A Note on the Logic and Structure of Global Accounting

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The purpose of this brief note is to lay out the logical structure of global accounting. It does this by starting with the simplest possible economic description of a college (or other non-profit organization) in which the basic stock-flow tautologies of Hicks' accounting[1] can be seen to function clearly and then introducing complications, step by step, in order to describe a realistic institution operating in the US in the 199O's.[2] All the endless complications that are encountered in fitting actual data into this structure are ignored here in order to concentrate on the logic of the structure itself — whatever those pragmatic complications, they must fit within this framework.

Income, Spending, Saving, and Wealth

Start with a college or university in which all current income is in money (m) form, Y_m; all current spending is not only in money form, CX_m, but is truly current in that it buys nothing that endures past the end of the year; there are assets, A_j, and

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1 The underlying identities that structure the Global Accounts are discussed in, <u>inter alia</u>, J.R. Hicks, ***Value and Capital (an Inquiry into Some Fundamental Principles of Economic Theory),*** **Oxford: Clarendon Press, 1939, pp 171-184. See too, for a more topical description of the same structure, Richard J. Meisinger, College and** ***University Budgeting: An Introduction for Faculty and Academic Administrators.*** **National Association of College and University Business Officers; Washington, D. C.; 1984.**

2 While I've chosen to tell the story in a series of simple equations, these can easily be converted into T-accounts if the reader finds that format more comfortable.

liabilities, $\mathbf{L_j}$, that are valued at the beginning (j =0) and end (j = 1) of the year and whose sum is net worth (wealth), $\mathbf{NW_j}$; but, in this simplest case, that wealth doesn't yield interest and dividends (i&d) or capital gains, realized, Kg,, or unrealized (u), Kg,; there's no depreciation, Dpr, or disposal, Dsp, of capital stock during the year; and there's no inflation. Therefore the year's total saving is,

(1) $\mathbf{S_m = Y_m - CX_m}$,

all in money terms. Its wealth -- or net worth -- is

(2) $\mathbf{NW_j} = \mathbf{A_j} - \mathbf{L_j}$.

Then

(3) $\mathbf{S_m} = \mathbf{\Delta NW} = NW_1 - NW_0$

relates the year's saving to beginning and end of year net worth. Saving (1) can be positive, negative or zero, depending on whether current spending is less than, more than, or equal to current income. If saving were negative, of course, the year's current spending was supported by drawing down net worth; if saving was positive, the excess of money income over current spending added to net worth.

Total saving and net worth can be separated into their financial, f, and physical capital, k, parts,

(4) $\mathbf{S_m} = \mathbf{S_{mf}} + \mathbf{S_{mk}}$

and

$$(5)\quad NW = NW_f + NW_k.$$

with

$$(6)\quad S_{mf} = \Delta NW_f = \Delta(A_f - L_f)$$

and

$$(7)\quad S_{mk} = \Delta NW_k.$$

Clearly, financial or physical saving can be negative while total saving is positive so long as the other component of total saving is sufficient to make up for it. Indeed, if total saving is zero, a pure portfolio shift can take place in which one kind of net worth increases because it is "paid for," dollar for dollar, by a reduction in the other form of net worth -- by buying a building with financial assets or by borrowing, for instance; or, in the other direction, by selling a building and banking the proceeds. Any combination is allowable, so long as it satisfies (4)-(7).

Saving and Wealth with Asset Income, Inflation, Depreciation, Deferred Maintenance, and Capital Disposal

Now, with that framework established, introduce realism, a step at a time.

1. If financial assets started paying **interest and dividend income,** and nothing else changed, that (money) income would be added to both sides of (1) which would then become

(8) $S_m + i\&d_m = Y_m + i\&d_m - CX_m$.

2. If there were also **realized capital gains** on those financial assets, FKg_m, those would be added, too, to both sides, making

(9) $S_m + i\&d_m + FKg_m = Y_m + i\&d, + FKg_m - CX_m$.

(Of course, realized capital gains can be positive or negative.) Since there are now lots of money income and saving items floating around, they can be collected as

$$Y'_m = Y_m + i\&d, + FKg_m$$

and

$$S'_m = S_m + i\&d, + FKg_m$$

to simplify **(9)** back to

(10) $S'_m = Y'_m - CX_m$.

All are in money values.

