Alternative Output, Input and Income Concepts for the Production Accounts

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Introduction: 1

- **The basic problem: GDP is not a measure of income.**

Why is this?

- **GDP includes depreciation as part of "income".**
- **GDP excludes resource depletion (or augmentation); there is no charge for mineral depletion; no gains or losses from changes in land use; no additions to income from forest growth or domestic animal growth; no adjustments for aquifer depletion.**

The international System of National Accounts was last revised in 2008. A new revision is underway which will take at least some of the above problems into account.

The purpose of this paper is to look at the current SNA production accounts and suggest a way forward which will address at least some of the above problems.

Introduction: 2

- **Our basic approach is to take depreciation out of user costs, replace user costs by waiting costs and replace gross investment by the changes in the capital stocks of the production unit over the accounting period.**
- **Our approach to firm accounting is essentially the same as that advocated by the economist Hicks (1961) and the accountants Edwards and Bell (1961). Here is a quote from Edwards & Bell.**

"The business firm can be viewed as a receptacle into which factors of production, or inputs, flow and out of which outputs flow...The total of the inputs with which the firm can work within the time period specified includes those inherited from the previous period and those acquired during the current period. The total of the outputs of the business firm in the same period includes the amounts of outputs currently sold and the amounts of inputs which are bequeathed to the firm in its succeeding period of activity." Edgar O. Edwards and Philip W. Bell (1961; 71-72).

Introduction: 3

"We must look at the production process during a period of time, with a beginning and an end. It starts, at the commencement of the Period, with an Initial Capital Stock; to this there is applied a Flow Input of labour, and from it there emerges a Flow Output called Consumption; then there is a Closing Stock of Capital left over at the end. If Inputs are the things that are put in, the Outputs are the things that are got out, and the production of the Period is considered in isolation, then the Initial Capital Stock is an Input. A Stock Input to the Flow Input of labour; and further (what is less well recognized in the tradition, but is equally clear when we are strict with translation), the Closing Capital Stock is an Output, a Stock Output to match the Flow Output of Consumption Goods. Both input and output have stock and flow components; capital appears both as input and as output" John R. Hicks (1961; 23).

Introduction: 4

- **Hicks and Edwards and Bell obviously had the same model of production in mind: in each accounting period, the business unit combines the capital stocks and goods in process that it has inherited from the previous period with "flow" inputs purchased in the current period (such as labour, materials, services and additional durable inputs) to produce current period "flow" outputs as well as end of the period depreciated capital stock components which are regarded as outputs from the perspective of the current period (but will be regarded as inputs from the perspective of the next period).**
- **This model of production could be viewed as an *Austrian model of production* in honour of the Austrian economist Böhm-Bawerk (1891) who viewed production as an activity which used raw materials and labour to further process partly finished goods into finally demanded goods.**

The Accounting Framework for a Firm: 1

Equation (1) below defines the production unit's *pure profits* in period t, Π^t, using the Hicks, Edwards and Bell approach to production theory:

(1) $$\Pi^t \equiv P_Y^t Q_Y^t - P_Z^t Q_Z^t - P_{IP}^t Q_{IP}^t - P_L^t Q_L^t + P_K^t Q_K^t - (1+r^t) P_K^{t-1} Q_K^{t-1}$$

where $P_Y^t Q_Y^t$ = the value of output produced during t;

$P_Z^t Q_Z^t$ = the value of intermediate input purchased during t;

$P_{IP}^t Q_{IP}^t$ = the value of purchased investment goods;

$P_L^t Q_L^t$ = the value of labour input during period t;

$P_K^t Q_K^t$ = the end of period t value of the capital stock;

$P_K^{t-1} Q_K^{t-1}$ = the beginning of period t value of the capital stock;

r^t = the firm's period t cost of capital.

The Accounting Framework for a Firm: 2

There are a number of things to note about definition (1):

- **The cash flow of the firm is $P_Y^t Q_Y^t - P_Z^t Q_Z^t - P_{IP}^t Q_{IP}^t - P_L^t Q_L^t$ and in principle, these are market transactions.**
- **$P_{IP}^t Q_{IP}^t$ is the value of purchased investment. The firm could also be making units of the investment good during period t. More on this issue later.**
- **The prices for the beginning of period t and end of period t capital stocks, P_K^{t-1} and P_K^t are not observed market prices like the other prices. They have to be estimated by the accountant. This is a weakness of the Hicks-Edwards-Bell approach.**
- **The capital stocks, Q_K^{t-1} and Q_K^t, are also not observed and hence also have to be estimated by the national income accountant. However, capital stocks have to be estimated using the current SNA framework as well.**

