The Dynamics of Spatial Inequality and Polarisation in Iran

By

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Abstract

This paper analyses the extent and dynamics of inequality amongst the provinces of Iran. It reviews various theoretical propositions for possible convergence and divergence and argues that while the evidence from the more developed countries supports the case of convergence the empirical evidence for developing countries is ambiguous at best. Straight and population weighted measures of inequality are used to see the evolvement of inequality amongst the provinces of Iran with respect to two indicators of income and consumption with a rural and urban break up. Polarisation in distribution depicts a disturbing picture for urban areas and this is traced around a few proposed dimensions. The results reveal a close cluster of the provinces in Iran drifting behind the rest of the provinces.

Keywords: Inequality, polarisation, spatial inequality, regional disparities, Iran

1. Introduction

Spatial inequality within individual developing countries has received relatively less attention in the literature of development. This is probably because we tend to think of a developing country as a homogenous economic, political and social entity. Yet there are, more often than not, vast disparities amongst various regions within a developing country. Curiously this problem has attracted little attention at the policy making level in developing countries. Iran is no exception to this. Regional disparities in Iran have been growing at an alarming rate leading to serious problems including migration with its associated problems from backward provinces to the more affluent ones.

A glance through the first human development report for Iran (PBOUN, 1999) reveals remarkable regional disparities. In 1996 nearly 18% of population had less than $1 a day in the poorest province as compared to only 0.4% in the province of Tehran. The real consumption expenditure per capita of the poorest 20% of population in the top provinces was nearly four times of that of the poorest province. Population not expecting to reach the age of 40 for the worst and best provinces were nearly 18% and 7% respectively. Similarly the percentage population not having access to clean water in the worst and best provinces were 14% and 0.2%. As for the percentage of population having no access to sanitation the corresponding figures were 62% and 15%. The indicators of literacy and education reveal similar disparities. In the most deprived province (Sistan and Baluchestan) only 48% of adults were literate as compared to nearly 85% in Tehran. The secondary school enrolment ratios for the best and worst provinces were 92% and 43% respectively. Female secondary enrolment ratios were much worse with the corresponding figure of 78% and 25%. The mortality rate of children under the age of 5 in the worst region was nearly three times of that in the best province. The corresponding figures for maternal mortality rates were much worse, nearly fifteen times.

The report acknowledges considerable differences in human development amongst the regions of Iran: “There are wide disparities in human development at provincial level” (p 20). Gender adjusted indices of the Gender-related Development Index (GDI) and Gender Empowerment Measure (GEM) also reveal significant regional differences. More critically, the Human Poverty Index (HPI) reveals a far more

disturbing picture. The value of the index is 3.5 times worse for the *poorest* province as compared to the *richest* province.

The dynamics of spatial inequality is of particular interest to policy making and the purpose of this paper is to contribute to the empirics of this topic by investigating the dynamics of inequality amongst the provinces of Iran. The rest of this paper is organised as follows. Section 2 reviews the theoretical models and empirical studies of spatial inequality. Section 3 tests for the hypothesis of convergence of per capita income (and also per capita consumption expenditure) across the provinces of Iran. Section 4 studies the extent of inequality amongst the provinces taking the population concentration into account. Section 5 studies the incidence of polarisation and section 6 decomposes inequality around a number of proposed dimensions. Section 7 concludes.

2. Literature review

The theoretical literature on spatial inequality in developing countries is relatively scarce. The few theoretical models discussed in the literature are often the extension of models of growth and inequality to spatial inequality in the context of geographical regions or regions within a country.

Out of the classical economists perhaps Ricardo's model is more relevant to the case of comparative development, though it was designed with different sectors of production in mind. In this model the process of growth is smooth but at a declining rate eventually approaching the steady state of zero growth due to the diminishing returns in agriculture (Boyer 1996). This may be one of the earlier models which brought in the idea of diminishing returns being the basis of the diversion of resources to alternative sectors and locations. On the contrary, Malthus and Marx saw the process of growth as an unbalanced one in general which may have implications for regional imbalances (Martin and Sunley 1998, Dunford and Smith 2000).

The neoclassicals, optimistic about market forces regarded regional inequality as a passing phase and postulated that market forces would ensure that the returns to all factors of production would approach their marginal products. Regional inequality initially arises in the process of the allocation of resources but factor mobility and

efficient market forces would eventually ensure regional equality (Smith 1975). However, a pre-requisite of efficient markets is the existence of fully competitive markets which are not present in most developing countries. Similarly the inverted U hypothesis sustains that regional inequalities within developing countries will be eventually reduced through factor mobility. The common explanation of classical and neoclassical economists seems to be resource endowment whether land based or industry (capital) based (Kaldor 1970).

Neo-Keynesians such as Harrod and Domar stated that the dynamics of equilibrium between the consumption and investment decisions would ensure an unstable growth path (Boyer 1996). In contrast neoclassicists such as Solow and Swan envisaged a smoother growth path. Given the fully competitive markets and the availability of similar technology for the same rate of investment every economy would grow at a similar rate determined by the exogenous technical progress and population growth. Assuming a production function with constant returns to scale and the diminishing returns of capital, the economies with lower levels of initial productivity enjoy a higher rate of growth in productivity and as such will *catch up* with the more developed economies. This was taken to be extendable to regions within a country.

