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HOUSEHOLD EXPENDITURE POLARIZATION: EVIDENCE FROM THE ARAB REGION

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Abstract

This paper analyzes the trend and changes of household expenditure polarization in five Arab countries between 1975 and 2006. Applying a set of recent polarization measures developed by Duclos et al. (2004) and Wolfson (1994), we find that polarization remained stable in most countries except Yemen which witnessed a significant increase of polarization during the period 1998–2006. While bi-polarization evolves in the same direction as inequality, our empirical results show that polarization per se behaves differently from inequality. The decomposition of polarization by geographical region shows that in all five countries' household expenditures are spatially polarized, where nearly 80% of overall polarization is explained by intra-regional polarization.

ملخص

تحلل هذه الورقة البحثية الاتجاهات والتغييرات التي طرات علي النواحي المختلفة التي تستقطب الإنفاق العائلي في خمس دول عربية بين عامي 1975 و 2006. وعن طريق تطبيق مجموعة من المعايير الخاصة بهذا الاستقطاب التي وضعها مؤخرا دوكلو وآخرون في عام 2004 وولفسون في عام 1994، نجد أن درجة الاستقطاب ظلت مستقرة في معظم البلدان، باستثناء اليمن الذي شهد زيادة كبيرة في الاستقطاب خلال الفترة من عام 1998 و حتى عام 2006. وبينما نجد ان ثنائية الاستقطاب تتطور حتى تصير الى نوع من التفاوت الاجتماعي، فان النتائج العملية تبين أن الاستقطاب في حد ذاته يختلف عن التفاوت الاجتماعي. وبتحليل هذا الاستقطاب حسب المناطق الجغرافية، يتضح انه في جميع البلدان الخمسة نجد ان النفقات العائلية تستقطب حسب المكان، حيث يتم شرح ما يقرب من 80 ٪ من حالات الاستقطاب العام حسب درجة الاستقطاب بين المناطق المختلفة.

1. Introduction

Issues related to income distribution—and inequality level in particular—were and continue to be a major concern for policy makers. Economists provide several rationales for studying income distribution patterns among individuals and their changes over time. First, efficient redistribution policies through education and provisions of public goods meet with a wide consensus in a fairly homogenous society but face strong opposition in an unequal one (Benabou, 2000). Second, as argued by Easterly (2001), less inequality and a homogeneous society are often associated with better socioeconomic indicators, economic policies, less political instability, civil war and ethnic minorities at risk, and more democracy. However, inequality measures fail to capture all patterns of income distribution—in particular, population clustering in a few income intervals and the decline of the 'middle class'. Such income distribution characteristics are better captured by the notion of polarization, which assesses the extent to which the population is clustered around a small number of distant poles. Esteban (2002) gives a simple example which illustrates the fundamental difference between polarization and inequality. Let us consider a distribution f with four individuals with incomes 2, 4, 6 and 8. The mean income is 5. Consider an equalizing transfer where the richest transfers one unit to the second richest and the second poorest individual just below the mean income transfers one unit to the poorest individual. We obtain a new and more equal distribution g with incomes 3, 3, 7, 7. However, we will face a new phenomenon where two-social classes emerge displaying a higher inter-class distance or a polarized society. Inversely, a high unequal society, with few persons appropriating most income, is not a polarized society, simply because most people are concentrated around the same pole in the income space.

The conjecture that motivates studies of polarization is that the more polarized a society is, the more likely a conflict may break out. According to Esteban and Ray (1994), the phenomenon of polarization is closely linked to the generation of tensions, to the possibilities of articulated rebellion and revolt and to the existence of social unrest. Consequently, finding a rise in income polarization may be a mean to predict possibilities of social unrest.[1]

Over the last decade, a large body of theoretical and empirical literature on the measurement of polarization has been developed.[2] However, most empirical studies of income polarization have been applied to developed countries. Little is known about this phenomenon in the Arab region, making it legitimate to question the trends of income polarization in the region.[3] Indeed, most Arab countries have been forced in the late 1980s to adopt reforms in their development models towards a private-led, market model. However, the fear of immediate consequences of economic reforms on perceived inequality and social unrest has significantly slowed reforms. Bibi and Nabli (2008) note "...This has generally prevented the emergence of a new social contract, with countries 'stuck' between an old model which became ineffective and a new one which cannot be fully embraced". Our analysis of polarization will give some useful results for policy makers in order to assess the effects of redistributive policies, as well as the effects of recent economic reforms on income distribution.

In this paper we rely on polarization measures proposed by Wolfson (1994) and Duclos, Esteban and Ray (2004)—hereafter DER—and a set of microeconomic data drawn from household surveys in five Arab countries to analyze the trend of household expenditure polarization and its decomposition by geopolitical regions. When addressing this issue we

1 See also Esteban and Ray (2009) for a theoretical analysis linking the level of conflict to inequality and polarization.

2 See for instance Wolfson (1994), Esteban and Ray (1994) and Duclos, Esteban and Ray (2004),Wang and Tsui (2000) and Zhang and Kanbur (2001) among many others.

