“Innovation and Productivity in Services in LAC: The Role of Public Policies”

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Contents

• The LAC productivity challenge.

• What are services?

• Innovation in Services.

• Allocative Efficiency.

• Conclusions.
The Productivity Challenge

Evolution of the relative GDP per capita, TFP, and factor accumulation vs. USA

- Loss due to poor accumulation
- Loss due to poor productivity

\[ \text{Index } 1960=1 \]
The Productivity Challenge

• To accelerate economic growth and close the per capita income gap with industrialized countries, policies are needed that promote significant productivity.

• A typical Latin American country would have been able to increase its per capita income by 54% from 1960 if productivity would have grown at rates in tandem with the rest of the world.

• **Not all sectors are equal**: Productivity growth is higher in agriculture compared to other sectors in LAC, although still below the world average. Manufacturing lags well behind agriculture and **services** lie even further behind in terms of productivity growth.
The Productivity Challenge

Evolution of Aggregate Productivity in LAC (relative to the US)

- Low productivity is serious and cuts across all productive sectors.
- Without a doubt, the problem is more acute in the service sector. Relative to the US, productivity in this sector has decreased by 60% since 1960.
- The problem is especially severe within traditional services.
- But why is this problem worrying?

Source: Author’s elaboration based on Timmer y de Vries (2007). Productivity in LAC corresponds to the average sector productivity for countries in the sample for each year.
The Productivity Challenge

- The service sectors went up from employing 40% of the labor force in 1970 to 60% in 2005.
- So we are moving employment to the sector with worst productivity performance. It is like we are undergoing a massive “reverse” productive transformation.
- It is Baumol’s disease at its perfect realization.
The Productivity Challenge

Average relative productivity in LAC (in 2007), relative to the productivity of 10% of the most productive firms in the USA, by industry.

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Source: Author’s elaboration using Enterprise Survey 2010 and the Survey of Business Owners 2007. Calculations made using the median between sectors in a given country and then by calculating the median among countries.

- The typical service firm in LAC has a productivity that is equivalent to 8.8% of the most productive firms from the same sector in the U.S. This is 4 points lower than the relative productivity in manufactures.

- Only 0.6% of service firms in the region have a productivity at the level of 5% of most productive firms of the same sector in the U.S.

- One hypothesis is that LAC firms innovate little, especially in services—taking the notion of innovation broadly, looking at more than just R&D and technological or non-technological innovation.
The Productivity Challenge

- The traditional policy recommendation “improving competitiveness and increasing exports as the strategy for growth” might not be the right one or at least a sufficient one.

- Without a doubt, these numbers suggest that an increase in productivity in the large service sector is key for bolstering economic growth and reducing poverty in Latin America and the Caribbean over the next two years.

- But what is behind productivity? Aggregate productivity is a weighted average of the productivity of individual firms.

- Productivity suffers when:
  - (i) firms are not very productive or
  - (ii) productive firms cannot grow

This study addresses both of these aspects.
The Productivity Challenge

Aggregate Productivity

\[ P_t = \sum_{i=1}^{n} S_{it} P_{it} \]

**Sources**

**Firm Improvements:** *Within* \((P_{it})\)
- Management
- Organization
- Quality of inputs
- R & D
- ICT
- Knowledge

**Growth of the Most Productive Firms:** *Between* \((S_{it})\)
- Barriers in the allocation of resources to the most productive firms

**External Factors**
- Externalities
- Competition (both internal and external)
- Regulation
- Functioning of input markets
- Institutional Framework

Source: Based on Syverson (2011)
What are services?

A set of very heterogeneous products and activities that are different from goods along various dimensions:

1. Highly intangible *(e.g. a haircut)*

2. Produced and consumed at the same time *(you can’t store a haircut for later on)*

3. Production requires *interaction* between the client and the provider (e.g. a haircut requires that the hairdresser and the client are present!!!). There is a lot of co-innovation *(they have to be in agreement!!!)*

4. *Less tradable* because they are less transportable.

5. They are more than just a sector since there are *service activities* in other sectors (industrial services, e.g. IBM y NOKIA son SERVICE businesses)
**What are services?**

In this project:

We divide services between:

- **traditional services**
  (trade, hotels, restaurants, land transportation, etc.)

- **knowledge intensive services (KIBS)**
  (telecommunications, business services, computer services, and R&D)

We do not look at industrial services, nor construction or public services. The focus is on the sector rather than the activity.
Innovation in Services.

**What is Innovation?** Innovation is the implementation of a product (good or service), production process, organizational model or marketing method that is either new or significantly improved (OECD, Oslo Manual, 2005).

We compile official Innovation Surveys data for six LAC countries (Chile, Colombia, Peru, Mexico, Brazil and Uruguay).

Project run in parallel to the OECD INNOSERV Project.

**We look at:**

(A) Innovation Inputs: R&D and composition of innovation expenditures.

(B) Determinants of Innovation Investments

(C) Innovation Outputs: Differentiating between technological and non-technological innovation.

(D) Determinants of Innovation Investments.

