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Cohort Size Effects on U.S. Enrollment Decisions*

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Abstract: Although considerable effort has been expended on measuring the returns to education in the U.S., and on modeling the individual decision-making process in human capital investment, surprisingly little work has been done in terms of attempts to forecast college enrollment rates in the U.S. population, despite the obvious need for such forecasts. In the relatively small subset of forecasting literature, cohort size variables tend to play a significant role, and one of the most successful models, in terms of forecasting accuracy, appears to be the work of Ahlburg, Crimmins and Easterlin (198l), which predicted an increase in enrollment rates throughout the 1980s when most other models were predicting a decline. It is important to re-assess these models now, since for the first time since the 1960s both enrollment rates and the size of the college-aged population appear to be on the rise. Although total enrollments for women increased substantially during the 1970s and 1980s, for males the large fluctuations in enrollment rates and in population size largely cancelled each other out, so that there was virtually no change in total enrollments over those two decades.

The purpose of this study has been to draw together this literature in a more unified framework where it is possible to compare seemingly different results and make use of the information they provide to develop an improved model. In doing so it has been possible not only to demonstrate that cohort size effects have indeed been significant over the past forty-five years, but also to explain the mechanism underlying these effects. Projections of enrollment rates made using an updated version of the Ahlburg-Crimmins-Easterlin model indicate that total enrollments of U.S. residents aged 18-24 may increase by 30% over the next decade, from the current 8.8 million to 11.4 million.

* This is a considerably revised and updated version of an earlier paper entitled “Cohort Size Effects on Enrollment Decisions”. A am very grateful for Dennis Ahlburg’s detailed comments on that earlier paper, in helping to shape this later version, and to the Andrew W. Mellon Foundation for financial support in its preparation.

The period since World War II has seen tremendous fluctuations in college enrollment rates among U.S. residents. For example, the college enrollment rate of men aged 18-24 doubled from about 18% in 1948 to 36% in 1969, then declined to 26% in 1979, and then increased again to 34% in 1993. Remarkably, however, because these fluctuations in rates moved inversely to fluctuations in the resident population of college-age males, the ***number*** of U.S. male residents aged 18-24 enrolled in college remained virtually unchanged from 1970 to 1990, at about four million.[1]

However, for males aged 20-24 the 1990s have seen sharp increases in both the enrollment rate (from 25% to 31%) and in the numbers enrolled (from 2.6 million to 3.0 million). It is vitally important to know if we are observing a major change in enrollment behavior, because in 1998 the population aged 20-24 will begin to increase sharply, from 17 million in 1997 to 20 million by 2005. A combination of increasing enrollment rates and a growing college-age population would produce enrollment increases in the next decade on a scale not experienced since the 1960s. And yet the literature associated with aggregate level enrollment forecasting is surprisingly sparse, especially in recent years.

On the one hand, there has been an extensive literature since the mid 1970s focused on the college wage premium -- the difference between the average wage of college and high school graduates -- under the assumption that fluctuations in this wage premium, together with costs, can explain the fluctuations in enrollments.[2] But despite the effort devoted in this literature to explaining the wage premium, there has been very little recently which attempts to explain the response of male college enrollment rates to changes in this return. This is emphasized by Rosen (199 l).[3]

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1 Throughout this paper, the focus will be enrollments and enrollment rates *among U.S. residents,* rather than total college enrollments including foreign students.

2 See, for example, Freeman (1975, 1976, 1977 and 1979), Welch (1979), Mattila (1982), Berger (1983, 1984 and 1985), Murphy, Plant and Welch (1988), Coleman (1991), Murphy and Welch (1991 and 1992), Mincer (1991) and Katz and Murphy (1991).

3 Stapleton and Young (1988) examine the college premium, and then examine the possible relationship between cohort size and enrollment rates in a fairly recent paper, but the latter is done through a series of simulations, with no attempt to "address the very difficult question of whether the actual adjustment has approximated the optimal adjustment." Blackburn, Bloom and Freeman (1991) is a more recent attempt which tests the relationship between enrollments and the wage premium. They find a strong positive relationship, but their analysis looks only at the

On the other hand, another series of studies has focused on cohort size effects on enrollment rates (Ahlburg et al, 1981; Wachter and Wascher, 1984; Falaris and Peters, 1985; Nothaft, 1985; Connelly, 1986).[4] The underlying assumption in this literature is that the mechanism through which cohort size affects enrollment rates is the college wage premium, and these studies cite findings in the wage premium literature regarding tested empirical relationships between cohort size and the wage premium.

Thus these two series of studies have been complementary, but the latter series (looking directly at the relationship between cohort size and enrollments) has not produced consistent results. The two most influential -- by Ahlburg, Crimmins and Easterlin (1981, referred to throughout this study as the *ACE* model), and by Wachter and Wascher (1984, referred to hereafter as the WW model) -- predicted diametrically opposing trends in the 1980s: *ACE* correctly predicted a continued increase in enrollment rates, while WW predicted a decline. Although both of these studies found strong evidence that the decision to invest in human capital is a function of cohort size, they differed with regard to the question of symmetry of cohort effects about the peak of the boom: whether or not symmetry exists, and if not, whether cohort effects are stronger on the leading or the lagging edge.

The purpose of this paper is to update the *ACE* and WW models of cohort size effects on enrollment, in the process attempting to address the symmetry question, and also attempting to elaborate further on the mechanism whereby cohort size impacts enrollment rates. The underlying assumption in this approach is that cohort size does have an effect on the college wage premium, and hence on enrollments as suggested by the researchers cited above -- but that this effect might be somewhat more complex than that suggested in many of these studies.

Section A describes briefly the findings of the literature on the effects of cohort size on the college wage premium, section B summarizes and contrasts the approaches taken by *ACE* and WW in modeling the effects of cohort size on enrollments, section C discusses the

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period 1980-89 in this regard.

[4] Connelly does not produce empirical evidence, but develops a theoretical framework in which enrollment is a function of the wage premium, which is in turn a function of cohort size.

differences between *ACE* and WW cohort size variables, section D discusses the cohort size mechanism and develops a theoretical framework for a cohort size model, and section E presents revised models of enrollment rates for men and for women.

A. Effect of Cohort Size on the Wage Premium

All of the researchers cited previously find support for the hypothesis that increasing relative cohort size adversely impacts the college wage premium. Coleman (1991), for example, finds evidence of cyclic effects in the entire period from 1940 to 1988.[5] The mechanism by which relative cohort size affects the college wage premium is accepted to be that proposed by Welch (1979): a declining substitutability between workers by experience level, with increasing levels of education.[6] That is, on-the-job experience does not confer much benefit on workers with low levels of education, so that younger and older workers with low levels of education can be fairly easily substituted for each other (Stapleton and Young, 1988 estimated an elasticity of substitution of 0.735 for high school graduates). Thus increasing relative cohort size (increasing numbers of younger less experienced workers relative to the number of older more experienced workers) will have little effect on the relative wages (the wages of younger relative to older workers) of young high school graduates.

On the other hand, Stapleton and Young estimate that the elasticity of substitution between younger and older college graduates is only 0.0246: these workers tend to serve as *complements* for each other, rather than substitutes, so that increasing numbers of younger relative to older college workers will depress the relative wages of the younger workers. Thus, with increasing relative cohort size, young college graduates find their wages slipping more markedly relative to older workers, than do young high school graduates.

The early cohort size studies (prior to 1988) focused almost exclusively on supply side

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5 Coleman attempted but failed to discern any secular trend in enrollment rates. Goldin and Margo (1992) describe a "wage compression" in the 1940s which is consistent with the pattern found by Coleman for that period.

6 An exception here is work by Blackburn, Bloom and Freeman (1991), which attributes earnings differentials to the simple change in relative supply of college to high school graduates, rather than to their changing supply relative to older cohorts. They also find effects of industry and occupation shifts, unionization, immigration, educational quality and the minimum wage.

effects on the college wage premium, while more recent work has recognized the importance of demand side effects, as well. The papers coauthored by Murphy find that changes in the level and balance of international trade have a strong effect on the college wage premium, along with cohort size effects: imported goods tend to “replace” low skilled domestic jobs (the jobs of those with less than a college education), while exported goods tend to represent greater proportions of skilled than unskilled labor, and thus disproportionately benefit the wages of skilled workers. The paper by Mincer attributes the demand effects largely to technological change as measured by investments in research and development.

It seems to be established that cohort size plays a (negative) role in determining the college wage premium, and human capital theory predicts that the college wage premium should have a positive effect on college enrollments. Thus, indirectly, relative cohort size is expected to have a negative effect on college enrollment levels, through the wage premium.

B. The ACE and WW Models of Enrollment

Both *ACE* and WW are aggregate time series models which attempt to explain enrollment rates for the age groups 18-19 and 20-24 in the period since 1948. The *ACE* model takes the enrollment series to 1976, while the WW model takes them to 1980. However, the *ACE* model attempts to explain the civilian college enrollment *percentage* -- the percentage of the civilian noninstitutionalized population which is enrolled in college -- while the WW model chooses to explain the (log) *total* enrollment *proportion:* the log of the proportion of the total noninstitutional population (including armed forces) which is enrolled in all forms of education (college and non-college level).

The primary hypothesis in the *ACE* model is that enrollments are a negative function of relative cohort size: the larger a cohort relative to its parental cohort, the less likely it will be to enroll in college, all other things equal. The measure of relative cohort size used is essentially a five year moving average of an appropriately lagged General Fertility Rate (GFR). In this model, then, cohort size effects are hypothesized to be symmetric about the peak of the baby boom: there is no effect of *position* relative to the peak, since a cohort on the leading edge will experience the same effect as one of the same relative size on the lagging edge.

The WW model, on the other hand, hypothesizes that position is crucial: theirs is termed a "differential tracking model." The assumption here is that members of the baby boom strategize in order to distance themselves from the peak of the boom in the labor market (presumably because the effects of cohort size will be worst for the peak boom cohorts). They assume that education and experience are at least to some extent interchangeable, so that members of leading edge cohorts will invest "more intensively" in education in order to make themselves competitive with the (smaller cohorts of) more experienced workers, rather than with the larger cohorts of new labor market entrants. In order to capture this effect WW use a cohort size variable which differs for leading and lagging edge cohorts: a logged ratio of the weighted sum of ten older cohorts to the weighted sum of ten younger cohorts. Thus, this variable will be negative for cohorts on the leading and positive for cohorts on the trailing edge of the boom.[7]

Since WW followed *ACE*, and attempted to follow in the tradition set by *ACE* and other studies, the variables (other than those measuring cohort size) used in the two are very similar. Each included a measure of real income, representing either 'ability to pay', or parents' desire to invest in higher education for their children as a 'consumption good' -- a normal good whose consumption rises with increasing income. The measure used in both cases is the median real total annual income of males aged 45-54, on the assumption that this age group represents the parents of college-aged children.[8] Both models also include a measure representing the Vietnam draft, for the period 1960-72, on the assumption that school deferments allowed during most of this period would have caused the draft to have a positive impact on enrollments. Both use the annual number of inductees relative to the number of

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[7]WW also present unconstrained results in which the numerator and denominator are entered separately, relative to own cohort size, to test the assumption of equal absolute values of the coefficients. Their results support this assumption.

[8]The WW model uses this variable measured in thousands of real dollars while the ACE model measures it in hundreds of real dollars.

males aged 16+.[9] Unlike *ACE,* however, WW also include a measure of total military enlistment in the age group, on the assumption that "the rate of enlistment itself will decrease enrollment rates by taking some males who would have enrolled in school otherwise."(p.210) In the models for women, both *ACE* and WW replace the draft variable with a marriage variable, the percentage of women in each age group who are ever-married.

Both models are reported to produce strong results, with significant coefficients bearing the expected signs. Moreover, WW report that tests in which they include either a simple *ACE* measure of relative cohort size or a measure of the college wage premium, along with their own variables, produce insignificant coefficients on these additional variables while the signs and significance of their own variables remain largely unaffected. Thus it would appear that, on the basis of data through 1980, the WW model dominates.[10]

However, we are now in a position to test these two models by re-estimating them, or close approximations of them[11] on data for the original study periods, and then using the regression coefficients to prepare within sample forecasts using actual values of all variables which are now available through to 1993.[12] These forecasts are of particular interest

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9 The WW model uses inductees per 1000 males aged 16+, while the ACE mode1 uses inductees per 100 males aged 16+.

10 This effect does not appear to be due to excessive collinearity between the *ACE* and WW variables: in the 1948-80 period the correlation coefficients are 0.445 and 0.15 for the 18-19 and 20-24 age groups, respectively. For the 1948-93 period, these same coefficients are 0.226 and 0.230.

