

Cardoso, José; Morgado, João; Salvucci, Vincenzo

**Working Paper**

## Mapping deprivation in Mozambique: An analysis of census data (1997-2007)

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WIDER Working Paper 2016/166

## **Mapping deprivation in Mozambique**

An analysis of census data (1997–2007)

José Cardoso,<sup>1</sup> João Morgado,<sup>2</sup> and Vincenzo Salvucci<sup>3</sup>

December 2016

**Abstract:** In this study we analyse the evolution of deprivation indicators and of a multidimensional poverty index using Mozambican census data for 1997 and 2007. We analyse deprivation levels according to eight different indicators reflecting housing conditions and access to public utilities/basic services. Using the Alkire Foster method, we also construct a multidimensional poverty index based on the selected deprivation indicators. The results are presented at the provincial and administrative post levels. They suggest that more than two-thirds of households could be considered poor in 2007 with respect to the chosen deprivation dimensions. We also identify marked geographical disparities in the incidence of poverty and deprivation both among and within provinces.

**Keywords:** multidimensional poverty, deprivation, Mozambique

**JEL classification:** I31, O18, R15

**Tables and maps:** All tables and maps are the authors' own calculations.

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<sup>1</sup> Directorate of Economic and Financial Studies, Ministry of Economics and Finance, Maputo, Mozambique; <sup>2</sup> World Bank, Mozambique Country Office, Maputo, Mozambique; <sup>3</sup> UNU-WIDER, Helsinki, Finland, corresponding author: [Vincenzo@wider.unu.edu](mailto:Vincenzo@wider.unu.edu).

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Katajanokanlaituri 6 B, 00160 Helsinki, Finland

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## 1 Introduction

Between 1998 and 2007, the Mozambican economy registered an impressive average growth rate of 8.4 per cent (IMF 2016). Nevertheless, this remarkable economic growth performance was not always followed by generalized improvement in household welfare. Throughout this period, consumption poverty evolution went through two markedly different phases: a sharp reduction followed by stagnation. Between 1997 and 2003, the incidence of poverty (headcount) dropped from roughly 70 per cent of the population to 54 per cent, remaining at that level in 2008/09 (DNEAP – MPD 2010).

In developing countries poverty is commonly measured via consumption because this variable is generally taken as a good proxy for the multiple deprivations faced by the poor. Nonetheless, as underlined, for example, by Alkire (2011), several empirical studies have demonstrated non-negligible mismatches ‘between key social and income indicators, and even between income and key material deprivations’ (Alkire 2011: 2). Moreover, censuses seldom collect consumption data. For these reasons, this paper analyses the evolution of poverty in Mozambique between 1997 and 2007 using a multidimensional approach. This allows us to also assess to what extent the consumption poverty measures and alternative measures based on different deprivation indicators convey similar or complementary information for the Mozambican case.

The present multidimensional analysis was undertaken using census data for 1997 and 2007. These surveys included comparable well-being indicators that reflect two important dimensions of the living standards of the population, namely housing conditions (type of housing, roof, walls, and floor), and access to public utilities/basic services (electricity, water, sanitation, radio). For each indicator, we conducted an analysis of the deprivation levels in 1997 and 2007, and analysed the variation over time. Since the censuses cover the whole population, we were able to construct deprivation maps disaggregated at the provincial and administrative post levels.<sup>1</sup> To our knowledge, this is a novelty for the case of Mozambique.

In addition to this, we constructed a multidimensional poverty index based on the Alkire Foster method (Alkire and Foster 2011), which aggregates the selected indicators into a synthetic measure. We computed the poverty incidence ( $H$ ) and the adjusted poverty incidence ( $M^h$ ), which corresponds to the incidence of poverty weighted by its intensity, i.e. the average deprivation suffered by the poor.

Our results suggest that, from a multidimensional perspective, more than two-thirds of Mozambican households could be considered poor in 2007. In addition to this, the great majority of our indicators revealed a Centre/North versus South divide, whereby the North and Centre regions tend to be considerably more deprived than the South. Finally, we also noticed that lower levels of deprivation tend to be concentrated along major roads (particularly the N1 in the South Region and the Beira–Chimoio road in the Centre region), in large urban centres (e.g. provincial capitals), and in some border areas.

A comparison between our results and the estimations of consumption poverty contained in the Third National Poverty Assessment (DNEAP – MPD 2010) shows considerably different patterns. These differences demonstrate that the standard assessments of consumption poverty

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<sup>1</sup> Mozambique is divided into 11 provinces, including the capital Maputo. Each province is sub-divided into districts, which are in turn divided into smaller administrative posts (*posto administrativo*).

could greatly benefit from being complemented by multidimensional analyses such as the one proposed in this study. The paper proceeds as follows: Section 2 presents the data and discusses the method employed; Section 3 presents the results; and Section 4 concludes.

## 2 Data and methodology

This study is based on the two most recent censuses conducted in Mozambique, in 1997 and 2007. The censuses covered the whole population of the country, including those who were temporarily absent. Fewer questions are generally asked in censuses than in household surveys, so the choice among available deprivation indicators was quite limited. This study uses those indicators that are included in both censuses and describe housing conditions (type of housing and quality of roof, walls, and floor) and access to public utilities/basic services (electricity, safe water, quality sanitation, and radio ownership). We believe that these indicators, although not covering all the dimensions of well-being, nonetheless reflect important dimensions of a population's living standards. On the one hand, access to safe water and quality sanitation is directly linked with individual and public health, and has well studied implications on child nutrition (e.g. Lee et al. 1997; Smith and Haddad 2000). On the other hand, housing conditions and access to services such as electricity have been established as robust proxies for long-term well-being, in contrast with income or consumption, which are considerably more volatile (Arndt et al. 2016; Tran et al. 2015). Moreover, ownership of a radio is a proxy not only for ownership of durable goods but also for ease of access to information.

For each of the selected indicators, the conditions under which a household is considered deprived are defined (see Table 1). Based on these criteria, we present a table for each of them, showing the percentage of deprived households at national level in 1997 and 2007. In addition to this, two sets of maps showing the evolution of the deprivation levels between 1997 and 2007 at provincial and administrative post levels are presented.

Besides the analysis of the individual levels of deprivation, we also aggregate the indicators to construct an index of multidimensional poverty based on the Alkire Foster (AF) method. This index is based on the idea that poverty can be understood 'as multiple deprivations that are simultaneously experienced' (Alkire and Foster 2011: 12).

The AF method employs a 'dual cut-off' approach: after the selection of a group of indicators that should reflect the general well-being of a given population, which we assume is verified in our case, a deprivation cut-off is defined for each element. Based on this cut-off, each indicator is transformed into a binary variable, assigning a value of 1 to the deprived individuals and 0 to the non-deprived.

Given that the relative importance of each indicator may not be the same, a weight or 'deprivation value' is defined for each variable. A weight of 50 per cent was assigned to each of our two dimensions—housing conditions and public utilities/basic services. Within each dimension, the weight is evenly divided among the indicators (see Table 1).

Table 1: Multidimensional poverty index composition

Dimension	Indicator	Deprivation condition
Housing conditions (50%)	House type (12.5%)	Hut or other type of precarious house
	Roof (12.5%)	Thatched roof
	Walls (12.5%)	Reed, tin, carton, or cob walls
	Floor (12.5%)	Adobe or clay floor
Public utilities/services (50%)	Electricity (12.5%)	No electricity in the house
	Running water (12.5%)	No access to running water or public fountain
	Sanitation (12.5%)	No toilet or improved latrine in the house
	Radio (12.5%)	No radio in the household

The following step is the definition of a poverty cut-off,  $k$ , corresponding to the percentage of (weighted) deprivations a given individual or family must face to be considered poor. For this specific analysis we considered a (rather high) cut-off of 70 per cent. Based on these assumptions, the two following indicators of multidimensional poverty will be presented:

- Poverty incidence ( $H$ ): the percentage of individuals or families facing a percentage of deprivations higher than the poverty cut-off,  $k$ .
- Adjusted poverty incidence ( $M^0$ ): the share of poor families ( $H$ ) weighted by the mean percentage of deprivations among the poor (also called poverty intensity,  $A$ ). Hence, the adjusted poverty incidence is equal to the product of the incidence of poverty,  $H$ , and its intensity,  $A$ :  $M^0 = HA$ .

$M^0$  can also be understood as a ratio between the aggregate deprivations experienced by the poor and the maximum possible range of deprivations across society (Alkire and Foster 2011).

### 3 Results

This section presents the evolution of deprivation for housing conditions and access to public utilities/basic services at household level for 1997 and 2007. Within each of these dimensions, four indicators are presented. In addition to this, the last part of this section presents the evolution of two indicators of multidimensional poverty based on the eight aforementioned indicators.

#### 3.1 Housing conditions

Housing deprivation in Mozambique is described through four indicators, one considering the house type, and three additional ones reporting on its different components (roof, walls, and floor).

##### *Type of housing*

Table 2 presents the distribution of the population according to its house type at national level. Families residing in huts and precarious houses were considered deprived. Between 1997 and 2007, the level of ‘housing deprivation’ decreased by approximately 18 percentage points. However, in 2007 the large majority of families were still deprived with respect to proper housing (70 per cent). It should also be noted that by 2007 only 2.53 per cent of households were living in a conventional house or apartment.

Table 2: Housing type (%) – national level

1997		2007	
House	9.22	Conventional house	1.76
Apartment	1.20	Apartment	0.77
–	–	Mixed house	15.44
–	–	Basic house	11.44
Collective house	0.01	Collective house	0.03
Wood/Zinc house	1.34	Part of commercial building	0.10
Hut	85.40	Hut	69.25
Precarious house	2.72	Precarious house	0.54
Unknown	0.11	Others/Homeless	0.67
Non-deprived	11.77	Non-deprived	29.53
Deprived	88.23	Deprived	70.47
Total	100	Total	100

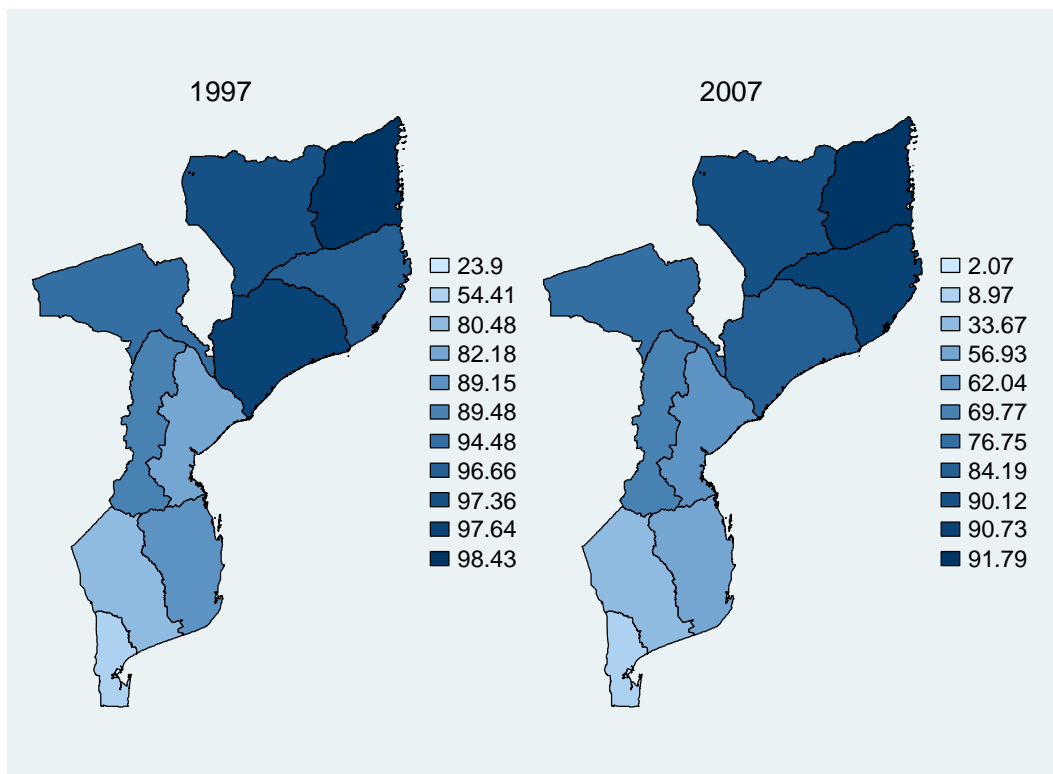
Maps 1 and 2 present the evolution of the levels of ‘housing deprivation’ at provincial and administrative post (AP) levels. While Map 1 shows the percentage of deprived families in each province, Map 2 groups the APs into four intervals of housing deprivation: 0–80 per cent, 80–90 per cent, 90–95 per cent and 95–100 per cent. One clear pattern can be identified in Map 1: the South region not only has considerably lower levels of deprivation but also registers the most pronounced improvements between 1997 and 2007. It is also clear that the North region is considerably more deprived than the rest of the country while the Centre region seems to be in an intermediate position.

