INCOME DISTRIBUTION AND INCOME SOURCES IN URUGUAY

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This paper is concerned with changes in the distribution of income sources in Uruguay after the late eighties. An apparent stability in the distribution of total incomes is hiding deep transformations affecting the generation of that income. The distribution across all income earners at the end of the eighties exhibited two well-distinguished poles, each associated with one of the main income sources: pension benefits and wages. This bimodality diminished during the nineties due to the reduction in polarization by income sources. In the same period we find that in the case of labor earnings there was a net transfer of population mass from the middle of the distribution to both extremes, which results in an increasing polarization within this income source. This phenomenon resembles the Anglo-Saxon experience of the shrinking middle class.

I. Introduction

The purpose of this paper is to study the evolution of income distribution by sources in Uruguay between 1989 and 1997, the last year of available uniform data. Low levels of inequality compared to other Latin American Countries have

characterized its income distribution. Papers on the topic developed by Bucheli and Rossi (1994) and Vigorito (1998) show that income distribution has not varied very much during recent years. This is in contrast to the situation experienced by the remaining Latin American countries, which have increased their levels of inequality.

Other studies show, however, greater inequalities in certain components of household income. Bucheli and Rossi (1994) reveal important changes in the distribution of pensions; Miles and Rossi (1999) and Gradín and Rossi (2000) indicate a growing inequality in the distribution of wages since the beginning of the 1990s. According to this last paper, between 1990 and 1996 the Gini index grew by 17 per cent in Montevideo and by 12 per cent in the rest of urban Uruguay, the increase in the Theil index was even larger (36 and 30 per cent respectively). The same paper demonstrates that the wage distribution in Uruguay also increased its degree of bipolarity, shrinking in the middle.

The evolution of the distribution of income in Uruguay has to be seen in the context of important changes in the labor market and in the social protection system. This paper is concerned with these distributive transformations, providing empirical evidence of how an apparent stability in total income distribution is hiding intense transformations in the generation of income from different sources: labor income, pensions and self-employment income.[1]

In our view, the transformations occurred in the income distribution by sources in Uruguay can be easily characterized from the point of view of polarization because, as will be demonstrated in the next sections, they involved two different processes going in opposite directions regarding polarization in society.

On the one hand, the well-known phenomenon of the *disappearing* or *shrinking middle class* is found within the distribution of labor income for the same period in the way described by Wolfson (1997): "A more polarized income distribution is one that is more *spread out* from the middle, so there are fewer individuals or families with middle level incomes. In addition there is a sense that this spreading out is also associated with a tendency toward *bimodality*, a clumping of formerly middle level incomes at either higher or lower levels" (p. 402).

On the other hand, in this paper we show that a fundamental change appears in the underlying poles of the distribution of total income across earners, so that starting from a highly polarized distribution, polarization substantially decreased, at least as far as the phenomenon of polarization was summarized by Esteban and Ray (1994): "Suppose that the population is grouped into significantly-sized *clusters*, such that each cluster is very *similar* in terms of the attributes of its

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[1] Other less relevant (and more irregular) incomes have been omitted, as other social benefits or grants.

members, but different clusters have members with very *dissimilar* attributes. In that case we would say that the society is *polarized*" (p. 819). In our case, clusters are given by the different way households obtain their main income: the labor market or the pensions system.

As a consequence, in order to summarize distributional changes we will use polarization indices because measures that are consistent with the Lorenz dominance criterion are not adequate in this context. Indeed they cannot distinguish between convergence to the global mean and convergence to local poles. Only an approach based on polarization indices is able to adequately make this crucial distinction.[2]

The structure of the paper is as follows. Section II focuses on Uruguay's economic framework, Section III deals with changes in labor earnings as well as in total incomes, which are analyzed through the estimation of their respective underlying densities. Using the same tool, section IV analyzes retirement incomes. In order to summarize distributional changes, sections V and VI present the results of computing polarization indices from an extension of Esteban and Ray's contribution to the measurement of polarization. The last section summarizes the main conclusions.

II. The economic framework

Uruguay is a particular country within the Latin American context. Uruguay is mainly an urban country. Half the total urban population lives (and nearly two thirds of the economic activity is carried out) in the metropolitan area of Montevideo. The other half of the urban population and one third of economic activity are dispersed among the rest of urban Uruguay, which is composed of cities generally not larger than 30,000 inhabitants.

The macroeconomic framework in the country can be summarized as follows. A deep recession occurred at the beginning of the eighties but the Uruguayan economy substantially grew from the recovery of democracy in 1985 until 1994. By 1995 the country underwent a new period of recession that finished in 1996. This period was also characterized by a stabilization plan that considerably reduced inflation, and provided an increasing opening of the Uruguayan economy within the free trade area of MERCOSUR with Argentina and Brazil. A major reform of the state was conducted but, unlike other Latin American countries, to a great extent, public intervention was preserved.

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[2] Note that in both cases inequality goes down, while convergence to a unique central pole involves less polarization and convergence to two distant local points moves society to a higher level of polarization.

Regarding the labor market, the country experienced an increase in the rate of women's participation, as well as in the level of education of the new entrants. A demand favoring the more skilled people was also observed. Furthermore, this labor market experienced a crucial institutional reform affecting the degree of centralization in wage negotiation. Until 1990 wage increases were decided in bargaining councils by unions, employers and government representatives, adjusted three times a year for the entire economic sectors and uniformly for workers from Montevideo and the rest of urban Uruguay. A decentralization process began in 1990, with wage increases decided on a local level and bargaining councils practically disappearing. This fact, jointly with the fall in industrial employment, where unions had had more preponderance, could explain the important de-unionization process observed in the Uruguayan work force, where membership is not compulsory. While in 1986 four out of ten workers were members of labor unions, in 1997 the proportion had diminished to one out of ten.

