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**THE SOCIO-ECONOMIC SIGNIFICANCE  
OF FOUR PHONETIC CHARACTERISTICS  
IN NORTH AMERICAN ENGLISH**

**Germán Coloma**

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# The Socio-Economic Significance of Four Phonetic Characteristics in North American English

Germán Coloma\*

## Abstract

This paper uses a least-square regression method that relates per-capita income to four phonetic characteristics (r-dropping, and the so-called “father-bother”, “cot-caught” and “pin-pen” mergers), to study the socio-economic significance of those characteristics in North American English. As a result we find a positive and statistically significant relationship between per-capita income and r-dropping, and between per-capita income and the presence of the “cot-caught” merger, and a negative and statistically significant relationship between per-capita income and the “pin-pen” merger. No statistically significant relationship is found, however, between per-capita income and the presence of a “father-bother” merger or split.

**Keywords:** statistical regression, phonetic characteristics, per-capita income, North American English.

## 1. Introduction

In previous work (Coloma, 2010) we proposed a method, drawn from the field of economic statistics (also known as “econometrics”), to detect the socio-economic significance of linguistic variables. That paper also has an illustration of the method, using data from Spanish-speaking countries.

In this paper we apply essentially the same methodology to analyze the socio-economic significance of four phonetic characteristics that are useful to define different geographic areas in North American English. The method consists of running a least-square regression whose dependent variable is per-capita income, and whose independent variables are dummy variables that capture the presence or absence of certain linguistic characteristics. The estimated coefficients are what economists call the “hedonic prices” associated with the included characteristics, and are useful to detect if those characteristics can be seen as positive or negative sociolinguistic markers.

The paper is organized in four additional sections besides this introduction. In section 2 we describe the four phonetic variables that we use, and their geographic distribution in the United States of America and Canada. In section 3 we quantify

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\* CEMA University; Av. Córdoba 374, Buenos Aires, C1054AAP, Argentina. Telephone: (54-11)6314-3000; E-mail: gcoloma@cema.edu.ar. The views and opinions expressed in this publication are those of the author and are not necessarily those of CEMA University.

those variables according to the population and the income of the areas in which each phonetic characteristic appears. In section 4 we briefly explain the methodology used and the results obtained, and in section 5 we present the conclusions of the whole paper.

## **2. Phonetic characteristics of North American English**

North American English is supposed to have a number of phonetic characteristics that are useful to contrast it with other varieties of English outside North America<sup>1</sup>. Some of these characteristics are also used to distinguish among accents within North America, and those accents are typically associated with certain geographical areas.

One of the characteristics that is generally considered as typical of North American English is rhoticity, that is, the use of the phoneme /r/ in syllabic codas in words such as “car”, “beer” and “more”. Non-rhotic accents, conversely, have lost that r-sound, and have sometimes replaced it by a glide. These non-rhotic accents are also said to exhibit “r-dropping”, especially when they are considered from the point of view of rhotic-accent speakers.

Although rhoticity seems to be dominant in North America, there are areas of the United States in which r-dropping is common and even characteristic. Following Labov, Ash and Boberg (2007), we can consider that r-dropping is a feature of the English generally spoken in the states of Alabama, Georgia, Louisiana, Mississippi, South Carolina, Connecticut, Maine, Massachusetts, Rhode Island, New Hampshire and New York<sup>2</sup>.

A second phonetic characteristic that is widespread in North America is the so-called “father-both-merger”, that is, the merger of the phonemes /ɑ/ and /ɒ/ in words such as “father” and “both-”, or “palm” and “pot”. When those phonemes merge into a single one, the new phoneme is generally pronounced using the unrounded open back vowel sound [ɑ]<sup>3</sup>.

The “father-both-merger”, however, is not present in the typical speech of some North American areas. These areas are the US states of Connecticut, Maine,

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<sup>1</sup> See, for example, Swan (2006).

<sup>2</sup> In fact, the isoglosses reported by Labov, Ash and Boberg (2007) do not exactly coincide with state borders. In this paper, however, we will approximate them to those borders, in order to make them comparable with the quantitative information that we use in the following sections.

