Review of Income and Wealth
Series 42, Number 1, March 1996

DOES GNP EXAGGERATE GROWTH IN "ACTUAL" OUTPUT? THE CASE OF THE UNITED STATES

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Measures of national product can be misleading because there is nonmarket production. There are also distortions due to transactional activities, which are expenditures to support transactions, not actual output consumed. For 1950–89, this study recalculates output for the United States, adjusting for transactional activities and nonmarket production. Due to relatively rapid growth in transactional activities, GNP overstates output growth in the 1950s; because there was slow expansion of transactional activities in the early 1970s, GNP understates actual output. Since 1974, increases in transactional activities and shifts to market production lead GNP to exaggerate improvement of "actual" output per capita.

I. INTRODUCTION

There have been many studies of the apparent slowdown in productivity and economic growth in the United States.[1] Concerns about economic performance have not been confined to academic publications, but also have been expressed in the news media. For example, Bartley (1992) wrote in the *Wall Street Journal* that despite reported increases in GNP, there was a widespread perception that living standards had not improved. *The Economist* (1990) suggested that factors such as rising transaction costs and shifts from housework to the labor force have led the U.S. economy to "run to stand still."

Market transactions are crucial for specialization and division of labor. It is costly, however, to protect property rights and carry out transactions: "the Walrasian auctioneer" is not free. It is costly for government to maintain law and order and provide national defense. Financial intermediaries are paid to improve the intertemporal allocation of resources. Wholesalers and retailers must be paid to bring buyers and sellers together. Consequently, GNP includes *transactional activities*, that is, expenditures to support transactions, not actual output consumed.

If it costs more to exchange a given amount of output, then recorded GNP will rise although goods consumed will not increase. Therefore, inclusion of transactional activities makes national product accounts misleading (see North, 1987). Failure to control for these activities leads U.S. total factor productivity growth to be overstated (see Fuess and Van den Berg, 1992).

Note: The authors thank the editor and two anonymous referees for constructive comments and suggestions. Also, we appreciate the observations of Matthew Cushing, Andrew Filardo, Arne Hallam, Mark Loewenstein, and Gary Zarkin. We thank John Musgrave, Bureau of Economic Analysis, for information on U.S. capital stocks. We are responsible for any remaining shortcomings.

[1]For reviews of productivity research, see Maddison (1987), Nelson (1981), Stone (1980), and Williamson (1991). For analyses of productivity and slower economic growth, see Baily and Gordon (1988), Darby (1984), Denison (1979; 1985), and Romer (1987).

Nonmarket production also can cause conventional national accounting measures to distort the economy's performance. For example, increased labor force participation raises measured output, in part because some previously unpaid housework is transferred to markets. When market-provided goods and services replace nonmarket labor, the resulting increase in measured GNP exaggerates the economy's "actual" output.

There have been several efforts to adjust national income and product accounts for housework.[2] Eisner (1988; 1989) has developed a "Total Incomes System of Accounts," which includes valuation of household production and adjusts for some governmental transaction costs (police and defense). Devereux and Locay (1992) estimated values of housework and calculated per capita growth rates of U.S. "total" product—market production plus housework. Eisner and Devereux and Locay reported that their adjusted measures of total product grew more slowly than recorded national product.

To derive an appropriate output measure, Devereux and Locay acknowledged (pp. 400–401) that transaction costs should be subtracted from national product, but they did not control for such outlays. Eisner adjusted only for some public sector transactional activities. This study adjusts for transactional activities—in both the public and private sectors—and nonmarket production—not just housework—to see whether GNP has exaggerated growth in the U.S. economy's "actual" output.

To account for transactional activities, we needed disaggregated data. In the public sector, detailed government expenditure data are available since 1949. To account for private sector transactional activities, we needed disaggregated national product data. The Bureau of Economic Analysis has reported such data for GNP through 1990. Since the complete cyclical phase that started with the 1990 recession cannot be included in the analysis, we estimated the growth of per capita actual growth for the years 1950–89.[3]

We find that GNP indeed has misstated actual output in the United States. For the 1950s and early 1970s, transactional activities distort measures of national product. Since 1974, expansion of transactional activities and shifts from nonmarket production combine to exaggerate improvement in actual output per capita.