11 Minor changes in the variables used here should be noted. First, the draft variable used in these re-estimated equations is the number of inductees relative to males aged 20-24, rather than males aged 16+, since inductees were drawn from the 20-24 age group. Second, the WW cohort size variable is constructed by summing weighted five-year population groups of adjacent cohorts, rather than weighted single year age groups. This latter expedient was used simply in order to avoid having to enter annual population figures for thirty single-year age groups, and because WW state that they found little sensitivity in their results to alternate weightings in their cohort size variables. And finally, the cohort size variable in the *ACE* mode1 has been estimated using the final GFR published annually in *Vital Statistics,* rather than the figures in monthly bulletins which were reportedly used by *ACE.*

12 In results not presented here, the author was able closely to reproduce the original WW and *ACE* results for the original sample periods (1948-80 and 1948-76). The estimated signs and significance of nearly all variables were very close to those estimated by *ACE* and WW, although the values of coefficients changed marginally reflecting altered mean values of the variables. The coefficients on cohort size for the women were somewhat less significant in these re-estimated equations. Presumably the differences here arise as a result of using a different source for the GFR.

In addition, the WW unconstrained results (using two cohort size variables) have also been reproduced very closely. Use of those estimates for forecasting 1981+ provides similar results to those presented in Figures 1 and

Fig.1a: Forecasting 1981-93 Enrollments with WW Model
total enrollment for males aged 18-19

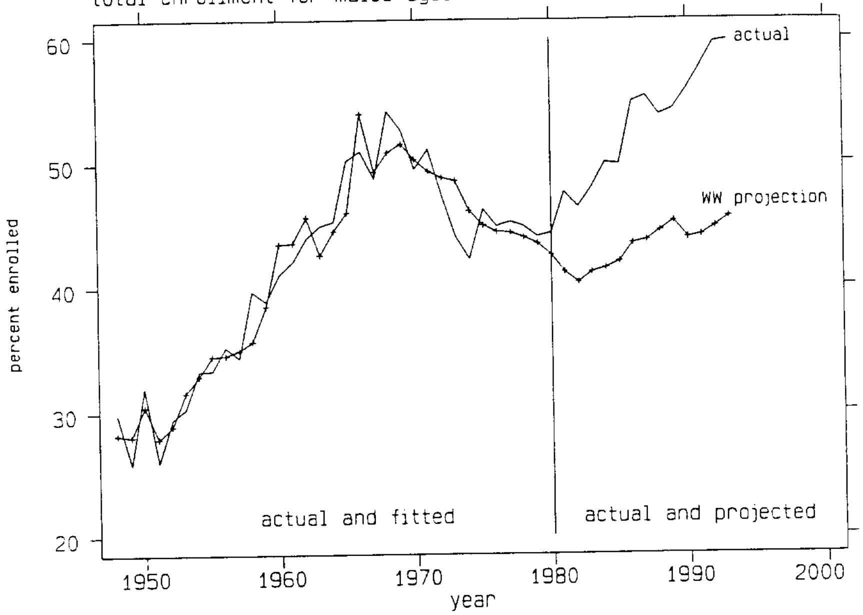


Fig.1b: Forecasting 1977-93 Enrollments with ACE Model
college enrollment for males aged 18-19

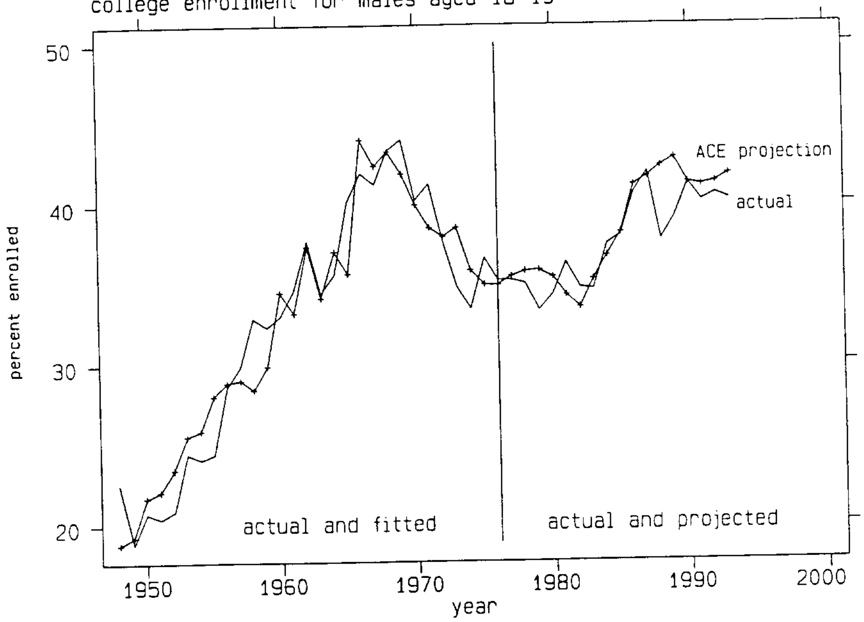


Fig.2a: Forecasting 1981-93 Enrollments with WW Model
total enrollment for males aged 20-24

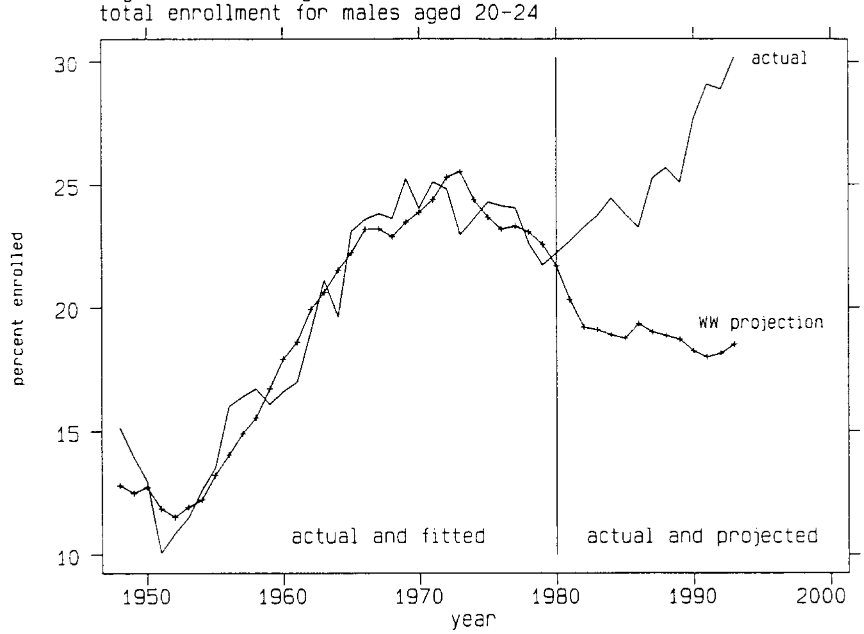
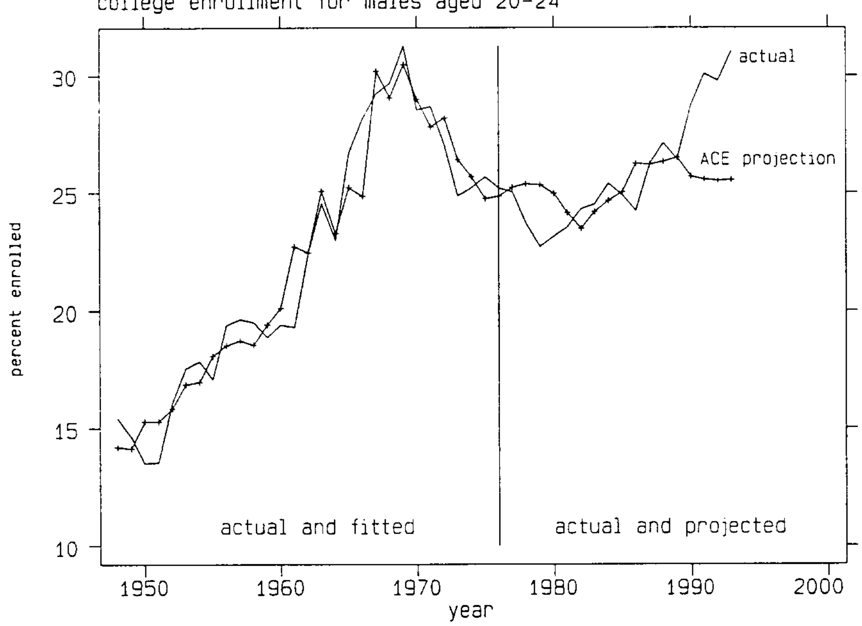


Fig.2b: Forecasting 1977-93 Enrollments with ACE Model
college enrollment for males aged 20-24



because 1980 saw the passage of the baby boom peak through college entrance, and the 1980s ushered in the entry of post-peak cohorts.

Figures 1 and 2 present the actual and predicted values for males aged 18-19 and 20-24, respectively. Here it can be seen that, while the *ACE* model accurately predicts the upsurge in enrollment rates which occurred in the 1980s, the *WW* model severely underpredicts this upsurge for males aged 18-19, and incorrectly predicts a continued decline for males aged 20-24. This is consistent with the hypothesis underlying the *WW* model, which is that enrollment rates are asymmetric about the peak of the baby boom, with pre-boom cohorts enrolling at higher rates than post-boom cohorts. It can be seen that this hypothesis does not appear to accord well with the experience of the 1980s.[13] However, it should be noted that the *ACE* model appears to underpredict enrollments rates for males aged 20-24 in the 1990s, indicating that this model does not completely fit U.S. experience, either: we will return to this issue later in the paper.

C. Examining Underlying Differences Between *ACE* and *WW* Cohort Size Variables

In order to understand how these two models could have both produced solid results for the period up to the late 1970s, with the *WW* model appearing to dominate in that period but the *ACE* model demonstrating superior predictive capability, it is helpful to examine the cohort size variables they use, and the patterns exhibited by them in the period under analysis. Figure 3 presents these two variables at a similar scale, for comparison, with 1980 -- the

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[13]It might be thought that this difference in the predictive power of the two models results from technical differences in defining variables, rather than underlying theory. In order to test this possibility, the two models were re-estimated for males in results not presented here, with cohort size variables drawn from the same data source (contemporaneous population figures, rather than the lagged birth rate used by *ACE*) and technical definition (with neither model using logged variables, and with the *WW* model fitted using the enrollment variable used by *ACE*: college enrollment as a percent of civilian population). The results and significance of the two models are virtually unchanged by these alterations, except for the fact that the sign on the military in the *WW* 20-24 model has changed in this model: this effect will be discussed in the next section. Also, in figures not reported here, the predictions of the two models for the 1980s were found to be unaffected by these changes.

In addition, to test whether the different predictive capacities might be due to the use of different forecast periods (1981-93 for *WW*, and 1977-93 for *ACE*) the two models were tested using common estimation and forecast periods (that is, first using 1976 as the breakpoint for both models, and then using 1980 as the breakpoint for both). This change had virtually no effect on the predictions of the two models for the 1980s and early 1990s.

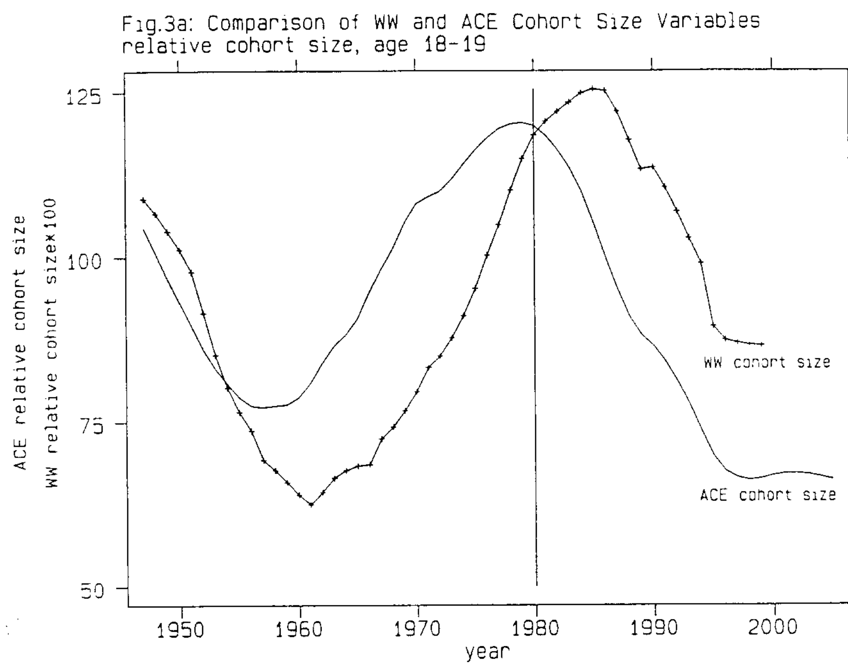
Fig.3a: Comparison of WW and ACE Cohort Size Variables
relative cohort size, age 18-19
ACE relative cohort size
WW relative cohort size*100
125
100
75
50
1950
1960
1970
1980
1990
2000
year
WW cohort size
ACE cohort size

