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THE BABY BOOM'S LEGACY: RELATIVE WAGES IN THE 21ST CENTURY

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ABSTRACT

This paper assesses the impact of the post WWII baby boom on relative wages, when this baby boom cohort becomes the oldest segment of the workforce. Time series data are used to estimate a model of the demand for workers in eight age/sex groupings. Using these estimates, we simulate relative wages in the year 2020 assuming the age/sex composition of the workforce behaves according to projections. The results are used to examine the baby boom's potential impact on wages of older, prime-age, and teenage workers, as well as the anticipated wage gap between males and females.

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THE BABY BOOM'S LEGACY: RELATIVE WAGES IN THE 21ST CENTURY

The economic impact of the large cohort born between 1946 and 1964 has been explored by several researchers. Analysis to date focuses mainly on the downward pressure on baby boomer's wages as their cohort entered the labor force (c.f. Freeman, 1979; Russell, 1982; Welch, 1979). The present paper extends this literature by assessing the baby boom's impact on relative wages in the year 2020 when this generation will be the oldest segment of the workforce.

Several important public policy questions are addressed. First, will the changing demographic structure decrease the relative wages of prime-age workers? If so, there may be justification for social policy encouraging early retirement among those age 55+ to lessen downward pressure on prime-age workers' wages. A second question that the research addresses is, how will the graying of the workforce affect teeenage workers wages? Because teens' wages and school attendance are linked, pay reductions may influence their investments in human capital and future earnings potential (Ehrenberg and Marcus, 1982). Finally, we investigate whether changing age structures are predicted to affect the female/male wage gap forty years hence.

The analysis uses national time series data (from 1955 to 1984) to estimate an econometric model of the demand for workers in eight different age/sex categories. Labor groups analyzed by sex are teens (age 16-19), young workers (age 20-34), mature workers (age 35-54) and older workers (age 55+). Estimated coefficients are employed to predict changes in relative wages to the year 2020, when the youngest of the baby boom group will be over age 55. Section I presents our methodology and data, section II summarizes our elasticity estimates, section III describes the policy simulation and section IV draws conclusions.

I. Methodology and Data

Hamermesh and Grant (1979) recommend using a production function approach to compute how wages would change in response to changes in factor quantities. Rather than estimating a translog model directly, we estimate the coefficients in the relevant output share equations. In the empirical application below, cost shares will be utilized as the dependent variable since in competitive equilibrium they are equal to output shares.

Estimated coefficients are used to compute elasticities of complementarity and factor price elasticities. Elasticity variances are computed by applying the delta method.[1]

Coefficient estimates will also be employed in the policy simulation to determine the total effect of a changing labor force on relative wage rates. The effect of a quantity change ($\%\Delta\ X_j$) on wages of labor subgroup i ($\%\Delta\ W_i$) is computed as:[2]

$$\%\Delta\ W_i = 1/S_i\ [\textstyle\sum_j \gamma_{ij}\ (\%\Delta\ X_j)] - \%\Delta\ X_i + \textstyle\sum_j S_j\ (\%\Delta\ X_j),$$

where S_i is the share of the i^{th} input to total cost and the γ_{ij} are estimated translog coefficients.

Like all production function models, the framework assumes that input supply changes are exogenously determined. We do not attempt to relax this assumption since there exist few instruments in time series data. The likely effect of instrumenting has been shown to be

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[1]The derivation appears in Appendix 1.

[2]The derivation of this formula appears in Appendix 2..

negligible in a study by Ehrenberg and Smith (1987) though Borjas (1986) finds that instrumenting alters a few of his findings.

The model is estimated with symmetry and homogeneity imposed.[3] Imposing these cross-equation constraints on the system of equations implies that disturbance terms may be correlated across equations. Thus the model is estimated using an iterative Seemingly Unrelated Regressions technique.

Estimation requires data on the quantity of each labor input, capital, and each input's share of total costs. All variables are annual national aggregates.[4] Derivation of employment, hours, weeks, and wage data is detailed in Freeman (1979). Capital quantity and price data are taken from the MIT-Penn-SSRC (MPS) data bank.

II. Elasticity Estimates

Table 1 presents statistically significant substitutes and complements within all labor categories.[5] Two conclusions emerge:

1. Most substitution occurs across gender for different age categories. Complementarity occurs across age groups for a given gender (with the exception of teenagers).