On the other hand the structuralist school of dualism postulates that regional inequality is an inevitable outcome of capital accumulation and profit maximisation and that market forces tend to increase rather than decrease regional inequality. Myrdal's (1957) *circular and cumulative causation* thesis proposes that the creation of a *favoured* region may have its origin in an historical accident but there is a natural tendency for all economic activities with higher than average returns (such as industry, commerce, banking and insurance) and the know how with all the social amenities that go with these to cluster within such a core region with *backwash* effects on *unfavoured* regions. There may be some centrifugal *spread effect* (along the lines of trickle-down effects) but these do not point to the achievement of an equilibrium. On the contrary "even in a rapidly developing country many regions will be lagging behind, stagnating or becoming poorer; and there would be more regions in the last two categories if market forces alone were left to decide the outcome." (Myrdal 1957, p 32).

Kaldor (1970 and 1981) argues that the resource endowment and location theory do not provide a clear explanation for the causes of divergent regional growth rates. He argues against the assumption of diminishing returns to factors of production in the favoured regions and considers the Myrdal principle of *circular and cumulative causation* to be synonymous to the existence of increasing returns to scale in processing activities which are mainly located in *favoured* regions. He reiterates that the Adam Smith principle of the division of labour takes place mainly through the continuous sub-division of industries into more specialised industries and hence the higher industrial expansion in the *favoured* region. The close association between the development of manufacturing industries and urbanisation ensures "a strong positive association between the growth of productivity and efficiency and the rate of growth in the scale of activities – the so-called Verdoorn Law." (Kaldor 1970, p 340). Fast growing regions, relative to backward regions, experience higher increase in productivity coupled with a relative drop in efficiency wages and Kaldor (1970) argues that it is through this that the process of *cumulative causation* operates.

The structuralist and dependency theories, mainly discussed at inter-national but extended to intra-national level, maintain that the dependency of the periphery on core regions and the unbalanced transfer of values between them intensifies the regional inequality and that this is an inevitable outcome of capitalism (Kay 1989, Emmanuel 1972).

Embodied in the proposition of convergence is the expectation that a region's growth is solely related to its background and independent of the economy of which it is a part. Quah (1993a) argues against such expectation and suggests that this assumption has inherent limitations. Furthermore, the proposition of the diminishing returns to capital and labour and their interregional spillovers, and the common access to the same technology are questioned (Dunford and Smith 2000).

The more recent empirical literature is along the lines of two opposing theoretical models of regional inequality discussed above: convergence and divergence. Most of these studies are cross-country studies and test the hypothesis of convergence (see for example Baumol 1986, Romer 1986, Baumol and Wolff 1988, Lucas 1988, Mankiw, Romer and Weil 1992, Barro and Sala-i-Martin 1995, Sala-i-Martin 1996 and

Dunford and Smith 1999). Two possible, and sometimes related, forms of convergence are suggested: β-convergence and σ-convergence. The former suggests that poorer countries will tend to grow faster than the more developed ones. This is mainly because of the diminishing marginal returns to capital in the richer countries. The latter form of convergence envisages that the cross-country inequalities would tend to decrease over time (Lucas 1988, Mankiw et al. 1992, Barro and Sala-i-Martin 1992, 1995), that is a reduction in inequality which can technically take place in a variety of ways.[1]

The general consensus is that there exists an evidence of convergence only amongst the richer countries and some middle-income countries. This provided support for the idea of *convergence clubs* in the sense that convergence may apply to groups of countries, which have similar initial conditions and structures.[2] This gave rise to the idea of *conditional b-convergence* where the average growth rate of per capita output is a function of the initial level of per capita output and a set of additional variables defining the steady-state growth path of per capita output (Hossain 2000).

It is tempting to think that such similarities are more likely to exist amongst the regions within a country than amongst different countries for a variety of reasons including a perceived higher degree of homogeneity, similarity of institutions and less visible boundaries amongst the regions within a country. Maybe it is for this reason that the hypothesis of *catching up* seems much more extendable to regional development.

The empirical intra-national studies on a number of countries provide some evidence on convergence within the richer countries. Barro and Sala-i-Martin (1995) give examples of both types of b -convergence and s -convergence having taken place amongst different states in the USA, various prefectures in Japan and different regions within Germany, United Kingdom, France, Italy and Spain. Chatterji and Dewhurst (1996) conclude that convergence has taken place amongst counties/regions within

[1] The first type of convergence is a necessary but not a sufficient condition for having the second (see Quah 1993b, Sala-i-Martin 1996b and Martin and Sunley 1998).

[2] For a review of *club convergence* and also the related issue of *conditional convergence* see Martin and Sunley 1998.

the United Kingdom though its speed depended on economic conditions at the time. Coulombe (2003) suggests that since 1950 relative per capita income and human capital in 10 Canadian provinces did generally converge to a long-run steady state, though of different forms.

