BUSINESS AND BABIES: THE INFLUENCE OF BUSINESS CYCLES ON BIRTH RATES

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The recent economic recession has revived interest in the effects of economic fluctuations on birth rates. Both in popular thinking and in the scholarly literature it is assumed that the low birth and marriage rates of the 1930s were attributable to the great depression. Correspondingly, the continuing marriage and baby boom of the past decade is commonly thought to reflect the prosperity of the postwar years. There have been predictions that the 1957-58 recession would be followed by a significant recession in births.(1)

While there has been general awareness that vital events are influenced by economic conditions, there have been relatively few published studies that apply statistical measurement to this relationship. There have been excellent reasons for this, both in the defects of the basic data and in the methodological problems of measurement. The basic data are now improved, but the problems of measuring and interpreting the degree of covariance between economic data and vital statistics have not been entirely resolved. Among the more serious of these problems is serial or auto-correlation in time series, an influence that tends to exaggerate the apparent covariance.

Studies by Thomas, and particularly the well-known paper by Galbraith and Thomas(2), attempt to avoid this error by using trend deviations rather than absolutes in analysis of the relation between business cycles and births. Using trend deviations these authors found a correlation of .80 between the Bureau of Labor's suggested index of factory employment and total births for the years 1919-1937, with births lagged one year. The authors state their conclusion that

> "Marriages are 'controlled' during depressions, and, within marriages, births of all orders are likewise controlled. Since birth rates of higher orders are overweighted with births to the lower income, occupational, and educational classes, it is clear that the birth control movement has penetrated deep into the social structure during the past two decades.(3)

The present paper will: (1) summarize the application of similar methods to annual data in the entire period since World War I,(4) and (2) extend the analysis to monthly and quarterly data using both correlation and reference cycle techniques.

Correlation Analysis

The present study correlates trend deviations of economic measures (as independent variables) to measures of nuptiality and natality (as dependent variables). This method greatly reduces the serial correlation that often inflates the apparent covariance in time series, for example, when this covariance is measured by absolutes, by annual percent change, or by deviations from moving averages.(5)

For the test of the relationship between vital rates and business activity by the conventional correlation technique, three economic indicators are used: (a) real per capita personal income, (b) the Federal Reserve Board's index of industrial production and (c) non-agricultural employment. Each of these has been related for the period 1920-58 (omitting years most directly affected by World War II) with measures of nuptiality and natality, i.e., marriages per 1000 unmarried women 15 to 44 years of age and births per 1000 women 15 to 44. The use of these data reduces the variability resulting from changes in the age structure of the population. The relation between economic fluctuations, nuptiality and natality are shown in Chart 1. In this chart per capita income in constant dollars is used as representative of the economic indicators.

It will be noted that since World War I the three variables have had quite different trends, indicated by the three dissimilar lines plotted on Chart 1.

1. Economic Activity. There have been wide fluctuations around a strong upward historical trend of growth, which for personal income has averaged over 2% per year. Personal income, and indeed most indices of economic activity, were far below this historical trend throughout the decade 1930-1940, far above it during the war years, and close to the historical