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[3]A test for symmetry and homogeneity is not rejected at the 5% level. Tests for separability of labor from capital and consistent male and female aggregates are all rejected at conventional levels.

[4]Data descriptions and complete descriptive statistics are contained in Appendices 3 and 4.

[5]Factor price and factor complementarity elasticities are reported in Appendix 5.

TABLE 1.

Statistically Significant Complements and Substitutes[a]

(Elasticities of factor complementarity[b] ranked from highest to lowest)

Complements		Substitutes	
FT-MM	+4.24	FT-MO	-7.99
FY-FM	+3.86	FT-FY	-7.80
MY-MO	+1.07	FT-FM	-7.22
		FO-MM	-1.65
		FY-MM	-0.81

Notes:

[a] Elasticities are statistically significant at the 95% level.

[b] Variable Definitions:

FT = Female teen (16-19) MT = Male teen(16-19)
FY = Female young (20-34) MY = Male young (20-34
FM = Female mature (35-54) MM = Male mature (35-54)
FO = Female older (55+) MO = Male older (55+)

2. Older males are complementary with young males, and substitutable with female teens. Older females are substitutable with mature males.

III. Policy Simulation

To determine the impact on relative wages caused by the aging of the workforce, we apply the simulation formula above to our coefficient estimates and projections of how the entire age distribution is likely to change over time. Table 2 reports two projections of labor force patterns between 1985 and 2020 by age/sex subgroup obtained from data published by the Bureau of Economic Analysis (BEA) and the Social Security Administration (SSA). Both series are used in the empirical analysis below since the magnitudes differ due to different extrapolation methodologies. Both forecasts show the percentage of older workers will increase substantially as the baby boom ages. Predicted growth in female participation also implies larger changes for women than men. Changes in each labor group's wages are computed allowing capital to vary as predicted.[6]

Reported simulation results (see Table 3) indicate the predicted change in the wage of several labor subgroups between 1985 and 2020. If labor supply patterns behave according to projections, the evidence indicates that the aging of the workforce will have little effect on the wage distribution by age. While older workers' wages are predicted to increase 1.2 to 5.6%, prime-age workers' (mature and young) are predicted to increase a similar 4.4 to 7.8%. This finding is contrary to the notion that incentives for early retirement are needed to protect prime-age workers' wages.

[6]The value of capital stock for 2020 is imputed from a regression of actual capital stock from 1955 to 1984 on a trend variable.

TABLE 2.
Projected Changes in Labor Supply
By Age and Sex: 1985(actual) - 2020

Demographic Group	BEA Projections (1)	SSA Projections (2)
Female teen	21.5%	19.5%
Female young	3.8	4.1
Female mature	32.4	47.3
Female older	54.5	92.0
Male teen	16.5	18.4
Male young	-9.9	-4.7
Male mature	23.5	32.7
Male older	46.1	81.2

Notes:

Column 1 is the difference between the actual number of workers in that age/sex group in 1985 and Bureau of Economic Analysis projections for 2020 (US Department of Commerce, 1981).

Column 2 is the difference between actual number of workers in that age/sex group in 1985 and Social Security Administration projections for 2020 (US Social Security Administration, 1983).

Age groups are given in Table 1.

TABLE 3.
The Baby Boom's Impact on Wages: 2020 versus 1985[a]

Average predicted wage change for:	%Δ in Wage (BEA projection)	%Δ in Wage (SSA projection)
Older workers	5.6%	1.2%
Mature workers	7.8	4.4
Young workers	6.1	5.7
Teen workers	24.3	1.5
Female workers	-10.3%	-7.8%
Male workers	12.2	8.6

[a] Age groups are given in Table 1.

However, when we consider males and females separately, we see that prime-age women will be hurt relative to older workers. The predicted increase of 1.2 to 5.6% for older workers is contrasted with a 10.8 to 15.7% decrease for prime-age women. Female workers as a whole will also be hurt in comparison with male workers. While male wages are predicted to increase 8.6 to 12.2%, female wages are predicted to decrease 7.8 to 10.3%. This result is driven by prime-age workers: among this age group, men's wages are forecasted to increase 11 to 14.9% and women's to decrease 10.8 to 15.7%. As a result the female/male wage gap will rise by the year 2020, ceteris paribus.