However, when it comes to developing countries the outcome seems to be different to those of the richer countries and at best ambiguous.

Ferreira (2000) considers *s-convergence* as a feature of regional growth experience in Brazil between 1970 to 1986. However, this study observes that after 1986 the process of convergence slowed down to a halt. The same paper concludes that the states with similar structural features seem to fit a conditional converge to their specific steady state. On the other hand Cardenas and Ponton (1995) conclude that the longer view for the regions of Colombia during 1950 to 1990 is that they have converged at a rather high rate of 4% per annum.

Wei and Kim (2002) in a study of inter-county inequality in Jiangsu province of China conclude that for the period of 1950-95 neither β-convergence nor σ-convergence took place in these counties. Riskin (1988) observes that substantial disparities between Chinese provinces in the 1950s became much more serious with industrialisation and argues that the regional disparities in terms of rural poverty remained high through time.

Fedorov (2002) highlights the growing regional inequalities in Russia in the1990s and concludes that regional inequality during the transitional period in Russia has increased significantly. Vanderpnye-Orgle (2002) discusses the growing trends in spatial inequalities in Ghana during the period of stabilisation and structural adjustment programmes - late 1980s to late 1990s - and concludes that regional inequality increased during the first stages of reform period, followed by a short period of decline before resuming its increasing trend for the rest of the period to 1999.[3]

[3] The reader may be interested to note that Ghana is often quoted as the success story of reform programmes by the World Bank and IMF.

The Philippines Human Development Report 1997 (HDNUNDP) reports changes in the Human Development Index (HDI) across various provinces in the Philippines for 1990 to 1994 ranging from an increase of nearly 25% to a decrease of nearly 4%. The Human Development Report for Zimbabwe reports striking differences in the constituent indicators of human poverty index across its provinces ranging from 33% to just over 6% for illiteracy and from just above 28% to less than 1% for no access to clean water (UNDP et al.1998).

Hossain (2000) in a study of convergence amongst the regions of Bangladesh concludes that convergence of per capita output levels did take taken place between 1982-91 in Bangladesh. However, between 1991-97 there was no evidence of such convergence and furthermore a few regions were left behind this process for the full, or a part of the, sample period.

Regional disparities in India is probably the most discussed case in the literature of regional inequality within a country. A large number of studies conclude that inequality amongst the Indian states have worsened through time (see for example Dreze and Sen 1995, Datt 1998, Datt and Ravallion 1998 and Ravallion and Datt 2002). Studies which observe some evidence of convergence are rather limited and conditional. Dreze and Srinivasan (1996) find some evidence of convergence, though weak, in the average per capita expenditure levels amongst the regions in India and note that the head-count index of rural poverty between 1972-73 and 1987-88 in almost all regions of India had declined though to different extents. Kumar Das and Barua (1996) in a long term study observe that inequality amongst the Indian states have been rising in almost every sphere of economic acitivity. Nagaraj et al. (2000) find no evidence of *s-convergence* and note that regional inequality in India has been increasing over time. However, this study finds some evidence of conditional *b-convergence* across the states depending on their characteristics with the observation that such a convergence "does not rule out persistent income inequalities due to the dispersion of steady-state income levels." (p 45). Noorbakhsh (2003a and 2003b) note that some regional indicators provide little evidence of decreasing regional disparities in India. Chronic and multidimensional poverty in some states have remained

persistently high while some better-off as well as poor states succeeded in reducing this and closing the gap (Mehta and Shah 2003). The National Human Development Report 2001 for India (2002) remarks that the human development index and human poverty index show no decline in the extent of disparities amongst the states of India over the decade of 1980s.

In brief the evidence seems to suggest that the experience of developing countries appears to be inconsistent with that of the richer countries.

3. Regional Convergence in Iran

There seems to be large disparities amongst the provinces of Iran. As discussed above the two prevailing views in theoretical literature on growth advocate opposing outcomes for regional disparities over time. It would be of interest to see if the regions of Iran have moved towards convergence into a steady state over time as anticipated by one school or have diverged more as predicted by the other school.

We have selected two indicators for this study for which we have regional data available at an interval of a decade with rural/urban breakdowns. These are consumption expenditure per capita (CEPC) and income per capita (INPC) both available at regional level from household surveys for 1991 and 2001.[4] The choice of income indicator is mainly in line with the literature on convergence which is usually related to growth in income. The consumption indicator has been selected as a monetary measure of general welfare allowing for the inter-regional comparison of welfare.[5]

(i) b -convergence - We first test to see if b -convergence amongst the provinces of Iran has taken place by running the following growth regression derived from the neoclassical production function model (Barro and Sala-i-Martin1995, Martin and Sunley, 1998).

