EXPANDING IMPUTED VALUES IN THE NATIONAL INCOME AND PRODUCT ACCOUNTS*

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After defining economic activity the author lists the chief types of non-market economic activities for which he has prepared estimates for the United States 1929–1973, and briefly describes his methodology and data sources. Some major findings are:

(1) As of 1973 GNP adjusted to include the additional imputations was 63.5 percent larger than the official estimate.

(2) At least since 1929 imputed values have grown faster than official GNP, especially when both are measured in terms of real factor costs.

(3) The personal sector comprises a far larger portion of the national economy—almost one-third—when account is taken of imputed labor and property compensation, and its relative importance has grown.

(4) Gross government product is more than 60 percent higher when the imputed rental value of public property is added to the compensation of general government employees.

(5) Reflecting the relative growth of non-business wealth, imputed property income has risen much faster than monetized property income. This has mitigated the decline in the property share of expanded gross national income compared with its share in the official estimates.

The official national income and product accounts of most countries contain but a limited range of imputed values for non-market economic activities. In the United States imputations accounted for only 7.6 percent of GNP in 1973, down from 8.7 percent in 1929, and they comprise only a few activities for which significant market counterparts exist.[1]

The case for expanding imputations so that national income and product will cover all significant types of non-market as well as market activities is strong in order to provide a better basis for inter-temporal growth calculations, and for inter-spatial comparisons of income and product in absolute and *per capita* terms. The case has become stronger in recent years as data from time-use surveys furnish a basis for estimating the labor time devoted to non-pecuniary production activities; and as progress in wealth estimation makes possible estimates of the imputed rental values of non-business properties contributing to want-satisfaction.

In this paper we present and describe exploratory estimates for the major types of non-pecuniary economic activities, not now included in the U.S.

*The research on which this paper is based was supported by grants from the National Science Foundation to the National Bureau of Economic Research's project on the Measurement of Economic and Social Performance under the direction of Richard Ruggles. The author was assisted by Elizabeth S. Wehle of NBER in preparing some of the estimates. This is a revised version of the paper prepared for August 1977 meetings of the International Association for Research in Income and Wealth in York, England.

[1]Bureau of Economic Analysis, U.S. Department of Commerce, *The National Income and Product Accounts of the United States, 1929–74, Statistical Tables*, Table 8-3, pp. 356–7 (1929–45) and pp. 304–7 (1946–74).

accounts, which add over 50 percent to the official GNP estimates in 1929 and more than 60 percent in 1973. We do not attempt the still more ambitious task essayed by Nordhaus-Tobin and others[2] to exclude the value of intermediate products believed to be included in NNP, additionally to include the imputed value of non-economic leisure-time activities, and otherwise adjust for various disamenities in order to arrive at a more meaningful basis for assessing changes and differences in economic welfare. But the estimation of the value of excluded economic activities is a large step in that direction, as well as providing a more comprehensive and detailed measure of production which many economists feel is the major objective of national product estimates.

Even the limited goal of expanding imputations raises various consequential conceptual, as well as statistical, problems, of which I shall briefly address a couple in this introductory section. The first is the problem of drawing a line between economic and non-economic activity and then, having done so, of identifying the chief types of non-market economic functions for which imputed values are to be estimated. I define as economic those activities undertaken primarily for the sake of the resulting income or product, while non-economic activities are undertaken primarily for their own sake—social, recreational, and other leisure-time pursuits. This is consistent with the criterion that non-market services could as well be purchased under favorable supply conditions, but not the non-economic activities.[3] This, like other attempts to define "economic", is not entirely satisfactory. And some activities near the boundary line may be difficult to classify according to any criterion—some "do-it-yourself" work, for example. But a degree of ambiguity attaches to most classificatory schemes, and I do not believe there would be much debate concerning most of the non-market activities I have classed as economic, shown in Table 2 and discussed below.

The other issue relates to the basis for valuation of unpaid factor services—market price (where available) or opportunity cost. Here I agree with Murphy and Adler-Hawrylyshyn in their papers for this conference[4] that since GNP is a measure of final production at market prices we should use the former principle. But in a few cases there is no market counterpart (notably, the value of schoolwork), and opportunity cost is used. Also, for much non-business property, significant market analogues do not exist and we build up the rental value estimates as the sum of the net interest, rent and depreciation components.

Summary of Methodology and Sources

This summary will be brief, since with a few exceptions the imputed values presented in this paper were developed as a by-product of a recent study I

[2]See William D. Nordhaus and James Tobin, "Is Growth Obsolete?" *The Measurement of Economic and Social Performance*, Vol. 38 of Studies in Income and Wealth (New York: National Bureau of Economic Research, 1973).

