PUBLIC CAPITAL
Measurement Issues

Matilde Mas (University of Valencia and Ivie)

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SEVENTH FRAMEWORK PROGRAMME

Ivie

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PUBLIC CAPITAL: MEASUREMENT ISSUES

- **TANGIBLE PUBLIC CAPITAL**
  - Statistical Issues
  - Methodological Problems
- **INTANGIBLE PUBLIC CAPITAL**
  - Framework (CHS, Intan-Invest)
  - SPINTAN

PUBLIC CAPITAL: MEASUREMENT ISSUES

- **TANGIBLE PUBLIC CAPITAL**
  - Statistical Issues

Main problems faced

1. From the statistical side

- Different levels of government
- Market vs non-Market industries
- Assets vs Public Functions

2. From the methodological side

- From GFCF to capital services: User cost of capital

References:

- OECD (2001): “Measuring Productivity” OECD Manual
- OECD (2009): “Measuring Capital” OECD Manual

PROBLEMS FROM THE STATISTICAL SIDE

- Different **levels of government** included. It can differ between countries and it can be difficult to have information regarding all of them with the required disaggregation.

- **Problems to measure total public GFCF**: public budgets do not follow NA criteria.

- Besides, **investments made by the public sector through capital transfers** to **(legally) private firms** will not be recorded neither by NA nor by COFOG data.

- **Market vs. non-market industries**. GFCF data is usually split by industry, but not by institutional sector.
  - **By industry**: NACE Rev. 2, ISIC, Rev. 4, NACE Rev.1.1, NAICS, etc.
  - **By institutional sector**: Non-financial corporations (S11), Financial corporations (S12), **General government (S13)**, Households (S14) and **Non-profit Institutions Serving Households (NPISH) (S15)**

PROBLEMS FROM THE STATISTICAL SIDE

- **Market vs non-market industries**
  - Non-market vs. public sector
  - Definition of public sector: Government sector (**S13**) or Government sector + NPISH (**S13+S15**)?
    - ESA 2010 definition: "The public sector consists of all institutional units resident in the economy that are controlled by government. The private sector consists of all other resident units."
    - Table 1 sets out the criteria used to distinguish between public and private sector and between market and non-market

Criteria	Controlled by government (public sector)	Privately controlled (private sector)
Non-market output	**General government**	**NPISH**
Market output	**Public corporations**	**Private corporations**

PROBLEMS FROM THE STATISTICAL SIDE

- **Market vs non-market industries**
  - Non-market/public activities are generally concentrated in a few industries:
    - Scientific research and development (NACE Rev. 2 M72),
    - Public administration and defence; compulsory social security (O84), Education (P85)
    - Human health activities (Q86)
    - Social work activities (Q87-Q88)
    - Creative, arts and entertainment activities, gambling and betting activities (R92-R92).
  - It is difficult to separate the market and non-market part of these industries.
  - Moreover, lately NSI and international databases tend to not split these industries between market and non-market components (or public-private): **cross-classified NA data by industry and institutional sector are not available for the majority of countries.**

PROBLEMS FROM THE STATISTICAL SIDE

- **In the case of Spain**, NSI offered this information in the *input-output framework* up to 2007 (*Spanish National Accounts. 2000 Base*). Since then, it does not include the distinction within each industry by institutional sector in its official publications.
- **BBVA Foundation-Ivie database** uses complementary public budget data to estimate public GFCF, as this distinction is not included in NA for all the industries.

PROBLEMS FROM THE STATISTICAL SIDE

- **Assets vs. public functions**
  - **Asset categories** vs. classification of the **functions of government** (COFOG).
    - **NA** publishes information on **GFCF by asset category and industry**
    - **Public budgetary data** are usually classified **by functions of government** (**COFOG**).
      - This classification shows the purpose for which expenditure transactions are undertaken.
      - The COFOG classification describes government expenditure according to ten major functions (Table 2), and according to two additional levels of increased detailed breakdown (not presented here).
        - As an example, the second level is necessary to provide information on research and development expenditure.