Another important change, from the point of view of its potential consequences in the distribution of income, took place in the social protection system and is related to the indexation of pensions. Before 1989, pensions were adjusted annually and linked to the wage index. Given that the inflation rate used to be high, the government was allowed to make payments in advance. The reform, approved by referendum in December of 1989, established that increases had to take place in the same month as public sector wages (more than one per year) and the rise had to be equivalent to the variation of the wage index within the adjustment period. This fact, in a context of high inflation rates implied substantial improvements in the level of pensions, moving this group up in the global distribution of income.

This study is based on data from the Household Survey of Uruguay from 1989 through 1997 (*Encuesta de Hogares*, Instituto Nacional de Estadística).[3] This survey has been carried out, in its present format, every month since 1981; its frame is the civilian population of Uruguay (RUU), broken down into one survey for Montevideo and another for the rest of urban Uruguay. It contains individual data on monthly labor earnings, non-labor earnings, age, sex, educational level, hours worked per week, marital status, occupation characteristics, and other relevant variables. All monetary variables have been deflated using the consumer price index of December of 1996. Descriptive statistics describing the data set and the variables to be used are shown in Table 1.

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[3] In 1998, the survey incorporated relevant changes affecting the sample. Among them, the new sample is based on the new 1996 Census; it changed the method for replacing households; and it included new villages from the greater Montevideo and excluded others. All these changes make comparability before and after 1998 quite difficult.

Table 1. Descriptive statistics

	Labor[*]		Pensions[**]		Total[***]		Household's equivalent income[****]	
	1989	1997	1989	1997	1989	1997	1989	1997
Montevideo								
Observations	8,708	7,950	7,358	8,498	18,085	18,937	19,247	16,746
%	46.5	42.3	57.5	60.7	51.6	50.9	30.3	29.8
Mean	5,754	6,350	2,437	3,535	5,138	5,695	3,199	3,454
Standard Deviation	5,381	6,219	2,635	3,317	5,869	6,207	3,253	3,297
RUU								
Observations	10,032	10,863	5,442	5,499	16,958	18,302	44,217	39,466
%	53.5	57.7	42.5	39.3	48.4	49.1	69.7	70.2
Mean	3,286	3,580	1,447	2,105	2,866	3,312	2,832	3,029
Standard Deviation	2,424	3,280	4,278	1,997	4,079	3,355	2,852	2,960
Uruguay (total)								
Observations	18,740	18,813	12,800	13,997	35,043	37,239	63,464	56,212
Mean	4,433	4,750	2,016	2,973	4,038	4,524	2,943	3,156
Standard Deviation	4,256	4,942	3,466	2,955	5,208	5,152	2,955	3,046

Notes: All monetary units are expressed in constant pesos of December, 1996. [*] All employees with a positive amount of labor earnings. [**] All individuals receiving a pension benefit of any source. [***] Labor and self-employment earnings plus pension benefits. All individuals receiving one of these sources. [****] Household's equivalent income from any source, assuming redistribution within the household and with OECD equivalent scales (weight 1 for the first adult, 0.7 for the rest, and 0.5 for each child).

III. Distributional changes in the labor market and total income

In order to analyze how the labor income distribution changed in Uruguay during the nineties, in a first stage we estimate densities for labor income, considering only those individuals who earned some positive amount. As a consequence, we inspect how the whole distribution changed over time, rather than concentrating on particular points. These densities are estimated with the non-parametric technique known as *kernels*, without any assumption about the shape of the distribution. It smoothes the density avoiding the noise induced by the use of a sample instead of the whole population. We estimate a function $\hat{f}(y)$ over the logarithm of incomes $\boldsymbol{y}=(y_1, ..., y_n)$ in the sample assuming that there

exists an original density $f(y)$ from which the sample was extracted. The estimator we use is:

$$\hat{f}(y_j) = \frac{1}{h(y)} \sum_{i=1}^{n} K\left(\frac{y_j - y_i}{h}\right) \forall j ,$$ (1)

where $h(.)$ is the adaptive bandwidth (locally adjusted), and $K(.)$ is the *kernel* function, which is Gaussian in our case.[4]

Figure 1.A displays how labor income (in logarithms) distribution changed in Uruguay from 1989 to 1997, with income expressed in real terms. Given that the average labor income did decrease, the distribution shifted a little to the left. A specific distributive change stands out in the Figure, showing a prominent shrinkage in the middle of the distribution, while both extremes substantially increased in size. The phenomenon is referred to in the labor economics literature as *the disappearing middle class*, drawing the attention of a number of researchers since the second half of the eighties in the US.[5] In other words, the distribution generated by the labor market became more polarized as Wolfson (1994 and 1997) or Esteban and Ray (1991, 1993 and 1994) conceptualized this notion.

