Canadian Studies in Population, Vol. 8, 1981, pp. 27-40

OUT-MIGRATION, FERTILITY, MORTALITY AND NATURAL INCREASE DURING THE DEMOGRAPHIC TRANSITION

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Résumé—Cette étude présente un modèle multivarié qui esquisse 1) les voies casuelles qui se trouvent dans l'hypothèse qui admet que la migration externe ralentit les baisses du taux de natalité par suite de la pression démographique; 2) les relations de la migration externe et de l'augmentation naturelle avec les baisses en taux de mortalité rural; et 3) l'importance relative des changements en taux de natalité versus des changements en taux de mortalité dans la cause des changements en augmentation naturelle rurale. L'utilité par une analyse longitudinale des données démographiques de l'Angleterre et du Pays de Galles (1820-1930) et de la Suède (1750-1920).

Abstract—This paper presents a multivariate model which delineates: 1) the causal paths underlying the hypothesis that out-migration slows declines in the rural birth rate due to population pressure; 2) the relationships of out-migration and natural increase with declines in the rural death rate; and 3) the relative importance of changes in the birth rate versus changes in the death rate in causing changes in rural increase. The utility of the model is illustrated by a longitudinal analysis of demographic data from England and Wales (1820-1930) and Sweden (1750-1920).

Key Words—**demographic transition, out-migration, fertility, mortality**

Introduction

The hypothesis that out-migration represents a significant demographic response which may produce variations in the process of the demographic transition had been discussed in the transition theory literature for several years. Davis (1963) lists out-migration along with celibacy, sterilization, abortion and postponement of marriage in outlining the components of a "Multiphasic Response" to population pressure resulting from lower mortality. Friedlander (1969) presents the most extensive discussion of migration, *per se*, arguing that migration from rural areas slows the demographic transition by providing an escape valve for the population pressures that arise when mortality rates decline. Either emigration from a country or migration to urban areas which need manpower is thought to serve this function. It has become customary to reference Friedlander's work (Easterlin, 1976; Nam and Gustavus, 1976; Macisco, 1972; Mott, 1972; Uhlmann, 1972; Zelinsky, 1971a), but at present this interesting research line has not been thoroughly investigated.

The purpose of our study is to present a model which: 1) examines the causal paths underlying the out-migration hypothesis; 2) includes the relationships of out-migration and natural increase with declines in the death rate; and 3) specifies the relative importance of declines in the birth rate and declines in the death rate in causing changes in natural increase. Following Friedlander's analysis, this paper investigates the extent to which out-migration

**This is an equally coauthored paper, with the names appearing alphabetically.*

counterbalances the effects of natural increase in rural areas. In our model, however, a twenty year time lag is explicitly built in to capture the effects of natural increase in terms of entry into the labour force and new family formation. Thus, while both we and Friedlander employ natural increase as a proxy for population pressure, the time lag procedure represents a conceptual improvement. Furthermore, as will be elaborated later, focusing on change in rural areas makes natural increase a more tenable measure of population pressure.

We should note at this point that population pressure is not the only cause of rural out-migration. Taeuber (1970) sketches how transitions in family structure, in her case study from extended families to nuclear families, can affect fertility and migration rates. Zelinsky (1979, 1971b) presents a mobility transition theory which parallels changes in rates of physical mobility with changes in vital rates, technology, political structure and socio-economic variables. The research in this area indicates that rural out-migration would occur at certain stages of modernization even if there was not rural population pressure. Furthermore, there is evidence that rural net out-migration is a response that tends to occur in the early and intermediate stages of industrialization; but rural net out-migration may be reversed in a later stage entered into beginning around 1970 by several advanced industrialized nations, namely, the United States, Japan, Norway, Sweden, the two Germanies, France and Great Britain (Vining and Kontuly, 1978). Finally some developing countries currently experiencing a demographic transition may not replicate the rural out-migration experiences of Sweden and England-Wales, because the internal, as well as global, political-economic structures are different. With these cautions in mind we will turn now to a more detailed presentation of the out-migration hypothesis.

