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Chapter VI

THE VARIABILITY OF THE NATIONAL PRODUCT

THE estimates of outlay and income presented in this volume yield information concerning both the level and the variability of the national product. For reasons of convenience we have chosen to treat these two questions separately. The problem of determining the absolute dollar volume of the product has already been discussed in Chapter III. For many purposes, and especially in connection with the investigation of the business cycle, the variability of the national product through time is still more interesting. The bearing of our estimates upon this topic will be the subject of the present chapter.

§1. *Agreement of the Annual Measures*

Level and variability are by no means entirely independent problems. Defects in the measurement of the level of the product may lead to, or be associated with, erroneous representation of its movement through time, and vice versa. Nevertheless, the two problems seem to differ sufficiently, from a conceptual viewpoint, to justify separate consideration. The quarterly estimates, developed in Chapters IV and V, add nothing to our knowledge concerning the level of the product (Chapter III), but throw light upon the question of its variability.

Before comparing our quarterly series for outlay and income, a comparison to which we shall turn in the next section, it is convenient to start with a brief reconsideration of the annual data in Tables 3 and 5 of Chapter

II. Not only are these data basic to the various quarterly estimates, but the annual figures have a conceptual comprehensiveness and a degree of independence in the determination of successive items which cannot be claimed for the quarterly totals.

The annual estimates of outlay and income, compared directly in Chapter III, reappear in Table 19 in the form of percentage changes from year to year. It may be re-

TABLE 19

YEAR-TO-YEAR PERCENTAGE CHANGES IN THE NATIONAL PRODUCT

Years	*As Measured by*	
	Outlay (Table 3)	Income (Table 5)
1921–22	+.6	+3.0
1922–23	+18.3	+17.5
1923–24	−1.5	+.5
1924–25	+9.8	+5.8
1925–26	+3.7	+6.7
1926–27	−1.2	−2.1
1927–28	+.6	+2.5
1928–29	+7.1	+6.4
1929–30	−13.2	−11.6
1930–31	−19.2	−20.1
1931–32	−24.2	−26.8
1932–33	−4.0	−3.6
1933–34	+19.2	+18.3
1934–35	+13.8	+11.6
1935–36	+17.2	+18.1
1936–37	+4.4	+3.1
1937–38	−12.8	−6.1

called that our data for outlay run ahead of our income totals by amounts ranging from zero to between 7 and 8 percent (Table 6). Since the distance between the levels of the two estimates fluctuates considerably, there is naturally less agreement in the reported year-to-year percentage changes than could be desired. The sharpest change in relative level, and the most serious discrepancy between the two measures of year-to-year fluctuation,

occurs between 1937 and 1938. This marked divergence suggests strongly that, in spite of the excellent agreement in level in 1938, at some point or other the data for that year suffer from incompleteness of source material, and that they may presently need revision as fresh information becomes available. If we disregard 1937–38 for the moment, we find that the most considerable disagreement in year-to-year movement appears in 1924–25, when income rises 5.8 percent, whereas the increase in outlay is 9.8 percent. In only one pair of years, 1923–24, do the two series disagree in direction, a small decline in outlay being accompanied by a small increase in income.

It is hardly necessary to remind the reader that these discrepancies have no significance whatever except as an indication of the margin of error to be found in one or both sets of estimates. Such year-to-year variations in the results reported by two different measures of a single quantity—the national product—may of course be purely fortuitous. If in some years random errors cancel out, and in other years reinforce each other, then the disagreements are a measure of the precision (or lack of it) to be expected in calculations of the kind undertaken in this volume.

It is possible on the other hand that such discrepancies may have another explanation, originating in the circumstances of particular years. There is first of all the difficulty of making sure that the figures reported apply accurately to the calendar year to which they are supposed to refer. Among components of our series this difficulty is particularly acute in the case of direct taxes collected from individuals by Federal and State governments, whose fiscal year reports have to be adjusted to a calendar-year basis in a manner which cannot but be arbitrary.[1]

[1] Such taxes have to be deducted in computing income for our purposes. See Table 5 and discussion in Chapter II, §5.

Similarly the excess of expenditures over receipts of State and local governments, a component of outlay, is derived from changes in the level of obligations outstanding without adequate allowance for variations in governmental balances. Nor are data for private business always satisfactory in this respect. Many of the income components are derived, directly or indirectly, from corporate accounts. Not all corporations, however, have fiscal years which end on December 31st, although we generally have to assume that the effects of this inconsistency can be neglected, even if the assumption is not really a safe one. Nor are these defects necessarily confined to the existence of irregular accounting periods. For example, costs incurred and entered as applicable to year One may come to be paid out, or be reported as paid out, only in year Two. This complication would not matter if a proper adjustment were made to the savings of the enterprises concerned, but it is not always possible to do so exactly, if at all. Again, output may be sold in one year against payment in the following year, without the recording of an appropriate increase in accounts receivable. Sometimes, moreover, we can measure a form of expenditure only indirectly, as when construction contracts are used as an indicator of outlays for construction. In such cases it is probable that the distribution of expenditures will not be allocated correctly among twelve-month periods. Of course, such matters are important only if the extent of the discrepancy changes from year to year. For example we may notice that during 1930–31 and 1931–32 a larger decline is reported for income than for outlay. This might conceivably be due in part to the unintended inclusion in outlay of goods whose sale resulted in bad debts, and which would consequently fail to give rise to any income. Possibilities of this kind, however, are cited here merely by way of illustration.