The estimation of the same densities - separately for Montevideo and the rest of urban Uruguay (RUU) - shows that workers from Montevideo contributed to the increase in the upper tail while workers from the rest of urban Uruguay contributed to the enlargement of the lower tail (Figure 1.B). Comparing the densities in both distributions we observe that they moved apart from each other. While the density corresponding to Montevideo shifted to the right, that corresponding to the rest of urban Uruguay moved towards the left. In both cases the mode is less prominent in 1997 than it was in 1989.
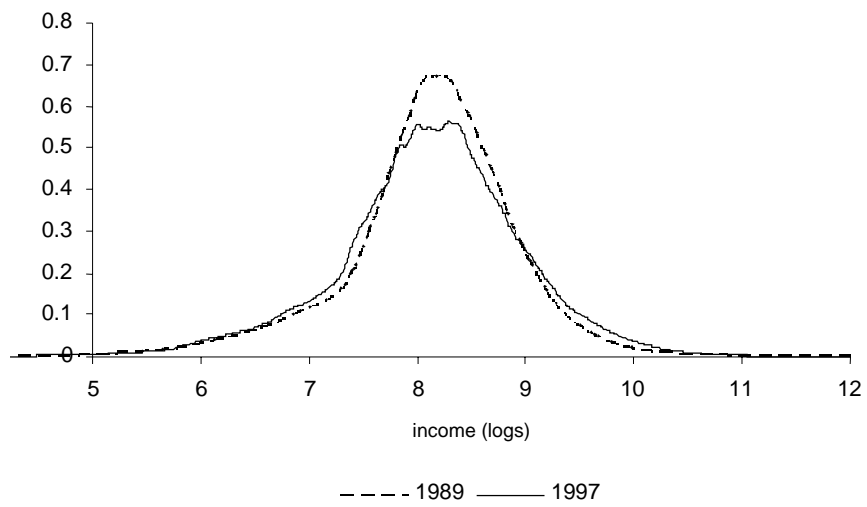
What is the reason for this increasing polarization in labor earnings? In Gradín and Rossi (2000), for instance, we show that the distribution of wages in Montevideo presented increasing polarization by qualification and age, which was consistent with increasing returns to education and experience. In the rest of urban Uruguay there was evidence of increasing wage polarization by sector (public versus private) and branch of activity. In both cases, Montevideo and rest of urban Uruguay, polarization by sex declined, showing that the gender gap did not explain this tendency towards augmenting polarization.

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[4] We refer to Silverman (1986) and subsequent literature for details regarding this technique.

[5] A major part of these studies were published in the *Monthly Labor Review*, but other similar studies were conducted in different countries and on different dates.

Figure 1. Densities of labor income

A. Uruguay

income (logs)

– – – 1989 ——— 1997

B. Montevideo and the rest of urban Uruguay (RUU)

income (logs)

– – – Montevideo 1989   ——— Montevideo 1997
– · – · RUU 1997   ——— RUU 1997
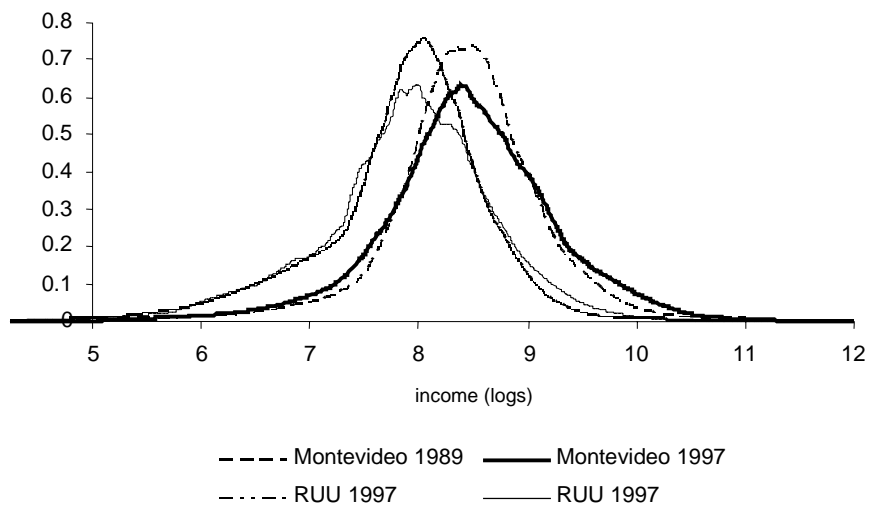
One could expect at first that, given this clear polarization increase in labor income distribution and considering that wages account for more than a half of incomes, we would find a similar trend if we lumped all income sources together. In

the remainder of this section we will show that it was not the case in Uruguay for the period we are considering.

Figures 2.A and 2.B show the changes in densities of the distribution of total individual income across any type of earner for Montevideo and the rest of urban Uruguay. Total income includes labor income, pensions and self-employment income, omitting other less-relevant sources of income. It is shown in Figure 2.A that in 1989 the distribution in Montevideo was quite bimodal; a great proportion of the population was gathering at two well-defined poles that were significantly separated from each other. This bimodality, however, almost disappears by 1997.

A similar trend is found outside Montevideo in Figure 2.B, the difference being that the first mode is even more outstanding in 1989, and though smoothed during the nineties, it still persists in 1997. The distribution for the whole Uruguay (omitted here), that is just the weighted average of both regions, reproduces the same process. Thus, we cannot say that labor income polarization resulted in a higher polarization in total income. Some other force was acting in the opposite direction, compensating this trend. The next section identifies this force as the big shift experienced by pension benefits.

IV. Distributional changes and retirement pensions

Whenever a bimodal distribution is found, one should immediately inspect whether or not this distribution is just the result of summing up two different sub-distributions, in this case two income-generation processes, each exhibiting a different unique mode so that bimodality results from aggregation.