[3]See Oli Hawrylshyn, "Towards a Definition of Non-Market Activities", *The Review of Income and Wealth*, March, 1977, p. 87.

[4]Since published in this Review: Murphy, Martin, "The Value of Nonmarket Household Production: Opportunity Cost versus Market Cost Estimates", Series 24, No. 3, September 1978, pp. 223–42 and Adler, Hans J., and Oli Hawrylyshyn, "Estimates of the Value of Household Work, Canada, 1961 and 1971", Series 24, No. 4, December 1978, pp. 333–56.

prepared for the National Bureau of Economic Research and are described in that volume.[5]

The basic approach has necessarily been from the factor cost side. Estimates of unpaid working hours and of the real stocks of non-business property can be prepared from available data, although the data are of varying quality. Estimates of average hourly earnings and index numbers of property prices and of gross rates of return are also available as a means of arriving at imputed values in current and constant prices.

Since gross national product less indirect business taxes plus subsidies equals gross factor cost, it is appropriate to compare the current imputed values with the official measures, and to combine them—just as is done in the official accounts—with income and product originating in the non-business domestic sectors which are likewise estimated at factor cost. But in constant prices, the imputed values represent real factor cost rather than real product in an output sense, since output quantities and prices, even for a base-period, are not available for the non-market services. Therefore, real imputed values are not comparable with real GNP, particularly with that originating in the business sector which largely reflects final outputs. It is meaningful, however, to compare real imputed values with real gross factor cost corresponding to the official real product estimates, and to add them together as we do below.

The estimates of real gross national income and product and imputed values are stated in constant 1958 prices. Since this project began the official estimates have been shifted to a 1972 price base, but we recalculated, by sector, to the 1958 base. To obtain real gross factor cost originating in the business sector, we extrapolated the official 1958 value by our index numbers of real gross factor input.[6] Since the official real income and product estimates for the non-business sectors represent real factor costs, we merely converted them from a 1972 to a 1958 factor price base by the appropriate ratios.

To avoid repetition in the following section, to obtain real labor costs we multiplied total hours in each category by constant 1958 average hourly labor compensation. To obtain real property costs, we multiplied the real gross stocks by the 1958 net interest (or rent) percentage, and added real depreciation on structures and equipment.

Unpaid Household Work

Non-market household work is first measured in terms of time spent on five major types of activity:

(1) Food and beverage preparation, service, and clean-up;
(2) Care of home, grounds, and equipment; construction and repairs;
(3) Making and caring for clothing and home furnishings;
(4) Care of family, including transportation (but excludes amusing children);
(5) Household management, record-keeping, shopping, etc.

[5]John W. Kendrick, *The Formation and Stocks of Total Capital* (New York: National Bureau of Economic Research, 1976).

[6]John W. Kendrick, *Postwar Productivity Trends in the United States 1948–1969* (New York: National Bureau of Economic Research, 1973), Table A-20a, p. 250.

Data on time worked by family members, for husband-wife families and other categories of households, by significant characteristics, were assembled from seventeen time-budget surveys conducted between 1924 and 1976. When the surveys were standardized for composition and characteristics of households, and adjusted for comparability of activities included, there was no discernible trend in the number of hours devoted to unpaid household work over the past

TABLE 1

AVERAGE WEEKLY HOURS OF UNPAID HOUSEHOLD WORK BY HOUSEHOLD MEMBERS, BY TYPE OF FAMILY AND/OR HOUSEHOLD

	Employment Status of Wife:	
A. Husband-Wife Households	Employed	Not Employed
Household member and Family type		
Wives		
No children under 18 years	27.4	38.4
All children 6–17 years	37.5	51.5
Some children under 6 years	44.2	59.8
Husbands		
No children under 18 years	7.7	11.2
All children 6–17 years	10.5	11.6
Some children under 6 years	11.7	11.3
Other adults		
No children under 18 years	0.6	1.0
All children 6–17 years	0.8	0.2
Some children under 6 years	—	0.1
Teenagers (12–17 years)		
All children 6–17 years	8.5	7.2
Some children under 6 years	1.1	2.7
Pre-teens (6–11 years)		
All children 6–17 years	3.4	4.9
Some children under 6	2.2	2.8

	Employment Status:	
B. Non-Husband-Wife Households	Employed	Not Employed
Primary individuals living alone		
Females	21.9	30.7
Males	13.7	19.2
Heads without spouses of 2+ persons households		
Female heads	29.6	43.9
Male heads	14.6	27.2
Other adults in 2+ person households	Combined	
Female heads	4.2	
Male heads	3.0	
Teenagers in one-parent households		
Female heads	4.7	
Male heads	2.8	
Pre-teens in one-parent households		
Female heads	2.1	
Male heads	1.2	

Source: Elizabeth S. Wehle, "Unpaid Household Work—Methodology and Sources", unpublished paper available on request to the *Review*.

half-century. Consequently, average hours worked per week per year were held constant for persons in each type of household, by significant characteristic (sex, and employment status), as shown in Table 1. Some of the surveys contained data relating to race and location (rural or urban), but the differences according to these characteristics were not deemed large enough to warrant their inclusion.