The Out-Migration Hypothesis

Friedlander provides the most detailed description of the out-migration hypothesis. Following the logic that there are alternative demographic responses to population pressures produced by high rates of natural increase, he notes that "the adjustment in reproductive behaviour made by a community in response to a rising 'strain' such as that resulting from higher natural increase, is likely to differ depending upon the ease with which the community can relieve the strain through out-migration" (1969: 359). He links his hypothesis to transition theory by arguing that large scale rural-urban migration or external migration can often explain differences among countries in the speed of decline in birth rates. Migration, Friedlander continues, can also account for variance among countries in rural-urban birth rate differentials. The essence of the argument is that migration is an alternative to declines in rural birth rates as a means to lessen population pressure. Friedlander gives the following hypothetical illustration:

> We may consider . . . two societies, A and B, which at a starting point were similar in the following sense: They were of the same size in both the rural and the urban sectors, had the same rural and urban birth rates and death rates and were predominantly rural at the starting point. We assume . . . that with "general modernization" death rates began to fall. The response in the urban areas of both societies might have been a decline in birth rates through the different responses. However, due to differences in social-economic structure, these two societies may have differed in the *timing* and in the *emphasis* of the demographic response in the rural sectors. In population *A*, large-scale migration to the cities and perhaps abroad might have been feasible due to rapid industrialization, and this response could have fitted well into the general social and economic system. Consequently, it is possible that for many years, the predominant response in the rural sector of *A* was rural/urban migration while a decline in birth rates could have been a very much delayed response. In population *B* on the other hand, the process could have worked in a reversed order. Since it has no rapidly developing cities and possibly no outlet for external migration, the main response in rural areas of B might have been a sharp decline in birth rates as an initial response (1969:362).

Note how rural and urban rates are treated differently in the example. Rural birth rates are a dependent variable. Urban birth rates and rural death rates, however, are implicitly considered to be of secondary importance. Friedlander assumes that rural death rates will decline, presumedly due to improved standards of living, thereby increasing the rural natural growth rate. The higher rural natural growth rate will create population pressure in the rural sector and cause declines in the birth rate, unless the potential surplus population is absorbed by growing urban areas or by emigration from the country. Urban birth rates, on the other hand, are assumed to undergo a general decline. This is due, in part, to the fact that the urban areas represent points of destination for the rural migrants, restricting the possible alternative responses. This assumption is supported with data from Sweden and England and Wales, revealing that urban birth rates declined during the same periods that the urban sector was absorbing surplus rural population (Friedlander, 1969: 372 and 374).

Friedlander suggests that a high agricultural density combined with a slow "industrialization/urbanization" process may be responsible for the early decline of the birth rate in France and for a lower rural than urban birth rate during some periods of France's industrialization, both of which are often considered puzzling. A lack of opportunities for out-migration, he argues, meant that other responses were employed, resulting in the lower rural birth rate. The hypothesis has relevance for the current experience of less developed countries. What are the effects, for example, of the out-migration stream from rural Mexico to urban Mexico and the United States?

The bulk of the data mustered by Friedlander to support the out-migration hypothesis is from England and Wales for the decades 1820 to 1930 and from Sweden for the decades 1750 to 1920. England and Wales is used to illustrate the case of extensive out-migration and Sweden is used to illustrate more limited migration. Declines in the rural birth rate in Sweden occured earlier and more rapidly than in England and Wales. Out-migration from rural areas is posited as an alternative response which permitted the retention of higher birth rates and, therefore, higher rates of natural increase in rural England and Wales than in rural Sweden. There is, however, considerable variation over time in the rates of out-migration for both countries. The generality of this hypothesis, therefore, should be examined in a longitudinal framework. In its simplest form the hypothesis suggests that periods of higher rural out-migration should be associated with slower declines in rural birth rates in both countries.

As widely accepted as the out-migration hypothesis has become, there is evidence which raises doubts about the relationship of out-migration to declines in the birth rate. Easterlin (1976), for example, in an analysis of population changes in the Northern United States during the nineteenth century, notes that birth rates declined despite out-migration opportunities. A comparison of states in India found that high rural out-migration was associated with low rural birth rates (Hedderson, 1976). Studies of counties in the United States have indicated that those rural areas with high rates of out-migration have low birth rates (Chang, 1974; Markides and Tracy, 1977). These studies raise serious questions about the out-migration hypothesis as presented by Friedlander. We will re-examine Friedlander's data in a multivariate model. First, however, we will discuss the theoretical basis for the expected relationships.

Causality and the Out-Migration Hypothesis

Superficially the out-migration hypothesis suggests a *negative* zero-order relationship between out-migration and declines in the birth rate in rural areas. Since a gradual decline in mortality is assumed (Friedlander, 1969: 366), a positive relationship between out-migration and natural increase is also implicit. Friedlander's explanation is that the high birth rates and high natural increase in rural areas are sustained by opportunities to migrate to cities or to emigrate, thereby lessening population pressure by absorbing surplus rural population.