There are other considerations of a similar nature which appear to warrant discussion. It is quite possible that the reliability of corporate income statements as reported to the Bureau of Internal Revenue may vary from one year to another. If underreporting of income were more serious in 1932 and 1933 than in earlier years, discovery of the fact would contribute to an explanation of the sudden increase in the ratio of outlay to income which took place in 1932. Is this a reasonable hypothesis? As one might expect, there is practically no direct evidence on the subject of tax evasion, in respect either of its amount or of its variability. The Bureau of Internal Revenue may have been more lenient or less curious when business was at a low ebb, or it may not. It is true that the estimates of additional tax assessments given in Appendix B show a marked cyclical swing, but this can readily be explained by the movement of corporate income itself, and can hardly be regarded as evidence of variation in the pertinacity of the Bureau of Internal Revenue from one year to another.[2]

Be that as it may, the question of the reliability of income data derived from the *Statistics of Income* is not entirely resolved by a discussion of evasion. For our figures for negative corporate income derive from the same sources as those for positive. A corporation reports no net income, and its tax liability remains nil, whatever the size of the deficit which it claims to have experienced. But the size of this deficit, though of no immediate concern to the Bureau of Internal Revenue, does affect directly our estimates of income. It is a fair assumption that returns reporting no net income are scrutinized less closely than returns which do report net income. Since

[2] As explained in Chapter III, §3, the additions to corporate income disclosed by audit, for which rough estimates are offered in Appendix B, §19 (Table 30), have not been included in any of our totals; because of this omission, which cannot easily be remedied, the level of our income totals is probably too low.

they have in any case no tax liability, firms currently reporting deficits are likely to charge off less, with a view to reducing their tax liability in future years, than they would choose to do were they liable for tax during the year in question. Insofar as costs can be shifted from one year to another, they are likely to be charged against income in good years rather than in bad. Any such tendency would lead to an understatement of income in good years and a corresponding overstatement in bad years. This might contribute to an explanation of the disparity in the movement of outlay and income between 1937 and 1938; but elsewhere there is little sign that the tendency is important, for in 1932 and 1933 the shortfall of income is greater, not smaller, than in 1929. But we are already well within the realm of speculation, and in the absence of more definite information it seems unprofitable to develop this point further.

A closely related question concerns the stability of the depreciation and depletion allowances used for tax purposes, that is, of the allowances upon which the income figures are based. But this problem is not important in the present connection, for the figures for depreciation and depletion which enter the outlay totals are derived, like the income figures themselves, mainly from internal revenue statistics.

Lastly, an important potential source of error is to be traced to the fact that price indexes enter into the calculations at a number of points, and especially in connection with the measurement of the value of the net change in inventories (outlay), and the removal of inventory profits (income). Errors may arise both through erroneous assumptions concerning the manner in which enterprises value their inventories, and through the choice of unsuitable price series for the necessary conversions. The sharpest price movements of the period occurred in 1921,

1930, 1931 and 1933, but the agreement between outlay and income does not stand out as notably inferior in these years compared with others in the period.

On the outlay side, the data for the net change in inventories presented in Table 3 are a modification of those given by Kuznets,[3] the revision arising through the use of quarterly data shown in Appendix C to derive annual figures. As can be seen from Table 3, the item is substantial and fluctuates sharply. It may easily be subject to such errors as would distort the year-to-year movements in the totals for outlay.

On the income side, the adjustment made in Table 4 in order to remove inventory profits, an adjustment taken directly from *National Income and its Composition*, is equally substantial, fluctuates with equal violence, and is at least equally insecure. Some evidence is presented in Appendix C to suggest that this adjustment, although proper in direction, is excessive. If this judgment is correct, it implies that the income totals shown in line D of Table 4, as well as in Table 5, are too high in 1921, 1926, 1930, 1931, 1932 and 1938, and too low in 1933 and 1934. Unfortunately, this is not a particularly illuminating conclusion; if such a revision were made it would do little or nothing to diminish the variability from year to year of the ratio of outlay to income shown in Table 6, or to improve the agreement between year to year changes in the two series reported in Table 19. That we arrive at a negative conclusion is not altogether surprising, for the inventory profit and the net change in inventories in current prices are together equal to the difference between the value of inventories at the beginning and their value at the end of the year. Since this difference is basic to most of the estimates for inventory

[3] *Commodity Flow and Capital Formation*, Vol. I (National Bureau of Economic Research, 1938), Table VII–10; and *Bulletin 74* (National Bureau of Economic Research, 1939).

changes and for inventory profits, the sum of the two is probably more reliable than either taken separately. It follows that such a revision of the adjustment to exclude inventory profits would imply, to some extent at any rate, a corresponding revision in the inventory change and in the outlay totals. Thus, although the inventory items are probably the weakest links in the derivation of outlay and income taken separately, this weakness can contribute only in minor degree to the discrepancy between the two.

§2. *Agreement of the Quarterly Measures*

We may now turn to the quarterly material assembled in Chapters IV and V. The remainder of this chapter will be devoted to a comparison of the same two estimates—for outlay and for income—quarter by quarter for the eighteen-year period. We are interested in observing how far the fluctuation of the two series is similar, and how far it differs, only as a means of testing their accuracy. It is hardly necessary to remind the reader that outlay and income are intended as measures of one and the same quantity, and that discrepancies between their movements from quarter to quarter have no significance whatever except as an indication of the errors to which one or both sets of estimates may be subject.[4]

Let us begin with a graphical comparison. The outlay totals in Table 11 and the income totals in Table 18 are shown together in Chart V. The agreement between the general level of the two series in this chart is better than that suggested by an inspection of the annual data in Table 6, because not all of the adjustments required by the income totals can in fact be carried out quarterly.[5]