The average hours in the table were based on two of the more recent and larger surveys. The first, reported by Kathryn Walker and Margaret Woods[7], covered 1296 husband-wife households in Syracuse, N.Y., and its suburbs, over the year ending in April 1968 in order that seasons of the year, as well as days of the week, could be adequately represented. Various patterns of family composition, by employment status of the wife, were differentiated, which we consolidated into the groups shown in the table by means of the 1970 Public Use sample.

The Walker-Woods data were supplemented and extended by data from a tape prepared for the National Bureau of Economic Research's Project on Measurement of Economic and Social Performance by F. Thomas Juster, program director of the Institute for Social Research, University of Michigan Survey Research Center. The Michigan data were collected from a random sample of 1519 households including husband-wife households with one or more other adults present as well as those with no other adults; one-person households, and those with two or more members but no spouse or household head. The interviews were conducted in waves during the fall of 1975 and spring of 1976. Institutional populations are excluded.

To obtain total hours the averages for the groups shown in the table were multiplied by the annual estimates for the numbers of persons in each category from the Current Population Surveys of the Census Bureau. Total annual hours were then multiplied by the average hourly labor compensation of household employees as estimated by the Bureau of Economic Analysis.

Other Unpaid Labor Services

The value of time devoted to school work by students of working age (taken to be 14 years and over in this study) is second only to house work in the labor category. In view of the investment characteristics of education, there can be no question but what school work represents economic activity. Good data are available on numbers of full-time and part-time students by educational level, from the Office of Education. After conversion to full-time equivalents and adjustment for average unemployment rates, we multiplied the numbers at each educational level by the average annual labor compensation of persons in the same age bracket who started working after attaining the prior level of education.

Estimates of the volume of volunteer labor were "benchmarked" on a 1964 Labor Department survey of the numbers of persons so engaged, and hours worked, extrapolated backward and forward in time by fragmentary data assembled by Wolozin.[8] Since adequate distributions by occupational type of volunteer

[7]Kathryn E. Walker and Margaret E. Woods, *Time-Use: A Measure of Household Production of Family Goods and Services* (Washington: Center for the Family of the American Home Economics Association, 1976).

[8]Harold Wolozin, "The Value of Volunteer Services in the U.S. Economy", unpublished manuscript prepared for the National Bureau of Economic Research, 1966.

activity were not available, we multiplied hours worked by average hourly compensation in the services sector of the economy, adjusted to exclude effects of changes in industry and occupational mix.

The normal frictional unemployment associated with technological and other dynamic economic changes, taken to be 3 percent of the civilian labor force, is considered to represent a social cost of economic progress and efficiency. Also, the unemployed are engaged in job-search, which, as part of investment in mobility, is a productive activity with both individual and social returns. Since there is no market wage-rate for job-search as such, we multiply the average number of frictionally unemployed persons by the average compensation of all employees, adjusted to exclude effects of changing composition.

Final Products Charged by Business to Current Expense

The investments charged by business to current expense would, if capitalized, have added to gross profits and to GNP. The tangible investments (small tools, etc.) had been estimated by B.E.A. until 1966; since then we extrapolated the B.E.A. numbers by total producers' durable equipment expenditures. The intangible investments—comprising company-financed R & D, employee education and training, health, safety, and selected mobility costs—were based on data gathered by the National Science Foundation, and the Departments of Labor and Health, Education and Welfare. To be consistent with our treatment of the non-business sectors we deflated the totals by the implicit deflator for property compensation.

The consumption outlays charged by business to current expense consist of two distinct categories. Employee consumption, consisting largely of business travel and entertainment expenses, is viewed as a supplement in kind to wages and salaries, and thus increases both labor compensation and GNP. The estimates were based on those prepared by B.E.A. for its input–output matrices. The other category, public consumption subsidized by business advertising expenses (radio and TV programs, newspapers and magazines) is viewed as a business transfer payment, and thus increases GNP but not gross national income. It is this item which accounts for the difference between the total value of imputations and the total imputed factor costs in the tables. The employee consumption portion was deflated by the implicit deflator for labor compensation in the business sector, whereas the public consumption portion was deflated by appropriate components of the B.E.A. price deflators for personal consumption expenditures.