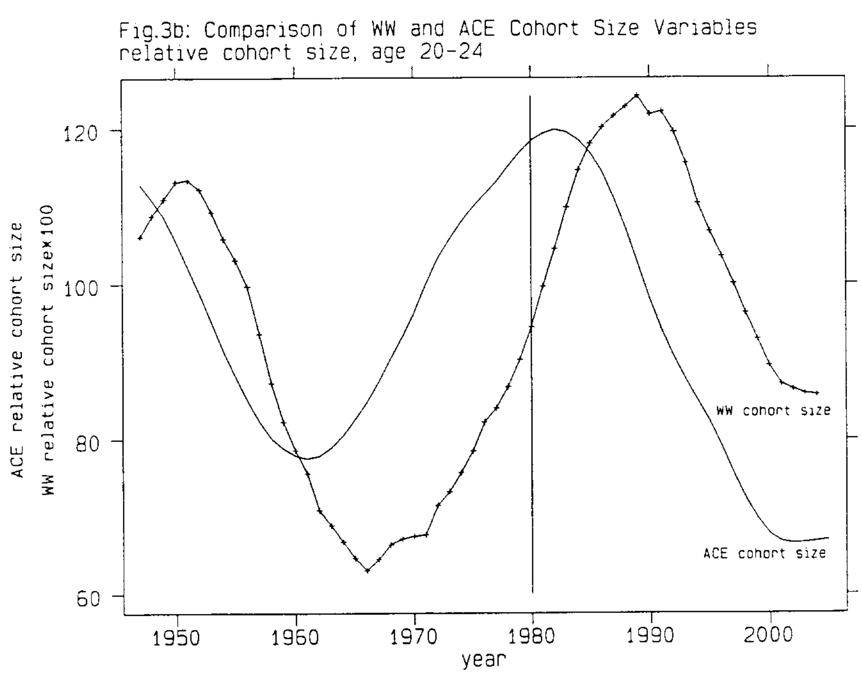
Fig.3b: Comparison of WW and ACE Cohort Size Variables
relative cohort size, age 20-24
ACE relative cohort size
WW relative cohort size*100
120
100
80
60
1950
1960
1970
1980
1990
2000
year
WW cohort size
ACE cohort size

final observation in the WW study -- denoted with a vertical line.[14]

With the help of Figure 3, it can be appreciated that these two variables are virtually identical except for shift and scale parameters. As a result, in the period under analysis they would have had identical effects in a regression (only producing different intercept terms) *except at the turning point in the* 1960s. Unfortunately for time series researchers, that turning point occurred at the same time that the Vietnam war was producing severe distortions in enrollment patterns. Thus, we have the equivalent of one equation in two unknowns, without observations from another turning point. Models using these two variables could both produce credible results simply by changing the emphasis on the Vietnam draft. Adding another turning point -- the one that occurred around 1980 -- provides a better test for the two models.

This is demonstrated in Table 1, where results of the two models are presented for males for their original periods, for the full 1948-93 period, and for the period since 1954. While the *ACE* model produces stable, consistent and significant results for virtually any subperiod examined, the WW model produces coefficients, signs and significance levels on the cohort size and real income variables which change markedly depending on the subperiod examined. Thus it would appear that the results produced by the WW model for the period prior to 1980 are a statistical artifact which resulted from the one-off occurrence of the Vietnam draft at a turning point in the cohort size variable.

In addition, it should be noted that the WW variable as used is potentially unstable in that it contains no controls for the size of parental cohorts. That is, the WW model cannot distinguish between a population with a fluctuating growth rate such as the post WWII situation, and a growing or declining population with a constant non-zero growth rate. In a population with a constant positive growth rate, for example, the WW variable would be consistently negative despite a constant ratio of young to old population, so that their estimated negative coefficient would imply ever-increasing enrollment rates simply as a result of population growth. It is the ratio of young to old workers, in the end, which drives the

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[14] It should be noted that although WW estimated two separate cohort size variables (older and younger relative cohort sizes), they used only one variable in their model -- the ratio of these two -- since tests indicated that the two had equal but opposite coefficients.

relative cohort size concept (that is, workers sufficiently far apart in age that they will no longer be close substitutes for each other in the labor market) -- therefore any model which attempts to simulate cohort size effects must include this ratio, together with any other proposed variables.

In results available from the author, it was found that when a combination of the WW and *ACE* models is estimated for the full period (1948-93), either by putting an *ACE* cohort size variable into the WW model, or by putting the WW cohort size variable into the *ACE* model, the results for males consistently show negative and significant coefficients on the *ACE* variable and insignificant coefficients on the WW variable, indicating that with two turning points in the period being estimated, the *ACE* hypothesis dominates. The results for women are not so clear-cut, however. In some cases both of the variables are significant for women, when included in the same model for the full period (1947-93). This result will be explored further in section D.2.

D. Examining the Cohort Size Mechanism

In this section, an attempt is made to elaborate an underlying structural framework to explain what's going on under the surface of a cohort size model, drawing on previous literature as much as possible but adding a few original insights. First, a number of different forces other than the college wage premium which are hypothesized to affect enrollments are discussed, and then a general framework is outlined. In the discussion which follows, the terms 'male relative income'(RY) and 'college wage premium' (CWP) are defined as follows:

$$RY_m = Y_{HS}/FAMY_{45\text{-}54} \quad (1)$$

$$RY_f = Y_{All}/FAMY_{45\text{-}54} \quad (2)$$

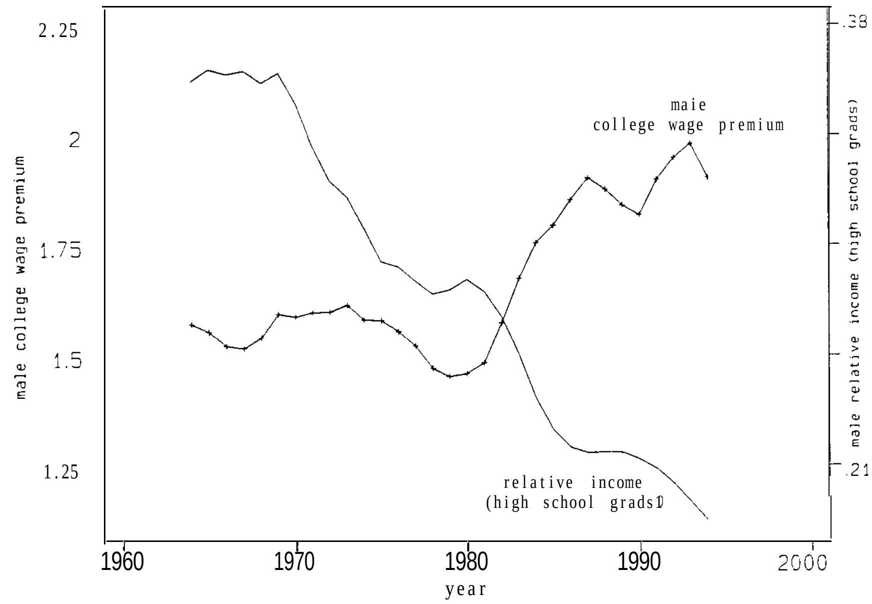
$$CWP_i = WColle,tfe,JWHS,\ i \qquad i = males, females \quad (3)$$

where

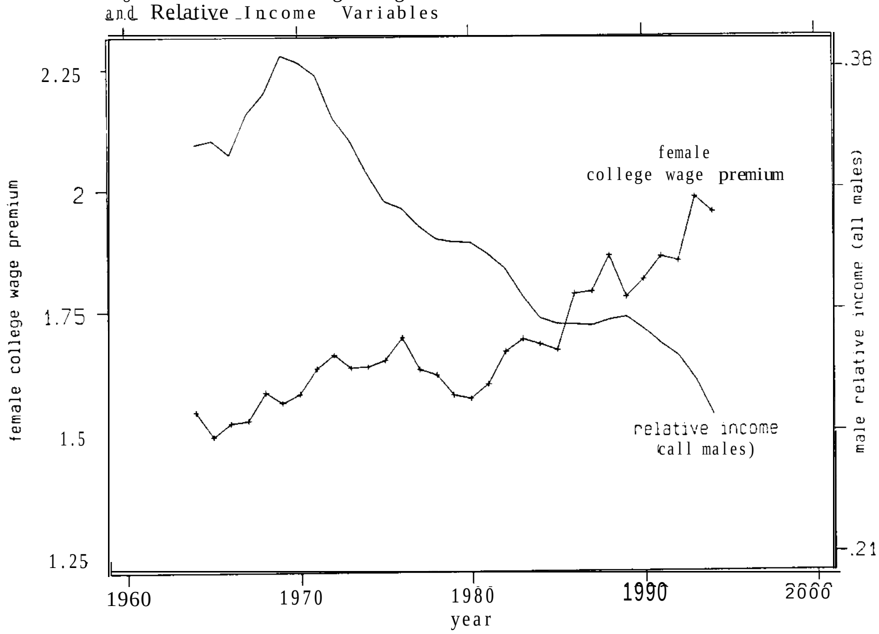
Y — is the expected annual earnings of a given group of young males; that is, a five year moving average of the average annual earnings of all unenrolled males in the group, in their first five years of potential work experience, multiplied by their activity rate.

FAMY45-54 — is a proxy for material aspirations; that is, the five year moving average

Fig.4a: Male College Wage Premium and Relative Income Variables



Flg.4b: Female College Wage Premium and Relative Income Variables



	of the average annual income of all families with children, with a head (of either sex) aged 45-54.
W	is the expected hourly wage of a given group; that is, the average hourly wage of all unenrolled persons in the group, in their first five years of work experience, multiplied by the group's activity rate.

and the subscripts HS, College and *All* denote, respectively, persons with only 12 years of education, persons with 16+ years of education, and persons regardless of educational attainment. The rationale behind these definitions will be developed in the following sections, and the historic patterns of the variables since the mid 1960s for men and for women are illustrated in Figures 4a and 4b.

1. Effect of Relative Income on College Enrollments

Easterlin (1980) defines male relative income as the earnings of a young male relative to his material aspirations. He assumes that young people's material aspirations are a function of, among other things, the standard of living they experienced in their parents' homes when they were teenagers, and this standard of living is in turn a function of their family income in their parents' homes. Thus we can estimate male relative income using the earnings of young men relative to family income in older families with children.

The literature cited earlier, on the effect of relative cohort size on wages, indicates that changes in cohort size bring about fluctuations in the potential earnings of young relative to older males. Hence changes in relative cohort size will bring about fluctuations in young men's earnings relative to older family incomes and thus relative to their own material aspirations.

What happens when a young man estimates that his own market earnings will be insufficient to meet his material aspirations? Easterlin has suggested that various adjustments will be made, trade-offs between material and 'psychic' wellbeing, intended to bring per capita income closer to the desired standard. Some of the adjustments he suggests are delayed marriage and/or family formation (see Oppenheimer at al, 1993, and Macunovich, 1996b, for empirical support of this hypothesis), greater acceptance of two-earner families (see, for example, Fair and Macunovich, 1996, and Macunovich, 1996a), moonlighting, and doubling-up in living arrangements.

Now consider a young man approaching high school graduation. His options are to join the labor force with only a high school education, or to invest in further education. In the first case the relative income he achieves will be that of a high school graduate relative to his family's current income. If he is in a large cohort facing reduced earning potential, he can improve on that income relative to his family's income, by achieving a higher level of education relative to his own parents. Thus on the one hand he experiences some increased motivation to continue in school if he is in a large cohort and anticipates that his earnings as a high school graduate will fall short of his aspirations.

On the other hand, as discussed in section A, large cohorts face a declining college wage premium -- the difference between a college and a high school wage -- and this effect of cohort size will reduce his motivation for further education. Thus the net effect of cohort size on his enrollment probability will be a combination of these two forces, positive and negative.

For young women, declining male relative income would tend to have a positive impact on college enrollment rates. In a gender-differentiated society like the U.S. in the post WWII period,[15] in which young people have traditionally looked first to male earnings for household support, declining male relative income signals, as hypothesized above, delayed/foregone marriage and childbearing -- or, in the event of marriage, an increased possibility of forming two-earner households. Thus there will be an increase at the margin, over and above any secular trend in young women's educational attainment and labor force participation, in the proportion of young women who anticipate an increased likelihood of, and increased intensity of, future labor market participation. That is, given the low level of young males' earning potential relative to these women's material aspirations, they might choose to forego marriage entirely, or else to participate themselves in the labor market to supplement their partners' earnings. In either case their labor force participation will be increased, and the human capital model suggests that in this situation young women would be more likely to invest -- and to invest more intensively -- in higher education.

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[15] A recent survey indicates that 48% of Americans still think of the 'traditional' male-breadwinner, female-homemaker family as the ideal -- a higher proportion than in most other developed countries (Lewin, 1996).

This suggests that both male and female enrollment rates will be negative functions of *male* relative income (but positive functions of the college wage premium). For males, the appropriate relative income measure will be the expected average earnings of a high school graduate, relative to the average income of older families with children (as illustrated in Figure 4a), while for females it will be the expected average earnings of all young males -- assuming that the males are making optimal adjustments with regard to their own levels of education -- relative to the average income of older families with children (as illustrated in Figure 4b).