PROBLEMS FROM THE STATISTICAL SIDE

- **Assets vs. public functions**

Table 2. COFOG, the 10 functions of government

Code	Function
01	General public services
02	Defence
03	Public order and safety
04	Economic affairs
05	Environmental protection
06	Housing and community amenities
07	Health
08	Recreation, culture and religion
09	Education
10	Social protection

- International statistical databases offers information on government expenditure by COFOG: Eurostat, OECDStats, etc., and also many NSI.
- **In the case of Spain**, IGAE (*Intervención General del Estado,* Controller General´s Office) offers information on GFCF by COFOG functions and sub-functions and by level of government. **BBVA Foundation-Ivie series for the Public Sector are based mainly on this information**.

PROBLEMS FROM THE STATISTICAL SIDE

- **International sources of information:**
  - **Eurostat**: public GFCF by COFOG, GFCF and fixed assets (stocks) by industry and asset, total GFCF by institutional sector (**industry and institutional sector cross-classified data is not available**)
  - **OECD**: public expenditure by COFOG, GFCF by industry and asset, total net and gross capital stock (**non-available data by institutional sector**)
  - **AMECO**: total, private and general government GFCF, total GFCF by asset, total GCF by institutional sector (**but S15** (Non-profit Institutions Serving Households (NPISH) **aggregated with S14** (Households)), total net capital stock (**non-available data by industry**)
  - **EU KLEMS (WORD KLEMS)**: GFCF by industry and asset, real fixed capital stock by industry and asset (**non-available data by institutional sector**)
  - ***WIOD** (Socio-economic accounts)*: GFCF by industry, real fixed capital stock by industry (**non-available data by institutional sector and by asset**)
  - **APO Productivity Database**: total GFCF and total net capital stock (**non-available data by institutional sector, asset and industry**)

PROBLEMS FROM THE STATISTICAL SIDE

- National sources: Spanish BBVA Foundation-Ivie database: **"Historical series on public capital and its territorial distribution"**
  - This database provide in-depth information on **public GFCF and public capital stock from 1900 to 2012, classified according to government functions** and according to region and province (data are obtained from public accounts, NA data, yearbooks about infrastructures, etc.).
    - Public sector is considered (NPISH sector not included)
    - Data by function of government and infrastructure type (non-available data by asset)
  - The public sector investment series are classified by expenditure function and investing agent. The capital stock series follow the same classification by function but do not take into account the breakdown by investing agent because of the constant change in capital ownership over the long period analyzed.
  - OECD (2001) methodology is used to estimate capital stock: The estimations focused exclusively on net capital, were not broken down by types of assets and there was no calculation of the productive capital.
  - More details on the links: http://www.ivie.es/en/banco/stock/banco3.php and http://www.fbbva.es/TLFU/tlfu/ing/areas/econosoc/bbdd/index.jsp

PROBLEMS FROM THE STATISTICAL SIDE

- National sources (II): Spanish BBVA Foundation-Ivie database: **"Capital stock in Spain and its distribution by territories (1964-2012)"**
  - This database covers three variables: investment, capital stock and capital services.
  - It follows OECD (2009) methodology.
  - Data are classified by asset and industry: At a national level, 18 different asset types and 31 industries are considered, following the NACE-2009 classification.
  - Public infrastructures have been retained in asset breakdown (which was a distinctive characteristic of the BBVA Foundation-Ivie series)
  - It includes also the distinction between public and private sector for two industries: Education (P85) and Health and Social Services (Q86-Q88) (besides Public Administration (O84))
  - In addition, there is data by regions and provinces with disaggregation by 18 types of assets, and 25 and 15 industries, respectively.
  - More details on the links: http://www.ivie.es/en/banco/stock/banco2.php and http://www.fbbva.es/TLFU/tlfu/ing/areas/econosoc/bbdd/index.jsp

PUBLIC CAPITAL: MEASUREMENT ISSUES

- **TANGIBLE PUBLIC CAPITAL**
  - Statistical Issues
  - Methodological Problems
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PUBLIC CAPITAL: MEASUREMENT ISSUES

- **TANGIBLE PUBLIC CAPITAL**
  - Methodological Problems

Public *Tangible* Capital. Capital Services

From the **methodological perspective** the **distinction** between private and public capital is **not relevant for individual assets** (as long as the information is available). The main difference between the two arises from the **user cost expression**.

For **Public** capital:

- National Accounts (NA) do not assign a net return to the flow of services provided by public capital.
- The only recognized flow is public fixed capital consumption.
- Thus, **the main difference with respect to Private** capital services comes from the **user cost expression** which transforms the volume index of capital of an asset into the **Value of its capital services.**

Public *Tangible* Capital. Capital Services

Main Implications:

1. **NA Gross Operating Surplus** figures are **underestimated** because the value of the capital services provided by public capital is not fully considered.
2. Consequently, the **value of output** is **also underestimated in NA** figures, afecting both its level and its rate of growth.