Rental Values of Non-business Property

The land, structures, equipment and inventory stocks owned by the personal and government sectors obviously supply a stream of productive services which should be valued and included in gross national income and product. This is recognized by B.E.A. in the case of owner-occupied dwellings, although the imputed space rental value is included in gross business product. Thus, the official estimates measure income and product originating in the personal and government sectors only in terms of labor compensation. But for a complete production function analysis, both labor and non-labor factor costs must be estimated as an

approximation to value added and, in real terms, as inputs into the process of producing the final outputs of the non-business sectors.

Ideally, the rental values would be estimated in terms of what is charged for comparable facilities by the private real estate industry. Because of lack of data, and absence of comparability in some major instances, we build up the rental values as the sum of imputed net interest on the property, plus depreciation charges for the fixed reproducibles. The first step in the process is the estimation of the gross and net stocks, in current and constant prices. These estimates are described in *The Formation and Stocks of Total Capital.*

For the household sector, the net interest rates applied to the stock estimates were the average net borrowing rate for the debt-financed portion of the stocks, and the average net lending rate for the portion representing equity. For the government sector, the average borrowing rates of Federal and of state and local governments were applied to the stock estimates for each segment. To the imputed net interest costs were added the depreciation estimates, in current and constant prices, which emerged as a by-product of the fixed reproducible stock estimates obtained by the perpetual inventory approach.

Major Findings

Relative Trends of Imputations in Current Values by Type

The imputations included in the official Commerce Department GNP estimates declined from a high of 8.6 percent of GNP in 1929 to 5.1 percent in 1948, thereafter rising to 7.6 percent in 1973. The largest component, imputed space rent on owner-occupied nonfarm dwellings, represented 60 percent of the total in 1929, and over three-fourths in 1973. Its ratio to GNP also rose, following a decline from 1929 to 1948. The imputed value of services rendered without charge by financial intermediaries comprised the same 1.3 percentage of GNP in 1973 as in 1929, after trending down to 1948. Reflecting the relative decline of agriculture, food produced and consumed on farms and farm space-rental declined almost continuously from 1.6 percent of GNP in 1929 to 0.3 percent in 1973. Payments in kind (mostly food) after a small relative increase from 1929 to 1948, declined from 0.7 percent of GNP to 0.2 percent in 1973.

The additional imputations presented in our study added another 53.5 percent to official GNP in 1929, rising to 63.5 percent in 1973. Combining the official and additional imputations, the estimated value of total non-monetized economic activity rose from roughly 62 percent of official GNP in 1929 to almost 71 percent in 1973. Although the market share of economic activity undoubtedly rises in the earlier stages of economic development, our numbers suggest that beyond some point of affluence and reduced average hours worked for pay, the non-market sector grows faster than market transactions.

Looking at the various types of non-market activity, beginning with the household sector, the largest item is the value of the services of housewives and other unpaid family workers. Comprising about 26 percent of GNP in 1929, this category declined a bit to 24.4 percent in 1973. In view of the rising labor force participation of females, particularly married women, and the shorter hours

worked at home by women with paid jobs, it may seem surprising that the relative decline of this category was not steeper. But the imputed average earnings of household workers rose much more than the implicit price deflator for GNP, so that the drop in time spent in household work relative to market production was cushioned by the relative increase in price.

The imputed value of school work rose steadily from less than 5 percent of GNP in 1929 to over 11 percent in 1973. This reflected an increase in the proportion of youngsters 14–17 years of age completing high school, and particularly the increase in proportions 18 years of age and over going on to higher education. The estimated value of volunteer labor increased proportionately even more, from 0.6 percent of GNP in 1929 to 2.0 percent in 1973. Although the earlier estimates of this category are not firmly based, it seems plausible that there should have been a substantial relative increase in volunteer work in view of the downward trend in average hours worked per year and little change in the proportion of adults in the paid labor force. The costs of frictional unemployment eased a bit in the post-World War II period from the 2.0 percent of 1929.