2. *Effect of Marriuge on College Enrollment Rates*

Both the *ACE* and WW models include controls in the women's equations, for the percentage of the age group who are ever-married. This treatment assumes that marriage is exogenous in an enrollment equation, rather than simultaneously determined. However, such an assumption contradicts the other elements of Easterlin's relative income hypothesis. That is, if as hypothesized by Easterlin, marriage is postponed and/or foregone when relative cohort size is large and hence male relative income is low,[16] then marriage is endogenous in a cohort-size enrollment equation since it is determined by the same factors as enrollment -- namely, relative cohort size and male relative income.

Thus its inclusion by both ACE and WW leaves only a partial effect of cohort size on enrollment rates indicated by the coefficient of cohort size. The remainder of the effect of cohort size acts through the marriage variable. To some extent we can think of the coefficients on cohort size in the *ACE* and WW models as indicating the effect of cohort size acting through the college wage premium, while the effect of cohort size acting through male relative income is indicated by the coefficient of percent ever-married. This is useful, since one of these effects is positive (the effect through male relative income) while the other is negative (that through the wage premium) -- but in order to get an idea of the net effect of cohort size, it is necessary to estimate the women's enrollment equations without a marriage

[16]This hypothesis of Easterlin's, regarding the effect of male relative income on marriage and divorce rates, is supported in Macunovich (1996b).

variable.

Because both the *ACE* and WW cohort size variables were sometimes found to be jointly significant in a combined model for women, as indicated in the previous section, a combined model is estimated here, excluding the marriage variable. These results are presented in Table 2, where we find that the overall effect of relative cohort size (as measured by the *ACE* variable) is negative, as hypothesized, but that there is a strong asymmetry -- as indicated by the positive and significant coefficient of the *WW* variable. Since the value of the WW cohort variable is negative for the leading and positive for the trailing edge, its positive and significant coefficient in all equations indicates higher enrollment rates for trailing edge cohorts, all other things equal. This is consistent with the fact that trailing edge cohorts of the baby boom have experienced lower male relative income, holding relative cohort size constant, than leading edge cohorts. These lower male relative incomes on the trailing edge would increase female enrollments on the trailing edge relative to those on the leading edge.

However, given the strongly monotonic pattern of female enrollment rates, we can't rule out the existence of an underlying positive secular trend which could be creating an impression of asymmetry. Such a positive secular trend might be the result of a self-reinforcing effect of increasing female labor force participation rates, as attitudes toward women's roles adapt to the changing reality of women's participation in the labor market. An attempt was made to estimate the models in Table 2 with a time trend, but this produced highly inconsistent and in many cases nonsensical results (such as a negative effect of family income).

3. *Effect of Family Income and Family Size on College Enrollments*

To the extent that college education is viewed as a normal consumption good, the demand for that good should be a positive function of real family income, as long as young adults of college age are supported by their families. In this sense, the real income of all males aged 45-54 used in the *ACE* and WW models is simply a proxy for family income. It is a less than ideal proxy in that it omits the effects of both changing average numbers of workers per family and changing average size.

Increasing average family size will have a negative effect on enrollments, holding average real family income constant, since more children will be competing for the same family resources. There are two methods of controlling for family size: by using a family income figure which is adjusted for family size, or by using a total family income figure and assuming that relative cohort size proxies for the change in average family size. The latter method has been suggested by Goldberg and Anderson (1974), and is assumed to be one of the reasons for the negative effect of relative cohort size in the *ACE* model.

4. *Effect of Direct College Costs and Financial Aid on College Enrollments*

There is an extensive literature on this topic, which generally finds a positive effect of financial aid (Blakemore and Low, 1983a and 1983b; Fuller, Manski and Wise, 1982; McPherson and Schapiro, 1991; and Savoca 1990 and 1991). However, this literature focuses on disaggregated and cross-sectional analyses, because adequate time series data are not available. The simple use of total real financial aid is an inadequate time series measure, since the goal of financial aid has been to pursue “needs blind” and affirmative action goals: thus increasing proportions of lower income students will require higher levels of aid, even holding enrollments constant. Similarly, average levels of awards, even controlling for average costs, will be biased by the changing income mix of students over the years. Total number of aid recipients might be a useful measure, but is not available in a long enough time series for testing at the aggregate level. And even this measure could be biased, reflecting an increasing tendency to attempt to attract minority and low income students, rather than any attempt to increase total enrollments. As a result of these considerations, the equations here contain no controls for direct college costs, and in this sense are mis-specified.

5. *Effect of the Size of the Military on College Enrollments*

To some extent, the military is simply another potential employer of young adults and in this sense, (assuming that military wages are in line with those in the civilian sector), its size should not be included in an enrollment equation. However, because prior to 1974 some young men were drafted into the military, and because service in the military results from patriotism and other motivations not exhibited in job choices in the civilian sector, the military does require separate treatment. Treating it as a separate equation in a simultaneous system is inappropriate, however, because of the exogenous nature of inductions when the draft is in effect. Including it as a variable in an enrollment equation has been the traditional response to this problem.

However, it is difficult to predict a sign on such a variable in an enrollment equation. We first have to specify whether we define enrollment rates as the number enrolled divided by the total or by the civilian population. But even then, the sign of the effect will depend on the extent to which the military draws from the college-bound and non college-bound populations. Effects ranging from positive through zero to negative can be anticipated, depending on the military's disproportionate draw by education level, regardless of the method of defining enrollment rates. It is also conceivable that the sign of the effect can change over time, if the proportional 'draw' of the military (among college-bound and non college-bound populations) changes as it might depending on the nature of current military involvements.

The results displayed by the WW model illustrate some of these ideas. For example, the sign on the military in the WW equation for males aged 18-19 remains negative and significant even when the definition of enrollment is changed from enrolled as a percentage of the total population, to enrolled as a percentage of the civilian population. This suggests that the military draws disproportionately from college-bound young men in the 18-19 age group. Perhaps at this age young men who find college unaffordable see the military as a way of acquiring more training without paying college tuition.

In addition, educational deferments were permitted during a large portion of the Vietnam draft period. As a result, it is generally believed that enrollments during this period were a *positive* function of the size of the draft, and also a positive function of the size of the voluntary force, to the extent that young men who bore low numbers in the draft lottery "volunteered" in order to choose their service (Angrist, 1990). However, to the extent that those who were drafted would have enrolled in college, there will be an offsetting negative effect of the draft on enrollment rates.

6. Effect of "Over-Enrollment" on the College Premium

Stephan and Levin (1992) argue that the average quality of physical scientists declined during the 1970s because enrollments cut so deeply into the small pre-boom cohorts of the 1960s. If we think of a cohort as arrayed in order of ability and assume that those with the highest ability are most likely to enroll in college, then increasing enrollment rates necessarily draw from ever-lower levels of ability. To the extent that relative cohort size positively affects enrollments in immediate pre-boom cohorts as demonstrated by Stapleton and Young (1988), then this effect would have combined in the late 1960s and early 1970s with the positive effect of the military draft to produce, on average, lower quality college graduates. This lower average quality of graduate in the 1970s would have depressed the observed college wage premium. This argument differs from Freeman's (1976) hypothesis of "overinvestment" in college, since he was concerned there with a secular growth in the imbalance between supply of and demand for college graduates in this century, with no consideration of quality.

7. *Effect of International Trade on Enrollment Rates*

Since the mid 1980s economists have begun to report measured effects of the trade deficit on domestic earnings. Burtless (1995) provides a review of some of these studies, indicating that there is as yet no consensus, but there is mounting evidence that 'less-skilled workers in the North have suffered sizable losses as a result of manufactured imports from the South.' (p.814) Those who feel that there is an effect, suggest that less-skilled workers might be hurt by mounting levels of imports -- while at the same time more highly skilled workers benefit disproportionately as the level of exports increases. This suggests that although cohort size measures in an enrollment equation will control for potential fluctuations in the college wage premium arising from imperfect substitutability between *younger and older* workers, another measure might be required to reflect the effect of imperfect substitutability between *more- and less- skilled* workers. While both of these effects might be captured in a wage premium variable, a cohort size variable must be supplemented with a variable measuring international trade. This hypothesis will be tested in section E.

7. Developing a Model to Describe Male College Enrollments

Based on the considerations outlined above, the optimal approach to estimating the effects of cohort size on college enrollments would be to estimate a simultaneous system of equations involving cohort size:

$$ENR = h(CS,DIF,RY,Xenr) \quad (4)$$

$$DIF = g(CS,POS,ENR,QUAL,T,Xdif) \quad (5)$$

$$QUAL = j(CS,ENR,Xqual) \quad (6)$$

$$RY = f(CS, POS, T, Xry) \quad (7)$$

where

CS	is relative cohort size, measured by the size of the cohort under study relative to its parental cohort
DIF	is the college wage premium, the average expected hourly wage of young college graduates relative to that of young high school graduates
ENR	is the college enrollment rate of the cohort under study
POS	is a measure of cohort position, a variable whose value on the leading edge differs from its value on the trailing edge of the baby boom. Assume here that it is specified like the WW variable, to be negative for leading edge cohorts and positive for trailing edge cohorts.
QUAL	is the average quality of college graduates
RY	is male relative income, measured by the earnings of young men relative to the income of their parental families
T	is a per capita measure of the volume of international trade, in constant dollars
X	is a vector of other factors such as financial aid, college costs, real family income, and the military

Probably the first effect of cohort size will be on relative income: as demonstrated by Welch (1979), Berger (1983,1984,1985) and Stapleton and Young (1988), among others, an increase in the supply of young workers relative to older more experienced workers will depress the wages of the young workers ($\delta RY/\delta CS<0$). But this effect on young workers' relative incomes will hit those with only a high school education at least four years before it will affect those with a college education because of the time needed to obtain the college education; thus there will be a temporary increase in the college wage premium as the first baby boom cohorts hit the job market, at the same time that the relative income measure begins to decline. Stapleton and Young (1988) refer to this as a timing effect. And in general on the leading edge of the baby boom the college wage premium will be higher than on the lagging edge, because of this four year lag effect: the average relative size of new cohorts of workers with only a high school education will be larger(smaller) than the average relative size of new cohorts of college graduates in any given year on the leading(lagging) edge of the boom ($\delta DIF/\delta POS<0$).

It is felt by some researchers that cohorts on the lagging edge of the baby boom will experience a more negative effect of relative cohort size on wages, than those on the leading edge ($\delta RY/\delta POS<0$), possibly because of the "bottleneck" in hirings and promotions caused for lagging edge cohorts by the peak of the baby boom as it enters the labor market, and/or because of the favorable aggregate demand effects of the baby boom on leading edge cohorts. And, as amply demonstrated by the authors cited in the first section of this paper, the effect of relative cohort size on the college wage premium will be negative ($\delta DIF/\delta CS<0$) because of the declining substitutability of young and old workers with increasing levels of education. This effect will, of course, be exacerbated by any secular increase in enrollment rates ($\delta DIF/\delta ENR<0$).

Stephan and Levin (1992) suggest that the average quality of college graduates will decline as enrollment rates increase ($\delta QUAL/\delta ENR<0$), and Easterlin (1980) suggests that average quality will decline as cohort size increases because of overcrowding in the home and school ($\delta QUAL/\delta CS<0$). This latter point is substantiated in work on SAT scores by Bishop (1991).

Finally, human capital theory tells us that enrollment rates will be a positive function of the college wage premium ($\delta ENR/\delta DIF>0$). The relative income hypothesis suggests, though, that college enrollment is an adjustment young males can make to improve their potential income relative to that of their parental family (and hence relative to their material aspirations), so that enrollment rates should be a negative function of the relative earnings of high school graduates ($\delta ENR/\delta RY<0$). And Goldberg and Anderson (1974) and Ahlburg et al (198 1) suggest that enrollment rates will be a negative function of cohort size because of the implied increase in family size and hence in competition for family resources to fund a college education ($\delta ENR/\delta CS<0$).

Because of the timing of all of these effects, there may have been a temporary surge in enrollment rates among early boom cohorts, as their relative income began to fall and the college wage premium rose. This temporary surge would have occurred at the same time that the Vietnam draft was also encouraging higher enrollment rates. Thus we observed in the late 1960s unparalleled male college enrollment rates in the U.S. This would have been a short-lived effect, however, as increased enrollment rates compounded the effect of increasing cohort size, sharply reducing the college wage premium then as relative incomes continued to decline. All but one of the effects on the college wage premium would have been negative as we moved into the mid- and late 1970s: cohort size, enrollment rates, and the average quality of graduates. Thus, as we moved into the peak of the boom, the college wage premium plummeted, and its decline was so precipitous that its effect outweighed the positive effect on enrollments of declining male relative income, so that enrollment rates declined as well.

But the decline in enrollment rates in the late 1970s would have begun to exert a positive effect on the average quality of graduates, and this in combination with the declining enrollment rates would have begun to exert a positive effect on the college wage premium.[17] Thus, just prior to the baby boom peak, the wage premium bottomed out and began to increase, producing a positive effect on enrollments at a time when relative income was still declining and therefore also exerting a positive effect on enrollments. This set the stage for increasing enrollments among post-peak cohorts, because the effects of changes in the wage premium and in relative income move in the same direction for these later cohorts. And for these post-peak cohorts the dampening effect of their increasing enrollment rates on the wage premium will be mitigated by their declining cohort size.