Three different points are discussed here:

1. **Rate of return** of **public vs private** capital
2. **Exogenous vs Endogenous** calculations
3. **User cost expression**

Rate of Return of Public *vs* Private Capital

Assume that the ownership of $K_{j,t}$ (Volume Index of Capital for asset *j*) is divided between private ($K^p_{j,t}$) and public ($K^g_{j,t}$) at time *t*. The superscript *p* and *g* refer to private (p) and public (g) capital, respectively.

The value of the capital services ($VCS_{j,t}$) provided by asset *j* at time *t* can be computed as:

$$VCS_{j,t} = cu_{j,t} K_{j,t-1} = cu_{j,t} K^p_{j,t-1} + cu_{j,t} K^g_{j,t-1} \quad [1a]$$

Or, alternatively, as

$$VCS^*_{j,t} = cu^p_{j,t} K^p_{j,t-1} + cu^g_{j,t} K^g_{j,t-1} \quad [1b]$$

$cu_{j,t}$ = user cost of the capital services.

Rates of Return of Public *vs* Private Capital.

Equation [1a] assumes that the user cost (more specifically, the rate of return) is the same for private and publicly owned assets

An example is Nordhaus´ (2004) *basic principle for measuring non-market activities*: "Non-market goods and services should be treated as if they were produced and consumed as market activities. Under this convention, the prices of non-market goods and services should be imputed on the basis of the comparable market goods and services" (pg. 5).

Equation [1b] assumes that the rates of return are different. Examples: Jorgenson and Landfeld (2004) ; OECD Manual (2009) or Moulton (2004).

Jorgenson and Landfeld (2004): "For government, the imputed rate of return is set equal to the average of corporate, non-corporate, and household rates of return…" (pg. 35)

Public *Tangible* Capital. Rates of return

OECD Manual (2009). Makes a **similar** recommendation than **Jorgenson and Landfeld (2004)** but only when full information on rates of return for the market and the household sector is available.

When this information is not available **it recommends** to use the household rate of return measured by the **social rate of time preference.** It also suggests the **borrowing rates for government bonds** as an alternative (pgs 142-144). Notice that the last two are, both of them, exogenous rates of return.

Moulton (2004), following Slater and Davies (1998) proposes **four general ways** of estimating the rate of return of government fixed capital: a) by means of an econometric estimation; b) the use of a pre-determined rate such as the rate set by the U.S. Office of Management and Budget (OMB); c) the rate of return for comparable private business activities; or d) the interest rate at which governments borrow

Endogenous vs Exogenous calculations

As for the **rate of return** in the user cost expression [2] **two approaches** are used: **Endogenous** (ex-post) or **Exogenous** (ex-ante)

OECD (2009) recommendation: "There are at least **two situations when the exogenous approach(…) is a useful choice**:

First, when the **stock of assets** considered **is incomplete**…(such as for) **land** for which information may not be available or at least not with reliable quality (…).

Second, "**when no empirical distinction can be made between the market sector and the government sector**, computations with an endogenous approach will imply a downward bias of the rate of return because there is no net operating surplus for government assets so that the market sector´s operating surplus will be brought into relation with an asset base that comprises assets in the total economy and is therefore too big" (pg. 139).

The Spanish estimates (FBBVA-Ivie) follow the **exogenous** approach for both, private and public capital.

Consistent use of the endogenous approach

Lets assume that we chose the endogenous approach. Then,

- **According to NA practices**:

  GOS^{NA} = GOS^{NA} (private)+Public Capital Consumption

$$GOS^{NA} = GOS^{NA,p} + \sum_j \sum_i \delta_{j,t} p_{j,t-1} KP^{g}_{j,i,t-1}$$

  GOS = Gross operating surplus; NA = National Accounts; *j* assets, *t* time and *i* industries.