(D) Impacts of Innovation Outputs in Productivity.
Innovation in Services

- Do services invest in R&D?

Note: Data refers to the percentage of firms who invest in R&D.

- OECD firms invest more in R&D within the manufacturing sector than they do within the service sector. The same is true for LAC, although the gap is smaller.
- Compared to the OECD, there is a deficit in the proportion of firms that invest in R&D in both manufacturing and services.

Innovation in Services

Distribution of Expenditure on Innovation Activities

Manufactures

Services

- In terms of innovation investment, LAC firms allocate less to R&D than do OECD firms, both in manufacturing and services.
- In services, firms in LAC invest in innovation in other activities (e.g. training, know-how and management assistance, franchising, software, etc.)
- This pattern is also different within manufacturing; while there is little investment in R&D, there is a bias toward machinery and equipment.

*In summary, when service firms invest in innovation, they do it through a different set of inputs than manufacturing.*

Innovation in Services

• Understanding the determinants of innovation in services? Are they different from manufacturing?

• Innovation is the result of *deliberate investment decisions (in tangibles and intangibles)* carried out by firms. These investments generate new knowledge that give rise to innovation (product, process, or new intellectual property, etc.) and will ultimately have an impact on productivity.

• The conceptual model is based on a typical sequence of events:
  1. The firm decides whether or not to invest in innovation;
  2. The firm decides the intensity of its investment;
  3. The production of innovations: if the firm introduces new products or processes (other measures use patents or innovative sales);
  4. Productivity as a function of innovations.
Innovation in Services

Appropriability Conditions (intellectual property, competition) and financing

Investment in Innovation

New Knowledge

Access to the knowledge of others

Firm’s Knowledge Base, Size, etc.

Innovation (Product and/or Process)

Productivity

Capital Intensity, Quality of Work

Adapted from CDM (NBER, 1998)
# Innovation in Services

<table>
<thead>
<tr>
<th>Impact on the innovation of:</th>
<th>Manufacturing</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of knowledge accumulated</td>
<td>High Relevance</td>
<td>Medium Relevance</td>
</tr>
<tr>
<td>Ability to protect intellectual property through formal mechanisms</td>
<td>High Relevance</td>
<td>Medium Relevance</td>
</tr>
<tr>
<td>Relevance of external (market) sources of information (externalities)</td>
<td>High Relevance</td>
<td>High Relevance</td>
</tr>
<tr>
<td>Relevance of public sources of information (externalities)</td>
<td>Not Relevant</td>
<td>Medium Relevance</td>
</tr>
<tr>
<td>Formal links to promote innovation (cooperation)</td>
<td>Medium Relevance</td>
<td>High Relevance</td>
</tr>
<tr>
<td>Fixed cost (size)</td>
<td>High Relevance</td>
<td>Low Relevance</td>
</tr>
<tr>
<td>Financing</td>
<td>Medium Relevance</td>
<td>High Relevance</td>
</tr>
<tr>
<td>Human capital</td>
<td>High Relevance</td>
<td>Medium Relevance</td>
</tr>
<tr>
<td>Commercial integration (exports and foreign ownership)</td>
<td>Medium Relevance</td>
<td>Not Relevant</td>
</tr>
</tbody>
</table>

**Innovation in Services**

Percentage of firms that introduce Technological and Non-Technological Innovation

- Both technological and non-technological innovation occurs at lower rates among LAC firms than OECD firms— in both manufactures and services.
- The intensity of technological innovation and non-technological innovation is similar for manufactures in the OECD and LAC alike. However, there is a bias toward non-technological innovation in services for both regions (i.e. business plans, organizational change, commercialization)

The impact of technological innovation is greater in manufacturing than in services. However, the impact of non-technological innovation is more important for service firms.

These large impacts suggest that this is a profitable investment. Why don’t businesses (both in manufacturing and services) invest more in innovation?
Innovation in Services

There are no significant differences between the major obstacles reported by manufacturing firms and those reported by service firms \(\rightarrow\) suggests horizontal policies.

However, a more detailed analysis suggests that some obstacles could be a larger impediment to services than to manufacturing, especially for firms in within the knowledge-intensive service sector.
Firms in all sectors recognize that external financing poses an important obstacle for innovation. However, if we keep in mind only those firms with innovation potential and we look at what would happen if restrictions to financing were relaxed, we find a much stronger response from the service sector, particularly from the KIBS sector.
Innovation in Services

Firms that Received Government Support for Innovation

Distribution of Government Support for Innovation

- The % of firms that receive government support is greater in the OECD than in LAC for both manufacturing and services.
- In both regions, public policies are biased toward manufacturing.
- Within both sectors, public policies also demonstrate a “high-tech” bias. The % of firms receiving public support is greater for both “high-tech” manufacturing firms and KIBS.

Innovation in Services

• In summary:

1. The distinction between R&D and innovation is important in services. Many businesses innovate, but few conduct R&D.

2. Innovation in services is more open; it is based on external inputs and demands greater collaboration: *high potential for externalities*.