The out-migration hypothesis is based on the idea that out-migration offsets the effects of rural natural increase. The crucial migration dimension is the extent to which migration "absorbs" previous natural increase. If the out-migration is small, additions to the population through natural increase will eventually generate "population pressure", due to increased competition for limited agricultural opportunities. This is particularly true in the face of land enclosure and improved farming techniques. Under such population pressure the response might be to reduce the birth rate. Alternatively, out-migration might increase, completely offsetting previous natural increase. According to Friedlander, in this situation there would be no pressure for declines in the birth rate. Out-migration, then, is viewed as an alternative to other behavioural adjustments that would influence the birth rate. *Again, the basic hypothesis suggests a negative zero-order relationship between out-migration and declines in the birth rate, and a positive relationship between out-migration and natural increase.*

When we consider the relationships of migration with other variables more carefully, however, it is unclear what the zero-order relationships will be. What would a *positive* correlation between out-migration and declines in the rural birth rate indicate? One explanation is that such a correlation would indicate adjustments to population pressure are being made through *both* out-migration and reductions in the birth rate. Such events would be in accordance with Davis' theory of a multiphasic response. Davis suggests that both responses might be employed together in order to ". . . maximize new opportunities and to avoid relative loss of status" (Davis, 1963: 366). Out-migration in itself might still be slowing the decline in birth rates, but this effect is obscured in the zero-order relationship by the positive effects of natural increase on both out-migration and declines in birth rates. Although at first glance a positive zero-order correlation between out-migration and declines in the birth rate would seem to contradict Friedlander's hypothesis, it is necessary to examine the relationship controlling for the effects of other factors, like previous increase. If the partial relaitonship is negative, this would be consistent with Friedlander's hypothesis.

Pinpointing causality, as Friedlander notes, is also complicated by the selectivity of the migrants. Age is the most consistent selectivity variable (Thomas, 1938; Lee, 1966), and it is generally found that migrants tend to be concentrated in their early fecund years. A stream of migration from rural areas could alter the age structure, producing declines in crude measures of fertility, such as the crude birth rate or the general fertility rate. Strong sex selectivity might also affect marriage rates, due to changes in the sex ratio, and reduce age specific fertility measures. For purely demographic reasons, therefore, extensive out-migration from rural areas could tend to lower birth rates and thereby reduce the rate of natural increase. This might lead to positive correlations between migration and declines in the birth rate independent of any behavioural adjustments in childbearing by the non-migrant couples, again apparently contradicting the out-migration hypothesis. (For a discussion of the effects of selectivity, see Davis, 1977.)

There may be a tendency, however, for intuitive guesses to overestimate the effects of age and sex selective migration on birth rates. Keyfitz (1971) had demonstrated, through applications of stable population theory, that a stream of out-migration must be very large and selective to substantially affect birth rates by altering the age structure of a population. In most cases, therefore, it can be assumed that the age structure and sex ratio effects of out-migration are of secondary importance.

Analysis

Table 1 reproduces data on England and Wales and Sweden developed by Friedlander (1969: 372, 374). It should be noted that portions of the data are estimated for England and

TABLE 1. RURAL BIRTH RATES, RURAL DEATH RATES, AND NET RURAL OUT-MIGRATION* IN ENGLAND AND WALES AND SWEDEN, 1750-1930.

	England and Wales			Sweden		
Period Beginning	Rural Birth Rates	Rural Death Rates	Net Rural Out-Migration Rates	Rural Death Rates	Rural Death Rates	Net Rural Out-Migration Rates
1750	-	-	-	36	26	20
1760	-	-	-	35	26	17
1770	-	-	-	34	28	22
1780	-	-	-	32	26	16
1790	-	-	-	34	24	20
1800	40	21	71	31	27	24
1810	40	18	92	34	25	24
1820	40	20	102	35	22	14
1830	40	20	21	32	22	18
1840	39	19	304	32	20	10
1850	42	17	228	33	21	36
1860	42	18	289	32	19	56
1870	41	18	275	31	17	62
1880	38	17	241	29	16	125
1890	35	17	138	27	16	77
1900	30	15	123	27	16	82
1910	25	15	120	23	15	83
1920	19	12	36	19	13	66
1930	15	12	84	-	-	-

Source: Friedlander, Dov. 1969. Demographic Responses and Population Change. Demography 6:359-381

*Net rural out-migration refers to both rural to urban migration and emigration. The rates are calculated from data provided by Friedlander, pp. 372 and 374.