II. Growth of GNP per capita

Table 1 (first column) reports the growth of real GNP per capita for 1950–89 and several subperiods (see appendix, "GNP per capita"). A number of short business cycles occurred during the 1950s, followed by sustained GNP growth between 1961 and 1969. After a brief slowdown, GNP expanded between late 1970 and 1973. There were bouts of recession and expansion during the 1974–82 span, followed by steady GNP growth over the years 1983–89. Given these distinct

[2]Gronau (1973; 1980) also has estimated values for home production. On measuring the value of housework in the nineteenth century, see Folbre and Wagman (1993).

[3]Disaggregated GDP data have been reported since 1990, but observations extend back only to 1977. To maximize our sample, without mixing GNP and GDP data, we focused on GNP-based figures for the economy's sectors.

variations, we divided the sample period as follows: 1950–60, 1961–69, 1970–73, 1974–82, and 1983–89.[4]

For the entire forty-year sample, per capita GNP increased at an average annual rate of 2.08 percent. The growth rate for the 1950s was virtually identical to that for the entire sample. During the 1960s, per capita GNP expanded nearly three percent per year, but in the early 1970s annual improvement was approximately two percent. Growth was much slower for 1974–82, averaging only 0.60 percent per year, but rebounded to a brisk rate of 2.86 percent for 1983–89. According to recorded GNP figures, improvement in output per capita was better during the 1980s "recovery" than in the 1950s and early 1970s, nearly matching the "booming" 1960s.

To see whether GNP misstates the economy's performance, we recalculated per capita output growth. We controlled first for transactional activities and then for nonmarket production.

TABLE 1

AVERAGE ANNUAL GROWTH RATES OF REAL OUTPUT PER CAPITA, 1950–89: GNP AND OUTPUT CONTROLLING FOR TRANSACTIONAL ACTIVITIES
(in percents)

		Controlling for Transactional Activities:			
Period	GNP	Government	Government & Finance-Insurance-Real Estate	Government, Finance-Insurance-Real Estate & ½ Wholesaling-Retailing	Government, Finance-Insurance-Real Estate & Wholesaling-Retailing
1950–89	2.08	2.11	2.02	1.98	1.92
1950–60	2.07	1.82	1.68	1.66	1.63
1961–69	2.98	3.10	3.05	3.04	3.03
1970–73	2.06	2.84	2.85	2.76	2.65
1974–82	0.60	0.55	0.41	0.39	0.36
1983–89	2.86	2.88	2.83	2.69	2.52

Note: Data sources for GNP and transactional activities are listed and described in the appendix.

III. CONTROLLING FOR TRANSACTIONAL ACTIVITIES

With aggregate time series data, there is not always a clear distinction between transactional activities, "the market process," and output exchanged. Following Wallis and North (1986), we concentrated on broad categories of activity that incorporate transactional functions.[5]

Wallis and North defined transactional activities as those efforts necessary to protect property rights and support the exhange of output. For every tenth year between 1870 and 1970, they estimated transaction costs in the U.S. and

[4]Each subperiod begins and ends at a similar point in the business cycle. Thus, average annual expansion of output per capita can be measured for each subperiod and this mean growth rate should not be biased by cyclical fluctuations in the economy.

[5]In his comment on the Wallis and North study, Davis (1986) focused on problems with separating out transactional activities.

their share of GNP. In the public sector, they focused on government activities that protect persons and property. In the private sector, they concentrated on outlays for financial and marketing activities.[6]

A. *Public Sector Transactional Activities*

Many governmental efforts serve to define or protect property rights. These operations include national defense, police, and administration of government. As noted by Eisner (1989, 40), such activities are intermediate to production of output. However, a measure of final output should filter out intermediate activities, so we subtracted from real GNP governmental outlays for administration, defence, diplomacy, law and order, and public safety (for details, see appendix, "Transactional Activities").