In this section we show that, indeed, the two modes found in the distribution of total income in both Uruguayan urban regions in 1989 were the result of aggregating income from two distinct sources, labor income and retirement pensions, which account for almost 80% of total income. This is shown in Figures 3.A and 3.B for both years and areas. For this, we make an exhaustive partition of the population according to their main source of income: labor, retirement pensions and self-employment incomes. This breakdown leads the total income density to be the weighted sum of sub-population densities, with the weights being respective population shares. We omit the representation of the third source, self-employment, to allow a better view of distributional changes.

In Montevideo in 1989 (Figure 3.A) both main sources of income, labor and retirement pensions, show two distant poles separated by a great distance. These poles correspond to the modes observed in the aggregate density (Figure 2.A). So

Figure 2. Densities of total income

A. Montevideo
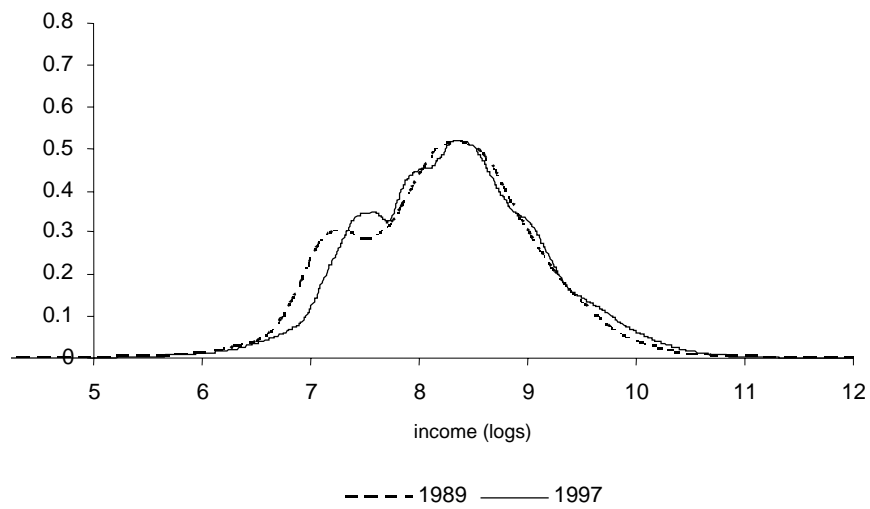
B. The rest of urban Uruguay (RUU)
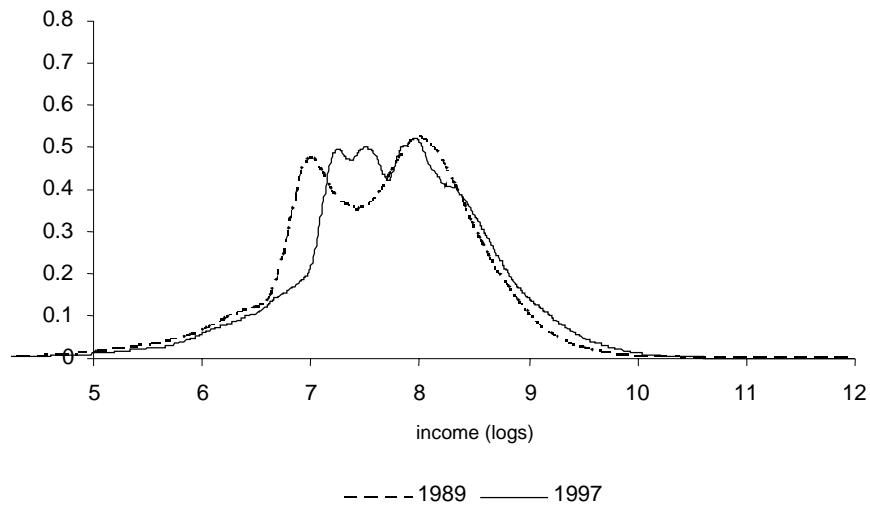
we can interpret the generation of income in 1989 as the result of two different stochastic processes, where one's position in the income space substantially depends on which is the main source of income. One will be in a higher position