3 A recent approach paper on a Research Program on Equity and Inequality in the Arab Region prepared by Bibi and Nabli (2008) for the ERF strongly recommends empirical studies of inequality and polarization in the Arab region.

can improve our understanding of several aspects of social, economic and political changes in the Arab region. The layout of the paper is as follows: Section 2 presents theoretical measures of polarization. Section 3 presents the ethical foundations underlying the measures of polarization. In Section 4 we present data used. Section 5 presents results and Section 6 concludes.

2. Theoretical Framework

In this section, we present analytical tools that will be used to portray polarization levels, their changes and the contribution of socioeconomic groups to overall polarization within each country included in our study. The most commonly used polarization measures are those proposed by Wolfson (1994) and DER (2004). The former measure reflects the notion of bi-polarization. It is designed to capture the formation of two equal-sized groups in the society: those above the median income and those below it. The measure proposed by DER (2004) measures polarization without assuming a specific number of income groups or poles. It is designed to capture the formation of an arbitrary number of groups. In what follows we present a formal derivation of both indices and we briefly discuss their axiomatic foundations.

2.1 Wolfson's measure of bi-polarization

Wolfson (1994) starts from the idea of the disappearing middle class. He considers that a movement of individual incomes from the middle to both tails of the income distribution generates the phenomenon of bipolarization or bimodality of the income distribution. Formally, the Wolfson's index of bipolarization can be written as:

$$P^{w} = 2(2T - Gini)/(m/\mu) \tag{1}$$

$$= \left(\frac{m}{\mu}\right)\left[0.5 - L - \frac{G}{2}\right] \tag{2}$$

where μ and m are respectively the mean and median incomes and L(0.5) the income share of the bottom half of the population. It captures how distant the distribution is from the symmetric bimodal. Low values of P^W indicate a less polarized distribution, with 0 corresponding to perfect equality and 0.25 corresponding to perfect bimodality—where half the population has zero income and the other half has twice the median. An increase of P^W indicates a deepening in polarization or a disappearance of the middle class.

2.2 Duclos Esteban and Ray's (DER2004) measure of polarization

Let us consider an income distribution defined by a density f over R_+. DER assume that each individual feels two things: identification with similar people, and alienation from dissimilar people. For someone with income x, the sense of identification depends on the density $f(x)$ at x. For two people with incomes x and y, the sense of alienation is monotonic in distance $|x - y|$. The interaction between both feelings gives rise to the effective antagonism of x towards y (under f). Such antagonism can be written as

$$T(i, a), \tag{3}$$

where $i = f(x)$, $a = |x-y|$, and T is some arbitrary, continuous and non-decreasing function with $T(i, 0)=T(0, a)=0$. Polarization is defined as the addition of all effective antagonisms in the distribution:

$$P(f) = \iint T(i,a) f(x) f(y) dy dx \tag{4}$$

Equation (4) gives a general class f polarization measure that fits into what DER call the identification-alienation framework. DER's approach places a set of axioms (more on this

below) on this framework so as to narrow down a functional form of T and render the following useable measure of polarization:

$$P_\alpha^{DER}(f) = \iint f(x)^{1-\alpha} f(y)|x-y| \; dydx \tag{5}$$

where $\alpha \in [0.25, 1]$ indicates the degree of polarization aversion displayed by the measure.

For the empirical estimation of DER, first note that for every distribution function f with associated density f and mean μ, equation (5) can be rewritten as:

$$P_\alpha^{DER} = \int_y f(y)^\alpha a(y) dF(y), \tag{6}$$

with $a(y) \equiv \mu + y(2F(y)-1) - 2\int_{-\infty}^{y} xdF(x)$. A natural estimator of $P_\alpha(F)$ based on a random sample of n *i.i.d* observations of income $y_i, i = 1 \ldots n$ and ordered such that $y_1 \le y_2 \le \ldots \le y_n$, is

$$P_\alpha(\hat{F}) = n^{-1} \sum_{i=1}^{n} \hat{f}(y_i)^\alpha \hat{a}(y_i), \tag{7}$$

where $\hat{a}(y_i)$ is given as

$$\hat{a}(y_i) = \hat{\mu} + y_i(n^{-1}(2i-1)-1) \; n^{-1}(2\sum_{j=1}^{i-1} y_j + y_i), \tag{8}$$

where $\hat{\mu}$ is the sample mean and $\hat{f}(y_i)^\alpha$ is the nonparametric kernel estimator of $f(y_i)^\alpha$.

DER show that $n^5(P_\alpha(\hat{F}) - P_\alpha(F))$ has an asymptotic limiting normal distribution $N(0, V_\alpha)$, with

$$V_\alpha = \text{var}((1+\alpha) f(y)^\alpha a(y) + y\int f(x)^\alpha dF(x) + 2\int_y^\infty (x-y) f(x)^\alpha dF(x)) \tag{9}$$

The last result given by equation (9) will be used to make statistical comparisons of income polarization within and between countries.