If transactional activities expand more quickly than other components of GNP, then GNP growth will overstate improvement in output. Excluding government transactional activities (GOVT), output per capita grew at an average rate of 2.11 percent per year over the entire sample period (see Table I, second column), which is nearly equal to the 2.08 percent rate using GNP.

Government transactional activities apparently do not distort the impression of economic growth, but for some subperiods, growth rates are affected substantially. For 1950–60, excluding GOVT lowers the annual growth rate more than 12 percent, from 2.07 to 1.82 percent. In contrast, for 1970–73 the adjusted growth rate rises more than one-third, from 2.06 to 2.84 percent. These distortions are due largely to shifts in defense spending. Trend rates of growth in nondefense government transactional activities did not change noticeably over the subperiods. The defense share of real GNP, however, increased sharply in the 1950s and fell markedly between 1970 and 1973.

B. *Public and Private Sector Transactional Activities*

Activities to support exchange are not confined to the government sector. Wallis and North (1986) treated finance-insurance-real estate (FIRE) and wholesale-retail trade (WRET) as areas of the private sector involved primarily with facilitating exchange.

In the FIRE sector, intermediaries are paid to channel purchasing power between savers and borrowers, to spread risk, and to transfer real property. In the U.S., FIRE data also include "housing services" and "rental income", which are payments for housing, not the arrangement of transactions. Therefore, we excluded only the nonhousing portion of FIRE from measured GNP (see appendix, "Transactional Activities").

Over the forty-year sample, FIRE sector transactional activities expanded more rapidly than GNP. Controlling for these transaction costs shrinks the average annual growth rate of per capita output by 0.09 points, down to 2.02 percent per year (Table 1, third column).

[6]In his analysis of "productive" and "unproductive" output, Wolff (1987) also focused on transactions, including many of the same activities identified by Wallis and North.

FIRE sector transactional activities increased fastest during the 1950s and 1970s.[7] These time spans were marked by volatile swings in real GNP; also, inflation accelerated during the 1970s. If recession or inflation leads an economy to use more resources to preserve wealth or spread risk, then GNP will exaggerate economic growth. For 1950–60 and 1974–82, controlling for FIRE sector transactional activities cuts 0.14 points off the average yearly growth rate of output per capita; for 1974–82 this is a reduction of more than one-fourth. In contrast, for the years of sustained GNP expansion, 1961–69 and 1983–89, adjusting for FIRE sector transactional activities shaves the growth rate by no more than 0.05 points, a reduction of less than 2 percent.

The "market process" involves operating stores and other marketing efforts. Thus, the wholesale-retail sector (WRET) includes transactional activities. Payments to the WRET sector, however, could represent more than transaction costs.

Hirshleifer and Glazer (1992, 377–378) argued that transporting goods reflects a cost of production, not a transaction cost: shipping transforms a good just as baking transforms grains into bread. Similarly, modifying goods and providing convenience to shoppers are acts of production. Further, shopping may provide some entertainment value to consumers. Unfortunately, there is no straightforward method for extracting a purely transactional component from aggregated WRET figures.

For 1950–89 and each of the subperiods, the WRET sector's share of GNP expanded (see appendix, "Transactional Activities"). If *any* of this relative enlargement of wholesaling and retailing reflects increased costs of conducting markets, then GNP should overstate output growth. WRET's share of real GNP grew fastest in the 1980s.[8] Suppose only one-half of the WRET sector represents transaction costs. Then failure to control for these activities during the 1980s "recovery" leads GNP to overstate average annual output growth by 0.14 points, or almost five percent (Table 1, fourth column). In the extreme, if all of WRET represents transaction costs, then GNP exaggerates growth by 0.31 points (fifth column).

C. *GNP and Adjusted Output: Comparison of Growth Rates*

Controlling for transactional activities, growth of output per capita follows a pattern similar to that of measured GNP: relatively rapid expansion in the 1960s, slower improvement in the early 1970s, much slower growth over 1974–82, and then resurgence over 1983–89. Nevertheless, failure to control for transactional activities can result in a misleading impression of economic growth.

