# A QUANTITATIVE ANALYSIS OF SOME ASPECTS OF THE URBANIZATION PROCESS IN EGYPT IN THE TWENTIETH CENTURY[1]

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Urbanization is a complex dynamic process involving structural change in the socio-economic system. This structural change moves the socio-economic system through different states of urbanism.

Theortically, a state of urbanism is generally thought of as a way of life characterized by a muthitude of factors ranging from the purely physical, such as the nature of transportation arteries, to the purely social, such as the degree of uniformity in cultural frames of reference (Wirth, 1938, and Said, 1960). Clearly, the measurement of such a complex phenomenon is not an easy task and can only be approximate.

The measurement of urbanism in Egypt has usually suffered from two basic shortcomings : An underlying conceptual framework of a ruralurban dichotomy and an operational definition based on the population size of he residential agglomeration (Hamdan, 1959, Said, 1960 and Abu-lughod, 1965).

The purpose of the present work is to characterize the urbanization process in Egypt in the twentieth century through the study of some indicators of urbanism available in the Egyptian censuses of 1907, 1917, ... 1947 and 1960 at the level of the residential agglomeration (a village, a town or a city). The conceptual framework underlying the

(1) This paper is a report on the first stage of a project undertaken by the Social Research Center of the American University in Cairo. Massive data collection and processing operations were required to arrive at the results included hererin. In this regard, the sincere efforts of Mrs. Mohga Badran and Miss Denise Batani, both of the Social Research Center, and Dr. Salah Hamid and Mr. Naguy Shehad, both of the Computer Center of the American University in Cairo, are gratefully acknowledged.

analysis is the rural urban continuum. The approximate measurement of urbanism is achieved through a system of indicators. The indicators used are : Population size of the residential agglomeration ($X_1$), proportion of illiterate males to all males ($X_2$), proportion of illiterate females to all females ($X_3$), and population density per km² ($X_4$). The relationships between each of these four indicators and the state of urbanism are well-known. No claim is made that these four indicators exhaustively characterize the state of urbanism, but they are the only appropriate indicators of urbanism available in all the censuses considered at the residential agglomeration level. A study of the structure and time trends of the four indicators is followed by the construction of an index of urbanism based on the four indicators with the objective of sketching profiles of urbanism for Egypt in the time period (1907-1960).

## 1. NATURE AND LIMITATIONS OF THE DATA :

The raw data of the present analysis consists of th evalue of each of the four indicators considered for every residential agglomeration included in each of the six Egyptian censuses taken in the twentieth century.

In addition to the general shortcomings of census data in Egypt (El-Badry, 1965), the time series nature of the data present additional difficulties due to differential under - or over-enumeration and differences in definitions and/or classification procedures in successive censuses. For example, it has been advanced that the 1947 census was subject to a high degree of over-enumeration reaching about 6% (El-Badry, 1955) while the expected enumeration error in de facto censuses taken in developing countries is in the opposite directions.

Illiteracy proportions derived from the 1917 census data are very low and those derived from the 1927 census data are very high compared to their values expected on the basis of the long-term trend observed in the period (1907-1960) (see tables I-c and I-d). We believe that both the 1917 and 1927 censuses suffer from definition and/or classification procedure errors with respect to illiterate individuals but, obviously, in opposite direction.

## 2. STRUCTURE and TIME TRENDS OF INDICATORS OF URBANISM FOR EGYPTIAN RESIDENTIAL AGGLOMERATIONS (1907-1960).

The average size of the Egyptian residential agglomeration, measured by the arithmetic mean, almost doubled in the time period (1907-1960) from 3079 in 1907 to 6130 in 1960. However, it must be noted

that the median size rose from 1988 to 3285 in 1960. The median size is smaller than the average size because of the skewed nature of the distribution of sizes (i.e., the concentration of residential agglomerations at small sizes). Further, the variability in sizes, as measured by the standard deviation, was more than four times as high in 1960 as it was in 1907. As the size of the smallest residential agglomeration remained almost stable throughout the entire period, this large increase in variability is most likely due to considerable increases in the population size of large residential agglomerations. This conclusion is supported by the fact that the median size, as well as the first and third quartiles of size, did not show an increase comparable to that observed in the mean size or the size of the largest residential agglomeration. While the first, second and third quartiles of size increased by 60-70% over the time interval considered, the size of the largest residential agglomeration increased five times.