At this stage a question is in order. When can the DER index and inequality follow the same path? DER index can be decomposed as:

$$P_\alpha^{DER} = \bar{a} \; \bar{\iota}_\alpha (1 + \rho), \tag{10}$$

where $\bar{a} = \iint |y-x| \; dF(x)dF(y)$, represents the average distance between individual $\bar{\iota}$, reflects the density of people clustered around a given income level and is equal to $\int f(x)^{1+\alpha} dx$. The third component is a correlation between identification and alienation. When a significant change of inequality occurs, coupled with a neglected change of identification, polarization and inequality may vary in the same sense. On the other hand the decomposition (equation 10) is helpful to analyze the change in polarization level. It tells policy makers whether an observed change in polarization is derived from identification or alienation component. This is of great importance for policies aiming to reduce polarization. Indeed, a policy aiming to reduce alienation should bring group averages together, while a policy to reduce identification should increase the spread of poles.

3. Ethical Foundations of Polarization Measures

In this section we discuss the ethical foundations of polarization measures described by a set of axioms or desirable proprieties that measures should satisfy. Most of the following axioms

are based on the notion of basic density, which can be defined as unnormalized (by population), symmetric and unimodal. Any basic density can undergo a slide. A slide to the right by x is a new density g such that $g(x) = f(y - x)$ and the same applies to a slide to the left. Any basic density can also undergo a λ − squeeze. The concept of a squeeze is defined as follows. Let f be any basic density with mean μ, and let λ lie in [0, 1]. A λ − *squeeze* of f is a transformation of this density as follows $f^{\lambda}(x) = 1/\lambda\, f(x - [1 - \lambda]\, \mu/\lambda)$

axiom 1 If a distribution is composed of a single basic density, then a squeeze of that density cannot increase polarization. The λ − *squeeze* as defined above creates a reduction in inter-individual alienation but also serves to raise identification of agents who are located "centrally" in the distribution. These two effects must be counterbalanced.

axiom 2 If a symmetric distribution is composed of three basic densities with the same root and mutually disjoint supports, then a symmetric squeeze of the side densities cannot reduce polarization.

axiom 3 Consider a symmetric distribution composed of four basic densities with the same root and mutually disjoint supports. An equal slide of the two inner densities outwards towards the outer densities makes polarization go up.

axiom 4 (Population invariance) Let F and G be two distributions with possibly different, unnormalized populations such that $P(F) \geq P(G)$.

Then for all $k > 0$, $P(k\ F) \geq$ P(kG), where kF and kG represent (identical) population scalings of F and G respectively.

Then polarization indices are invariant with the increase of population size by replicating it.

axiom 5 (Scale invariance) The change of scale does not affect the polarization. Let F and G be two distributions with the same mean. Then, if $G(x)$ is more polarized than $F(x)$ the same relation applies between $G\frac{x}{m}$ and $F\frac{x}{m}$.

axiom 6 (Increased bi-polarization) The polarization increases if the incomes below or above the median income move closer to each other. In other words, polarization is an increasing function of the concentration of the population (monotonic function).

This axiom is more demanding than axiom 2, so if a polarization measure respects axiom 6, it must also respects axiom 2.

axiom 7 (Increased spread) Polarization increases if the income of a person moves away from the median income. Consider two distributions with the same mean and median such that $\left|m - F^{-1}(p)\right| \leq \left|m - G^{-1}(p)\right|$, for every $p \in [0, 1]$, then G is more polarized than F.

This axiom is more demanding than axiom 3. Also, axiom 1is a special case of axiom 7,than if a polarization measure verifies axiom 7 it must also verify axiom 1 and axiom 3.

axiom 8 Consider a uniform distribution with support $[a, b]$. Let us partition this support into n intervals of length $\frac{b-a}{n}$. Then polarization increases further to λ − *squeeze* of n uniform densities. The increase does not depend on the number of contracted densities.

axiom 9 (Non monotonicity) Consider a symmetric distribution composed of four basic densities drawn from the same kernel and the distance between the inner densities and outer densities is sufficiently small. In this case, polarization should not vary monotonically after a population transfer from the inner towards the outer densities.

This axiom is not compatible with axiom 7 and there is no measure that could satisfy both requirements.

axiom 10 The flipping of a distribution around the midpoint of its support should leave polarization unchanged. Let f be a density with support [a, b] and let $g(x) = f(2M - x)$ where $M = \frac{b-a}{2}$. Polarization under f and g should be the same.

The bipolarization measure P^W is based on axiom 6 and axiom 7, so P^W satisfies axioms 1 to 7, and fails to satisfy axioms 8 to 10.

The polarization measure P^{DER} as defined in equation (5) is based on axioms 1 to 5. P^{DER} also respect axioms 8 to10 and fails to respect axioms 6 and 7. More recently Esteban and Ray (2009) have added an additional axiom based on the following idea. Consider three population groups in the society with population shares r, q and p such that $r < q < p$ and r is small enough. The very small group r cannot be contributing much, on its own, to social tension. If instead the population of such group is transferred to group q which is equally opposed to the largest group of size p, then polarization cannot decrease. Esteban and Ray (2009) show that the only polarization measure that satisfy this axiom is P_1^{DER} that is the DER measure for $\alpha = 1$ given by $P_1^{DER}(f) = \iint f(x)^2 f(y)|x-y| \, dydx$. In the empirical section all our analysis will be based on the assumption $\alpha = 1$ for the DER measure. Intermediate results for different values of α will be given in the appendix.