Defining Investment and Capital Stocks: 1

- We have defined P_{IP}^t and Q_{IP}^t as the period t price and quantity of purchased investment goods.
- However, the production unit may also produce units of the investment good internally for its own use. Thus define $Q_{II}^t \geq 0$ as the amount of internally produced investment and P_{II}^t as the imputed price for a unit of this internally produced investment.
- Define period t *total investment* as the sum of purchased investment, Q_{IP}^t, plus internally produced investment, Q_{II}^t:

(2) $Q_I^t \equiv Q_{IP}^t + Q_{II}^t$.

- Internally produced investment poses problems for the national income accountant. Firm accounting records will record expenditures that were incurred in making Q_{II}^t but may not record the actual number of units of the investment good that were made. But we carry on and assume that total investment defined by (2) can be calculated.

Defining Investment and Capital Stocks: 2

- **Our next assumption relates period t total investment to the beginning and end of period t capital stocks held by the unit:**

(3) $Q_K^t = (1-\delta^t)Q_K^{t-1} + Q_I^t$

where δ^t **is the *period t geometric depreciation rate*.**

- **The price of a new unit of the capital stock at the beginning of period t,** P_K^{t-1}**, should be equal to the price of a new investment good at the *beginning* of period t.**
- **Note that this beginning of the period price is not necessarily equal to the period t market price of the investment good,** P_{IP}^t**, since** P_{IP}^t **price represents the *average price* of the purchased investment good over the entire duration of period t.**
- **One could approximate** P_K^{t-1} **in various ways; for example, set it to equal the average of** P_{IP}^t **and** P_{IP}^{t-1}**.**
- **In the next slide, we substitute (3) into (1) and the user cost of capital emerges.**

The User Cost of Capital: 1

- **Define the *period t asset inflation rate* i^t using the following equation:**

(4) $1+i^t = P_K^t/P_K^{t-1}$.

- **Thus** $P_K^t = (1+i^t)P_K^{t-1}$. **Now use (4) to eliminate** P_K^t **and use (3) to eliminate** Q_K^t **from definition (1).**
- **This allows us to express period t pure profits** Π^t **for the production unit as follows:**

(5) $$\Pi^t = P_Y^t Q_Y^t - P_Z^t Q_Z^t - P_{IP}^t Q_{IP}^t - P_L^t Q_l^t + (1+i^t)P_K^{t-1}[(1-\delta^t)Q_K^{t-1}+Q_I^t] - (1+r^t)P_K^{t-1}Q_K^{t-1}$$
$$= P_Y^t Q_Y^t - P_Z^t Q_Z^t - P_{IP}^t Q_{IP}^t + P_K^t Q_I^t - P_L^t Q_L^t - U^t Q_K^{t-1}.$$

- **The *period t user cost of capital* is defined as follows:**

(6) $$U^t \equiv [(1+r^t) - (1+i^t)(1-\delta^t)]P_K^{t-1} = [r^t - i^t + (1+i^t)\delta^t]P_K^{t-1}.$$

- **The second equality in (6) defines Jorgenson's user cost of K.**

The Negative User Cost Problem: 1

(6) $U^t \equiv [(1+r^t) - (1+i^t)(1-\delta^t)]P_K^{t-1}$

$= [r^t - i^t + (1+i^t)\delta^t]P_K^{t-1}$.

- The user cost of capital is supposed to be a substitute for the price of renting a unit of capital for the accounting period.
- There are 4 variables that appear in the user cost:

  r^t = the (nominal) cost of capital;

  $i^t = (P_K^t / P_K^{t-1}) - 1$ = the asset one period inflation rate;

  δ^t = the asset one period depreciation rate;

  P_K^{t-1} = the beginning of the period price of the asset.
- The r^t and δ^t terms will make the user cost positive but the asset inflation term i^t will tend to make the user cost negative if i^t is positive. This can happen for land assets where the depreciation rate is 0 and large increases in land prices are common.