The average proportion of illiterates in the Egyptian residential agglomeration declined over the time interval (1907-1960). However, the final values reached are still quite high, 46% for males and 65% for females. Also, as may be expected, the decline in the median proportion of illiterates was faster in the case of males than in the case of females. Further, while the first quartiles of the distributions of residential agglomeration according to the proportion illiterate were declining at a faster rate than the third quartiles, i.e. residential agglomerations became more spread out towards lower values, the differences in the rate of decline were larger for males than for females.

Due to increases in the average area of the Egyptian residential agglomeration, the average population density increased by about 80% only in the time period (1907-1960), compared to a 100% increase in the average size. Also, in contrast with the distribution of residential agglomerations according to population size, the distribution of residential agglomerations according to population density in skewed to the left, i.e. residential agglomerations are concentrated at larger densities.

Product moment correlation coefficients show the expected direction for the relationship among the four variables considered, population size, $X_1$, and density, $X_4$, are positively correlated, both are negatively correlated with the proportion of illiterate males, $X_2$, and the proportion of illiterate females, $X_3$, and the last two variables are again positively

correlated. Howevea, the strength of these relationships did vary from one census date to another. In 1907, the proportion of illiterate females was almost not correlated with any other variable. This is due to the fact that the proportion of illiterate females was constant at the value 1.0 for the overwhelming majority of residential agglomerations. The strength of the correlation between $X_2$ and $X_3$ increased over time, but the fact that it was only 0.56 in 1960 is another indication of female education lagging behind male education. The correlation between $X_1$ and $X_2$ has been gnerally decreasing - this is not the case for the correbetween $X_1$ and $X_3$ - which tends to indicate that male literacy is getting to be less a function of the size of the residential agglomeration. The very weak correlations between $X_1$ and both $X_2$ and $X_3$ in 1947 are probably due to the nature of the suspected over-enumeration of the 1947 census which is likely to have been limited to towns and cities in the form of addition of domestic servants thus inflating their sizes with a totally illiterate increment (El-Badry, 1955).

### 3. CONSTRUCTION OF AN INDEX OF URBANISM :

An index of urbanism that is a function of the four indicators considered was constructed using the technique of principal components (Morrison, 1965). Principal components are orthogonal linear combinations of a set of variables explaining successively smaller proportions of the variability of the original set of variables. The prinicpal components technique was considered ideal as an objective method of arriving at the coefficients of a linear index of urbanism. Coefficients of the first principal components, those explaining the largest proportion of variability in the original variables, and proportions of total variability accounted for by them are given in table III.

As may be expected, the coefficients of $X_2$ and $X_3$ in all first principal components are negative while those of $X_1$ and $X_4$ are positive. It should be clear that the importance of $X_1$ and $X_4$ in the system of four indicators used to approximately measure urbanism — as reflected by the magnitude of their coefficients — in the first principal components is declining over time.

The first principal component derived from the 1960 census data

$$Y = 2782\ X_1 \ — \ 6232\ X_2 \ — \ 6468\ X_3 \ + \ 3403\ X_4$$

was chosen as a basis for an index of urbanism reflecting the most recent structure of the system of indicators used. However, the index

Y admits negative values. It seemed preferrable to have a positive range for the index of urbanizm and this was accomplished by adding a constant equal to 12700 to Y, thus arriving at the index.

$$U = Y + 12700$$

The constant 12700 is thought of as an absolute minimum of Y that would characterize a residential agglomeration of two illiterate adults, a male and a female, living on a large area of land (i.e., X. small).

The characteristics of profiles of urbanizm based on the index U are presented in Table IV and the profiles for 1907, 1937 and 1960 in graph I. The graph does not show the indices corresponding to the two primates, Cairo and Alexandria and large cities. However, the index of urbanism for Cairo is that included in table IV as the Maximum.

Unfortunately, the difficulties of the data on illiterate population in the censuses of 1917 and 1927 mar the corresponding profiles of urbanism to a great extent. Accordingly, the value of these profiles as components of the profile trend over time is doubtful.

Now, we may ask whether the index U is worth the trouble of its construction. Specifically, does the index U add any information over what can be gleaned from the size of the residential agglomeration alone ? The answer is in the affirmative. Further, the index U adds increasingly more information as the size of the residential agglomeration decreases. To arrive to these conclusions it is sufficient to observe that the minimum of the index U increased to be more than sixty times its initial value over the interval (1907-1960) while the minimum population size declined over the time interval considered. The first quartile of U increased more than seven folds, the median almost six times and the third quartile about five times, while the corresponding measures of size did not increase by more than 65%. Undoubtedly, a micro-level comparison between U and size would reveal a richer picture for the difference between the two indicators of urbanism.

The profiles of urbanism arrived at support the concept of a «rural-urban» continuum rather than the concept of a dichotomy. No natural cutoff points between sizeable subgroups of residential agglomerations are discernable on the U axis.

