DEMOGRAPHIC CORRELATES OF URBAN DEVELOPMENT

James Stafford

Lakehead University, Thunder Bay, Ontario, Canada

Résumé — Cet exposé étudie la relation des variables économiques et démographiques du système urbain au Canada de 1951 à 1971. La méthodologie utilisée consiste en une analyse de correlation des variables sélectionnées parmi les 46 plus grands centres urbains et métropolitains comme unité d'analyse. Les résultats indiquent un manque d'association entre les variables économiques et démographiques. Le niveau de salaire et la valeur moyenne ajoutée ne sont pas associés avec la fécondité, la mortalité ou la structure d'âge. Le pourcentage des travailleurs embauchés dans les industries manufacturières n'est pas associé avec les variables démographiques. La seule relation utile et compatible semble être celle du taux global de fécondité et l'indice Gini.

Abstract — This paper investigates the association of economic and demographic variables in the Canadian urban system from 1951 to 1971. The methodology involves a correlation analysis of selected variables with the 46 largest urban areas and Metropolitan Areas as units of analysis. The results indicate a lack of association between demographic and economic variables. Wage level and average value added are not associated with fertility, mortality, or age structure. The percentage of the labour force engaged in manufacturing industries is not associated with demographic variables. The only fruitful and consistent association appears to be that of the General Fertility Rate and the Gini Index.

Key Words — **age structure, fertility, mortality, industrial structure**

Canadian cities have played a major role in the economic history of Canada. They grew from trans-shipment points and trading nodes, when the economy was based on the export of furs, fish, and timber, to a more complex system wherein certain cities along the St. Lawrence River dealt in trade and commerce for the nation while those in the rest of the country acted as central places for the scattered rural and town populations.

After the rapid urbanization of the 1950's, an organic structure evolved in which the economies of cities began playing specialized regional roles within the total urban system. Montreal, Toronto, and Vancouver became cosmopolitan hubs of commerce and industry. Maritime cities which had flourished in earlier times, became slow growth, central places in a region that stagnated because of tenuous primary industries. Cities in the south of Ontario and Quebec prospered as part of a manufacturing heartland while those in the north boomed briefly as they specialized in extractive industries. Prairie cities continued their roles as agricultural central places.

One would presume that a unique demographic character would be associated with the distinctive functions of these cities. A justification for demographic analysis is that demographic trends influence and are influenced by changing social and economic conditions.

The topic investigated in this paper is the association of economic and demographic variables in Canadian cities. Does a decline in a city's fertility rate precipitate higher family income or does it result in slower population growth which may discourage capital investment in that area? What demographic features do the fastest growing Canadian

cities have in common and how do they differ demographically from those with slower growth?

Much has been written about the relationships among various economic and demographic variables at the national level (Coale and Hoover, 1958; Morss and Reed, 1972; Spengler, 1975; King, 1974). One of the reasons for the slow economic progress of an underdeveloped country is said to be the high fertility rate and the large proportion of the population that is too young to contribute to the economic welfare of the country. The resulting age structure with its broad base results in an increasing population which reduces the rate of savings and investment in the economy. Instead income is spent on food, clothing, housing and education, reducing the amount available for capital investment.

There is not the same degree of consensus regarding the effects of demographic factors on economic growth in developed countries where the population base is narrower. It is generally agreed that a base that is too narrow does not stimulate investment and expansion of capital, but there is no consensus as to the optimum proportion of young people necessary to guarantee a healthy growing labour force without absorbing too much profit in maintaining the dependent population. A growing population provides a stimulus for aggregate demand, and ensures the addition of a younger, more vigorous, more flexible work force that can more readily adapt to new industries and to changes in the old ones. An expanding population will also propagate the psychological component of economic development. It provides a climate of optimism among investors who are confident of future economies of scale and increasing demand.

A slimmer base results by definition in a proportionately larger labour force. The association between age structure and per capita productivity is such that a narrow population base allows greater per capita productivity because of the lower dependency ratio, *ceteris paribus*. However, the *ceteris paribus* looms large. A slimmer base over a long period of time will result in a lower proportion of young workers in the labour force. The argument has been made that productivity is higher among young, vigorous workers than among older, conservative workers.

A further consideration concerns the work organization and milieu in a work force made up largely of older workers. Spengler suggests that a stationary population with its narrow base may result in too much power among the elderly whose time horizon and propensity to take risks may be less than that of younger workers (Spengler, 1975:13).