3.1 Decomposing polarization by sub-population groups:

Decomposing the polarization index by population groups constitutes an interesting determinant of polarization and the contribution of each group to overall polarization. Araar (2008) proposes an analytical decomposition of the DER index into a within and between groups component. In this section we will briefly present the proposed decomposition. Recall that given equation (5), the polarization index can be rewritten as:

$$P = \int f(x)^{1+\alpha} \alpha(x) dx \tag{11}$$

$a(x)$ is the alienation component which can be decomposed into the expected deprivation $\delta(x)$ and the expected surplus $\sigma(x)$ of an individual with income x.

The expected deprivation $\delta(x)$ of an individual with income x can be defined as follows:

$$\delta(x) = \int \tau(x,y) f(y) dy \tag{12}$$

Where $\tau(x, y)$ is the relative deprivation of household with income x compared to that with income y and is equal to $(y - x)_+$.

Then the expected surplus $\sigma(x)$ of an individual with income x is equal to

$$\delta(x) = \int \tau(y,x) f(y) dy \tag{13}$$

Replacing $a(x) = \delta(x) + \sigma(x)$ in equation (11) we find that

$$P = \int f(x)^{1+\alpha} [\delta(x) + \sigma(x)] \, dx \tag{14}$$

$$= \text{D} + \text{S} \tag{15}$$

where $D = \int f(x)^{1+\alpha} [\delta(x)] \, dx$ is the deprivation component and the complement part S is the surplus.

When the distribution is symmetric, or when the parameter α equals zero, these two components are equal. Given the usual asymmetric distribution of incomes, $D > S$ as expected (Araar, 2008).

To obtain the free scale index, DER propose to divide the absolute polarization index by $\mu^{1-\alpha}$. Based on equation (14) and letting the density function for the group g be f_g, the contribution of individuals with income x to the overall polarization— or equivalently the antagonism felt by an individual—can be written as

$$c(x) = \frac{f(x)^{1+\alpha} a(x)}{\mu^{1-\alpha}} \tag{16}$$

Now consider any characteristic (e.g. race, region or sectors) yielding a partition of the whole population in G groups each with size n_g, with $\sum n_g = n$ and $g = 1...G$. DER index can be then rewritten as

$$P = \sum_g c_g(x)\ dx \tag{17}$$

where $c_g(x)$ denotes the contribution of group g with income x to the DER index. It can also be expressed as follows:

$$c_g = \pi_g(x) \frac{f(x)^{1-\alpha} a(x)}{\mu^{1-\alpha}} \tag{18}$$

where π_g denotes the proportion of individuals belonging to group g and earning income x.

On the basis of the decomposition of the alienation component $a(x) = \phi_g\ a_g(x) + \tilde{a}_g(x)$, equation (18) can be rewritten as

$$c_g(x) = \phi_g^{\alpha} \psi_g^{1-\alpha} \left[\frac{\pi_g(x) a_g(x) f(x)_g^{1+\alpha}}{\mu_g^{1-\alpha}} + \frac{\pi_g(x) \tilde{a}_g(x) f(x)_g^{1+\alpha}}{\mu_g^{1-\alpha}} \right. \tag{19}$$

where ϕ_g and ψ_g are respectively the population and income shares of group g. Hence, the DER can be decomposed as follows:

$$P = \sum \phi_g^{1+\alpha} \psi_g^{1-\alpha} R_g P_g + \tilde{P} \tag{20}$$

$$= \left[\sum \phi_g^{1+\alpha} \psi_g^{1-\alpha} R_g P_g \right] + \left[\sum_g \phi_g^{1+\alpha} a(\dot{\mu}_g) \right] \tag{21}$$

$$= Within + Between \tag{22}$$

where

$R_g = \frac{\int a_g(x)\ \pi_g(x)\ f(x)_g^{1+\alpha} dx}{\phi_g \int_g (x) f(x)_g^{1+\alpha} dx}$. This component depends on the population share and the correlation between the density function of the group and that of the population

$\dot{\mu}_g = \frac{\mu_g}{\mu}$ and $a(\dot{\mu}_g) = \sum_h \phi_h \left| \dot{\mu}_g - \dot{\mu}_h \right|$

According to Araar (2008), the indicator ($1 - W/P$) shows how many groups are locally polarized. Perfect identification of groups and lower local polarization coincide, in general, with the higher relative contribution of the between group component to the polarization index.

4. Data

The data used in this paper is taken from a series of household expenditure surveys conducted in the following Arab countries during the period 1975–2006: Egypt (1997), Morocco (1991, 1999), Syria (1997, 2004), Tunisia (1975, 1980, 1985, 1990, 1995 and 2000) and Yemen (1998, 2006). As an indicator of household wellbeing we use household expenditures normalized by an adult equivalence scale defined as $\sqrt{s}$, where s is household size. Table 1 provides some details on the surveys used.