For the 1950s, adjusting for expansion of defense spending and FIRE sector transactional activities shrinks per capita output growth by nearly one-fifth. With the defense cutbacks of the 1970s, in contrast, improvement is understated by more than one-fourth.

[7]For 1950–60, FIRE transactions increased from 4.6 to 5.9 percent of GNP. The share varied little between 1961 and 1973 (between 5.9 and 6.4 percent), before rising to 7.4 percent in 1982. For 1983–89, the share fluctuated between 7.3 and 7.8 percent.

[8]Between 1983 and 1989 there was a sustained rise in WRET's share of real GNP, from 16.1 to 17.4 percent. For 1950–82, the share fluctuated between 13.6 and 16.2 percent.

The economy's performance between 1974 and 1982 was worse than suggested by the sluggish GNP figures. Accounting for transactional activities drives economic growth, already feeble, down by 30 to 40 percent.

The economy's resurgence in the 1980s also must be reconsidered. Wholesale-retail trade expanded rapidly between 1983 and 1989. Even if only half of the WRET sector reflects transactional activities, then failure to account for those activities leads economic growth to be overstated by almost 5 percent.

IV. Growth of "Actual" Output per capita

GNP can present a misleading impression of economic performance because it includes transactional activities. We now examine whether nonmarket production aggravates the gap between GNP growth and actual improvement in output.

To carry out the analysis one might estimate annual values for nonmarket production and simply add them to the nontransactions portion of real GNP. There already have been several attempts to estimate the value of housework at various points in time. Such estimates require "shadow wages" for housework and total hours spent in such work. Eisner (1988) has described many problems with imputing the value of housework and reported widely varying estimates of such production. He also noted that there is an absence of adequate annual data series on households' use of time.[9] Further, housework does not reflect all nonmarket production, for it misses activities in the "informal" or "underground" economy.[10]

We bypassed estimation of shadow wages, housework hours, or the implicit value of informal production by using the framework of Solow's (1957) growth model to simulate expansion of actual output. Instead of using one set of assumptions to generate one simulation of actual output, we used several different conjectures to generate a range of estimates. This approach helps illustrate the robustness of our findings.

A. *Growth Model of "Actual" Output*

"Actual" output should include the nontransactions (NT) portion of real GNP and also nonmarket (NM) production. Let $\mathrm{GNP}_t^{NT,NM}$ denote actual output in year t. Suppose actual output depends on the economy's entire stock of capital, K_t, and work effort, W_t, according to the function

$$\mathrm{GNP}_t^{NT,NM} = e^{pt} K_t^{\alpha} W_t^{1-\alpha}, \tag{1}$$

where p is the "actual" rate of total factor productivity (TFP) growth. Expressing equation (1) in logarithmic form and differentiating with respect to time yields

$$G(\mathrm{GNP}^{NT,NM}) = p + \alpha G(K) + (1-\alpha) G(W), \tag{2}$$

[9]Devereux and Locay (1992) used household time-use figures for some years to extrapolate a series for 1930–85. Time-use observations may be difficult to compare because earlier observations in the sample excluded housework by unmarried women and all men but later figures include such efforts.

[10]There have been many attempts to measure unrecorded economic activity; for example, see Feige (1979) and Tanzi (1982; 1983). Also see the review by Thomas (1992).

where $G(\cdot)$ is the growth operator. Expansion of actual output is determined by weighted growth rates of capital and work and by TFP growth. We use equation (2) as the foundation for calculating actual output growth.

B. *Simulating the Growth of "Actual" Output*

Figures for capital and work must reflect both market and nonmarket use of these factors. The U.S. Department of Commerce reports quality-adjusted figures for various types of capital. For the market sector, we summed fixed nonresidential private capital, government capital, and fixed residential capital. We then added household durable goods to market capital to yield the total capital stock (see appendix, "Capital").[11]

Darby (1984) argued that labor stock measures must be modified to account for human capital. If human capital is not distributed evenly across the population, there must be controls for demographic characteristics. Using Darby's procedure as a guide, we adjusted labor force data for age, gender composition, immigration and education. In the adjustments, we made three different assumptions about the impact of gender discrimination on the measurement of labor productivity (see appendix, "Adjusted Labor Force").