Another argument which favours an expanding labour force is made by Keyfitz (1973) who points out that vertical mobility is reduced in a stationary population. A broader population base causes an expanding labour force which in turn generates a larger number of higher order jobs. Many more opportunities for occupational advancement are created by this general expansion. Absence of expansion resulting in reduced opportunities for advancement may dampen enthusiasm and reduce the vigour of the younger workers, whose numbers are already reduced by the demographic restrictions and whose motivation may already be dampened by the milieu created by the predominantly older, conservative work force.

A final factor which may subtract from the economic advantages of a narrow demographic base is the age-specific salary scale of the labour force. Older workers receive considerably more income with the result that per capita salary expenditure in a labour force of a given size would be higher in a population with a narrower base. In addition to this direct effect of age distribution on average wage, Spengler argues that age-specific wage levels will tend to be higher in a stationary population (1975:8). The reason for this is

that there will be pressure on wages to be higher in order to attract workers from one industry to another. Proportionately fewer workers will enter the labour force at a given time, so industries that are expanding rapidly must offer higher wages in order to attract persons who are already in the labour force. Such industries have the additional problem of overcoming the inertia propagated by the conservatism of the older work force.

These concerns imply a complex relationship among various population and economic dynamics in developed countries with their limited range of fertility rates. A number of intervening and situational factors must be considered when we evaluate economic and demographic interaction. One important situational consideration from the researcher's point of view is the unit of analysis that is used when relationships among these variables are being gauged. Demographic-economic associations which exist at the international level may not hold at the regional level, or may be reversed when census tracts are taken as the unit of analysis.

Two studies indicate that when developed and underdeveloped countries are used as the unit of analysis, the relationship between demographic and economic attributes conformed to expectations. (Stockwell, 1974; Stockwell and Hutchinson, 1975). The underdeveloped countries experienced higher vital rates, more rapid population growth, and lower proportions of the population in working ages.

Studies which take regions within a country as the units of analysis tend to reflect similar relationships (Stockwell, 1966; Beegle, 1966; Ray, 1971; Sly and Chi, 1972). The crucial dimension in regional studies is often the rural-urban dimension. The *more developed* regions are often urban areas or urban-dominated regions while the *less developed* regions tend to lack urban nodes. Thus Kruegel (1971) and Beegle (1966) found that regional fertility patterns could be predicted on the basis of distance from a metropolitan area.

D. Michal Ray (1969) factor analyzed 76 socio-economic variables and spatial locators for each of the census counties in Canada. The largest number of economic and demographic variables loaded on the *urban-rural contrasts* factor, indicating that this dimension encompasses most of the economic and demographic variation in Canada.

Purpose

The purpose of this study is to investigate the conformity of economic-demographic correlates within an urban system with those in a regional or international context. Such correlates using urban areas as the units of analysis are of concern for a number of reasons. First , urbanization trends of the recent past have left the developed countries with the bulk of their populations living in or near cities. At the same time the dominant economic functions are occurring in urban areas. Thus any predictions of either an economic or a demographic nature requires a considerable knowledge of the way the economic and demographic variables interact within the urban context.

A second reason for examining economic and demographic correlations using cities as units of analysis is that the standard associations as derived from international and regional studies may not obtain in the urban context. Ray's (1969:16) comprehensive study revealed that demographic and economic variables loaded on a rural-urban factor rather than on a metropolitan factor. The inference from his study is that demographic and economic associations obtain when comparing urban and rural areas but do not obtain when comparing urban areas. Two other studies in Canada verify the tenuous association between demographic and economic characteristic when the units of analysis are urban areas in Canada. Hodge (1965) analyzed economic, demographic, and sociological variables pertaining to all but the four largest incorporated areas in Saskatchewan. The only

69

demographic correlate of economic potential was urban size. The age structure was independent of this dimension. Similar results were obtained when the Alberta urban system was investigated (Stafford, 1975).

Methodology

The methodology involves a longitudinal study of 46 large urban areas in Canada using census data in 1951, 1961, and 1971. Various indicators of demographic and economic variables are investigated for association, using Pearson product-moment correlation coefficients in an attempt to establish which demographic variables are associated with selected economic variables in the Canadian urban system over the 20-year period.

The units of analysis in the study are the 46 urban areas, or groups of contiguous urban areas, and Metropolitan Areas which had populations in excess of 25,000 in 1961. The one exception is Corner Brook which met this requirement in 1961, but which did not exist as a city in 1951. The 46 cities were selected because a considerable amount of data were available for them as a result of work done by Hartwick and Crowley (1972).

