Demographic Differentials in the World System: A Research Note

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World system theory posits major structural differences between nations that are continually recreated and highly resistant to change. Wallerstein, Galtung, Frank, and others argue that development of nations on the periphery is suppressed because those nations occupy subordinate positions in the world division of labor. World system theory does not deal explicitly with demographic processes; yet it is clear that high population growth rates have been impeding the further development of late-developing countries. If world system status actually does govern the character and speed of national development, then its relationship with fertility and mortality ought to be investigated.

One possibility is that a nation's position in the world economic system determines its level of development, and the latter determines its vital rates. In this case, system status would affect vital rates only indirectly, and these vital rates would have a separate feedback effect on development. However, a key claim of world system theory is that development outside the core of the world economy has been basically different from that which has occurred within the core. This raises another possibility: that development effects on fertility and mortality may be attenuated outside the core. Vital rates may not decline in association with development in non-core countries as they apparently did in core countries, a pattern which could be attributed to the persistence of mass poverty in non-core nations well after the occurrence of substantial development. Therefore, fertility and mortality rates would be higher in periphery nations than would be expected on the basis of levels of development in those nations. After controlling for level of development, vital rates would be highest in periphery nations, at intermediate levels in semi-periphery nations, and lowest in core nations. We report results of initial tests of that hypothesis in this paper, as a first step in our continuing research on demographic aspects of world stratification.

Methods

Data on demographic variables and development, for 92 nations in two time periods, were obtained from tables compiled by the World Bank. The data covered nations over the full ranges of development and demographic levels. Dependent variables included average annual population growth rates (1960–70 and 1970–77), crude birth and crude death rates, child mortality rates (ages 1–4), and life expectancies at birth (all 1970 and circa 1977). Total fertility rates also were obtained for the 92 nations, but they were available for sufficient cases only for the circa 1977 period. Energy consumption per capita, measured at 1960 and 1970, was used to indicate level of development.

The individual dependent variables were regressed on logged values of energy consumption to control for development effects on demographic rates. Higher order terms (squared, cubed, etc.) were introduced sequentially as independent variables in the regression equations, until no significant (.05 critical level) increment in explained variance resulted from entering the next higher power of logged energy consumption. We thereby identified the best fitting functions of energy consumption before turning our attention to the residual impacts of world system status. Fitting curvilinear functions was theoretically appropriate, since it is reasonable to assume that vital rates decline curvilinearly, from an upper plateau to a near-replacement-level floor, as development proceeds. As our reported results will show, high coefficients of determination were obtained from regressing the dependent variables on energy consumption power terms.

Results of Snyder's and Kick's network analysis of international interactions were used to assign each nation to either the core, semiperiphery, or periphery of the world system.[1] We entered dummy variables for status, with core status as the suppressed category, into the best fitting regression equations to determine whether system status had the hypothesized effects, net of development. After reviewing those test results, we conducted more stringent tests of hypotheses concerning status effects on fertility. Child mortality rates were entered as a control variable, along with the development controls, in the crude birth rate and total fertility rate equations.

Results

Results of the first stage of the analysis are given in Table 1. Regression coefficients, coefficients of determination, and significance levels are reported for the regression of each dependent variable in each time period on the lagged development controls, world system status, and development–

status interactions. The number of logged energy consumption per capita power terms fitted into a given equation can be discerned from the number of regression coefficients reported in the table. Some of the interaction terms between first order logged energy consumption and statuses were significant and were included as controls in the regressions reported in the second column under each dependent variable. We interpreted the significant interaction terms as controls because they reflect status differences in slopes of dependent variables on development, or, in other words, curvilinearity in development effects that was not picked up by the power terms.[2] Fully controlling for development effects before examining residual status effects required controlling for significant interaction terms. To test our hypotheses, we focused on the significance and rank-ordering of status dummy regression coefficients and the significance of additions to R-square resulting from the entry of the status dummies.

The first dependent variable to consider is average annual population growth rates. In both 1960–70 and 1970–77, semi-periphery and periphery rates were higher than core rates, controlling for development. Periphery growth rates were only slightly higher (or lower, controlling for significant interactions in the first period) than semi-periphery rates. Their differences from the core, about 1 percent per year in the two equations without interaction terms, were large. In the earlier period, status alone contributed to 10.6 percent to the coefficient of determination, but its contribution fell by one-half, to 5.3 percent, in the second period. Total explained variance rose by about 8 percent between the periods, implying that development effects became stronger and status effects weaker over time.