In 10 years, housing deprivation decreased by about 40 percentage points in the South and less than 7 percentage points in the North (Table A1). By 2007, less than 10 per cent of households in Maputo Province and Maputo City were deprived, whereas more than 90 per cent were deprived in the Northern Provinces (Nampula, Cabo Delgado, and Niassa). The north–south divide also seems to exist within the Centre region: in both censuses the Centre-south provinces of Manica and Sofala registered lower levels of deprivation than the Centre-north provinces of Tete and Zambézia. Moreover, housing deprivation decreased considerably faster in the former provinces.

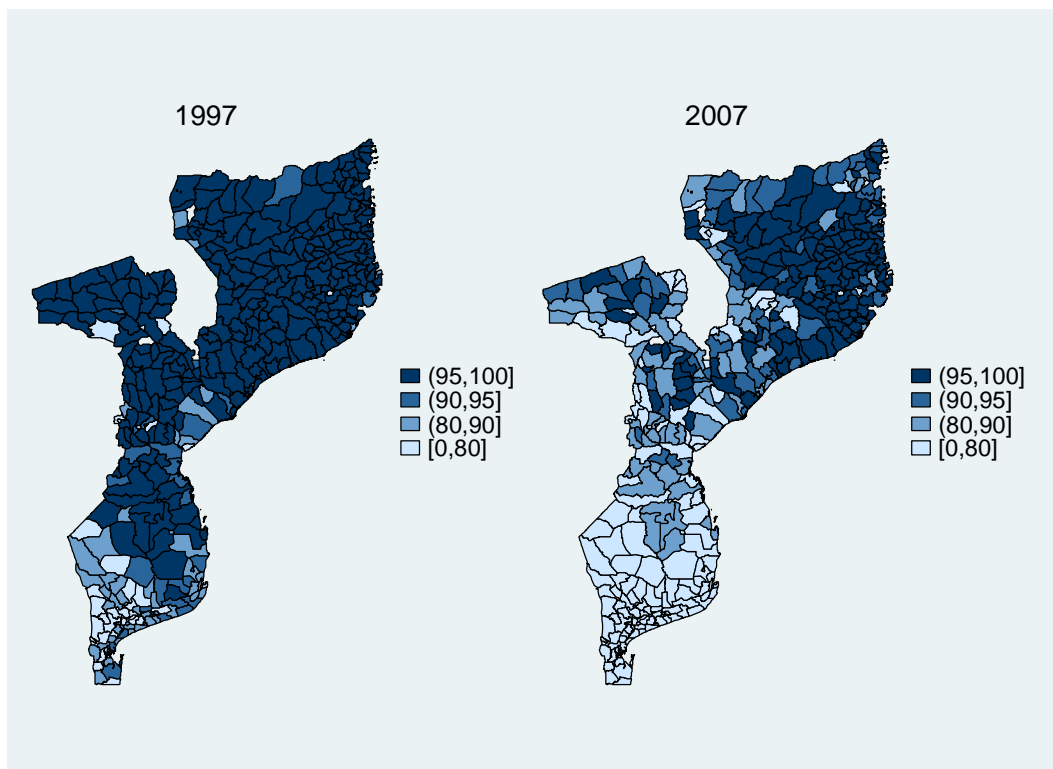
Map 2 presents the evolution of deprivation within each province. In general, lower levels of deprivation are visible along major roads—particularly the N1 in the coastal part of the South region and the east–west Beira–Chimoio road in the Centre—and around large urban centres (e.g. provincial capitals). Moreover, it is noticeable that in some border areas, particularly along the border with Zimbabwe in the province of Tete, ‘housing deprivation’ is considerably less acute.

Furthermore, a sharp reduction in housing deprivation is widespread in the South region, in contrast to what happens in the rest of country. By 2007, all the APs in the southern provinces had levels of housing deprivation below 80 per cent, with the exception of Inhambane, where a few APs remained in the 80–90 per cent interval (Table A2).

Map 1: Housing deprivation by province, 1997–2007



Map 2: Housing deprivation by administrative post, 1997–2007





### *Type of roof*

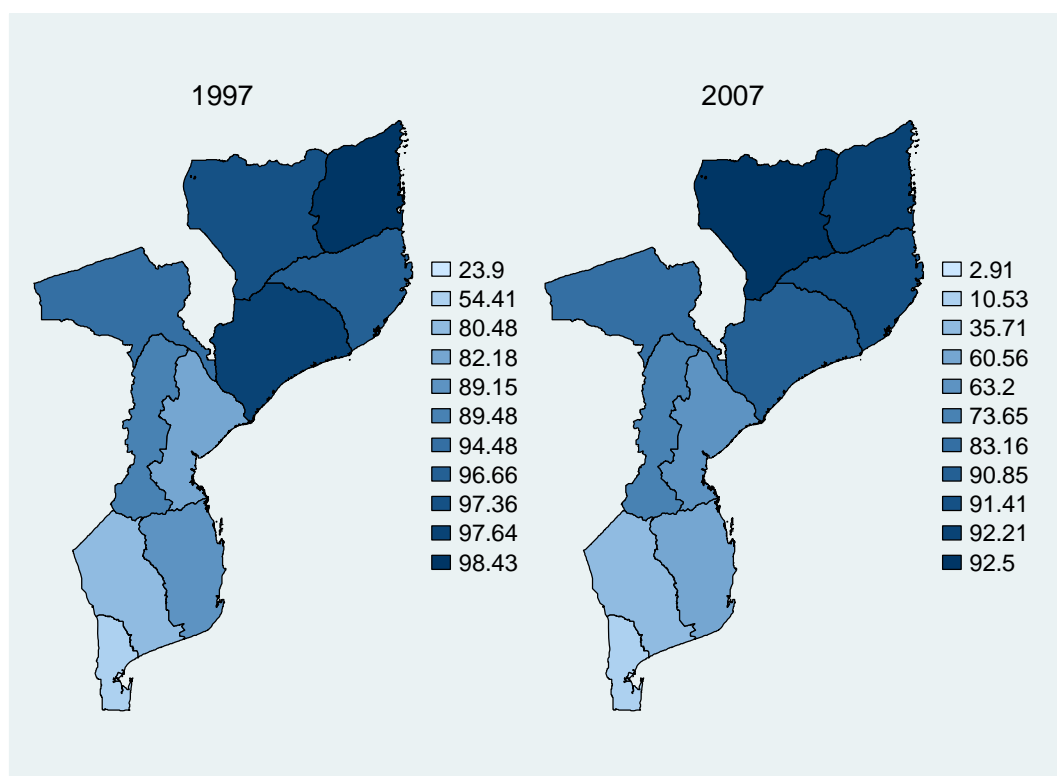
Table 3 presents the distribution of the population according to roof type at national level. The great majority of families are deprived of a good quality roof despite the considerable improvements achieved between 1997 and 2007. During these 10 years, the percentage of deprived families (i.e. families living under a thatched roof) decreased from 82.5 per cent to 73.4 per cent. Nonetheless, much of this improvement was due to an increase in *lusalite* (fibre cement) roofs, which are not particularly safe, while the percentage of families having concrete and tiled roofs actually decreased.

Map 3 depicts roughly the same patterns observed in the case of housing deprivation. Families in the South are substantially less deprived in terms of roof type and experienced a much faster improvement between 1997 and 2007. The North lags behind also in this case, with rates of deprivation above 90 per cent (Table A3). Finally, the distribution of administrative posts by deprivation level portrayed in Map 4 presents similar patterns (Table A4).

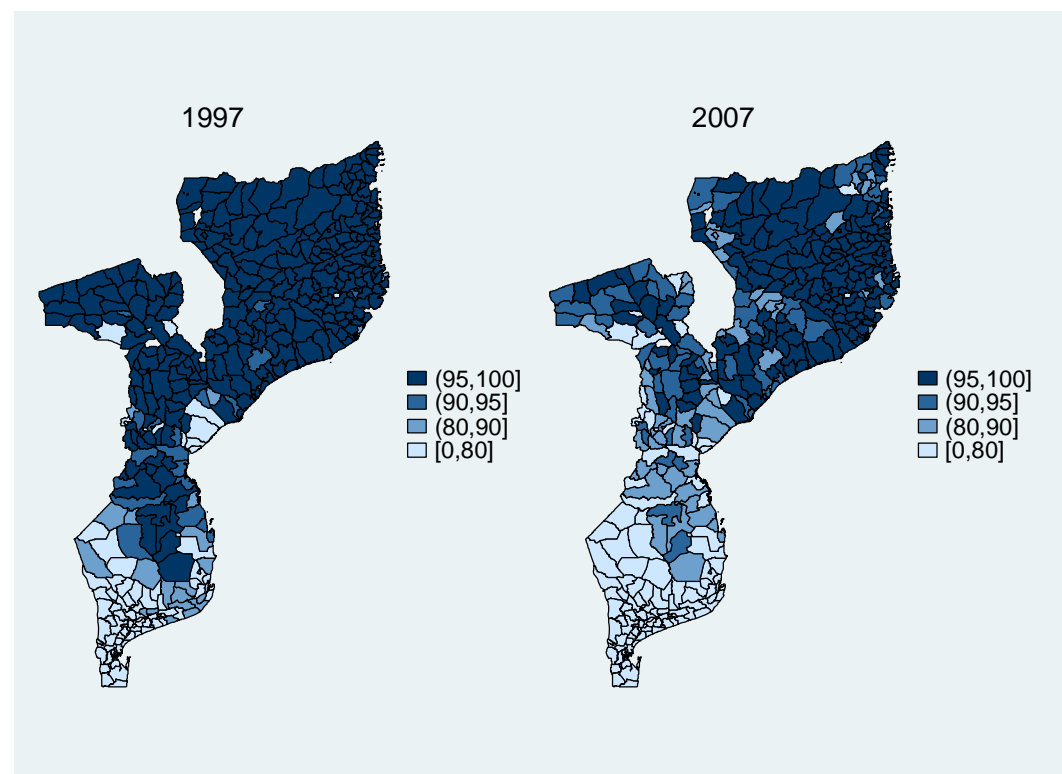
Table 3: Roof type (%)—national level

Roof type (%)	1997	2007
Concrete	1.65	1.39
Tiled	0.50	0.22
<i>Lusalite</i> (fibre cement)	2.71	1.92
Zinc	12.59	22.98
Thatch	81.31	72.40
Others	1.25	1.08
Non-deprived	17.44	26.58
Deprived	82.56	73.42
Total	100	100

Map 3: Roof deprivation by province, 1997–2007



Map 4: Roof deprivation by administrative post, 1997–2007



### *Type of floor*

Table 4 shows the categories of floor type and their relative frequencies. A family is considered deprived when the floor is made of adobe or clay.<sup>2</sup> ‘Floor deprivation’ decreased by approximately 7 percentage points between 1997 and 2007. However, in 2007, 80 per cent of the population remained deprived of a good quality floor. The disaggregated levels of floor deprivation shown in Maps 5 and 6 depict regional disparities similar to the ones noted in respect of type of housing and roof conditions. There is a north–south divide, where the levels of deprivation are positively correlated with the distance from the capital, Maputo. Nevertheless, floor deprivation differs from the previous cases in some aspects. For example, in 1997 the deprivation levels in Sofala were closer to those in Gaza and Inhambane than they were to the other central provinces. This pattern was less evident in 2007. In addition to this, and despite the significant reduction of floor deprivation in the South region (20 per cent; see Table A5), the improvements were not as widespread through the region as in previous cases (see Map 6). In this case, significant improvements were registered only close to the main roads (N1) and main urban areas.