The imputed rental value of personal sector property declined from 10.4 percent of GNP in 1929 to about 8 percent in 1948, then rose to a new high of 11.3 percent in 1973. The relative decline reflected the reduced levels of personal sector capital outlays during the Great Depression and World War II, with the increase thereafter reflecting the stronger rates of expenditure for land, equipment, and inventories.[9]

The imputed values of business outlays charged to current expense, which really represent final products, showed a modest relative increase from 5.5 percent of GNP in 1929 to 5.8 per cent in 1973. Tangible capital outlays remained around 0.3 per cent of GNP throughout. But intangible investments for research and development, and for education, health, safety, and mobility of employees, rose from around 2 percent of GNP in 1929 to 3.5 per cent in 1973. A major increase of intangible investments and capital stocks relative to tangible investments and capital stocks was taking place in all sectors.[10]

Personal consumption financed by business advertising expenses with the media remained relatively constant at around 0.7 per cent of GNP. But consumption of employees charged to business expenses showed a relative decline of almost one-half, from 2.5 percent of GNP in 1929 to 1.3 percent in 1973. In part, this reflected a tightening-up by tax authorities on "expense-account living" of certain classes of employees.

The imputed rental values of government property rose sharply from 3.7 percent of GNP in 1929 to 8.1 percent in 1948, reflecting a major relative increase in public capital formation and stocks. After 1948 it eased off somewhat to 7.0 percent in 1973.

Although we do not show the annual estimates in this paper it should be noted that the imputed values continue to increase significantly in recession years as well as in expansion years, both in current and in constant prices. Therefore, the

[9]Kendrick, *op. cit.*, Chapter 2, pp. 58–60. BEA is in process of preparing capital stock estimates for the non-business sectors, which will furnish an even better basis for imputing rental values when completed.

[10]*Ibid.*, Chapters 3 and 4.

expanded income and product estimates show smaller percentage declines during contractions than the official market-oriented measures.

Relative Trends of Imputations in Constant Prices, by Type

It would not be appropriate to relate imputed values in constant prices to real GNP, as noted earlier. The reason is that the imputations are made in terms of the quantities of factors employed in non-market activities, valued at factor prices; whereas gross product originating in the predominant business sector is measured largely in terms of final outputs, valued at market prices. Since productivity has advanced significantly over the years in the business economy, market prices have risen proportionately less than factor prices. So despite the fact that imputed values have risen in relation to GNP in current prices, in constant prices they would be seen to have declined (from 65 percent in 1929 to 53 percent in 1973).

TABLE 2

IMPUTATIONS BY SECTOR AND TYPE IN RELATION TO GROSS NATIONAL PRODUCT

	A. Billions of Dollars				B. Percentage of GNP			
	1929	1948	1966	1973	1929	1948	1966	1973
GNP, official	103.4	259.1	753.0	1,306.3	100.0	100.0	100.0	100.0
Additional imputed values								
Personal Sector, total	45.7	117.7	349.5	663.4	44.2	45.4	46.4	50.8
Unpaid household work	27.1	73.6	180.1	318.4	26.2	28.4	23.9	24.4
Volunteer labor	0.6	2.9	15.4	25.8	0.6	1.1	2.0	2.0
School work	5.1	15.7	60.9	148.1	4.9	6.1	8.1	11.3
Frictional unemployment	2.1	4.5	12.3	24.1	2.0	1.7	1.6	1.8
Imputed rentals:								
Household capital	10.4	20.5	76.5	138.5	10.1	7.9	10.2	10.6
Institutional capital	0.3	0.5	4.3	8.5	0.3	0.2	0.6	0.7
Business sector, total	5.8	14.7	46.9	75.5	5.5	5.7	6.2	5.8
Investments expensed								
Tangible	0.3	0.9	1.8	2.3	0.3	0.3	0.2	0.3
Intangible	2.2	6.9	27.0	45.6	2.1	2.7	3.6	3.5
Consumption expensed								
Employee	2.6	5.2	11.9	17.4	2.5	2.0	1.6	1.3
Public	0.7	1.6	6.1	9.2	0.7	0.6	0.8	0.7
Government sector								
Imputed rentals	3.8	21.0	49.9	91.2	3.7	8.1	6.6	7.0
Total Imputed Values	55.3	152.8	446.3	830.1	53.5	59.8	59.3	63.5

When real imputed values are related to real gross national income, the comparisons are valid since both measure real factor costs. On this basis, as shown in Table 3 the total real imputed costs rose from about 46 percent of real gross national income to over 74 percent in 1973. This was a significantly sharper relative increase than that based on current values which went from 58 percent in 1929 to 69 percent in 1973. The reconciliation between the two sets of numbers lies in the implicit price deflators, which rose substantially more for gross national income (from roughly 32 in 1929 to 203 in 1973) than for imputed costs (from 40

in 1929 to 189 in 1973). Most of the relatively slower rate of increase in the factor price deflators for imputed values came in the labor factor prior to 1958, and in the capital factor thereafter.