Total work effort must include both market and nonmarket labor. We assumed that work overall grows in proportion with the working-age population.[12] Then we made the same demographic changes for the population as for the labor force (see appendix, "Adjusted Population"). This procedure in effect assumes that the productivity of nonmarket work is the same as for market labor. According to Becker (1981), household labor should be as productive as market labor on average, but there are likely to be substantial variations in relative productivity over a worker's lifetime. Gronau (1973; 1980) reported that household productivity could be higher or lower than that of market labor. Given these observations, we also performed simulations assuming that nonmarket labor is 25 percent less (more) productive than market work.[13]

With three different assumptions about the influence of gender discrimination and three other assumptions about the relative productivity of nonmarket work, we generated nine separate series for the adjusted population. Let $G(\mathrm{POP}^{ADJ})$ denote the growth of the adjusted population. Equation (2) now becomes

$$(2') \qquad G(\mathrm{GNP}^{NT,NM}) = p + \alpha G(K) + (1-\alpha) G(\mathrm{POP}^{ADJ}).$$

Implementing equation (2′) still requires total factor productivity growth, p, and the capital share of actual output, α, neither of which is directly observable.

[11]Devereux and Locay (1992) also used household durable goods to calculate household capital. They excluded automobiles and televisions, assuming that they were not used primarily for household production. If these items are used to produce transportation and entertainment services, we contend that they should be included in household capital. Therefore, we used the growth of the entire stock of household durable goods.

[12]In using the adult population to represent total labor, we must assume that the proportion of the population in market and nonmarket work is steady over the sample period.

[13]Not only do shifts from nonmarket work to market labor cause mismeasurement of output, but another type of distortion also can occur. If factor-specific productivity differs between market and nonmarket work, then such shifts will affect labor productivity. Our adjustment procedure addresses both the potential shift effect and the measurement problem.

We calculated TFP growth in the market sector controlling for transactional activities, p^{NT}, and used the resulting series to respresent p.[14] Under each of the four definitions of transactional activities (see Table 1), we used a modified version of equation (2) to calculate p^{NT}. Given the three different assumptions about labor market discrimination, there are three p^{NT} series for each definition of transactional activities (see appendix, "TFP Growth").

For capital's share of actual output, α, we used its share of market output, α^{MK}, reported in the national income accounts. We also allowed for differences between the shares. Over 1950–89, α^{MK} varied between 0.24 and 0.35, so we set $\alpha = \alpha^{MK} \pm 0.05$.

With observations for $G(K)$, $G(\text{POP}^{ADJ})$, p, and α in hand, we used equation (2′) to simulate the growth of "actual" output. Subtracting total population growth yields the growth of actual output per capita. Under each definition of transactional activities, we combined the nine series for $G(\text{POP}^{ADJ})$, the three sets for p, and the three series for α to yield eighty-one simulations.

C. *Growth of "Actual" Output per capita: Results*

Table 2 reports annual growth rates of "actual" output per capita. To save space, we do not present all of the simulations. For each definition of transactional activities, we report the mean, maximum, and minimum growth rates. To aid comparison, Table 2 also reprints (from Table 1) the growth rates calculated with GNP and GNP adjusted only for transactional activities. Despite the many different assumptions used in the simulations, Table 2 reveals the same pattern for improvement in actual output per capita as for GNP per head. There are crucial differences, however.

For the entire 1950–89 sample period, the maximum improvement in actual output per capita is less than the growth rates calculated with GNP or GNP adjusted only for transaction costs (see Table 2).[15] Accounting for both nonmarket production and transactional activities reduces the average annual growth rate of per capita output by 0.18–0.37 points. Controlling for nonmarket production alone shaves an average of nearly 0.21 points, or about 10 percent, off the growth rate for transactions-adjusted GNP.