[4] Some provinces were excluded from the survey of 1991 as the data was not available. The household survey for 1991 indicates that it was not possible to infer from the sample for the province for these provinces. (See SCI 1991a for details)

[5] For a study of regional disparities with respect to non-monetary indicators see Noorbakhsh (2002). However, we also consider non-monetary indicators later in this paper.

$$(\frac{1}{T})\log(\frac{y_{it+T}}{y_{it}}) = a + b\ \log(y_{it}) + u_{it} \qquad (1)$$

where $y_{it} = \frac{Y_{it}}{\overline{Y}_t}$ is the ratio of the (income or consumption) variable in the i[th] province to the average for the sample of provinces under consideration. $(\frac{1}{T})\log(\frac{y_{it+T}}{y_{it}})$ is the annualised growth of the variable concerned in the i[th] province over the period of t and t+T. A value of b in the range of $-1\langle b\langle 0$ would be an evidence of b - convergence i.e. the nearer the value of b to –1 the higher the speed of convergence and the nearer to zero the lower the speed of convergence.[6] By implication zero means no convergence and a positive value for b indicates a divergence.

Table 1 shows the results for our indicators of CEPC and INPC for urban and rural data. The figures within brackets are the t-ratios.

Table 1. Growth regressions for consumption and production per capita.

Indicator growth	α	β	R^2	F
CEPC:				
Urban 1991 to 2001	-0.005 (-0.140)	-0.025 (-1.589)	0.39	2.53
Rural 1991 to 2001	-0.009 (-0.200)	-0.035 (-1.880)*	0.45	3.53*
INPC:				
Urban 1991 to 2001	-0.007 (-0.173)	-0.054 (-2.991)***	0.62	8.95***
Rural 1991 to 2001	-0.006 (-0.125)	-0.019 (-1.137)	0.30	1.29

*** Significant at the 1% level.
* Significant at the 10% level.

The results for CEPC show some signs of convergence. The signs are correct for urban data but the b coefficient is not significant. F-statistic is also not significant. However, the results for rural areas are slightly better as both b and F-statistics are significant but only at the 10% level. These results provide some limited support for the case of convergence.

[6] Chaterji (1992) and Chaterji and Dewhurst (1996) distinguish between weak convergence where $\beta<0$, and strong convergence where $-2<\beta<0$.

As for INPC the results for urban data firmly support the case of convergence as the b coefficient is significant at the 1% level with the correct sign. R^2 is relatively high and the F-statistic is significant at 1% level of significance. However, the speed of convergence is extremely slow as the magnitude of b is extremely slow. At this rate it would take a very long time for the convergence to complete its course.

(ii) s -convergence - This type of convergence postulates that cross-regional dispersion (inequalities) would tend to decrease over time. If the variance of the variable concerned is smaller than the same in the initial period then this type of convergence has taken place. That is $\sigma_{yt+T} < \sigma_{yt}$ indicates the existence of σ-convergence and vice versa.

We have selected three measures for investigating such a possible convergence: the coefficient of variation (CV) which is the ratio of the standard deviation to the mean of distribution, standard deviation of log (y_{it}) and also gini coefficient (GiniC) as a measure of dispersion amongst the provinces.[7]

Table 2 presents the results. The measures are computed for the years for which data is available in order to see the dynamic evolvement of both indicators over the decade.

[7] The GiniC coefficient has been computed as follows:

$$GiniC = \frac{2\mathrm{cov}(y, r_y)}{N\bar{y}}$$

where $\mathrm{cov}(y, r_y)$ is the covariance of indicator y and ranks of all provinces according to y and $\bar{y}$ is the mean of y (see Pyatt et al., 1980). It must be pointed out that this in fact is a measure of the concentration (dispersion) of indicator y, hence we called it GiniC in order to distinguish it with the population-weighted Gini coefficient which we will employ later in the paper.

Table 2. Measures of s -convergence for PCNSDP

Indicator	CV	SD$\log(y_{it})$	GiniC
CEPC			
Urban			
1991	0.2199	0.0891	0.1185
2001	0.2038	0.0852	0.1068
Rural			
1991	0.2516	0.1083	0.1413
2001	0.2388	0.0964	0.1263
INPC			
Urban			
1991	0.2306	0.0998	0.1289
2001	0.1801	0.0816	0.1022
Rural			
1991	0.2941	0.1270	0.1656
2001	0.2715	0.1282	0.1542

CV measure in Table 2 shows a tendency towards convergence for CEPC and INPC for both urban and rural areas; in all cases this measure shows a drop for 2001 as compared to 1991. The standard deviation of $\log(y_{it})$ shows a drop across with the exception of the income variable for the rural data where it increases for 2001 as compared to that of 1991. The GiniC measure as a measure of concentration shows a drop across. Overall the results strongly support the proposition that over the period of study s -convergence has taken place amongst the regions of Iran. Once again these results are general and it would be hard to make a conclusive remark about the speed of convergence.

4. Population-weighted measures of regional inequality

The measures considered so far were for investigating the possible occurrence of convergence as this particular strand of literature on inequality and convergence postulates. However, these measures assess the degree of concentration between the provinces without taking into account that the spread of population amongst the provinces varies. It may well be the case that the less developed provinces are more populated which makes the situation more critical and vice versa.