Wales, starting with information from Carrier (1953), Glass and Eversly (1965), Registrar General of England and Wales (1961), Swaroof (1960) and Weber (1899) and making assumptions about differences between rural and urban areas (see Friedlander, 1969: 378-380). Furthermore, the rural-urban distinction in Sweden is problematic, due to the existence of rural industry (Mosher, 1978). Taylor for example, notes that, "scattered rural manufactures in Sweden ... could do something to absorb surplus population. Agriculture, however, had to play the major part" (1971: 28). Natural increase can be considered an adequate proxy for population pressure only to the extent that rural opportunities are limited to agriculture. Bearing in mind these *caveats* about the data, Friedlander's compilation provides a rare time series of information on rural areas. In the absence of a comparable time series of socioeconomic information, which would serve to more adequately define the concept of "population pressure", focusing on rural areas and building in a twenty year time lag for the effects natural increase should serve in large part to offset the conceptual limitations.

An additional problem is that we are confined to measures of crude birth rates and crude death rates, with the denominator represented by the population at the *beginning* of each time period. It is not possible, therefore, to separate the purely demographic effects of migrant selectivity from more clearly behavioural adjustments, and the figures are somewhat inflated in comparison to those that would derive from mid-period estimates of population size. Mosher (1978) attempted to deal with these problems for Sweden by computing "probability" (population at the beginning of the period) and "central" (mid-period population) general fertility rates from 1840 to 1920. It is thought that general fertility rates, being more clearly age and sex specific, would more clearly depict behavioural adjustments. Both the probability and central general fertility rates calculated by Mosher correlate with Friedlander's crude birth rate at 0.98. This suggests that the discrepancies are of a nearly constant order of magnitude. Furthermore, consistent with the argument by Keyfitz (1971) mentioned earlier, changes in the crude rates are likely to predominantly represent behavioural adjustments rather than changes in age and sex structure.[1] Finally, the crude rates are most appropriate for decomposing the determinants of natural increase. While changes in age and sex structure may have a modest effect, the net effect is still a change in natural increase and, therefore, in conditions of "population pressure" in rural areas.

Working with Friedlander's original data, we have calculated a set of change variables over twenty year intervals - declines in rural birth rates, declines in rural death rates and net migration rates for each interval. The birth rate and death rate changes are calculated by subtracting the rate at time t from the rate at time $t - 20$, so that a larger positive number indicates a greater *decline*. The net migration rates are based on the total *out*-migrants divided by the mid-decade $(t - 10)$ population. The means, standard deviations and simple correlations between these variables are presented in Table 2.

Focusing on the relationship between out-migration and declines in the birth rate, for England and Wales there is a correlation of -0.73.[2] For Sweden, however, there is a *positive* correlation of 0.51. This suggests that Sweden may represent a case of *complementary* rather than *alternative* responses. As indicated earlier, however it is necessary to examine the partial relationship for an adequate test of the out-migration hypothesis. We think the following multivariate model is a method of resolving this issue.

A Multivariate Model

The bivariate approach is inadequate for considering the association between out-migration and declines in the birth rate. Natural increase, as an indicator of population pressure, is expected to have positive effects on *both* out-migration and declines in the birth rate. Therefore, the correlation between the latter two variables is problematic. The correlation will be positive

TABLE 2. PEARSON ZERO-ORDER CORRELATION MATRIX, MEANS AND STANDARD DEVIATIONS FOR SELECTED VARIABLES: ENGLAND AND WALES ABOVE THE DIAGONAL AND SWEDEN BELOW THE DIAGONAL

	Natural Increase Rate (t-20)	Decline in Rural Birth Rate (t-20 to t)	Decline in Rural Death Rate (t-20 to t)	Rural Net Migration Rate (t-20 to t)	Natural Increase Rate (t)	England and Wales: Mean	England and Wales: Standard Deviations
Natural Increase Rate (t-20)*	--	-0.53	-0.67	0.74	0.82	19.84	3.99
Decline in Rural Birth Rate (t-20 to t)	0.59	--	0.59	-0.73	-0.91	3.83	5.01
Decline in Rural Death Rate (t-20 to t)	-0.16	-0.13	--	-0.45	-0.61	1.28	1.38
Rural Net Migration Rate (t-20 to t)	0.65	0.51	0.09	--	0.86	358.23	155.35
Natural Increase Rate (t)	0.36	-0.37	0.56	0.23	--	17.28	6.96
Sweden:							
Mean	10.19	1.77	1.56	94.03	9.98		
Standard Deviation	2.92	2.63	1.82	63.75	3.05		

Note: The variables and correlations are obtained from data presented in: Friedlander, Dov. 1969. Demographic Responses and Population Change. Demography 6:359-381. See Table 1. There are 14 time points for England and Wales and 18 time points for Sweden.
*The time unit for t is a decade; t-20 refers to the decade 20 years prior to t.
The rates are per thousand population per year. They are the annual rates of increase for the decade.

when natural increase is sufficient to cause both responses to occur together. It will be zero when out-migration is impossible and declines in the birth rate occur alone. And it will be negative when out-migration reduces population pressure sufficiently to have a negative impact on declines in the birth rate (outweighing the spurious positive association created by both variables being positively correlated with natural increase).