The differential factor price movement reflects the composition of the imputed factor costs which is quite different from that of measured national income. But we suggest that greater reliance should be placed on the constant dollar estimates in Table 3 than on the current value estimates in Table 2, since in the estimating process the real estimates were prepared first, based on hours worked and real capital stocks, and then converted to current values by application of the relevant factor prices.

Rather than describe the relative movements of the real imputed values by type as shown in Table 3, as we did above with reference to Table 2, it sufficies to observe that in almost all cases the increases in the ratios of imputed values to gross income are sharper in constant prices than in current values. This is

TABLE 3

IMPUTATIONS BY SECTOR AND TYPE IN RELATION TO GROSS NATIONAL INCOME

	1929	1948	1966	1973
A. Billions of Constant 1958 Dollars				
Gross national income, official base	293.6	354.7	501.5	583.8
Additional imputations:				
Personal sector, total	113.0	157.7	274.9	354.7
Unpaid household work	74.2	98.1	131.2	145.6
Volunteer labor	1.6	4.3	11.7	13.4
School work	12.4	22.8	47.0	68.7
Frictional unemployment	5.0	6.5	9.5	13.0
Imputed rental values				
Household capital	18.6	24.9	72.6	110.3
Institutional capital	1.2	1.1	2.9	3.7
Business sector, total	15.0	16.3	29.6	33.5
Investments expensed	4.9	8.7	20.0	29.2
Employee consumption expensed	10.1	7.6	8.7	4.3
Government sector, rentals	7.4	30.5	39.6	44.3
Total	135.4	204.5	344.1	432.5
B. Ratios of Imputed Values to Gross National Income (Percentages)				
Personal sector, total	38.5	44.5	54.8	60.8
Unpaid household work	25.3	27.7	26.2	24.9
Volunteer labor	.5	1.2	2.3	2.3
School work	4.2	6.4	9.4	11.8
Frictional unemployment	1.7	1.8	1.9	2.2
Imputed rental values				
Household capital	6.3	7.0	14.4	18.9
Institutional capital	0.4	0.3	0.6	0.6
Business sector, total	5.1	4.6	5.9	5.7
Investments expensed	1.7	2.5	4.2	5.0
Employee consumption expensed	3.4	2.1	1.7	0.7
Government sector, rentals	2.5	8.6	7.9	7.6
Total	46.1	57.7	68.6	74.1

particularly marked for the imputed rental values of household and public properties. In the case of unpaid household work the relative decline almost vanished. Although the shift of women to paid employment reduced average hours worked in households per person, the decline only paralleled that taking place in paid employment.

Imputations in Relation to Income and Product, by Sector

The proportionate additions to income and product represented by imputations differ considerably by sector from the adjustments on a total national basis. This is true both for levels, and for relative changes in current and real dollars. With respect to levels, looking at 1973 we see that, in contrast to the overall increase in GNP of 63.5 percent contributed by imputations, in the personal sector imputed values were over 17-fold the official estimates! That is, to the $40.4 billion official figure, representing the compensation of household servants and employees of private non-profit institutions, we have added $663.4 billion, consisting of $516.4 billion for unpaid labor and $147.0 billion for the rental value of property owned in the sector other than dwellings. Instead of 3.1 per cent of GNP by official estimate, the personal sector represents 33 per cent of adjusted GNP when imputed values are added both to the sectoral and total gross products (See Table 4). This is by far the largest impact of imputations, since those for the personal sector comprise almost 80 percent of total imputations. We maintain that the adjusted estimates give a far more realistic picture of the household sector in aggregate economic activity.

Gross government product is expanded by 61 per cent in 1973 when the imputed rental value of public property amounting to $91.2 billion is added to the $149.1 billion official estimate which includes labor compensation alone. Since the proportionate increase in gross government product is almost the same as that in total GNP as a result of imputations, the public sector share remains around 11 percent on both bases.

The smallest effect of imputations is on business sector product, which is raised by only 7 percent. But due to the greatly expanded share of the personal sector in adjusted GNP, the business sector share falls from 84.8 percent of the official basis to 55.4 percent on the adjusted basis.

The trend in gross product of each sector before and after adjustment also differs from that in adjusted GNP relative to the official series, which rose from 1.535 in 1929 to 1.635 in 1973. In the government sector, the ratio of adjusted to official gross product fell from 1.88 to 1.61 over the same period. But this was more than offset by an increase in the personal sector ratio from 16.8 in 1929 to 17.4 in 1973. The business sector ratio rose only slightly from 1.06 to 1.07.

In constant prices, the sectoral patterns are somewhat different from the current value patterns (See Tale 4B). Instead of falling, the ratio of adjusted real gross income originating in government to the unadjusted estimates rose from 1.61 in 1929 to 1.69 in 1973 (after a bulge on both bases in 1948). The personal sector ratio rose even more in constant than in current prices—from 16.5 in 1929 to 20.8 in 1973. The business sector ratios show virtually the same movements in both current and constant prices.

