Measuring Productivity in the Public Sector: A personal view

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Problems faced:

• As a user of official statistics
• As a supplier of Spanish investment and capital services data (FBBVA-Ivie)
Main References:

- Eurostat’s Handbook on price and volume measures in National Accounts (2001)

Problems faced as a user of official statistics:

1. Public Sector definition
2. Output measurement in National Accounts (NA)
3. Education and Health in NA
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As a user of official statistics

1. Public Sector Definition

- The public sector is usually defined as general government plus public corporations.
- ESA95 defines the General Government sector (S.13) fairly precisely (partly forced by the Maastricht Treaty).
- In ESA95 the distinction between market and non-market producers depends on whether or not prices charged for sales are economically significant.
- Economically significant prices are defined as prices that generate sales covering more than 50% of production costs (“the 50% criterion”)
- Previous to ESA95, the definition of the Public Sector was less precise and different among countries.

Implication 1. Precise computation of productivity in the Public Sector should be restricted to the General Government.

Implication 2. Long term analysis should bear in mind that Public Sector definition changed in 2000 (when ESA95 was implemented).

2. Output measurement in National Accounts

- For many years the output of the Public Sector has been measured as output = input, thus implying no productivity gains.
- In 1993, the UN System of National Accounts recommended to measure directly the output of public services.
- The SNA recommendations are not mandatory, but in the EU they were legally adopted (under a decision of Dec. 2002).
- The Atkinson Report (2005) warned about the implications of using the old (US) and new (UK) approach on public sector productivity measurement.
- At present, there are notable differences among the methodologies followed by the different countries in the health and education sectors.

Implication 1. Since 2002, the comparisons among countries are flawed by the different measurement practices.

Implication 2. From a long term perspective, the analysis is also flawed by the 2002 methodological change.
3. More on Education and Health information in NA

- Since 2000, NA provide information for the health and education sectors without distinguishing their private or public nature. Additionally, health information is available jointly with Social Works.
- It is possible —using existing data— to separate the private and public parts.
- However, the new 2008 NA base will not provide private/public distinction anymore, making this separation more difficult in the future.

**Implication:** Measured *General Government* productivity usually includes *private* Education, Health and Social Services.
Problems faced as a supplier of investment, and capital services data based on official statistics (FBBVA-Ivie):

1. Data availability
2. Infrastructures in NA
3. Computation of capital services: The rate of return on public capital

Investment and capital services data are needed for MFP measurement.

1. Data availability

• Investment
  • Very limited number of products in the base year 2000 (assets in base 2008) considered by Spanish NA:
    - 10 (6 in base 2008) in NA tables and 118 products in SUT tables for total economy.
    - 6 products for 29 industries in NA GFCF matrices.
  • Need to harmonize the time series after changes in methodologies (long series are needed for capital services computation)

• Deflators
  • No Hedonic Prices
  • No Software (until 1995), Hardware and Communication deflators
    (For the three ICT assets we use the harmonized method proposed by Schreyer et al. (2004))
2. Infrastructures in FBBVA-Ivie database

After Ashauer (1989) very influential paper, an important role on economic growth was given to infrastructures.

- Spanish data. GFCF available for 18 assets, of which:
  - 3 ICT assets (hardware, software, communication)
  - 6 types of infrastructures (roads, railways, airports, ports, water & urban infrastructures)

And 44 branches of activity, of which:

- 15 manufactures
- 24 services

Where is infrastructures information available?

### Infrastructures in NA

**Base 2000 (10 products)**

1. Products of agriculture, livestock and fishing
2. Metal products and machinery
   - 2.1. Metal products
   - 2.2. Machinery and equipment
   - 2.3. Office machinery and computers
   - 2.4. Other machinery and equipment
3. Transport equipment
   - 3.1. Motor vehicles
   - 3.2. Other transport equipment
4. Housing construction
5. Other constructions (infrastructures included*)
6. Other products

**Base 2008 (6 assets)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN.111</td>
<td>Tangible fixed assets</td>
</tr>
<tr>
<td>AN.1111</td>
<td>Dwellings</td>
</tr>
<tr>
<td>AN.1112</td>
<td>Other buildings and structures</td>
</tr>
<tr>
<td>AN.1113</td>
<td>Machinery and equipment</td>
</tr>
<tr>
<td>AN.11131</td>
<td>Transport equipment</td>
</tr>
<tr>
<td>AN.11132</td>
<td>Other machinery and equipment</td>
</tr>
<tr>
<td>AN.1114</td>
<td>Cultivated assets</td>
</tr>
<tr>
<td>AN.112</td>
<td>Intangible fixed assets</td>
</tr>
</tbody>
</table>

Notes: Products shaded in grey are not available in NA GFCF matrices.