- **From an analytical perspective**:

  GOS (private, *p*) = Value of private capital services

$$GOS^{NA,p} = \sum_j \sum_i cu_{j,t} KP^{p}_{j,i,t-1}$$

Consistent use of the endogenous approach

- **Standard computation** of the internal rate of return:

$$GOS_t^{NA} = \sum_j \sum_i cu_{j,t}^{NA} \left[KP_{j,i,t-1}^{p} + KP_{j,i,t-1}^{g} \right]$$

$$cu_{j,t}^{NA} = cu_{j,t}^{NA}(r_t^{NA}, \pi_{j,t}, \delta_{j,t})$$

- **Consistent computation**: Compute the internal rate of return considering only the market sector:

$$GOS_t^{NA} - \sum_j \sum_i \delta_{j,t} p_{j,t-1} KP_{j,i,t-1}^{g} = \sum_j \sum_i cu_{j,t}^{R} KP_{j,i,t-1}^{p}$$

$$cu_{j,t}^{R} = cu_{j,t}^{R} \left[r_t^{R}, \pi_{j,t}, \delta_{j,t} \right]$$

where R stands for *Revised*.

Consistent use of the endogenous approach

Be aware that **in order to use consistently the endogenous approach** we need to have **a clear distinction between assets belonging to the market and non-market industries**

- **Revised Gross Operating Surplus** (including the value of public capital services):

$$GOS_t^R = GOS_t^{NA} + \sum_j \sum_i cu_{j,t}^R KP_{j,i.t-1}^g - \sum_j \sum_i \delta_{j,t} p_{j,t-1} KP_{j,i,t-1}^g$$

- **Revised Nominal Value Added** (including the value of public capital services):

$$(PQ)_{i,t}^R = (PQ)_{i,t}^{NA} + \sum_j cu_{j,t}^R KP_{j,i,t-1}^g - \sum_j \delta_{j,t} p_{j,t-1} KP_{j,i,t-1}^g$$

User Cost expression

In practice, the user cost expression can adopt different versions. Mas, Pérez and Uriel (2005), following Harper, Berndt and Wood (1989), considered the four different specifications:

Four procedures to calculate user cost

Procedure	Rate of return (i)	Capital gains/losses (q)
M1	Endogenous (see equation 3)	Current variations in prices $q_{jt} = \frac{p_{j,t} - p_{j,t-1}}{p_{j,t-1}}$
M3	Exogenous r = 4% $i_t = r + \pi_t^e$ $\pi \equiv$ inflation (ICP) $\pi_t^e = \frac{\pi_{t-1} + \pi_t + \pi_{t+1}}{3}$	Expected variations $(q_{j,t}^e)$ $q_{j,t}^e$ (expected) = $\frac{q_{j,t-1} + q_{j,t} + q_{j,t+1}}{3}$
M4	Endogenous (see equation 3)	Expected variations $(q_{j,t}^e)$ as M3
M5	Exogenous Long-term government bond yields	Expected variations $(q_{j,t}^e)$ as M3

Source: Mas, Pérez and Uriel (2005) "El stock y los servicios de capital en España (1964-2002): Nueva metodología", Fundación BBVA.

