS MODEL

To capture possible spatial interaction effects, this paper uses a model proposed by Dendrinos and Sonis (1988, 1990). Hewings, *et. al.* (1996) claimed that this model captures spatial effects without making use of any *a priori* weighting matrix, such as an adjacency matrix that signifies interaction only with the nearest neighbors. In addition, this model is capable of generating results for the structure of the spatial correlation among a given country's regions. It is also possible to look at the effects of any individual region on the others.

As stated by Magalhaes *et. al.* (2001), growth in regional output is traditionally viewed in regional growth theory as either (i) a zero-sum game or (ii) generative. In the

first approach, growth in one region can only happen at the expense of another region, so that regional interaction plays an important role in development. In the second case, some endogenous processes within a region can also generate regional growth. The Dendrinos-Sonis model takes the first approach. Therefore, the model presented in this section represents a zero-sum game but the key feature is that this model operates with *relative* growth, not absolute growth, so that by definition, it is a zero-sum game. Hence, it is entirely possible for a region to experience a decrease in its share of GDP, at the same time that it experiences growth in its absolute GDP.

This paper follows an application of the Dendrinos-Sonis model to Indonesia made by Nazara *et. al.* (2001). The basic model, as applied to the case of regional income, is as follows. Denote x_{it} as the relative income of region i at the time t. In this paper, we use the regional share of the national GDP at constant prices of 1975. If we consider that there are n regions in the economy, we can define the vector X_t as follows:

$$X_t = [x_{1t}, x_{2t}, \ldots, x_{nt}] \quad i = 1, \ldots, n \quad t = 0, 1, \ldots, T$$

The relative discrete socio-spatial dynamics can be described as:

$$x_{i,t+1} = \left[\frac{F_i(x_t)}{\sum_{j=1}^{n} F_j(x_t)} \right] \quad i, j = 1, \ldots, n \quad t = 0, 1, \ldots, T \quad (1)$$

where $0 \leq x_{i,t} \leq 1$, $F_i[x_t] \geq 0$, and $\sum_{i=1}^{n} x_{i,t} = 1$. Note that the function $F_i(\bullet)$ can take any arbitrary form if it satisfies the positive value property. If the first region is selected as the numeraire or reference region, then:

$$G_j[x_t] = \frac{F_j[x_t]}{F_1[x_t]} \quad \forall j = 2, 3, \ldots, n \quad t = 0, 1, \ldots, T \quad (2)$$

By using (2), the process defined in (1) can also be represented by the following system of equations:

$$x_{1,t+1} = \frac{1}{1 + \sum_{j=2}^{n} G_j[x_t]} \quad \text{where } j = 2, 3, \ldots, n. \quad (3)$$

$$x_{j,t+1} = x_{1,t+1} G_j[x_t] \tag{4}$$

Since the numeraire guarantees that the sum of all regional shares is equal to one, it plays an important function in this model. This implies that a region's economic growth is not independent of the share of other regions and therefore, the Dendrinos-Sonis Model can be seen as a working framework of the competitive model in terms of proportions (Nazara, *et. al.*, 2001). In this model, each region is in competition to reach a higher share of the national GDP, and, as previously mentioned, an increase in absolute values does not ensure an increase in its share.

Following Dendrinos and Sonis (1988), a log-linear specification of $G_j[x_t]$ is adopted, so that:

$$G_j[x_t] = A_j \prod_k x_{kt}^{a_{jt}} \quad \text{where } j = 2,3,......,n. \quad k = 1,2,......,n. \tag{5}$$

where $A_j > 0$ represents the locational advantages of all regions, $j = 2,3,......,n.$, and the coefficient a_{jk} can be expressed in this way:

$$a_{jk} = \frac{\partial \ln G_j[x_t]}{\partial \ln x_{kt}} \quad \text{where } j = 2,3,......,n. \quad k = 1,2,......,n. \tag{6}$$

These coefficients can be interpreted as the regional growth elasticities with $-\infty < a_{jk} < \infty$. In other words, a_{jk} is the percentage growth in region j relative to that in region 1, the numerarie, with respect to one percentage change of income in region k.