REAL PER CAPITA PERSONAL INCOME, NUPTIALITY & FERTILITY AND RESPECTIVE TRENDS ... 1920-1958

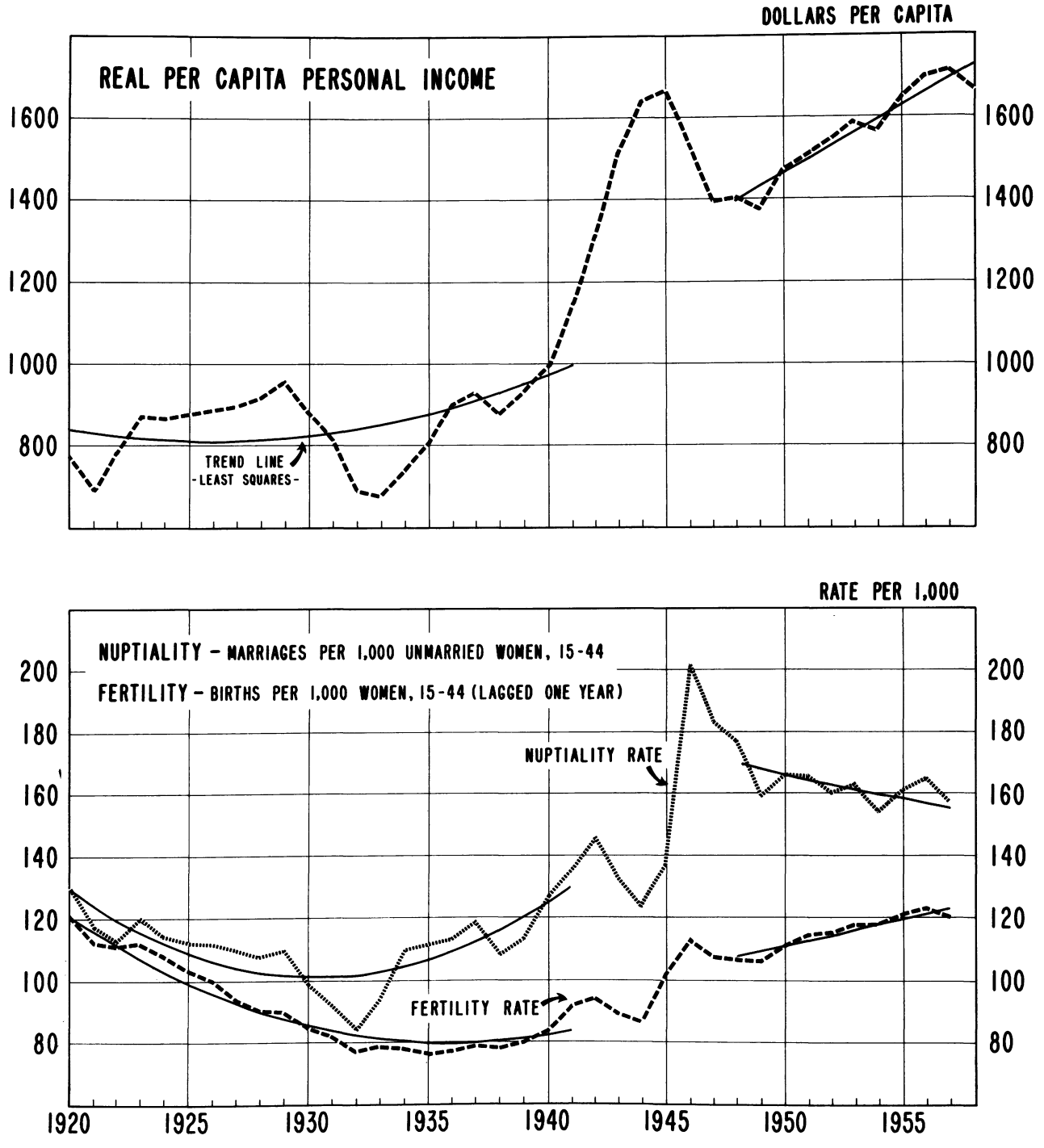

CHART I

trend during the 1920s and since World War II.

2. Nuptiality. Marriage rates were drifting downward in the 1920s, and experienced a very sharp dip in the worst depression years, followed by a recovery so strong that by 1940 "postponed" marriages had effectively been made up. This is evidenced by the fact that the proportions of women married at each age in 1940, at the end of the depression decade, were very similar to the proportions in 1930 at the end of a decade of prosperity. In the years 1940-1946, marriage rates were of course sharply influenced by the threat and fact of the draft, the outbreak of war, mass conscription, and finally postwar demobilization. Since World War II nuptiality has drifted downward but has remained at much higher levels than before the war. The higher birth rates of the postwar period are attributable in part to the higher proportions married.(6)

3. Natality. The plotted fertility rates shown on Chart 1 basically describe a shallow U-shaped curve, somewhat distorted by events connected with World War II. There is less year-to-year variability than in the economic indices or in nuptiality.

It will be evident that there is only general correspondence between the major trends of the three variables. The downward trend of nuptiality and fertility is usually interpreted as a reflection of the spread of voluntary control of family size among progressively larger segments of the population. The downward drift of fertility was accentuated, but not drastically, by the headlong economic decline of the early '30s. At its low point in 1933 the fertility rate was only 14% below its 1930 level, a year which reflected the peak prosperity and employment conditions of 1929. During the preceding three years, 1927-1930, reflecting a period of economic prosperity, the decline in fertility had been 10%, suggesting on this rough basis of comparison that the depression brought about a decline of only 4% more than otherwise would have occurred. After 1933 the historical decline of fertility was checked and stabilized so that fertility was higher than would have been expected with the continuation of pre-depression trends.