Figure 3. Densities of total income by main income sources

A. Montevideo
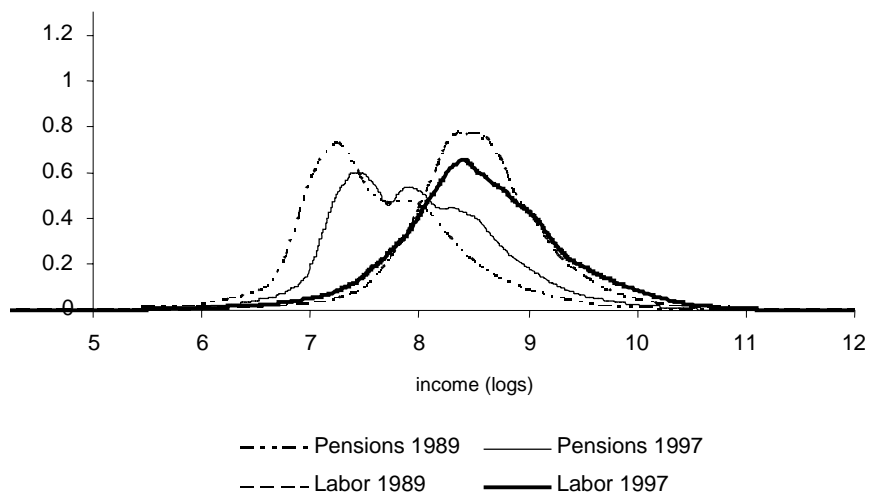
B. The rest of urban Uruguay (RUU)
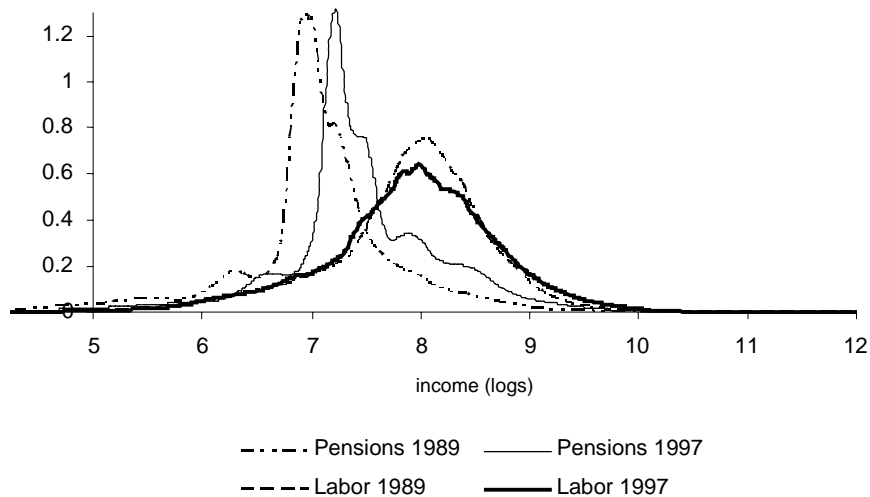
provided income is obtained mainly in the labor market, and in a lower position in the case of the pension system. The result of this is a high degree of polarization in total income. But we find that the distribution by income sources changed during the nineties in two different aspects. On one hand, the density of those

mainly receiving retirement pensions moved to the right, approaching that of labor income earners; on the other, labor income earners now exhibit a higher degree of internal dispersion. We observe, as a consequence, a significant increase in overlapping between both groups of income receivers, which finally explains that the bimodality in the aggregate distribution gradually faded with time. In 1997 the distinction between labor income and retirement pension recipients appears to be much less crucial than in 1989. A quite similar result is found in the RUU (Figure 3.B) with both income sources displaying a substantially lower degree of internal dispersion than in the capital, especially visible in the case of those receiving pension benefits. In both urban areas the new modes are less prominent than before.

V. Polarization in Uruguay: Income groups

So far we have devoted the analysis to the direct observation of densities. The problem with this approach is that it does not allow to quantify the phenomenon we are analyzing. In this section we summarize distributive changes in relative income using a battery of indices to be able to measure the intensity of these distributional changes.

In order to measure polarization, several indices have been proposed in the literature. Apart from the contributions of Wolfson and Esteban and Ray, one can mention Chakravarty and Majumder (2001), Wang and Tsui (2000) or Zhang and Kanbur (2001). In this paper we use the index proposed by Esteban and Ray (1994), obtained following an axiomatic approach, but due to its difficulties in being implemented in personal income distributions, we follow the extension proposed in Esteban, Gradín and Ray (1999) to make it operative in this context. So, for a given distribution f we compute polarization as follows:

First, we fit a 2-spike distribution to the original density, such that in preserving the same income it minimizes the error of representing f by this degenerated distribution. This defines groups as two income-classes such that in the representation all members in each group are grouped into its respective mean income. The error is defined as the intragroup dispersion within the group as measured by Gini index of inequality. The same is undertaken for a 3-group representation.[6]

Secondly, we compute polarization in the 2- and in 3-spike distributions using

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[6] The same exercise was conducted with other number of groups posing the same results. In Esteban, Gradín and Ray (1999) it is shown that the measure proposed by Wolfson (1994) is a particular case of this approach when there are two groups of identical size.

Esteban and Ray's index (*simple polarization*). This is polarization between-groups, from which we subtract the error of the representation (*intragroup heterogeneity*), as increasing dispersion within the groups should reduce overall polarization.

Then, for ρ being the 2-spike (or 3-spike) optimal representation, the measure for *extended polarization* is:

$$P(f;\alpha,\rho) = ER(\alpha,\rho) - \beta\left[G(f) - G(\rho)\right], \qquad (2)$$

where α is a parameter indicating the sensitivity to polarization (and so the distance to the notion of inequality) that lies in the [1,1.6] interval in order to fulfill a set of axioms; β is the weight assigned to the error term; G is the Gini coefficient of inequality and *ER* is the index of simple polarization proposed in Esteban and Ray (1994) computed over the 2 or 3-spike distribution with average incomes (y_1, y_2, y_3) expressed in logs and the respective population shares (p_1, p_2, p_3), defined as follows:

$$ER(\alpha;\rho) = \sum_i \sum_j p_i^{1+\alpha} p_j \left| y_i - y_j \right|. \qquad (3)$$

In the case of $\beta=0$, equation (2) simplifies to (3).