Rising relative income for the baby bust cohorts would be expected to counter to some

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17 It is interesting to note that in the late 1970s the experience differential in college graduate wages (the differential between younger and older workers with college degrees) should have begun to decline, since the reduced enrollment rates of the baby boomers would have produced, on average, high quality graduates relative to the quality produced by early boom cohorts (with their high enrollment rates). This effect would have been intensified in the experience of the U.S. postwar baby boom, because of the added impetus to enrollments among pre-boom and early boom cohorts of the Vietnam draft, and also by the fact that, as Stephan and Levin (1992) suggest, the liberal funding of the “sputnik era” in the early 1960s encouraged abnormally high enrollment rates among pre-boom cohorts. Thus experienced workers with college degrees and 10-20 years’ experience would have been, on average, much poorer quality than new college graduates in the late 1970s and early 1980s.

extent the positive effects of the wage premium on enrollment rates. To date, however, we have experienced virtually no increases in male relative income since about 1970. Demand-side effects such as changing technology, the level and balance of international trade, and possibly the size of the military, appear to have been countering the beneficial effects of declining cohort size since the early 1980s thus keeping male relative incomes low and enrollment rates high. These aggregate demand effects on young workers have been discussed by Murphy, Plant and Welch (1988), Murphy and Welch (1991 and 1992), Mincer (1991) and Katz and Murphy (1991). If the absence of improvements in male relative income has been the result of changes in international trade, our experience since 1980 provides support for Easterlin's contention that the benefits of smaller relative cohort size would be suppressed in an open economy.[18]

E. Estimating Modified Enrollment Models for Males and for Females

We have already seen that the *ACE* enrollment model functioned well as a reduced form explanation of male enrollment rates between 1948 and 1990. It produced stable and consistent results for any subperiod tested, and accurately forecast the rising enrollment rates of the 1980s using data only through 1976. WW-type "cohort position" variables tested insignificant in this male model. However, we do know that this reduced-form *ACE* model appears to perform less well in the 1990s -- a result which may be due to the increasing significance of international trade on relative wages during this period. It would be useful to test this hypothesis -- and also to test the effect of the two underlying mechanisms whereby cohort size is assumed to affect enrollments: the college wage premium and male relative income.

For women, results presented in Table 2 suggested that the effect of cohort size on female enrollments is asymmetric about the peak of the baby boom, unlike the effect on male enrollments, with enrollments not only lower for boom cohorts than for bust cohorts, but also lower for pre-boom than for post-boom cohorts. One explanation for this phenomemon is

[18] Easterlin (1987, p.33) discusses the fact that 'Before the 1920s. . .[t]he potential benefit of small generation size was. .lost in the influx of European workers.' The 1980s and 90s have seen the same effect, but from traded goods, rather than influxes of workers.

simple mis-specification. That is, given the fairly linear trend of female enrollments, omission of a control for increasing levels of international trade would make it appear that cohort size effects differ pre- and post-boom. Thus it could well be that the underlying male and female enrollment models are in fact quite similar, and this hypothesis will be tested here.

Two problems arise in attempting to test a structural model for male and female enrollments -- that is, a model containing explicit controls for male relative income and the college wage premium. First, data are not available prior to the early 1960s for accurately estimating the college wage premium and male relative income; and second, it is extremely difficult to implement a structural enrollment model for men using time series data because of the collinearity of cohort size, relative income and the college wage premium. In addition, the one-time effect of the Vietnam draft, occurring as it did just when the baby boom began entering college age, complicates attempts to identify these effects separately in aggregate models for males.

Fortunately, the problem of collinearity is greatly reduced in estimating a structural model of the female enrollment rate, since the female rate is assumed to be a function of the *female* college wage premium and male relative income (rather than male measures of each). Thus it is possible to estimate a structural model containing both of these variables for women, to supplement the modified reduced form *ACE* model.

The approach taken here, then, is to accept the *ACE* model as the best reduced form model for the entire period 1947-93 -- with some modifications -- and to test some of these other effects in the shorter period since 1964 using data developed from March Current Population Survey (CPS) public use tapes.

The modified *ACE* model (the 'reduced form' model, denoted *ERace* and the structural model (denoted *ER,)* estimated here, for both men and women, are:[19]

$$ER_{ace,i,j} = f(CS_{ACE,j}, Y_{45\text{-}54}, Trade, Draft_j) \qquad j = 18\text{-}19,\ 20\text{-}24 \qquad (8)$$

$$ER_{RY,i,j} = g(RY_i, CWP_i, FAMY_{45\text{-}54}, Draft_j) \qquad i = males, females \qquad (9)$$

19 The intention originally had been to estimate a combined *ACEIWW* model, in modified form, but the WW cohort size variable was found not to be significant in any of these modified models.

where CS_{ACE}, *Draft* and $Y_{45\text{-}54}$ denote the cohort size, draft and real income variables defined by ACE, and $Y_{45\text{-}54}$, RY_i, CWP_i *and* $FAMY_{45\text{-}54}$ are defined as they were in equations *(1)* through (3). The *ACE* model has been modified here by including a trade variable (exports plus imports, divided by total population) and using a logistic transformation of the dependent variable, since it is a bounded variable: percent enrolled. Correspondingly, the independent variables (except for the military draft) are all used in logged form. Total trade per capita will be used here, rather than exports or imports alone, on the assumption that increasing exports would act as a 'carrot' and imports as a 'stick' to induce increased enrollments. Note that there is no theoretical reason to include the trade variable in the structural models, since the effect of such a variable should be included in the measures of male relative income and the college wage premium.

Although it is unconventional to include a draft variable in an enrollment equation for young women, that convention is broken here. It is assumed that the pronounced increases in the enrollment rates of young men which were induced by the draft would have had a positive influence on young women's enrollment rates -- both because of a 'role model ' effect and because with large numbers of men serving in Vietnam or in school, young women would anticipate higher levels of labor force participation for themselves and would therefore choose to invest in higher education at increased rates.

Table 3 (columns 1 and 4) presents, for males, the result of estimating the modified *ACE* model for the full period 1948-93. In Table 3 it can be seen that per capita trade exerts the expected positive and significant effect on college enrollments for males 18-19 and 20-24, while leaving the signs and significance of the other coefficients unchanged from the original *ACE* model. A comparison of the results in Tables 1 & 3 indicates that the trade variable produces a considerable improvement in the explanatory power of the model, especially for males 20-24 (where the adjusted R^2 increases from only 0.87 to 0.93).

Although it is not possible to estimate a full structural model of male enrollment rates at this aggregate level, it is possible at least to test the hypothesized mechanisms underlying the cohort size model, in partial models. The remainder of Table 3 presents two sets of model results, one including a male relative income term (columns 3 & 6) and the other a

Fig.5a: Estimating Enrollments with Modified ACE Model
total enrollment rates, males aged 18-19

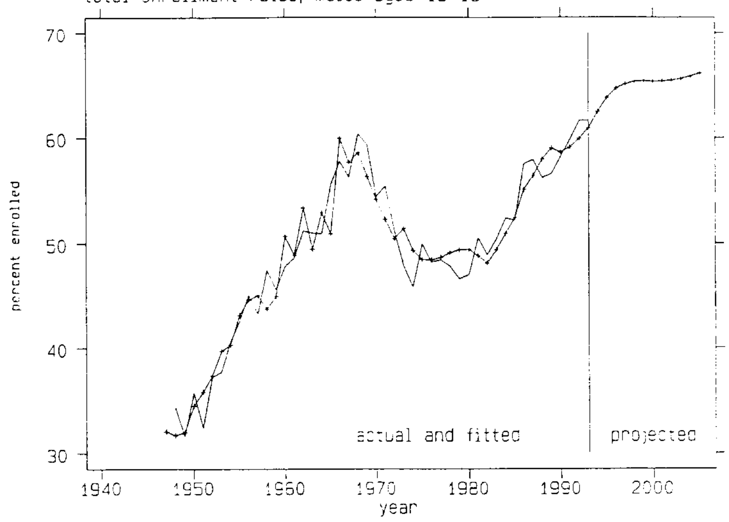


Fig.5b: Estimating Enrollments with Modified ACE Model
college enrollment rates, males aged 18-19

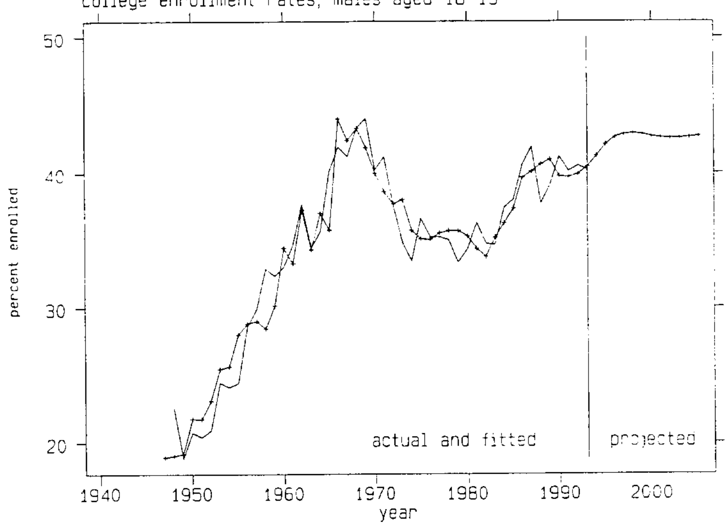


Fig.5c: Estimating Enrollments with Modified ACE Model
college enrollment rates, males aged 20-24

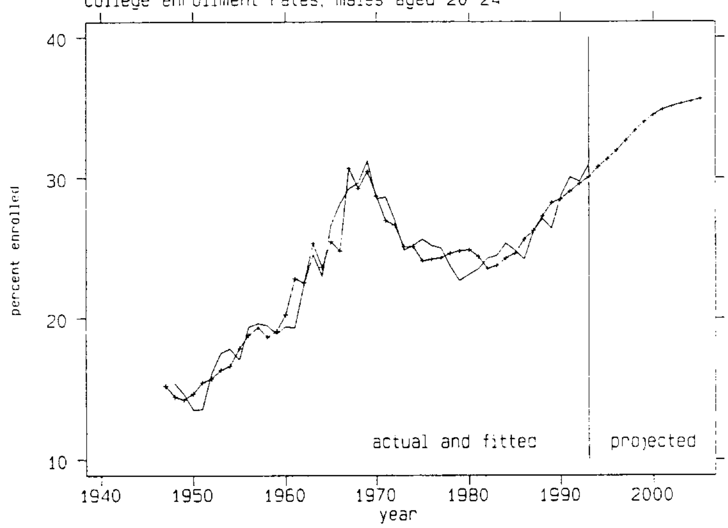


Fig.6a: Estimating Enrollments with Reduced Form ACE Model
college enrollment rates of women aoed 18-19

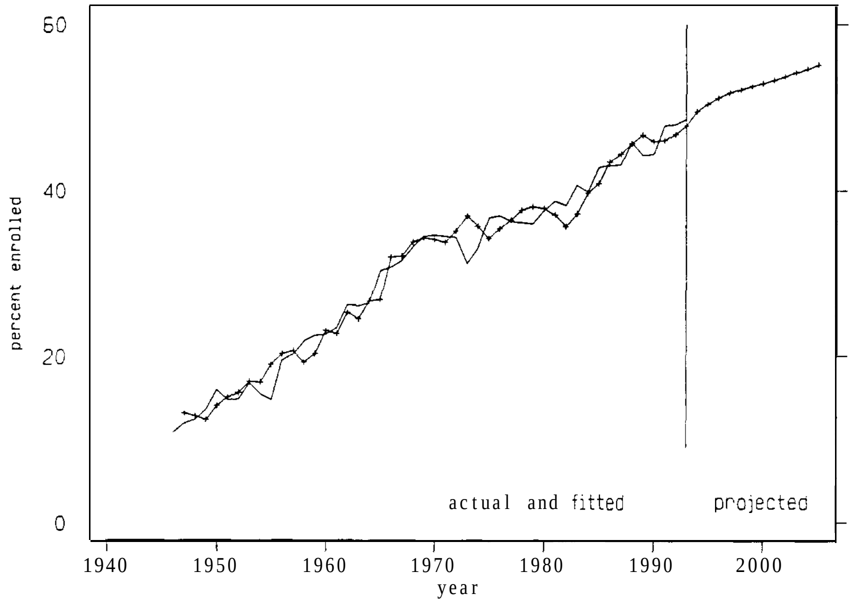
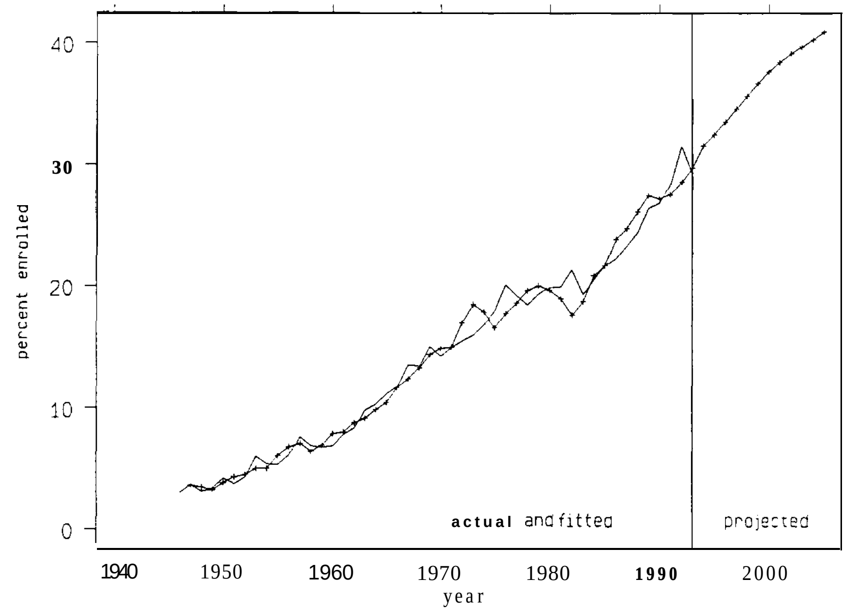


Fig.6b: Estimating Enrollments with Reduced Form ACE Model
college enrollment rates of women aged 20-24



college wage premium (columns 2 & 5). There we see the strongly significant negative effect of male relative income, and the strongly significant positive effect of the college wage premium, as hypothesized, on enrollment rates at all levels.