The Negative User Cost Problem: 2

- **Negative user costs are problematic. If investors (at the beginning of the accounting period) can anticipate what asset prices will be at the end of the accounting period, then they should immediately buy assets that have negative user costs because they can earn excess profits by doing so. Thus negative user costs should be arbitraged away.**
- **Of course, investors cannot perfectly forecast future asset prices so the above argument does not necessarily apply.**
- **The above argument particularly does not apply to land prices because the transactions costs of buying and selling a property are in general very high.**
- **Jorgenson always advocated using ex post asset inflation rates in his user costs. This is a perfectly correct strategy if one wishes to calculate ex post rates of return on assets for a production unit.**

The Negative User Cost Problem: 3

- **However, if we take a national income accounting perspective, the use of ex post inflation rates in the user cost formula can lead to very volatile user costs, even if they turn out to be positive. These volatile user costs will not approximate rental rates (when they exist), which are much smoother.**
- **Jorgenson always advocated using ex post asset inflation rates in his user costs. This is a perfectly correct strategy if one wishes to calculate ex post rates of return on assets for a production unit.**
- **The problem is the fact that asset prices, P_K^t, are quite volatile and asset inflation rates are even more volatile since they are ratios of asset prices (minus 1).**
- **My own take on user costs and the use of ex post asset inflation rates is that for purposes of measuring productivity and sustainable income, we should smooth the ex post asset inflation rates if they are volatile.**

The Negative User Cost Problem: 4

- Even if we use smoothed asset inflation rates in the user costs, it can happen that user costs for various types of land still end up being negative.
- Again, personally, I am willing to accept negative user costs for land assets that use smoothed land inflation rates because the transactions costs of buying and selling land are so high.
- Why are there so many slides on the problem of negative user costs? We need to recall definition (1) which defined the profits of the production unit under consideration:

$$(1)\quad \Pi^t \equiv P_Y^t Q_Y^t - P_Z^t Q_Z^t - P_{IP}^t Q_{IP}^t - P_L^t Q_L^t + P_K^t Q_K^t - (1+r^t) P_K^{t-1} Q_K^{t-1}.$$

- Recall that $P_K^t = (1+i^t)P_K^{t-1}$. The Hicksian approach to the measurement of outputs and inputs adds the end of period value of the capital stock to normal outputs and subtracts $(1+r^t)$ times the value of the beginning of the period capital stock to inputs.

The Negative User Cost Problem: 5

(1) $\Pi^t \equiv P_Y{}^t Q_Y{}^t - P_Z{}^t Q_Z{}^t - P_{IP}{}^t Q_{IP}{}^t - P_L{}^t Q_L{}^t + P_K{}^t Q_K{}^t - (1+r^t) P_K{}^{t-1} Q_K{}^{t-1}$.

- **The basic problem with the Hicksian accounting framework for measuring production unit outputs and inputs is that there are no definite market prices that we can use to value assets at the beginning and end of the accounting period (unless the unit actually buys or sells the asset at the beginning or end of the accounting period).**
- **Standard commercial accounting theory solves this valuation problem by using historical purchase prices for the assets (until they are sold or retired).**
- **As economists interested in sustainable consumption and production, we have the freedom to choose alternative methods for the valuation of durable assets.**
- **In the following slides, we assume that we have solved the asset valuation problem.**

Concept 1: Gross Domestic Output and Input; 1

- ***Period t Gross Domestic Input or Income*** **generated by the production unit, GDI^t, can be defined as the production unit value of labour services $P_L{}^tQ_L{}^t$ plus the value of capital services $U^tQ_K{}^{t-1}$ plus the value of pure profits Π^t:**

(8) $GDI^t \equiv P_L{}^tQ_L{}^t + U^tQ_K{}^{t-1} + \Pi^t$.

- **To get the measure of production unit output that corresponds to the income measure defined by (8), replace Π^t in (8) by the right hand side of (5). This leads to the following definition of *period t Gross Domestic Output*, GDO^t:**

$$\text{(9) } GDO^t \equiv P_Y{}^tQ_Y{}^t - P_Z{}^tQ_Z{}^t - P_{IP}{}^tQ_{IP}{}^t + P_K{}^tQ_I{}^t$$
$$= CVA^t + P_K{}^tQ_I{}^t$$
$$= GDI^t$$

where period t *Comprehensive Value Added* of the production unit, CVA^t, is defined as *Regular Value Added*,

$VA^t \equiv P_Y{}^tQ_Y{}^t - P_Z{}^tQ_Z{}^t$, less market expenditures on the investment good, $P_{IP}{}^tQ_{IP}{}^t$.

Gross Domestic Output and Input: 2

(8) $GDI^t \equiv P_L{}^t Q_L{}^t + U^t Q_K{}^{t-1} + \Pi^t$;

(9) $GDO^t \equiv P_Y{}^t Q_Y{}^t - P_Z{}^t Q_Z{}^t - P_{IP}{}^t Q_{IP}{}^t + P_K{}^t Q_I{}^t$.