The analysis of teens remains inconclusive because of the large differences between SSA and BEA results.

IV. Conclusions

Coefficients from a translog production function are used to estimate demand elasticities and predict the relative wages of men and women in the year 2020. Our elasticity results indicate that, with the exception of teens, substitution occurs across gender and complementarity occurs across age groups for a given gender. Also, we find several interdependencies with older workers: older men are complementary with young men and substitutable with teenage women, while older women are substitutable with mature men.

The simulation results indicate that wages of prime-age workers will not deteriorate in relation to older worker's as a result of the aging of the baby boom cohort. Conclusions for teens cannot be drawn. The general result does not hold for women, however. Prime-age women are predicted to lose in comparison with older workers and with men, increasing rather than reducing wage differentials by sex, ceteris paribus.

Appendix 1.

Appendix for "The Baby Boom's Legacy"
Levine and Mitchell, September 1987

FORMULAS FOR ELASTICITY VARIANCES

In a translog system of share (S_i) equations, equation i is represented by:

$$S_i = \underset{(TxK)}{X} \; \underset{(Kx1)}{\alpha_i} + \underset{(Tx1)}{\varepsilon_i}$$

where: $X = (e \; x)$,

$e =$ column of 1's (Tx1),

$x =$ observed variables [T x (K-1)].

The OLS estimator for α_i is:

$$\hat{\alpha}_i = (X'X)^{-1} X' S_i = \alpha_i + (X'X)^{-1} X' \varepsilon_i.$$

The mean cost share of input i may be written as:

$$\bar{S}_i = \frac{e'S_i}{T} = \frac{e'X \alpha_i}{T} + \frac{e'\varepsilon_i}{T}$$

$$= \bar{X} \alpha_i + \bar{\varepsilon}_i.$$

Therefore an estimate of $\bar{S}_i$ is $\bar{X} \alpha_i$.

Consider the covariance between the estimate of the coefficient, α_i, and the mean share, S_j:

$$E[(\hat{\alpha}_i - \alpha_i)(\bar{S}_j - \bar{X} \alpha_j)] = E[(X'X)^{-1} X' \varepsilon_i \bar{\varepsilon}_j]$$

$$= (X'X)^{-1} X' E \left[\varepsilon_i \frac{\varepsilon_j' e}{n} \right] = (X'X)^{-1} X' E(\varepsilon_i \varepsilon_j') \frac{e}{n} .$$

If we assume that $E(\varepsilon_i) = E(\varepsilon_j) = 0$, that the only correlation among the error terms is across inputs and not observations (over time), and that the covariance between any two inputs i and j is σ_{ij}, then $E(\varepsilon_i \varepsilon_j') = \sigma_{ij} I_T$

$$\Rightarrow E[(\hat{\alpha}_i - \alpha_i)(\bar{S}_j - \bar{X} \alpha_j)] = (X'X)^{-1} X' (\sigma_{ij} I_T) \frac{e}{n}$$

$$= (\sigma_{ij}/n) (X'X)^{-1} X'e$$

$$= (\sigma_{ij}/n) (X'X)^{-1} X' \quad (e \; x) \begin{bmatrix} 1 \\ 0 \\ \cdot \\ \cdot \\ \cdot \\ 0 \end{bmatrix}$$

$$= (\sigma_{ij}/n)(X'X)^{-1}(X'X)\begin{bmatrix}1\\0\\ \vdots\\0\end{bmatrix} = (\sigma_{ij}/n)\begin{bmatrix}1\\0\\ \vdots\\0\end{bmatrix} = (\sigma_{ij}/n)\ e_1$$

where $e_1 = \begin{bmatrix}1\\0\\ \vdots\\0\end{bmatrix}$.

From this we see that the only nonzero covariance is between the estimated mean share and the first coefficient. But, since X = (e x), the first coefficient is just the constant term.

This result also follows for estimates restricted by symmetry and homogeneity. If we redefine $\alpha_i = \begin{bmatrix}\gamma_i\\ \delta_i\end{bmatrix}$, where γ_i is the scalar constant and the δ_i's are the remaining coefficients, then these restrictions may be written as $R\begin{bmatrix}\delta_i\\ \vdots\\ \delta_n\end{bmatrix} = r$ where n is the number of equations in the system. The restricted GLS (Seemingly Unrelated Regressions with cross-equation constraints) estimates are linear functions of only unrestricted (OLS) estimates of $\delta_1, \ldots, \delta_n$, not functions of estimates of $\gamma_1, \ldots, \gamma_n$. Therefore, the covariance between the restricted estimates and the estimated mean share is also equal to zero.