The focus of the study is on the interplay of demographic and economic forces within a Canadian city over time. There is no concern with sampling from a population of cities or with generalizing to cities of other countries.

The problem which is extremely difficult to overcome in this type of study is to obtain indicators which are valid measures of the variables associated with each city. Urban data are a function of the administrative boundaries of the urban area and these boundaries may change independently of the real changes in the location of the population associated with that urban area. The administrative boundaries of most cities coincide fairly closely with the boundaries of the geographical, areal distribution of the population, but occasionally they do not. Even when the administrative and real boundaries coincide closely, we know that the epistemic correlations are not perfect thanks to the rich store of empirical evidence accumulated by urban ecologists which reveals that social, demographic and economic traits of a city's inhabitants are not distributed evenly throughout the city.

Given the one central problem of this study, which is to investigate the association of economic and demographic variables over a period of time using individual cities as the units of analysis, we are faced with the insurmountable problem of adjusting the data in 1951 and 1961 to coincide with the area of each city in 1971, which is the conventional approach in this type of study. This is impossible because such data are not available except population size, which has been adjusted in this study. The weakness in this conventional method is that the 1971 boundaries do not contain the population associated solely with the city in 1951, 1961 and even 1971. It is possible that the administrative boundary of the urban population in 1971 underbounds the true urban population while overbounding the true urban populations in 1951 and 1961. Overbounding is usually not serious because the non-urban population is not numerous, and would not significantly bias the indicators, but severe underbounding, on the other hand, can result in considerable bias because the population outside the administrative boundaries is not homogeneous with the population that is being recorded.

An additional bias is introduced when these cities are compared at different points in time. An attempt to measure the association of variables in 1951 when the area is overbounded, with variables in 1971 when the area may be underbounded, introduces a greater bias than the alternative of using data based on administrative boundaries in both 1951 and 1971 when both represent a slight underbounding of the true urban populations. This is not to suggest that the use of administrative boundaries to define the

urban population is better than other methods, but only that other methods also have their defects.

The most appropriate boundaries for defining populations of cities are Metropolitan Area boundaries, but these are only available for CMA's and CA's. In those cases in which a city grew large enough to be classified as a Metropolitan Area, we were faced with the alternatives of retaining the city as the unit of analysis throughout the period or of switching to the Metropolitan Area as the unit of analysis as the data became available. Converting the unit of analysis is not appropriate in a longitudinal study, so urban data were used in all cases except those in which Metropolitan Area data were available in 1951.

The statistical model used to investigate the possible associations among the various demographic and economic variables was correlation analysis using Pearson product-moment correlation coefficients. The demographic variables were measures of population size, age distribution, mortality and fertility in 1951, 1961, and 1971, as well as measures of residual change in these variables from 1951 to 1961 and from 1961 to 1971. Economic variables were selected to tap economic welfare, industrial structure and specialization, and agglomeration. With the exception of population size, all of the economic variables consisted of values in 1951, 1961, and the residual change from 1951 to 1961. Analysis of data over time allows us to examine associations that might not be apparent if we were confined to contemporaneous variables. Differences in the strengths of these relationships over time might suggest a causal relationship between economic and demographic characteristics of cities.

The measures of rates of economic and demographic change from 1951 to 1961 and from 1961 to 1971 represent an alternative method of determining whether economic change influences demographic characteristics. The measurement of change is particularly difficult because the abstraction is two-fold: we first develop concepts of the state of our environment at two points in time, and then we compare the two sense impressions and simultaneously consider the length of time between formation of these impressions (Coleman, 1968:429). Three major problems confronted by the analyst attempting to measure change are regression effects, ceiling effects and zero-boundary effects. Regression effects are the not uncommon phenomena of scores of individual cases regressing towards the mean upon second measurement. However, even when all scores improve, a ceiling effect often obtains whereby lower scores progress further than higher scores which appear to be impeded by a real or imaginary ceiling. Students who wish to raise their mark from 80 per cent to 90 per cent experience the ceiling effect while students raising their mark from 40 per cent to 50 per cent do not. The zero-boundary effect obtains when higher scores tend to decline further than lower scores. Percentage, or relative, change is subject to all three problems and is consequently not a useful way of measuring change in cities of varying sizes. An alternate measure of change, deviational change, involves regressing values of later measures on those of the initial measurement. The resulting regression equation $\hat{Y} = a + bX$, provides expected values of the variable at the second time of measurement given its values at the time of the first measurement and given the overall pattern of change of all cases. Deviational change is the difference between the observed score A and the expected score Y. It is considered by Rummel (1970:239) to be the only measure which surmounts all the problems of change measurement.