- GDI^t defined by (8) is easy to understand; Gross Domestic Income generated by the production unit is equal to the value of labour services plus the value of Jorgensonian capital services plus pure profits.
- However, GDO^t is harder to relate to traditional measures of gross output for a firm.
- If $P_K{}^t = P_{IP}{}^t$ and all investment is purchased so that internally produced investment $Q_{II}{}^t = 0$ and hence total investment $Q_I{}^t$ equals purchased investment $Q_{IP}{}^t$, then $P_K{}^t Q_I{}^t = P_{IP}{}^t Q_{IP}{}^t$ and Gross Domestic Output produced by the production unit collapses down to ordinary value added so that

  $VA^t \equiv P_Y{}^t Q_Y{}^t - P_Z{}^t Q_Z{}^t = GDO^t$.
- Thus under these conditions Hicksian gross output for the firm boils down to traditional value added.

Concept 2: Net Domestic Output and Input: 1

- **The problem with the gross income measure, GDI^t defined by (8) is that it includes the value of depreciation as a component of income.**
- **But depreciation is not a component of income that can be spent on the purchase of consumer goods and services.**
- **Thus the depreciation component of user cost should be removed as a source of income and transferred to the net output accounts; i.e., depreciation should be treated as deduction from production unit revenues and be treated as a type of intertemporal intermediate input expense.**
- **The period t value of depreciation (valued at end of period prices of the capital stock) is $P_K^t \delta^t Q_K^{t-1} = (1+i^t)\delta^t P_K^{t-1} Q_K^{t-1}$.**
- **Subtract this term from period t Gross Domestic Income in order to define the period t *Net Domestic Income*, NDI^t, generated by the production unit as follows:**

Net Domestic Output and Input: 2

(12) $NDI^t \equiv GDI^t - (1+i^t)\,\delta^t P_K^{t-1} Q_K^{t-1}$

$= P_L^t Q_L^t + [r^t - i^t] P_K^{t-1} Q_K^{t-1} + \Pi^t$ using (8) and (6).

- Note that $(1+i^t)\,\delta^t P_K^{t-1} Q_K^{t-1}$ is the depreciation term in the user cost value that was present in the Gross Income concept.
- The second line in (12) shows that the new "income" that accrues to the owners of the capital stock is $[r^t - i^t] P_K^{t-1} Q_K^{t-1}$.
- It is not clear why we would want to subtract $i^t P_K^{t-1} Q_K^{t-1}$ from the other sources of income so in our next income concept, we will transfer this term over to the output side of the accounts.
- In order to obtain the output measure NDO^t that matches up with the net income measure NDI^t defined by (12), substitute the right hand side of (5) to eliminate Π^t from the second line in (12).
- We obtain the following expression for the *Net Domestic Output* NDO^t produced by the production unit during period t:

Net Domestic Output and Input: 3

(13) $NDO^t \equiv P_Y{}^t Q_Y{}^t - P_Z{}^t Q_Z{}^t - P_{IP}{}^t Q_{IP}{}^t + P_K{}^t [Q_I{}^t - \delta^t Q_K{}^{t-1}]$

$= CVA^t + P_K{}^t [Q_I{}^t - \delta^t Q_K{}^{t-1}]$ using definition (10)

$= NDI^t$.

- The second line of (13) tells us that period t Net Domestic Output is equal to the production unit's Comprehensive Value Added, CVA^t, plus the production unit's period t gross investment, $Q_I{}^t$, less period t depreciation of the starting capital stock, $\delta^t Q_K{}^{t-1}$, valued at the end of period capital stock price, $P_K{}^t$.
- Note that $Q_I{}^t - \delta^t Q_K{}^{t-1}$ is *period t net investment*.
- Further note that this period t net investment is valued at the end of period t price of the capital stock, $P_K{}^t$.
- The measure of net output defined by (13) adds the value of net investment to a comprehensive measure of value added produced by the production unit during period t.