A more definitive representation of the role of out-migration during the demographic transition is given by the path diagram in Figure 1. Several aspects of this model are different from previous work. First, the effects of natural increase and out-migration on declines in the birth rate are considered simultaneously. If Friedlander's out migration hypothesis is generalizable, the path coefficient from the rural net migration rate to declines in the birth rate can be hypothesized to be consistently negative because we are controlling, at least roughly, for the effects of population pressure on this relationship.

Second, the effects of natural increase and out-migration on declines in the rural death rate are included. Previous research on this hypothesis has treated declines in the death rate as totally exogenous. This exogenous treatment seems unrealistic. Population pressure would tend to hinder socio-economic development in rural areas, with a resultant negative effect on declines in the death rate. Additionally, it follows that if out-migration releases population pressure, the rural net migration rate should in turn have a positive effect on declines in the death rate.[3]

Third, the path diagram in Figure 1 allows one to assess the relative importance of each of

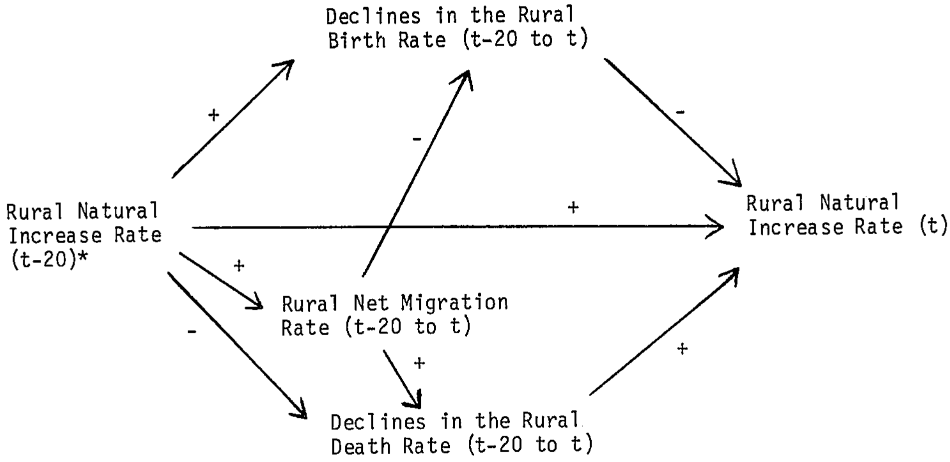


FIGURE 1. PATH DIAGRAM OF HYPOTHESIZED MULTIVARIATE RELATIONSHIPS

demographic variables involved in determining natural increase. The results of this analysis are presented in Table 3 and illustrated in Figures 2 and 3. The equation for natural increase at time t is the following:

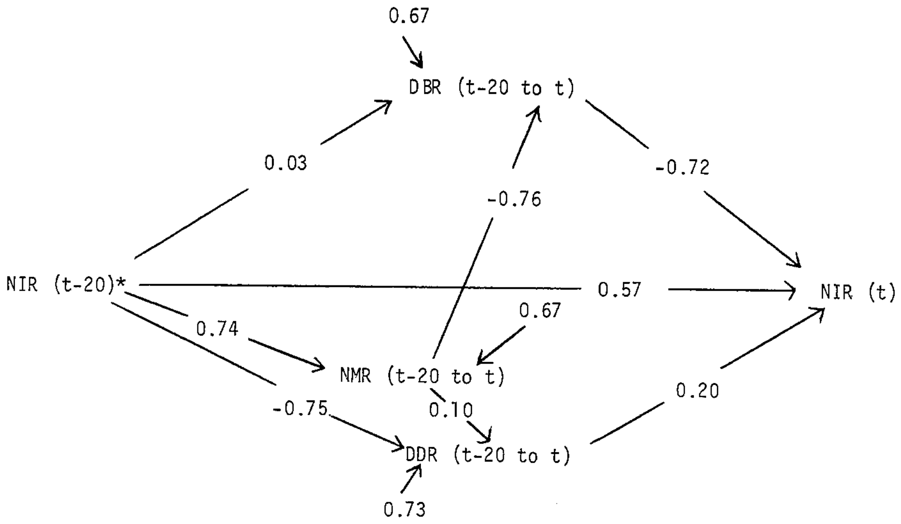
$$NIR_t = NIR_{(t-20)} - DBR_{(t-20\ to\ t)} + DDR_{(t-20\ to\ t)}$$