TABLE 4

IMPUTATIONS IN RELATION TO OFFICIAL GROSS NATIONAL INCOME AND PRODUCT ESTIMATES, BY SECTOR

	1929	1948	1966	1973
A. Billions of Current Dollars, and Ratios as Indicated				
Personal sector				
Gross product, official	2.9	5.6	21.1	40.4
Imputations	45.7	117.7	349.5	663.4
Adjusted gross product	48.6	123.3	370.6	703.8
Ratio to official	16.8	22.0	17.6	17.4
Business sector, official				
Gross product	95.4	234.9	651.1	1,107.8
Imputations	5.8	14.7	46.9	75.5
Adjusted gross product	101.2	249.6	698.0	1,183.3
Ratio to official	1.06	1.07	1.07	1.07
Government sector				
Gross product, official	4.3	17.4	76.5	149.1
Imputations	3.8	21.0	49.9	91.2
Adjusted gross product	8.1	38.4	126.4	240.3
Ratio to official	1.88	2.21	1.65	1.61
Rest-of-the-World, gross product	0.8	1.2	4.2	9.0
Total GNP, official	103.4	259.1	753.0	1,306.3
Imputations	55.3	152.8	446.3	830.1
Adjusted gross product	158.7	411.9	1,199.3	2,136.4
Ratio to official	1.535	1.590	1.593	1.635
B. Billions of Constant 1958 Dollars, and Ratios as Indicated				
Personal sector				
Gross income, official	7.3	7.9	15.5	17.9
Imputations	113.0	157.7	274.9	354.7
Adjusted gross income	120.3	165.6	290.4	372.6
Ratio to official	16.5	21.0	18.7	20.8
Business sector				
Gross income, official	272.7	318.5	425.9	495.7
Imputations	15.0	16.3	29.6	33.5
Adjusted gross income	287.7	334.8	455.5	529.2
Ratio to official	1.06	1.05	1.07	1.07
Government sector				
Gross income, official	12.2	27.0	5.61	64.6
Imputations	7.4	30.5	39.6	44.3
Adjusted gross income	19.6	57.5	95.7	108.9
Ratio to official	1.61	2.13	1.71	1.69
Rest-of-World				
Gross income, official	1.4	1.3	410	5.6
Total gross national income	293.6	354.7	501.5	583.8
Total imputations	135.4	204.5	344.1	432.5
Adjusted total	429.0	559.2	845.6	1,016.3
Ratio to official	1.461	1.577	1.686	1.741

Imputations and Functional Shares

Finally, it is of some interest to see how the imputations affect the relative movements of labor and property income, and thus their shares in gross national income before and after adjustment. It will be recalled that the total factor cost

imputations rose from about 58 percent of gross national income in 1929 to 69 percent in 1973. As shown in Table 5A, the property compensation component rose somewhat faster than the labor, increasing its share of the aggregate imputed

TABLE 5

U.S. GROSS NATIONAL INCOME BY FACTOR TYPE: OFFICIAL ESTIMATES, IMPUTED VALUES, AND ADJUSTED TOTALS

	1929	1948	1966	1973
A. Billions of Current Dollars; Percentages and Ratios as Indicated.				
Gross national income, official	94.5	239.3	683.9	1,184.3
Labor compensation	63.2	171.5	493.3	879.1
Percentage of GNI	66.9	71.7	71.6	74.3
Property compensation	31.3	67.8	190.6	305.2
Percent of GNI	33.0	28.3	28.4	25.7
Imputed factor income, total	54.5	151.2	440.2	820.9
Ratio to GNI (percent)	57.7	63.2	64.4	69.3
Labor compensation	37.5	98.3	280.7	542.3
Ratio to official labor compensation	59.3	57.3	56.9	61.7
Percent of imputed total	68.8	65.0	63.8	66.1
Property compensation	17.0	52.9	159.5	278.6
Ratio to official property compensation	54.3	78.0	83.6	91.3
Percent of imputed total	31.2	35.0	36.2	33.9
Adjusted GNI (Official + imputed)	149.0	390.5	1,124.1	2,005.2
Labor compensation	100.7	269.8	774.0	1,421.4
Percent of adjusted GNI	67.6	69.1	68.9	70.9
Property compensation	48.3	120.7	350.1	583.8
Percent of adjusted GNI	32.4	30.9	31.1	29.1
B. Billions of Constant 1958 Dollars; Percentages and Ratios as Indicated				
GNI, Official base	293.6	354.6	501.5	583.8
Labor compensation	236.5	282.4	362.1	401.6
Percent of GNI	80.6	79.6	72.2	68.8
Property compensation	57.1	72.2	139.4	182.2
Percent of GNI	19.4	20.4	27.8	31.2
Imputed factor cost, total	135.4	204.5	344.1	432.5
Ratio to GNI	46.1	57.7	68.6	74.1
Labor compensation	103.3	139.3	208.1	245.0
Ratio to official labor compensation	43.7	49.3	57.5	61.0
Percent of imputed total	76.3	68.1	60.5	56.6
Property compensation	32.1	65.2	136.0	187.5
Ratio to official	56.2	89.1	97.6	102.9
Percent of imputed total	23.7	31.9	39.5	43.4
Adjusted real GNI, total	429.0	559.1	845.6	1,016.3
Labor compensation	339.8	421.7	570.2	646.6
Percent of adjusted real GNI	79.2	75.4	67.4	63.6
Property compensation	89.2	137.4	275.4	369.7
Percent of adjusted real GNI	20.8	24.6	32.6	36.4