5. Results

We begin by presenting a summary of result for all countries included in this study. Table 2 presents estimates of the Gini index, bipolarization and DER's polarization indices. Although the surveys used are not fully comparable, we note that Syria in 1997 exhibits the lowest inequality and bipolarization levels, followed respectively by Yemen and Egypt. Morocco and Tunisia exhibit significantly higher levels of inequality and bipolarization. While the Gini and Wolfson indices follow the same path by ranking countries in the same way, the picture changes with the DER measure. The lowest level of polarization or 'spikiness' of expenditure distribution is registered in Yemen in (1998) followed by Egypt (1997), while Syria (1997) ranks third. Morocco and Tunisia, the least equal countries, exhibit the same highest level of polarization. This first look at the result shows that polarization behaves somewhat differently from inequality, which will also be confirmed by examining the individual experience of each country.

Table 3 shows estimates of polarization and inequality indices for all countries and years. Note that we could not perform a trend analysis for Egypt because only one survey was available. However, we note that the upper and lower rural regions are the main contributors to the inter-regional component of overall polarization. These same regions host a significantly high proportion of poor individuals (see Table 4).

The Moroccan experience 1991–1999

Over the period 1991–1999 there was no statistically significant change in inequality or in polarization[4]. The decomposition of the DER measure into its identification and alienation components shows that the identification sentiment also remains stable over the period. On the other hand, decomposition by geographical regions (see Table 5) shows that the contribution of intra-group polarization is very high (83.6%) reflecting a non-negligible level of spatial polarization. The Tensift region seems to attract a significant part of the poor individuals given its highest ration $D/S = 4.55$ whereas the center area has the highest relative contribution to the intra-group polarization.

The Syrian experience 1997–2004

Syria witnessed a significant increase (of nearly 5.6%) in the inequality level between 1997 and 2004 coupled with a sharp rise in the bipolarization level (10.4%), implying the disappearance of the middle class. However, the level of polarization according to the DER measure remained constant. The stability of the DER index can explained by decreases in the identification sentiment (greater spread around income poles) which counteracts the rise of inequality, thus the overall antagonism in the society remains constant. As for the regional

[4] See Table 10 for a formal statistical test of changes in inequality and polarization level.

decomposition of polarization, Table 8 shows that the north east region contains a significant proportion of poor households with the highest ratio *D/S* = 4.025 and it is also the highest contributor to inter-regional polarization (19%). Also the level of polarization in 2004 in Syria is mostly explained by intra-regional polarization (68.2%).

The Tunisian experience 1975–2000

Tunisia experienced a different trend in polarization which remained globally constant over the period 1975–2000, contrary to the significant decreases of inequality over the same period. On the other hand, the bipolarization index has sharply decreased within the same period and followed exactly the same path of the Gini index. Figure 1 depicts the trend of all indices with respect to the base year 1975, as well as the average identification sentiment ($\bar{\iota}$). As can be seen in the figure, when an index does not change significantly (see Table 12) its value is considered the same as the previous period. In general, polarization behaves differently from inequality in several sub-periods between 1975 and 2000. Indeed during the period 1980–1985 characterized by a severe economic crisis, inequality and bipolarization levels remained stable, while polarization rose significantly by 10%. This increase was explained by a significant rise in the identification sentiment. For the period 1985–1990, characterized by macroeconomic stabilization programs, polarization as well inequality indices significantly decreased. After 1990 all indices remained stable without any significant change until 2000. According to Table 6, the most deprived regions are the north and center west with a relatively high D/S ratio compared to other regions. The center east region contributed the most to the within group polarization. On the other hand the share of intra-regional polarization was nearly 86% denoting a highly spatial polarized society.

The Yemenite experience 1998–2006

During the period 1998–2006 Yemen experienced dramatic changes of all indicators with rises of 18%, 16% and 12% of inequality, polarization and bipolarization indices respectively. The significant change of polarization is driven mainly by the alienation component, although the identification sentiment witnessed a similar rise of nearly 4%. A deeper analysis of the causes of such dramatic changes over a short period of 8 years is beyond the scope of this paper and will be the subject of future research. Similarly to other countries, the intra-regional polarization for Yemen is very high (it explains 81.7% of overall polarization, see Table 7) implying a spatially polarized expenditure distribution. The center east region (Hajjaj Mahwit, Al-Hodeideh and Dhammar) has the highest contribution to the inter-regional polarization.

6. Conclusion

The last two decades have seen considerable interest in the theoretical and empirical measurement of polarization. The main motivation of this research agenda has been that social policies based on inequality measures tend, in general, to transfer resources from the well-off to the less well-off and disregard the unexpected effects of such transfers on aggravating polarization or the clustering of incomes around local poles. Such a situation can quickly translate into social unrest and conflict. Polarization analysis offers complementary and perhaps targeted recommendations—beyond the usual recommendation of spending on the poor. A polarization-based policy brings deeper insights to social transfers. It takes into account where the individuals lie on the income distribution grid and whether polarization is derived from alienation (inequality) or identification. Bearing the importance of the polarization phenomenon in mind, this paper portrays polarization levels and trends in five Arab countries. The results empirically confirm that polarization and inequality can evolve in different directions as shown by the Tunisian experience during the period 1975–2000. The cases of Syria and Yemen merit particular attention due to the significant increases of

polarization and inequality in the recent period. The analysis of Morocco shows polarization and inequality as stable during the period 1991–1999. All in all, our decomposition analysis by geographical region shows that all the household expenditures in the five countries are spatially polarized where nearly 80% of overall polarization can be explained by intra-regional polarization. Finally we note that our analysis is simply descriptive. More attention should be devoted to (i) the determinants of polarization (and inequality), (ii) alternative decompositions of polarization according to different social groups (by gender or educational level) or geographical areas (urban-rural or geopolitical zones).