<sup>3</sup> For a more precise description of this and other mergers analyzed in this paper, see Thomas (2006).

Massachusetts, Rhode Island, New Hampshire and Vermont, and the Canadian provinces of Prince Edward, Nova Scotia, New Brunswick and Newfoundland. In those cases we can speak of a “father-bother split”, which implies the actual difference between /ɑ/ and /ɒ/ in words such as “father” and “bother”, or “palm” and “pot”.

Another important vowel merger that is common in North American English is the so-called “cot-caught merger”, that is, the merger of the phonemes /ɒ/ and /ɔ/ in words such as “cot” and “caught”, or “pot” and “bought”<sup>4</sup>. This merger is supposed to be a general feature of the English spoken in Canada, and also of the accent of the following US states: Alaska, Arizona, California, Colorado, Idaho, Kansas, Kentucky, Maine, Minnesota, Montana, Nebraska, New Hampshire, Oklahoma, Nevada, New Mexico, North Dakota, Oregon, Utah, Vermont, Washington, West Virginia and Wyoming<sup>5</sup>.

A last phonetic characteristic that we are going to use in this paper is the so-called “pin-pen” merger, which is the merger of the phonemes /ɪ/ and /e/ into a single one when they appear before nasal consonants (in words such as “pin” and “pen”, or “tin” and “ten”). The typical pronunciation for this merger is the unrounded semi-closed front vowel sound [ɪ], and its geographical distribution is supposed to occur in the states of Alabama, Arkansas, Georgia, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Nebraska, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia and West Virginia.

The intersection of the isoglosses for the four phonetic characteristics described defines nine different geographic areas. One of them is the one that coincides with the characteristics that seem to be dominant in the whole North American continent, which are rhoticity, the “father-bother” merger, and the absence of the “cot-caught” and “pin-pen” mergers. These characteristics are associated with the accent that is commonly referred to as “General American” (GA) in most phonetics’ textbooks<sup>6</sup>, and we will use that expression to name the geographical area

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<sup>4</sup> When the “cot-caught” merger appears together with the “father-bother” merger, the three phonemes of standard British English which are commonly denoted as /ɑ/, /ɒ/ and /ɔ/ merge into a single one, which is typically pronounced as [ɑ]. In accents characterized by the “cot-caught” merger and the “father-bother” split, conversely, /ɒ/ and /ɔ/ merge into a phoneme whose standard pronunciation is the rounded mid-open back vowel [ɔ], and the unrounded open vowel [ɑ] is kept as separate phoneme.

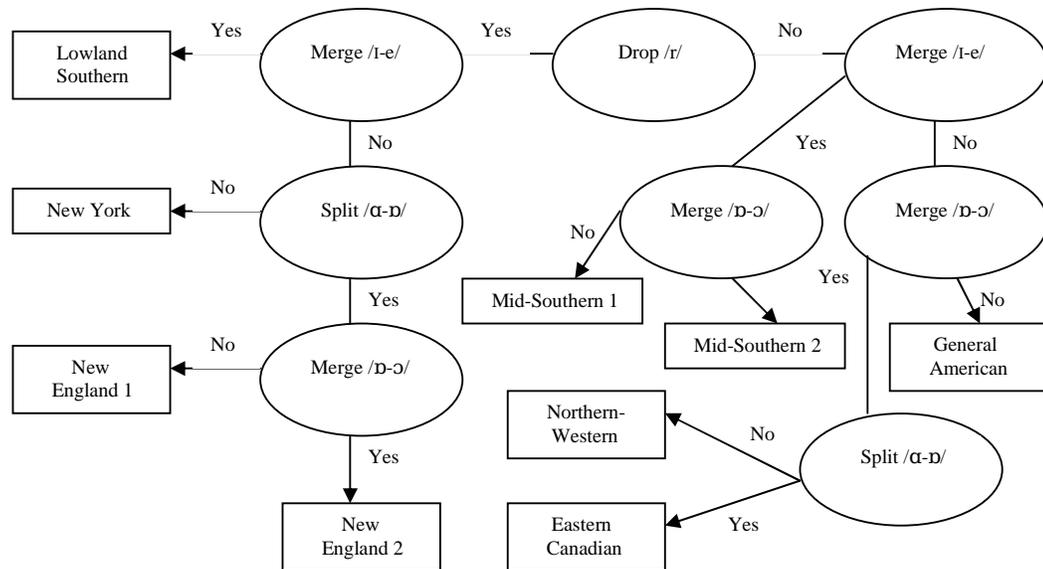
<sup>5</sup> This feature, for example, is used to characterize the kind of American (Californian) English described in Ladefoged (1999).