The adopted log-linear form allows the process to be rewritten as:

$$\ln x_{j,t+1} - \ln x_{1,t+1} = \ln A_j + \sum_{k=1}^{n} a_{jk} \ln x_{k,t} \text{ where } j = 2,..,n. \ k = 1,..,n. \tag{7}$$

This model captures the regional interactions in which each region competes to increase its share of gross domestic product. The performance of each region depends on two factors: (i) its comparative advantages, and (ii) the behavior of the rest of the regions. This second factor is revealed in the sign and magnitude of the elasticity a_{jk}. A negative sign in this coefficient implies a competitive relationship between the region j and k, i.e., if the GDP share of region j increases, the share of the region k will

decrease relative to the numeraire region and vice-versa. In contrast, a positive coefficient indicates a complementary relationship between *j* and *k*, so that when region *j* raises its GDP share, region *k* also increases its share, again relative to the numeraire region.

In view of the fact that a system of equations is employed, the Seemingly Unrelated Regression (SUR) estimator is used. Data for the seven regions during the 1960 – 1996 is employed and the region that maintained the highest per-capita GDP during this period, Bogotá, is used as the numeraire.

IV. RESULTS AND ANALYSIS

Our analysis will be carried out in two steps. First, the outcome of the Dendrinos-Sonis model is presented together with an analysis of statistical properties. Secondly, attention is directed to the analysis of the coefficient signs in order to reflect characteristics of interactions among regions.

Initial estimates revealed that some variables were not significant in the model; the system was re-estimated by removing the insignificant explanatory variables. In this case, the employed SUR technique generates higher efficiency of the estimates, and would also make sure that the solution achieves the maximum of the likelihood function.

Since there was an income polarization process in Colombia during the 1960-1996 period, the expectation was that there would be a weak degree of interaction among regions. Therefore, one would expect that most regions would exhibit a strong competitive evidence rather than complementary relationship with other regions.

Table 1
Results of the Dendrinos-Sonis Model for Colombia Using All Variables

	Caribbean	West-Central	North-Central	South-Central	Pacific	Bogotá	New Depts.	R2
Caribbean	0.724 (1.23)	-0.415 (-0.63)	0.386 (0.82)	0.061 (0.08)	0.511 (0.73)	-0.478 (-0.66)	-0-039 (-0.30)	0.94
West-Central	-1.00*** (-1.67)	-0749 (-1.11)	-0.095 (-0.19)	-0.44 (-0.60)	-1.21*** (-170)	-1.28*** (-1.75)	-0.26*** (-1.95)	0.83
North-Central	-0.699 (-1.038)	-0.852 (-1.12)	0.31 (0.57)	-0.808 (-0.99)	-0.711 (-0.88)	-1.523*** (-1.84)	0.254*** (-1.68)	0.94
South-Central	-1.788* (-3.58)	-2.24* (-4.01)	-0.631 (-1.57)	-0.554 (-0.91)	-1.635* (-2.74)	-2.114* (-3.45)	-0.393* (-3.52)	0.88
Pacific	-1.004** (-2.19)	-1.49* (-2.90)	-0.363 (-0.98)	-0.23 (-0.41)	-0.776 (-1.41)	-1.297** (-2.30)	-0.353* (-3.44)	0.91
New Depts.	-0.715 (-0.71)	-0.527 (-0.47)	-0.268 (-0.33)	-0.162 (-0.13)	-0.569 (-0.47)	-0.847 (-0.69)	0.65* (2.90)	0.93

Numeraire: Bogotá. The equations are represented across the rows. t-statistic in parentheses. * significant at 1%.

** significant at 5%.*** significant at 10%.

SUR estimates of the Dendrinos-Sonis model for Colombia are shown in Table 1. Although just some coefficients turned out to be significant, the majority of the coefficients for the lag of dependent variables have a negative sign as expected. The results provide for the following interpretation; the fact that regions permanently compete to reach a higher share of the national GDP, and that when a region increases its share the others will decrease theirs, implies that the income polarization process will persist in the Colombian economy.

In addition, this interpretation is reinforced by results showing a country with a low level of integration among the different regions. The non-significance in some coefficients presents evidence of poor regional interaction.