The results of estimating for women the modified reduced form *ACE* model, and the new structural model, are presented in Table 4. Column (1) presents the *ACE* model, where we see a highly significant positive coefficient on the trade variable, and an overall improvement in the explanatory power of the reduced form model, as compared with the results in Table 2 -- with a stronger improvement in the model for age 20-24, as was the case with the male model.

The results of estimating a structural model for women are presented in the second column of Table 4, where we can see highly significant coefficients on the college wage premium and male relative income variable, with the expected signs, for women in both age groups. Family income is positive and significant both for 20-24 year olds, and also for 18-19 year olds. The benefit of these structural models is that they demonstrate the underlying mechanism operating in the cohort size models.

It is interesting to note that the draft variable is highly significant, with the same positive effect as in the men's equations, in both the reduced form and structural models for women aged 18-19 -- although it was not found to be significant for women aged 20-24.

Because it is possible to project the *ACE* cohort size variable given the historic pattern of the General Fertility Rate, the modified *ACE* models in Tables 3 and 4 were used to project enrollment rates over the next decade, on the assumption that real income and trade patterns exhibited since 1960 will remain relatively stable (that is, holding real income constant, and assuming a 1% per annum increase in the log of per capita trade).[20] These projections are illustrated in Figures 5 (for men) and 6 (for women).

Under these (fairly conservative) assumptions, the college enrollment rate for males aged 20-24 would rise from the current 3 1% to nearly 36% over the next decade, while the

20 The (log) real annual income of males 45-54 held virtually steady over the full period 1948-93, and in 1980-93, while logged per capita trade increased at a steady 1.6% per annum in 1900-93, 1960-93, 1980-93 and 1990-93. In unlogged terms, per capita trade increased at a steady 10% per annum in each of these periods, and the rate of increase assumed here reduces this rate slightly, to about 8% per annum.

18-19 rate would increase from its current 41% to about 42.5% in the next few years, but then remain fairly constant thereafter. At the same time, and under the same assumptions, the rate for women 18- 19 increases from 48% to 55%, while the rate for 20-24 year olds increases from 31.6% in 1994, to 41% in 2005.

These forecasts of increasing rates are particularly significant because they will occur during a period when the absolute size of the college-age population begins to increase dramatically, as shown in Figure 7a. The enrollment levels which result when the projections presented in Figures 5 and 6 are applied to the populations in Figure 7a, are illustrated in Figure 7b. Given the pattern of relative cohort size which was set by the General Fertility Rate twenty years ago, and assuming a 1% per annum increase in logged per capita trade, total college enrollment of U.S. residents in the 18-24 age group is projected to increase by 30% over the next decade, from about 8.8 million in 1994 to 11.4 million in 2004.

F. Conclusions

Since at least the early 1970s cohort size has been hypothesized to operate on college enrollment rates in the U.S. Several studies have demonstrated the effects of cohort size on the college wage premium, and others have demonstrated effects of cohort size on enrollments, but with opposing hypotheses regarding the expected effects of cohort size on enrollment rates. The purpose of this study has been to draw together this literature in a more unified framework where it is possible to compare seemingly different results and make use of the information they provide to develop an improved model. In doing so it has been possible not only to demonstrate that cohort size effects have indeed been significant over the past forty-five years, but also to explain the mechanism underlying these effects.

What we find is a combination of relative income effects and college wage premium effects -- all emanating from cohort size -- operating on both male and female enrollment rates, with young men and women tending to enroll at higher rates when male relative income is low and when the wage premium is high. The combination of these two effects produced greatly reduced enrollment rates in larger cohorts, and is now tending to produce higher enrollment rates as cohort size declines through the 1990s. Adding to this strong positive effect of cohort size on enrollment rates, it appears that an increasing level of international

Fig.7a: Actual and projected college-age population aged 18-19 & 20-24, in thousands

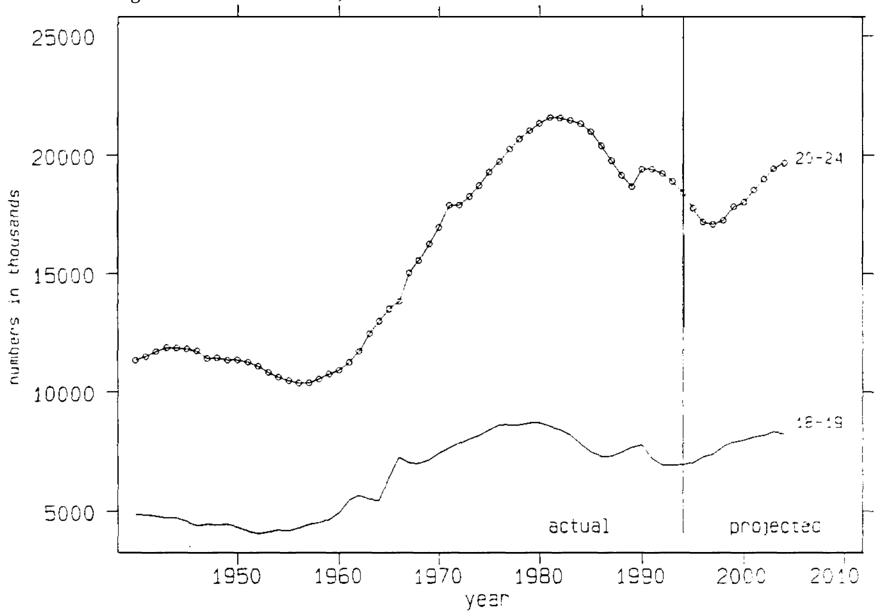
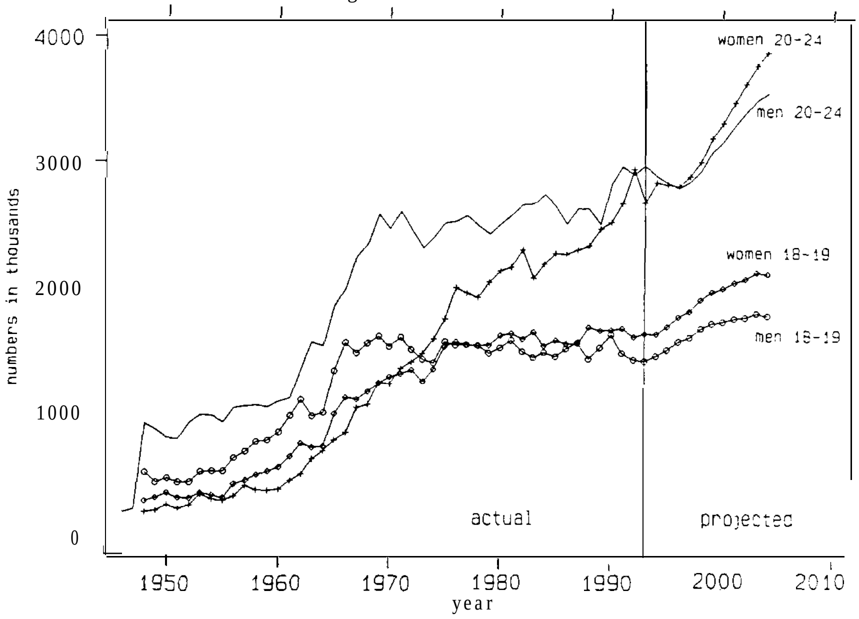


Fig.7b: Actual and projected college enrollments, in thousands far men and women aged 18-19 & 20-24



References

Ahlburg, Dennis, E.M.Crimmins and R.A.Easterlin (1981). "The Outlook for Higher Education: A cohort size model of enrollment of the college age population, 19482000," *Review of Public Data* Use,9:21 *l-227*.

Alsalam, N. (1985). "The Dynamic Behavior of College Enrollment Rates: The effects of baby booms and busts," Working Paper 21. Rochester, NY: University of Rochester.

Angrist, Joshua D. (1990). "Lifetime earnings and the Vietnam Era Draft Lottery: Evidence from Social Security administrative records," *AER, 80(3):313-336.*

Berger, Mark C. (1983). "Changes in Labor Force Composition and Male Earnings: a production approach," *Journal of Human Resources, 18: 177-196.*

Berger, Mark C. (1984). "Cohort Size and Earnings Growth of Young Workers," *Industrial and Labor Relations Review,* 37:582-591.

Berger, Mark C. (1985). "The Effect of Cohort Size on Earnings Growth: A reexamination of the evidence," *Journal of Political Economy, 93:561-573.*

Berger, Mark (1989). "Demographic Cycles, Cohort Size and Earnings," *Demography,* 26(2):311-321.

Bishop, John (1991). "Achievement, Test Scores and Relative Wages," in *Workers and Their Wages,* edited by M.Kosters, AEI Press: Washington, DC.

Blackbum, McKinley, David Bloom and Richard Freeman (1991). "Changes in Earnings Differentials in the 1980s: Concordance, convergence, causes and consequences," Working Paper 61, Jerome Levy Institute, Bard College, Annandale-on-Hudson, NY.

Blakemore, Arthur E. and Stuart A. Low (1983a). "Scholarship Policy and Race-Sex Differences in the Demand for Higher Education," *Economic Enquiry,* XXI(October):504-519.

Blakemore, Arthur E. and Stuart A. Low (1983b). "A Simultaneous-Determination of Post-High School Educational Choice and Labor Supply," Q*uarterl Review of Economics and Business, 23(4):81-92.*

Burtless, Gary (1995). "International Trade and the Rise in Earnings Inequality", *Journal of Economic Literature,* XXXIII(June 1995):800-816.

Coleman, Mary T. (1991). "Movements in the Earnings-Schooling Relationship," unpublished manuscript, Bureau of Economics, Federal Trade Commission.

Connelly, Rachel (1986). “A Framework for Analyzing the Impact of Cohort Size on Education and Labor Earnings,” *Journal of Human Resources, 21:543-562.*

Dooley, Martin D. and Peter Gottschalk (1984). “Earnings Inequality Among males in the U.S.: Trends and the effect of labor force growth,” *Journal of Political Economy, 92:59-89.*

Easterlin, Richard A. (1980). *Birth and Fortune: The impact of numbers on personal fortune,* University of Chicago Press: Chicago.

Fair, Ray C. and Diane J. Macunovich (1996). “Explaining the Labor Force Participation of Women 20-24”, Cowles Foundation Discussion Paper No. 1116, Yale University, New Haven, CT 06520-8281.

Falaris, F.M. and H. Elizabeth Peters (1985). “The Effect of the Demographic Cycle on Schooling and Entry Wages,” Working Paper 85-6, National Opinion Research Center, Chicago, IL.

Freeman, Richard B. (1975). “Overinvestment in College Training?” *Journal of Human Resources, 10:287-3 11.*

Freeman, Richard B. (1976). *The Overeducated American, New* York: Academic Press.

Freeman, Richard B. (1977). “The Decline in rewards to College Education,” *Review of Economics and Statistics, 59: 18-29.*

Freeman, Richard B. (1979). “The Effect of Demographic Factors on Age-Earnings Profiles,” *Journal of Human Resources, 14:289-318.*

Fuller, Winship C., Charles F. Manski and David A. Wise (1982). “New Evidence on the Economic Determinants of Postsecondary Schooling Choices,” *Journal of Human Resources, XVII(4):477-498.*

Goldin, Claudia and Robert A. Margo (1992). “The Great Compression: The wage structure in the United States at mid-century,” *The Quarterly Journal of Economics,* CVII(l):l-34.