We have employed two measures of inequality, which take into account the population share of each province, for investigating the extent and dynamics of inequality amongst the provinces of Iran. These measures are the Lorenz-consistent Gini coefficient (GiniP) and the Generalized Entropy (GE) set of measures which are

also Lorenz-consistent (Cowell 1995, Shorroks 1980, 1984 and Fedorov 2002). The first one measuring inequality amongst the provinces can be presented as:

$$GiniP = \frac{1}{m}\sum_{i=1}^{R}\sum_{j=1}^{R} f(y_i) f\ (y_j)\left| y_i - y_j \right| \qquad (2)$$

where y_i is the value of the indicator in province i, $f(y_i)$ is the population share of province i in total population and m is the mean value for the indicator under consideration.

The GE measures given below are sensitive to various parts of the distribution depending on the selected value for c.

$$GE = \begin{cases} \sum_{i=1}^{R} f(y_i)\left[\left(\frac{y_i}{m}\right)^{c} - 1\right], & c \neq 0,1 \\ \sum_{i=1}^{R} f(y_i)\left(\frac{y_i}{m}\right)\log\left(\frac{y_i}{m}\right), & c = 1 \\ \sum_{i=1}^{R} f(y_i)\log\left(\frac{m}{y_i}\right), & c = 0 \end{cases} \qquad (3)$$

where all variables are as defined above. For c=0 we will have the mean logarithm deviation which is more sensitive to lower values of the index i.e. the bottom part of the distribution. For c=1 this measure (the Theil Entropy measure) is sensitive to all parts of the distribution and setting $c \neq 0,1$ makes the measure sensitive to the middle part of the distribution. Table 3 presents the results for these measures for the selected indicators.

Table 3. The population-weighted measures of inequality.

Indicator	GiniP	GE(c=0)	GE(c=1)	GE(c=2)
CEPC				
Urban				
1991	0.3399	0.0466	0.1988	0.4102
2001	0.3793	0.0548	0.2542	0.5369
Rural				
1991	0.3099	0.0120	0.0472	0.0954
2001	0.2670	0.0087	0.0380	0.0805
INPC				
Urban				
1991	0.2806	0.0469	0.1822	0.3715
2001	0.3653	0.0635	0.2686	0.5635
Rural				
1991	0.3102	0.0119	0.1005	0.2058
2001	0.3022	0.0097	0.0967	0.1947

GiniP, which is sensitive to all parts of the distribution, demonstrates a reverse situation for CEPC for urban areas. There is a considerable increase in GiniP coefficient for 2001 as compared to that of 1991. This indicates an increase in inequality in urban areas of different provinces. Similarly the results for the income indicator INPC show an increase in GiniP in urban areas and hence a higher inequality. However, the corresponding coefficients for rural areas show a drop in both cases of CEPC and INPC

The GE (c=0) measure, sensitive to the lower part of the distribution, shows a similar pattern. For both CEPC and INPC there are considerable increases in this measure for urban areas for 2001 as compared to that of 1991. However, this measure depicts a drop for the rural areas over the decade. GE (c=1) measure, sensitive to all parts of the distribution reveals a similar pattern: a considerable increase for urban areas and a decrease for rural areas. For GE measure with $c \neq 0, 1$, sensitive to the middle part of the distribution we used c=2. The results once again reveal the same pattern. It seems that when we take the population weights into consideration there has been a considerable increase in inequality amongst the urban areas of provinces though there has been a decrease in inequality amongst rural areas of provinces.

5. Regional Polarisation

The more recent literature on inequality distinguishes between inequality and polarisation in distribution. The latter reflects the dynamics of *clustering around extremes* in a distribution.[8] Polarisation in the context of regions may be described as a situation where there are groups of regions at the extremes of the distribution with high intra-group homogeneity but with a high inter-group heterogeneity. This reflects a different feature of the distribution than that of the inequality. Technically speaking, an equalising transfer of welfare, of the Pigou-Dalton type, from a region above the median of the distribution to a region below the median would reduce inequality and polarisation, provided that this transfer would not result in a region to move to the other side of the median. However, if such a transfer was from a region on one side of the median to another region on the same side then inequality would decrease but polarisation would increase (Wolfson 1997).

Esteban and Ray (1994) link the phenomena of polarisation in a society to the generation of tensions and social unrest and social conflict. In the context of regions the proposed *convergence* of regions may take place around local means at the extremes of the distribution as opposed to the global mean. That is regions will cluster around the highly developed and highly backward poles, the case of a clear division. Esteban and Ray (1994) propose an index for measuring polarisation based on two characteristics of the clusters: *identification* as measured by the population of each cluster and *alienation* as measured by the difference between the clusters. The idea is that the size of cluster carries weight in terms of identification and alienation.

