# Measuring Intangible Investment in the Public Sector

C. Corrado, (The Conference Board), New York
K. Jager, (The Conference Board), New York
J. Haskel, (Imperial College, CEPR and IZA), London
M.Iommi, (LUISS Lab and ISTAT), Rome
**C. Jona-Lasinio, (LUISS Lab and ISTAT), Rome**

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# Overview

- Writing a SPINTAN Methods Manual
- Starting point: nominal intangible investment
- Own account organizational capital in the Public sector: some conceptual issues
- Prices and volume measures of intangibles: looking for the best price measure
- Net capital stocks
- Issues for discussion

# Measurement method chapter: outline

- Introduction
- Knowledge capital in the Public Sector
  - CHS type of asset: market vs nonmarket
  - Information, scientific and cultural assets
  - Societal competencies
- Measurement methods
  - Nominal investment flows
  - Prices and volume measures of intangibles
  - Net stocks
  - Return to nonmarket capital
- SPINTAN estimates
  - Data description
  - Empirical evidence
  - The European economies and the US
  - China, India and Brazil
- Conclusions and future developments

# The scope of intangible assets used by the public sector: industries of interest

Table 1: **SPINTAN Industries of Interest**

| NACE SECTION | INDUSTRY TITLE | NACE NUMBER |
|---|---|---|
| MB | Scientific research and development | 72 |
| O | Public administration and defence; compulsory social security | 84 |
| P | Education | 85 |
| QA | Human health activities | 86 |
| QB | Residential care and social work activities | 87-88 |
| R | Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities | 90-91 |
| | Gambling and betting activities; sports activities and amusement and recreation activities | 92-93 |

NOTE—NACE Rev. 2.

Besides Public administration and defense, other industries in the table contain a mix of **market** and **nonmarket** producers.

# Multiple measurement dimensions of Public intangibles

**Nonmarket sector - industries**

**CHS intangible assets**

- **Information, Scientific and Cultural assets**
  - **NA intangibles** (Software, R&D, Mineral exploration)
  - **Non NA intangibles** (Open data, Cultural and heritage, including design, Brands, Organizational capital, Function-specific human capital)
- **Societal Competencies**

Nominal intangibles are measured as:

$$P^N N_t = \sum_{i=1}^{N} \sum_{s=1}^{S} (\gamma_{i,s,t}^{own-account} \lambda_{i,s,t}^{own-account} OwnCost_{i,s,t}^{Indicator} + \gamma_{i,s,t}^{purchased} \lambda_{i,s,t}^{purchased} Purchased_{i,s,t}^{Indicator}) \quad (1)$$

where:

- $P^N N_t$ is nominal expenditure, in industry $i$ and institutional sector $s$;
- *OwnCost* and *Purchased* are time-series indicators of the own-account and purchased components of intangible investment;
- $\lambda$ indicates the adjustment to the time-series indicator that is needed to transform it to a sector-industry gross output (own-account) or gross spending measure.
- $\gamma$ is the capitalization factor, namely, a parameter that adjusts a spending measure to a measure of investment—a fraction of revenues or employee time, say, devoted to long-lived activities.

# Purchased intangibles

- To estimate the purchased measures of non-national accounts CHS intangibles, our time series for $Puchased^{Indicator}$ are obtained from use tables in current prices (NACE Rev. 2 basis), available from most national statistical offices (NSOs) (from 2002 ESA95; from 2010 ESA2010); for earlier years, we implemented a backcasting procedure (Bacchini et al., 2015).
- Use tables provide intermediate purchases by industry (columns) and by product (rows) according to Classification of Products by Activity (CPA) codes.
- For the four CHS purchased assets, design, brands, organizational capital, and training, we use the following codes: Architectural and engineering services, technical testing and analysis services (CPA M71); Advertising and market research services (CPA M73); Legal and accounting services, services of head offices and management consulting services (CPA M69 and M70); and Education services (CPA P85).