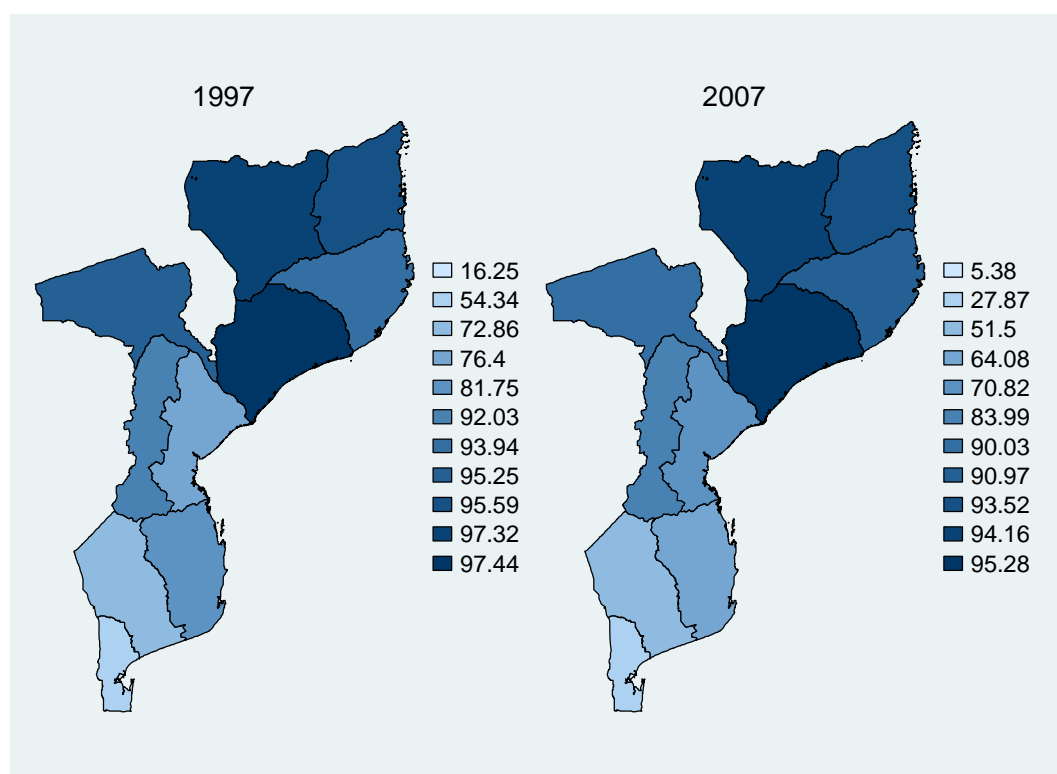
Table 4: Floor type (%)—national level

Floor type (%)	1997	2007
Wood/Parquet	1.26	1.02
Marble/Granite	0.04	0.15
Cement	12.75	19.52
Mosaic/Bricks	0.24	0.80
Adobe/Clay/Nothing	85.21	77.86
Others	0.50	0.64
Non-deprived	14.30	21.56
Deprived	85.70	78.44
Total	100	100

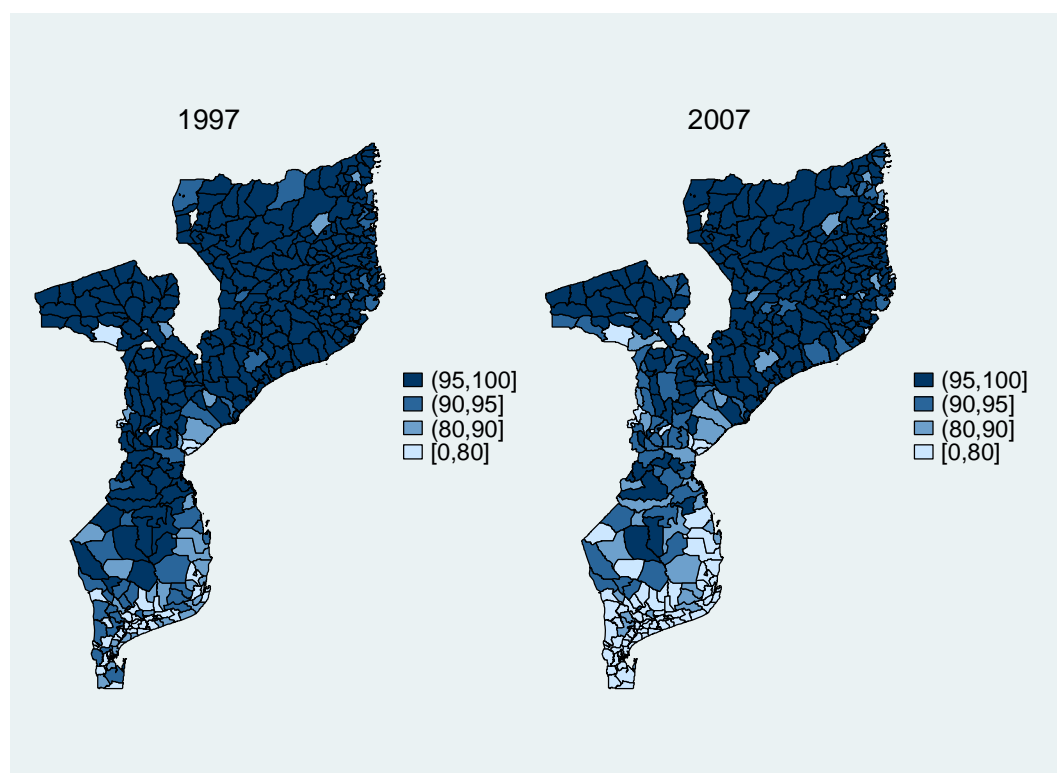
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<sup>2</sup> Adobe floors had to be considered among the poor-quality categories to allow for a comparison between 1997 and 2007. This results from an inconsistency in the questionnaire between the two surveys.

Map 5: Floor deprivation by province, 1997–2007



Map 6: Floor deprivation by administrative post, 1997–2007



### *Type of wall*

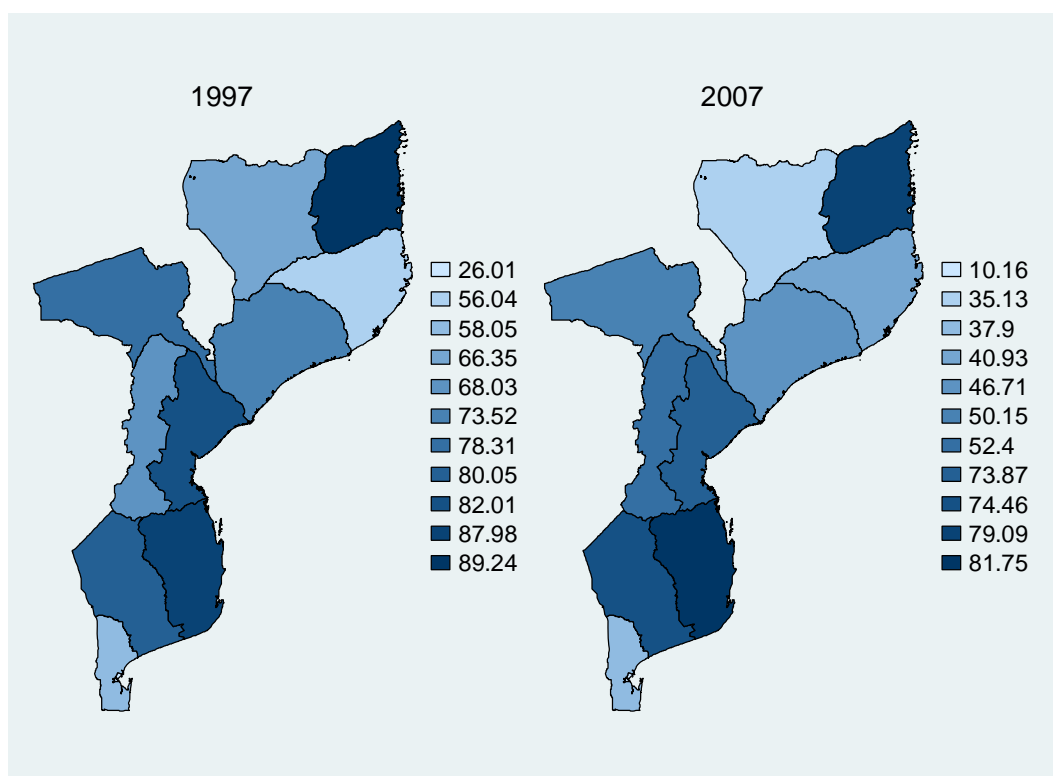
The last indicator of this subsection is wall conditions. A family is considered deprived if it is living in a house with walls made of reed, cob, tin, or carton. The 10 years separating the two censuses were characterized by a sharp reduction in ‘wall deprivation’ of roughly 18 percentage points (see Table 5). Overall, of the three housing elements presented in this study, this component presents the lowest levels of deprivation—51.7 per cent in 2007. Nonetheless, it should be highlighted that the biggest share of non-deprived families still lives in houses with adobe walls rather than cement or brick walls.

As shown in Map 7, the north–south divide identified in the previous three indicators is not so evident here. Unexpectedly, the levels of wall deprivation are particularly high in the two southern provinces of Gaza and Inhambane. Sofala in the Centre and Cabo Delgado in the North also present high deprivation rates. On the other hand, provinces that are very deprived in other indicators, such as Niassa or Nampula, present for this indicator deprivation rates similar to those verified in Maputo. The same patterns are observable at the AP level. By 2007, the rates of deprivation for most APs in Niassa, Nampula, Zambezia, Tete, and Manica were below 80 per cent.