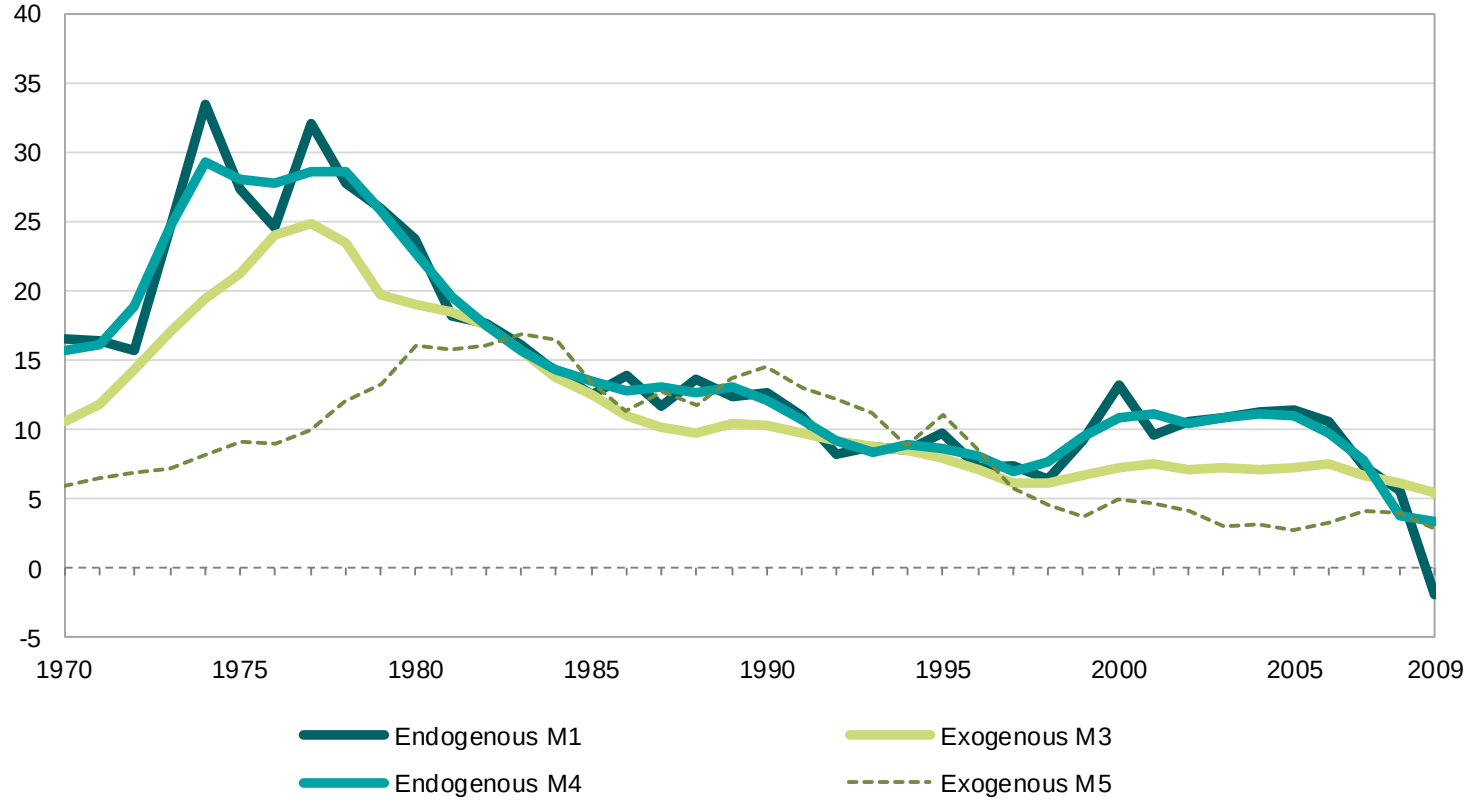
$$GOS_t = \mu_{j,t} KP_{j,t-1} = \sum_j (i_t + d_{j,t} - q_{j,t}) p_{j,t} KP_{j,t-1} = \sum_j (i_t + d_{j,t} - q_{j,t}) KP_{j,t-1}^C \quad [3]$$

GOS = gross operating surplus; t = time; μ = user cost; j = assets;

KP^C = nominal productive capital; d = depreciation; p = prices

Nominal rate of return. Spain (1970-2009)