Like Eisner (1988) and Devereux and Locay (1992), we find that ignoring nonmarket work over an extended period of time leads to overstatement of economic growth. However, it would be hasty to conclude that actual output always grew more slowly than GNP or transactions-adjusted GNP. Table 2 also shows that the distortion varies substantially across subperiods.

[14]Using p^{NT} as a substitute for p implies that TFP growth is equal in the market and nonmarket sectors. If there is a small difference between p and p^{NT} (such as 5 percent), then over the forty-year sample period there would be shrinkage (expansion) of the nonmarket sector to a degree that is inconsistent with available estimates of the size of the household sector (see Thomas, 1992).

[15]The maximim estimates always coincide with (1) the highest assumed value of α and (2) the assumption that market labor is more productive than nonmarket work. Since $G(K)$ generally exceeded $G(\text{POP}^{ADJ})$, putting more weight on capital—a higher α—raises growth rates for actual output. If market labor is relatively more productive, then as the share of market work increases, the movement to market employment enhances actual output growth.

TABLE 2

AVERAGE ANNUAL GROWTH RATES OF REAL OUTPUT PER CAPITA, 1950–89: BEFORE AND AFTER ADJUSTMENT FOR TRANSACTIONAL ACTIVITIES AND NONMARKET PRODUCTION
(in percents)

Period	Official GNP	GNP Adjusted For: Transactional Activities Only	Transactional Activities and Nonmarket Production: Mean	Maximum	Minimum
		Adjusting for Transactional Activities in: Government			
1950–89	2.08	2.11	1.90	2.07	1.69
1950–60	2.07	1.82	1.69	1.88	1.50
1961–69	2.98	3.10	2.99	3.13	2.82
1970–73	2.06	2.84	2.78	2.93	2.60
1974–82	0.60	0.55	0.18	0.39	−0.09
1983–89	2.86	2.88	2.54	2.79	2.26
		Adjusting for Transactional Activities in: Government & Finance-Insurance-Real Estate			
1950–89	2.08	2.02	1.81	1.99	1.61
1950–60	2.07	1.68	1.54	1.74	1.35
1961–69	2.98	3.05	2.94	3.09	2.77
1970–73	2.06	2.85	2.78	2.94	2.60
1974–82	0.60	0.41	0.04	0.26	−0.22
1983–89	2.86	2.83	2.49	2.74	2.21
		Adjusting for Transactional Activities in: Government, Finance-Insurance-Real Estate & ½Wholesaling-Retailing			
1950–89	2.08	1.98	1.77	1.94	1.56
1950–60	2.07	1.66	1.52	1.72	1.33
1961–69	2.98	3.04	2.93	3.08	2.77
1970–73	2.06	2.76	2.70	2.85	2.51
1974–82	0.60	0.39	0.02	0.24	−0.24
1983–89	2.86	2.69	2.36	2.61	2.07
		Adjusting for Transactional Activities in: Government, Finance-Insurance-Real Estate & Wholesaling-Retailing			
1950–89	2.08	1.92	1.71	1.89	1.51
1950–60	2.07	1.63	1.50	1.70	1.31
1961–69	2.98	3.03	2.92	3.07	2.76
1970–73	2.06	2.65	2.59	2.74	2.41
1974–82	0.60	0.36	−0.01	0.21	−0.27
1983–89	2.86	2.52	2.19	2.44	1.90

Note: Data sources for GNP and transactional activities are listed and described in the appendix. Inputs used to simulate growth of actual output are also described in the appendix.

For 1950–60, improvement in actual output is worse than GNP growth, no matter which definition of transactional activities is used. In the 1960s, expansion of GNP fits within the range of estimates for actual output growth. For 1970–73, actual output grew more quickly than GNP. Further, for 1950–73, growth rates of GNP adjusted for transactional activities easily fall within the range for actual output growth. For the first 24 years of the sample, gaps between actual output and GNP are due mostly to variations in transactional activities. The results are different for the latter years of the sample, 1974–89.