It would be unreasonable to argue from these major trends that the prosperity of the 1920s "caused" the fertility declines of that period and that the depression brought about the end of this decline in the 1930s. But conversely the pattern of major trends does not support the belief that the depression "caused" the low birth rates of the 1930s. While it is true that marriage and birth rates were relatively low in the depression years and relatively high in the years of prosperity, there is no clear indication of causal relationship, so far as the major trends are concerned.

The statistical measurements of covariation employed in this study require the removal of secular trends and the measurement of deviations from these trends. The precise definition of trends inevitably involves arbitrary elements. For present purposes least squares lines were fitted for all series, in each case parabolas for the data for the period 1920-1941 (1921-1942 for the birth rates) and linear least squares lines for the postwar materials. The trend lines are plotted in Chart 1 and the results of correlation analysis are shown in the first column of Table I.

The possible effects of using different trend lines were tested by computing a set of correlation coefficients based on deviations from assumed historical geometric rates of growth for income (2.3 per cent per year) and industrial production (3.9 percent), the measure of employment being represented by unemployment as a percent of the civilian labor force. The results are shown for comparative purposes in Table I. The two sets of correlations are generally consistent, and in some instances identical, giving confidence that the particular method of determining trend is not a decisive factor in the results.

The correlation data suggest the following generalizations:

1. There is a high degree of correlation between year-to-year fluctuations in economic indicators, in nuptiality and in fertility.

2. The relationship between the economic indicators and fertility was very stable for the interwar period, with no important difference where different independent variables or trend lines were employed. Not unexpectedly the coefficients in this series approximate the figure of .80 obtained by Galbraith and

TABLE I

CORRELATIONS OF PERCENTAGE DEVIATIONS FROM TRENDS OF FERTILITY, NUPTIALITY AND ECONOMIC INDICES

Period	Independent Variable	Dependent Variable	Correlation Coefficient[a/] Method I	Method II
1920-41	Per capita income	Fertility[b/]	.77	.74
	Industrial production	"	.76	.73
	Employment[c/]	"	.76	-.73
	Per capita income	Nuptiality	.68	.76
	Industrial production	"	.76	.74
	Employment[c/]	"	.72	-.72
1948-57[d/]	Per capita income	Fertility[b/]	.66*	.86
	Industrial production	"	.78	.79
	Employment[c/]	"	.57**	-.65*
	Per capita income	Nuptiality	.79	.79
	Industrial production	"	.66*	.66*
	Employment[c/]	"	.63*	-.45***
1920-41	Nuptiality	Fertility[b/]	.55	.49*
1948-57	"	"	.41***	.30***

*, **, Significant at .05, .10 level respectively.*** Not statistically significant. Unless otherwise indicated all values significant at .01 level.

a/ Methods as described in text. b/ Lagged one year. c/ For Method II, unemployment as percent of civilian labor force. d/ 1947-1956 for Method II.

Thomas for their series (using somewhat different variables) in the period 1917-1937.

3. The relationship between economic indicators and nuptiality for the interwar period is also quite stable, with a range of coefficients from .68 to .76. The results give confidence that the method of determining the trend lines is not a decisive factor in the measurements of the interrelationship in the interwar years.

4. There is much greater variability in the coefficients for the past decade, perhaps owing to the shorter series and lower statistical reliability of the results. The selection of years in this shorter series makes a significant difference in the results. There is some suggestion that the relation of employment or unemployment to nuptiality and fertility is lower in the postwar than in the interwar period. This is a result to be expected in view of the fact that even during postwar recessions a relatively small part of the total population was directly affected by unemployment per se. Otherwise, the relationships seem to be of the same general order of magnitude as in the interwar period. The coefficients of correlation between nuptiality and fertility are the lowest in the series, both for the interwar and the postwar series.