Results for 1989 and 1997 by main income sources across individuals in Uruguay are presented in Table 2, together with total income (the sum of all sources) and households' equivalent income. In this Table, *extended polarization* as defined in (2) is computed in Part A for two cases: bi-polarization (2 groups) and tri-polarization (3 groups), providing the corresponding figures for *simple polarization* according to equation (3). For the computation of polarization we take an intermediate value of α (=1.3), but results are quite similar with a higher and a lower level (1.6 and 1). The parameter β in extended polarization is 1, giving the same weight to both components, simple polarization and intragroup heterogeneity.[7] In Table 2 Part B, we present results for the well-known Gini index of inequality for the whole population, as well as the within-groups component (in 2 and 3 group cases), called *intragroup heterogeneity* (second term of equation 2). Part C of Table 2 displays the size of groups in the case of tri-polarization under two assumptions: when these three groups are obtained endogenously (minimizing intragroup

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[7] In Gradín (2002) there is a justification for this value of β. Under certain conditions it is the largest value consistent with the general principle that a progressive transfer within groups increases bipolarization while with a progressive transfer between groups bipolarization is reduced.

Table 2. Polarization in Uruguay, 1989-97

		Labor		Pensions		Total income		Households' equivalent income	
		1989	1997	1989	1997	1989	1997	1989	1997
A. Polarization									
2 groups	-extended	0.094	0.112	0.113	0.125	0.126	0.127	0.105	0.111
	- simple	0.208	0.237	0.229	0.239	0.257	0.256	0.218	0.227
3 groups	- extended	0.110	0.132	0.119	0.135	0.152	0.150	0.118	0.125
	- simple	0.164	0.190	0.177	0.190	0.210	0.209	0.170	0.178
B. Inequality (Gini)									
Whole population		0.382	0.436	0.430	0.434	0.463	0.468	0.393	0.414
Intragroup heterogeneity									
	- 2 groups	0.114	0.125	0.117	0.115	0.130	0.129	0.113	0.116
	- 3 groups	0.054	0.057	0.058	0.055	0.059	0.058	0.052	0.053
C. Middle income group size									
Endogenous (minimum intragroup heterogeneity)[*]		0.401	0.380	0.356	0.327	0.376	0.363	0.378	0.370
Exogenous [**]	- 75-125% average	0.312	0.256	0.214	0.205	0.236	0.221	0.276	0.252
	- 60-140% average	0.504	0.418	0.409	0.356	0.379	0.365	0.448	0.423
D. Income difference between extreme groups [***]		5.2	6.7	6.2	6.3	7.7	7.8	5.4	6

Notes: [*] An endogenous middle class means that cut-off points to construct the 3 groups distribution are obtained through minimization of intragroup heterogeneity. These are the groups used to compute polarization with 3 groups. [**] An exogenous middle class means that cut-off points to construct the 3 groups distribution are fixed arbitrarily to be a percentage to the mean, with results provided in two different cases: between 75 and 125% of the mean and between 60 and 140%. [***] Ratio of the richest group' income to the poorest' one in the 3 groups distribution. The case of individual total incomes only considers those people with a positive amount of any source and no redistribution within households is assumed. In the case of households' incomes, perfect redistribution within households is assumed with all people belonging to the sample (regardless of being income receivers or not).

heterogeneity) and when they are defined in an exogenous way (assuming that the middle group has incomes lying in the range 25% above and below average income, and the same with the percentage being 40%). Finally, Part D of Table 2 provides the ratio of the richest group average income to the poorest one (in the three-group case).

These results show that both main sources of income experienced an increase in extended polarization for two and three underlying income classes, but in a different way. Focusing in the three-group case[8], we find that in 1997 wage earners were 20% more polarized in labor incomes than in 1989 (the index moved from 0.110 to 0.132). This shift in polarization was due to a big increase in the distance between extreme groups. The richest group mean income was 5.2 times that of the poorest in 1989, while this ratio was 6.7 in 1997. The increase in polarization in pensions, however, was more limited (from 0.119 to 0.135, that is 13%) and had nothing to do with increasing distance between extreme groups. Indeed, the ratio of incomes between the richest and the poorest groups appears to be quite stable (from 6.2 to 6.3). Polarization increased because of extreme groups based on pensions being internally more homogenous (within-group dispersion went from 0.058 to 0.055) and because of increasing size of endogenous extreme groups (there was a 32.7% of population in the middle group in 1997 versus 35.6% in 1989). Labor income also shows a substantial increase in inequality, Gini rises from 0.382 to 0.436, in contrast with stability in the case of pensions (around 0.430).

How did all these distributional changes affect the distribution of total income? We see in the third column of results in Table 2 that it remained unchanged, only a low increase in Gini coefficient is found (from 0.463 to 0.468), with no relevant change in polarization (from 0.152 to 0.150). If we rather look at the variable that ultimately is relevant for welfare, household equivalent income[9], we see that it slightly increased (5-6%) in both polarization (from 0.118 to 0.125) and inequality (from 0.393 to 0.414). However, after the previous analysis we can conclude that it was the result of household formation rather than the result of the process generating incomes. Elements such as the correlation between income sources in a household, the number of earners or the household composition might explain this increasing inequality and polarization.

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[8] The discussion for two groups does not differ too much. Results are included in Table 2 for robustness.

[9] Defined using OECD equivalent scales (weighting 1 the first adult, .7 the rest of adults and .5 children) and weighting each household according to the number of members. In this case all individuals have incomes, as we attribute to each person the adjusted income of her household.