value from around 31 percent to near 34 percent over the 44-year period. Since the property share of the official gross national income estimates had fallen from 33 percent in 1929 to around 26 percent in 1973, this means that the ratio of imputed to official property compensation rose sharply—from 54 percent to 91 percent over the period. This reflects the fact that the real wealth of the personal

and public sectors had grown much more than the real wealth of the business sector, as documented in other studies.[11] Imputed labor costs also rose in relation to the official labor estimates, but much less sharply, from 59.3 percent in 1929 to 61.7 percent in 1973.

As a result of the divergent movement of the factor shares of the imputed values compared with the official estimates, when the two are added together to obtain adjusted gross national income estimates, the adjusted factor shares show less change than the official estimates. As shown in Table 5A, the labor share of the adjusted income total rose from 67.6 to 70.9 percent in 1973. The decline in the property share is correspondingly moderated from 32.4 to 29.1 percent over the same period.

The functional distribution of income in the total economy is probably of less analytical significance than in the business economy, if only because decision makers in the non-business sectors are probably less sensitive to relative changes in factor prices in their decisions regarding factor proportions. Since imputations are relatively minor in the business sector, we have not here spelled out their implications for factor shares. But judging from Table 2, adjusted business gross income estimates would show a slightly higher property share and a smaller relative decline in that share.

It is also of some interest to look at the factor proportions of gross factor cost in constant prices, as shown in Table 5B. This, of course, reflects the relative magnitudes and rates of growth in the real factor inputs. It will be recalled the imputed real factor costs rose sharply relative to the official gross national income estimates in constant prices—from about 46 percent in 1929 to 74 percent in 1973. The imputed real property costs rose even more sharply, as their percentage of total imputed real costs rose from 23.7 to 43.4 percent over the same period. This contrasts with the downward trend of the property share in current prices, reflecting the fact that the implicit price deflator for labor compensation rose much more than the implicit property price deflator.

The imputed real labor cost did increase relative to the deflated official labor cost estimates, from almost 44 per cent in 1929 to 61 percent in 1973. But the relative increase of the imputed real property costs was much sharper, from about 56 to almost 103 percent over the same period.

As a result, the property proportion of total adjusted gross factor costs, which combines the market and imputed values, rose distinctly more, from about 21 percent in 1929 to 36.4 percent in 1973, than the property proportion of the official gross factor cost estimates adjusted for price changes, which grew from 19.4 percent to 31.2 percent between the same years.

The real factor cost estimates, presented in this study, and the factor prices implicit in our current and constant value numbers, would make possible calculations of historical elasticities of substitution in the national economy and its major sectors.[12] We leave these calculations and further analyses for another occasion.

[11]See John W. Kendrick, assisted by K. Lee and J. Lomask, *The National Wealth of the United States, by Major Sector and Industry* (New York: The Conference Board, 1976).

[12]See John W. Kendrick and Ryuzo Sato, "Factor Prices, Productivity, and Economic Growth", *American Economic Review*, December 1963. The authors estimate the elasticity of substitution in the U.S. business economy 1919–60 to be approximately 0.6.

We believe that this study and related work by others demonstrate the feasibility and importance of expanding imputations in the U.S. income and product accounts. It is gratifying that since this paper was presented at the 1977 IARIW meetings in York, the Bureau of Economic Analysis has begun to develop estimates of selected types of non-market activity. It is hoped that they will eventually be published, at least on an occasional basis, to make possible continuing analyses of trends in economic aggregates and structure including non-market activities.