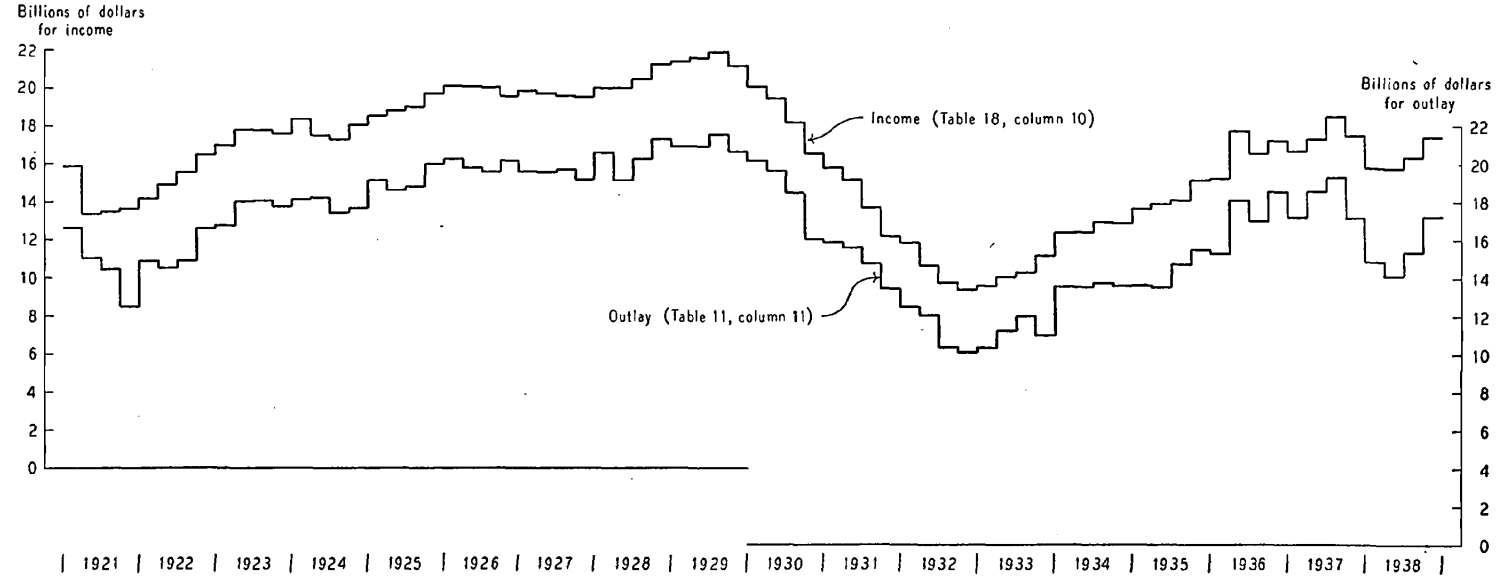
[4] Cf. Chapter III, §1, above.

[5] As explained in Chapter V, §6.

CHART V

COMPARISON OF OUTLAY AND INCOME

(Seasonally Adjusted)



In particular, the exclusion of direct taxes paid by individuals quarter by quarter, if this could be achieved, would lower the income series appreciably. It is not likely, however, that the collection of direct taxes from individuals fluctuates markedly in the short run (apart from seasonal movement), and the distortion of the picture attributable to this omission is probably unimportant. As far as short run movements are concerned, the comparability of the two series shown in Chart V is prejudiced mainly by our inability to exclude profits and losses realized from the sale of capital assets quarter by quarter from the income totals. It is naturally impossible to say whether the movements of the two series from quarter to quarter would agree more closely if such an exclusion were feasible. Because we are interested in the movement of the quarterly series, rather than in their level, they are shown in Chart V on separate base lines.

An inspection of the chart suggests that agreement is poor during the trough of 1921. The turning point in income precedes the turning point in outlay, and in other respects the movements are dissimilar. From the second quarter of 1922 to the beginning of 1924 the agreement is close, but in the recession of that year income declines in the second quarter, whereas outlay does not do so until the third quarter: again, income revives in the fourth quarter of 1924, but outlay scarcely picks up until the first quarter of 1925. Between 1925 and 1929, despite sporadic fluctuations, agreement is once more close; however, the bulge in outlay in the last quarter of 1926, and again in the first quarter of 1928, finds no reflection in the income series.

Both series have their peak in the third quarter of 1929, and for the next four years their movements are in quite remarkable agreement. After reaching their maxima, both decline continuously for thirteen succes-

sive quarters, reaching low points in the fourth quarter of 1932. Thereafter, income rises steadily until the second quarter of 1936, when distribution of the bonus takes place. Outlay, on the other hand, rises much less steadily, and suffers a setback in the last quarter of 1933 which is not reflected in the data for income. (This decline was apparently due to the fact that consumption rose less than seasonally, while inventories declined.) The bulge in both series in the second quarter of 1936 is accounted for by the distribution of the veterans' bonus, and has no particular significance as a test of agreement. From the middle of 1936 to the end of the period, the agreement between the two series is again remarkably close, except for the more violent decline of outlay, as compared with income, during the second half of 1937 and the first half of 1938.

From the foregoing brief review of the comparative data presented in Chart V, it appears that agreement is rather better in the more recent than in the earlier years of the period. This judgment is confirmed by the statistical treatment below. I think there can be little doubt that the improvement is significant, and that it is due in turn to improvements in the character and availability of the underlying data.

In order to obtain a somewhat more precise notion of the extent of the discrepancies in movement between the two series, I have rearranged the data, as shown in Table 20. Column 1 reproduces the outlay totals given in the chart and presented originally in Table 11. In column 2 the income totals of Table 18 (shown in the chart as they appear there) have been adjusted to the same average level, for the whole period, as the outlay totals in column 1. We thus obtain a series of differences in column 3 which are independent of the disparity in absolute level between the outlay and income estimates over the period as a

whole.[6] From these differences we can make a rough estimate of the chances of disagreement for any given quarter, once the series have been adjusted to the same absolute level. The distribution is somewhat skew, the mode being a shortfall of outlay (or an excess of income) of about half a billion dollars. Without regard to sign, 59 of the 72 differences, or roughly four fifths, are less than a billion dollars—or, say, 5 percent of the 1929 level. The mean of the differences, again without regard to sign, is $568 million, or about 3 percent of the 1929 level.

In columns 4 and 5 of Table 20 the two series are reproduced in index form, the average level of each during the year 1929 being regarded as 100. While this arrangement will facilitate comparison between these and other series by interested readers, its immediate purpose is different. By and large, source material for the entire study is more complete and detailed for 1929 than for any other year in the period. If, therefore, outlay and income are to be based on any single year, and their difference in level in that year neglected, 1929 seems the appropriate year to choose. Since the income series in column 2 is slightly higher than the outlay series for that year, the differences between the indexes in columns 4 and 5 will show a relatively larger excess of outlay, or smaller excess of income, in any quarter than that given in column 3. Such differences are of course expressed as percentages of the 1929 level; the largest is found in the second quarter of 1921, when outlay is reported as 71.6 percent, but income only 62.2 percent of 1929, a difference of nearly 10 points.

In the third quarter of 1933 (57.2 and 47.9 percent of 1929 respectively) the difference is almost as large. In sixteen other cases the difference is 5 points or more;

[6] This difference in absolute level was discussed in Chapter III and will not be treated further here.