* Infrastructures are included in the following NA industries: Electricity, gas and water supply, Transport, storage and communication and Public administration.
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Infrastructures in FBBVA-Ivie database

<table>
<thead>
<tr>
<th>CLASSIFICATION OF INDUSTRIES</th>
<th>TRANSPORT AND STORAGE AND COMMUNICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Agriculture, hunting and forestry</td>
<td>Transport and storage and communication</td>
</tr>
<tr>
<td>2. Fishing</td>
<td>Road infrastructures</td>
</tr>
<tr>
<td>3. Mining and quarrying of energy producing materials</td>
<td>Road infrastructures</td>
</tr>
<tr>
<td>4. Mining and quarrying except energy producing materials</td>
<td>Airports infrastructures</td>
</tr>
<tr>
<td>5. Manufacture of food products, beverages, and tobacco</td>
<td>Road infrastructures</td>
</tr>
<tr>
<td>6. Manufacture of textiles and wearing apparel</td>
<td>Rest of Transport and storage</td>
</tr>
<tr>
<td>7. Manufacture of leather and footwear</td>
<td>Communication</td>
</tr>
<tr>
<td>8. Manufacture of wood and cork</td>
<td>Financial intermediation</td>
</tr>
<tr>
<td>9. Manufacture of paper; publishing and printing</td>
<td>Real estate activities</td>
</tr>
<tr>
<td>10. Manufacture of coke, refined petroleum products and nuclear fuel</td>
<td>Road infrastructures</td>
</tr>
<tr>
<td>11. Manufacture of chemicals and chemical products</td>
<td>Public administration</td>
</tr>
<tr>
<td>12. Manufacture of rubber and plastic products</td>
<td>Rest of infrastructure</td>
</tr>
<tr>
<td>13. Manufacture of other non-metallic mineral products</td>
<td>Water infrastructures</td>
</tr>
<tr>
<td>14. Manufacture of basic metals and fabricated metal products</td>
<td>Railway infrastructures</td>
</tr>
<tr>
<td>15. Manufacture of machinery and equipment n.e.c.</td>
<td>Airport infrastructures</td>
</tr>
<tr>
<td>16. Manufacture of electrical and optical equipment</td>
<td>Ports infrastructures</td>
</tr>
<tr>
<td>17. Manufacture of transport equipment</td>
<td>Urban infrastructures</td>
</tr>
<tr>
<td>18. Manufacturing n.e.c.</td>
<td>Rest of public administration</td>
</tr>
<tr>
<td>19. Electric power, gas and water supply (water infrastructures included)</td>
<td>Non-market education</td>
</tr>
<tr>
<td>20. Construction</td>
<td>Non-market health</td>
</tr>
<tr>
<td>21. Hotels and restaurants</td>
<td>Non-market social work</td>
</tr>
<tr>
<td>22. Real estate activities</td>
<td>Market education</td>
</tr>
<tr>
<td>23. Other community, social and personal services</td>
<td>Market health and social work</td>
</tr>
</tbody>
</table>

Note: Infrastructures are shaded in grey.

Statistical sources used to cover infrastructures data:

Main: Budget settlements: General, Central, State and Local Governments starting in
- 1800: roads
- 1821: ports, health and education
- 1835: water and urban infrastructures
- 1845: railroads

Complemented with:
- Ministry of Public Works and Transportation Annual Statistical Report
- Public Administration Accounts
- Regional Accounts
- Port Authority Annual Report
- Airport Authority (AENA) Annual Report
- General Accounts of the State Administration (IGAE)
- RENFE (Railways) Annual Report
- ...
Infrastructures in FBBVA-Ivie database

