

A stylized satellite account for human capital

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Structure of the presentation

1. Background and motivation
2. The output of education sector
3. A satellite account for human capital
4. A numerical example
5. Concluding remarks

1. Background and motivation

- Human capital

- Concept

Petty (1691), Smith (1776), Engel (1883); Schultz (1961), Becker (1964), Mincer (1974)

- Definition

Human capital is broadly defined as ‘the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being’ (OECD, 2001).

- Implications for measurement

Stepwise approach, starting from focusing on formal education and economic benefits accrued to individuals taking education (e.g. Liu and Fraumeni, 2014)

- Measuring methodologies

Various approaches: indicators-based (e.g. Barro and Lee, 2013), cost-based (e.g. Kendrick, 1976), income-based (e.g. Jorgenson and Fraumeni, 1989, 1992)

1. Background and motivation (cont.)

○ Human capital and the System of National Accounts (SNA)

- Human capital has not yet been incorporated in the SNA (see e.g. SNA 2008)

WHY? SNA production boundary and asset boundary

- Satellite account for human capital

Maintaining the link to, while without overburdening, the core accounts of the SNA (e.g. Abraham and Mackie, 2005 ; Boarini et al., 2012)

- Which measuring approach to choose?

Indicators vs. monetary measures

- How to reconcile the two approaches within one and the same framework?

Large discrepancies are found between the estimates of human capital by the cost-based and the income-based approaches (e.g. Ervik et al., 2003; Gu and Wong, 2010, 2014)

2. The output of education sector

- Two different views about what is the output of education sector
- First view, as education services

$$(1) \quad P_E E = P_M M + P_L L + CFC + NOS$$

$$P_M M = \sum_{i=1}^I P_i M_i$$

$$P_L L = \sum_{j=1}^J P_j L_j$$

- *This equation indicates that the total value of the gross output of the education sector ($P_E E$), after subtracting the value of intermediate consumption ($P_M M$), gives rise to the value added for the education sector that consists of compensation of employees ($P_L L$) and remuneration for capital services, the latter including consumption of fixed capital (CFC) and the net operating surplus (NOS).*
- *The SNA convention: the net operating surplus (NOS) = 0.*

2. The output of education sector (cont.)

○ Two different views about what is the output of education sector (cont.)

■ Second view, as human capital investment

• *The cost-based approach*

$$(2) \quad P_H^C H^C = P_E E + HFC_E + P_L \tilde{L}$$

• *The income-based approach*

$$(3) \quad P_H^I H^I = \Delta L I N_E$$

• *It has been found that*

$$P_H^I H^I > P_H^C H^C$$

3. A satellite account for human capital

- Main points

- The generation of human capital is a production process that is undertaken by ***individual persons*** when taking formal education or training and courses.
- The product of this production activity is the investment in human capital, measured by the lifetime income approach, to be added to the human capital stock that is already accumulated and embodied in the person in concern.
- Production account for an individual taking education:

$$(4) \quad P_H^I H^I = P_{\tilde{M}} \tilde{M} + P_{\tilde{L}} \tilde{L} + GOS_H$$

$$P_{\tilde{M}} \tilde{M} = P_E E + HFC_E$$

3. A satellite account for human capital (cont.)

- Main points (cont.)

- By inserting equation (2) into equation (4), one yields:

$$(5) \quad GOS_H = P_H^I H^I - P_H^C H^C$$

- Advantages

- *Consistent with reality*
- *Conceptually clearer*
- *Both the cost-based and the income-based approaches are within one and the same framework, a first step towards making reconciliation between the two approaches*
- *Consistent with the SNA convention (output vs. outcome)*

4. A numerical example

Table 1. Supply table (traditional)

	Industries				Imports	Total supply
	Other industries	Education by				
		Market producer	Government	NPISHs		
Products						
Other products	100	0	0	0	0	100
<i>Education</i>						
Pre-primary	0	2	3	2	0	7
Primary	0	2	3	2	0	7
Secondary	0	2	3	2	0	7
Tertiary	0	2	3	2	0	7
Training & courses	0	3	0	0	0	3
Total output	100	11	12	8	0	131

4. A numerical example (cont.)

Table 2. Use table (traditional)