To compute the variance on the elasticity estimates, define:

$\hat{V}_{ij}$ = estimated variance of $\hat{\alpha}_{ij}$

$\hat{\sigma}_{ij}$ = estimated $E(\varepsilon_i \varepsilon_j)$.

Note that $\text{Var}\begin{bmatrix}\bar{S}_i\\ \bar{S}_j\end{bmatrix} = \text{Var}\begin{bmatrix}\bar{\varepsilon}_i\\ \bar{\varepsilon}_j\end{bmatrix} = 1/T\begin{bmatrix}\sigma_{ii} & \sigma_{ij}\\ \sigma_{ji} & \sigma_{jj}\end{bmatrix}$

$\Rightarrow$ estimated $\text{Var}\begin{bmatrix}\bar{S}_i\\ \bar{S}_j\end{bmatrix} = 1/T\begin{bmatrix}\hat{\sigma}_{ii} & \hat{\sigma}_{ij}\\ \hat{\sigma}_{ji} & \hat{\sigma}_{jj}\end{bmatrix}$.

From all of the above,

$$V = \text{estimated Var}\begin{bmatrix}\hat{\alpha}_{ij}\\ \bar{S}_i\\ \bar{S}_j\end{bmatrix} = \begin{bmatrix}\hat{V}_{ij} & 0 & 0\\ 0 & \hat{\sigma}_{ii}/T & \hat{\sigma}_{ij}/T\\ 0 & \hat{\sigma}_{ji}/T & \hat{\sigma}_{jj}/T\end{bmatrix}.$$

The formula for cross-input elasticities of complementarity evaluated at the mean share is:

$$c_{ij} = h(\alpha_{ij}, \bar{S}_i, \bar{S}_j) = 1 + \left(\alpha_{ij}/\bar{S}_i\bar{S}_j\right).$$

According to the delta method*, the estimate of c_{ij} is asymptotically unbiased and normally distributed with variance $(Dh)'\,V(Dh)$ where Dh is the Jacobian of h. In this case,

$$Dh = \frac{1}{\bar{S}_i\bar{S}_j}\begin{bmatrix}1\\ -\hat{\alpha}_{ij}/\bar{S}_i\\ -\hat{\alpha}_{ij}/\bar{S}_j\end{bmatrix}$$

Thus,

$$\text{Var}(c_{ij}) \approx \frac{1}{\bar{S}_i^{\,2}\,\bar{S}_j^{\,2}}\left(1 \quad -\hat{\alpha}_{ij}/\bar{S}_i \quad -\hat{\alpha}_{ij}/\bar{S}_j\right)\begin{bmatrix}\hat{V}_{ij} & 0 & 0\\ 0 & \hat{\sigma}_{ii}/T & \hat{\sigma}_{ij}/T\\ 0 & \hat{\sigma}_{ji}/T & \hat{\sigma}_{ij}/T\end{bmatrix}\begin{bmatrix}1\\ -\hat{\alpha}_{ij}/\bar{S}_i\\ -\hat{\alpha}_{ij}/\bar{S}_j\end{bmatrix}$$

*For a discussion of the delta method, see Rao, C. R., Linear Statistical Inference and Its Applications. New York: John Wiley and Sons, 1965, pp. 386-387.

Similarly, the formula for the own elasticity of complementarity is:

$$c_{ii} = h(\alpha_{ii}, \bar{S}_i) = 1 + \frac{\alpha_{ii}}{\bar{S}_i^2} - \frac{1}{\bar{S}_i}$$

Applying the delta method:

$$Dh = \frac{1}{\bar{S}_i^2}\begin{pmatrix} 1 \\ 1 - 2\alpha_{ii}/\bar{S}_i \end{pmatrix}$$

$$\mathrm{Var}(c_{ii}) \approx \frac{1}{\bar{S}_i^4}\begin{pmatrix} 1 & 1 - 2\alpha_{ii}/\bar{S}_i \end{pmatrix}\begin{bmatrix} \hat{V}_{ii} & 0 \\ 0 & \hat{\sigma}_{ii}/T \end{bmatrix}\begin{bmatrix} 1 \\ 1 - 2\alpha_{ii}/\bar{S}_i \end{bmatrix}$$