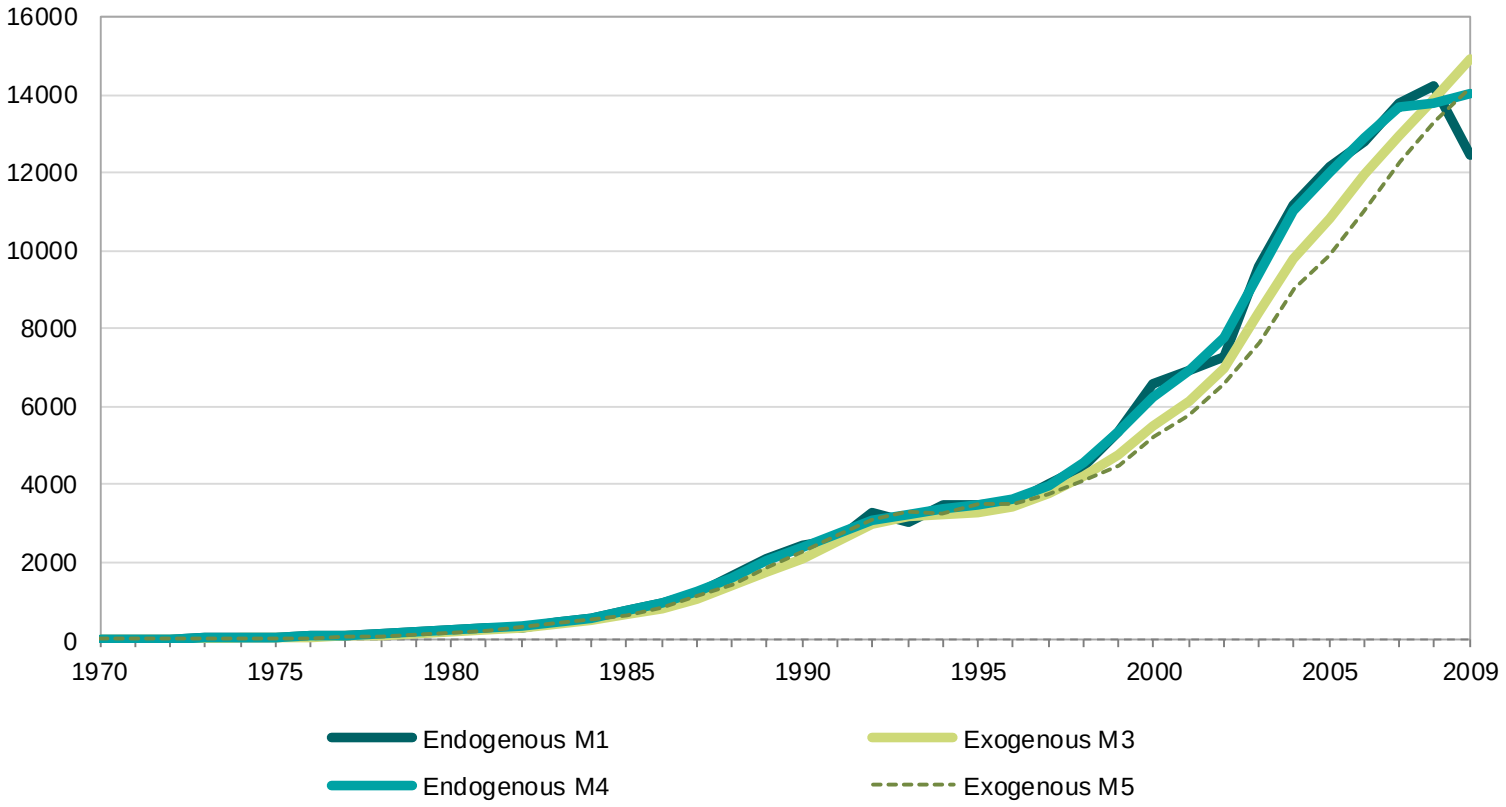
(Percentage)



Source: BBVA Foundation/Ivie and own elaboration

Capital services. Spain. Software (1970-2009)

(Millions of euros)



Source: BBVA Foundation/Ivie and own elaboration

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MARKET INTANGIBLE CAPITAL.

- **Measuring intangibles**.

- **Seminal work: Corrado, Hulten & Sichel (2005, 2009): USA**

  - They developed a proposal to expand NA boundaries to include a selected group of intangible assets.

  - They develop a new model, including (some) intangibles as investment, instead of following the NA practice of treating them as intermediate consumption goods and services.

  - Following their proposal, “any use of resources that reduces current consumption in order to increase it in the future […] qualifies as investment”. Then, all types of capital should be treated symmetrically (tangible & intangible).

MARKET INTANGIBLE CAPITAL. INTAN-Invest INITIATIVE

- **INTAN-Invest**: cross-country intangible investment and capital data:

  - **Project coordinators**: Carol Corrado (TCB, US); Jonathan Haskel (IC, UK); Cecilia Jona-Lasinio (LUISS, Italy); Maximiliano Iommi (ISTAT, Italy)
  - **Market sector** (NACE sectors A through K (excluding real estate) plus sector O) data on intangible assets.
  - **Sectoral disaggregation**. 9 industries
  - **27 EU countries plus Norway and the US**.
  - **1995-2010 period**
  - **Previous projects**: two funded by the European Commission 7th Framework Program (COINVEST, which ran from 1 April 2008 to 30 September 2010, and INNODRIVE, which ran from 1 March 2008 to 1 April 2011) and an ongoing effort of The Conference Board.
  - More information at: http://intan-invest.net/

MARKET INTANGIBLE CAPITAL. INTAN-Invest INITIATIVE

- **INTAN-Invest classification of intangible capital assets**

Table 1. INTAN-Invest Intangible capital assets types

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

[1] Included as GFCF in ESA 2010 National Accounts. Software and Mineral explorations were also considered as GFCF by ESA 1995, but not R&D.