Partial and multiple correlation analysis for the interwar period is presented in Table II. The results suggest that when the economic variables are held constant there is effectively no correlation between nuptiality and fertility. In other words, the data imply that the influence of nuptiality on trend deviations in fertility is a secondary effect of economic fluctuations.

The correlations between economic indicators and fertility (i.e. .76-.77) in the interwar period suggest that the economic indicators explain some 58-59% of the variance in fertility series. These data combined with the simple correlation between nuptiality and fertility (.55, Table I) suggest that about 30 per cent or roughly one half is exercised through nuptiality and the remainder

TABLE II

PARTIAL AND MULTIPLE CORRELATIONS FOR TREND DEVIATIONS, 1920-1941[a/]

Variable	Correlation Coefficient
	Partial
Nuptiality Constant	
Per Capita Income & Fertility	.65
Industrial Prod. & "	.64
Employment & "	.62
Per Capita Income Constant	
Fertility & Nuptiality	-.06*
Industrial Production Constant	
Fertility & Nuptiality	-.08*
Employment Constant	
Fertility & Nuptiality	.004*
	Multiple
Fertility & Nuptiality with	
Per Capita Income	.77
Industrial Production	.76
Employment	.76

* Not statistically significant.
a/ Fertility lagged one year throughout.

TABLE III

CORRELATIONS FOR TREND DEVIATIONS 1947 QUARTER 3 THROUGH 1958 QUARTER 3[a/]

Variables		Coefficient
Independent	Dependent	
Per Capita Total Personal Income	Fertility	.48
	Nuptiality	.58
Per Capita Disposable Income	Fertility	.33*
	Nuptiality	.54
Index of Industrial Production	Fertility	.59
	Nuptiality	.66
Unemployment as Percent of Civilian Labor Force	Fertility	-.43
	Nuptiality	-.45
Nuptiality	Fertility	.42

* Significant at .05 level. Unless otherwise indicated all values significant at .01 level.

a/Data seasonally adjusted, by quarter, with fertility lagged nine months.

through the direct influence of economic conditions on fertility.

The coefficients for the postwar period (not shown) are of questionable significance, but indicate a somewhat lower level of influence of economic conditions, especially employment, than for the interwar period.

A final step in the correlation analysis was to apply it to monthly and quarterly data. Because of the difficulty of obtaining a monthly seasonally adjusted series of nuptiality rates, correlation coefficients were computed based on seasonally adjusted data by quarters. As in the case of the annual data, linear least squares lines were assumed to represent the secular trend, in this case for the period from the third quarter of 1947 through the third quarter of 1958. Correlations of percent deviations from these trends, in which fertility rates were matched with the economic indicators and nuptiality nine months earlier, are presented in Table III.

The coefficients are generally lower than for the annual data. The highest relationship was found with the index of industrial production, which tends to support the hypothesis suggested earlier in this paper that in a prosperous era, the general economic climate may influence fertility more than specific factors such as employment. It is interesting that the coefficients for nuptiality are higher than those for fertility, indicating that marriages may well be more immediately responsive to changes in economic conditions than births. The computed line of regression indicates positive conformity to changes in the economic variable, in the ratio of one to five for fertility rates and about three to five for nuptiality rates with the index of industrial production.

The above figures relate to aggregate and period data. The aggregate fertility index used, for example, masks divergent secular trends in the rates for the several parities, as shown in Chart 2.(7)

It will be noted that the parity rate for first births was first to turn upward from the long secular decline that culminated in the low fertility of the thirties. The upturns of parity rates