To find the variances for the factor price elasticities, we have the formulas:

$$\eta_{ij} = \bar{S}_j\, c_{ij} = \bar{S}_j + \alpha_{ij}/\bar{S}_i\,.$$

$$\Rightarrow Dh = \begin{bmatrix} 1/\bar{S}_i \\ -\alpha_{ij}/\bar{S}_i^2 \\ 1 \end{bmatrix}$$

$$\Rightarrow \mathrm{Var}(\eta_{ij}) = (1/\bar{S}_i \quad -\alpha_{ij}/\bar{S}_i^2 \quad 1)\begin{bmatrix} \hat{V}_{ij} & 0 & 0 \\ 0 & \hat{\sigma}_{ii}/T & \hat{\sigma}_{ij}/T \\ 0 & \hat{\sigma}_{ji}/T & \hat{\sigma}_{jj}/T \end{bmatrix}\begin{bmatrix} 1/\bar{S}_i \\ -\alpha_{ij}/\bar{S}_j^2 \\ 1 \end{bmatrix}$$

For the own-price elasticity:

$$\eta_{ii} = \bar{S}_i\, c_{ii} = \bar{S}_i + \frac{\alpha_{ii}}{\bar{S}_i} - 1$$

$$\Rightarrow Dh = \begin{bmatrix} 1/\bar{S}_i \\ 1 - \alpha_{ii}/\bar{S}_i^2 \end{bmatrix}$$

$$\Rightarrow \mathrm{Var}(\eta_{ii}) = (1/\bar{S}_i \quad 1 - \alpha_{ii}/\bar{S}_i^2)\begin{bmatrix} \hat{V}_{ii} & 0 \\ 0 & \hat{\sigma}_{ii}/T \end{bmatrix}\begin{bmatrix} 1/\bar{S}_i \\ 1 - \alpha_{ii}/\bar{S}_i^2 \end{bmatrix}$$

Appendix 2.

Appendix for "The Baby Boom's Legacy"
COMPUTING RELATIVE WAGE CHANGES DUE TO CHANGES IN LABOR SUPPLY
Levine and Mitchell, September 1987

This appendix derives a formula to compute relative wage changes due to changes in the distribution of labor supply along the lines of Ehrenberg and Smith (1987). We adopt a general translog production function of the form:

$$\ln Y = \alpha_o + \Sigma_i \ \alpha_i \ \ln Xi + 1/2\Sigma_i \ \Sigma_j \ \gamma_{ij} \ \ln X_i \ \ln X_j \qquad (A.1)$$

where: X_i = i^{th} input,
Y = output,
i = (1, . . . , n),
j = (1, . . . , n).

Rather than estimating this directly, we derive and estimate the coefficients in the relevant share equations:

$$Si = \alpha_i + \Sigma_j \ \gamma_{ij} \ \ln X_j \ , \qquad (A.2)$$

where Si = the share of the ith input to total output. In the empirical application, cost shares are utilized since in competitive equilibrium they are equal to output shares.

From equation (A.2):

$$dSi = \Sigma_j \ \gamma_{ij} \ \mathrm{dlog} \ X_j, \qquad (A.3)$$

where the share is defined as:

$$Si = W_i X_i \ /Y. \qquad (A.4)$$

Taking logs and totally differentiating:

$$(1/S_i) \ dS_i = \mathrm{dlog} \ S_i = \mathrm{dlog}W_i + \mathrm{dlog}X_i - \mathrm{dlog}Y \qquad (A.5)$$

$$\approx \%\Delta W_i + \%\Delta X_i - \%\Delta Y$$

$$\Rightarrow \ \%\Delta W_i \approx (1/S_i) \ dS_i - \%\Delta X_i + \%\Delta Y.$$

From (A.5):

$$\%\Delta W_i \approx (1/S_i) \ [\Sigma_j \ (\gamma_{ij})(\%\Delta X_j)] - \%\Delta X_i + \%\Delta Y$$