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Figure 1: Polarization and Inequality Trends: Tunisia 1975–2000

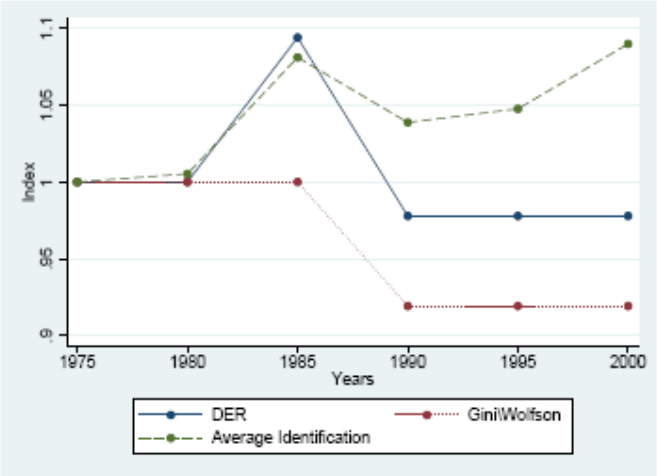

Table 1: Surveys Used

Country	Year	Survey Name	Nb. Household
Egypt	1997	Egyptian Integrated Household Survey	2402
Morocco	1991	Morocco Living Standards Survey	3323
	1999	Morocco Living Standards Survey	5129
Syria	1997	Household Income and Expenditure Survey	27926
	2004	Household Income and Expenditure Survey	26990
Tunisia	1975	Household Budget Survey	4960
	1980	Household Budget Survey	5944
	1985	Household Budget Survey	7454
	1990	Household Budget Survey	7734
	1995	Household Budget Survey	10800
	2000	Household Budget Survey	12960
Yemen	1998	Household Budget Survey	15120
	2006	Household Budget Survey	13641

Table 2: Polarization Levels in Five Arab Countries

Country	Gini	rank	Wolfson	rank	DER1	rank
Syria_97	.318	**1**	.125	**1**	.181	**3**
	(.003)		(.001)		(.002)	
Yemen_98	.332	**2**	.138	**2**	.169	**1**
	(.004)		(.002)		(.002)	
Egypt_97	.345	**3**	.142	**3**	.177	**2**
	(.008)		(.004)		(.004)	
Morocco_99	.361	**4**	.155	**4**	.184	**4**
	(.005)		(.003)		(.002)	
Tunisia_00	.376	**5**	.166	**5**	.185	**5**
	(.007)		(.003)		(.003)	

Table 3: Results

	Tunisia						Syria		Morocco		Yemen		Egypt
Years	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**1997**	**2004**	**1991**	**1999**	**1998**	**2006**	**1997**
Wolfson	.183	.182	.181	**.168**	.173	.166	.125	**.138**	.164	.155	.138	**.155**	.142
	(.003)	(.003)	(.003)	(.003)	(.002)	(.003)	(.001)	(.001)	(.005)	(.003)	(.002)	(.002)	(.004)
DER1	.181	.184	**.198**	**.177**	.181	.185	.181	.185	.183	.184	.169	**.197**	.177
	(.002)	(.003)	(.003)	(.002)	(.002)	(.003)	(.002)	(.001)	(.004)	(.002)	(.002)	(.004)	(.004)
$\bar{\iota}$	.568	.571	.614	.590	.595	.619	.739	.716	.646	.653	.638	.665	.663
$\bar{a}$	.409	.408	.415	.376	.385	.376	.318	.336	.361	.361	.332	.393	.345
ρ	-.219	-.219	-.236	-.204	-.209	-.214	-.234	-.232	-.211	-.221	-.201	-.258	-.228
Gini	.409	.408	.415	**.376**	.385	.376	.318	**.336**	.359	.361	.332	**.393**	.345
	(.005)	(.007)	(.005)	(.004)	(.004)	(.007)	(.003)	(.002)	(.007)	(.005)	(.004)	(.008)	(.008)

Notes: Bootstrapped standard errors are in parentheses. Bold numbers denote a significant change of the index of interest compared to the previous period.