MARKET INTANGIBLE CAPITAL. INTAN-Invest INITIATIVE

- **Measuring intangibles**:
  - Estimation of nominal GFCF (quantities (N(t)) and prices (PN(t))) associated with each asset listed in table 1.
    - Prices: Harmonised Software deflator and Business Sector Value Added Deflator for the other intangibles
    - Quantities: spending on defined intangible
  - Capitalization factor for each asset (how much of an identifiable data series on intangible spending is investment, i.e., what portion of an indicator series fits the definition of investment as "any use of resources that reduces current consumption in order to increase it in the future" (CHS 2005, p. 19))
  - Geometric Depreciation Function (OECD, 2009)

$$\delta = d/T$$

The parameter *d* is the "declining balance rate" which, intuitively, reflects the degree of convexity of the asset age-price profile. For a given service life, higher values for this parameter result in faster rates of economic depreciation.

- **Measuring intangibles**

Table 2. Capitalization factors and depreciation rates for intangible assets

Asset type	Capitalization factor	Depreciation rate
Computerized information[1]		
1. Software	Included in NA	.315
2. Databases	Included in NA	.315
Innovative property		
3. Mineral exploration[1]	Included in NA	.075
4. R&D (scientific)[1]	100%	.150
5. Entertainment and artistic originals	Included in NA	.200
6. New product/systems in financial services	8%	.200
7. Design and other new product/systems	50%	.200
Economic competencies		
8. Brand equity		
a. Advertising	60%	.550
b. Market research	60%	.550
9. Firm-specific resources		
a. Employer-provided training	100%	.400
b. Organizational structure	20% (own-account) *80% (purchased)*	.400

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NON-MARKET INTANGIBLE CAPITAL. SPINTAN

- **SPINTAN database**

  – SPINTAN goal is to produce **estimates on intangible investment and capital of the Non-market sector disaggregated by industry and by institutional sector**

  – Information on total expenditure in intangible assets in the public sector is needed

    ➢Public sector is used as a synonym of Non-market sector, which refers to the following institutional sectors: **Government sector (S13) and NPISH (S15)**

  – It is **desirable that SPINTAN database is consistent with NA principles and coherent with INTAN-Invest business sector intangibles**. Then, SPINTAN will complete the coverage of intangible investment, making possible the generation of total economy growth accounts with intangible as productive assets

NON-MARKET INTANGIBLE CAPITAL. SPINTAN

- **SPINTAN database**
  - SPINTAN classification of intangible assets: INTAN-Invest approach (see Table 1), but slightly modified to include more assets specific to the public sector.
  - Methodological Framework and measurement guidelines: Corrado, Haskel and Jona-Lasinio (2014)

Private/Market

- Computer software
- Databases
- R&D (broadly defined)
- E&A originals
- Design
- Mineral exploration
- Brands
- Organizational capital
  - Manager capital
  - Purchased org. services
- Firm-specific human capital (employer-provided training)

Public / NonMarket

- Computer software
- Open data (information assets that can be leveraged by market)
- R&D
- Cultural assets (including arch. & engineering design)
- Mineral exploration
- Brand
- Organizational capital
  - Manager capital (what does this mean?)
  - Purchased org. services
- Function-specific human capital (employer-provided training)

NON-MARKET INTANGIBLE CAPITAL. SPINTAN

- **SPINTAN database**
  - SPINTAN industries of interest (industries that contain significant non-market production):
    - Scientific research and development (NACE Rev. 2 M72),
    - Public administration and defence; compulsory social security (O84),
    - Education (P85),
    - Human health activities (Q86),
    - Residential care and social work activities (Q87-Q88)
    - Creative, arts and entertainment activities, gambling and betting activities and amusement and recreation activities (R92-R93)

NON-MARKET INTANGIBLE CAPITAL. SPINTAN

- **SPINTAN database**

  - Similar statistical problems than tangible capital:
    - Problems to measure public intangible expenditure:
      - » public budgets do not follow NA criteria/classifications
      - » different levels of government,
      - » existence of grants and subsidies which from NA accounts perspective will be assigned to the recipient industries and to the Public Sector. Differences among countries may be important.
    - Market vs. non-market industries
    - Assets vs. public functions