	Industries				Final use					Total use
	Other industries	Education by			Final consumption by			GCF	Export	
		Market producer	Government	NPISHs	Households	Government	NPISHs			
Products										
Other products	60	5	5	5	5	5	5	10	0	100
Education										
Pre-primary	0	0	0	0	2	3	2	0	0	7
Primary	0	0	0	0	2	3	2	0	0	7
Secondary	0	0	0	0	2	3	2	0	0	7
Tertiary	0	0	0	0	2	3	2	0	0	7
Training & courses	3	0	0	0	0	0	0	0	0	3
Total use	63	5	5	5	13	17	13	10	0	131
Value added	37	6	7	3						
Compensation of employees	30	3	6	2						
Other net taxes on production	0	0	0	0						
Consumption of fixed capital	3	1	1	1						
Net operating Surplus	4	2	0	0						
Total output	100	11	12	8						

4. A numerical example (cont.)

- For this simple economy, the following identities for both the industries and the products are observed: (1) output by industry = input by industry; (2) total supply by product = total use by product.

- GDP for this simple economy:
 - By the production approach, $\text{GDP} = \text{total output} (131) - \text{intermediate consumption} (63 + 5 + 5 + 5) = 131 - 78 = 53$.
 - By the income approach, $\text{GDP} = \text{compensation of employees} (30 + 3 + 6 + 2) + \text{other net taxes on production} (0) + \text{consumption of fixed capital} (3 + 1 + 1 + 1) + \text{net operating surplus} (4 + 2 + 0 + 0) = 41 + 0 + 6 + 6 = 53$.
 - By the expenditure approach, $\text{GDP} = \text{final consumption by households} (13) + \text{final consumption by government} (17) + \text{final consumption by NPISHs} (13) + \text{gross capital formation} (10) + \text{net export} (0) = 13 + 17 + 13 + 10 + 0 = 53$.

- The output of education sector for this simple economy:
 - Value = expenses for training courses that are treated as part of intermediate consumption (3) + the sum of households final consumption expenditure for the purpose of education (by the market producers (8) + by non-market producers (government and NPISHs) on behalf of households (12 + 8) + buying books etc. (1) = 32.

4. A numerical example (cont.)

Table 3. Supply table (extended)

	Industries				<i><u>Individuals taking education</u></i>	Imports	Total supply
	Other industries	Education by					
		Market producer	Government	NPISHs			
Products					-		
Other products	100	0	0	0	-	0	100
Education					-		
Pre-primary	0	2	3	2	-	0	7
Primary	0	2	3	2	-	0	7
Secondary	0	2	3	2	-	0	7
Tertiary	0	2	3	2	-	0	7
Training & courses	0	3	0	0	-	0	3
HC investment					-		
Pre-primary					<u>10</u>		10
Primary					<u>10</u>		10
Secondary					<u>10</u>		10
Tertiary					<u>10</u>		10
Training & courses					<u>10</u>		10
Total output	100	11	12	8	<u>50</u>	0	181

4. A numerical example (cont.)

Table 4. Use table (extended)

	Industries					Final use					Total use	
	Other industries	Education by			<u>Individuals taking education</u>	Final consumption by			GCF			Export
		Market producer	Government	NPISHs		Households	Government	NPISHs	Other assets	<u>HC</u>		
Products					-							
Other products	60	5	5	5	<u>1</u>	4	5	5	10	-	0	100
Education					-							
Pre-primary	0	0	0	0	<u>7</u>				0	-	0	7
Primary	0	0	0	0	<u>7</u>				0	-	0	7
Secondary	0	0	0	0	<u>7</u>				0	-	0	7
Tertiary	0	0	0	0	<u>7</u>				0	-	0	7
Training & courses	0	0	0	0	<u>3</u>	0	0	0	0	-	0	3
HC investment					-							
Pre-primary					-					<u>10</u>		10
Primary					-					<u>10</u>		10
Secondary					-					<u>10</u>		10
Tertiary					-					<u>10</u>		10
Training & courses					-					<u>10</u>		10
Total use	60	5	5	5	<u>32</u>	4	5	5	10	<u>50</u>	0	181
Value added	40	6	7	3	<u>18</u>							
Compensation of employees	33	3	6	2	<u>3</u>							
Other net taxes on production	0	0	0	0	<u>0</u>							
Consumption of fixed capital	3	1	1	1	<u>0</u>							
Net operating Surplus	4	2	0	0	<u>15</u>							
Total output	100	11	12	8	<u>50</u>							

4. A numerical example (cont.)

- Within the new supply and use framework, the following identities for both the industries and the products are still observed: (1) output by industry = input by industry; (2) total supply by product = total use by product.