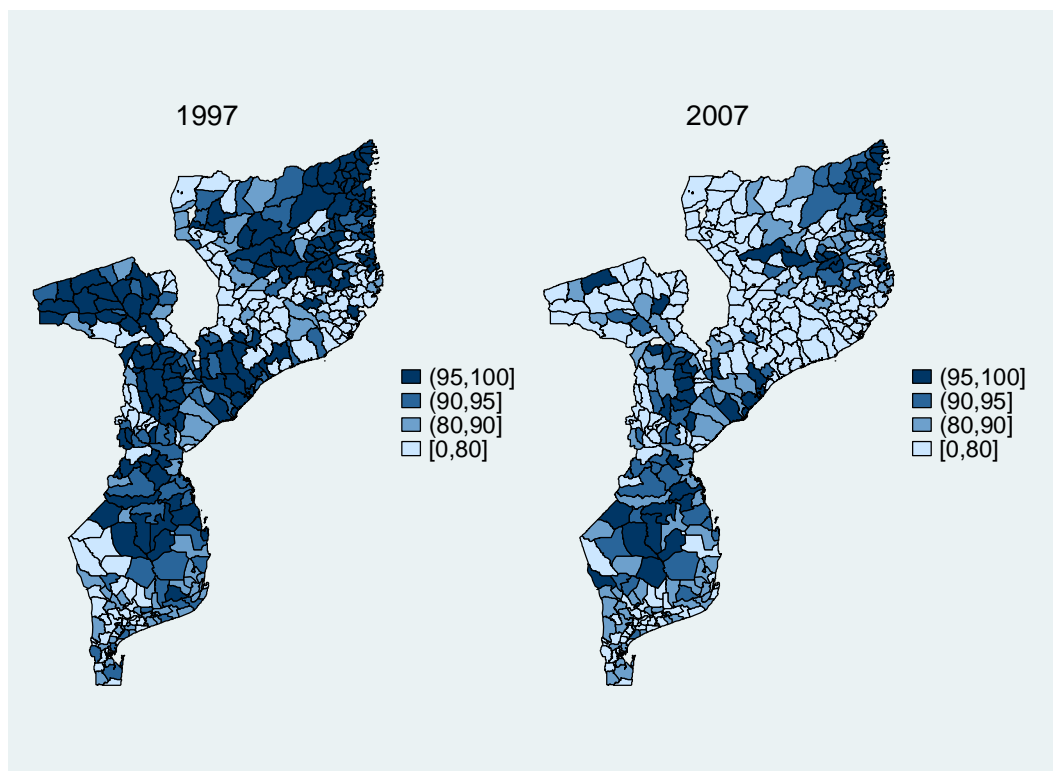
Table 5: Wall type (%)—national level

Wall type (%)	1997	2007
Cement blocks	7.43	11.86
Bricks	2.41	4.76
Wood/Zinc	1.58	0.89
Adobe blocks	18.74	30.73
Reed	20.31	17.78
Cob	47.71	33.35
Tin/Carton	0.16	0.13
Others	1.66	0.51
Non-deprived	30.17	48.27
Deprived	69.83	51.73
Total	100	100

Map 7: Wall deprivation by province, 1997–2007



Map 8: Wall deprivation by administrative post, 1997–2007



### 3.2 Public utilities/Basic services

The following subsections describe household access to public utilities/basic services. In particular, we present deprivation levels for access to electricity, safe water, quality sanitation, and radio ownership.

#### *Electricity*

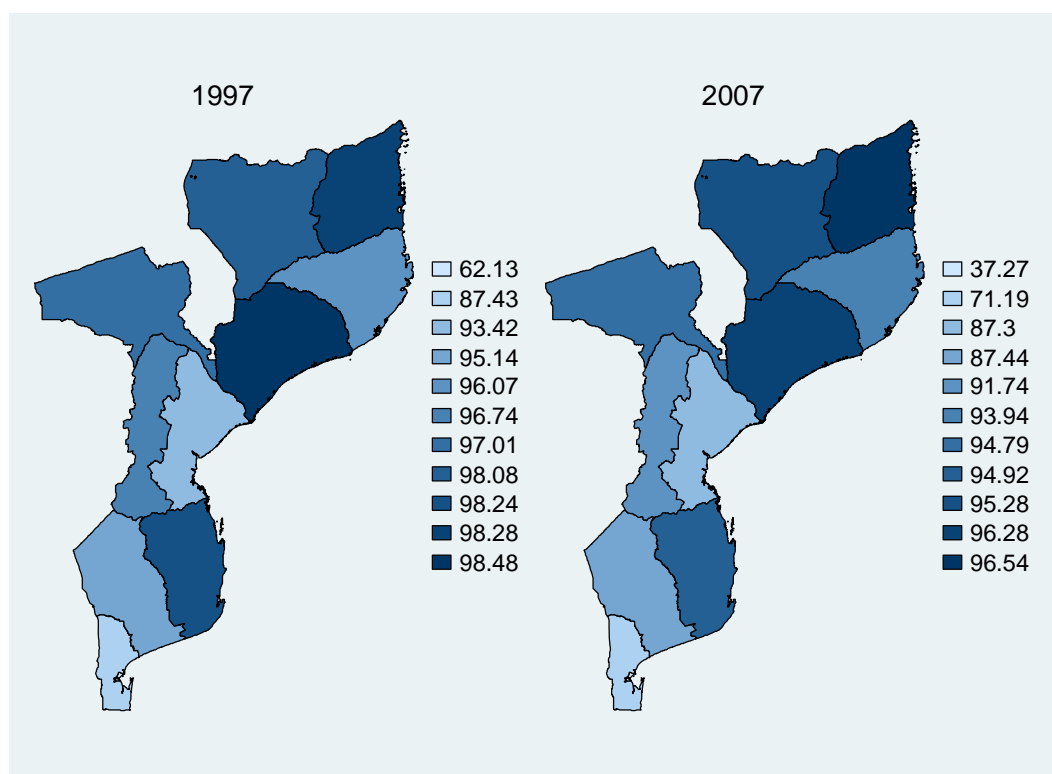
Access to electricity barely increased between 1997 and 2007. In 10 years, the level of ‘electricity deprivation’ decreased by roughly 5 percentage points at national level, from approximately 95 per cent to 90 per cent, as shown in Table 6. The regional disparities that characterize the ‘housing conditions’ indicators can also be observed for access to electricity. The South presents not only the lowest levels of deprivation—particularly in the province of Maputo—but also the most significant improvements over time (Table A9).

Table 6: Electricity deprivation (%)—national level

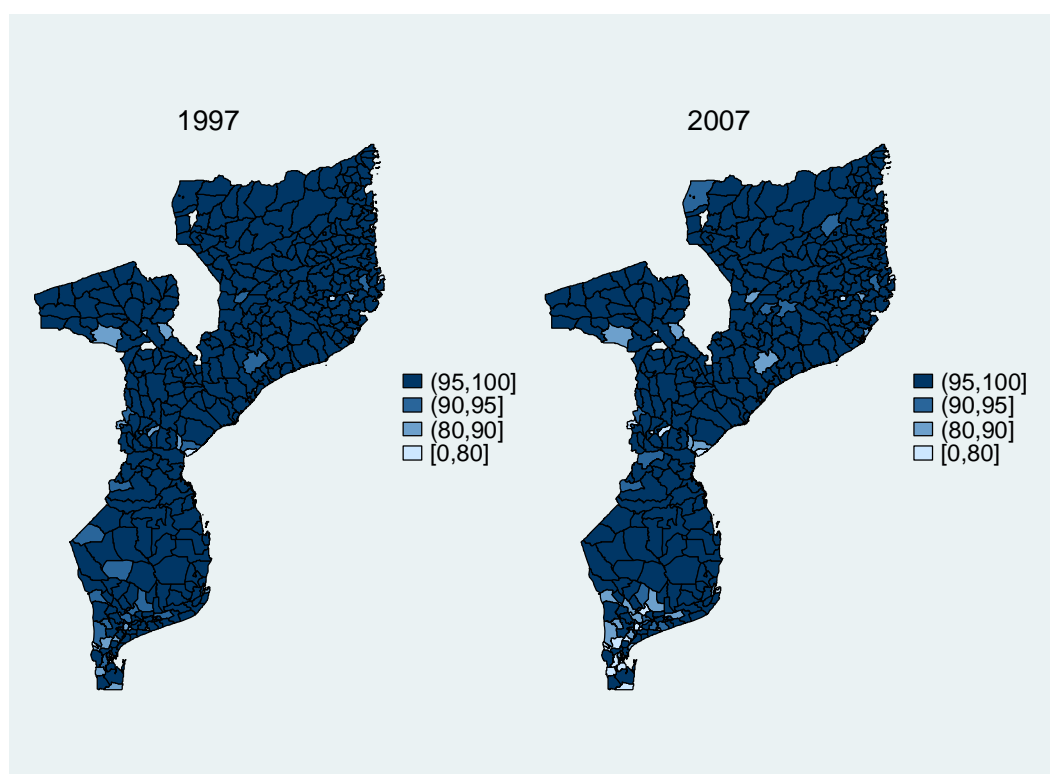
Electricity deprivation (%)	1997	2007
Non-deprived	5.22	10.23
Deprived	94.78	89.77
Total	100	100

At the AP level the situation is somewhat different from what we observed in the previous subsections. For housing conditions, lower levels of deprivation were observed along the major roads, in border areas, and across the South region as a whole, whereas in the case of access to electricity lower levels of deprivation are recorded only in the provincial capitals and in the area surrounding the city of Maputo.

Map 9: Electricity deprivation by province, 1997–2007



Map 10: Electricity deprivation by administrative post, 1997–2007



### *Water*

Table 7 presents frequencies with respect to water source types. A household is considered ‘water deprived’ when its water source is a well, water hole, river or lake. According to this definition, more than two-thirds of families were deprived of a safe water source throughout the decade covered by this study, when the deprivation rate decreased by merely 5 percentage points from 84 per cent to 79 per cent. Furthermore, the percentage of families with access to running water—either inside or outside the house—amounted to only approximately 10 per cent in 2007. The rates of deprivation at the provincial level follow the same north–south divide that is common across the indicators previously analysed (Map 11). Nonetheless, for access to both electricity and safe water, the province of Sofala seems to be less deprived than the other central provinces, with rates of deprivation similar to those observed, for example, in the southern province of Gaza.

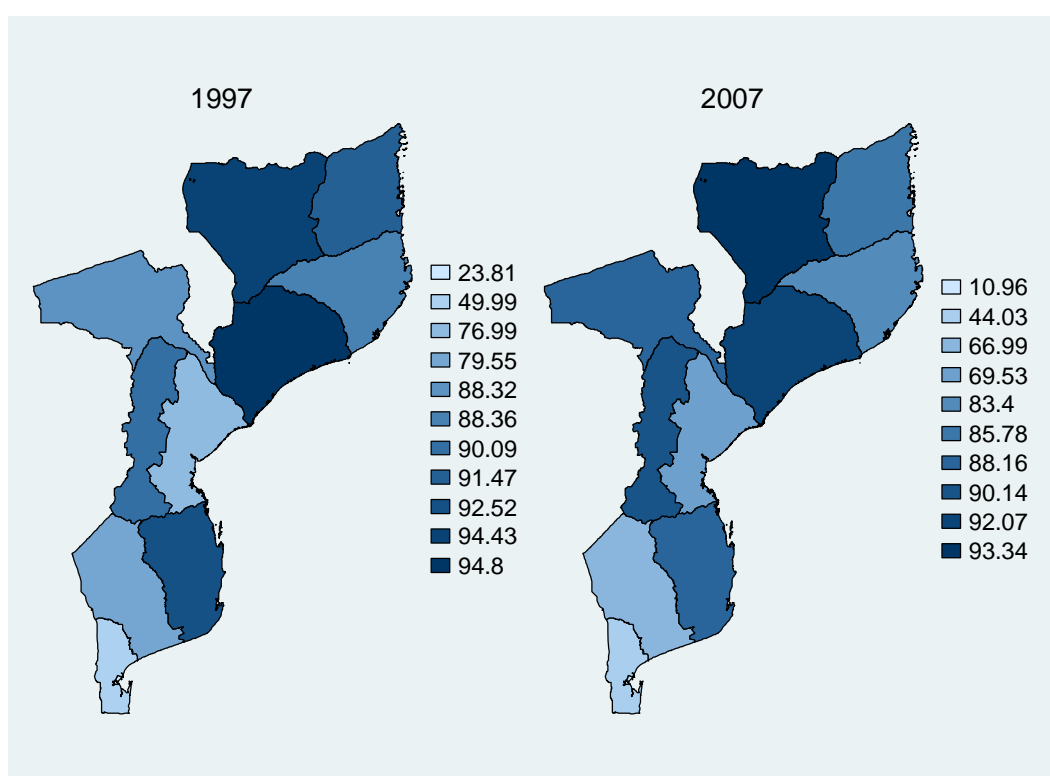
For water conditions, lower levels of deprivation can also be observed outside the main urban centres. In this case, deprivation tends to be lower along some communication routes (N1 in the South region, Beira–Chimoio road, and Chokwe–Chicualacuala railway) and in border areas (Map 12).