TABLE 20

COMPARISON OF OUTLAY, INCOME AND BANK DEBITS, SEASONALLY ADJUSTE
QUARTERLY 1921–38

Millions of current dollars, except where indexes are shown

Year and Quarter	*Outlay (Table 11)*	*Income (Table 18) Adjusted to Mean Level of Outlay*[a]	*Difference (1−2)*	*Indexes: Average 1929 = 100*	
				Outlay (Table 11)	Income (Table 18)
	(1)	(2)	(3)	(4)	(5)
1921					
i	16,619	16,086	+533	79.2	74,0
ii	15,028	13,528	+1,500	71.6	62.2
iii	14,424	13,653	+771	68.7	62.8
iv	12,462	13,808	−1,346	59.4	63.5
1922					
i	14,865	14,345	+520	70.8	66.0
ii	14,504	15,080	−576	69.1	69.3
iii	14,889	15,740	−851	70.9	72.4
iv	16,604	16,679	−75	79.1	76.7
1923					
i	16,788	17,165	−377	80.0	78.9
ii	18,010	18,021	−11	85.8	82.9
iii	18,071	17,988	+83	86.1	82.7
iv	17,743	17,824	−81	84.5	82.0
1924					
i	18,136	18,554	−418	86.4	85.3
ii	18,206	17,726	+480	86.7	81.5
iii	17,428	17,503	−75	83.0	80.5
iv	17,619	18,272	−653	84.0	84.0
1925					
i	19,120	18,731	+389	91.1	86.1
ii	18,599	19,011	−412	88.6	87.4
iii	18,767	19,223	−456	89.4	88.4
iv	19,991	19,978	+13	95.3	91.9
1926					
i	20,281	20,350	−69	96.6	93.6
ii	19,779	20,321	−542	94.2	93.4
iii	19,552	20,232	−680	93.2	93.0
iv	20,169	19,799	+370	96.1	91.0
1927					
i	19,550	20,076	−526	93.2	92.3
ii	19,513	19,916	−403	93.0	91.6
iii	19,681	19,798	−117	93.8	91.0
iv	19,154	19,714	−560	91.3	90.6

Quarterly Change as Shown by		*Bank Debits*[b]	
Outlay (Table 11)	Income (Table 18)	Data	First Differences
(6)	(7)	(8)	(9)
..	..	49,931	..
−1,591	−2,526	47,028	−2,903
−604	+124	47,370	+342
−1,962	+153	48,079	+709
+2,403	+530	47,199	−880
−361	+725	49,112	+1,913
+385	+652	50,627	+1,515
+1,715	+927	52,909	+2,282
+184	+480	57,115	+4,206
+1,222	+845	57,653	+538
+61	−33	54,788	−2,865
−328	−162	56,272	+1,484
+393	+721	56,986	+714
+70	−817	55,747	−1,239
−778	−221	56,786	+1,039
+191	+760	59,094	+2,308
+1,501	+453	63,060	+3,966
−521	+276	62,603	−457
+168	+209	64,683	+2,080
+1,224	+746	66,595	+1,912
+290	+367	68,169	+1,574
−502	−29	66,307	−1,862
−227	−88	67,862	+1,555
+617	−427	66,960	−902
−619	+273	69,355	+2,395
−37	−158	70,184	+829
+168	−116	71,000	+816
−527	−83	72,363	+1,363

TABLE 20 (continued)

	(1)	(2)	(3)	(4)	(5)
1928					
i	20,563	20,212	+351	98.0	92.9
ii	19,151	20,213	−1,062	91.3	92.9
iii	20,235	20,705	−470	96.4	95.2
iv	21,265	21,492	−227	101.3	98.8
1929					
i	20,890	21,610	−720	99.5	99.4
ii	20,894	21,830	−936	99.6	100.4
iii	21,515	22,135	−620	102.5	101.8
iv	20,650	21,422	−772	98.4	98.5
1930					
i	20,153	20,320	−167	96.0	93.4
ii	19,632	19,646	−14	93.5	90.3
iii	18,484	18,401	+83	88.1	84.6
iv	16,046	16,726	−680	76.5	76.9
1931					
i	15,895	15,973	−78	75.7	73.4
ii	15,572	15,333	+239	74.2	70.5
iii	14,765	13,843	+922	70.4	63.6
iv	13,417	12,339	+1,078	63.9	56.7
1932					
i	12,485	12,004	+481	59.5	55.2
ii	12,044	10,794	+1,250	57.4	49.6
iii	10,327	9,853	+474	49.2	45.3
iv	10,087	9,484	+603	48.1	43.6
1933					
i	10,320	9,692	+628	49.2	44.6
ii	11,216	10,176	+1,040	53.4	46.8
iii	11,998	10,413	+1,585	57.2	47.9
iv	10,978	11,329	−351	52.3	52.1
1934					
i	13,554	12,529	+1,025	64.6	57.6
ii	13,545	12,549	+996	64.5	57.7
iii	13,737	13,099	+638	65.6	60.2
iv	13,590	13,028	+562	64.8	59.9
1935					
i	13,638	13,816	−178	65.0	63.5
ii	13,522	14,090	−568	64.4	64.8
iii	14,740	14,310	+430	70.2	65.8
iv	15,509	15,387	+122	73.9	70.7

(6)	(7)	(8)	(9)
+1,409	+492	73,763	+1,400
−1,412	+1	78,514	+4,751
+1,084	+485	74,517	−3,997
+1,030	+777	79,873	+5,356
−375	+117	81,974	+2,101
+4	+217	79,578	−2,396
+621	+301	87,242	+7,664
−865	−704	84,043	−3,199
−497	−1,088	73,337	−10,706
−521	−665	73,243	−94
−1,148	−1,229	67,394	−5,849
−2,438	−1,654	63,780	−3,614
−151	−743	59,133	−4,647
−323	−632	57,820	−1,313
−807	−1,471	53,589	−4,231
−1,348	−1,484	47,823	−5,766
−932	−331	43,172	−4,651
−441	−1,195	39,721	−3,451
−1,717	−928	37,425	−2,296
−240	−365	34,647	−2,778
+233	+206	34,220	−427
+896	+477	35,055	+835
+782	+234	39,954	+4,899
−1,020	+905	36,692	−3,262
+2,576	+1,184	39,684	+2,992
−9	+20	43,090	+3,406
+192	+543	41,652	−1,438
−147	−70	41,505	−147
+48	+778	44,550	+3,045
−116	+270	46,958	+2,408
+1,218	+217	48,920	+1,962
+769	+1,064	50,091	+1,171