The data in Table 2 present some qualitative results of the Dendrinos-Sonis model. In this table, actual values have been replaced by the signs of the coefficients. By ordering regions according to their level of complementarity and competitiveness, this table attempts to establish a qualitative spatial dependence hierarchy. Again, high competition among regions is revealed. Regions with the largest proportion of national GDP - Bogotá, West-Central and Pacific – as well as the one with the highest growth rate – New Departments- exhibit a competitive relationship. This means that an increase in the share of the most dynamic economies will result in a decrease in the other regions'share.

Table 2
Qualitative Analysis of the Competitive and Complementary Relationships Using All Variables

(a) Qualitative Relationships							
	Caribbean	**West-Central**	**North-Central**	**South-Central**	**Pacific**	**Bogotá**	**New Depts.**
Caribbean	+	-	+	+	+	-	-
West-Central	-	-	-	-	-	-	-
North-Central	-	-	+	-	-	-	-
South-Central	-	-	-	-	-	-	-
Pacific	-	-	-	-	-	-	-
New Depts.	-	-	-	-	-	-	+
(b) Qualitative Ordering							
	North-Central	**South-Central**	**Caribbean**	**Pacific**	**New Depts.**	**Bogotá**	**West-Central**
Caribbean	+	+	+	+	-	-	-
North-Central	+	-	-	-	-	-	-
New Depts.	-	-	-	-	+	-	-
West-Central	-	-	-	-	-	-	-
South-Central	-	-	-	-	-	-	-
Pacific	-	-	-	-	-	-	-
	Complementary		←———————————→			Competition	

The outcome of re-estimation of the model excluding non-significant variables is shown in Table 3. The included explanatory variables still explain a high proportion of variation in the dependent variable. In addition, the signs of the coefficients remain stable, magnitude of elasticity coefficients in general drops, and coefficients continue to be statistically significant.

The fact that New Departments exhibits only a significant relationship with itself (lagged once) reflects the poor integration of this region with the rest of the country. This result is also similar to the conclusions obtained from the application of the analysis of shift-share to Colombian economic growth by Bonet (1999), who found that local endowment is the key factor in regional performance.

In addition, it is also important to note that the Caribbean region shows non-significant coefficients from the other regions while the effects of this region on others are negative when they are significant. The poor interaction of this region could be one of the reasons for its poor economic performance.

Table 3

Results of the Dendrinos-Sonis Model for Colombia Using Selected Variables

	Caribbean	West-Central	North-Central	South-Central	Pacific	Bogotá	New Depts.	R2
Caribbean	NS	NS	NS	NS	NS	NS	NS	-
West-Central	-0.454* (-3.47)	NS	NS	NS	-0.734* (-2.69)	-0.867* (-5.34)	-0.171* (-3.14)	0.82
North-Central	NS	NS	NS	NS	NS	-0.979* (-4.82)	-0.28* (-5.21)	0.90
South-Central	-1.446* (-6.47)	-2.037* (-5.60)	NS	NS	-0.942** (-2.35)	-1.389* (-8.24)	-0.268* (-4.01)	0.87
Pacific	-0.697* (-6.60)	-1.173* (-6.07)	NS	NS	NS	-0.831* (-6.99)	-0.241* (-5.52)	0.90
New Depts.	NS	NS	NS	NS	NS	NS	0.745* (20.4)	0.91

Numeraire: Bogotá. The equations are represented across the rows. t-statistic in parentheses.
* significant at 1%.
** significant at 5%.
*** significant at 10%. NS: not significant in the previous regression.

There is not a region with clear positive effects in the economy. North Central is the only one with two positive coefficients whereas the other regions either have just one or do not have any. This evidence reveals the degree of regional competitiveness in the economy. It can be expected that a positive shock in the GDP of any region at time *t* could not have a constructive impact on the other regions' GDP in time *t+1*.

Since coefficients in the Dendrinos-Sonis Model represent regional growth elasticities, it is possible to identify which regions have a higher or lower impact on others. According to the results of Table 3, the South Central region receives the highest

impact from other regions because their coefficients with the Caribbean, West Central and Bogotá regions are greater than one in absolute value. While the West Central region shows the highest negative coefficients with other regions, the New Departments region exhibits the lowest ones with absolute values lower than one in absolute value.