The demographic variables were correlated with three measures of each indicator of economic status — 1951 values, 1961 values, and residual change values from 1951 to 1961. One indicator of economic status is population size. Presumably as a city grows eco-

71

nomically, it attracts immigrants and grows numerically. Thus its population size is an indication of how it has fared economically — cities grow larger rather than richer. One risk in using this measure is that of confusing growth and welfare criteria. In large cities there is some evidence that expanding populations bring about a decline in welfare because of diseconomies of scale associated with pollution, housing shortages, social overhead capital, and welfare services (Richardson, 1971:80).

An alternate indicator of economic performance is level of wages, which makes up about two-thirds of all earned income (Samuelson, 1955:186). Wages are supposed to reflect real income although we cannot be sure they do because they are a function of the cost of living, range of choice of consumer goods, range of choice in occupations, and productivity of the public sector of the economy (Thompson, 1968:62). Variations in the rates at which females entered the labour force weakened this measure as an indicator of economic change from 1951 to 1961, with the result that only male wages were considered in this analysis.

A third indicator of economic performance is average value added, which is calculated by deducting costs of materials, fuels, and electricity consumed from the gross value of the products, and dividing by the number of establishments. Such data by urban area and Metropolitan area are available only for manufacturing industries, but were retained in this analysis because of the crucial role played by manufacturing industries in the growth of regions. Average value added reflects the size of establishments which is an indicator of economies of scale and size of export base. It captures some of the value added in non-manufacturing industries if we are willing to assume spill-over effects from one industry to the next.

A fourth indicator of economic performance is a measure of economic specialization. Specialization supposedly allows more exports which provide economic returns to the community. A number of methods have been developed to measure the degree of concentration/distribution of industries, each of which has many detractors. One measure which has suffered the fewest criticisms, perhaps because it makes the humblest claims, is the Gini index. It simply reflects the difference between the distribution of a city's labour force in various industries compared with that of a hypothetical city with equal proportions of its labour force in all industries. The resulting coefficients are comparable in that a city with a higher Gini coefficient has a larger proportion of its labour force in a few industries than does a city with a smaller Gini index. The values used in this study were calculated in Hartwick and Crowley (1972).

The final indicators of economic performance also reflect the structure of the labour force. Sector theories of development hold that a region or city will develop as its labour force flows from primary to secondary industries and from secondary to tertiary industries. The two indicators of economic performance are thus taken to be percentage of the labour force in manufacturing industries, and percentage of the labour force in service industries.

Results

Before investigating relationships between various economic and demographic variables, a brief perusal of associations among the demographic variables is in order. The high intercorrelations between different indicators of age structure are predictable and need no elaboration here. The associations of fertility, mortality and age structure are not so predictable and deserve some attention.

Table 1 reveals that residual change in the standardized mortality rate is not consist-

TABLE 1   CORRELATION COEFFICIENTS OF VARIOUS DEMOGRAPHIC
INDICATORS IN 46 CANADIAN CITIES, 1951-1971

		GFR					SMR				
		1951	61	71	51-61	61-71	1951	61	71	51-61	61-71
1951	YDR	.85	.31	-.10	-.09	-.37	.65	.62	.71	.19	.37
1961	YDR	.75	.47	.03	.14	-.34	.38	.36	.43	.11	.39
1971	YDR	.28	.69	.57	.63	.19	.01	.32	.06	.48	-.12
51-61	YDR	.10	.38	.18	.38	-.06	-.27	-.27	-.15	-.10	.15
61-71	YDR	-.15	.52	.66	.66	.43	-.23	.15	-.19	.50	-.39
1951	OADR	-.62	-.26	.09	.03	.32	-.57	-.53	-.56	-.14	-.31
1961	OADR	-.53	-.28	.10	-.04	.35	-.48	-.46	-.44	-.15	-.21
1971	OADR	-.41	-.24	.09	-.06	.30	-.35	-.35	-.30	-.12	-.14
51-61	OADE	.16	-.11	-.05	-.20	.15	.17	.10	.23	-.04	.23
61-71	OADR	.33	.08	-.04	-.08	-.12	.37	.33	.39	.07	.21
1951	DR	.71	.24	-.07	-.10	-.28	.48	.47	-.52	.16	.28
1961	DR	.29	.23	.13	.11	-.01	-.07	-.08	-.03	-.04	.21
1971	DR	-.21	.34	.60	.49	.50	-.38	-.10	-.29	.29	-.27
51-61	DR	-.20	.10	.23	.22	.21	-.48	-.48	-.35	-.18	-.04
61-71	DR	-.49	.25	.66	.54	.64	-.43	-.06	-.36	.40	-.50
1951	AG IND	-.68	-.32	.05	-.02	.32	-.59	-.58	-.58	-.21	-.29
1961	AG IND	-.54	-.34	.04	-.10	.32	-.44	-.44	-.41	-.17	-.21
1971	AG IND	-.37	-.32	-.05	-.17	.19	-.29	-.34	-.25	-.19	-.07
51-61	AG IND	.24	-.09	-.01	-.23	.06	.29	.26	.32	.07	.19
61-71	AG IND	.43	-.02	-.29	-.25	-.35	.41	.25	.42	-.09	.37