Natural increase at time t (NIR_t) is equal to natural increase twenty years earlier (NIR_{t-20}) minus declines in the crude birth rate $(DBR_{t-20\ to\ t})$ plus declines in the crude death rate $(DDR_{t-20\ to\ t})$.[4] Migration enters the system as an intervening variable, potentially affecting $DBR_{(t-20\ to\ t)}$ and $DDR_{(t-20\ to\ t)}$, but having no direct impact on NIR_t.

The model is designed with a twenty year lag in order to capture the effects of rural natural increase in terms of population pressure. The effects of high natural increase are most clearly demonstrated at the time that the new population is entering the agricultural labour force and preparing to form new families. In terms of decades, we believe the twenty year span best captures this relationship. Ten years would be too short for an impact on population pressure and thirty years would be too long, concealing many of the changes that might have occurred.

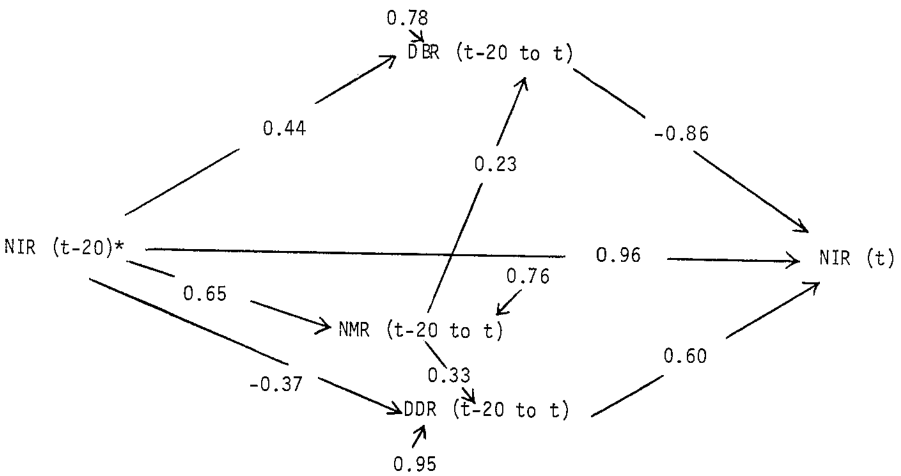
As an empirical test of the model we have reanalyzed the data sets for England and Wales and Sweden that were developed by Friedlander. As noted above, this spanned from 1820 to 1930 for England and Wales and from 1750 to 1920 for Sweden. Because our model includes variables lagged twenty years, we are not able to include the first two decades of each data set in the analysis. Figures 2 and 3 present the path coefficients (standardized regression coefficients) obtained for the two countries being considered.

The coefficients for England and Wales completely correspond to the hypothesized model in Figure 1. The strong negative correlation between $NIR_{(t-20)}$ and $DBR_{(t-20\ to\ t)}$ for England and Wales (−0.53, see Table 2) becomes positive, though slight, when $NMR_{(t-20\ to\ t)}$ is controlled. Rural natural increase at $t-20$ is strongly and positively related to out-migration and out-migration is strongly and negatively related to declines in the rural birth rate. This provides strong support for Friedlander's contention that out-migration served as an *alternative* to declines in the birth rate in England and Wales.



*The time unit for t is a decade; t-20 refers to the decade 20 years prior to t.

FIGURE 2. STANDARDIZED PATH COEFFICIENTS FOR RURAL ENGLAND AND WALES, 1800 TO 1930



*The time unit for t is a decade; t-20 refers to the decade 20 years prior to t.