Recording of year t investment in infrastructures

<table>
<thead>
<tr>
<th>INDUSTRIES</th>
<th>TYPES OF ASSETS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INFRASTRUCTURES</td>
</tr>
<tr>
<td></td>
<td>1. Agric.</td>
</tr>
<tr>
<td></td>
<td>10 Road</td>
</tr>
<tr>
<td></td>
<td>11 Water</td>
</tr>
<tr>
<td></td>
<td>12 Railway</td>
</tr>
<tr>
<td></td>
<td>13.Airport</td>
</tr>
<tr>
<td></td>
<td>14.Post</td>
</tr>
<tr>
<td></td>
<td>15 Urban</td>
</tr>
<tr>
<td></td>
<td>16.Other</td>
</tr>
</tbody>
</table>

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3. Computation of capital services

- Infrastructures are mainly provided by the public sector.
- 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.
Implications:

1. NA Gross Operating Surplus (GOS) 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, affecting both its level and rate of growth.

3. This fact affects both, econometric estimates and growth accounting results, when the endogenous approach is chosen.

Implications (cont.):

4. If the standard (endogenous) approach is used when computing the rate of return, 1 & 2 will have consequences on:
   a) the user cost;
   b) the input shares;
   c) the growth accounting results
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• According to NA practices:
  \[ GOS = GOS_{\text{private}} + \text{Public Capital Consumption} \]
  \[ GOS^{\text{NA}} = GOS^{\text{NA, private}} + \sum_j \sum_i \delta_{j,t} P_{j,t-1} K^{g}_{j,t-1} \]

• From an analytical perspective:
  \[ GOS_{\text{private}} = \text{Value of private capital services} \]
  \[ GOS^{\text{NA, private}} = \sum_j \sum_i cu_{j,t} K^p_{j,t-1} \]

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• Standard computation of the internal rate of return:
  \[ GOS^{\text{NA}} = \sum_j \sum_i cu^{\text{NA}}_{j,t} \left[ K^p_{j,t-1} + K^g_{j,t-1} \right] \]
  \[ cu^{\text{NA}}_{j,t} = cu^{\text{NA}}_{j,t} \left( \rho^{\text{NA}}_{t} \pi_{j,t}, \delta_{j,t} \right) \]

• An Alternative estimate: Revised computation (referring only to the private sector)
  \[ GOS^{\text{NA}} = \sum_j \sum_i \delta_{j,t} P_{j,t-1} K^p_{j,t-1} = \sum_j \sum_i cu^{\text{R}}_{j,t} K^p_{j,t-1} \]
  \[ cu^{\text{R}}_{j,t} = cu^{\text{R}}_{j,t} \left( \rho^{\text{R}}_{t}, \pi_{j,t}, \delta_{j,t} \right) \]

[ 20 ]
Applying 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…the prices of non-market goods and services should be imputed on the basis of the comparable market goods and services”

- \( GOS^R_t = GOS^{NA}_t + \sum_j \sum_i c_{j,i} R^{K^P^g}_{j,i,t} - \sum_j \sum_i \delta_{j,i} P_{j,i,t-1} K^P^g_{j,i,t-1} \)

- \( (PQ)^R_{i,t} = (PQ)^{NA}_{i,t} + \sum_j c_{j,i} R^{K^P^g}_{j,i,t} - \sum_j \delta_{j,i} P_{j,i,t-1} K^P^g_{j,i,t-1} \)
1. **FBBVA Estimates** do not present this problem since they use the exogenous approach for the computation of the internal rate of return.

2. Until 2010 we have used the **same rate of return (4%)** for private and public assets.

3. The last revision used an exogenous rate of **4% for private capital** and **3.5% for public assets**, following the OECD *Measuring Capital Manual* (2nd edition) recommendations where the measurement problems that have been presented here are also highlighted.

**Concluding Remarks:**

1. Measurement of Output and productivity of the Public Sector (in fact General Government) has improved over the last years.

2. This is thanks to the combined efforts of UN, Eurostat, OECD, and the Atkinson Report.
Concluding Remarks:

But some **important tasks** are still pending:

- To improve the measurement of the education and health sectors using a common methodology (which includes the harmonization of the DRG information among countries).
- To extend the number of assets considered by NA.
- To pay attention to the measurement of infrastructures (both private and public) by NA, now practically absent.
- To discuss the methodological problems posed by considering for public assets only the consumption of capital and not the net rate of return.