<sup>6</sup> See, for example, Rogers (2000), chapter 6.

in which they are all present. That area consists of the states of Delaware, Florida, Hawaii, Illinois, Iowa, Maryland, Michigan, New Jersey, Ohio, Pennsylvania, South Dakota and Wisconsin, and the District of Columbia.

The second important geographic area that we will define is characterized by rhoticity, the “father-bother” merger, the “cot-caught” merger, and the absence of the “pin-pen” merger (see figure 1). This combination appears in the US states of Alaska, Arizona, California, Colorado, Idaho, Minnesota, Montana, Nevada, New Mexico, North Dakota, Oregon, Utah, Washington and Wyoming, the Canadian provinces of Alberta, British Columbia, Manitoba, Ontario and Saskatchewan, and the three Canadian “territories” (Yukon, Northwest and Nunavut). As the largest part of this area is in the Northern and Western regions of the United States and Canada, we will define it as “Northern-Western” (NW).

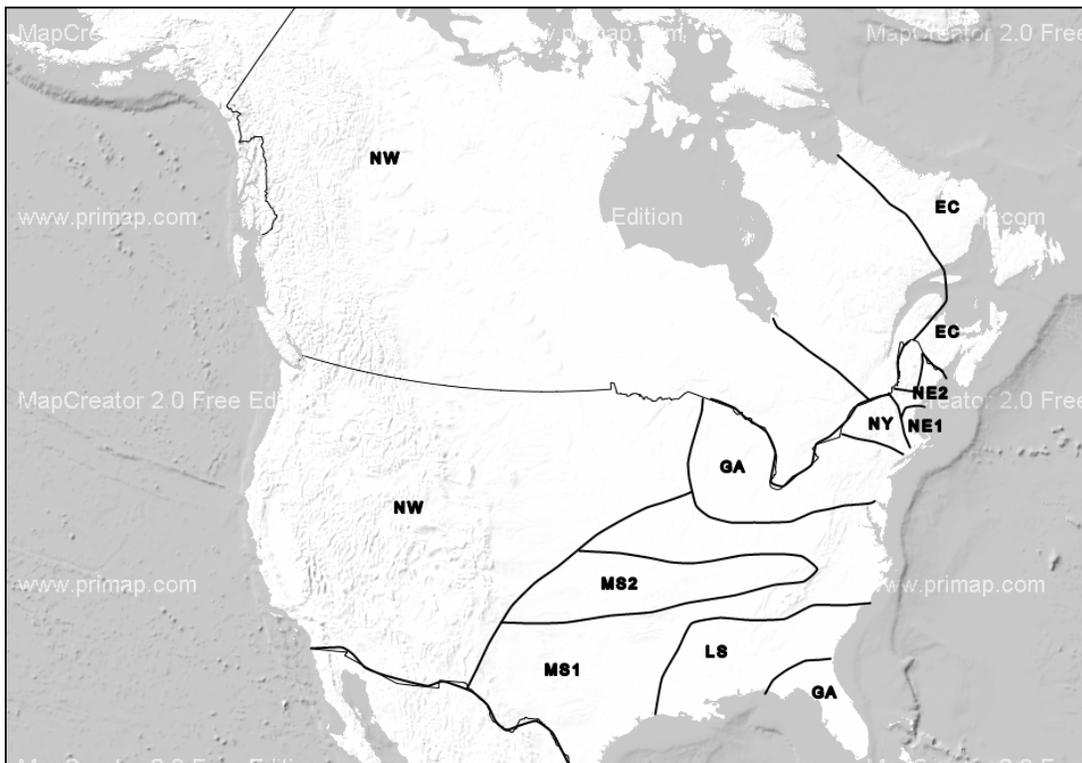
**Figure 1. Phonetic characterization of the North American English areas**