# Own account intangibles

- .....at the moment we focus only on Organizational Capital

# Organizational capital

- "Organizational capital consists of knowledge, know-how and business practices, and is embedded in a firm's managers and employees"
- ....thus the firm is the appropriate business unit to study organizational structure!
- When we move to the nonmarket sector we need to clarify a number of issues both in terms of definitions and measurement methods.
  - Does the OC definition adopted for the market sector can be applied symmetrically to the nonmarket sector?

# Organizational capital

- Who is responsible for creating organizational capital in public and private firms?
- Beyond managers, what is the role of other professionals in generating organizational knowledge? (O'Mahony 2014)
- ...and own account organizational capital is created by the same professionals in public and private firms?
- The answers to the above questions are a matter of discussion in SPINTAN.

- Empirical measures are often generated by an expenditure based approach (purchased and own account) (Corrado Hulten and Sichel (2005) and see Le Mouel and Squicciarini (2012) for a review of the literature).
  - "The own-account component is represented by the value of executive time spent on improving the effectiveness of business organizations, i.e., the time spent on developing business models and corporate cultures. The own-account portion is estimated as a proportion of the cost and number of persons employed in executive occupations", CHS(2005).
- Is a cost based measure appropriate to evaluate an activity performed in the public sector where, contrary to the private sector, the correspondence between the compensation of employees and productivity is not guaranteed?
  - Is this country specific?

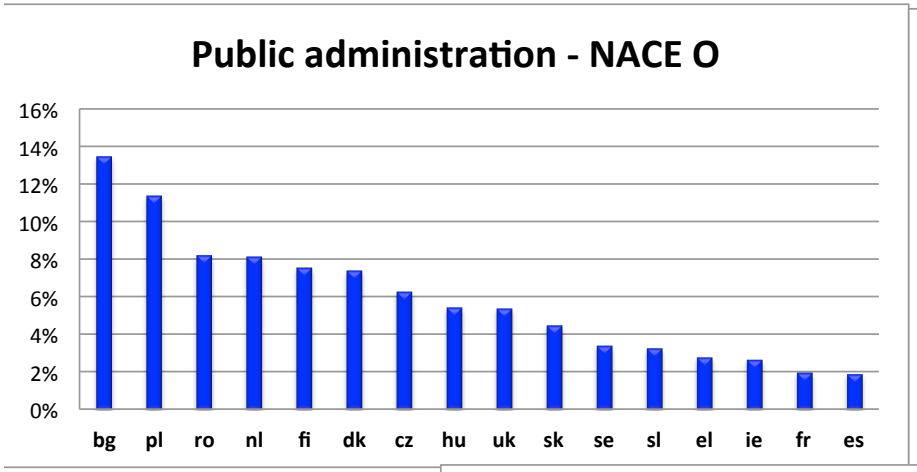
# Share of ISCO1 in Total employee

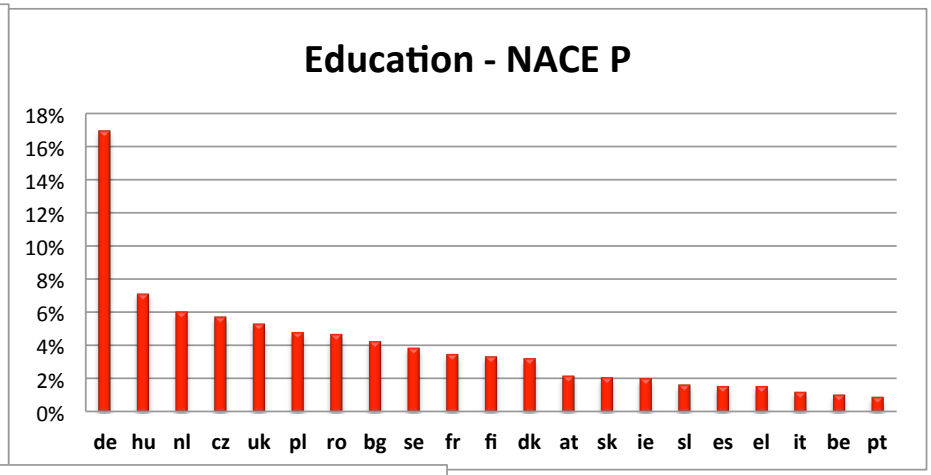
**Share of ISCO1 in Total Employee - SES 2010 (EU aggregates- Unweighted averages)**