FIGURE 3. STANDARDIZED PATH COEFFICIENTS FOR RURAL SWEDEN, 1750 TO 1920

Note the difference, however, in the model for Sweden. All of the signs are in the hypothesized direction, except for the path from $NMR_{(t-20\ to\ t)}$ to $DBR_{(t-20\ to\ t)}$. The effects of previous rural natural increase are strong and positive on both out-migration and declines in the birth rate. Even controlling for previous natural increase, however, there is a moderate *positive* path from out-migration to declines in the rural birth rate for Sweden. It may be, as Friedlander suggested, that the lower rate of out-migration in Sweden did not have significant effects relative to other variables on declines in the rural birth rate. Nevertheless, the positive coefficient for Sweden is more consistent with the notion of *complementary responses*, deriving from Davis' (1963) original theory of multiphasic response. This interpretation corresponds well with historical accounts of a growing class of dependent farm labourers in Sweden. Taylor, for example, notes that, "In Sweden, where more than a million additional people were absorbed into farming between the middle of the eighteenth century and the middle of the nineteenth, the number of freeholders increased very little, that of farm-servants living-in grew fast, and that of crofters and cotters increased most of all, nearly quadrupling in the same period" (1971: 28-29). Furthermore, larger scale out-migration really begins in Sweden following a monetary crisis and agricultural setbacks in the 1860's (Taylor, 1971: 30; see also Table 2). These types of conditions are more conducive to a "multiphasic" rather than an "alternative" pattern of responses.

In other respects the hypothesized signs for the path coefficients were found. For both cases previous natural increase was negatively related to declines in the death rate and out-migration appears to augment declines in the death rate. For England and Wales the latter effect is small; however, more important than the size of this path coefficient (0.10) is how greatly it differs from the zero-order correlation (−0.45). The multivariate model, by controlling for the effects of population pressure, suggests that the negative zero-order association is spurious.

This multivariate model allows one to better assess the indirect effects of out-migration on natural increase (table 3). For example, the Swedish data indicate that while out-migration is having a *negative* impact on natural increase by increasing slightly the decline in the birth rate, out-migration is having an equal *positive* impact on natural increase by increasing declines in the death rate. In England and Wales, on the other hand, out-migration has a positive impact on natural increase through both sets of indirect paths. These indirect effects are crucial for assessing the total impact of these variables and to our understanding of the total process of demographic change over time. In the current examples, they reflect broadly different historical circumstances worthy of more detailed investigation.

The model also delineates more completely the ramifications of natural increase, including its indirect impacts on future natural increase. The Swedish data illustrate that natural increase, by speeding declines in the birth rate and slowing declines in the death rate, can indirectly lead to less natural increase in the future. The total indirect effect (−0.60), largely offsets the direct positive effect. In England and Wales, on the other hand, the total indirect effect (+0.20) augments the direct effect. For both cases the total effect (direct and indirect) is positive. This indicates that over time there is a positive feedback effect of changes in natural increase. If natural increase rises it will induce, *ceteris paribus*, additional rises in the future. If natural increase declines, the declines will induce, *ceteris paribus*, additional declines in the future.

The absolute value of the direct path coefficients to natural increase are determined by the variances of the respective variables for each country (see Guest, 1974: 460). Our model's path coefficients for England and Wales show that the variance was greatest for declines in the birth rate followed in descending order by natural increase *(t−20)* and declines in the death rate (see also Table 2). For Sweden, however, rural natural increase *(t−20)* had the greatest variance followed in descending order by declines in the rural birth rate and declines in the rural death rate. The variances in England and Wales were greater for previous natural increase and declines in the birth rate than in Sweden, but smaller for declines in the death rate (see Table 2).

TABLE 3. DIRECT AND INDIRECT EFFECTS OF OUT-MIGRATION, DECLINES IN THE CRUDE DEATH RATE, DECLINES IN THE CRUDE BIRTH RATE AND NATURAL INCREASE, RURAL ENGLAND AND WALES AND RURAL SWEDEN*

	Dependent Variables							
	Net Migration		Decline in the Crude Death Rate		Decline in the Crude Birth Rate		Natural $Increase_t$	
Predicting Variables	England and Wales	Sweden	England and Wales	Sweden	England and Wales	Sweden	Rural England and Wales	Sweden
$Natural\ Increase_{t-20}$								
Direct	.74	.65	-.75	-.37	.03	.44	.57	.96
Indirect	-	-	.07	.21	-.56	.15	.25	-.60
Net Migration								
Direct	-	-	.10	.33	-.76	.23	-	-
Indirect	-	-	-	-	-	-	.57	.00
Decline in the Crude Death Rate								
Direct	-	-	-	-	-	-	.20	.60
Indirect	-	-	-	-	-	-	-	-
Decline in the Crude Birth Rate								
Direct	-	-	-	-	-	-	-.72	-.86
Indirect	-	-	-	-	-	-	-	-

*These effects were calculated by summing the products of the beta coefficients for the appropriate paths.

Mortality, therefore, plays a greater role in Sweden during the period under consideration and, once begun, declines in the rate of natural increase and the birth rate occured much more rapidly in England and Wales (see Table 1). This suggests two quite different transition experiences.