Analyses of fertility and mortality measures are more pertinent to the inquiry because they indicate the sources of status effects on population growth rates. Tests based on fertility measures strongly confirmed our hypotheses. All six of the estimated fertility equations (crude birth rates in both periods and total fertility rates in the second period, with and without interaction effects) contained significant regression coefficients for status that were appropriately rank-ordered. Those effects persisted even after development controls accounted for 70 percent or more of the variances in the dependent variables. Again, the differences between the periphery and the semi-periphery were smaller than those between the latter and the core. Nevertheless, non-core status in the world system was associated with fertility levels higher than development levels alone would predict, and a smaller but persistent difference between non-core statuses also existed. We conducted additional tests of the fertility hypotheses using conventional measures of national dependency in the world economy, instead of status in the world system. Using total fertility rates as the dependent variable and trade as a percent of GNP, commodity concentration, concentration of export receivers, and exports as a percent of GNP as al-

Table 1. VITAL RATES REGRESSED ON THE BEST-FITTING DEVELOPMENT POLYNOMIAL AND STATUS IN THE WORLD ECONOMY (N=92)

	Population G.R. 1960-70		Crude Birth Rate 1970		Crude Death Rate 1970	
Intercept	.581ns[b]	-5.665*	59.910**	7.442ns	18.716**	-2.539ns
LogENCPC	.791ns	3.509*	-63.069ns	-38.907ns	15.281ns	19.839*
LogENCPC^2	-.203ns	-.453*	60.189ns	50.290ns	-11.975**	-8.993ns
LogENCPC^3			-23.292*	-18.347ns	1.951**	1.234ns
LogENCPC^4			2.914*	2.100ns		
Semiperiphery	1.139***	7.449***	9.477***	56.646*	-.596ns	10.916ns
Periphery	1.242***	6.709**	11.668***	61.433**	.287ns	22.702ns
SP x LogENCPC		-2.088**		-15.572*		-3.485ns
P x LogENCPC		-1.780*		-16.717*		-8.010ns
R-SQ change status	.106***		.050***		.003ns	
R-SQ change interactions[a]		.065**		.010ns		.019ns
Multiple R-square	.422***	.487***	.813***	.823***	.706***	.725***
	Population G.R. 1970-77		**Crude Birth Rate 1977**		**Crude Death Rate 1977**	
Intercept	8.060ns	2.309ns	42.609***	-36.000ns	37.203***	12.007ns
LogENCPC	-16.576ns	-12.166ns	.223	34.226*	-13.291***	-.813ns
LogENCPC^2	13.284ns	10.888ns	-2.172ns	-5.630**	1.586*	.078ns
LogENCPC^3	-4.173ns	-3.371ns				
LogENCPC^4	.444ns	.347ns				
Semiperiphery	.955**	4.837ns	7.778**	62.918**	-2.366ns	7.103ns
Periphery	1.015**	5.335ns	10.620***	75.205**	-.928ns	18.980ns
SP x LogENCPC		-1.157ns		-16.087*		-2.497ns
P x LogENCPC		-1.326ns		-19.920**		-6.514ns
R-SQ change status	.053**		.034**		.020ns	
R-SQ change interactions		.008ns		.020*		.025ns
Multiple R-square	.564***	.574***	.771***	.790***	.561***	.586***

Key: LogENCPC is logged value of 1960 or 1970 energy consumption per capita in kilograms coal equivalent. The superscripts indicate powers of LogENCPC - squared, cubed, and quartic; Status dummy variables are derived from Snyder and Kick. Core status is the suppressed category, with which periphery and semi-periphery are contrasted; SP x LogENC and P x LogENC are multiplicative development-status interaction terms.

[a] None of the power term interactions were significant.

[b] ns=nonsignificant.

*=.05; **=.01; ***=.001 significance.

Child Mortality 1970		Life Expectancy 1970		Total Fertility Rate 1977	
10.001ns	-37.286ns	66.685***	102.852***	5.479***	-6.066ns
42.717*	48.986*	-45.948**	-45.384*	.500ns	5.472*
-27.591**	-18.740ns	28.229***	18.394*	-.419ns	-.903**
4.150**	2.242ns	-4.157***	-2.265ns		
2.622ns	35.286ns	-4.083ns	-38.819*	1.089*	9.692*
5.899*	58.227*	-5.451*	-48.874*	1.324**	10.859**
	-10.245ns		11.283ns		-2.526*
	-18.428*		14.933*		-2.918*
.014ns		.012ns		.025*	
	.016ns		.009ns		.020*
.760***	.776***	.821***	.830***	.719***	.739***

Child Mortality 1977		Life Expectancy 1977		Total Fertility Rate 1977c	
41.547***	4.577ns	75.963***	102.328***	-1.103ns	-6.465ns
-11.364***	-1.008ns	-49.307ns	-53.605ns	9.392ns	7.270ns
		26.083	22.566ns	-4.183*	-1.846ns
		-3.485*	-2.750ns	.498ns	.131ns
-.891ns	25.611ns	-3.073ns	-18.985ns	1.252**	8.537ns
3.032ns	44.746*	-4.994*	-33.616ns	1.412**	9.763*
	-6.595ns		4.416ns		-2.168ns
	-12.491*		9.285ns		-2.585ns
.017ns		.011ns		.030*	
	.028*		.008ns		.009ns
.694***	.721***	.770***	.778***	.730***	.740***

[c] Log ENCPC^3 is included to adjust for interaction though it did not significantly increase the explained variance.

ternative dependency indicators, we found in each test that degree of dependency was positively related to fertility, after development was controlled.[3]

Tests based on mortality measures (crude death rates, child mortality rates, and life expectancies), however, disconfirmed our hypotheses. In only one of the twelve equations (life expectancy in 1970) were the status coefficients significant, and that relationship had disappeared by 1977. Most likely, the moderate status effects on population growth rates resulted from the absence of mortality effects combined with strong status effects on fertility, although the discrepancies in time periods and lack of migration data preclude a definite conclusion.