Table 4

Qualitative Analysis of the Competitive and Complementary
Relationships Using Selected Variables

(a) Qualitative Relatioships

	Caribbean	West-Central	North-Central	South-Central	Pacific	Bogotá	New Depts.
Caribbean	NS	NS	NS	NS	NS	NS	NS
West-Central	-	NS	NS	NS	-	-	-
North-Central	NS	NS	NS	NS	NS	-	-
South-Central	-	-	NS	NS	-	-	-
Pacific	-	-	NS	NS	NS	-	-
New Depts.	NS	NS	NS	NS	NS	NS	+

NS: not significant in the previous regression.

Bogotá is still a region that has a negative impact on the rest of the regions. The biggest impacts of Bogotá are in the South-Central region with an elasticity greater than one in absolute value (-1.38), and the North Central region with an elasticity close to minus one (-0.97).

When consideration is given to factors that played an important role in the income polarization process (the consolidation of Bogotá as the main metropolis in the 1990's), the fact that Bogotá has negative coefficients indicates that it is likely that income disparity pattern will persist. Given that Bogotá concentrates a high proportion of national government expenditures, public finance policy should take into consideration the spatial effects that an investment in Bogotá will have on the rest of the regions in order to consider some redistribution effects. Without access to interregional trade data, the results presented here suggest that spillover effects are not expected to be large.

This type of bi-directional interaction is another significant piece of interregional competition and complementarity mentioned by Nazara, *et. al.* (2001). They stated three possible cases for interaction. First, they consider the situation in which two regions *i* and *j* may be in a (+,+) pair of impact signs making these two regions complements of one another. Secondly, they contemplate the case in which two regions may also be in a (-,-) pair of impact signs. In this case, both regions are mutually competing for economic growth. Finally, they consider the asymmetric case in which the two regions engage in a (+,-) pair of impact signs. Here *i* can have a positive impact in *j*, but *j* is negatively impacted by an economic growth in *i*.

Even though this issue was not addressed directly by the Dendrinos-Sonis model because it needs to develop an *nxn* interregional-impact matrix, a first attempt to estimate a bi-directional interaction among Colombian regions is included in Table 5. The prevalence

of the (-,-) pair in this matrix strengthens the earlier finding of a high degree of competition among Colombian regions. In addition, there are a couple of contrary signs of relationship which indicate an asymmetric impact between some regions.

Table 5

Regional Bi-Directional Interaction in Colombia

	Caribbean	West-Central	North-Central	South-Central	Pacific	Bogotá	New Depts.
Caribbean	(+,+)	(- , -)	(+, -)	(+ , -)	(+ , -)	(-, NU)	(- , -)
West-Central	(- , -)	(-, -)	(-, -)	(- , -)	(- , -)	(-, NU)	(- , -)
North-Central	(-, +)	(-,-)	(+,+)	(- , -)	(- , -)	(-, NU)	(- ,-)
South-Central	(- , +)	(-,-)	(-, -)	(- , -)	(- , -)	(-, NU)	(- , -)
Pacific	(- , -)	(- , -)	(-, -)	(- , -)	(- , -)	(-, NU)	(- , -)
New Depts.	(- , -)	(- , -)	(-, -)	(- , -)	(- , -)	(-, NU)	(+,+)

NU means that this region is the numeraire and therefore, the model is not able to estimate the impact of the other regions in Bogotá.

V. CONCLUSIONS

The application of the Dendrinos-Sonis model to Colombia provides an overview about the form of competition and complementarity among the country's different regions. This first attempt shows a weak degree of regional integration which is consistent with the growth of income disparities between 1960 and 1996. These results reflect the low interaction among Colombia's regional economies.

Policy makers have to take into account the competitive regional relationship in order to propose an adequate policy strategy. Given the set of regional economic behavior, regions with rich natural endowment will have a greater probability of higher development, and consequently the income imbalances will increase. Policy recommendations should include the adoption of regional redistribution strategies, or other interventions (such as construction of infrastructure) that might enhance regional interaction and integration.