We employ two of the more commonly used measures of polarisation in recent literature. First the Esteban and Ray index, which is the product of the functions of identification and alienation.

$$ER = A\sum_{i=1}^{R}\sum_{j=1}^{R} p_i^{1+a} p_j \left| y_i - y_j \right| \qquad (4)$$

[8] See for example Esteban and Ray (1994) and Wolfson (1994 and 1997) on the concept and measurement, Zhang and Kanbur, (2001) and Fedorov (2002) on the application of the recommended measures.

where A is a normalisation scalar, R the number of provinces, p_i and y_i are the population size and the value of the characteristic (indicator) for province i, respectively. The parameter a reflects the degree of polarisation whose range is between 0 and 1.6, where for $a = 0$ the ER index is equivalent to Gini coefficient as can be seen from comparing equations (2) and (4). The higher a the higher the weight attached to polarisation. We set $a = 1.5$ in order to give a high weight to polarisation.[9]

The second measure of polarisation we employ is the Wolfson index, which is based on the Lorenz curve and derived from the Gini coefficient. (Wolfson 1997). It can be written as:

$$W = 2(2T - Gini)/(m/m) \qquad (5)$$

where T=0.5-L(0.5) and L(0.5) indicates the share of the bottom half of regions of the index, Gini is the Gini coefficient of the distribution, m and m are the median and mean respectively.

Table 4 displays the measures of regional polarisation for both per capita consumption and income indicators.

Table 4. Measures of regional polarisation

Indicator	ER	Wolfson
CEPC		
Urban		
1991	0.0139	0.3767
2001	0.1635	0.5171
Rural		
1991	0.0240	0.0778
2001	0.0236	0.0717
INPC		
Urban		
1991	0.0095	0.1954
2001	0.1409	0.4803
Rural		
1991	0.0230	0.2491
2001	0.0227	0.2322

[9] This is the most common value employed in the empirical literature on polarisation, for example see Zhang and Kanbur (2001) and Fedorov (2002).

The results for CEPC indicate a substantial increase in polarisation for urban areas and a small decrease for rural areas. The ER measure for urban areas has increased more than ten fold over the decade signalling that there has been a high combination of increase in distance between the urban communities in various provinces and more concentration of these communities around the extreme poles of the distribution. In brief the relatively poor urban communities of different provinces may have become closer to each other (in terms of consumption) and the same may have happened to rich urban communities of different provinces. At the same time the distance between these two poles has increased. The Wolfson measure for urban areas for CEPC also shows a substantial increase for urban areas, once again indicating a considerable tendency towards the extreme poles of the distribution. The results for the consumption indicator for rural areas however, show some decline in polarisation over the decade.

The results for INPC depict equally considerable increases in polarisation. The ER measure for urban data has increased by nearly fifteen folds indicating a respective substantial increase in polarisation in income per capita over the decade. The picture is better for the rural areas. The Wolfson measure for urban data gives the same signal as it has increased considerably in 2001 as compared to 1991 while it shows a decrease in polarisation for rural areas.

6. Decomposition of Inequality and Dimensions of Polarisation

The ER and Wolfson measures indicate an increasing level of polarisation for urban areas. The interesting question is whether such an increase has occurred around a specific characteristic of the provinces. This query may be investigated in an indirect manner by finding out that if exogenously determined given clusters of regions have experienced low/high levels of within-group and between-group inequality. This may help us to have a meaningful interpretation of the dynamics of polarisation as well as more details about the sources of inequality.

For our purpose we employ the index suggested by Kanbur and Zhang (1999, 2001). This index (KZ) is derived from GE measure (equation 3) and is based on the

property of GE being additively decomposable.[10] The KZ index measures polarisation around an *a priori* determined dimension which may tell us more about the nature of the process. This fits well with the hypothesis of convergence which relates the reasons for convergence to *a priori* existing conditions in regions. However, it is very important to note that the dimensions of polarisation may be in reality much more complex than can be attributed to a single characteristic.

The KZ index is derived by first decomposing the GE measure of inequality into *within-group* and *between-group* inequality. For K exogenously given groups, as determined by an *a priori* dimension, the GE measure of inequality I for indicator y can be decomposed into additively within-group and between-group segments:

$$I(y) = \sum_{g=1}^{K} w_g I_g + I(m_1 e_1, \ldots, m_K e_K) \qquad \textbf{(6)}$$

$$w_g = \begin{cases} f_g \left(\frac{m_g}{m}\right)^c & c \neq 0,1 \\ f_g \left(\frac{m_g}{m}\right) & c = 1 \\ f_g & c = 0 \end{cases}$$

Where I_g is inequality in the g^{th} group, m_g is the mean of the g^{th} group, e_g is a vector of 1's of length n_g (where n_g is the population of the g^{th} group) and f_g is the population share of the g^{th} group.

The first term on the right had side of equation (6) gives the contributions of within-group inequality to total inequality while the second term is the contribution of between-group inequality to total inequality. The KZ index is the ratio of the first component to the second in equation (6); more formally:

$$KZ = \frac{between - group inequality}{within - group inequality} = \frac{I(m_1 e_1, \ldots, m_K e_K)}{\sum_{g=1}^{K} w_g I_g} \qquad (7)$$

[10] For this property and the relevant discussion and formalisation of the decomposition see Shorrocks (1980 and 1984).