	GFR				
SMR	1951	61	71	51-61	61-71
1951	.63	.02	-.22	-.30	-.29
1961	.57	.29	.08	.03	-.12
1971	.66	.00	-.22	-.27	-.27
51-61	.15	.42	.38	.40	.16
61-71	.42	-.06	-.16	-.29	-.16

GFR   General Fertility Rate

SMR   Standardized Mortality Rate

YDR   Youth Dependency Ratio

OADR   Old Age Dependency Ratio

DR   Dependency Ratio

AG IND   Aging Index

ently associated with any of the other demographic indicators. However, static measures of SMR are associated with static measures of age structure, although the trend indicates that this relationship is weakening. The correlation coefficient of SMR and YDR declined from 0.65 in 1951 to 0.06 in 1971; the correlation coefficients of SMR and each of the other indicators of age structure weaken over that 20 year period. The 1951 measures of age structure invariably have correlation coefficients of greater absolute magnitude than 0.40 with SMR regardless of which year the standardized mortality rate is recorded. This implies that mortality rates have not fluctuated to the extent that indicators of age structure have, and is borne out by the fact that the stability coefficients of SMR were

	1951	1961
1961	0.76	
1971	0.84	0.76

while the stability coefficients of, for example, the dependency ratio were

73

TABLE 2 (CONTINUED)

		Gini Index			Population				
		1951	1961	51-66	1951	1961	1971	51-61	61-71
1951	YDR[a]	.49*	.45*	.01	-.27	-.28	-.29	-.17	-.16
1961	YDR	.56*	.50*	-.04	-.38	-.38	-.38	.06	-.06
1971	YDR	.32	.35	.15	-.19	-.17	-.17	.19	.11
51-61	YDR	.28	.23	-.08	-.29	-.26	-.25	.38	.13
61-71	YDR	.02	.10	.20	.02	.03	.04	.18	.16
1951	OADR[a]	-.40*	-.30	.17	.04	.04	.05	.04	.07
1961	OADR	-.23	-.15	.16	-.04	-.04	-.04	-.08	-.02
1971	OADR	-.10	-.03	.15	-.10	-.11	-.11	-.16	-.10
51-61	OADR	.41*	.39	.03	-.22	-.24	-.25	-.36	-.25
61-71	OADR	.43*	.38	-.04	-.22	-.24	-.26	-.27	-.31
1951	DR[a]	.38	.40*	.11	-.32	-.33	-.34	-.19	-.15
1961	DR	.38	.40*	.13	-.46*	-.46*	-.47*	-.01	-.08
1971	DR	.17	.27	.30	-.27	-.27	-.27	-.01	-.02
51-61	DR	.18	.19	.08	-.33	-.33	-.32	.14	.02
61-71	DR	-.08	.03	.28	.01	.01	.02	-.00	.04
1951	AG IND[a]	-.44*	-.35	.16	.13	.13	.14	.08	.12
1961	AG IND	-.28	-.19	.19	.04	.03	.03	-.08	-.01
1971	AG IND	-.13	-.06	.16	-.05	-.05	-.06	-.14	-.09
51-61	AG IND	.35	.37	.11	-.22	-.24	-.26	-.43*	-.31
61-71	AG IND	.42*	.37	-.04	-.25	-.26	-.28	-.18	-.27
1951	SMR[a]	.25	.18	-.13	-.04	-.06	-.07	-.36	-.19
1961	SMR	.28	.25	-.02	-.02	-.04	-.05	-.32	-.12
1971	SMR	.40*	.27	-.22	-.11	-.12	-.13	-.23	-.14
51-61	SMR	.14	.17	.12	.01	.00	.00	-.08	.03
61-71	SMR	.37	.29	-.15	-.17	-.17	-.17	.09	-.05
1951	GFR[a]	.56*	.52*	.01	-.35	-.34	-.34	.04	-.02
1961	GFR	.43*	.58*	.49*	-.31	-.28	-.27	.44*	.19
1971	GFR	.26	.38	.36	-.26	-.26	-.25	.10	.14
51-61	GFR	.19	.39	.54*	-.17	-.14	-.12	.48*	.23
61-71	GFR	-.01	.02	.07	-.09	-.11	-.10	-.21	.03
1951	Pop[a]	-.65*	-.65*	-.14	1.00	1.00	.99	.00	-.04
1961	Pop	-.65*	-.65*	-.12	1.00	1.00	1.00	.06	-.00
1971	Pop	-.64*	-.64*	-.12	.99	1.00	1.00	.10	.06
51-61	Pop	-.00	.10	.28	.00	.06	.10	1.00	.64*
61-71	Pop	.03	.08	.13	-.04	-.00	.06	.64*	1.00