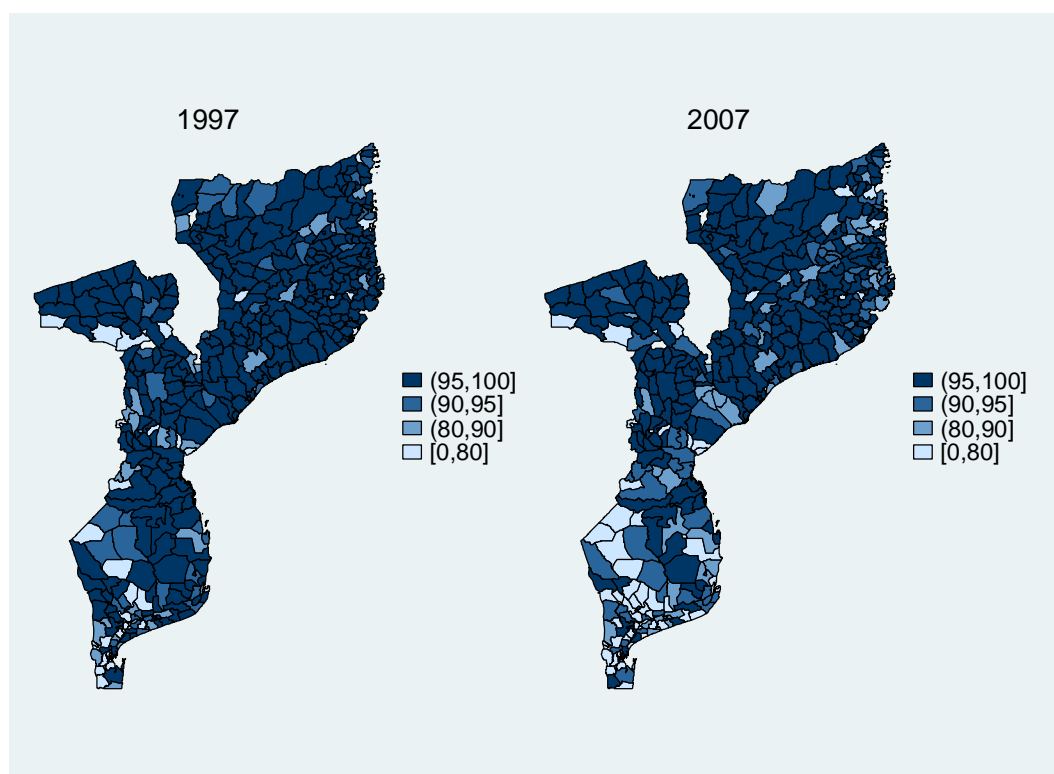
Table 7: Access to water (%)—national level

Access to water (%)	1997	2007
Running water inside	2.50	2.02
Running water outside	6.33	8.22
Public fountain	6.96	10.42
Well/Water hole	66.06	60.82
River/Lake	16.99	17.10
Others	1.16	1.43
Non-deprived	15.80	20.80
Deprived	84.20	79.20
Total	100	100

Map 11: Water deprivation by province, 1997–2007



Map 12: Water deprivation by administrative post, 1997–2007



### *Sanitation*

The evolution of sanitation conditions between 1997 and 2007 is displayed in Table 8. According to our definition, a household is considered deprived when the house does not have a toilet or improved latrine.<sup>3</sup> Between the two censuses a reduction in the level of ‘sanitation deprivation’ of roughly 10 percentage points was recorded. However, in 2007, 84 per cent of households were still deprived, and only 3.5 per cent had a toilet. As shown in Map 13, deprivation in quality sanitation at provincial level is also marked by the north–south divide already identified (Table A13).

At AP level, deprivation in quality sanitation follows roughly the same pattern observed with access to electricity. The APs with a higher prevalence of quality sanitation are almost exclusively located around the major urban centres and along the N1 road within the South region.

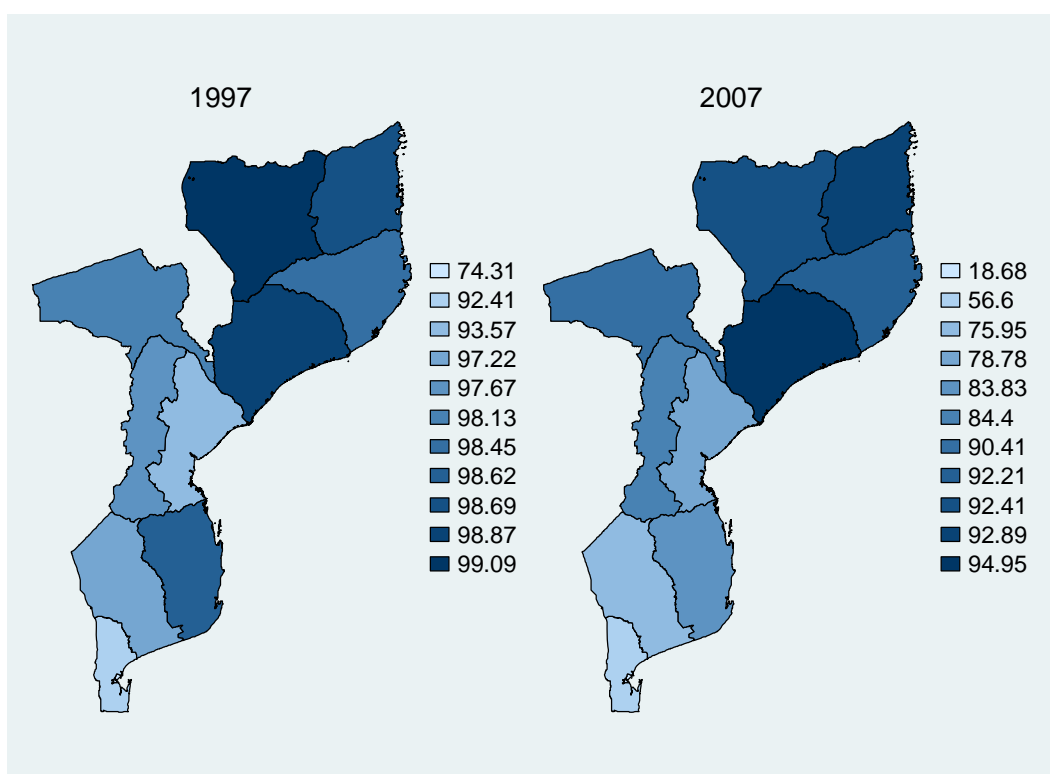
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<sup>3</sup> The options included in the census questionnaire are different in 1997 and in 2007. In 1997 improved latrines were not common and virtually all latrines could be considered as non-improved. Conversely, in 2007 improved latrines and improved traditional latrines were more widespread, so these options were added in the 2007 questionnaire. We consider households whose house had either an improved latrine or an improved traditional latrine as non-deprived.

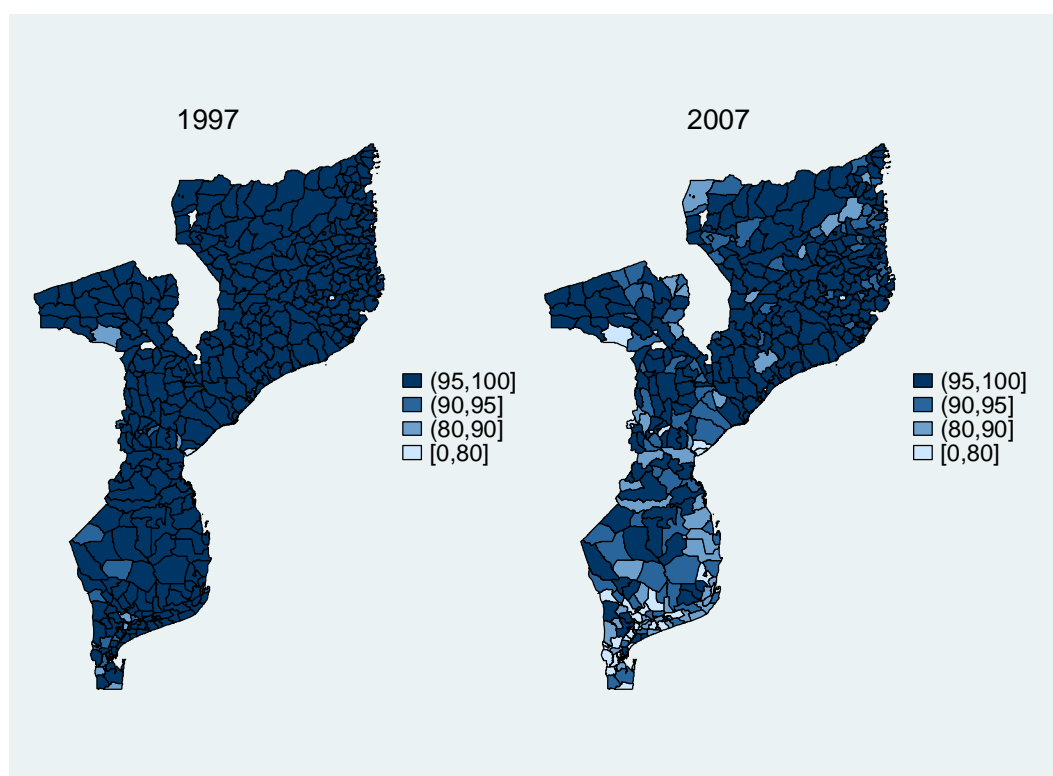
Table 8: Sanitation type (%)—national level

Sanitation type (%)			
1997		2007	
Toilet w/ flush	2.26	Toilet	3.51
Toilet w/out flush	1.13	Improved latrine	6.58
-	-	Improved traditional latrine	5.74
Latrine	30.92	Non-improved latrine	30.73
Nothing	65.69	Nothing	53.44
Non-deprived	3.39	Non-deprived	15.90
Deprived	96.61	Deprived	84.10
Total	100	Total	100

Map 13: Sanitation deprivation by province, 1997–2007



Map 14: Sanitation deprivation by administrative post, 1997–2007



### *Radio ownership*

Among the four indicators included in this section, radio ownership is by far the one with the lowest levels of deprivation. Between 1997 and 2007 radio ownership increased by approximately 20 percentage points, resulting in rates of deprivation slightly above 50 per cent by the end of the period (Table 9).