NON-MARKET INTANGIBLE CAPITAL. SPINTAN

- **SPINTAN database**
  - Main data sources:
    - USE tables
    - Statistics on Government expenditure by function (COFOG)
    - Employment and labour cost data (LFS, SES, etc.)
    - Budgetary information
    - Other national specific sources (national surveys, country specific studies, etc.)
  - Some problems arise when looking for information on expenditures on intangibles assets by industry and institutional sector

NON-MARKET INTANGIBLE CAPITAL. SPINTAN

- **SPINTAN database**

USE tables

- They usually report total expenditure made by each industry, but generally **they don't provide information regarding institutional sectors**
  - ➢ Thus, for mixed industries, additional indicators are needed to estimate the share in total expenditure that is made by units belonging to Government and NPISH sector

- USE table disaggregation of products is **not detailed enough** to estimate intangible assets
  - » Thus, additional indicators (SBS, national surveys, etc.) are needed

- USE tables compiled according to NACE Rev.2 and ESA 2010 are not yet available for all the countries (e.g. Spain)

NON-MARKET INTANGIBLE CAPITAL. SPINTAN

- **SPINTAN database**

COFOG data

- COFOG data are a breakdown of government expenditure according to service type, and as such, COFOG data may be mapped to NACE.
  - A correspondence between industry classification and COFOG divisions and groups (first and second level categories) is available but it needs to be worked out carefully.

- Not available with the most detailed breakdown for all the countries
- General government GFCF potentially excludes a significant portion of publicly-financed investment (grants, subsidies,…). This portion is different between countries.

NON-MARKET INTANGIBLE CAPITAL. SPINTAN

- **SPINTAN database**

Employment and labour costs data

- NA employment data: The information is needed with a higher level of detail than that usually published by Eurostat or NSI. In addition, NA do not offer information by institutional sector.
- Other surveys, as LFS and SES: tailor-made extractions from microdata are sometimes required, especially to make the distinction between market and non-market sector

Budget or administrative data and other national sources

- They are specific of each country. Thus, analysis of these data needs to be country specific
- Budgetary information does not follow NA criteria or industry classifications
- It is not easy, as with the previous sources, to centralize the update of the information each year in a multi-country project.

NON-MARKET INTANGIBLE CAPITAL. SPINTAN

- **SPINTAN database**
  - Assets:
    - Already included in NA (ESA 2010): Software, Mineral exploration, Entertainment and artistic originals and R&D
    - Not included in NA: Design and other new products/systems, Brand equity, Training and Organisational Capital
      - An estimation is needed, using the sources already mentioned
  - Capitalization of public intangibles. As for public tangible capital two issues should be faced:
    - Selection of adequate services lives
    - Selection of rate of return on public sector assets

Intangible Capital. Measurement Issues

For the **selection of the rate of return** we must distinguish between assets already recognized by NA from those which are not.

1. **Assets already recognized by NA** (such as software and R&D)

If they are **owned by the market sector** its consideration will not change GVA. These assets should be treated by NA as any other tangible asset.

But, if they are **owned by the non-market sector, GVA** will increase. It should be included the net return to these assets since NA will only recognized the comsuption of fixed capital.

2. For the remaining assets, its inclusion will cause a symetric increase of both, GFCF and GOS, **regardless the ownership** by the market or the non-market sector. Thus GVA will increase in both cases.

Intangible Capital. Measurement Issues

The computation of the **user cost of capital for intangible assets can be done** by using an endogenous or **exogenous rate of return for both, market and non market**

Alternatives:

- Ex-post rate of return for both, tangible and intangible assets, in the market sector.

- Ex-post rate of return computed only for tangible assets in the market sector

- A selection of market rate of interest for different assets
- Financing costs of government projects (proxied by Government bonds)
- The social rate of time preference
- Others

Intangible Capital. Measurement Issues

The **social time preference rate** reflects the value that society attaches to present, as opposed to future consumption while the **remaining rates** reflect the opportunity cost for investment in the private sector.

Given the requiered information, the **government rate** of return can be measured as a **weighted average** of **both types of opportunity costs** reflecting the fact that public spending could have crowded out both, private investment and private consumption.

However, it is very important **to assure consistency** between **public tangible and intangible capital** rates of return.

PUBLIC CAPITAL
Measurement Issues

Matilde Mas (University of Valencia and Ivie)

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SEVENTH FRAMEWORK PROGRAMME

Ivie

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