The presence of the “pin-pen” merger, conversely, is strongly associated to the Southern and Midland areas of the United States. Its intersection with other phonetic characteristics, however, allows us to define three separate regions in this set of states. We will use the expression “Lowland Southern” (LS) to define the area in which the “pin-pen” merger coexists with r-dropping, and this occurs in the states of Alabama, Georgia, Louisiana, Mississippi and South Carolina. On the other hand, for the states in which the “pin-pen” merger occurs but the accent is rhotic, we will use the

expression “Mid-Southern”. This group of states can be further divided into two subsets, depending on the fact that they also exhibit the “cot-caught” merger. The area denoted as “Mid-Southern 1” (MS1) is the one in which we simultaneously find rhoticity and the “pin-pen” merger but no “cot-caught” merger, which covers the states of Arkansas, Indiana, Missouri, North Carolina, Tennessee, Texas and Virginia. The area denoted as “Mid-Southern 2” (MS2) is the one in which we simultaneously find rhoticity, the “pin-pen” merger and the “cot-caught” merger, and this occurs in Kansas, Kentucky, Nebraska, Oklahoma and West Virginia (see figure 2)<sup>7</sup>.

**Figure 2. Approximate borders of the North American English areas**



The combination of r-dropping and no “pin-pen” merger is characteristic of the North-Eastern part of the United States. In New York (NY), for example, this occurs together with the “father-bothor” merger and the absence of the “cot-caught” merger. In the group of states generally referred to as New England, conversely, r-dropping coexists with the “father-bothor” split. These New English states can be further divided in two subsets, regarding the presence or absence of the “cot-caught”

<sup>7</sup> The map on figure 2 has been drawn using Map Creator 2.0.

merger. The group of New English states where the “cot-caught” merger is absent (NE1) is formed by Connecticut, Massachusetts and Rhode Island, while the group of New English states in which the “cot-caught” merger is present (NE2) is constituted by the states of Maine and New Hampshire.

The last area that arises when we overlap the geographic distribution of the four phonetic characteristics described in this section is the one in which we simultaneously find the “father-bother” split and the “cot-caught” merger, but no r-dropping and no “pin-pen” merger. This covers the Canadian provinces of Prince Edward, Nova Scotia, New Brunswick and Newfoundland, and the US state of Vermont. Although one US state is present in this set, we will use the expression “Eastern Canadian” (EC) to refer to it, since most of its population is located in the eastern (or “maritime”) provinces of Canada.

**Table 1: North American English phonetic characteristics**

Code	Area / Characteristic	Drop /r/	Split /ɑ-ɒ/	Merge /ɒ-ɔ/	Merge /i-e/
GA	General American	No	No	No	No
NW	Northern-Western	No	No	Yes	No
LS	Lowland Southern	Yes	No	No	Yes
MS1	Mid-Southern 1	No	No	No	Yes
MS2	Mid-Southern 2	No	No	Yes	Yes
NY	New York	Yes	No	No	No
NE1	New England 1	Yes	Yes	No	No
NE2	New England 2	Yes	Yes	Yes	No
EC	Eastern Canadian	No	Yes	Yes	No

All the intersections of the four phonetic characteristics and their use to define geographic areas appear on table 1. In it we have used the labels “Split /ɑ-ɒ/”, “Merge /ɒ-ɔ/” and “Merge /i-e/” to refer to the “father-bother” split, the “cot-caught” merger and the “pin-pen” merger, respectively. Note that all the characteristics have been described as “deviations from the General American standard” (so the General American area has a “No” in each of the four columns of the table).