Net Domestic Output and Input: 4

(13) $NDO^t \equiv P_Y{}^t Q_Y{}^t - P_Z{}^t Q_Z{}^t - P_{IP}{}^t Q_{IP}{}^t + P_K{}^t [Q_I{}^t - \delta^t Q_K{}^{t-1}]$

- The problem with the net output measures of output and income, NDO^t and NDI^t, is the fact that the income measure NDI^t does not accurately measure the nominal income generated by the production unit over the period.
- NDI^t omits the capital gains (or losses) that accrue to the initial capital stock held by the production unit.
- Adding these capital gains to NDI^t leads to period t *Comprehensive Net Domestic Income* generated by the producer over period t, $CNDI^t$, defined on the following slide:

Concept 3: Comprehensive Net Domestic Income: 1

(14) $CNDI^t \equiv P_L{}^t Q_L{}^t + r^t P_K{}^{t-1} Q_K{}^{t-1} + \Pi^t$

$= NDI^t + i^t P_K{}^{t-1} Q_K{}^{t-1}$ using the second line in (12).

- The first line in (14) tells us comprehensive nominal income is equal to payments to labour $P_L{}^t Q_L{}^t$ plus interest and dividend payments to the owners of the production unit for tying up their capital for the period $r^t P_K{}^{t-1} Q_K{}^{t-1}$ plus any pure profits Π^t that might have occurred.
- The second line in (14) tells us that $CNDI^t$ is equal to NDI^t plus capital gains on the production unit's initial capital stock.
- We note that Rymes (1968) (1983) defined $r^t P_K{}^{t-1} Q_K{}^{t-1}$ as Waiting Services and he advocated replacing the user cost of capital by waiting services.
- This measure of income makes the most sense to us.

Comprehensive Net Domestic Income: 2

- We use the right hand side of (5) to eliminate Π^t from the right hand side of (14).
- We obtain the following expression for period t *Comprehensive Net Domestic Output*, $CNDO^t$, for the production unit:

$$(15)\ CNDO^t = P_Y^t Q_Y^t - P_Z^t Q_Z^t - P_{IP}^t Q_{IP}^t + P_K^t [Q_I^t - \delta^t Q_K^{t-1}] + i^t P_K^{t-1} Q_K^{t-1}$$

$$= CVA^t + P_K^t [Q_I^t - \delta^t Q_K^{t-1}] + i^t P_K^{t-1} Q_K^{t-1}$$

$$= CVA^t + P_K^t [Q_K^t - Q_K^{t-1}] + i^t P_K^{t-1} Q_K^{t-1}$$

$$= CVA^t + P_K^t Q_K^t - (1+i^t) P_K^{t-1} Q_K^{t-1} + i^t P_K^{t-1} Q_K^{t-1}$$

$$= CVA^t + P_K^t Q_K^t - P_K^{t-1} Q_K^{t-1}.$$

- Thus $CNDO^t$ is equal to comprehensive value added, CVA^t, plus the value of the end of period capital stock, $P_K^t Q_K^t$, less the value of the beginning of the period capital stock, $P_K^{t-1} Q_K^{t-1}$.
- This is a very simple definition of net (nominal) output.

Discussion of Alternative Income and Output Concepts: 1

- $CNDO^t$ is equal to $CVA^t + P_K^t Q_K^t - P_K^{t-1} Q_K^{t-1}$;
  NDO^t is equal to $CVA^t + P_K^t [Q_K^t - Q_K^{t-1}]$.
- Thus the comprehensive net income measure is a maintenance of financial capital approach to the measurement of income whereas the net income measure is a maintenance of real physical capital approach.
- Generating estimates of the nominal income generated by a production unit is not the end of the story.
- In order to evaluate the contributions of a production sector to the creation of income, it is necessary to convert the nominal income measure into a real income measure; i.e., the nominal measure of income should be divided by a consumer price index to convert nominal income flows into real income flows.

Discussion of Alternative Income and Output Concepts: 2

- **Our suggested comprehensive measure of real income generated by a production unit (which is $CNDI^t$ deflated by a consumer price index) is exactly the income concept recommended by the accountant Sterling:**
- **"It follows that the appropriate procedure is to (1) adjust the present statement to current values and (2) adjust the previous statement by a price index. It is important to recognize that *both* adjustments are necessary and that neither is a substitute for the other. Confusion on this point is widespread." Robert R. Sterling (1975; 51).**
- **Sterling (1975; 50) termed his income concept *Price Level Adjusted Current Value Income*. Unfortunately, Sterling's income concept has not been widely endorsed in accounting circles due to difficulties in implementing it in an unambiguous manner.**
- **But conceptually, Sterling's income concept is consistent with our Comprehensive Net Domestic Product income concept that is deflated by a consumer price index.**