A useful benchmark for this index is 1 where the contributions of both types of inequality to total inequality are the same.[11]

The KZ index does not distinguish between the groups and the decomposition of inequality is in terms within-group and between-group inequality. Depending on the procedure adopted for grouping and the underlying logic we may be interested to decompose equation (7) further in order to distinguish between the extent of inequality within each group. For example it may be the case that polarisation takes place in one group more than the other and indeed the members of one group may form a cluster far away from the other group even though the latter may not form a cluster. Equation (8) formalises this breakdown.

$$KZ_g = \frac{between-groupinequality}{within-each-groupinequality} = \frac{I(m_1 e_1,...,m_K e_K)}{w_g I_g} \quad \text{, g=1, 2, …, K} \qquad (8)$$

We have selected a number of dimensions such as literacy, education, health and urbanisation around which we may suspect that polarisation in urban areas of provinces of Iran may have taken place. These are: adult literacy (ADLIT), combined enrolment rate at all levels of education (CER), under five mortality rate (U5MR) and provinces with cities with a population of more than 0.5 million (CITY). It should be noted that these dimensions are purely suggestive and do not exhaust a possible list nor are they mutually exclusive. The data for these dimensions is for 1996 with the exception of CITY which is for 1991 when census took place and the source is PBOUNDP(1999).

For each of the selected dimensions we have categorised provinces into two groups: those with a value above the average for the sample and those below.[12] Equation (8), therefore produces two indices for the group higher than the sample mean (KZH) and the group lower (KZL). We selected GE (c=1) measure for decomposition as it is sensitive to all parts of the distribution.

[11] Fedorov (2002) proposes a modified version of KZ index which is the ratio of the between-group inequality to total inequality: $I(m_1 e_1,...,m_K e_K)/I(y)$.

[12] The reader may wish to note that this is a rather *soft* criteria for grouping as we expect a wider spread around the mean value therefore it would be reasonable to suggest that a higher degree of polarisation around the selected dimensions should be regarded as a more serious case.

Table 5 shows the results for these dimensions for CEPC indicator. Columns 2 and 3 show the percentages of within-group inequality attributable to the group above the mean (higher group hereafter) and the group below the mean (lower group hereafter). The next two columns show the percentages of within-group and between-group inequality. The KZ index is provided in the next column. It must be noted that the modified KZ index suggested by Fedorov (2002), as explained in footnote 11, is in effect the percentage contribution of between-group inequality to total inequality which appears under the column entitled 'Between'. In addition the last two columns in Table 5 show the KZ index for the higher (KZH) and lower (KZL) groups. The growth rates for the shares of inequality accounted for and the numbers of the members of each group are also provided.

Table 5. Hypothetical dimensions of polarisation and percentage group shares of inequality – CEPC

Dimensions	Higher group	Lower group	Within	Between	KZ index	KZH	KZL
ADLIT							
1991	60	6	66	34	0.52	0.57	5.67
2001	71	1	72	28	0.39	0.39	28.00
Growth (%)	18.33	-83.33	9.09	-17.65	-24.51	-30.41	394.12
Members	8	8					
CER							
1991	79	3	82	18	0.22	0.23	6.00
2001	88	1	89	11	0.12	0.13	11.00
Growth (%)	11.39	-66.67	8.54	-38.89	-43.70	-45.14	83.33
Members	8	8					
U5MR							
1991	58	5	63	37	0.59	0.64	7.40
2001	74	1	75	25	0.33	0.34	25.00
Growth (%)	27.59	-80.00	19.05	-32.43	-43.24	-47.04	237.84
Members	7	9					
CITY							
1991	79	8	87	13	0.15	0.16	1.63
2001	82	4	86	14	0.16	0.17	3.50
Growth (%)	3.80	-50.00	-1.15	7.69	8.94	3.75	115.38
Members	7	9					

Note: Percentage shares are presented in rounded figures while growth rates are computed before rounding.

As Table 5 shows around the dimension of adult literacy (ADLIT) in 1991, the higher group accounts for 60% of the total inequality while the lower group accounts for only 6% of the same. The total within-group share of inequality is, therefore, 66% with the between-group inequality accounting for 34% of the total. The KZ index is lower than 1 at 0.52 with the KZL being high at 5.67. In 2001 the share of inequality

within the higher group has increased to 71% coupled with a drop in the share of the lower group to 1%. Overall during the decade the within-group inequality increased coupled with a drop in between-group inequality. This resulted in a drop in KZ index but a nearly five fold increase in KZL index. In brief it means that over the decade there has been a decrease in between-group inequality, however, this has been coupled with an increase in inequality within the higher group and a decrease in the lower group. In terms of polarisation over the decade there has been a relatively small drop in polarisation in the higher group while there has been a strong move towards more polarisation in the lower group from a rather highly polarised initial position.

Around the dimension of CER in 1991 the lower group is again highly polarised and the inequality between this group and the higher group, relative to the inequality within this group is high. The KZL index shows this anomaly. In 2001 there has been a drop in polarisation due to a drop in between-group inequality combined with an increase in within-group inequality. However, there has been a reduction in percentage inequality in the lower group and the KZL measure shows a considerable increase in 2001 from a very large base value in 1991.

The dimension of U5MR shows an overall improvement in polarisation over the decade. However, this is mainly due to the increase of share of the higher group. The lower group again has been further polarised as demonstrated by the KZL value of 25 for 2001 showing a more than three fold increase as compared to that of 1991.