The reader may note that, although the characteristics used are not the same, this phonetic division of geographic areas strongly resembles the one used in the modern literature about North American dialectology<sup>8</sup>. It can even be seen as a refinement of the traditional classification of North American dialects into North-Eastern accents (New England 1, New England 2 and Eastern Canadian), Southern

<sup>8</sup> See, for example, Clopper and Pisoni (2006).

accents (Lowland Southern, Mid-Southern 1 and Mid-Southern 2) and standard American accents (General American, Northern-Western and New York).

### 3. Demographic and economic importance of phonetic characteristics

The demographic and economic importance of the four phonetic characteristics mentioned in the previous section can be assessed through a variety of indicators. The two most important ones are probably the total population and the gross domestic product (GDP), associated to each of the areas in which we have divided North America.

There are several sources on which we can rely to find the data needed to quantify population and GDP. We have basically used three of them, which are the US Department of Commerce (2009), Statistics Canada (2010) and the World Bank (2009). From them we have obtained the information to calculate the figures that appear on table 2.

**Table 2: Population and income by area (2008)**

Area	Population		GDP		GDPpc
	Thousands	%	Billions US\$	%	US\$/year
United States	304,060	92.24%	14,093,321	93.15%	46,350
General American	91,672	27.81%	4,157,765	27.48%	45,355
Northern-Western	75,428	22.88%	3,656,365	24.17%	48,475
Lowland Southern	26,177	7.94%	991,085	6.55%	37,861
Mid-Southern 1	62,677	19.01%	2,779,830	18.37%	44,352
Mid-Southern 2	14,312	4.34%	544,220	3.60%	38,026
New York	19,490	5.91%	1,180,099	7.80%	60,548
New England 1	11,050	3.35%	646,246	4.27%	58,483
New England 2	2,632	0.80%	111,172	0.73%	42,234
Vermont (East Can)	621	0.19%	26,540	0.18%	42,719
Canada	25,565	7.76%	1,035,785	6.85%	40,516
Northern-Western	23,235	7.05%	960,119	6.35%	41,322
Eastern Canadian	2,329	0.71%	75,666	0.50%	32,484
Total	329,625	100.00%	15,129,106	100.00%	45,898

The methodology to elaborate table 2 consisted of using the data from the US Department of Commerce at a state level and the data from Statistics Canada at a provincial and territorial level<sup>9</sup>. The information of the World Bank was useful to compute the GDP of the two countries in comparable units (which are 2008 US

<sup>9</sup> The figures on table 2 do not include the ones that correspond to the Canadian province of Quebec, which is supposed to be a basically Francophone area.

dollars of equal “purchasing power”), and this was used to homogenize the figures from national sources. With that we could also calculate per-capita income levels for the different countries and areas of those countries, which are expressed as GDP per capita figures (GDPpc) and appear in the last column of table 2.

The figures on table 2 show that the United States concentrates more than 90% of both the population and the GDP generated by English-language speakers in North America, and that its average GDP per capita is also higher than the Canadian one. The area related to the General American accent is the largest one in the United States (both measured by its population and its GDP) but, if we add the Northern-Western areas of both the US and Canada, that area becomes larger than the General American area. However, the region related to a higher per-capita income is the New York area, and the one related to a lower per-capita income is the Eastern Canadian area.

Combining tables 1 and 2, it is possible to calculate the population and the GDP per capita associated to the presence or absence of each of the four phonetic characteristics analyzed in this paper. Those figures are reported on table 3, which shows that the majority of the North American English speakers have a rhotic accent (i.e., no r-dropping) which possesses the “father-both-er” merger (i.e., no “father-both-er” split), but neither the “cot-caught” merger nor the “pin-pen” merger. These average characteristics coincide with the ones found in the General American area.