To find %ΔY in known terms:

$$Y = F(X_1, \ . \ . \ . \ , \ X_n),$$

$$dY = F_1 dX_1 + \ldots + F_n \, dX_n,$$

where F_i is the first-order derivative with respect to X_i. Dividing both sides by Y and multiplying each term on the right hand side by $X_i/X_i = 1$:

$$\frac{dY}{Y} = F_1 \frac{dX_1}{Y} + \frac{X_1}{X_1} + \ldots + F_n \cdot \frac{dX_n}{Y} \frac{X_n}{X_n}$$

If W = MP, then:

$$\frac{dY}{Y} = \frac{W_1 X_1}{Y} \frac{dX_1}{X_1} + \ldots + \frac{W_n X_n}{Y} \frac{dX_n}{X_n}$$

in which case:

$$\%\Delta Y \approx S_1 \ (\%\Delta X_1) + \ldots + S_n \ (\%\Delta X_n)$$

=> total effect on wages:

$$\%\Delta W_i \approx (1/S_i) \ [\Sigma_j \ \gamma_{ij} \ (\%\Delta X_j)] - \%\Delta X_i + \Sigma_j \ S_j \ (\%\Delta X_j). \qquad (A.6)$$

REFERENCES:

Ehrenberg, Ronald G. and Smith, Robert S. "Comparable Worth Wage Adjustments and Female Employment in the State and Local Sector." Journal of Labor Economics January 1987.

Appendix 3.

Data Appendix for "The Baby Boom's Legacy".
Levine and Mitchell, September 1987

EMPLOYMENT AND EARNINGS DATA:

I. Primary data sources

Male & female total employment figures by age, 1955-84: *Handbook of Labor Statistics 1985* (through 1983) and *Employment and Earnings* (for 1984).

Average weeks worked per year of full time and part time workers (male and female, by age groups): Derived from 1969 *Work Experience of the Population.*

Money income by age and sex for full-time workers, 1955-84: CPR P-60 series.

Full time year round workers as % of total employment by age and sex, 1955-84: CPR P-60 series.

Percent of full time workers by age and sex, 1955-84: SLFR series.

Number of teens age 14-19, 15-19, 16-19 by sex in selected years: CPR P-60 and SLFR series.

II. Data Manipulations:

A. Compute average weeks worked per year for full time and part time workers.

Using data from 1969 *Work Experience of the Population* (following Freeman, JHR 1979), we computed a weighted average of weeks by age and sex for all FT and PT workers by sex.

B. Devise weekly hours of work per week for FT and PT workers.

Like Freeman (JHR 1979), we assume average hours of FT workers = 40, average hours of PT workers = 20.

C. Compute money income of teens, adjusted by the different coverage of teenage groups, 1955-84. (1955-78 figures were for 14-19 year olds; 1979-on figures were for 15-19 year olds.)

This was done using CPR P-60 series by comparing earnings of FTFY workers in 1978 versus 1979. Earnings excluding the 14 year old males in 1979 were -2% (real) as compared to including the 14-year old males in 1978; thus the correction multiplied male incomes for 1955-78 by .98. For females the difference was +5.4%, so the correction factor for women was 1.06.

D. Determine the number of full time and part time workers by age & sex, 1955-84.

a. There are no readily available data on the number of full time and part time workers in all years needed. (The SLFR has figures for only some years -- 1959-70, 1972-78, 1982; figures are not available for 1955-58, 1971, 1979-81, 1983-5).

However CPR P-60 series reports data by age/sex/year for % of full time year round workers, which is used after adjusting by a correction factor to "inflate" the figures.

For three different years (1959, 1969, 1978) we computed the relationship between (i) the % of full time year round workers by age and sex, and (ii) the % of full time workers. The averages of the ratios across the three years were fairly stable, and were as follows:

male teens	= 4.28
male (20-34)	= 1.43
male (35-54)	= 1.20
male (55+)	= 2.02
female teens	= 7.73
female (20-34)	= 2.20
female (35-54)	= 1.70
female (55+)	= 3.90

We multiplied the % FTyear round by these corrrection factors to get a time series on % full time by age and sex (and, by subtraction, % part time).

b. The next task was to obtain numbers of FT and PT workers by age, sex, and year.

(i) # FT = % FT (from the last step) times the employment figures [from *Handbook of Labor Statistics* 1985 (thru 1983) and *Employment and Earnings* (for 1984)].