TABLE 20 (continued)

	(1)	(2)	(3)	(4)	(5)
1936					
i	15,302	15,462	−160	72.9	71.1
ii	18,113	17,993	+120	86.3	82.7
iii	17,015	16,787	+228	81.1	77.2
iv	18,569	17,470	+1,099	88.5	80.3
1937					
i	17,217	16,922	+295	82.0	77.8
ii	18,590	17,552	+1,038	88.6	80.7
iii	19,308	18,769	+539	92.0	86.3
iv	17,164	17,699	−535	81.8	81.4
1938					
i	14,867	16,038	−1,171	70.8	73.7
ii	14,132	15,985	−1,853	67.3	73.5
iii	15,353	16,572	−1,219	73.2	76.2
iv	17,215	17,646	−431	82.0	81.1

[a] The 72 items for outlay, shown in column 11 of Table 11 and reproduced here, have a mean $16,650 million. The mean of the income series (Table 18, column 10) is $16,436 million as it stan and this series is shown above after being multiplied by 1.0130 in order that it might have the sa mean as outlay.

while in the remaining 54 quarters it is less than 5 points. The mean discrepancy, without regard to sign, is 3.4 percent of the 1929 level. This, as one would expect, is slightly larger than the similar percentage computed from the differences in column 3, which are independent of the level during the entire period, rather than of the level in 1929.

So much for differences between the estimates for individual quarters. In columns 6 and 7 of Table 20 a rather different plan is followed. Here are shown separately for each series the differences between its value in each quarter and its value in the preceding quarter. Particularly if we are interested in testing the agreement of the two series so far as concerns very short run fluctuations, these two sets of first differences offer a more useful basis of comparison than that considered above. For the serial correlation among the successive differences between the two series adjusted for level (column 3) is

(6)	(7)	(8)	(9)
−207	+74	51,949	+1,858
+2,811	+2,498	53,316	+1,367
−1,098	−1,190	55,367	+2,051
+1,554	+674	59,350	+3,983
−1,352	−541	60,590	+1,240
+1,373	+622	59,329	−1,261
+718	+1,201	59,444	+115
−2,144	−1,056	56,555	−2,889
−2,297	−1,640	50,407	−6,148
−735	−52	49,715	−692
+1,221	+579	51,037	+1,322
+1,862	+1,061	53,945	+2,908

See *Annual Reports* of the Board of Governors of the Federal Reserve System. First quarter 1933 nated. Data are for 140 cities excluding New York City and have been adjusted for seasonal tion. Seasonal adjustment by ratio of moving average to data, as follows: 1.0160, .9989, 1.0386, .

high, because of the tendency for one series to run higher or lower than the other for several years at a time. This means that the distributions considered above (differences between outlay and income in terms of dollar values and relatives on a 1929 base, respectively) are mainly interesting as a measure of the discrepancy between outlay and income, when this discrepancy is viewed over moderate periods of time. If, on the other hand, we are interested rather in very short run fluctuations, the ability of the two series to represent these is tested more adequately by a comparison of their first differences.[7]

When we turn to columns 6 and 7 of Table 20, we may notice that 56 out of the 71 pairs of first differences agree as to sign. In other words the two series move in the same

[7] We might perhaps develop a still better criterion by comparing the deviations obtained by fitting trend lines to each series; this plan was not adopted here, both because of the labor involved and because of the uncertainty to which the interpretation of the results would inevitably be subject.

direction on four fifths of the occasions observed: in the remaining fifth of the cases the movements of the national product which they report disagree in direction. The coefficient of correlation between the two sets of first differences works out at .753 for 71 pairs of observations; this correlation would naturally be highly significant in a statistical sense, could the ordinary tests be applied.[8]

The same sort of comparison can be used to determine whether, as appears probable from first inspection, the two series agree better during the second than during the first half of the period. An arbitrary division is made for this purpose at the end of the year 1929. In Table 21

TABLE 21

MEASURES OF AGREEMENT BETWEEN OUTLAY AND INCOME

Series shown in Chart IV

	Mean of Differences, without Regard to Sign (column 3, Table 20)	*Agreement in Sign between First Differences (columns 6 and 7, Table 20)*	*Correlation Coefficient between First Differences (columns 6 and 7, Table 20)*
1921–29	$501 mil. (36 items)	24 out of 35 items	.568 for 35 items
1930–38	$636 mil. (36 items)	32 out of 36 items	.839 for 36 items
1921–38	$568 mil. (72 items)	56 out of 71 items	.753 for 71 items

the various statistics already mentioned have been computed separately for each of the two nine-year subperiods, and may thus be compared with those obtained for the eighteen years as a whole. At first sight the evidence appears contradictory, for the differences in column 3 of Table 20 (between outlay and income adjusted for level) are larger in the second half of the period than in the first. However, this criterion is affected by variations

[8] Since little is known about the sampling distribution of a correlation coefficient calculated from first differences, it is impossible to compute fiducial limits for such a statistic in the usual manner. The coefficient quoted in the text must therefore be regarded rather as a measure of the agreement actually observed than as an estimate of its "true" value.

in level as between different parts of the period, and is not really relevant to the question of short run fluctuations. The large mean difference for 1930–38 in the first column of Table 21 is a reflection of the substantial excess of outlay for most of these years (Table 6).

A better test of the behavior of the series during the two subperiods, with respect to their short run fluctuation, is afforded by the comparison of first differences carried out in the second and third columns of Table 21. Here the impression that the movements of outlay and income agree better during 1930–38 than during the first half of the period is very strong.[9] The higher correlation obtained during the second half of the period may be due partly to cyclical movement, but it is probably due also to improvements in the data. Such a conclusion would be in line with our general knowledge about the character of the source material from which the estimates are derived, for this material becomes more plentiful and reliable as the years advance.