**Table 3: Population and income by phonetic characteristic (2008)**

Characteristic	Population		GDPpc (U\$\$/year)	
	Thousands	%	Yes	No
R-dropping	59,350	18.01%	49,345	45,141
“Father-both-er” split	16,633	5.05%	51,682	45,591
“Cot-caught” merger	118,558	35.97%	45,329	46,218
“Pin-pen” merger	103,166	31.30%	41,827	47,752

If we want to consider the possibility that these phonetic characteristics operate as sociolinguistics markers in North American English, it may be useful to see which of them are associated to a higher per-capita income region and which of them are associated to a lower per-capita income region. By looking at the last two columns of table 3 we find that, whereas speakers that possess r-dropping and the “father-both-er” split have a higher per-capita income than the average, the “cot-caught” merger and the “pin-pen” merger are associated to areas in which the GDP per capita is lower than the North American average (which is U\$\$ 45,898 per year, as can be

seen on table 2). We have seen, however, that regions with and without each of these phonetic characteristics overlap among themselves. To analyze the socio-economic significance of these features, therefore, it may be useful to use a method that captures the partial correlation of each characteristic with per-capita income. This is what we do in the next section.

#### **4. Socio-economic valuation through hedonic pricing**

Hedonic pricing is an analytical method, originally developed in the field of economic statistics, to decompose the total value of a certain good or service into partial values, associated to the characteristics possessed by such good or service. It relies on a least-square regression analysis, in which the dependent variable is a monetary magnitude (e.g., the price of a good, or the income of a group of people), and the dependent variables represent the characteristics associated to that magnitude.

In a context like that, the so-called “hedonic prices” are the coefficients of the independent variables corresponding to the different characteristics, which are obtained as the result of a least-square regression analysis. This econometric methodology has proved to be very useful when economists want to price characteristics that have no comparable market value (e.g., the presence of adverse effects in drugs, the existence of a park in a certain neighborhood, the presence of pollution in a river). It has also been extensively used to isolate the effect of peoples’ characteristics on wages and other forms of income, both in cases in which those characteristics may have an impact on the person’s productivity (e.g., having a university degree) and in cases in which the focus of the study is wage discrimination (e.g., being part of a certain ethnic group)<sup>10</sup>.

Least-square regression analyses are relatively common in phonetics (to find correlations between acoustic variables used to characterize sounds) and in sociolinguistics (to find correlations between linguistic variables and environmental determinants such as gender, age and social class)<sup>11</sup>. They are also very frequently used in economics to explain the behavior of variables such as GDP per capita. It is not very common, however, to find regression analyses that correlate economic and linguistic variables, although there are some papers that have advanced in that

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<sup>10</sup> For a review of the literature about hedonic pricing, which includes a detailed explanation of its use in economics, see Nesheim (2006).

<sup>11</sup> See, for example, Clopper and Pisoni (2004) and Labov (2006).

direction, especially in what concerns the relationships between linguistic capacities and income levels. This last group of papers belong to the so-called “economics of language”, which is a relatively new branch of economics that tries to capture the effect that linguistic variables can have on economic phenomena<sup>12</sup>.

The method that we use in this section, although similar to the ones commonly used in economics, has a completely different and, probably, more modest objective. Its aim is not to explain economic phenomena through linguistic variables (or vice-versa), but to correlate per-capita income levels and phonetic variables, to see if those variables have a statistically significant value as a positive or negative sociolinguistic marker. In order to do that, we run a multiple least-square regression whose form is the following:

$$\text{GDPPC} = \alpha_0 + \alpha_1 * \text{DROPR} + \alpha_2 * \text{SPLITAO} + \alpha_3 * \text{MERGEOO} + \alpha_4 * \text{MERGEIE} \quad ;$$

where GDPPC is the per-capita income of the different US states and Canadian provinces, and DROPR, SPLITAO, MERGEOO and MERGEIE are “dummy variables” (i.e., variables that can take a value of either zero or one) that account for the presence or absence of the four phonetic characteristics analyzed in this paper (i.e., r-dropping, the “father-bother” split, the “cot-caught” merger, and the “pin-pen” merger).