Discussion of Alternative Income and Output Concepts: 3

- **Which income concept is "best"? The gross income concept clearly overstates sustainable consumption and so this concept can be dismissed.**
- **However, choosing between the physical and real financial maintenance perspectives is more problematical: reasonable economists could differ on this choice. The merits of the two perspectives were discussed by Pigou and Hayek over 80 years ago. Pigou (1941; 273-274) favoured the maintenance of physical capital approach while Hayek (1941; 276-277) favoured the maintenance of real financial capital approach (the approach of Sterling).**
- **Hayek noted that obsolescence of a capital good leads to a loss of income which is not captured in the maintenance of physical capital approach to income measurement but it is captured in the maintenance of financial capital approach.**

Discussion of Alternative Income and Output Concepts: 4

- **Moreover, the approach of Pigou does not capture the gains in income that are generated by increasing land prices.**
- **The amount of land could remain constant but increases in the price of business land that are greater than the change in the consumer price index should lead to an increase in the real income generated by a production unit but the approach of Pigou neglects these real income gains.**
- **Note that the current System of National Accounts omits the terms $P_K^t Q_K^t - P_K^{t-1} Q_K^{t-1}$ or $P_K^t [Q_K^t - Q_K^{t-1}]$ from Gross Domestic Product if the asset K is land or a natural resource.**
- **Thus our suggested measures of net output are more consistent with "green accounting" and the sustainability literature than the current System of National Accounts.**
- **As Hicks (1946; 184) said in his income chapter: "What a tricky business this all is!"**

Extension to the Aggregate Production Sector: 1

- We showed in the paper how to aggregate over producers and get expressions for aggregate output and input for our 3 concepts using macroeconomic data.
- Here are the output concepts:

(30) $GDO^{t*} = P_C^t Q_C^t + P_G^t Q_G^t + P_X^t Q_X^t - P_M^t Q_M^t + \Sigma_{n=1}^N P_{Kn}^t Q_{In}^t$;

(31) $NDO^{t*} = P_C^t Q_C^t + P_G^t Q_G^t + P_X^t Q_X^t - P_M^t Q_M^t + \Sigma_{n=1}^N P_{Kn}^t [Q_{Kn}^t - Q_{Kn}^{t-1}]$;

(32) $CNDO^{t*} = P_C^t Q_C^t + P_G^t Q_G^t + P_X^t Q_X^t - P_M^t Q_M^t + \Sigma_{n=1}^N P_{Kn}^t Q_{Kn}^t - \Sigma_{n=1}^N P_{Kn}^{t-1} Q_{Kn}^{t-1}$.

- Gross investments $\Sigma_{n=1}^N P_{Kn}^t Q_{In}^t$ appear in (30), net investments $\Sigma_{n=1}^N P_{Kn}^t [Q_{Kn}^t - Q_{Kn}^{t-1}]$ appear in (31) and beginning and end of period values of the N capital stocks appear in (32).
- The only intermediate inputs in the aggregate framework are imports, $P_M^t Q_M^t$.

Extension to the Aggregate Production Sector: 2

- **Here are the corresponding aggregate income concepts:**

$$\text{(33) } GDI^t \equiv P_L{}^t Q_L{}^t + \Sigma_{n=1}{}^N [r^t - i_n{}^t + \delta_n{}^t(1+i_n{}^t)] P_{Kn}{}^{t-1} Q_{Kn}{}^{t-1} + \Sigma_{f=1}{}^F \Pi^f ;$$

$$\text{(34) } NDI^t \equiv P_L{}^t Q_L{}^t + \Sigma_{n=1}{}^N [r^t - i_n{}^t] P_{Kn}{}^{t-1} Q_{Kn}{}^{t-1} + \Sigma_{f=1}{}^F \Pi^f ;$$

$$\text{(35) } CNDI^t \equiv P_L{}^t Q_L{}^t + \Sigma_{n=1}{}^N r^t P_{Kn}{}^{t-1} Q_{Kn}{}^{t-1} + \Sigma_{f=1}{}^F \Pi^f .$$

- **The aggregate income concepts are straightforward summations of the production unit income contributions.**

Conclusion

- **The current System of National Accounts for the production sector of the economy are not suitable for all purposes:**

  (i) They do not allow changes in resource stocks and land usage to enter the flow accounts of the production sector;

  (ii) They include depreciation as part of "income" and

  (iii) They do not allow capital gains or losses on beginning of the period asset holdings to enter the definition of "income".

- **Our suggested Comprehensive Net Domestic Income measure addresses the above problems.**
- **However, we are not suggesting that waiting services replace capital services for all uses of the accounts. We are suggesting Comprehensive Net Domestic Income and Output as supplements to the current SNA.**