For the 1974–82 and 1983–89 subperiods, actual output growth is much slower, by at least 10 percent on average, than expansion of GNP adjusted for

transactional activities. Since 1974, shifts from nonmarket work to market labor evidently have been large enough to distort the impression of the U.S. economy's actual output.

Focusing on 1974–82, GNP per capita expanded at an average annual rate of only 0.60 percent. Controlling for transactional activities, the growth rate shrinks between 0.05 and 0.24 points. Adjusting for nonmarket production reduces growth by another 0.37 points on average. Whereas GNP suggests sluggish growth for 1974–82, output per capita was actually stagnant.

The 1980s "recovery" also must be reevaluated. GNP per capita expanded at an average annual rate of 2.86 percent during the 1983–89 span, faster than any other subperiod except 1961–69. Accounting for transactional activities, especially the increased influence of wholesale-retail trade, the growth rate shrinks between 0.17 and 0.34 points. Controlling for nonmarket work shaves growth by another 0.33 points on average. Using our estimates of actual output, the recovery of the 1980s fell further short of the 1961–69 expansion than GNP suggests. In fact, the economy did not even match the expansion of 1970–73.

V. Concluding Remarks

The perception that there is a discrepancy between recorded output growth and improvement in the average living standard is accurate, but the discrepancy is not a recent phenomenon. This study shows a gap between measured GNP and "actual" output over much of the 1950–89 sample period. In the early years of the sample, 1950–73, the gap is due to relatively rapid (slow) growth in transactional activities. Since 1974, GNP growth exaggerates improvement in actual output due to the combined effects of relatively rapid expansion of transactional activities and shifts from nonmarket work to market production.

Between 1974 and 1982 there was virtually no growth in actual output, which supports the argument that the economy "ran to stand still." The stagnation of 1974–82 was followed by improvement in actual output per capita. The U.S. economy did not stand still after 1982, but the recovery does not measure up to the official statistics. This discrepancy shows that improvement in the average living standard during the 1980s is exaggerated.

Appendix

A. *GNP per capita*

Financial figures are expressed in 1982 dollars. GNP per capita is annual real GNP divided by the U.S. population. GNP and population data are from [6] (see "G. Data References" below).

B. *Transactional Activities*

Based on the studies by Wallis and North (1986) and Eisner (1989), we included the following in government transactional activities: (1) national defense,

(2) diplomatic endeavors (including foreign aid), (3) public safety, and (4) administration (which includes the judiciary, corrections, and inspection and regulatory activities).

Annual federal government expenditures for defense, international affairs, and government administration (including the administration of justice) are reported in [1].

State and local government expenditures are reported in [3] for 1987, 1982, 1977, 1972, 1967, 1962, 1957, and 1952. We used observations for those years to extrapolate an annual series of outlays for law and order. Disbursements for "Public Safety" are also reported in [3]. Further, [3] reports costs for administration, inspection, and regulatory activities by state and local governments. The editions for 1972–87 group these latter expenditures as "Inspection and Regulation," "Financial Administration," and "Other Government Administration." For 1962 and 1967, the categories are "Financial Administration," and "Other Government Administration." The 1952 and 1957 editions simply report "General Government" administrative expenditures.

Data for the finance-insurance-real estate (FIRE) and wholesale-retail (WRET) sectors are from [6]. FIRE figures include "housing services" and "rental income," which clearly are not transaction costs but payments for housing services. From the detailed data reported in [9], we calculated the nonhousing services portion of FIRE and excluded it from GNP.

C. *Capital*

"Fixed non-residential private capital," "government capital," "fixed residential capital," and "household durable goods" are from [4; 7].

D. *Adjusted Labor Force*

To adjust labor force measures, we followed Darby (1984) by defining four groups—older males (MO, aged 25–65 years), younger males (MY, 16–24), older females (FO), and younger females (FY)—and then specifying the adjusted labor force in year t, L_t, as

$$L_t = \mathrm{MO}_t + b_1\mathrm{MY}_t + b_2\mathrm{FO}_t + b_3\mathrm{FY}_t, \tag{A1}$$

where the b's reflect the relative productivity of each group.