3. If there were also **<u>unrealized</u> capital gains** on financial assets, FKg_u, they would be recognized as they added, like realized capital gains, to both income and saving, so (10) becomes

(11) $S'_m + FKg_u = Y'_m + FKg_u - CX_m$,

where the subscript, u, indicates an unrealized or non-monetary element in the accounts.

4. If there were **inflation** during the year, it would have two effects:

a. The first doesn't alter equation (11) but explains part of it: if there's inflation, part of the capital gains on financial assets (realized or unrealized) will be the result, simply, of that inflation -- asset values will increase because the measuring rod of money by which they're valued has shrunk. So some of the realized and unrealized capital gains income included in (11) above will be due solely to the year's inflation. Luckily, we can leave it at that because we're not called on to separate out the part of income in capital gains on financial assets that's due to inflation from the "true" part that's due to an increased relative value of the assets.

b. But exactly the same thing is happening to the replacement value of physical capital wealth -- plant, equipment, land, collections, etc. Just as the shrinking value of the dollar creates some of the capital gain in current value of financial assets, it also increases the replacement value of physical wealth. And like that capital gain in the current value of financial assets, any capital gain in the value of physical assets, KKg, adds to both sides of the equation -- it increases the current dollar value of both saving and income simply because the end-of-year "current dollar" is worth less than the beginning-of-year "current dollar". The fully maintained building that has a replacement value of $1 million at the beginning of the year (that would cost $1 million to build then) will have a replacement value of $1.1 million at the end of a year of 10 % inflation (it would cost $1.1 million to build then). So inflation will have added $100,000 to both the year's income and its "additions to capital." Equation (11) becomes, when we recognize the effect of the year's inflation on the value of physical capital,

$$(12) \quad S'_m + FKg_u + KKg_u = Y'_m + FKg_u - CX_m + KKg_u.$$

This assumes, not unrealistically, that physical capital appreciation is typically unrealized -- that the college doesn't often sell its appreciated properties for money. (Nothing important in the accounting would change if it did.) It's possible that some of the physical capital appreciation is not due to inflation but is due, instead, to an underlying increase in capital's relative value because of something like the discovery of oil on campus or the interest of a shopping center developer. But if some of the physical capital appreciation were real rather than inflation-induced, the accounting would still be the same. Indifference to the source of capital gains that is familiar in the case of financial assets carries over, too, to the appreciation of value of physical assets.

5. Depreciation (deterioration) of the physical capital stock is an erosion of its value due to time and use in production. In an important sense, it is like an unrealized capital gain on financial assets, but of opposite sign: both are changes after the beginning of the year in the value of the assets with which the year began. They have very different causes, but their effect on the accounts is the same, both alter end-of-year net worth. So, like appreciation, depreciation, Dpr_u, has to be subtracted from both sides of the equation, producing

$$(13) \quad S'_m + FKg_u + KKg_u - Dpr_u = Y'_m + FKg_u - CX_m + KKg_u - Dpr_u.$$

6. Disposal of physical capital can take place during the year. Like depreciation, it reduces the end-of-year net worth without generating money flows -- a part of the beginning of the year capital stock has simply disappeared in the course of the year. So, again like depreciation, disposals of capital, Dsp,, have to be subtracted off both sides of the equation, leaving, finally,

$$(14) \quad S'_m + FKg_u + KKg_u - Dpr_u - Dsp,$$
$$= Y'_m + FKg_u - CX_m + KKg_u - Dpr_u - Dsp,$$
$$= S,$$

as total saving.

This, then, is total saving in monetary and non-monetary terms for an institution with interest and dividend income, capital gains from financial and physical asset appreciation, realized and unrealized, that is affected by inflation, and whose capital stock is subject to depreciation and sometimes to disposal.

The Uses of Saving: Financial and Physical Wealth

The rather messy statement in (14) can be brought back into more familiar and serviceable form by looking at the uses to which saving is put: as it augments financial or physical net worth.