Juhn, Chinhui (1990). “The Decline of Male Labor Market Participation: the Role of Declining Market Opportunities,” University of Chicago.

Katz, Lawrence F. and Kevin M. Murphy (1991). “Changes in Relative Wages, 1963-1987: Supply and Demand Factors,” Harvard Institute of Economic Research, Discussion Paper 1580, Cambridge, MA.

Kosters, Marvin (1991). *Workers and their Wages,* AEI Press: Washington, DC.

Karoly, Lynn A. and Jacob Alex Klerman (1992). “Demographics, Sectoral Change, and Changing Relative Wages: A Regional Approach,” presented at AEA Meetings, Anaheim, CA January 1993.

Lewin, Tamar (1996). “Americans Attached to Traditional Roles for Sexes, Poll Finds”, New York *Times*, March 27, 1996, p.Al5.

Macunovich, Diane J. (1996a). “Relative Income and Price of Time: Examining Their Effects on Fertility and Female Labor Force Participation, 1963-93”, *Population and Development Review,* (forthcoming).

Macunovich, Diane J. (1996b). “Marriage and Divorce in the U.S.: Testing for cohort size effects,” Working Paper, Williams College, Williamstown, MA 01267.

Mattila, J. Peter (1982). “Determinants of Male School Enrollments: A time-series analysis,” *Review of Economics and Statistics, 64:242-25* 1.

McPherson, Michael S. and Morton Owen Schapiro (1991). “Does Student Aid Affect College Enrollment? New evidence on a persistent controversy,” *AER, 8 l(1):309-3* 18.

Mincer, Jacob (1991). “Human Capital, Technology, and the Wage Structure: What do time series show?” Working Paper 3581, NBER, Cambridge, MA.

Murphy, Kevin, Mark Plant and Finis Welch (1988). “Cohort Size and Earnings in the USA,” in *Economics of Changing Age Distribution in Developed Countries,* edited by R.D.Lee, W.B.Arthur and G.Rodgers, Clarendon Press: Oxford.

Murphy, Kevin and Finis Welch (1991). “The Role of International Trade in Wage Differentials,” in *Workers and Their Wages,* edited by M.Kosters, AEI Press: Washington DC.

Murphy, Kevin and Finis Welch (1992). “The Structure of Wages,” *Quarterly Journal of Economics,* February:285-326.

Nothaft, F.F. (1985). “The Effect of Cohort Size on Human Capital Investment and Earnings Growth,” Working Paper 42. Washington, DC: Board of Governors of the Federal Reserve System.

Oppenheimer, Valerie K., Matthijs Kalmijn and Vivian Lew (1993). “Men’s Transition to Work and Marriage Timing”, Department of Sociology, UCLA.

Savoca, Elizabeth (1990). “Another Look at the Demand for Higher Education: Measuring the price sensitivity of the decision to apply to college,” *Economics of Education Review, 9(2):* 123- 134.

Savoca, Elizabeth, (1991). "The Effect of Changes in the Composition of Financial Aid on College Enrollments," *Eastern Economic Journal*, XVII(1): 109-121.

Stapleton, David C. and Douglas J.Young (1988). "Educational Attainment and Cohort Size," Journal *of Labor Economics*, 6(3):330-361.

Stephan, Paula and Sharon Levin (1992). *Striking the Mother Lode in Science: The importance of age, place and time,* Oxford University Press: New York.

Wachter, Michael L. and W.L.Wascher (1984). "Leveling the Peaks and Troughs in the Demographic Cycle," *Review of Economics and Statistics, 66:208-215.*

Welch, Finis (1979). "Effects of Cohort Size on Earnings: the baby boom babies' financial bust," *Journal of Political Economy, 87:S65-S97.*

Table 1: Performance of ACE and WW Models in Various Sub-periods

The WW Model:

	Males Aged 18-19			Males Aged 20-24		
	1948-93	**1948-80**	**1954-93**	**1948-93**	**1948-80**	**1954-93**
WW Cohort Size	-0.33	-0.43	-0.07	-0.01	-0.56	0.09
	(3.4)	(6.1)	(0.6)	(0.1)	(4.0)	(1.1)
Real Income	0.06	0.07	-0.01	0.11	0.08	0.08
	(3.3)	(5.9)	(0.3)	(9.7)	(7.0)	(4.2)
Draft	0.003	0.004	0.005	0.006	0.001	0.006
	(2.4)	(4.4)	(3.7)	(3.4)	(0.9)	(4.1)
Military	-2.37	-1.17	-2.89	-0.96	-0.70	-1.13
	(3.8)	(2.6)	(4.2)	(3.9)	(3.7)	(3.0)
Intercept	-1.03	-1.33	-0.48	-2.30	-2.22	-2.02
	(5.6)	(10.2)	(1.9)	(21.3)	(25.5)	(10.8)
D-W stat	0.63	2.16	0.76	0.80	1.11	0.96
# of obs	46	33	40	46	33	40
Adj R-sq	0.852	0.933	0.739	0.877	0.931	0.821

The ACE Model:

	Males Aged 18-19			Males Aged 20-24		
	1948-93	**1948-80**	**1954-93**	**1948-93**	**1948-80**	**1954-93**
ACE Cohort Size	-0.16	-0.20	-0.15	-0.11	-0.06	-0.16
	(-6.2)	(4.3)	(5.1)	(4.5)	(2.7)	(4.7)
Real Income	0.38	0.41	0.35	0.26	0.21	0.32
	(17.9)	(10.0)	(10.8)	(15.1)	(12.5)	(9.7)
Draft	2.39	2.34	2.26	1.10	1.56	1.01
	(10.1)	(7.9)	(9.3)	(5.0)	(7.7)	(4.5)
Intercept	20.59	22.57	22.32	14.51	12.33	15.06
	(10.1)	(8.2)	(10.5)	(7.2)	(6.5)	(7.5)
D-W stat	1.62	1.62	1.72	0.81	1.55	0.93
# of obs	46	33	40	46	33	40
Adj R-sq	0.908	0.905	0.814	0.877	0.927	0.805

t-statistics in parentheses
For definitions of variables, see appendix.

Table 2: Estimating the Women's Enrollment Equation Without Controlling for Marriage, 1947-93

	Model 1		Model 2		Model 3	
	OLS	**Cochrane-Orcutt**	**OLS**	**Cochrane-Orcutt**	**OLS**	**Cochrane-Orcutt**
Women Aged 18-19:						
ACE cohort size	-0.66 (-6.4)	-0.64 (-5.0)	-0.23 (-6.8)	-0.23 (-5.0)	-30.36 (-5.8)	-27.01 (-4.1)
WW cohort size	0.15 (2.4)	0.18 (2.2)	10.03 (4.5)	10.64 (3.4)	8.45 (3.6)	9.40 (2.8)
Real income	0.19 (23.5)	0.19 (16.2)	0.61 (23.0)	0.60 (14.5)	0.67 (19.5)	0.63 (12.9)
Intercept	0.64 (1.4)	0.59 (1.1)	-0.57 (-0.2)	-0.13 (-0.0)	-7.48 (-3.3)	-7.39 (-2.4)
rho		0.29 (2.0)		0.42 (2.9)		0.41 (0.1)
D-W stat	1.00		0.70		0.72	
# of obs	47	46	47	46	47	46
Adj R-sq	0.939	0.895	0.942	0.885	0.933	0.869
Women Aged 20-24:						
ACE cohort size	-0.94 (-6.0)	-1.00 (-4.5)	-0.12 (-4.3)	-0.15 (-3.9)	-9.04 (-3.5)	-8.88 (-2.6)
WW cohort size	0.52 (5.8)	0.53 (4.5)	15.72 (9.2)	16.21 (7.5)	13.74 (8.4)	13.71 (6.1)
Real income	0.38 (33.9)	0.38 (23.2)	0.44 (22.6)	0.45 (16.2)	0.46 (18.3)	0.46 (12.5)
Intercept	-0.42 (-0.6)	-0.23 (-0.2)	-19.90 (-8.6)	-18.89 (-6.2)	-23.94 (-11.6)	-23.73 (-8.1)
rho		0.37 (2.7)		0.44 (3.2)		0.48 (0.0)
D-W stat	0.81		0.51		0.51	
# of obs	47	46	47	46	47	46
Adj R-sq	0.966	0.934	0.931	0.884	0.924	0.851

t-statistics in parentheses

Model 1 -- Includes a logged ACE variable in WW model.
Model 2 -- Includes an unlogged WW variable in the ACE model.
Model 3 -- Includes an unlogged WW variable in ACE model with a current population-based ACE cohort variable.

For definitions of variables, see appendix.

Table 3: Cohort Size Model of Male Enrollment Rates, 1948-93 and 1964-93

	Dependent Variable: College Enrollment			Dependent Variable: Total Enrollment		
	1948-93 Reduced Form	1964-93 Structural		1948-93 Reduced Form	1964-93 Structural	
	(1)	(2)	(3)	(4)	(5)	(6)
Males Aged 18-19:						
ACE cohort size	-0.68***			-0.97***		
	(5.9)			(8.8)		
Real Income	1.25***			0.87***		
	(8.8)			(6.6)		
Trade/capita	-0.02			0.09***		
	(0.6)			(2.9)		
Draft	0.09***	0.09***	0.10***	0.11***	0.12***	0.16***
	(6.9)	(5.4)	(6.8)	(8.8)	(6.1)	(8.0)
Male Relative Income			-0.52***			-1.07***
			(4.8)			(7.5)
College Wage Premium		0.85***			1.65***	
		(4.8)			(7.8)	
Family Income		0.24			0.43*	
		(1.1)			(1.7)	
Intercept	-2.81***	-1.60***	-1.25***	0.24	-1.85***	-1.38***
	(6.1)	(3.2)	(8.2)	(0.5)	(3.1)	(7.0)
D-W stat	1.54	2.20	1.73	2.07	1.92	1.56
# of obs	46	30	30	46	30	30
Adj R-square	0.9187	0.7220	0.6057	0.9286	0.8242	0.7017
Males Aged 20-24:						
ACE cohort size	-0.52***					
	(5.4)					
Real Income	0.52***					
	(5.2)					
Trade/capita	0.13***					
	(5.0)					
Draft	0.08***	0.08***	0.10***			
	(7.5)	(5.9)	(6.2)			
Male Relative Income			-0.49***			
			(4.2)			
College Wage Premium		0.76***				
		(4.3)				
Family Income		0.28*				
		(1.6)				
Intercept	-1.64***	-2.19***	-1.72***			
	(3.3)	(5.2)	(10.8)			
D-W stat	1.44	1.07	0.95			
# of obs	46	30	29			
Adj R-square	0.9313	0.6845	0.5638			

t-statistics in parentheses: *** significant at .01 level, * significant at .10 level.
For definitions of variables, see appendix.

Table 4: Reduced Form and Structural Models of Female College Enrollment Rates, 1947-93 and 1964-93

	Reduced Form Cohort Size Model 1948-93	Structural Model 1964-93
Women Aged 18-19:		
ACE cohort size	-0.34 ***	
	(2.7)	
Real Income	1.10 ***	
	(7.1)	
Trade/capita	0.25 ***	
	(7.2)	
Draft	0.05 ***	0.04 ***
	(3.38)	(2.5)
Male Relative Income		-0.96 ***
		(4.2)
Family Income		0.79 ***
		(2.6)
College Wage Premium		1.24 ***
		(3.5)
Intercept	-5.10 ***	-4.25 ***
	(10.1)	(6.8)
D-W stat	1.37	1.65
# of obs	46	29
Adj R-square	0.9666	0.9209
Women Aged 20-24:		
ACE cohort size	-0.53 ***	
	(4.6)	
Real Income	1.38 ***	
	(12.9)	
Trade/capita	0.37 ***	
	(13.2)	
Male Relative Income		-1.12 ***
		(4.7)
Family Income		1.10 ***
		(3.7)
College Wage Premium		1.65 ***
		(3.4)
Intercept	-7.00 ***	-6.26 ***
	(10.9)	(12.6)
D-W stat	1.44	1.47
# of obs	46	27
Adj R-square	0.9829	0.9423

t-statistics in parentheses: *** significant at .01 level.
For definitions of variables, see appendix.