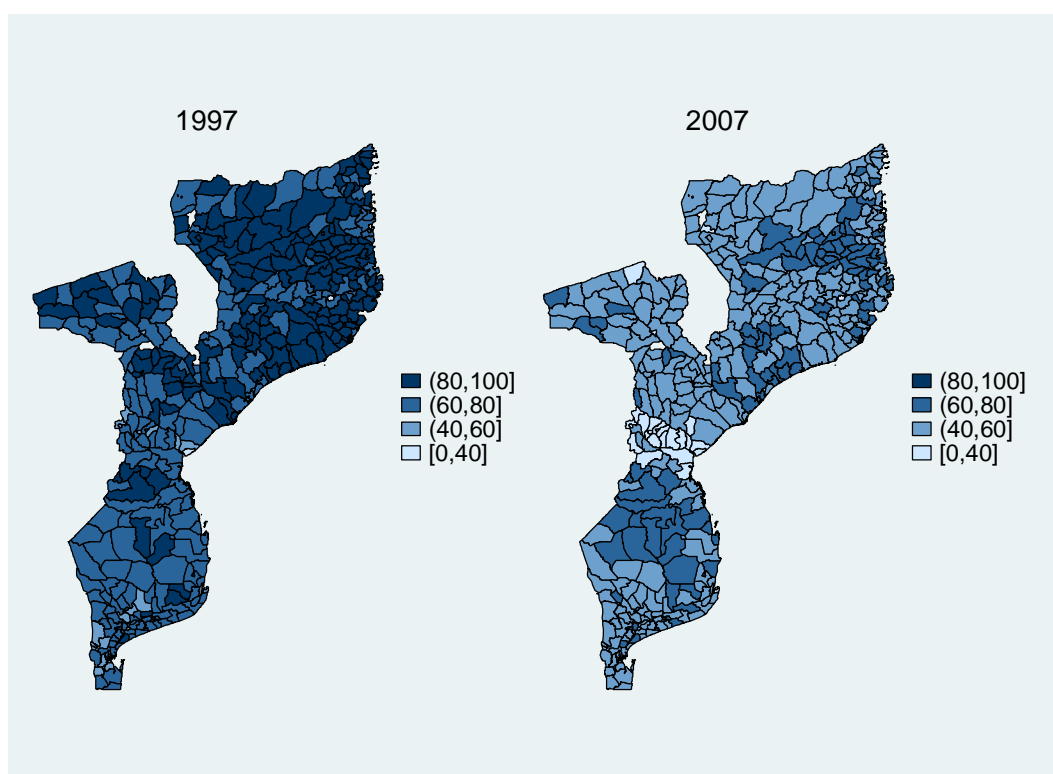
Table 9: Radio deprivation (%)—national level

Radio deprivation (%)	1997	2007
Non-deprived	28.27	48.47
Deprived	71.73	51.53
Total	100	100

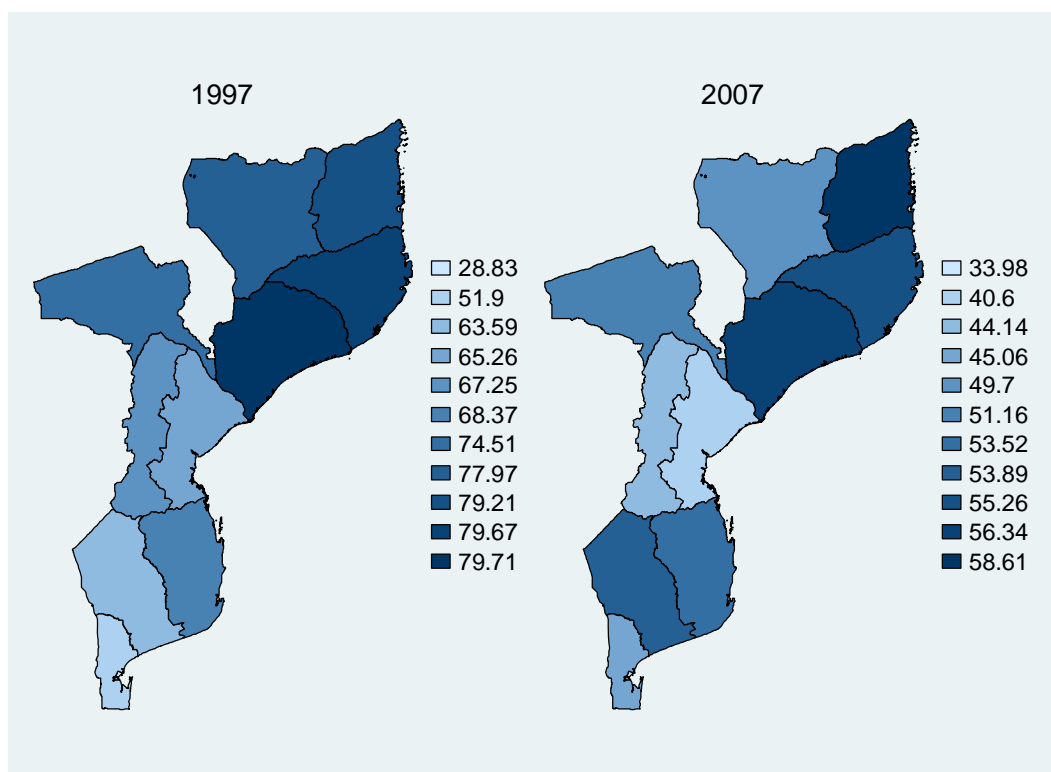
Unlike the indicators discussed before, ‘radio deprivation’ does not present a north–south divide (Table A15). In this case, the improvement registered at national level is widespread in the whole country, with deprivation rates around 50 per cent in most provinces.

The considerably lower levels of deprivation registered for this indicator justified a redefinition of the intervals used to group the administrative posts (0–40 per cent, 40–60 per cent, 60–80 per cent, and 80–100 per cent). As shown in Map 15, the geographical patterns observed here are very different from those of the other deprivation indicators. By 2007, no APs had a deprivation rate above 80 per cent (Table A16), and most were included in the interval 40–60 per cent.

Map 14: Radio deprivation by province, 1997–2007



Map 15: Radio deprivation by administrative post, 1997–2007



### 3.3 Multidimensional poverty

Subsections 3.1 and 3.2 described the levels of deprivation in housing and access to public utilities/basic services among Mozambican families. On the basis of this information we computed a multidimensional poverty index using the AF method.

Table 10 presents the values obtained for poverty incidence ( $H$ ) and adjusted poverty incidence ( $M^0$ ) at national level, for 1997 and 2007. The percentage of poor families—i.e. families with a weighted share of deprivations above 70 per cent—is shown by the index  $H$ . According to this indicator, poverty decreased by roughly 13 percentage points between the two censuses. However, in 2007, more than two-thirds of households (72.6 per cent) were still considered poor.

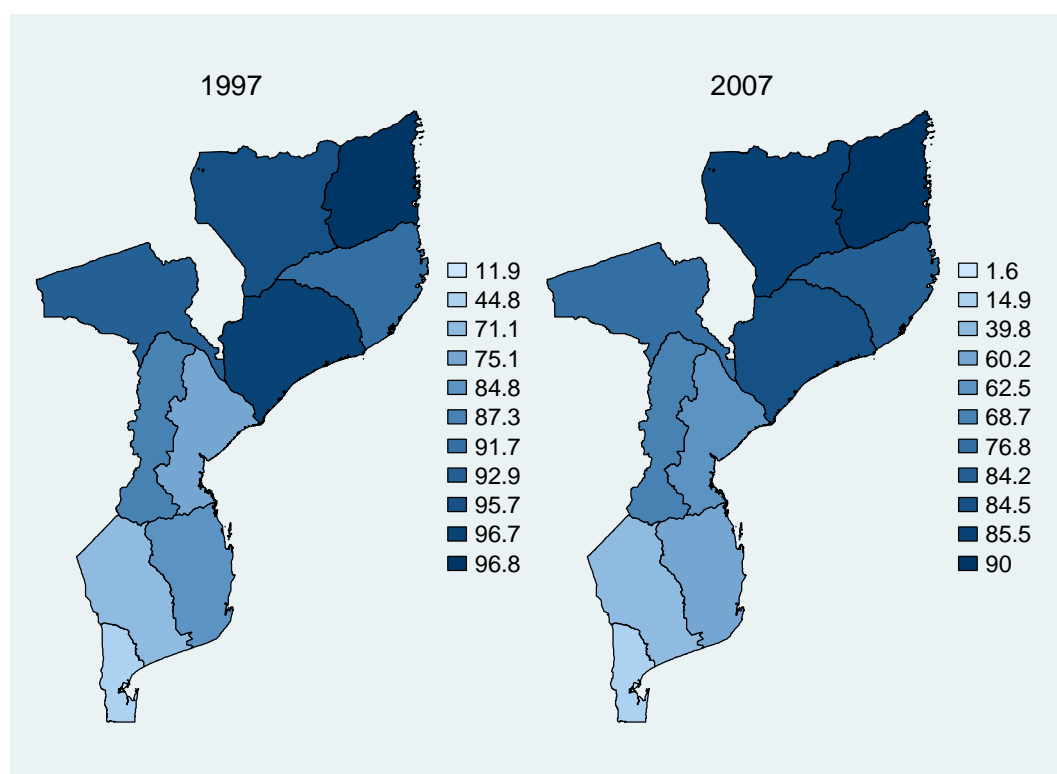
The adjusted poverty incidence ( $M^0$ ) is equal to poverty incidence weighted by the intensity of poverty, which is the mean percentage of deprivation among the poor. Thereby, in the extreme case of an intensity of poverty of 100 per cent (i.e. 100 per cent of deprivation for all poor families),  $M^0$  would be equal to  $H$ . The figures presented in Table 10 show that  $M^0$  is very similar to  $H$  both in 1997 and in 2007, which implies a very high intensity of poverty—93 per cent in 1997 and 89 per cent in 2007. Hence, the great majority of the population is not only poor but also extremely deprived with respect to the indicators selected.

Table 10: Poverty incidence ( $H$ ) and adjusted poverty incidence ( $M^0$ ) (%)—national level

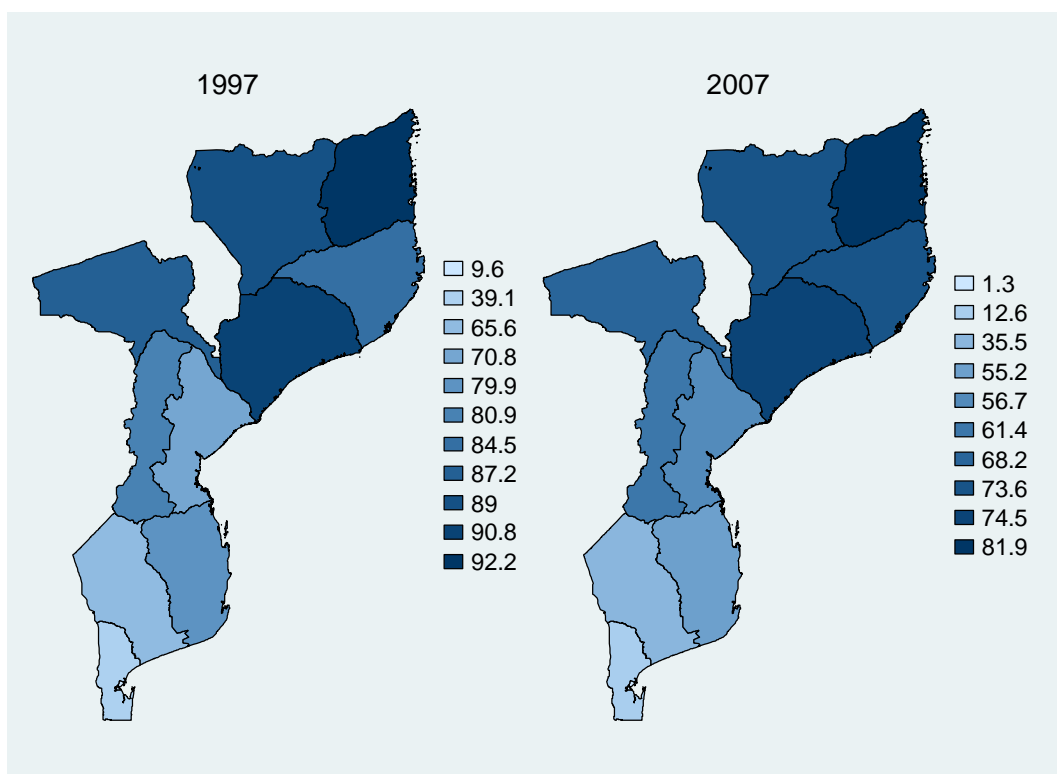
Multidimensional poverty	1997	2007
Poverty incidence ( $H$ )	85.89	72.63
Adjusted poverty incidence ( $M^0$ )	0.80	0.64

Maps 16 and 17 show the evolution of  $H$  and  $M^0$  between 1997 and 2007 at the provincial level. As expected, the north–south divide observed throughout the paper is verified here as well (Table A17). A clear example of the existing regional differences is that by 2007  $H$  was approximately 2 per cent in the capital Maputo compared with about 80–90 per cent in the north-central provinces of Niassa, Cabo Delgado, Nampula, and Zambezia.