Polarisation with respect to both groups around the dimensions of large cities , CITY, is low in 1991 and remains low over the decade. However, once again this is due to a high level of diversity and inequality within the higher group. The lower group's share of overall inequality is low which means that the difference between two groups, in relative terms for the lower group is high in 1991 with an increase in 2001.

Overall the results in Table 5 give a picture of an initially high degree of polarisation with some limited decrease in polarisation after a decade with the situation being much more acute for the lower group. Considering that in the case of ADLIT and CER 8 out of 16 and in the case of U5MR and CITY 9 out of 16 provinces are in the

lower group the above results are particularly disturbing. It suggests that the *poorer* group is forming a cluster which is far away from the *richer* group.

Table 6 shows the results for these dimensions for INPC indicator. For the income per capita indicator more or less the same pattern is repeated with some exceptions.

Table 6. Hypothetical dimensions of polarisation and percentage group shares of inequality – INPC

Dimensions	Higher group	Lower group	Within	Between	KZ index	KZH	KZL
ADLIT							
1991	63	16	79	21	0.27	0.33	1.31
2001	71	5	76	24	0.32	0.34	4.80
Growth (%)	12.70	-68.75	-3.80	14.29	18.80	1.41	265.71
Members	8	8					
CER							
1991	95	2	97	3	0.03	0.03	1.50
2001	86	8	94	6	0.06	0.07	0.75
Growth (%)	-9.47	300.00	-3.09	100.00	106.38	120.93	-50.00
Members	8	8					
U5MR							
1991	56	6	62	38	0.61	0.69	6.33
2001	68	3	71	29	0.41	0.43	9.67
Growth (%)	23.64	-50.00	14.52	-23.68	-33.36	-38.27	52.63
Members	7	9					
CITY							
1991	59	10	69	31	0.45	0.53	3.10
2001	69	1	70	30	0.43	0.43	30.00
Growth (%)	16.95	-90.00	1.45	-3.23	-4.61	-17.25	867.74
Members	7	9					

Note: Percentage shares are presented in rounded figures while growth rates are computed before rounding.

As Table 6 shows for ADLIT over the decade there was an increase in between-group inequality resulting in a rise in KZ index. This increase combined with a decrease in the share of the lower group in the overall inequality resulted in a considerable increase in the KZL index.

Around the dimension of CER there is a small decrease and increase in within-group and between-group inequality over the decade respectively. All three indices have decreased and they are all below 1 indicating a clear all round drops in polarisation around this dimension for 2001.

The dimension of U5MR depicts a clear case of polarisation for the lower group again. There has been an improvement in the overall KZ index, however, the KZL index is more than 9 for 2001 from an initially high value of more than 6 for 1991 once again indicating that the between-group inequality relative to the within-group inequality in the lower group is high. That is the closely clustered lower group has a very long distance with the higher group to catch up. It is notable that the number of provinces in the lower group for this dimension is higher than that of the higher group.

The dimension of CITY reveals an initially high level of polarisation in 1991 for the lower group. As for 2001 there is a considerable decrease in the share of inequality associated with the lower group. This has resulted in the KZL index to increase by ten fold. Once again the high number of members in the lower group give cause for concern with respect to the distance of this group from the rest of provinces.

Overall the results for INPC indicator are in line with those for the CEPC indicator. They show a high level of inequality in the higher group with a low level of inequality within the lower group combined with a considerable inequality between the two groups which is relatively high for the lower group. In brief a closely clustered poor group is drifting further away from a higher but more unequal group.

7. Summary and Conclusion

This paper examined the extent of inequality amongst the provinces of Iran. A preliminary investigation showed that these are on the increase. A review of the concept of convergence and the dynamics of regional disparities resulted in the recognition of two possible but opposing outcomes. While convergence and conditional convergence seem to be the case for the regions within richer and middle-income countries, in the case of developing countries, the evidence is leaning towards divergence or is in some cases inconclusive. In the case of Iran it seems that the evidence is in support of convergence, albeit a weak convergence. However, when we bring in the size of the population affected by the prevailing inequality the picture changes for urban areas. Population weighted Gini and various Generalised Entropy indices showed considerable increases in inequality for both income and expenditure

indicators over the period of study. For rural areas these measures confirm a decrease in inequality.

Measures of polarisation indicated that there is little evidence of clustering around the extremes of distribution for rural areas, however, in the case of urban areas polarisation seems to have increased considerably over the decade from an initially high level. A decomposition of the GE measure of inequality for urban areas around four dimensions of adult literacy, combined enrolment ratio, under five mortality rate and the existence of large cities in the region revealed a more accurate picture of inequality. The within-group inequality in the higher (above average) group had increased while the same for the lower (below average) group had decreased. At the same time the distance between these two groups had increased considerably. Overall this indicates a close clustering of the lower group and its remarkable drifting away from the higher group. Considering that the number of provinces in the lower group were high (half or more in the case of some dimensions) this is a rather disturbing picture indicating that a large and close cluster of poor provinces are being left behind the rest of the regions: a cause for concern for the policy makers in Iran.

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