Table 4: Decomposition of the DER Polarization Index According to Egypt's Geographical Zones

Group g	ϕ_g	ψ_g	P_g	R_g	D	S	D/S	AC	RC
Metro	.195	0.255	.193	1.053	.020	.010	1.924	.008	.044
Lower urban	.120	.110	.173	.909	.017	.005	3.180	.002	.013
Lower rural	.277	.231	.165	.897	.041	.011	3.564	.011	.064
Upper urban	.150	.195	.180	1.089	.015	.008	1.868	.004	.025
Upper rural	.258	.209	.169	.879	.040	.010	4.020	.010	.055
Within-group								.036	.202
Between-group								.141	.798
Total					.132	.045	2.948	.177	1.000

ϕ_g : The population share of group g.
ψ_g : The income share of group g.
P_g : Within-group polarization.
R_g : Ratio R see equation (20).
D : The deprivation component.
S : The Surplus component.
AC : The absolute contribution.
RC : The relative contribution.

Table 5: Decomposition of the DER Polarization Index According to Morocco's Geographical Zones

Group g	ϕ_g	ψ_g	P_g	R_g	D	S	D/S	AC	RC
South	.128	.143	.188	1.039	.016	.006 2	.829	.003	.017
Tensift	.172	.147	.195	.872	.029	.006	4.559	.005	.027
Center	.228	.281	.186	1.057	.025	.012	2.153	.010	.056
North West	.211	.205	.179	.981	.030	.009	3.254	.008	.043
Center North	.121	.100	.190	.854	.020	.004	4.522	.002	.013
East	.073	.069	.165	.953	.010	.003	2.823	.001	.005
Center South	.067	.055	.180	.876	.011	.003	4.299	.001	.004
Within-group								.030	.164
Between-group								.154	.836
Total					.140	.043	3.246	.184	1.000

Table 6: Decomposition of the DER Polarization Index According to Tunisia's Geographical Zones

Group g	ϕ_g	ψ_g	P_g	R_g	D	S	D/S	AC	RC
Great Tunis	.164	.220	.182	1.074	.016	.009	1.813	.005	.028
North East	.138	.119	.176	.921	.022	.006	3.835	.003	.017
North West	.131	.107	.180	.866	.022	.005	4.312	.003	.015
Center West	.148	.114	.182	.843	.025	.005	4.808	.003	.018
Center East	.189	.247	.191	1.078	.020	.010	2.042	.007	.040
South West	.114	.094	.179	.867	.019	.005	3.973	.002	.011
South East	.115	.099	.184	.904	.018	.005	3.915	.002	.012
Within-group								.026	.140
Between-group								.159	.860
Total					.141	.044	3.225	.185	1.00

Table 7: Decomposition of the DER Polarization Index According to Yemen's Geographical Zones

Group g	ϕ_g	ψ_g	P_g	R_g	D	S	D/S	AC	RC
Sanaa-Sadah-mreb- aljouf	.183	.157	.178	.934	.030	.008	3.900	.006	.028
Albaida-alhaj-abyn	.085	.072	.194	.907	.014	.003	4.484	.001	.006
Adan	.028	.039	.194	1.035	.003	.002	1.823	.000	.001
Taiz and ibb	.231	.224	.202	.951	.036	.010	3.506	.010	.052
Hajjah-almahwet-alhodeidah-dhammar	.310	.259	.188	.885	.054	.013	4.205	.016	.081
Shabwah-hadhramaut-almahara	.079	.085	.187	.857	.010	.004	2.177	.001	.005
Sanaa city	.084	.164	.235	1.083	.006	.004	1.388	.002	.009
Within-group								.036	.183
Between-group								.160	.817
Total					.152	.044	3.450	.197	1.000

Table 8: Decomposition of the DER Polarization Index According to Syria's Geographical Zones

Group g	ϕ_g	ψ_g	P_g	R_g	D	S	D/S	AC	RC
South	.304	.342	.192	.986	.037	.015	2.416	.017	.094
North East	.448	.406	.189	.927	.070	.017	4.025	.035	.190
Central	.157	.154	.204	.931	.024	.006	3.717	.005	.025
Costal	.090	.098	.174	1.036	.011	.004	2.548	.001	.008
Within-group								.059	.318
Between-group								.126	.682
Total					.142	.043	3.263	.185	1.000

Table 9: Results

	Tunisia					
Years	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**
Wolfson	.183	.182	.181	**.168**	.173	.166
	(.003)	(.003)	(.003)	(.003)	(.002)	(.003)
DER025	.300	.298	.303	.282	.287	.282
	(.003)	(.004)	(.003)	(.002)	(.002)	(.004)
DER05	.243	.243	.250	.232	.236	.234
	(.002)	(.003)	(.002)	(.002)	(.002)	(.003)
DER075	.207	.208	.218	.199	.204	.205
	(.002)	(.003)	(.003)	(.002)	(.002)	(.003)
DER1	.181	.184	**.198**	**.177**	.181	.185
	(.002)	(.003)	(.003)	(.002)	(.002)	(.003)
Gini	.409	.408	.415	**.376**	.385	.376
	(.005)	(.007)	(.005)	(.004)	(.004)	(.007)