- GDP is recalculated as :
 - By the production approach, $GDP = \text{total output (181)} - \text{intermediate consumption (60 + 5 + 5 + 5 + 32)} = 181 - 107 = 74$.

 - By the income approach, $GDP = \text{compensation of employees (33 + 3 + 6 + 2 + 3)} + \text{other net taxes on production (0)} + \text{consumption of fixed capital (3 + 1 + 1 + 1 + 0)} + \text{net operating surplus (4 + 2 + 0 + 0 + 15)} = 47 + 0 + 6 + 21 = 74$.

 - By the expenditure approach, $GDP = \text{final consumption by households (4)} + \text{final consumption by government (5)} + \text{final consumption by NPISHs (5)} + \text{gross capital formation (10 + 50)} + \text{net export (0)} = 4 + 5 + 5 + 60 + 0 = 74$.

4. A numerical example (cont.)

- The GDP difference ($74 - 53 = 21$) consists of two parts: the first is the value added generated from the production of human capital (18), and the second is due to the increased compensation for employees (3) that are previously treated as intermediate consumption in other industries within the framework of the SNA.
- The value added generated from the production of human capital (18) is itself the sum of two parts: the first is the compensation of employees (i.e. remuneration for own labor services used in the production process, valued of 3), and the second is the operating surplus claimed by the individuals (15).
- It is easy to confirm that equation (4) holds for this simple economy. In other words, the operating surplus (15) is equal to the difference of two estimates of human capital investment in that the estimates by the income-based approach are 50, while those by the cost-based approach are 35 ($32 + 3$)(see Table 4).

5. Concluding remarks

- By treating the creation of human capital as a production activity by the individuals taking education and/or training/courses, and the output of this production as a new product of investment in human capital, this paper presents a satellite account for human capital that extends both the production and asset boundaries of the current SNA.
- Within the satellite account, the inputs for producing human capital by the individuals include the education services provided by the education sector that are traditionally considered in the SNA as the output of the education sector.
- Since a fundamental and decisive input for producing human capital is own labor services that are reflected by the own time input used for learning, studying and practicing during the production process of human capital, the gross operating surplus from the production of human capital is allocated to the individual in concern, accordingly, the developed human capital is regarded as being owned by the individual him/herself.
- The gross operating surplus is demonstrated as being equal to the differences between the estimates by the cost-based and the income-based approaches to measuring human capital in the field. Thus, the new framework as presented in this paper makes an important step towards the reconciliation of the two most promising approaches.
- Based on a simple supply and use framework with human capital as a produced product/asset, a numerical example shows how to register the new product of human capital investment, and accordingly the relevant changes, compared with an old framework that is within the SNA.

5. Concluding remarks (cont.)

- The simple setting as presented in the paper can be extended in several directions. For instance, the new industry of ‘individuals taking education’ introduced in the paper may be further divided into ‘students taking education’ and ‘employees taking training/courses’.
- For the former, human capital accumulated can be recorded as work-in-progress, because the students are out of the current labor force. Once they enter into the labor force, their accumulated human capital can be registered as a negative change in stocks and as fixed capital formation by the same amount. While for the group of the employees, their human capital investments can be directly registered as fixed capital formation.
- Many types of training/courses are not bought from the market. On the contrary, they are frequently carried out internally within the working units. As shown in the new framework, these expenses by the employers can be registered as compensation of employees in kind and are then used by employees for producing human capital investment.
- Neither import nor export is currently taken into account. However, it is easy to cover both within the same framework. For example, domestic human capital investments can occur by taking imported education services, while domestic education services can also be bought by non-residents. Furthermore, migration of people with human capital embodied can change the stock level of human capital in a country.
- Last but not least, it merits to be mentioned that the basic framework can be very well applied to another important type of asset, i.e. health capital, which is sometimes regarded as the output of health sector, but should actually be considered as generated by investment activities conducted by the individuals themselves, in quite the same way as human capital is developed.