The behavior of both series over short intervals of time, unlike their absolute level, is influenced greatly by the inventory items each contains. Since these components are among the most doubtful of the whole range of estimates, their effect seems worth investigating separately.[10] Thus the outlay data presented in Chart V and discussed in Tables 20 and 21 include the estimated net change in business inventories in current prices shown in Table 11; while the income series has been adjusted, in the manner shown in Table 18, to exclude profits and

[9] If the ordinary tests are applied, the difference between the correlation coefficients (.568 and .839) for the subperiods works out at 2½ times its standard deviation with the use of the z transformation. (See R. A. Fisher, *Statistical Methods for Research Workers*, 7th ed., Edinburgh, 1938, Ch. VI.) However, as indicated in an earlier footnote, the applicability of this test is doubtful, since the coefficients are computed from data in the form of first differences.

[10] I have especially to thank William H. Shaw of the National Bureau of Economic Research for comments made in this connection.

losses arising through the revaluation of these inventories. The best form for these adjustments to take, when they are considered as part of an attempt to measure the behavior of the social product as a whole, may perhaps be open to controversy.[11] That some such adjustments must be undertaken—in order to obtain comparable measures of outlay and income—is, on the other hand, a conclusion which cannot be avoided. The question considered here relates merely to the accuracy of the adjustments we have actually made. If an estimate is sufficiently bad it may be worse than none at all. Especially in view of the considerations advanced in Appendix C, the uncertainty surrounding the inventory estimates has seemed to warrant a further comparison between alternative outlay and income totals which omit these adjustments.

Two such unadjusted series may easily be derived.[12] The comparison of their first differences yields a correlation that is uncomfortably high—a coefficient of .828,[13] which compares with .753 obtained previously for the adjusted data (Table 21). At first sight this result suggests that the inventory estimates are indeed worse than useless, and that their inclusion, required by logic, serves only to render the totals less accurate than they were before the adjustments were made. However, the difference between the two coefficients (.828 and .753) does not appear to be statistically significant, being approximately equal to its standard error, when this is computed for 71 pairs of observations by means of the z transfor-

[11] For example some readers may prefer to include the net change in the value of inventories (instead of the value of their net change) as a constituent of outlay, in which case no adjustment to income is required. But that is not the plan adopted in the present study.

[12] For outlay—Table 11, column 11 minus column 4. For income—Table 18, column 10 plus column 9.

[13] For the first and second subperiods distinguished in Table 21 the corresponding coefficients are .758 and .848.

mation.[14] The outcome of the test may therefore be regarded as negative; it fails to tell us anything of value about the accuracy of the inventory adjustments. Nevertheless, some readers, particularly if they have surveyed the evidence in Appendix C, may feel that the quarterly inventory data are so unreliable that they would prefer to omit these adjustments entirely, and to regard the unadjusted totals, for outlay and for income respectively, as the best available estimates. Since the inventory data have been shown separately, the totals can readily be altered to exclude them.[15]

I turn finally to a question of great practical interest, and one to which an answer must be attempted. If a single quarterly series is desired to represent the national product, should we do better to employ the outlay totals or the income totals for this purpose? The tests so far made indicate what differences will result from the employment of one series rather than the other, but they do not of themselves give us any clue as to which series it is preferable to use.

In Chapter III it was suggested, purely on external evidence connected with the methods used to derive each series, that the income totals may perhaps be superior to those for outlay if annual measures are required—measures, that is, of the general level of the dollar volume of the product, as defined, from one period to another.

[14] Admittedly we do not know the sampling distribution of the coefficients, but its dispersion would evidently have to be extraordinarily small to yield a significant difference between them.

[15] It will be noted that this discussion relates only to the adequacy of the inventory adjustments taken together, i.e. of our estimate of the net change in the value of inventories. We also made tests along similar lines: (1) by excluding the value of the net change in inventories from outlay, but correcting income for inventory profits; and (2) by excluding the correction for inventory profits from income, but including the value of the net change in inventories in outlay. These tests likewise yielded negative results. However errors in the partition of the net change in the value of inventories into the two adjustments mentioned, as distinct from errors in this net change itself, are not really relevant to the present discussion, for they are incapable of leading to a disagreement between the (adjusted) outlay and income totals.

Even if this judgment is justified, it does not necessarily follow that the income series is also superior, in quarterly form, to the outlay series, if we are interested mainly in measuring short run fluctuations. Some evidence internal to the data themselves should first be considered in any effort to settle this question. Although there are no movements in either series which would definitely surpass the bounds of plausibility, an inspection of Chart V suggests that the outlay data fluctuate more violently than do the figures for income. One is inclined to be a little suspicious, for example, of the peaks shown by outlay in the last quarter of 1926 and the first quarter of 1928. The instability of the two series can easily be compared. The mean of the first differences shown in Table 20, without regard to sign, is as much as $865 million for outlay but only $633 million for income.[16] A similar disparity is shown for each of the two subperiods. To readers with a definite opinion on the subject, this result may perhaps offer a criterion. To those who find sharp fluctuations in the product a plausible assumption, the outlay series may seem preferable. If, on the other hand, it is felt that it is easy to exaggerate the suddenness with which changes in the level of economic activity take place, the income series will be chosen. However, this test can hardly be called decisive.

It is possible, nevertheless, to try to answer this question from an entirely different angle. Up to this point a comparison of our data with other economic series has been deliberately omitted. The contribution which our results can make to the analysis of economic fluctuations in general will be the subject of a further study; while few available economic indexes can be called sufficiently comprehensive to throw much light upon the accuracy of

[16] The associated standard deviations are $702 million and $532 million, respectively. If the two means were derived from random samples, their difference would undoubtedly be significant.

these results themselves, or to establish the superiority of outlay or of income as a measure of the product. There is, however, one type of data which, in spite of certain deficiencies,[17] might be regarded as an exception on this score, i.e. bank debits. A comparison of the short run variability of outlay and income, respectively, with the variability of bank debits seemed interesting enough to warrant some attention. For this purpose the series for 140 cities outside New York[18] was taken on a quarterly basis; the seasonal was removed, and first differences were obtained. The data are reproduced in columns 8 and 9 of Table 20. For the 71 quarterly changes, debits and outlay move in the same direction on 46 occasions, debits and income on 55. If first differences are used, the correlation of debits with outlay is .449, with income .586. The agreement in movement between outlay and income, which yielded a correlation between first differences of .753 (Table 21), therefore appears better than the agreement between either one of these series and bank debits.