When used for sub-periods within the demographic transition the model will enable us to identify the different phases of population growth. There will be periods when changes in natural increase are occurring primarily because of declines in the death rate and other periods when the changes in natural increases are occuring primarily because of declines in the birth rate. The relative size of the path coefficients from these variables to natural increase will indicate which variable is dominating a particular period. If, as suggested by Mosher (1978), comparable time periods are identified for other nations, it may be possible to identify a set of transition types based on the relative effects of these variables.

Conclusion

In conclusion, we would like to reconsider the three aspects of our model noted in the introduction.

1) Refinement of the Causal Paths Underlying the out-Migration Hypothesis.

The difference between zero-order and partial relationships is most apparent for the effects of out-migration on declines in the death rate for the case of England and Wales. There we found a negative relationship in the zero-order analysis that did not remain in the multivariate context. Other differences were found between zero-order and partial relationships. However, more important than the difference between zero-order and partial relationships found in these two cases studies is that the model presented allows the examination of such differences.

2) The Effects of Out-Migration and Natural Increase on Declines in the Death Rate.

The empirical analysis confirmed the portion of the model that hypothesized that out-migration would be positively related to declines in the rural death rate. For Sweden the effects on natural increase of out-migration through declines in the death rate were about equal to the effects through declines in the birth rate. This finding underscores the need to consider the effects on the death rate when discussing the relationship between the out-migration and natural increase.

We found in both cases that natural increase was negatively related to declines in the death rate. These findings are consistent, but only partly, with Malthusian theory. The qualification is necessary because whenever the death rate increased, the following decade it decreased or remained unchanged (see Table 1). Thus the Malthusian expectation that rising death rates bring a halt to natural increase never occurred.

3) The Relative Importance of Declines in the Birth Rate and Declines in the Death Rate in Causing Changes in Natural Increase.

In both cases our analysis revealed that declines in the birth rate were more important than declines in the death rate in determining variance in the rate of natural increase. The greater importance of declines in the birth rate is particularly striking in the case of England and Wales. The difference between Sweden and England and Wales is greater for declines in the death rate — England and Wales having less variance — than for declines in the birth rate — England and Wales having more variance. Cases where the declines in the death rate have greater variance than declines in the crude birth rate are possible. Given a representative sample of demographic transitions, our model is suitable for addressing the issue of which is more general: transitions in which the variance of declines in the birth rate is greater or transitions in which the variance of declines in the death rate is greater. With the addition of more variables affecting declines in the birth rate and declines in the death rate the model would allow analysis of the factors that cause birth rate declines or death rate declines to dominate changes in the natural growth rate.

We think this model is a step toward improving our understanding of the interrelationships among out-migration, declines in the birth rate, declines in the death rate and changes in natural increase during the demographic transition. It may help to specify the different contexts in which the demographic transition may occur, and the role that migration may play in these contexts. At present, we must conclude that the out-migration hypothesis is too narrow to account for the range of possibilities. Our analysis suggests that in one context out-migration was an alternative, while in the other it was a complement to fertility declines. Further studies, explicitly building in socioeconomic variables to more clearly delineate the concept of population pressure, will help to specify the range and relative frequency of occurrence of these different contexts. This may prove especially fruitful for the analysis of currently developing countries.

Footnotes

1. The correlation between changes in the crude birth rate and changes in the general fertility rate is 0.94. The discrepancy between the two may reflect effects of changing age and sex structure, as suggested by Mosher (1978). Since the general fertility rate can also be affected by age and sex or sex structure changes, the total effect is somewhat larger than this discrepancy suggests. Nevertheless, it can be safely concluded that the effect is small.
2. We do not present inferential tests of significance because we are not using a sample to make inferences about a population. These correlations and the later regression coefficients represent the "true" relationships for these countries during the time period under consideration, bearing in mind the possibility of measurement error.
3. The same caveats about the effects of selectivity of migration on fertility also apply to the relationship with mortality. Extremely selective and extensive out-migration might actually have a negative impact on declines in the crude death rate. Again, however, we feel this possible effect is of secondary importance.

4. Guest presents a thorough treatment of this use of standardized path coefficients for decomposing the relative importance of the components of a variable in explaining its variance (Guest, 1974). Basically, the regression of a variable on its components yields an R^2 equal to 1.0, regression coefficients equal to 1.0 and beta coefficients which indicate the relative importance of the components in causing variance in the variables being decomposed.

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Received February, 1980; revised December, 1981.