[a] See Table 1 for description of variables

* $\geq |0.40|$

Discussion

The age structure reflects fertility, mortality, and migration patterns and should thus be associated to some extent with the economic performance of a city. Cities experiencing economic buoyancy should attract more migrants. Social benefits should accrue from economic development, resulting in more and better social services with a consequent damping effect on mortality rates. Improved economic conditions supposedly result in lower fertility rates. Thus the population in an economically advanced city should be older and healthier. Table 1 reflects that these relationships among mortality, fertility, and age structure, although not strong, are obtained. However in Table 2 the association of these demographic variables with the economic advantages is not so apparent. Cities

TABLE 2 (CONTINUED)

		Percentage of labour force in:					
		manufacturing industries			service industries		
		1951	1961	51-61	1951	1961	51-61
1951	YDR[a]	-12	.12	-.00	-.34	-.33	.05
1961	YDR	.20	.20	.02	-.37	-.37	-.02
1971	YDR	-.00	-.03	-.15	-.17	-.18	-.08
51-61	YDR	.18	.18	.03	-.16	-.17	-.11
61-71	YDr	-.13	-.16	-.19	.03	.02	-.08
1951	OADR[a]	-.25	-.27	-.11	.44*	.45*	.11
1961	OADR	-.27	-.29	-.13	.40*	.42*	.17
1971	OADr	-.27	-.28	-.08	.33	.35	.14
51-61	OADR	-.10	-.11	-.06	-.04	-.01	.20
61-71	OADR	-.03	-.00	.15	-.16	-.17	-.08
1951	DR[a]	.00	-.01	-.07	-.18	-.15	.13
1961	DR	-.06	-.08	-.11	-.00	.02	.16
1971	DR	-.30	-.33	-.22	.22	.23	.09
51-61	DR	-.08	-.09	-.09	.14	.15	.10
61-71	DR	-.33	-.36	-.19	.28	.27	-.01
1951	AG IND[a]	-.24	-.24	-.06	.42*	.43*	.06
1961	AG IND	-.27	-.28	-.10	.40*	.41*	.13
1971	AG IND	-.23	-.23	-.04	.31	.33	.12
51-61	AG IND	-.13	-.15	-.10	.01	.04	.21
61-71	AG IND	.07	.10	.16	-.20	-.20	-.03
1951	SMR[a]	.14	.14	.01	-.32	-.33	-.06
1961	SMR	.14	.13	-.06	-.42*	-.42*	.01
1971	SMR	.30	.30	.07	-.49*	-.51*	-.19
51-61	SMR	.05	.03	-.10	-.28	-.26	.09
61-71	SMR	.13	.16	.18	-.23	-.27	-.25
1951	GFR[a]	.15	.16	.05	-.39	-.38	.01
1961	GFR	-.36	-.38	-.13	.13	.12	-.04
1971	GFR	-.41*	-.44*	-.22	.20	.22	.10
51-61	GFR	-.48*	-.51*	-.17	.35	.34	-.05
61-71	GFR	-.24	-.27	-.18	.16	.18	.16
1951	Pop.[a]	-.04	-.02	.09	.09	.08	-.05
1961	Pop.	-.05	-.03	.09	.10	.09	-.07
1971	Pop.	-.05	-.03	.09	.10	.09	-.07
51-61	Pop.	-.20	-.18	.09	.19	.13	-.29
61-71	Pop.	.02	.00	-.08	-.02	-.01	.04

[a] See Table 1 for description of variables

* $\geq |0.40|$

with higher proportions of older persons are not larger cities nor do they have higher wage levels, but tend to be cities with larger proportions of the labour force in service industries. Cities with higher proportions of children 0-14 tend to be those cities with specialized industrial structures, i.e., mining towns and smaller towns dependent on only a few industries. The age structure of a population thus tends to be associated more closely with social than with economic conditions.