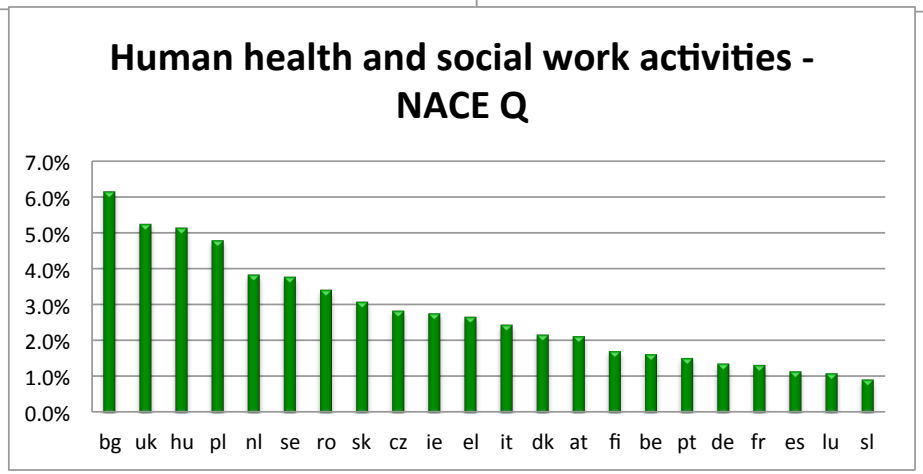
| | Public administration and defence; compulsory social security | Education | Human health and social work activities | Arts, entertainment and recreation | Business economy |
|---|---|---|---|---|---|
| **Continental Europe** | 5.1 | 5.9 | 1.9 | 6.1 | 6.0 |
| **Mediterranean** | 2.3 | 1.3 | 1.9 | 3.7 | 3.2 |
| **UK-IE** | 4.0 | 3.7 | 4.0 | 19.1 | 13.3 |
| **Scandinavian** | 6.1 | 3.5 | 2.6 | 5.6 | 6.0 |
| **Eastern Europe** | 7.5 | 4.3 | 3.8 | 6.7 | 6.0 |

Shares are highly heterogeneous across EU areas

# Share of ISCO1 in Total employee




...and even more differentiated across countries and industries

# Price measures

- Intangible investment in real terms is a particular challenge because units of knowledge cannot be readily defined. Most intangible assets are unique products (with the exception of copies, e.g. in the case of pre-packaged software) and a large amount is produced on own account.
- Possible suggestions are in the Handbook on Deriving Capital Measures for Intellectual Property Products (OECD 2010)
  - Hedonic prices (copies)
  - Producers price indexes (originals for sale)
  - Input based and productivity adjusted measures (originals for own use)

National Account Intangibles from NA while Non-NA Intangibles deserve some research

- Purchased: Sectoral Producer Price Indexes (SPPI) or Market Sector Value Added Deflator (MSVAD)
- Own account: input-based productivity adjusted measures