To proxy relative productivities, Darby used the average earnings of MY, FO, and FY relative to MO. Relying on data from Denison (1979, 33), who reported that these earnings ratios changed little from the late 1920s through the early 1970s, Darby set $b_1 = 0.515$, $b_2 = 0.565$, and $b_3 = 0.420$.

According to Bureau of Labor Statistics data [5], starting around 1973 FO rose relative to MO. By 1988 average annual female salaries were 59 percent of those of males; average hourly wages were nearly 68 percent of those of males. To approximate this pattern for FO, we adjusted b_2 from 0.565 in 1973 to 0.655 by 1989, using annual increments of 0.005. We did not observe a systematic change in the relative earnings of younger workers, so we kept $b_1 = 0.515$ and $b_3 = 0.420$ for the entire sample period.

Some of the earnings discrepancy between men and women could reflect discrimination rather than productivity differences. Aaron and Lougy (1986) reported that at least half of the gender earnings gap can be accounted for by differences in productivity attributes (for example, education and work experience), although such differences also could reflect discrimination (Zabalza and Tzannatos, 1985). We reset equation (A1) assuming that one-half of the earnings gap was due to productivity differences. To account for the possibility that earnings gaps were due solely to discrimination, we also reset (A1) assuming that males and females were equally productive. Thus, we used three diffferent specifications to generate adjusted labor figures.

In their early years in the U.S., immigrants earn less than native-born workers, presumably because the newcomers are less productive. It has been reported that immigrants achieve earnings parity in ten-to-fifteen years (Blau, 1980; Borjas, 1985; Chiswick, 1978). Data from the 1980 U.S. Census [2] show that earnings of first year male (female) immigrants were nearly 75 percent (90 percent) of those of native-born workers.

Assuming that earnings differences disappeared after fifteen years, we adjusted the components of L_t. Specifically, we altered the male (female) components by multiplying by 0.75 (0.90) the portion of each component consisting of first-year immigrants, multiplying by 0.7667 (0.9067) the portion consisting of second-year immigrants, etc.

The final adjustment is for education. Following Darby, we assumed that human capital, and thus labor productivity, increases 7 percent per year of schooling; this assumption is supported by evidence presented by Smith (1979). Let S_t signify the median number of years of schooling completed by people aged 25 and older in year t, as reported in [8]. Thus the adjusted labor force, L_t^{ADJ}, is

$$L_t^{ADJ} = (1.07)^{S_t} L_t. \tag{A2}$$

Figures for the labor force, broken down by gender and age groups, are reported in [5]. We derived immigration cohorts by taking the annual numbers of new immigrants and adjusting according to population-wide mortality rates. Immigration figures and mortality rates are reported in [8].

E. *Adjusted Population*

We made the same demographic adjustments for the working-age population, POP_t, as for the labor force.

Given the possibility that the level of productivity might differ between nonmarket work and market labor, we made two other adjustments. From the initial series POP_t we subtracted L_t^{ADJ} to obtain the stock of nonmarket labor. To account for the possibility that nonmarket labor may be relatively less productive, we shrank the nonmarket labor component by 25 percent and added it back to the adjusted labor force to obtain another population measure. We also expanded nonmarket labor by 25 percent and followed the same procedure.

Figures for the working-age (aged 16–65) population, broken down by gender and age groups, were obtained from [5].

F. *TFP Growth*

Modifying equation (2'), p^{NT} follows

$$p^{NT} = G(\text{GNP}^{NT}) - \alpha^{MK} G(K^{MK}) - (1 - \alpha^{MK}) G(L^{ADJ}), \tag{A3}$$

where $G(\text{GNP}^{NT})$ reflects GNP controlling for transactional activities, $G(K^{MK})$ and $G(L^{ADJ})$ are, respectively, growth of market capital and labor; α^{MK} is capital's share of market output, reported in [6]. Given the different assumptions about discrimination in the labor force, for each definition of transactional activities we generated three separate series for p^{NT}.

G. *Data References*

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