The dependency ratio appears to be associated weakly with only one measure of economic behaviour. Large cities tend to have larger proportions of their populations in the working ages from 15-64 years. This reflects the fact that larger cities are able to outgrow

77

other cities and maintain this growth as the result of rapid in-migraion of persons who are predominantly of working age (Stone, 1967:96-97). The fact that this association between in-migration and dependency ratio is not caught in our measure of residual change in population growth, which correlates −0.01 with 1961 dependency ratio, reflects the nature of the measure. The expected growth of larger cities using this measure is greater than that of smaller cities. Thus the larger proportion of in-migration in large cities is absorbed in the measure of expected growth, leaving the residual change in growth to be influenced by variations in fertility (0.45). Another way of expressing this is that variations from expected growth, by size of urban area, are more the result of variations in fertility than they are from variations in in-migration, at least as far as in-migration is reflected by dependency ratio.

The standardized mortality rate correlates most highly with the proportion of the labour force engaged in service industries suggesting a superficially obvious association between mortality rate and number of services available. Cities providing more services to residents experience lower mortality rates. An investigator would be cautioned to make certain that the services in question are related to health care. Business services are not likely to contribute to lower mortality rates.

The percentage of the labour force in service industries is not an indicator of economic development but reflects the structure of the labour force. This is reflected in the fact that percentage of the labour force in service industries does not associate with any of the more viable measures of economic development such as wage level, city size, or increase in population. The conclusion one must make is that standardized mortality rate does not appear to be associated with urban economic development. The General Fertility Rate, in addition to being one of the most sensitive indicators of demographic change used in this study, appears to be associated with economic indicators of growth to a greater extent than any of the other demographic indicators. The GFR is weakly associated with population, reflecting the customary association of fertility and city size. Fertility rates are commonly found to be lower in large cities.

The General Fertility Rate is associated more strongly with residual change in population than it is with population size. This suggests that variations from expected population growth are determined to a considerable extent by inter-urban variations in fertility. The economic variable having the strongest association with GFR is the Gini index. This suggests that cities with more specialized industrial structures tend to have higher fertility rates and that cities which experienced rapid increases in specialization over the preceding decade also tended to have higher fertility rates. Since degree of specialization and city size are inversely correlated we might summarize by stating that small cities with specialized industrial structures have higher fertility rates than large cities with broad industrial bases.

Conclusions

The results of this study imply that the economic-demographic correlates that obtain using regions and countries as units of analysis are much more tenuous when urban areas are used. This may reflect the contrasts in rural and urban socio-economic conditions. Urban areas can capitalize on agglomeration and scale economies to attain an economic buoyancy that is beyond the reach of rural areas.

A review of the literature reveals that demographic contrasts are also found in the urban-rural dichotomy, reflecting social differences in the two populations. Rural inhabitants are usually less well educated, are employed in primary industries, usually agriculture, and make less money than their urban counterparts. Turning to demo-

graphic variables, we note that rural fertility rates are higher, and the base of the rural population pyramid is much broader than the urban pyramid, reflecting fertility differentials and a migration stream from rural to urban areas.

The inter-urban contrasts are much less obvious than the urban-rural contrasts, resulting in weaker associations among economic and demographic variables. There is no apparent association between the economic status of a city and its demographic attributes when wage level and average value added are taken as measures of economic status. When population size is used as an indicator of economic status, an association with a demographic variable obtains. The dependency ratio has a weak negative association with population size, indicating that large cities tend to have larger proportions of working age persons in their populations. This is a result of the filtering up process by which net migration is away from smaller urban areas to the larger ones. This process would have an effect on the dependency ratio because most migrants are in the young working age category.

Demographic attributes of cities appear to be associated more closely with their industrial structures than with their economic status. Cities with older populations tend also to have larger percentages of their labour force engaged in service industries and tend to have more diversified industrial structures than do cities with younger populations. Cities with specialized industrial structures, in addition to having younger populations, also experience much higher fertility rates than do cities with diversified industrial structures.