Between income and debits there is evidently a slightly better agreement than between outlay and debits, a result which appears to favor the income series. But even if we could assume random sampling, the differences between the two coefficients of correlation (.586 with income, .449 with outlay) would not be significant for 71 observations. A comparison of the mean level of the differences, without regard to sign, for each series, is also inconclusive. Measured as a percentage in each case of the mean level of the series over the entire eighteen-year

[17] Inasmuch as we include imputed income on farms and accruing to homeowners, and income received in kind (e.g. by farm laborers and domestic servants), the coverage of bank debits is inadequate. And since we are interested only in final income, and not in business transactions in general—especially not in security transactions—the coverage of bank debits is also too broad for our purpose.

[18] The exclusion of New York City is usual in comparisons of this kind, since the New York component is much affected by stock market transactions.

period, we have for outlay a mean first difference ($865 million) of 5.20 percent and for income ($633 million) 3.85 percent. The mean quarterly first difference for bank debits is naturally higher ($2,489 million), but as a percentage of the eighteen-year mean level of the series ($56.9 billion) it measures 4.37 percent, and so fits neatly in between the corresponding percentages for outlay and for income, but does nothing to justify one measure rather than the other. It fails, that is, to confirm the belief that the short run fluctuations in our outlay series are excessive. On the other hand, the broad cyclical sweep in this series certainly exaggerates the cyclical movement of the national product, in part because of the sensitiveness of the debits series to stock market activity, even when New York City is not included. It is equally possible that the short run movement of the debits series overstates the short run movement of the product. In that case, the percentage quoted above (4.37), regarded as a measure of the short run instability of the product, would be too high, and the true percentage would be nearer that obtained for income (3.85) than the similar percentage for outlay (5.20). The comparison of the two series with outside bank debits is therefore consistent with the view that the quarterly income totals are preferable to those for quarterly outlay, though the evidence it offers in this connection is far from conclusive.

It is worth observing that this difference in the short run stability of the two series is closely connected with the inventory adjustments discussed previously. We have already noted that the coefficient of correlation between first differences of outlay and income is raised slightly, though not significantly, by the omission of these adjustments. While the omission reduces the covariance of the first differences by 27 percent, the associated decline in the variance of these differences is 49 percent for out-

lay but only 12 percent for income. In other words the insertion of the inventory adjustments adds considerably to the variability of outlay, but hardly at all to the variability of income. Indeed the disparity between the means of the first differences (without regard to sign), noted in the preceding paragraph, disappears if these adjustments are omitted: the means become $615 million for outlay and $608 million for income.[19] This result is far from easy to interpret.[20] If the substantial contribution to the instability of outlay attributable to the inclusion of the net change in inventories is reported correctly, we must somehow have failed to include in the income totals the full range of short run fluctuation appropriate to them. If, on the other hand, the more stable movement indicated by the income totals corresponds more nearly to the truth, then our estimates for the net change in inventories are wide of the mark, at least to the extent that they contribute excessively to the short run fluctuations of outlay.

The contrast in the short run stability of the two series, after adjustment for inventory items, is worth further brief discussion in the light of these alternatives. It is conceivable, for example, that the divergent behavior of the two series reflects the fact that a somewhat greater proportion of the income totals has been graduated—for lack of suitable interpolating media—than is the case with the quarterly outlay totals. The actual proportion, in the two final totals, is a little difficult to compare, owing to the treatment of depreciation.

If, however, outlay is measured before this deduction, and depreciation is added to income, we may say that in

[19] The standard deviations are $501 million and $484 million respectively.

[20] It is difficult to say, a priori, whether outlay should fluctuate more or less violently when inventory changes are omitted. It is argued in Appendix C that one would expect income to be less stable before than after the removal of inventory profits, but actually an opposite result was obtained: cf. Table 36 and Chart IX.

1929 roughly 75 percent of outlay is subject to actual interpolation, the remainder being graduated. The corresponding figure for income is about 60 percent. Prior to 1929 the fraction of income for which interpolating media are available is somewhat smaller, since several important payroll series do not become available until that year. It will be recalled that the chief outlay components subject to graduation are a large fraction of consumers' services, and (prior to 1929) the excess of expenditure over receipts of State and local governments. For income the corresponding items are all of long term income, short term income in the Finance, Service and Miscellaneous groups, and (for the purpose of this computation) also depreciation. Now it seems highly unlikely that any of these items on the income side actually exhibits marked instability for which we have failed to account. Consequently it appears unreasonable to suppose that the more erratic behavior of the outlay series can be justified and explained by deficiencies in the income data arising from the use of graduation formulae. The reader should perhaps be reminded in this context that profits and losses realized through the sale of capital assets have not been removed—as they should be—from the income totals, since there is no way of doing so quarter by quarter. Nevertheless, this consideration does nothing to illuminate the point at issue, for the removal of such profits or losses would be likely further to diminish the violence of fluctuation of the income totals.

The difficulty of discovering ways in which the income estimates are likely to underestimate the amount of short run fluctuation in the national product in any important degree suggests a reconsideration of the instability reported by the outlay totals. If outlay overstates the violence of short run fluctuation, it most probably does so, as we have seen, as a result of errors in the net change in business inventories. This possibility arises through

the weakness of the inventory estimates themselves, and may be traced also to our treatment of consumers' outlay for perishables.[21] Thus if output data are used to interpolate the consumption of commodities, the net addition to distributive inventories quarter by quarter should be subtracted, and added back later (as far as the totals are concerned) when we take account of the net change in business inventories as a whole. In treating the consumption of semidurable and durable goods we have been able to use sales data throughout, so that no allowance for changes in distributive inventories is necessary in computing consumption. But for consumers' perishables we could not do this, except for the last two years of the period, and had to rely instead upon output data. Nor was there any way in which we could make a proper allowance for inventory changes in order to convert the output data into a true measure of consumers' outlay. On the other hand the net change reported for all business inventories combined, as a constituent of private investment, implicitly includes perishable as well as other inventories, and may therefore lead to some duplication of such changes in the totals. Again, because both wholesale and retail inventories are interpolated with department store stocks, divergent movements in these two kinds of inventory would lead to errors in our estimates.[22]

The defects so far considered cast more doubt upon the movements of the outlay totals than upon those of the income estimates: in particular they lend support to the view that the instability of the former is excessive. In judging the relative reliability of the two measures of the product through a comparison of the methods used in deriving each, we are on even more difficult ground, if we are interested in short run movements, than we were

[21] See Chapter IV, §1, above.