We analyzed the fertility measures further by adding child mortality rates as a control before examining the residual status effects. Those results are reported in Table 2. Researchers agree that infant and child mortality (which are highly correlated) are positively related to fertility and can be considered determinants of fertility. The regression coefficients and additions to R-square listed in the first column under each dependent variable in the table show strong positive child mortality effects, independent of development. Results in the second columns reflect persisting status effects even after the controls had accounted for around 80 percent of the variances in the fertility measures. Differences between core and non-core fertility could not be attributed to either development or child mortality rate differences, but the periphery and semi-periphery had substantially equal fertility after the application of controls.[4]

Conclusions

Non-core status in the world economic system was associated with higher fertility and population growth rates than would be expected based on levels of national development and, in the case of fertility, child mortality. Mortality levels were not similarly affected. Differences between periphery and semi-periphery were not completely in line with expectations, either. Although the fertility relationships were very strong, the overall pattern of relationships called into question the causal argument on which the hypotheses were grounded. If continuing mass poverty in non-core nations, particularly in periphery nations, caused higher non-core fertility, then why did it not cause a fertility gap between the periphery and semi-periphery, and why did it not affect mortality? We concluded that the fertility relationship detected by our analysis still needs to be explained in more complete or accurate causal terms. Perhaps the lag in the effect of development on fertility is longer than that in the development–mortality relationship, so that the apparent status effects on fertility actually reflected the incompleteness of fertility's response to development. The theory of the

Table 2. 1970 CRUDE BIRTH RATE AND 1977 CRUDE BIRTH RATE AND TOTAL FERTILITY RATE REGRESSED ON BEST-FITTING DEVELOPMENT POLYNOMIAL, CHILD MORTALITY RATE, AND STATUS IN THE WORLD ECONOMY (N=92)

	Crude Birth Rate 1970		Crude Birth Rate 1977		Total Fertility Rate 1977	
Intercept	67.072***	53.179**	7.908ns	9.250ns	.614ns	.849ns
LogENCPC	-96.664*	-79.229ns	21.215***	12.683*	3.430***	2.292*
$LogENCPC^2$	84.421*	70.249*	-5.300***	-3.216**	-.838***	-.564**
$LogENCPC^3$	-28.734**	-24.433*				
$LogENCPC^4$	3.233**	2.835**				
Child mortality[a]	.506***	.447***	.718***	.692***	.097***	.096***
Semiperiphery		8.318***		7.312***		1.025**
Periphery		9.047***		7.438**		.883*
R-SQ change child mortality	.071***		.115***		.100***	
R-SQ change[b] status		.031***		.019**		.017*
Multiple R-square	.834***	.865***	.852***	.871***	.793***	.810***

[a]Child mortality is coterminous with the dependent variables. Nonsubstantive differences are obtained when lagged child mortality is introduced as a regressor.

[b]Interactions with development were nonsignificant and are not reported.

demographic transition posits that, as a consequence of societal development, mortality falls more rapidly than fertility. It follows that one could attribute the positive periphery and semi-periphery regression coefficients to the demographic transition of non-core countries. In our continuing research, we will address that possibility by analyzing world system status effects on relationships between change in development, child mortality, and fertility. We also plan to test other possible explanations of distortion in the development–fertility relationship. One promising hypothesis is Caldwell's. He theorizes that high fertility in developing countries is attributable to the political economy of the persisting traditional family. From this view, the fertility differentials we have observed may result not from penetration by world economic forces but, rather, from the opposite. To the extent that patriarchal family patterns remain intact, high fertility may continue despite economic and technological advances.

Notes

1. The authors will provide requestors additional information concerning the data on world system status.
2. This interpretation of interaction terms was borne out by regression results in which nonsignificant development power terms were added and interaction terms became nonsignificant (see last column lower panel Table 1). Negative interaction effects indicate that units of development produce steeper declines in fertility in the non-core than in the core reference category. This is consistent with the notion that the transition of fertility has been completed in the core and is still occurring in the non-core.
3. Detailed results of these and other tests not reported here will be mailed to requestors.
4. Zero-order relationships between all demographic rates and system status were strong and in the expected direction. Changes in, or disappearance of relationships after applying controls were due to the effects of control variables.

References

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