REAL PER CAPITA PERSONAL INCOME, NUPTIALITY RATES & GENERAL FERTILITY RATES BY 1ST, 2ND, 3RD AND HIGHER ORDER PARITY

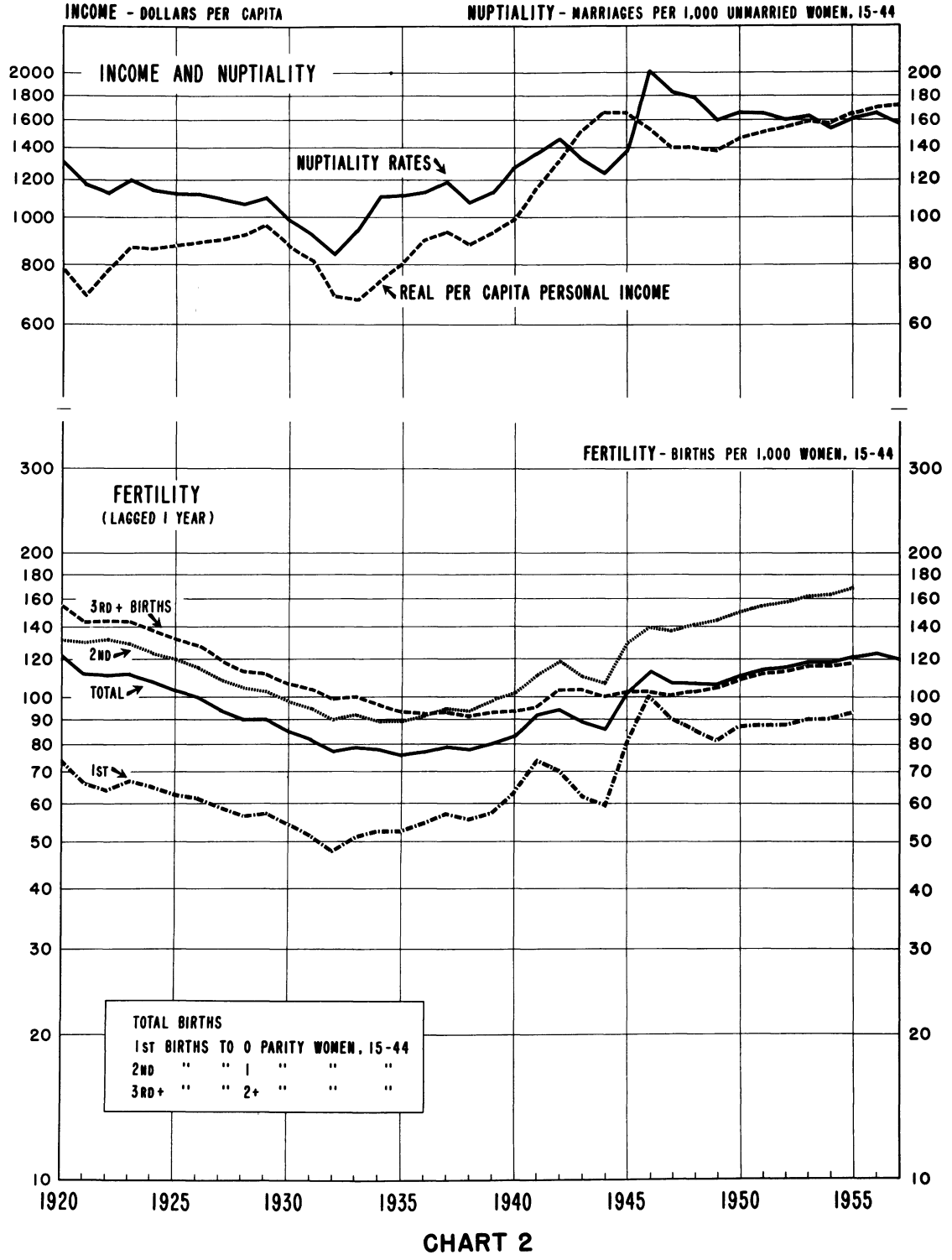

CHART 2

for first and second births were harbingers of the general rise of fertility in the postwar period. The parity rate for third and higher orders continued to decline through the decade, reaching its lowest point in 1939. This sequence would be expected with the continuing spread of family limitation to larger segments of the population and the reduction in the number of larger families.

It will be observed in Chart 2 that variability in parity rates for first births, and to a less extent second births, are chiefly responsible for the year-to-year fluctuations in general fertility, and it is clear that these are closely associated with the incidence of marriage. The aggregate rates for the third and higher orders of births to women having two or more children show little year-to-year variability. When the more immediate influence of marriage is removed, as in parity rates for higher orders of births, there is a clear secular trend, modified only slightly in its annual variations by economic fluctuations, and even by World War II.

Reference Cycle Analysis

The correlation analysis used in the preceding section of this report has important methodological weaknesses as a basis for statistical inference. As noted above the fitting of trend lines inevitably is arbitrary and may well produce vagaries in the results. The postwar period is too short to justify drawing firm conclusions from correlation data. Finally correlation techniques do not adequately measure the influence of critical turning points in cyclical behavior.