The most noteworthy result of this study is the lack of association of demographic and economic variables. Wage level and average value added are not associated with fertility, mortality, or age structure. The percentage of the labour force engaged in manufacturing industries is not associated with demographic variables. Finally, residual changes in these same economic variables are not associated with any demographic variables.

The tentative conclusion to be drawn from the lack of association of demographic and economic variables in this study is that demographic variables are not useful in explaining urban economic differences in the Canadian context nor in developing economic models of urban development. Urbanization of our society has resulted in a convergence of demographic attributes regardless of the economic status of the city. However, there is moderate association of demographic attributes and industrial structure. Measures of industrial structure, such as percentage of the labour force in service industries, reflect the social conditions of the city perhaps more than the economic conditions. This suggests that demographic variables are more useful as indicators of social conditions than of economic conditions when the city is the unit of analysis.

James Stafford

References

Beegle, J. Allan. 1966. Social Structure and Changing Fertility of the Farm Population, Rural Sociology. 31:415-427.

Coale, Ansley J., and Edgar M. Hoover. 1958. Population Growth and Economic Development in Low-Income Countries: A Case Study of India's Prospects. Princeton, N.J.: Princeton University Press.

Coleman, James S. 1968. The Mathematical Study of Change. In Hubert M. Blalock Jr. and Ann B. Blalock (eds.), Methodology in Social Research. New York: McGraw-Hill Book Company.

Crowley, Ronald W. 1973. Reflections and Further Evidence on Population Size and Industrial Diversification, Urban Studies 10:91-94.

Hartwick, John M., and Ronald W. Crowley. 1972. Urban Economic Growth: The Canadian Case. Working Paper A.73.5, Ministry of State for Urban Affairs, Ottawa.

Hodge, Gerald. 1965. The Prediction of Trade Center Viability in the Great Plains, Papers of the Regional Science Association 15:87-115.

Keyfitz, Nathan. 1973. Individual Mobility in a Stationary Population. Population Studies 27:339-348.

King, Timothy. 1974. Population Policies and Economic Development. Baltimore: The Johns Hopkins University Press.

Kruegel, David L. 1971. Metropolitan Dominance and the Diffusion of Human Fertility Patterns, Kentucky: 1939-1965, Rural Sociology 36:141-156.

Marshall, John U. 1975. City Size, Economic Diversity, and Functional Type: The Canadian Case, Economic Geography. 51:37-49.

Morss, Elliot R., and Ritchie H. Reed (eds.). 1972. Economic Aspects of Population Change. U.S. Commission on Population Growth and the American Future. Washington, D.C.: Government Printing Office.

Ray, D. Michael. 1969. The Spatial Structure of Economic and Cultural Differences: A Factorial Ecology of Canada, Papers of the Regional Science Association 23:7-23.

————. 1971. Dimensions of Canadian Regionalism. Geographic Paper Number 49. Department of Energy, Mines and Resources. Ottawa: Information Canada.

Richardson, Harry W. 1971. Urban Economics. Baltimore: Penguin Books, Inc.

Rummel, R. J. 1970. Applied Factor Analysis. Evanston: Northwestern University Press.

Samuelson, Paul A. 1955. Economics. Third Edition. New York: McGraw-Hill Book Company, Inc.

Sly, David F., and Peter S. K. Chi. 1972. Economic Development, Modernization, and Demograpic Behavior: Longitudinal Analysis of Mortality Change, The American Journal of Economics and Sociology 31:373-386.

Spengler, J. 1975. Stationary Populations: Economic and Educational Implications, Canadian Studies in Population 2:1-14.

Stafford, James, 1975. Census Indicators of Urban Development in Alberta. Paper presented at Conference on Social Indicators, University of Alberta, Edmonton.

Stockwell, Edward G. 1966. Some Demographic Correlates of Economic Development, Rural Sociology 31:216-224.

————. 1974. the Dimensions of Development: An Empirical Analysis, Population Review 18:35-51.

————, and Bruce W. Hutchinson. 1975. A Note on Mortality Correlates of Economic Development, Population Review 19:46-50.

Stone, Leroy O. 1967. Urban Development in Canada. 1961 Census Monograph. Dominion Bureau of Statistics. Ottawa: The Queen's Printer.

Thompson, Wilbur R. 1968. A Preface to Urban Economics. Baltimore: The Johns Hopkins Press.