Map 16: Poverty incidence by province, 1997–2007

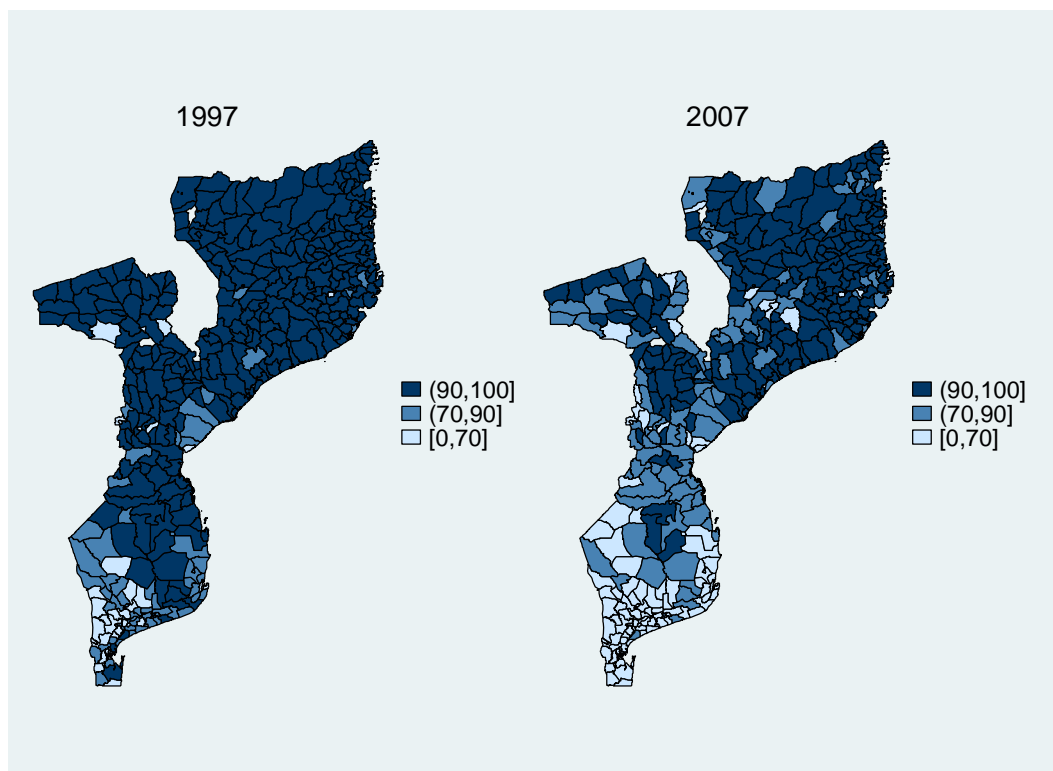


Map 17: Adjusted poverty incidence by province, 1997–2007



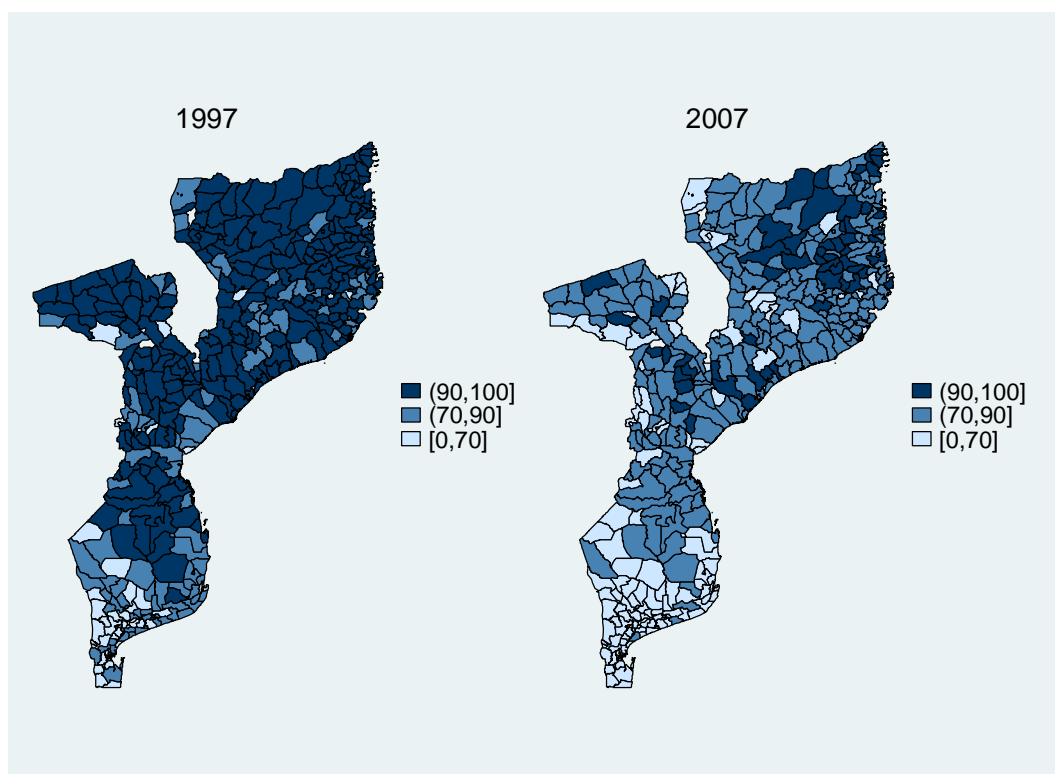
Maps 18 and 19 present the results for  $H$  and  $M^0$  at the AP level, grouping the APs in three intervals, 0–70, 70–90, and 90–100. Predictably, these two maps present the same geographical patterns as identified before. The APs with lower rates of multidimensional poverty are concentrated around the urban centres (Maputo and other provincial capitals), along the main communication routes in the South region (N1 and Chokwe–Chicualacuala railway), along the Beira–Chimoio corridor, and in some border areas, particularly Manica and Tete.

Map 18: Poverty incidence by administrative post, 1997–2007





Map 19: Adjusted poverty incidence by administrative post, 1997–2007



#### 4 Conclusions

Standard assessments of poverty, generally based on consumption measures, provide key information on the living standards of a population. However, they can greatly benefit from being complemented by multidimensional analyses, given that income or consumption variables are not always good proxies for other important deprivation dimensions. This paper presented an atlas of selected deprivation indicators and a multidimensional assessment of poverty in Mozambique based on census data for 1997 and 2007.

Our analysis suggests that families are extremely deprived in terms of good quality housing and access to public utilities/basic services. For most indicators used in this study, deprivation rates were above 70 per cent in 2007, and 90 per cent of households were deprived of access to electricity in that year. The only exceptions were wall conditions and radio ownership, which registered levels of deprivation around 50 per cent. Nevertheless, deprivation for all indicators decreased between 1997 and 2007, even though in some cases improvements were moderate at best (e.g. deprivation of safe water and electricity decreased by only 5 percentage points).

As expected, our measures of multidimensional poverty—poverty incidence and adjusted poverty incidence—reflected the levels of deprivation found for most individual deprivation indicators. Poverty incidence results indicate that in 2007 more than two-thirds of families (72.6 per cent) could be considered poor. The percentage for 1997 was about 86 per cent. Likewise, the adjusted poverty incidence decreased from 0.80 in 1997 to 0.64 in 2007. As mentioned before, these results imply a very high intensity of poverty, suggesting that the majority of poor households live in extreme deprivation with respect to the chosen indicators.

The maps presented in this study revealed marked geographical disparities in the incidence of poverty and deprivation: broadly speaking, we observed a north–south divide, the South region appearing to be consistently less deprived than the Centre and North regions. In addition to this, lower levels of deprivation seem to be concentrated along major roads and railways (e.g. N1 in the South region along the Beira–Chimoio road), in large urban centres (e.g. provincial capitals), and in some border areas.

A comparison between our results and the corresponding estimations of consumption poverty contained in the Third National Poverty Assessment also revealed some differences in geographical patterns. This emphasizes the complementarity of the consumption and multidimensional poverty analyses.

One limitation of our multidimensional analysis is certainly the lack of comprehensiveness. Given the limitations of the data collected in the censuses, especially in 1997, we were not able to include any indicators reflecting key well-being dimensions such as health or possession of important durable goods. Hopefully, the upcoming census of 2017 will allow us to update this study with a broader range of variables. Nonetheless, this study demonstrates that in order to accurately measure poverty in the long run, a robust assessment could benefit from the use of less volatile indicators such as the ones used in this paper.

Overall, our results might be a useful guide for policy-makers. This study may assist not only in the formulation of sectoral policies (e.g. access to basic services; housing) but also in establishing criteria for the allocation of resources across the country. Our geographical analysis allows not only comparisons to be made between the different regions and provinces of the country, but also the least prosperous areas and administrative posts within these areas to be identified.

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## Appendix A

Table A1: Housing deprivation (%) by region

Housing deprivation (%)	Region					
	1997			2007		
	North	Centre	South	North	Centre	South
Non-deprived	2.79	6.95	34.29	9.11	23.37	73.10
Deprived	97.21	93.05	65.71	90.89	76.63	26.90
Change deprivation (%)	-	-	-	-6.32	-16.42	-38.81

Table A2: Housing deprivation (%) by administrative post

Prevalence intervals (%)	Niassa		Cabo Del		Nampula		Zambézia		Tete		Manica	
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007
<80%	0.00	8.11	0.00	7.27	3.13	6.25	0.00	15.22	8.57	28.57	11.43	34.29
80–90%	5.41	18.92	1.82	7.27	3.13	3.13	2.17	23.91	0.00	34.29	2.86	45.71
90–95%	5.41	27.03	0.00	25.45	1.56	9.38	2.17	26.09	5.71	22.86	11.43	8.57
>95%	89.19	45.95	98.18	60.00	92.19	81.25	95.65	34.78	85.71	14.29	74.29	11.43
Prevalence intervals (%)	Sofala		Inhamb		Gaza		Maputo P		Maputo C			
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007		
<80%	3.23	25.81	3.70	81.48	36.36	100.00	48.15	100.00	100.00	100.00		
80–90%	12.90	32.26	29.63	18.52	47.73	0.00	37.04	0.00	0.00	0.00		
90–95%	12.90	19.35	29.63	0.00	11.36	0.00	11.11	0.00	0.00	0.00		
>95%	70.97	22.58	37.04	0.00	4.55	0.00	3.70	0.00	0.00	0.00		

Table A3: Roof deprivation (%) by region

Roof deprivation (%)	Region					
	1997			2007		
	North	Centre	South	North	Centre	South
Non-deprived	2.98	9.33	54.33	8.22	18.14	70.99
Deprived	97.02	90.67	45.67	91.78	81.86	29.01
Change deprivation (%)	-	-	-	-5.24	-8.81	-16.66

Table A4: Roof deprivation (%) by administrative post

Prevalence intervals (%)	Niassa		Cabo Del		Nampula		Zambézia		Tete		Manica	
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007
<80%	0.00	2.70	0.00	5.45	3.13	4.69	0.00	2.17	8.57	17.14	11.43	25.71
80–90%	0.00	13.51	3.64	9.09	3.13	4.69	2.17	13.04	0.00	14.29	2.86	40.00
90–95%	2.70	10.81	0.00	14.55	1.56	3.13	6.52	28.26	2.86	40.00	11.43	22.86
>95%	97.30	72.97	96.36	70.91	92.19	87.50	91.30	56.52	88.57	28.57	74.29	11.43
Prevalence intervals (%)	Sofala		Inhamb		Gaza		Maputo P		Maputo C			
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007		
<80%	16.13	19.35	33.33	74.07	75.00	100	100	100	100	100		
80–90%	3.23	35.48	37.04	18.52	22.73	0	0	0	0	0		
90–95%	16.13	16.13	11.11	7.41	2.27	0	0	0	0	0		
>95%	64.52	29.03	18.52	0	0	0	0	0	0	0		

Table A5: Floor deprivation (%) by region

Floor deprivation (%)	Region					
	1997			2007		
	North	Centre	South	North	Centre	South
Non-deprived	5.15	7.64	40.28	7.90	11.78	61.00
Deprived	94.85	92.36	59.72	92.10	88.22	39.00
Change deprivation (%)	-	-	-	-2.75	-4.14	-20.72