Total money saving, S’,, from (14) can be allocated to financial, S'_{mf}, or physical capital, S'_{mk}, saving so

$$S'_m = S'_{mf} + S'_{mk}$$

and (14) becomes

$$(15)\quad s = S'_{mf} + S'_{mk} + FKg_u + KKg_u - Dpr_u - Dsp_u$$
$$= Y'_m + FKg_u - CX_m + KKg_u - Dpr_u - Dsp_u.$$

But the use of saving in a money form to augment physical capital -- i.e. S'_{mk} -- describes spending on either new investment, I, or renovation and repair, RA, so that

$$(16)\quad S'_{mk} = I + RA$$

and (15) takes on its messiest form as

$$(17)\quad s = S'_{mf} + I + RA + FKg_u + KKg_u - Dpr_u - Dsp_u$$
$$= Y'_m + FKg_u - CX_m + KKg_u - Dpr_u - Dsp_u.$$

Recognizing that total saving, S, (including both monetary and non-monetary forms) is allocated to either financial saving, S,, or physical capital saving, S,, so

$$(18)\quad S = S_f + S_k,$$

the terms of (17) can be regrouped as financial saving,

$$(19)\quad S_f = S'_{mf} + FKg_u,$$

and physical capital saving,

$$(20)\quad S_k = I + RA + KKg_u - Dpr_u - \text{Dsp,.}$$

Two comments are useful. First, the amount of money saving allocated to financial saving, S'_{mf}, is not exogenously determined -- it is simply the part of total money saving not allocated to physical capital formation. Along with financial capital appreciation, it has to equal, of course, the increment to financial net worth, ANW,, definitionaly .

Second, (20) is the global accounts version of “additions to the value of capital stock” that must equal the year’s change in physical net worth. It is more recognizable when the year’s deferred maintenance, DM, is explicitly defined as

(21) $DM = Dpr - RA$

(dropping the **u** and m subscripts as no longer necessary). So deferred maintenance is defined, reasonably, as the amount of the year’s depreciation that’s not covered by spending on renovation and adaption during the year. And “additions to the value of capital stock” become

(22) $S_k = I - (Dpr - RA) + KKg - Dsp$

or

(23) $S_k = I - DM + KKg - Dsp.$

The real value of the year’s additions to the capital stock (in current dollars), stripped of its inflationary component, is

$S_k = I - DM - Dsp;$

new investment less the year's deferred maintenance and any disposal of physical capital.

These -- financial and physical saving -- have to equal the changes in financial and physical net worth, respectively, so

(24) $S_f = NW, - NW, = \Delta NW_f$ and

(25) $S_k = NW_{k1} - NW_{k0} = \Delta NW_k$.

Deferred Maintenance and Current Spending

One last point on savings and flows. If, as is often the case in college accounts, all or part of renovation and adaption spending, RA, has been treated as a current expenditure so that it is, in fact, included in CX_m of equation (1), it will have to be subtracted from CX_m and, consequently, added to S_m (since income is unaffected by a correction of the spending classification, from current to capital spending (hence saving)). When total money saving, S_m, is allocated between financial and physical saving, then, that RA component will clearly be part of physical capital saving, as reflected in (20) above.

Total Net Worth: The Stock of Wealth

While it has been useful to describe the structure of the accounts for a single year, with the widest time horizon as the difference between the beginning and end of that year, the college's wealth at any moment is, in fact, a function of saving done in prior years -- of past accumulations. So the beginning-of-year net financial worth -- financial assets and liabilities -- is the sum of each year's fmancial saving over all the years since the institution began. At the beginning of year t,

$$(26) \quad NW_{fo} = \sum_{i=o}^{t-l} S_{fi} = \sum_{i=o}^{t-l} (S'_{mfi} + FKg_{ui}),$$

expressed in current market values. Similarly, physical wealth is the sum of past saving in that form. So at the beginning of year t,

$$(27) \quad NW_{ko} = \sum_{i=o}^{t-l} (Ii + KK_{gi} - Dsp_i - DM_i)$$

$$= K_o - \sum_{i=o}^{t-1} DM_i,$$

where K_o is the current replacement value of physical assets and the last term is the current value of accumulated deferred maintenance.

Total institutional wealth, then, is

$$(28) \quad NW_o = NW_{fo} + NW_{ko}$$

$$= Afo - Lo + Ko - \sum_{i=o}^{t-l} DM_i$$

where A_{fo} is the value of financial assets (at market prices), L_o is value of (financial) liabilities, K_o is the accumulated beginning-of-year replacement value of the capital stock, and the last term is the current value of past accumulated deferred maintenance.

All institutional wealth, then, is valued in current replacement terms (market prices) and accumulated deferred maintenance is recognized as a liability against the current value of physical assets.