In a regression like this,  $\alpha_1$ ,  $\alpha_2$ ,  $\alpha_3$  and  $\alpha_4$  are the hedonic prices of the characteristics under analysis, and the estimated values for those coefficients are measures of the expected increases or decreases in GDP per capita that can be associated to those characteristics. As a result of our regression analysis, moreover, we also obtain measures of the statistical significance of those characteristics (which can be deduced from their respective “p-values”) and a measure of the goodness-of-fit of the regression (through the so-called “coefficient of determination” or “R<sup>2</sup> coefficient”)<sup>13</sup>. All these results are reported on table 4, which shows the output of three regressions performed using different assumptions.

On table 4, regression 1 and regression 2 are least-square regressions with 61 observations (corresponding to the 50 US states, the District of Columbia, the 9 Anglophone Canadian provinces, and an additional observation for the Canadian

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<sup>12</sup> For an introduction to the economics of language, with examples taken from the literature on the relationship between language proficiency and income, see Chiswick (2008).

<sup>13</sup> For an explanation of these concepts, see Kennedy (2008), chapter 2.

territories) in which the dependent variable (GDP per capita) has been weighted using the population associated to each observation<sup>14</sup>. Regression 1 uses the four phonetic characteristics as independent variables, while regression 2 omits the “father-both” split variable (which turns out to be statistically insignificant in regression 1). Regression 3 is identical to regression 2, but it only uses the 51 US observations and drops the 10 Canadian observations. The fit of the three regressions is remarkably good, since the corresponding  $R^2$  coefficients are all around 0.98.

**Table 4: Least-square regression results for GDPpc**

Concept	Regression 1		Regression 2		Regression 3	
	Coeff	P-value	Coeff	P-value	Coeff	P-value
Intercept	46140.39	0.0000	46160.29	0.0000	46199.07	0.0000
R-Dropping	9057.31	0.0002	9271.08	0.0001	9248.22	0.0001
Father-Bother Split	2239.53	0.7202				
Cot-Caught Merger	3269.87	0.0608	3257.90	0.0597	4332.49	0.0173
Pin-Pen Merger	-3333.70	0.0750	-3385.82	0.0676	-3467.15	0.0653
R-squared	0.98099		0.98095		0.98261	

The results obtained in our regression analyses seem to indicate that r-dropping is a statistically significant characteristic which is positively correlated to GDP per capita, and that the “father-both” split is not statistically significant as a linguistic marker of a higher or a lower per-capita income in North America. Moreover, r-dropping seems to increase expected per-capita income by more than US\$ 9,000 a year, and this coefficient is roughly the same in the three specifications that we have used. It is also statistically significant at a 1% probability level, since its p-value is always smaller than 0.01.

The hedonic price for the “cot-caught” merger, conversely, is only significant at a 10% level in regressions 1 and 2, and at a 5% level in regression 3. It is also positively correlated to GDP per capita, and its expected value is higher when we restrict ourselves to US observations (4,300 US\$/year) than when we also use Canadian observations (3,300 US\$/year). This may be due to the fact that the “cot-caught” merger is widespread in Canada, and GDP per capita in that country is smaller than the average US per-capita income.

The “pin-pen” merger is also significant at a 10% level but its hedonic price is negative, signaling an inverse correlation between this phonetic characteristic and per-

<sup>14</sup> All the regressions whose results are reported in this paper were run using E-Views 3.1.

capita income. In the three regressions performed, the coefficient obtained is in the range from U\$S 3,300 to U\$S 3,500 per year, which can therefore be considered as a measure of the expected decrease in per-capita income associated to areas in which the “pin-pen” merger is a dominant phonetic characteristic.

The results obtained using the hedonic-price methodology can be compared to the ones gotten through a more conventional set of “sociolinguistic regressions”, in which the dependent variables are the four phonetic characteristics and the independent variable is GDPpc. These results are reported on table 5. In it we can observe the estimated intercept for each regression, together with the coefficient corresponding to the GDPpc variable, the p-value for that coefficient, and the R<sup>2</sup> coefficient for each regression. The four regressions were run using a logistic (logit) model, in which the 61 observations were weighted by their associated population.