(ii) # PT = # Employed - # FT .

c. The final step was to adjust the employment figures for teens to reflect the fact that from 1955-78 kids age 14-19 were included, while from 1979 on, 15-19 year olds were included. Both figures were adjusted to include only 16-19 year olds.

The corrections could only use 1978 and 1979 data since other years did not have all the numbers necessary for computing the factors.

The 1955-78 correction is based on the fact that in 1978 there were 27% fewer 16-19 year olds (from SLFR data) than 14-19 year-olds (CPR P-60). The 1979-on correction factor is based on the finding that there were 24% fewer 16-19 year olds in 1978, than there were 15-19 year olds in 1979.

The correction factor for teens 1955-78 was hence .73, and .76 for 1979 forward. These are multiplied by the # PT and # FT emploment figures in the previous step.

E. Compute hourly wages for each age/sex group 1955-84.

For each age/sex/year, we divided money income of full time year round workers as adjusted in C, by hours computed by multiplying annual weeks of fulltime workers in A by weekly hours in B.

F. Compute total yearly hours worked for each age/sex group 1955-84.

This was equal to the hours computed by multiplying annual weeks in A by weekly hours in B of full time and part time workers, weighted by the number of full and time part time workers (from D).

Capital Data:

I. **Primary data source**:

MPS computerized quarterly data file*

II. **Methodology**:

The object was to compute the quantity of capital and its share of total cost.

1) The MPS data set includes quarterly quantity of equipment and quantity of structure variables in 1982 \$. A single quantity of capital variable was created by taking the annual average of these variables and summing them.

2) To get cost shares, it is necessary to estimate the compensation paid to capital equal to the quantity of capital times its rental rate. To get the rental rate, the MPS data set includes variables which measure the user cost of equipment and the user cost of structures multiplied by the price index for equipment and structures, respectively. To get the rental rate, these two variables were first divided by the appropriate price index and then aggregated to get annual rates. Then a weighted average was computed to get one rental rate for all capital.

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*The "user cost of structures" variable (RTPS) on the MPS data set contained unusual values for years prior to 1959. This was due to unusual values in some of the price indices used in its computation (PPSNV and PXXPFW1). Hence the variable was recreated from the MPS data set using different price indices without these flaws. The help of Flint Brayton of the Federal Reserve Board in diagnosing the problem and recreating this variable is greatly appreciated.

Appendix 4.

Appendix for "The Baby Boom's Legacy"
Levine and Mitchell, September 1987

DESCRIPTIVE STATISTICS: TIME SERIES DATA
(standard deviations in parentheses)

Input	Variables				
	SHARE	HOURS	KSTOCK	HWAGE	COSTK
FT	.007 (.001)	1451.41 (395.96)	---	8.74 (0.63)	---
FY	.073 (.020)	11148.58 (5177.59)	---	11.87 (1.37)	---
FM	.083 (.005)	14582.28 (2723.61)	---	9.86 (1.37)	---
FO	.031 (.003)	6283.78 (1167.38)	---	8.64 (1.39)	---
MT	.007 (.001)	1373.93 (356.03)	---	8.95 (1.63)	---
MY	.176 (.008)	29894.91 (6813.90)		10.28 (1.27)	---
MM	.266 (.031)	38384.14 (1973.66)	---	11.83 (1.93)	---
MO	.093 (.008)	14889.86 (453.18)	---	10.73 (2.07)	---
K	.265 (.022)	-----	2192.49 (705.47)	-----	0.216 (0.016)

Variables Definitions:

SHARE = Cost share of input i.
HOURS = total number of hours worked by workers in labor subgroup i (in millions).
KSTOCK = Capital stock (in billions of 1982 dollars).
HWAGE = Hourly wage rate (in 1982 dollars).
COSTK = Rental rate of capital.

FT = Female teen (Age 16-19)
FY = Female young (Age 20-34)
FM = Female mature (Age 35-54)
FO = Female older (Age 55+)
MT = Male teen (Age 16-19)
MY = Male young (Age 20-34)
MM = Male mature (Age 35-54)
MO = Male older (Age 55+)
K = Capital

Appendix 5.