Table 3. Polarization in Montevideo and the rest of urban Uruguay: 1989-97

Montevideo		Labor		Pensions		Total		Household	
		1989	1997	1989	1997	1989	1997	1989	1997
A. Polarization									
2 groups	- extended	0.097	0.115	0.132	0.138	0.124	0.127	0.100	0.115
	- simple	0.208	0.235	0.255	0.259	0.254	0.255	0.207	0.231
3 groups	- extended	0.109	0.130	0.142	0.152	0.147	0.149	0.109	0.129
	- simple	0.162	0.186	0.202	0.208	0.207	0.207	0.159	0.181
B. Inequality (Gini)									
Whole population		0.384	0.432	0.462	0.452	0.461	0.466	0.372	0.416
Intragroup heterogeneity									
	- 2 groups	0.111	0.121	0.123	0.121	0.130	0.128	0.106	0.115
	- 3 groups	0.053	0.056	0.060	0.056	0.059	0.058	0.050	0.053
C. Middle income group size (3 groups)									
Endogenous (min. intragroup heterogeneity)		0.384	0.376	0.341	0.348	0.379	0.369	0.378	0.366
Exogenous	- 75-125% average	0.294	0.244	0.185	0.203	0.232	0.224	0.289	0.249
	- 60-140% average	0.490	0.406	0.347	0.335	0.383	0.366	0.478	0.416
D. Income difference between extreme groups		5.2	6.5	7.3	7.1	7.6	7.7	4.9	6.0
A. Polarization									
2 groups	- extended	0.096	0.108	0.088	0.103	0.129	0.122	0.100	0.100
	- simple	0.206	0.227	0.196	0.207	0.253	0.243	0.209	0.206
3 groups	- extended	0.112	0.126	0.095	0.103	0.148	0.137	0.110	0.109
	- simple	0.163	0.181	0.148	0.154	0.204	0.192	0.162	0.159
B. Inequality (Gini)									
Whole population		0.365	0.405	0.373	0.378	0.445	0.434	0.378	0.370
Intragroup heterogeneity									
	- 2 groups	0.110	0.119	0.108	0.103	0.124	0.121	0.110	0.106
	- 3 groups	0.051	0.055	0.053	0.051	0.056	0.056	0.052	0.049

Table 3. (Continued) Polarization in Montevideo and the rest of urban Uruguay: 1989-97

Rest of urban Uruguay		Labor		Pensions		Total		Household	
		1989	1997	1989	1997	1989	1997	1989	1997
C. Middle income group size (3 groups)									
Endogenous (min. intragroup heterogeneity)		0.405	0.394	0.390	0.364	0.365	0.366	0.380	0.380
Exogenous	- 75-125% average	0.327	0.287	0.304	0.258	0.237	0.245	0.288	0.293
	- 60-140% average	0.504	0.456	0.558	0.475	0.368	0.382	0.479	0.485
D. Income difference between extreme groups		4.9	5.9	4.9	4.9	7.0	6.5	5.0	4.9

Note: The case of individual total incomes only considers those people with a positive amount of any source and no redistribution within households is assumed. In the case of households' incomes, perfect redistribution within households is assumed with all people belonging to the sample (regardless of being income receivers or not).

Table 3 displays the same results separately for Montevideo and rest of the urban country. In 1989 both urban regions showed similar distributive patterns, but the increase in labor income polarization was larger in Montevideo (from 0.109 to 0.130, that is 20%). Another significant difference between both regions is that total income polarization and inequality were reduced in the rest of urban Uruguay (from 0.148 to 0.137 in the case of extended polarization), being almost constant in Montevideo, while household income polarization and inequality were substantially increased only in Montevideo (extended polarization increased from 0.109 to 0.129). In the rest of urban Uruguay, household income polarization was rather constant or even declined (from 0.110 to 0.109).

In order to show how increasing polarization took place we account for the decline in the middle class in two different ways. First, we exogenously define the middle-income group to be all people whose income is higher than 75% of the average and lower than 125%; alternatively 60%-140% is also provided. Additionally, we provide the endogenous middle-income group used to compute polarization indices shown above (with 3 groups). In this case the interval defining the middle is different in each distribution, varying with time. With both definitions of the middle-groups, also presented in Part C of Tables 2 and 3, we observe a decline in its size that is smaller in the case of total and household income than

when considering different income sources. In the exogenous case (75-125%), for instance, the middle group for labor income earners shrank in Uruguay from 31.2% to 25.6% between 1989 and 1997. The middle group is larger in size in the rest of urban Uruguay than in Montevideo. However the decline in size is much lower if we consider all earners (from 37.6% to 36.3%) or households (from 37.8% to 37.0%). Furthermore the income ratio of top group to bottom group income in the three-groups optimal distribution -Part D of Tables- goes up in all three cases, even if the change is definitely stronger for labor income.

VI. Polarization in Uruguay: Groups by income sources

There were small changes in the level of polarization of total income and of household equivalent income in Uruguay between 1989 and 1997. The assumption in the previous section was that groups were formed by income classes. What if we assume that individual attachment to a group regards the income source rather than the income level? For this we follow Gradín (2000), using the Esteban, Gradín and Ray approach computing polarization for exogenous sub-populations, which are given in this case by the main income source (ρ^c) in both, total earners and household income. [10] Thus, we compute:

$$GP\big(f, \alpha, \rho^c\big) = P\big(f, \alpha, \rho^c\big) + \beta, \tag{4}$$

with the function P defined as in (2).

Table 4 summarizes the results of computing polarization by groups, where groups are defined according to which is the main source of income (pensions, wages or self-employment income). Polarization by groups computes GP as in equation (4), indicating the level of polarization originated by this particular partition (Part A of Table 4), which is the result of *simple polarization between groups* $ER(p^c, \alpha)$ - Part B of Table 4 - minus *intragroup heterogeneity* $[G(f) - G(p^c)]$ - Part C of Table 4 - plus the normalizing term β ($= 1$).