Appendix: Definitions and Sources of Variables Used

The following is an alphabetical listing of variables used in the analyses reported in this paper, with definitions and indicating the sources of the data used for each variable. Table A-l in this appendix indicates which variables were used in each model reported in the tables in the main text of this paper, and Table A-2 presents means and standard deviations for each variable.

adraft24 = 1960-73: annual number of inductees per 100 total males aged 20-24
all other years: zero
source.. Statistical Abstract, 1968, 1973, I975

al1draft = *adraft24* lagged one year

blsm1819 = percent of total males aged 18-19 in the military, each year
source.. 1948-92 -- *John Stinson, BLS*
1993-94 -- calculated as the difference between U.S. resident population plus armed forces overseas, and civilian U.S. population.

blsm2024 = percent of total males aged 20-24 in the military, each year
source.. 1948-92 -- John Stinson, BLS
1993-94 -- calculated as the difference between U.S. resident population plus armed forces overseas, and civilian U.S. population.

evm1819 = percent of all women each year aged 18-19 who are ever-married
Source: Current Population Reports, series P-20, "Marital Status and Living Arrangements", annually

evm2024 = percent of all women each year aged 20-24 who are ever-married
Source: Current Population Reports, series P-20, "Marital Status and Living Arrangements", annually

eww1819 = exp(wwl819)

eww2024 = exp(ww2024)

faminc = log(average total family income ($1967) of all families with children, with head of either sex aged 45-54, in thousands)
Source: Calculated from March Current Population Survey public use tapes, 1964-95

fsdiffe = log of five year moving average of the ratio of (average expected hourly earnings of females with 16+ years of completed education) divided by (average expected hourly earnings females with 12 years of completed education),
where average expected hourly earnings are average hourly earnings of all fulltime, full year workers in their first five years of potential work experience, multiplied by one minus the unemployment rate of the same group
and potential work experience = age minus completed schooling minus six
source: calculated from March Current Population Survey public use tapes, 1964-95

gfr1819 = five year moving average of (lag18(*GFR*)+lag19(*GFR*))/2, where *GFR* = General Fertility Rate
source.. Vital Statistics, Natality, 1987, and 1994 Annual Summary of Births, Marriages, Divorces and Deaths

gfr2024 = five year moving average of (lag20(*GFR*)+lag21(*GFR*)+lag22(*GFR*)+lag23(*GFR*)+lag24(*GFR*))/5, where ***GFR*** is the General Fertility Rate
source.. Vital Statistics, Natality, 1987

inc4.554 = median total income ($1967) of all men aged 45-54, in thousands
source.. Current Population Reports, series P-60, #167, 172, 174, 180, 184

l1ratio2 = ***ratio2*** lagged one year

l1unemp2 = first lag of average unemployment rate of all unenrolled female high school graduates working fulltime, full year in their first five years of potential work experience
where potential work experience = age minus completed schooling minus six
source: calculated from March Current Population Survey public use tapes, 1964-95

13ratio = ***ratio*** lagged three years

13sdiffe = ***fsdiffe*** lagged three years

lfe1819 = log of the proportion of noninstitutionalized females aged 18-19 enrolled in school
source.. enrollment numbers and population from Current Population Reports, series P-20, 'School Enrollment," annually

lfe2024 = log of the proportion of noninstitutionalized females aged 20-24 enrolled in school
source.. ***enrollment numbers and population from Current Population Reports, series P-20, "School Enrollment," annually***

lgfr1819 = log(*gfr1819*)

lgfr2024 = log(*gfr2024*)

linc4554 = log(median total income ($1967) of all men aged 45-54, in hundreds)
source.. ***Current Population Reports, series P-60, #167, 172, 174, 180, 184***

lmc1819 = log(*pmc1819*)

lmc2024 = log(*pmc2024*)

line1819 = log(*pme1819*)

lpf1819 = log(*pfem1819*)

lpf2024 = log(*pfem2024*)

met1819 = log of the proportion of total noninstitutionalized males aged 18-19 enrolled in school
source.. enrollment numbers and civilian *populationfrom* ***Current Population Reports, series P-20, "School Enrollment," annually***
military population from same sources as *blsm1819*

met2024 = log of the proportion of total noninstitutionalized males aged 20-24 enrolled in school
source.. enrollment numbers and civilian population from Current Population Reports, series P-20, "'School Enrollment, " annually

military population from same sources as blsm2024

pfem1819 = percentage of all noninstitutionalized civilian females aged 18-19 enrolled in college
source.. enrollment numbers and** civilian **population from Current Population Reports, series P-20, "'School Enrollment," annually

pfem2024 = percentage of all noninstitutionalized civilian females aged 20-24 enrolled in college
source: enrollment numbers and civilian population from Current Population Reports, series P-20, 'School Enrollment," annually

pme18194 = percentage of all noninstitutionalized civilian males aged 18-19 enrolled in school
source.. enrollment numbers and civilian population from Current Population Reports, series P-20, 'School Enrollment," annually

pmc1819 = percentage of all noninstitutionalized civilian males aged 18-19 enrolled in college
source.. enrollment numbers and civilian population from Current Population Reports, series P-20, "'School Enrollment," annually

pmc2024 = percentage of all noninstitutionalized civilian males aged 20-24 enrolled in college
source.' enrollment numbers and civilian population from Current Population Reports, series P-20, 'School Enrollment, " annually

ratio = log of the ratio of (the five year moving average of the average annual earnings of all unenrolled males in their first five years of potential work experience multiplied by their activity rate) to
(five year moving average of the average annual income of all families with children, with head of either sex aged 45-54)
where potential work experience is age minus completed schooling minus six
source.. calculated from March Current Population Survey public use tapes, 1964-95

ratio2 = log of the ratio of (the five year moving average of the average annual earnings of all unenrolled male high school graduates in their first five years of potential work experience multiplied by their activity rate) to
(five year moving average of the average annual income of all families with children, with head of either sex aged 45-54)
where potential work experience is age minus completed schooling minus six
source.. calculated from March Current Population Survey public use tapes, 1964-95

re11819 = total population aged 18-19, divided by total population aged 45-49
source.. Current Population reports, series P-25, "Total Population Including Armed Forces Abroad, " various years

re12024 = total population aged 21-23, divided by total population aged 45-49
source.. Current Population reports, series P-25, "Total Population Including Armed Forces Abroad, " various years

sdiffe = log of the five year moving average of the ratio of (average expected hourly earnings of males with 16+ years of completed education) divided by (average expected hourly earnings males with 12 years of completed education),
where average expected hourly earnings are average hourly earnings of all fulltime, full year workers in their first five years of potential work experience, multiplied by one minus the unemployment rate of the same group
and potential work experience = age minus completed schooling minus six
source.. calculated from March Current Population Survey public use tapes, 1964-95

tinc4554 = median total income ($1967) of all men aged 45-54, in hundreds
source.. Current Population Reports, series P-60, #167, 172, 174, 180, 184

trade = log((exports plus imports in constant 1987 dollars)/total U.S. population).
source.. Dave Wasshausen, Economics and Statistics Administration, U.S. Dept. of Commerce.

ww1819 = log((total population aged 25-29*.645)+(total population aged 20-24*2.28))-
log((total population aged 5-9*.645)+(total population aged 10-14*2.28))
where weights used are meant to replicate average of single year weights use by WW. (Their weights were ***l/n,*** where ***n*** is the number of years between cohort under observation and the lead or lag cohort)
source.. Current Population reports, series P-25, "Total Population Including Armed Forces Abroad," various years

ww2024 = log((total population aged 30-34*.645)+(total population aged 25-29*2.28))-
log((tota1 population aged 10-14*.645)+(total population aged 15-19*2.28))
(Their weights were ***l/n,*** where ***n*** is the number of years between cohort under observation and the lead or lag cohort)
source.. Current Population reports, series P-25, "Total Population Including Armed Forces Abroad," various years

wdraft24 = ***1960-73:*** annual number of inductees per 1000 total males aged 20-24
all other years: zero
source.. Statistical Abstract, 1968, 1973, 1975

Table A-1: Variables Used in each Table

	dependent variable	ACE cohort size	WW cohort size	real income	draft	marriage	military	family income	relative income	wage premium	trade
Table 1:											
ACE males 18-19	pmc1819	gfr1819		tinc4554	adraft24						
ACE females 18-19	pfem1819	gfr1819		tinc4554		evm1819					
ACE males 20-24	pmc2024	gfr2024		tinc4554	alldraft						
ACE females 20-24	pfem2024	gfr2024		tinc4554		evm2024					
WW males 18-19	met1819		ww1819	inc4554	wdraft24		blsm1819				
WW females 18-19	lfe1819		ww1819	inc4554		evm1819					
WW males 20-24	met2024		ww2024	inc4554	wdraft24		blsm2024				
WW females 20-24	lfe2024		ww2024	inc4554		evm2024					
Table 2:											
Age 18-19:											
Model 1:	lfe1819	lgfr1819	ww1819	inc4554		evm1819					
Model 2:	pfem1819	gfr1819	eww1819	tinc4554		evm1819					
Model 3:	pfem1819	rel1819	eww1819	tinc4554		evm1819					
Age 20-24:											
Model 1:	lfe1819	lgfr2024	ww2024	inc4554		evm2024					
Model 2:	pfem2024	gfr2024	eww2024	tinc4554		evm2024					
Model 3:	pfem2024	rel2024	eww2024	tinc4554		evm2024					
Table 3:											
Males 18-19:											
College Enrollment:	lmc1819	lgfr1819		linc4554	adraft24			faminc	ratio2	sdiffe	trade
Total enrollment:	lme1819	lgfr1819		linc4554	adraft24			faminc	ratio2	sdiffe	trade
Males 20-24:	lmc2024	lgfr2024		linc4554	alldraft			faminc	l1ratio2	sdiffe	trade
Table 4:											
Women 18-19:	lpf1819	lgfr1819	ww1819	linc4554				faminc	ratio	fsdiffe	trade
Women 20-24:	lpf2024	lgfr2024	ww2024	linc4554				faminc	l3ratio	l3sdiffe	trade

Table A-2: Means of Variables in Specific Subperiods
(Standard Deviations in Parentheses)

Tables **Years** **# of obs**	**1** **1948-80** **33**	**1** **1948-93** **46**	**1** **1954-93** **40**	**2** **1948-93** **46**	**3&4** **1964-93** **30**	**3&4** **1948-93** **46**
adraft24	0.945 (1.433)	0.678 (1.283)	0.780 (1.349)		0.825 (1.472)	0.678 (1.283)
alldraft	0.945 (1.433)	0.678 (1.283)	0.780 (1.349)		0.825 (1.472)	0.678 (1.283)
blsm1819	0.132 (0.051)	0.108 (0.058)	0.098 (0.054)			
blsm2024	0.168 (0.084)	0.140 (0.085)	0.131 (0.075)			
evm1819	26.987 (5.118)			23.277 (7.966)		
evm2024	65.481 (6.390)			59.562 (11.972)		
eww1819	0.841 (0.165)			0.931 (0.210)		
eww2024	0.847 (0.170)			0.929 (0.204)		
faminc					2.512 (0.133)	
fsdiffe					0.512 (0.070)	
gfr1819	96.773 (15.293)	96.968 (14.790)	98.788 (15.543)	97.914 (14.488)		
gfr2024	95.569 (13.370)	98.965 (13.956)	98.290 (14.714)	99.716 (14.085)		
inc4554	6.656 (1.756)	7.246 (1.769)	7.697 (1.414)	7.120 (1.833)		
l1ratio2					-1.146 (0.106)	
l3ratio					-1.126 (0.097)	
l3sdiffe					0.496 (0.057)	
lfe1819	-1.110 (0.266)			-1.010 (0.321)	-0.481 (0.232)	-0.846 (0.548)
lfe2024	-2.284 (0.554)			-2.099 (0.625)	-1.386 (0.300)	-1.923 (0.737)
lgfr1819	4.560 (0.157)			4.573 (0.148)		4.563 (0.152)
lgfr2024	4.550 (0.140)			4.592 (0.144)		4.584 (0.143)
linc4554						4.249 (0.274)
lmc1819						-0.660 (0.321)
lmc2024						-1.200 (0.287)
lme1819						-0.202 (0.319)
met1819	-0.901 (0.206)	-0.826 0.217)	-0.763 (0.151)			
met2024	-1.677 (0.277)	-1.590 (0.278)	-1.514 (0.202)			
pfem1819	26.439 (8.488)			30.056 (10.531)		
pfem2024	11.060 (5.601)			13.862 (7.409)		
pme1819		48.993 (7.512)				
pmc1819	32.803 (7.183)	34.452 (6.730)	36.425 (4.604)			
pmc2024	22.309 (5.026)	23.529 (4.849)	24.792 (3.780)			

Table A-2: Means of Variables in Specific Subperiods (Continued)
(Standard Deviations in Parentheses)

Tables	**1**	**1**	**1**	**2**	**3&4**	**3&4**
Years	**1948-80**	**1948-93**	**1954-93**	**1948-93**	**1964-93**	**1948-93**
# of obs	**33**	**46**	**40**	**46**	**30**	**45**
ratio					-1.146 (0.106)	
ratio2					-1.302 (0.206)	
rel1819				0.580 (0.120)		
rel2024				0.845 (0.185)		
sdiffe					-0.513 (0.070)	
tinc4554	66.560 (17.569)	72.456 (17.694)	76.967 (14.136)	71.202 (18.330)		
ww1819	-0.191 (0.192)	-0.092 (0.231)	-0.102 (0.244)	-0.096 (0.230)		-0.092 (0.231)
ww2024	-0.184 (0.197)	-0.090 (0.229)	-0.119 (0.231)	-0.097 (0.226)		-0.090 (0.229)
wdraft24	9.457 (14.336)	6.784 (12.834)	7.802 (13.487)			
pctot						4.369 *(1.119)*