An alternative method is the so-called "reference cycle" approach developed by the National Bureau of Economic Research.(8) It has the advantage that it does not depend upon any specific economic series but involves an examination of the degree and direction of movement of the dependent variable at crucial reference dates pre-determined by the Bureau to represent the turning points of cycles of economic activity. Besides affording various measures of the cyclical behavior of the series under consideration, the technique yields an index of conformity to reference cycles analogous to the coefficient of correlation.

The use of short-term data is an essential aspect of the reference cycle approach. In the absence of a monthly series of fertility rates, the crude birth rate (i.e., births per 1000 population) by months since 1919, seasonally adjusted and corrected for under-registration, was employed.

A striking feature of the birth rate series is the absence of cyclical pattern. The birth rate fluctuates within a relatively narrow range around its secular trend and without the marked peaks and troughs that characterize the measures of economic activity.(See Chart 3).

The National Bureau of Economic Research has identified eight business or reference cycles in the period from the trough of March 1919 to the trough of April 1958. For comparative purposes the birth rate series was also divided into eight groups, each one starting and end-ind nine months after the initial and terminal troughs of the reference cycles. Table IV presents the dates of each cycle and the average birth rate during the period concerned.

TABLE IV

AVERAGE BIRTH RATES
DURING SPECIFIED BUSINESS CYCLES

Cycle	Month and Year		Average
	Initial Trough	Peak	Birth Rate
1	12/19	10/20	27.8
2	4/22	2/24	26.0
3	4/25	7/27	23.8
4	8/28	5/30	20.3
5	12/33	2/38	18.8
	War Years Omitted		
6	7/46	8/49	25.4
7	7/50	4/54	25.0
8	5/55	4/58	24.9

The reference cycle technique further involves the subdivision of each cycle into nine stages; stages I, V and IX are the initial trough, peak and terminal trough respectively; stages II, III and IV are the expansion phase divided into three equal segments; stages VI, VII and VIII are three contraction periods of equal duration. The monthly data during each cycle are reduced to nine values,

TABLE V

REFERENCE CYCLE DATA FOR BIRTH RATES, 1919-1958

Cycle[1]	Reference Cycle Relative at Initial Trough	Peak	Terminal Trough	Aver. Monthly Change in Ref. Cycle Relatives During Phase: Expansion	Contraction	Preceding Expansion	Succeeding Expansion (Sign)
1	104.7	97.1	92.8	-.76	-.24	.52	Negative
2	99.2	100.8	98.5	.07	-.16	-.23	Positive
3	107.7	98.6	92.0	-.34	-.51	-.17	Negative
4	108.0	105.6	92.4	-.11	-.31	-.20	"
5	99.6	102.3	100.0	.05	-.18	-.23	"
6	92.8	96.2	95.5	.09	-.06	-.15	"
7	97.1	100.1	99.0	.09	-.08	-.17	"
8	99.5	99.1	97.1	-.01	-.22	-.21	....
Av.	101.1	100.0	95.9	-.12	-.22	-.10	....
Av.Dev.	4.3	2.2	2.7				

Index of Conformity to Reference Cycle				
Expansions	0			
Contractions	...	100		
Cycles, Trough to Trough	...	...	75	
Cycles, Peak to Peak	...	...	...	71
Cycles, Both Ways	...	...	73	

1/ For dates, see Table I

one for each stage, to represent the average value per stage as a percent of the average value of the birth rate during the entire cycle.

On the basis of these nine percentage values per cycle (called reference-cycle relatives) it was found that for the eight cycles combined the crude birth rate rose by .2 percent per month from stage I to II, declined by .4 percent per month from II to III, showed no change to stage IV and again declined by .2 percent per month between stages IV and V. In the contraction phase, the monthly rate of change was .1, -.3, -.3 and -.2 percent respectively between successive stages V to IX. These figures indicate first the relatively minor intra-cycle variability of the crude birth rate, second, the tendency to decline from stage to stage, which is the result of the marked secular decline from the early 1920s to World War II.