	Syria		Morocco	
Years	**1997**	**2004**	**1991**	**1999**
Wolfson	.125	.138	.164	.155
	(.001)	(.001)	(.005)	(.003)
DER025	.245	.257	.275	.273
	(.002)	(.001)	(.005)	(.003)
DER05	.211	.220	.230	.228
	(.002)	(.001)	(.004)	(.002)
DER075	.193	.198	.202	.202
	(.002)	(.001)	(.003)	(.002)
DER1	.181	.185	.183	.184
	(.002)	(.001)	(.004)	(.002)
Gini	.318	.336	.359	.361
	(.003)	(.002)	(.007)	(.005)

	Yemen		Egypt
Years	**1998**	**2006**	**1997**
Wolfson	.138	.155	.142
	(.002)	(.002)	(.004)
DER025	.255	.287	.262
	(.002)	(.005)	(.005)
DER05	.214	.239	.220
	(.002)	(.004)	(.004)
DER075	.188	.213	.194
	(.002)	(.004)	(.004)
DER1	.169	.197	.177
	(.002)	(.004)	(.004)
Gini	.332	.393	.345
	(.004)	(.008)	(.008)

Table 10: Test Statistics, Morocco

DER index ($\alpha = .25$)

t-Student

	1975	1980
1975	.00	
1980	-.34	.00

DER index ($\alpha = .5$)

t-Student

	1975	1980
1975	.00	
1980	-.45	.00

DER index ($\alpha = .75$)

t-Student

	1975	1980
1975	0	
1980	0	0

DER index ($\alpha = 1$)

t-Student

	1975	1980
1975	.00	
1980	.22	.00

Wolfson index

t-Student

	1975	1980
1975	.00	
1980	-1.54	.00

Gini index

t-Student

	1975	1980
1975	.00	
1980	.23	.00

Table 11: Test Statistics, Syria

DER index ($\alpha = .25$)

t-Student

	1997	2004
1997	.00	
2004	5.37	.00

DER index ($\alpha = .5$)

t-Student

	1997	2004
1997	.00	
2004	4.02	.00

DER index ($\alpha = .75$)

t-Student

	1997	2004
1997	.00	
2004	2.24	.00

DER index ($\alpha = 1$)

t-Student

	1997	2004
1997	.00	
2004	1.79	.00

Wolfson index

t-Student

	1997	2004
1997	.00	
2004	9.19	.00

Gini index

t-Student

	1997	2004
1997	.00	
2004	4.99	.00

Table 12: Test Statistics, Tunisia

DER index ($\alpha = .25$)
t-Student

	1975	1980	1985	1990	1995	2000
1975	.00					
1980	-.40	.00				
1985	.71	1.00	.00			
1990	-4.99	-3.58	-5.82	.00		
1995	-3.61	-2.46	-4.44	1.77	.00	
2000	-3.60	-2.83	-4.20	.00	-1.12	.00

DER index ($\alpha = .5$)
t-Student

	1975	1980	1985	1990	1995	2000
1975	.00					
1980	.00	.00				
1985	2.47	1.94	.00			
1990	-3.89	-3.05	-6.36	.00		
1995	-2.47	-1.94	-4.95	1.41	.00	
2000	-2.50	-2.12	-4.44	.55	-.55	.00

DER index ($\alpha = .75$)
t-Student

	1975	1980	1985	1990	1995	2000
1975	.00					
1980	.28	.00				
1985	3.05	2.36	.00			
1990	-2.83	-2.50	-5.27	.00		
1995	-1.06	-1.11	-3.88	1.77	.00	
2000	-.55	-.71	-3.06	1.66	.28	.00

DER index ($\alpha = 1$)
t-Student

	1975	1980	1985	1990	1995	2000
1975	.00					
1980	.83	.00				
1985	4.71	3.30	.00			
1990	-1.41	-1.94	-5.82	.00		
1995	.00	-.83	-4.71	1.41	.00	
2000	1.11	.24	-3.06	2.22	1.11	.00

Wolfson index
t-Student

	1975	1980	1985	1990	1995	2000
1975	.00					
1980	-.24	.00				
1985	-.47	-.24	.00			
1990	-3.54	-3.30	-3.06	.00		
1995	-2.77	-2.50	-2.22	1.39	.00	
2000	-4.01	-3.77	-3.54	-.47	-1.94	.00

Gini index
t-Student

	1975	1980	1985	1990	1995	2000
1975	.00					
1980	-.12	.00				
1985	.85	.81	.00			
1990	-5.15	-3.97	-6.09	.00		
1995	-3.75	-2.85	-4.69	1.59	.00	
2000	-3.84	-3.23	-4.53	.00	-1.12	.00

Table 13: Test Statistics, Yemen

DER index ($\alpha = .25$)

t-Student

	1998	2006
1998	.00	
2006	5.94	.00

DER index ($\alpha = .5$)

t-Student

	1998	2006
1998	.00	
2006	5.59	.00

DER index ($\alpha = .75$)

t-Student

	1998	2006
1998	.00	
2006	5.59	.00

DER index ($\alpha = 1$)

t-Student

	1998	2006
1998	.00	
2006	6.26	.00

Wolfson index

t-Student

	1998	2006
1998	.00	
2006	6.01	.00

Gini index

t-Student

	1998	2006
1998	.00	
2006	6.82	.00