**Table 5: Logistic regression results on GDPpc**

Dependent variable	Intercept	Slope	P-value	R-squared
R-Dropping	-4.27402	0.00006	0.194	0.0353
Father-Bother Split	-5.24661	0.00005	0.426	0.0371
Cot-Caught Merger	0.02937	-0.00001	0.699	0.0020
Pin-Pen Merger	5.26315	-0.00014	0.008	0.1206

One considerable difference between the results of the regressions described in table 5 and the ones reported on table 4 is their goodness of fit. Being univariate equations in which the dependent variable is a dummy variable, these regressions have much lower R<sup>2</sup> coefficients, which range from less than 0.01 to slightly more than 0.12. We can also see that the independent variable (which in these cases is always GDPpc) is statistically significant only for the “pin-pen” merger, but not for r-dropping, the “father-bother” split or the “cot-caught” merger.

For the cases of the r-dropping, “father-bother” split and “pin-pen” merger regressions reported on table 5, the signs of the slope coefficients coincide with the ones obtained in the regressions of table 4. The insignificant negative coefficient of GDPpc in the “cot-caught” merger logistic regression, conversely, contrasts with the much more significant and positive correlation found between per-capita income and the “cot-caught” merger in the hedonic-price regression (once we control for the interaction between that variable and the other phonetic characteristics under analysis).

## 5. Concluding remarks

The geographic distribution of four important phonetic characteristics that are present in North American English (r-dropping, and the “father-bother”, “cot-caught” and “pin-pen” mergers) is useful to define different areas and to study the relationship between the presence or absence of those characteristics and some socio-economic indicators for those areas. One of these indicators is per-capita income, which can be calculated using figures from the demographic and economic statistics of the United States and Canada.

In this paper we have tried to find the relationship between per-capita income and phonetic characteristics through different routes. We have first used a descriptive approach that calculates the figures for the GDP per capita that correspond to regions in which each of the four analyzed characteristics is either present or absent, and found some variation that seems to indicate that r-dropping and the “father-bother” split are associated to areas with a relatively higher per-capita income, while the “cot-caught” merger and the “pin-pen” merger are associated to areas with a relatively lower per-capita income. These results are essentially the same that we find when we run logistic regression equations in which each characteristic is the dependent variable and GDP per capita is the independent variable, although those equations always show a very poor fit and, sometimes, coefficients that are not statistically different from zero.

If we apply an alternative method (hedonic pricing), drawn from the literature on economic statistics, and use GDP per capita as the dependent variable and the four phonetic characteristics as independent variables, then our results improve considerably. We now find that, although the “father-bother” split coefficient is not statistically different from zero, the coefficients for r-dropping and the “cot-caught” and “pin-pen” mergers are statistically significant. We also find that, controlling for the presence of the other characteristics, the “cot-caught” merger seems to increase rather than decrease the expected per-capita income of the regions in which it is present. These results seem to be relatively robust, since they do not qualitatively change when we try different regression specifications.

The empirical exercise that we performed in this paper, however, may be subject to some criticism. One of its biggest weaknesses is that it relies on aggregate data (at a state or provincial level), and it is therefore unable to capture the association

between phonetic differences and variables such as gender, age or social class inside a particular geographic area<sup>15</sup>. This weakness, notwithstanding, has more to do with the actual database that we assembled than with the method itself, since it would be perfectly possible to apply a similar methodology using data from individuals (who report their personal incomes). The main advantage of the methodology presented here, we believe, is the fact that it addresses the correlation that linguistic variables simultaneously have with a socio-economic variable such as per-capita income, and measures that correlation through a set of monetary values (hedonic prices) that can be contrasted among themselves using their sign, their absolute value and their statistical significance.

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<sup>15</sup> In variables such as r-dropping, for example, a considerable social-class variation has been reported in several geographic locations (Romaine, 2001), and it is even possible to find cases in which r-dropping is associated to age or to the history of a person's family in a particular area (Sumner and Samuel, 2009).

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