However, an obvious distinction exists between the vast majority of residential agglomerations and a small subset with the largest U values. This subset probably consists of the large cities. Excluding the 1927 and 1937 profiles, the 95 th percentiles of U are not much different from third quartiles * and do not exceed 2% of the maximum value of U. It must be noted though that the relatively large population sizes of these cities dominates their values of the index U.

Finally, the shifting nature of the profiles render absurd the notion of establishing a fixed criterion for a rural-urban dichotomy that is constant for all times even if one such criterion is somehow established.

In conclusion, we believe that the construction of an index of urbanism that is a function of a set of relevant indicators in the framework of «rural-urban» continuum is more acceptable on theoretical grounds, and yields more information about the phenomenon studied, than the reduction of the problem of measurement of urbanism to the determination of a fixed cut-off point on the axis of the size of residential agglomeration.

TABLE I.

Structure and Time Trends of Indicators of Urbanism for Egyptian Residential Agglomerations (1907-1960)

a) Number of Residential Agglomerations

| C ensus Year | No. of Residential Agglomerations |
|---|---|
| 1907 | 3611 |
| 1917 | 3409 |
| 1927 | 3434 |
| 1937 | 3729 |
| 1947 | 3812 |
| 1960 | 4188 |

* The 95th percentiles are, for all profiles, 2700, 5500, 4100, 6600, 8300 and 9700.

b) Population Size : $X_1$

| Census Year | Arithmetic mean | Standard Deviation | Minimum | 1st. Quartile | Median | 3rd. Quartile | Maximum |
|---|---|---|---|---|---|---|---|
| 1907 | 3079 | 12566 | 47 | 1125 | 1988 | 3522 | 654476 |
| 1917 | 3787 | 16270 | 36 | 1308 | 2324 | 4074 | 790939 |
| 1927 | 4095 | 21095 | 49 | 1375 | 2461 | 4342 | 1064567 |
| 1937 | 4129 | 22499 | 47 | 1442 | 2508 | 4418 | 1312096 |
| 1947 | 5149 | 37950 | 40 | 1524 | 2715 | 4754 | 2090645 |
| 1960 | 6130 | 57727 | 24 | 1853 | 3285 | 5495 | 3348779 |

c) Proportion Illiterate, Males : $X_2$

| Census Year | Arithmetic Mean | Standard Deviation | Minimum | 1st. Quartile | Median | 3rd. Quartile | Maximum |
|---|---|---|---|---|---|---|---|
| 1907 | .929 | .056 | .080 | .914 | .939 | .959 | 1.000 |
| 1917 | .772 | .061 | .059 | .747 | .778 | .809 | .974 |
| 1927 | .853 | .075 | .104 | .813 | .863 | .905 | 1.000 |
| 1937 | .687 | .101 | .080 | .633 | .703 | .758 | .994 |
| 1947 | .627 | .125 | .055 | .545 | .633 | .715 | .939 |
| 1960 | .457 | .115 | .047 | .381 | .468 | .540 | .946 |

d) Proportion Illiterate, Females : $X_3$

| Census Year | Arithmetic Mean | Standard Deviation | Minimum | 1st. Quartile | Median | 3rd. Quartile | Maximum |
|---|---|---|---|---|---|---|---|
| 1907 | .996 | .037 | .010 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1917 | .847 | .051 | .008 | ,837 | .853 | .868 | 1.000 |
| 1927 | .988 | .037 | 0.000 | .988 | .994 | .998 | 1.000 |
| 1937 | .809 | .065 | .022 | .791 | .818 | ,841 | .986 |
| 1947 | .766 | .100 | 0.000 | .728 | .782 | .828 | 1.000 |
| 1960 | .649 | .074 | .039 | .625 | .664 | .292 | .985 |

e) Population Density Per $Km^2$ : $X_4$

| Census Year | Artihmetic Mean | Standard Deviation | Minimum | 1st. Quartile | Median | 3rd. Quartile | Maximium |
|---|---|---|---|---|---|---|---|
| 1907 | 456 | 523 | 1 | 252 | 380 | 550 | 16487 |
| 1917 | 510 | 568 | 2 | 295 | 430 | 610 | 18714 |
| 1927 | 555 | 842 | 1 | 312 | 452 | 639 | 26921 |
| 1937 | 655 | 1876 | 2 | 338 | 500 | 717 | 84420 |
| 1947 | 773 | 1878 | 1 | 467 | 539 | 763 | 74263 |
| 1960 | 826 | 1473 | 3 | 443 | 647 | 904 | 59877 |