# SPPI vs MVAD

**Service producer price index (SPPI) vs market sector value added deflator (MSVAD), 2007-2013**

| | Legal, accounting and management consultancy activities | | | Architectural and engineering activities | | | Advertising and Market Research | | |
|---|---|---|---|---|---|---|---|---|---|
| | SPPI | MSVAD | Difference | SPPI | MSVAD | Difference | SPPI | MSVAD | Difference |
| | (a) | (b) | (a)-(b) | (a) | (b) | (a)-(b) | (a) | (b) | (a)-(b) |
| BE | 1.0 | 1.6 | -0.6 | 1.4 | 1.6 | -0.2 | 0.8 | 1.6 | -0.8 |
| BG | na | - | - | na | - | - | na | - | - |
| CZ | 0.5 | 0.3 | 0.1 | 1.1 | 0.3 | 0.7 | 2.9 | 0.3 | 2.6 |
| DK | 1.8 | 2.1 | -0.3 | 2.4 | 2.1 | 0.3 | na | - | - |
| DE | 1.4 | 1.3 | 0.1 | 1.8 | 1.3 | 0.5 | 0.6 | 1.3 | -0.7 |
| IE | -0.5 | -0.4 | -0.1 | -3.9 | -0.4 | -3.5 | -1.0 | -0.4 | -0.5 |
| EL | na | - | - | 0.4 | 1.0 | 1.0 | -2.5 | 1.0 | 1.0 |
| ES | 0.8 | 0.4 | 0.4 | 1.1 | 0.4 | 0.6 | 1.3 | 0.4 | 0.9 |
| FR (1) | 1.0 | 0.5 | 0.5 | 0.3 | 0.9 | 0.9 | -1.4 | 0.9 | 0.9 |
| IT | na | 1.3 | na | na | - | - | na | - | - |
| LU | 2.1 | 3.8 | -1.7 | 0.5 | 3.8 | -3.3 | 0.5 | 3.8 | -3.3 |
| HU | 0.8 | 3.4 | -2.6 | 0.8 | 3.4 | -2.6 | -1.2 | 3.4 | -4.6 |
| NL | -0.2 | 1.4 | -1.6 | 0.5 | 1.4 | -0.9 | 0.0 | 1.4 | -1.4 |
| AT | 2.2 | 1.4 | 0.8 | 2.2 | 1.4 | 0.8 | 1.6 | 1.4 | 0.2 |
| PL (1) | 1.3 | 2.3 | -1.1 | 1.6 | 2.6 | 2.6 | 0.3 | 2.6 | 2.6 |
| PT | na | - | - | na | - | - | na | - | - |
| RO (2) | 4.7 | 4.0 | 0.7 | 3.5 | 5.3 | 5.3 | 1.8 | 5.2 | 5.3 |
| SI | 0.5 | 1.2 | -0.7 | -0.8 | 1.2 | -2.0 | 1.9 | 1.2 | 0.7 |
| SK | na | - | - | na | - | - | na | - | - |
| FI | na | - | - | 2.8 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| SE | na | - | - | na | - | - | na | - | - |
| UK | 0.5 | 2.3 | -1.8 | 1.6 | 1.7 | 0.0 | 3.0 | 2.3 | 0.7 |

(1) 2010-2013 (2) 2009-2012

# Net capital stock

- Intangibles are partially non-rival and returns to investments in intangibles are not fully appropriable.
- Is the Perpetual Inventory Method (PIM) the best method to calculate net sock estimates for intangible capital?
- Technical and data issues suggest it is the preferable methodology for intangibles.
- Depreciation rates of intangibles are relatively fast, mainly because of a high rate of "discards" even with little decay (that is productivity of the assets conditional on their continued ownership by, or survival in, the investing firm is long-lasting).

# Depreciation rates (INTAN-Invest)

Table 2. Depreciation rates for Intangible Assets

| Asset type | Depreciation Rate |
|---|---|
| *Computerized information* | |
| 1. Software | .315 |
| 2. Databases | .315 |
| *Innovative property* | |
| 3. Mineral exploration | .075 |
| 4. R&D (scientific) | .150 |
| 5. Entertainment and artistic originals | .200 |
| 6. New product/systems in financial services | .200 |
| 7. Design and other new product/systems | .200 |
| *Economic competencies* | |
| 8. Brand equity | |
| a. Advertising | .550 |
| b. Market research | .550 |
| 9. Firm-specific resources | |
| a. Employer-provided training | .400 |
| b. Organizational structure | .400 |

What depreciation rates for information assets?

# Issues for discussion

- Identifying the boundaries of organizational capital in the Public Sector
- Choose the best price measures for intangibles (independently of the industry-sector classification)
- Service lives and depreciation rates: information assets
- Methods manual

# Thank you