Table 4 shows, as expected from the graphical analysis, that polarization by income sources substantially declined in Uruguay. This is true regardless of the variable we analyze, total income (from 0.816 to 0.716) or household equivalent income (from 0.705 to 0.647), and occurred in both urban regions. In both

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[10] Different approaches have been proposed in order to deal with polarization under exogenous sub-populations. For instance, D'Ambrosio (2001) uses an alternative extension of Esteban and Ray's approach, replacing distances in terms of average incomes with an index of distance between sub-distributions. Zhang and Kanbur (2001) propose the use of the ratio "between-group" to "within-group" inequality.

Table 4. Polarization by main income source of income in Uruguay, 1989-97

		Individual total incomes		Households' income	
		1989	1997	1989	1997
A. Polarization by groups (*GP*)		0.816	0.716	0.705	0.647
B. Polarization between groups (*ER*)		0.108	0.067	0.035	0.021
population shares	Labor	0.518	0.489	0.635	0.590
(sum = 1)	Pensions	0.324	0.344	0.179	0.212
	Self-employed	0.158	0.168	0.186	0.198
Relative incomes	Labor	1.153	1.101	0.990	0.985
(average = 1)	Pensions	0.545	0.707	0.803	0.901
	Self-employed	1.434	1.307	1.224	1.151
C. Intragroup heterogeneity		0.292	0.351	0.330	0.374
(Gini within the group)					
	Labor	0.382	0.436	0.367	0.402
	Pensions	0.428	0.429	0.396	0.381
	Self-employed	0.513	0.520	0.436	0.465
D. Overlapping	Overall	0.711	0.791	0.870	0.919
(index I)	Labor-pensions	0.314	0.479	0.597	0.694

Note: The case of individual total incomes only considers those people with a positive amount of any source and no redistribution within households is assumed. In the case of households' incomes, perfect redistribution within households is assumed with all people belonging to the sample (regardless of being income receivers or not).

geographical areas the main source of reduction was the approximation between income poles, especially between labor earners and pensioners. Indeed, attending to relative incomes shown in Part B of Table 4, in Uruguay pensioners improved from 55% of the global average in total income to 71%, while self-employment and labor earners declined from 143 and 115% to 131 and 110%. Furthermore, groups generally became internally more dispersed; intragroup heterogeneity increased from 0.292 to 0.351 in the case of total income. However, this varies across groups because while inequality within labor earners increased throughout Uruguay, from 0.382 to 0.436, dispersion within pensioners remained stable (0.428-0.429). Similar results are found in the column for household equivalent income and in both urban areas.

Intragroup heterogeneity as measured by Gini, given that groups overlap, can be re-written as the weighted sum of Gini for each group, where each group is weighted accordingly to its population share and the degree of overlapping with the whole population.[11] Thus, the measure (4) allows us to take into account the degree of overlapping among sub-distributions, through the index *I*. For q_i indicating the *i*th sub-population share, the index is:

$$I = \sum_i I_i q_i \,, \tag{5}$$

where I_i indicates the overlapping between the *i*th sub-distribution and the overall population and comes from the breakdown of the Gini index of inequality, such that we re-write the intragroup heterogeneity as:

$$\varepsilon(f, \rho^c) = \sum_i s_i G\left(f_i\right) I_i \tag{6}$$

and it can be expressed as the weighted sum of each I_{ij} representing the overlapping between the *i*th and the *j*th sub-distributions, weights being respective population shares:

$$I_i = \sum_j I_{ij} q_j \tag{7}$$

We refer to Gradín (1999 and 2000) for details. Given that $I_{ij} \neq I_{ji}$, for two sub-populations *i* and *j* we will compute the overlapping between them as:

$$I_{ij}^* = I_{ij} q_i + I_{ji} q_j \tag{8}$$

According to Yitzhaki (1994), based on Laswell's notion of stratification, "perfect stratification occurs when the observations of each group are confined to a specific range, and the ranges of groups do not overlap. Hence we can view overlapping as non-stratification" (p. 148). According to this notion, Yitzhaki and Lerman (1991) and Yitzhaki (1994) develop overlapping indices behaving quite similarly to the indices used in this section, the latter being more directly connected to our measures of polarization.

The results in Part D of Table 4 show that the degree of overall overlapping increased between 1989 and 1997 in both geographical areas for both total and household equivalent income, but the increase was larger in the former case (from 0.870 to 0.919 in the whole country). Of special relevance was the large increase in

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[11] See Gradín (2000) for more details

overlapping between labor earners and pensioners subgroups in all cases (from 0.597 to 0.694 in the country), reducing social stratification or segmentation due to income sources in Uruguay at the same time that polarization was reduced.

VII. Conclusions

In this paper we have shown, using kernel densities and polarization summary indices, that income distribution in Uruguay showed a marked change between 1989 and 1997. The change affected the process generating income via different sources such as the labor market and the pensions system, exhibiting a process of declining polarization due to an approximation between income poles with a significant decline in social stratification.

However, an increasing polarization was observed within labor market earners. This polarization was characterized by a decline in the size of the middle-income group with an enlargement of the tails. The lower tail was enlarged due to the worsening of the economic position of middle-income workers in the rest of urban Uruguay, and the enlargement of the upper tail was due to the improvement of Montevideo middle-income workers.

The improvement in the position of pensioners compensated the increasing polarization within the labor market and pensions system. Thus total income did not experience an increase in overall polarization while household equivalent income increased a little in polarization, but for reasons other than income sources.

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