Appendix for "The Baby Boom's Legacy"
Levine and Mitchell, Spetember 1987

FACTOR PRICE ELASTICITIES
(Standard Errors in Parentheses)

	With Respect to Quantity of:								
Price of:	FT	FY	FM	FO	MT	MY	MM	MO	K[a]
FT	-0.05 (0.15)	-0.57** (0.19)	-0.60** (0.32)	-0.08 (0.24)	-0.10 (0.17)	0.23 (0.24)	1.13** (0.40)	-0.74** (0.25)	0.81 (0.01)
FY	-0.06** (0.02)	0.08 (0.08)	0.32** (0.06)	0.06 (0.04)	-0.03 (0.03)	0.18* (0.10)	-0.22** (0.07)	-0.05 (0.06)	-0.22 (0.004)
FM	-0.05* (0.03)	0.28** (0.05)	0.13 (0.11)	0.04 (0.06)	-0.06 (0.04)	-0.05 (0.06)	-0.02 (0.13)	-0.05 (0.07)	-0.22 (0.004)
FO	-0.22** (0.05)	0.14 (0.09)	0.11 (0.16)	0.37** (0.17)	-0.09 (0.06)	-0.01 (0.11)	-0.44** (0.20)	0.10 (0.12)	-0.15 (0.01)
MT	-0.11 (0.17)	-0.30 (0.27)	-0.73* (0.44)	-0.38 (0.29)	0.36 (0.23)	0.23 (0.36)	0.22 (0.50)	-0.14 (0.33)	0.82 (0.01)
MY	0.01 (0.01)	0.08 (0.04)	-0.02 (0.03)	-0.002 (0.02)	0.01 (0.01)	-0.24** (0.09)	0.03 (0.05)	0.10** (0.03)	0.44 (0.004)
MM	0.03** (0.01)	-0.06** (0.02)	-0.01 (0.04)	-0.05** (0.02)	0.01 (0.01)	0.02 (0.03)	-0.20** (0.06)	-0.02 (0.03)	0.29 [b]
MO	-0.06** (0.02)	-0.04 (0.04)	-0.04 (0.07)	0.03 (0.04)	-0.01 (0.02)	0.19** (0.06)	-0.06 (0.09)	-0.34** (0.07)	0.32 [b]
K[a]	0.02** (0.0003)	-0.06** (0.003)	-0.07** (0.003)	-0.02** (0.001)	0.02** (0.0004)	0.03** (0.004)	0.29** (0.003)	0.11** (0.001)	-0.32 (0.01)

Notes:
* \- Significant at 90% level
** \- Significant at 95% level
a - All elasticities with capital (K) are significant at the 95% level
b - Smaller than 0.0001

Variable definitions appear in Table 1.

Appendix for "The Baby Boom's Legacy"
Levine and Mitchell, September 1987

ELASTICITIES OF FACTOR COMPLEMENTARITY
(Standard Errors in Parentheses)

With Respect to Quantity of:

Price of:	FT	FY	FM	FO	MT	MY	MM	MO	K[a]
FT	-6.71	-7.80**	-7.22**	-2.56	-14.87	1.36	4.24**	-7.99**	3.04
	(21.25)	(2.68)	(3.86)	(7.57)	(23.81)	(1.34)	(1.52)	(2.70)	(0.04)
FY		0.11	3.86**	1.93	-4.12	1.04**	-0.81**	-0.56	-0.84
		(1.10)	(0.70)	(1.19)	(3.74)	(0.56)	(0.27)	(0.59)	(0.04)
FM			1.51	1.27	-8.83	-0.26	-0.77	-0.49	-0.83
			(1.39)	(1.90)	(5.35)	(0.36)	(0.49)	(0.81)	(0.04)
FO				11.79**	-12.28	-0.06	-1.65**	1.07	-0.58
				(5.45)	(9.16)	(0.62)	(0.76)	(1.31)	(0.04)
MT					52.02	1.33	0.84	-1.47	3.10
					(32.82)	(2.03)	(1.88)	(3.54)	(0.08)
MY						-1.37**	0.10	1.07**	0.17
						(0.53)	(0.17)	(0.33)	(0.03)
MM							-0.76**	-0.22	1.08
							(0.22)	(0.35)	(0.01)
MO								-3.67**	1.22
								(0.74)	(0.01)
K[a]									-1.22
									(0.05)

Notes:

* - Significant at 90% level
** - Significant at 95% level
a - All elasticities with capital (K) are significant at the 95% level

Variable definitions appear in Table 1.

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