As can be seen in Table V above, in four of the eight cycles, namely 2, 5, 6 and 7, the value of the birth rate at the business cycle peak exceeded its standing at the initial trough. During the contraction phase, the value at the terminal trough was always less than its level at the peak. In 7 of the 8 full cycles the average monthly rate of decline was greater during the contraction than the corresponding expansion phase. The algebraic signs yield indices of conformity to business cycles of 0, plus 100 and plus 75 respectively for the expansion, contraction and full cycle phases.

The index of conformity represents the percentage improvement over chance that the variable will move in accordance with fluctuations in business cycles.

According to the standards applied by the National Bureau of Economic Research, an index of conformity of more than 50 is indicative of close conformity.(9) The average index of conformity for birth rates, at 73, indicates a close relationship. But the index of conformity is computed from direction rather than

INDEX OF INDUSTRIAL PRODUCTION AND CRUDE BIRTH RATES FOR POST-WAR PERIOD

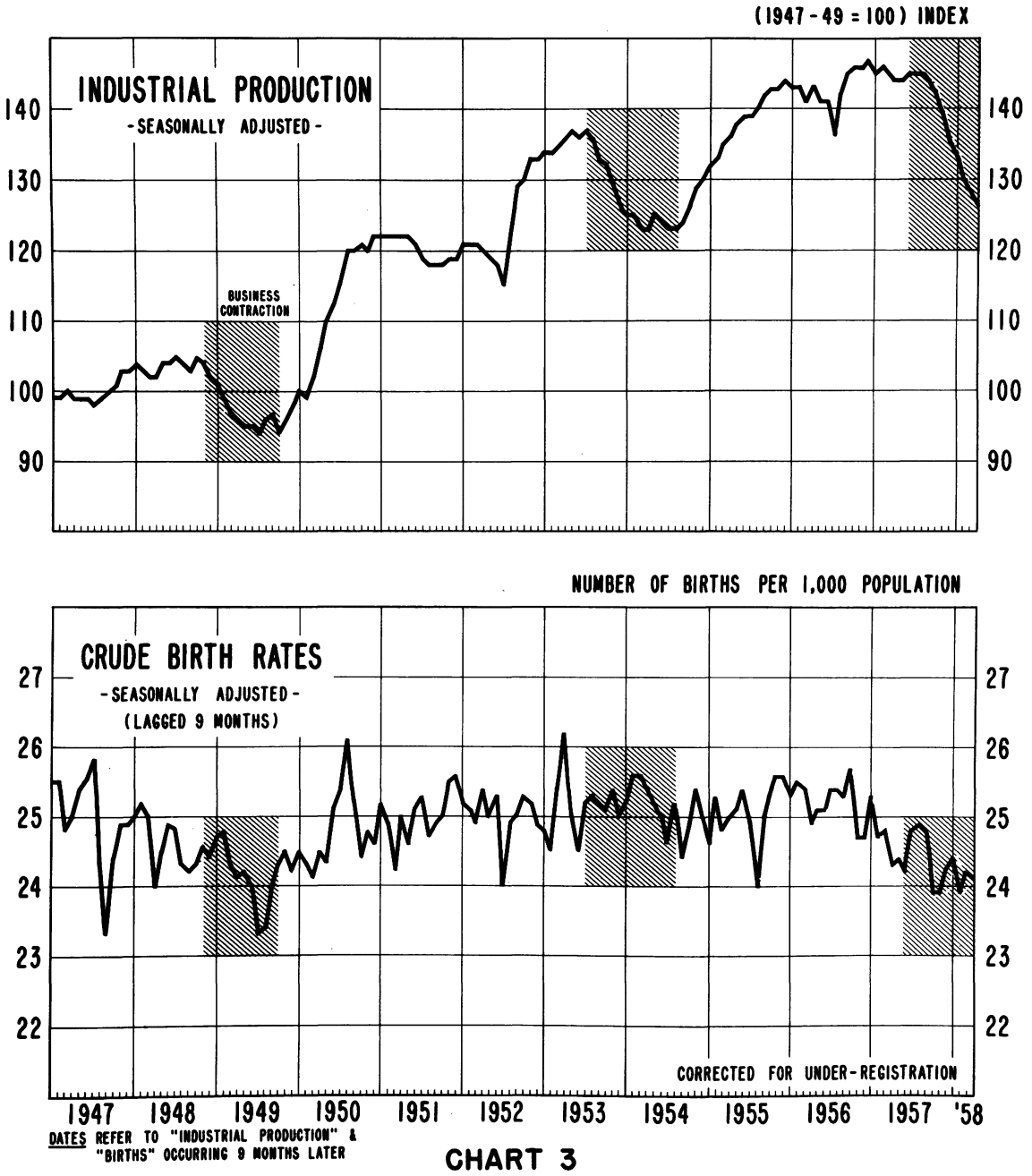

CHART 3

amount of change. As noted above the average amount of change in birth rates in concordance with phases of the business cycle is small.

The rather tenuous nature of the relationship is suggested by the postwar data shown in Chart 3. The birth rate was responsive to business contraction in 1949 and to the outbreak of the Korean War in 1950. It seems to have responded briefly but strongly to the dip in economic activity in mid-1952 but scarcely at all to the recession of 1953-54. Even the sharp business contraction of 1957-58 had had only mildly depressing effect on

the birth rate up to the end of 1958. In fact much of the drop in the birth rate reflected in lower 1958 figures apparently occurred as a result of a fall in the marriage rate antedating the onset of the recession. Much of the variability in the birth rate appears to be unrelated to economic cycles, and the birth rate has in any case fluctuated within narrow limits during the past decade.

Conclusions

In this study the influence of business cycles on natality has been examined with standard correlation and reference cycle techniques. At best these methods supply statistical inference and not direct measures of causality. Within this and other limitations the analysis suggests the following conclusions.

1. The level of natality (whether measured by crude birth rates or fertility rates) is chiefly determined by stable secular trends, and not by cyclical influences. These secular trends may well be quite independent of trends in economic activity. Thus the data of this study do not confirm the view that natality was low in the 1930s because of the depression.