However, as noted by Nazara, *et. al.* (2001), competition is not always bad and complementarity is not always good. Interregional competition could encourage innovation and invention among regions. Competition among regions is a competition among the economic agents in each region (Poot, 2000). The government should create necessary conditions to support the activities of local agents and, therefore, it plays an important role in regional economies. Some policy issues require further analysis to determine the circumstances where competition is bad and complementarity is good.

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APPENDIX 1

Regional GDP (Million Pesos 1975)

Year	Caribbean	West Central	North Central	South Central	Pacific	Bogotá	New Departments	National
1960	31.812	38.304	24.382	22.766	31.292	27.784	3.016	179.355
1961	33.813	40.678	24.850	24.105	33.200	29.463	3.654	189.764
1962	34.874	43.203	25.678	25.050	34.566	32.963	3.858	200.190
1963	36.329	44.424	26.331	24.843	34.612	35.155	3.960	205.653
1964	39.426	45.702	28.035	26.296	36.812	38.120	4.385	218.776
1965	42.301	47.593	28.324	26.269	38.062	39.855	4.495	226.899
1966	43.471	50.801	29.902	27.754	39.660	42.802	5.375	239.764
1967	44.086	52.790	30.846	28.707	41.766	45.192	7.165	250.552
1968	45.599	56.045	31.251	30.327	43.857	52.280	7.971	267.331
1969	49.994	58.470	31.789	32.073	46.571	55.138	9.029	283.063
1970	53.217	62.085	33.834	34.408	49.381	60.032	8.965	301.922
1971	58.236	63.804	35.552	36.046	51.315	63.859	10.545	319.356
1972	64.453	67.815	37.832	37.924	55.240	69.919	11.046	344.229
1973	69.373	73.456	39.027	39.555	58.287	76.912	12.091	368.701
1974	74.010	75.269	41.941	41.743	62.261	82.820	12.872	390.917
1975	78.506	78.087	43.431	44.077	63.076	87.433	14.120	408.729
1976	69.372	92.836	48.345	48.182	69.350	82.640	13.723	424.448
1977	73.285	95.434	49.885	50.736	68.282	89.768	14.741	442.131
1978	75.377	105.089	53.123	53.654	75.024	97.413	15.934	475.614
1979	80.144	112.030	55.383	60.125	79.712	98.915	16.983	503.292
1980	80.524	116.339	56.305	58.602	85.779	108.796	19.420	525.765
1981	81.337	117.686	58.440	59.590	85.365	114.632	20.686	537.736
1982	81.062	118.009	58.704	60.913	85.857	116.624	21.667	542.836
1983	84.842	117.727	59.061	61.746	88.382	118.018	21.604	551.380
1984	86.971	123.191	59.596	66.321	90.169	121.590	22.017	569.855
1985	89.773	126.049	62.869	69.114	93.830	122.337	23.589	587.561
1986	92.031	135.205	68.134	71.647	98.622	128.241	27.901	621.781
1987	96.901	141.015	70.795	75.166	101.551	137.445	32.291	655.164
1988	99.385	146.819	71.657	80.299	105.970	143.945	33.716	681.791
1989	105.559	146.278	73.630	83.334	111.464	147.618	37.185	705.068
1990	110.873	154.937	75.987	86.833	113.893	154.221	38.515	735.259
1991	114.034	158.725	76.825	88.985	114.976	152.544	43.887	749.976
1992	121.663	165.089	76.122	92.807	120.359	161.746	42.526	780.312
1993	120.703	169.985	79.665	98.164	128.303	180.837	44.678	822.335
1994	119.254	177.312	78.678	107.878	138.258	205.604	43.167	870.151
1995	118.974	191.977	75.890	119.244	158.046	208.259	47.144	919.534
1996	123.378	188.883	79.855	123.925	161.172	205.414	54.288	936.915
1997	128.292	198.778	81.377	130.330	161.976	212.137	56.950	969.839
1998	132.255	193.889	80.720	126.461	164.147	215.749	58.976	972.197
1999	126.590	185.648	82.350	120.704	159.918	191.466	62.031	928.708
2000	130.392	194.448	85.085	127.628	162.691	199.466	59.077	958.787

Source: Author's estimation based on Inandes (1960-1975), Pontificia Universidad Javeriana (1976-1979), and DANE (1980-2000).