Table II

Product Moment Correlations

| | 1907 | | | | 1971 | | | |
|---|---|---|---|---|---|---|---|---|
| | X | $X_2$ | $X^3$ | $X_4$ | $X_1$ | $X_2$ | $X_3$ | $X_4$ |
| X | 1.000 | | | | 1.000 | | | |
| X | —.119 | 1.000 | | | —.150 | 1.000 | | |
| $X_3$ | —.080 | .081 | 1.000 | | —.104 | .319 | 1.000 | |
| $X_4$ | .257 | —.107 | —.041 | 1.000 | .276 | —.241 | —.110 | 1.000 |
| | | | 1927 | | | | 1937 | |
| $X_1$ | 1.000 | | | | 1.000 | | | |
| X | —.124 | 1.000 | | | —.085 | 1.000 | | |
| X | —.164 | .229 | 1.000 | | —.078 | .530 | 1.000 | |
| $X_4$ | .262 | —.242 | —.182 | 1.000 | .121 | —.115 | —.088 | 1.000 |
| | | | 1947 | | | | 1960 | |
| $X_1$ | 1.000 | | | | 1.000 | | | |
| $X_2$ | —.007 | 1.000 | | | —.063 | 1.000 | | |
| $X_3$ | —.027 | .679 | 1.000 | | —.103 | .563 | 1.000 | |
| $X_4$ | .099 | —.106 | —.097 | 1.000 | .235 | —.101 | —.153 | 1.000 |

TABLE III

Coefficient of

First Principal Components*

and Proportion of Variability Accounted for

| Census Year | Coefficients $a_1$ | $a_2$ | $a_3$ | $a_4$ | Proportion |
|---|---|---|---|---|---|
| 1907 | .6150 | —.4348 | —.2959 | .5879 | .342 |
| 1917 | .4526 | —.5609 | —.4661 | .5130 | .402 |
| 1927 | .4701 | —.4979 | —.4812 | .5474 | .401 |
| 1937 | .2337 | —.6641 | —.6562 | .2713 | .400 |
| 1947 | .0621 | —.6908 | —.6903 | .2060 | .428 |
| 1960 | .2782 | —.6232 | —.6468 | .3403 | .417 |

* The variables used in the analysis were $X_1$, 10000 $X_2$, 10000 $X_3$ and $X_4$

Graph I

Profiles of Urbanism, Egypt,

1907, 1937 and 1960

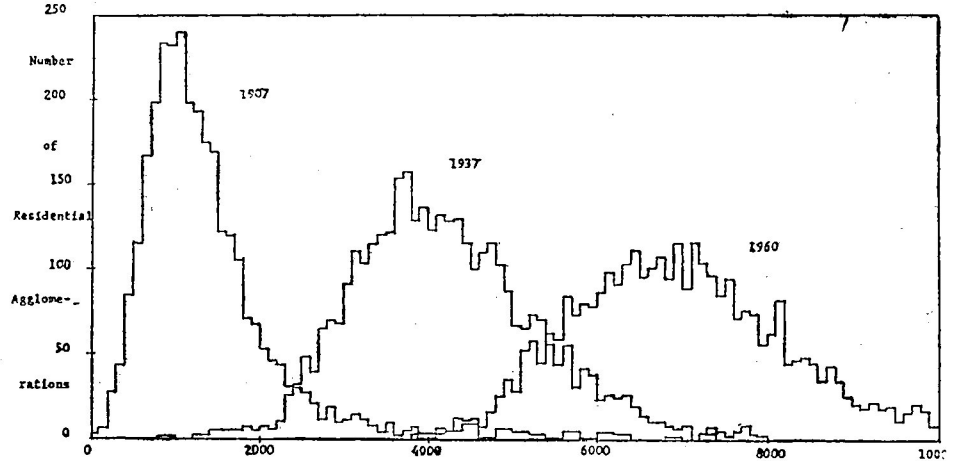

Table IV.
Characteristics of Urbanism Profiles
(1907—1960)

| Census Year | Minimum | 1st. Quartile | Median | 3rd. Quartile | Maximum |
|---|---|---|---|---|---|
| 1907 | 50 | 849 | 1120 | 1643 | 185,650 |
| 1917 | 1077 | 2770 | 324 | 3853 | 226,380 |
| 1927 | 39 | 1399 | 1908 | 2515 | 302,333 |
| 1937 | 902 | 3475 | 4143 | 4944 | 374,200 |
| 1947 | 1222 | 3965 | 4931 | 5956 | 583,783 |
| 1960 | 3153 | 6109 | 6966 | 7927 | 945,482 |

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