2. Year-to-year fluctuations in natality are to a large extent a function of economic cycles. The results of this study confirm the generally held view that nuptiality and fertility respond sensitively to economic conditions. The correlation between fertility and the economic indices used in this study are high. They suggest that economic conditions control rather more than half of the annual variance of fertility from its secular trend, the degree of control varying relatively little with the economic index, the choice of trend and the period covered. A possible exception is the low correlation of employment and unemployment with fertility in the postwar period. The reference cycle analysis corroborates correlation analysis in that both show a substantial degree of covariance between business cycles and natality.

3. Monthly and quarterly data for natality are not as highly correlated with economic indices as are annual data and cyclical data used in reference cycle analysis.

4. While fertility responds sensitively to business cycles in its trend deviations, changes in economic conditions are not accompanied by changes in fertility of comparable magnitude. Thus over the whole period studied a trend deviation of 4 percent in real per capita income produced a trend deviation of only 1 percent in fertility. Thus sharp business contractions, such as the 1957-58 recession, may be expected to produce much smaller fluctuations in fertility. Quick judgments that there will be a major recession in births following on the recent business recession may well prove to be premature and lacking in perspective.

FOOTNOTES

(1) Population Reference Bureau, "Recession in Births?", Population Bulletin, vol.14, no.6, October 1958.

(2) Virginia L. Galbraith and Dorothy S. Thomas, "Birth Rates and the Interwar Business Cycles," Journal of the American Statistical Ass'n. Dec.1941, pp.465-476.

(3) Ibid., p.473.

(4) This section of the paper draws heavily from materials presented in a paper by Dudley Kirk, "The Influence of Business Cycles on Marriage and Birth Rates in the United States" in Proceedings of the Conference on the Interrelations of Demographic and Economic Change, December 5-7, 1958, being published by National Bureau of Economic Research.

(5) This problem is discussed at length in the above paper, footnote 4.

(6) Cf. Wilson H. Grabill, Clyde V. Kiser, and Pascal K. Whelpton, The Fertility of American Women, New York, John Wiley & Sons, 1958, pp.369-70.

(7) Fertility rates by parity for Chart 1 were kindly supplied by P.K.Whelpton and Arthur A. Campbell.

(8) Arthur F. Burns and Wesley C.Mitchell, Measuring Business Cycles, National Bureau of Economic Research, Studies in Business Cycles No.2, 1947.

(9) Burns & Mitchell, op.cit. p.123