Table A6: Floor deprivation (%) by administrative post

Prevalence intervals (%)	Niassa		Cabo Del		Nampula		Zambézia		Tete		Manica	
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007
<80%	0.00	2.35	2.32	2.30	5.23	5.62	4.30	0.83	3.84	4.95	6.08	6.61
80–90%	5.99	6.22	9.41	14.32	9.98	15.96	0.00	13.26	4.03	6.18	5.06	6.91
90–95%	7.82	0.00	8.86	8.11	17.82	8.69	19.35	23.81	0.00	21.24	2.00	17.25
>95%	6.39	8.99	12.19	12.68	27.76	31.94	29.85	30.75	10.42	8.90	6.19	3.87
Prevalence intervals (%)	Sofala		Inhamb		Gaza		Maputo P		Maputo C			
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007		
<80%	6.27	5.26	12.49	20.04	21.52	19.66	13.32	14.47	24.64	17.90		
80–90%	7.55	16.95	40.32	15.37	12.92	3.71	4.74	1.13	0.00	0.00		
90–95%	10.05	18.11	16.72	0.97	11.80	1.83	5.58	0.00	0.00	0.00		
>95%	6.13	2.75	0.58	0.05	0.38	0.06	0.12	0.00	0.00	0.00		

Table A7: Wall deprivation (%) by region

Wall deprivation (%)	Region					
	1997			2007		
	North	Centre	South	North	Centre	South
Non-deprived	34.02	24.77	33.56	50.75	46.94	46.78
Deprived	65.98	75.23	66.44	49.25	53.06	53.22
Change deprivation (%)	-	-	-	-16.73	-22.17	-13.22

Table A8: Wall deprivation (%) by administrative post

Prevalence intervals (%)	Niassa		Cabo Del		Nampula		Zambézia		Tete		Manica	
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007
<80%	35.14	78.38	10.91	21.82	65.63	76.56	39.13	73.91	25.71	71.43	37.14	54.29
80–90%	16.22	13.51	7.27	10.91	10.94	9.38	10.87	8.70	5.71	14.29	8.57	11.43
90–95%	18.92	2.70	9.09	23.64	3.13	7.81	15.22	4.35	20.00	8.57	11.43	25.71
>95%	29.73	5.41	72.73	43.64	20.31	6.25	34.78	13.04	48.57	5.71	42.86	8.57
Prevalence intervals (%)	Sofala		Inhamb		Gaza		Maputo P		Maputo C			
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007		
<80%	6.45	22.58	3.70	25.93	43.18	47.73	48.15	51.85	100.00	100.00		
80–90%	19.35	22.58	40.74	48.15	38.64	27.27	33.33	44.44	0.00	0.00		
90–95%	29.03	19.35	29.63	14.81	13.64	13.64	14.81	3.70	0.00	0.00		
>95%	45.16	35.48	25.93	11.11	4.55	11.36	3.70	0.00	0.00	0.00		

Table A9: Electricity deprivation (%) by region

Electricity deprivation (%)	Region					
	1997			2007		
	North	Centre	South	North	Centre	South
Non-deprived	3.08	2.97	12.52	5.22	6.28	25.37
Deprived	96.92	97.03	87.48	94.78	93.72	74.63
Change deprivation (%)	-	-	-	-2.14	-3.31	-12.85

Table A10: Electricity deprivation (%) by administrative post

Prevalence intervals (%)	Niassa		Cabo Del		Nampula		Zambézia		Tete		Manica	
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007
<80%	0.00	2.70	1.82	1.82	3.13	4.69	0.00	2.17	2.86	2.86	0.00	8.57
80–90%	2.70	2.70	0.00	0.00	3.13	3.13	2.17	2.17	5.71	5.71	5.71	0.00
90–95%	2.70	2.70	0.00	3.64	3.13	1.56	2.17	4.35	0.00	0.00	11.43	11.43
>95%	94.59	91.89	98.18	94.55	90.63	90.63	95.65	91.30	91.43	91.43	82.86	80.00
Prevalence intervals (%)	Sofala		Inhamb		Gaza		Maputo P		Maputo C			
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007		
<80%	3.23	3.23	0.00	3.70	2.27	11.36	7.41	29.63	100.00	100.00		
80–90%	3.23	6.45	3.70	3.70	6.82	11.36	14.81	18.52	0.00	0.00		
90–95%	3.23	0.00	0.00	0.00	15.91	11.36	11.11	3.70	0.00	0.00		
>95%	90.32	90.32	96.30	92.59	75.00	65.91	66.67	48.15	0.00	0.00		

Table A11: Water deprivation (%) by region

Water deprivation (%)	Region					
	1997			2007		
	North	Centre	South	North	Centre	South
Non-deprived	9.98	10.37	34.44	14.43	13.01	45.04
Deprived	90.02	89.63	65.56	85.57	86.99	54.96
Change deprivation (%)	-	-	-	-4.45	-2.64	-10.60

Table A12: Water deprivation (%) by administrative post

Prevalence intervals (%)	Niassa		Cabo Del		Nampula		Zambézia		Tete		Manica	
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007
<80%	2.70	2.70	7.27	10.91	7.81	7.81	2.17	2.17	14.29	11.43	11.43	14.29
80–90%	2.70	2.70	7.27	9.09	3.13	10.94	2.17	8.70	5.71	5.71	17.14	2.86
90–95%	16.22	8.11	16.36	25.45	3.13	21.88	6.52	8.70	5.71	8.57	8.57	11.43
>95%	78.38	86.49	69.09	54.55	85.94	59.38	89.13	80.43	74.29	74.29	62.86	71.43
Prevalence Intervals (%)	Sofala		Inhamb		Gaza		Maputo P		Maputo C			
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007		
<80%	6.45	9.68	3.70	22.22	22.73	59.09	37.04	48.15	100.00	100.00		
80–90%	6.45	19.35	7.41	18.52	9.09	15.91	22.22	7.41	0.00	0.00		
90–95%	6.45	22.58	18.52	22.22	27.27	15.91	7.41	22.22	0.00	0.00		
>95%	80.65	48.39	70.37	37.04	40.91	9.09	33.33	22.22	0.00	0.00		

Table A13: Sanitation deprivation (%) by region

Sanitation deprivation (%)	Region					
	1997			2007		
	North	Centre	South	North	Centre	South
Non-deprived	1.40	2.42	8.22	7.59	10.39	39.07
Deprived	98.60	97.58	91.78	92.41	89.61	60.93
Change deprivation (%)	-	-	-	-6.19	-7.97	-30.85

Table A14: Sanitation deprivation (%) by administrative post

Prevalence intervals (%)	Niassa		Cabo Del		Nampula		Zambézia		Tete		Manica	
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007
<80%	0.00	2.70	0.00	1.82	1.56	4.69	0.00	2.17	0.00	5.71	0.00	11.43
80–90%	0.00	8.11	0.00	5.45	0.00	0.00	0.00	2.17	2.86	8.57	0.00	11.43
90–95%	0.00	16.22	3.64	23.64	1.56	14.06	2.17	6.52	2.86	22.86	8.57	14.29
>95%	100.00	72.97	96.36	69.09	96.88	81.25	97.83	89.13	94.29	62.86	91.43	62.86
Prevalence intervals (%)	Sofala		Inhamb		Gaza		Maputo P		Maputo C			
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007		
<80%	3.23	6.45	0.00	11.11	0.00	27.27	3.70	44.44	40.00	100.00		
80–90%	3.23	9.68	0.00	40.74	6.82	22.73	11.11	22.22	20.00	0.00		
90–95%	0.00	32.26	3.70	25.93	11.36	29.55	11.11	14.81	40.00	0.00		
>95%	93.55	51.61	96.30	22.22	81.82	20.45	74.07	18.52	0.00	0.00		

Table A15: Radio deprivation (%) by region

Radio deprivation (%)	Region					
	1997			2007		
	North	Centre	South	North	Centre	South
Non-deprived	20.69	25.65	44.75	44.82	49.30	52.75
Deprived	79.31	74.35	55.25	55.18	50.70	47.25
Change deprivation (%)	-	-	-	-24.13	-23.65	-8.00

Table A16: Radio deprivation (%) by administrative post

Prevalence intervals (%)	Niassa		Cabo Del		Nampula		Zambézia		Tete		Manica	
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007
<40%	0.00	5.41	0.00	1.82	1.56	1.56	0.00	2.17	0.00	5.71	0.00	40.00
40–60%	2.70	81.08	1.82	60.00	0.00	65.63	2.17	56.52	2.86	82.86	14.29	40.00
60–80%	32.43	13.51	36.36	38.18	29.69	32.81	32.61	41.30	65.71	11.43	60.00	20.00
>80%	64.86	0.00	61.82	0.00	68.75	0.00	65.22	0.00	31.43	0.00	25.71	0.00
Prevalence intervals (%)	Sofala		Inhamb		Gaza		Maputo P		Maputo C			
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007		
<40%	3.23	25.81	0.00	3.70	0.00	0.00	3.70	3.70	40.00	100.00		
40–60%	6.45	70.97	7.41	51.85	13.64	81.82	11.11	85.19	20.00	0.00		
60–80%	51.61	3.23	77.78	44.44	84.09	18.18	11.11	11.11	40.00	0.00		
>80%	38.71	0.00	14.81	0.00	2.27	0.00	74.07	0.00	0.00	0.00		

Table A17: Poverty incidence ( $H$ ) and adjusted poverty incidence ( $M^0$ ) (%) by region

Indicators	North			Centre			South		
	1997	2007	Change	1997	2007	Change	1997	2007	Change
$M^0$ (%)	89.23	78.47	-10.7	86.83	70.36	-16.4	54.58	30.25	-24.3
$H$ (%)	95.49	88.88	-6.61	92.50	79.23	-13.2	59.26	33.61	-25.6

Table A18: Poverty incidence ( $H$ ) (%) by administrative post

Prevalence intervals (%)	Niassa		Cabo Del		Nampula		Zambézia		Tete		Manica	
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007
<70%	0.00	8.11	1.82	3.64	3.13	6.25	0.00	8.70	8.57	11.43	11.43	22.86
70–90%	5.41	16.22	0.00	12.73	6.25	14.06	4.35	23.91	0.00	45.71	8.57	45.71
>90%	94.59	75.68	98.18	83.64	90.63	79.69	95.65	67.39	91.43	42.86	80.00	31.43
Prevalence intervals (%)	Sofala		Inhamb		Gaza		Maputo P		Maputo C			
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007		
<70%	3.23	9.68	7.41	55.56	25.00	84.09	51.85	96.30	100.00	100.00		
70–90%	16.13	48.39	37.04	33.33	61.36	15.91	33.33	3.70	0.00	0.00		
>90%	80.65	41.94	55.56	11.11	13.64	0.00	14.81	0.00	0.00	0.00		



Table A19: Adjusted poverty incidence ( $M^0$ ) by administrative post

Prevalence intervals (%)	Niassa		Cabo Del		Nampula		Zambézia		Tete		Manica	
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007
<70%	2.70	13.51	1.82	5.45	6.25	9.38	2.17	17.39	8.57	31.43	11.43	34.29
70–90%	13.51	70.27	9.09	54.55	23.44	73.44	21.74	67.39	14.29	60.00	22.86	60.00
>90%	83.78	16.22	89.09	40.00	70.31	17.19	76.09	15.22	77.14	8.57	65.71	5.71
Prevalence intervals (%)	Sofala		Inhamb		Gaza		Maputo P		Maputo C			
	1997	2007	1997	2007	1997	2007	1997	2007	1997	2007		
<70%	3.23	12.9	7.41	59.26	36.36	93.18	66.67	96.3	100	100		
70–90%	22.58	67.74	59.26	40.74	59.09	6.82	33.33	3.70	0.00	0.00		
>90%	74.19	19.35	33.33	0.00	4.55	0.00	0.00	0.00	0.00	0.00		