[22] Deficiencies in the inventory estimates are considered in detail in Appendix C.

in Chapter III, where we were concerned only with their general level. To take a single example, it is easy enough to see that both unfinished commodities and services rendered to business may not have been adequately excluded from outlay, and that the annual, and therefore also the quarterly, estimates for this side of the account may tend to exaggeration. In judging their short run reliability, moreover, we can point to other weaknesses, notably in the interpolation procedures.

It is quite possible that the defect in the methods used in the construction of the estimates for outlay may lead also to an overstatement of its short run variability. In apportioning the gross output of commodities and services between consumers and business users, we are generally compelled to assume, for lack of more specific information, that the allocations chosen hold good over longish periods of time. But we may expect the relative share of gross output going to business users to rise in periods of expansion, and to contract in periods of recession. Our failure to vary the proportionate allocation appropriately through time will evidently tend, if this expection is realized, to exaggerate the instability of the product as reported by our measures of outlay. On the other hand it does not seem that the income estimates suffer from any corresponding weakness.[23]

The foregoing discussion has been centered upon errors likely to affect the short run stability of the data, because this is a characteristic which can readily be tested. Not all sources of error will show up in this form, and some of the interpolation procedures may be regarded with suspicion on more general grounds. We have considered at great length the uncertainty surrounding the inventory measurements. It should be remembered, however, that

[23] I am indebted to Simon Kuznets for drawing my attention to the point discussed in this paragraph.

our temporal distribution of expenditures for construction, and perhaps for producers' durable goods and other items, also is open to question. Unfortunately the weaknesses are not all on the outlay side—if they were, then of course we could adopt the income series as unequivocally superior for measurement of short run movement, as it would appear to be for measurement of the general level. The most serious weakness in the quarterly income estimates is probably to be traced to the determination of residual income for Distribution.[24] But doubts on this score are matched by uncertainty concerning the magnitude of the adjustment required to exclude inventory profits and losses, and by the absence of any attempt to remove profits and losses realized through the sale of capital assets. By and large, however, it appears that the quarterly income totals may perhaps be superior, as a short run measure of the product, to the quarterly totals for outlay.

Although necessary and useful up to a point, the listing of possible sources of error, none of which can be accurately appraised for significance, is an occupation that may easily induce an unjustified sense of frustration. Every builder of estimates must ask himself how far he should go in warning the reader of their weaknesses. In the face of such a catalog of perplexities as the foregoing, one is almost tempted to reverse the process, and to start an inquiry as to how it can possibly happen that the agreement, for example between the two final estimates in Chart V, is as good as it turns out to be.

§3. *Conclusion*

In any statistical inquiry, at least if it is at all complicated and technical, the vision of the reader is inevitably obscured by the mass of detail which encumbers the route

[24] See Chapter V, §1, above.

at every turn. Despite the fact that many of the basic calculations have been presented only in summary form, or have been relegated to appendices, it cannot be claimed that the present study is in any way an exception. Some attempt, however brief, must be made to review the course we have followed. It is convenient to begin by recalling the objectives with which we set out.

In Chapter I it was argued that the ultimate purpose of those who compile estimates of income and capital formation must be to obtain a single measure of the national product, for as long a period and at as frequent intervals as possible, and broken down in as many different ways as the material will allow. Limitations of time imposed upon a single-handed investigator with many other preoccupations, and deficiencies in the source material now available, required that this study should be confined to a survey of the parts of the field which are of most immediate interest to the present writer. Accordingly, the chief aim has been to attempt to derive a single series for the dollar volume of the product, quarterly from 1921 through 1938, broken down both by type of income and by type of outlay.[25]

A definition of the national product suitable for statistical interpretation, in terms of actual or imputed money flows, was undertaken in Chapter II. Annual estimates of the product were then assembled, both for outlay and for income, and in Chapter III these were compared. We emerged with the conclusion that, while the differences between the two estimates throw considerable light upon the precision of measures of this kind, it is not at present possible to effect any such detailed reconciliation as would allow of the construction of a *single* series (either annual or quarterly) broken down by type of outlay and by type of income.

[25] Among many other possible breakdowns, not considered in this volume, may be mentioned distribution by size of income, and by region.

In Chapters IV and V quarterly estimates were derived for outlay and for income respectively. Finally, in the present chapter, these quarterly estimates are compared, and the information they yield concerning the variability of the product is summarized. Only so far is it possible at present to push matters in the direction of the eventual construction of a single set of quarterly estimates with two breakdowns of the kinds indicated.

But if the main objective—the construction of a single series—has not been attained, the survey has nevertheless yielded two important byproducts. One of these is the data concerning errors of estimate, presented for the annual series in Chapter III, and for the quarterly series in the earlier sections of the present chapter. It must naturally be the object of subsequent study in this field to reduce these errors to a degree which will eventually render possible the construction of a single series.

The other byproduct is related even more directly to the question of future investigation, i.e. the deficiencies of source material brought to light at various points in our work. Some of these deficiencies are already in process of being remedied. For instance, the sample of corporations in mining and manufacturing reporting net income quarterly has been reinforced substantially in recent years. Again, since 1936 the Department of Commerce has made available quarterly sales data covering practically the entire range of consumption goods. In other parts of the field, however, progress has been much less rapid. Among important matters concerning which our ignorance is still abysmal we may mention gross and net income in the service industries, net income in wholesale and retail distribution, inventory movements, and the receipts and expenditures of State and local governments. In these regions the improvement of outlay and income estimates must wait principally upon better data, both annual and quarterly.