3. Services protect their intellectual property through informal and ad-hoc mechanisms.

4. There are fewer fixed costs, but services face greater challenges when it comes to accessing finance for innovation (high product specificity, intangibility, difficulties in IP protection)

5. Technological innovation continues to be relevant for productivity, but non-technological innovation is also important for service firms.

6. Service firms are the least likely to receive government support, especially traditional service firms.
Innovation in Services

• Rationale:
  They are the same as manufacturing (externalities, information asymmetries, coordination, competition, etc.), but there could be a higher incidence in services due to the very nature of the sector (intangibility, interaction, openness, etc.).

• Types of intervention:
  1. Support of innovation comes in different “flavors” and can be analyzed using different classifications. In thus study, we highlight two dimensions:
  2. Innovation support can be: (i) Horizontal (cross-cutting) or (ii) Vertical (in support of specific sectors)
  3. They can take the form of inputs or public goods (generic human capital, knowledge, multiple use infrastructure, etc.) or market interventions (subsidies, exonerations, credit, etc.).
  4. We defined these two dimensions in a useful 2x2 matrix; each quadrant poses considerations around different capacities and institutions.
Innovation in Services.

• There are a few vertical programs in services with a strong bias toward KIBS (examples):

1. **Vertical - Public Good**: CITE-Software (Peru), Sustainable Tourism Certification (Costa Rica), Center for Software Testing (Uruguay), CENIBIOT (Costa Rica), PRONATUR (Argentina), Logistics Center (Panamá).

2. **Vertical - Market**: IT Law, Prosfot, CT-BT, CT-INFO (Brasil), Prosoft 2.0 (México), Innovaturismo (Uruguay), Fonsoft, LNPIS, Fonarsec-TIC, Fonarsec-BT (Argentina).

• But a high level of horizontality dominates policies, both in the type of public good as well as the market, and where services (except KIBS) are not priorities.

1. **Example**: How would you characterize public policies for innovation in the service sector in your country?

2. **Answer**: There are no specific guidelines in place to support any sector in particular. The tendency is to install instruments or open platforms for those that want to utilize them. There is no specific initiative for the service sector.

3. **Unanswered question**: But if the policies are horizontal, and services face the same problems as manufacturing with similar or even more intensity why we observed less service firms using the programs than manufacturing?
Innovation in Services

• Interventions can be seen through another 2x2 matrix:

1. According to the eligibility of expenditure, support can be focused on *technological* or *non-technological innovation*. In other words, it could be based on support for R&D and the purchase of equipment or on “softer” activities such as utilizing consulting services to bring about organizational change, the development of new service concepts, or new business models.

2. Firms are seen as either *generators* of knowledge or *users* of knowledge, depending on whether you are taking a *supply* side or a *demand* side approach.

3. These two dimensions are defined in a 2x2 matrix that can also be used to grade the instrument matrix.
## Innovation in Services

<table>
<thead>
<tr>
<th>TYPE</th>
<th>SUPPLY</th>
<th>DEMAND</th>
</tr>
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<tbody>
<tr>
<td>Technological</td>
<td>Technological Development Funds, Tax credits, Technology Consortiums, IT Law, Prossoft 2.0, Fonsoft, Software Service Center, CT-BT, CT-INFO, Technological Services Program</td>
<td>Credit for Technology Adoption (BNDS, FONTAR), PRONATUR, CITE Software, Vouchers for technological services, technological extensions.</td>
</tr>
<tr>
<td>Non-Technological</td>
<td>Program on innovation management</td>
<td>Sustainable Tourism Certification, Vouchers for innovation management and organizational change</td>
</tr>
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Source: Author’s elaboration.
Innovation in Services

In summary:

1. Although there are horizontal support programs, in practice these programs are not neutral in that they demonstrate a bias toward technological innovation and little, if any, consideration is given to non-technological innovation. The focus on higher technological innovation is given to vertical programs, which consequently leads to a bias toward KIBS.

2. At the same time, the focus on “supply” biases the instrument matrix against those sectors that are more likely to adopt technology and existing best practices than generate new, productive knowledge.

3. This leads to a marginal space for policies suitable to the traditional service sectors (and to a lesser degree, more traditional manufacturing).

4. OECD countries are adjusting their instrument matrix in two directions: (a) incorporating vertical programs that are oriented toward traditional services (e.g. Finland’s SERVE prioritizes retail), (b) adjusting the design of horizontal programs to accommodate non-technological innovation (e.g. tax credits in Holland and Denmark, public purchases in the UK) and (c) including the activities of industrial services (e.g. Japan.)
Allocation Efficiency in Services

• Aggregate productivity is dependent on the growth of the most productive and innovative firms. If there are market distortions that block this growth, it is highly probable that the impact of innovation will be limited to the aggregate level.

• Additionally, if a potentially innovative business deduces that it is not going to be able to grow because the market does not reward innovation, then it is highly likely that the business will decide not to innovate.

• The question is whether the markets are allocating resources in an efficient manner: if they are, one would find that a firm’s market participation (their relative size) is positively correlated with their productivity (also in relative terms). If this is taken to be true, it suggests that the most productive firms can grow, thereby increasing aggregate productivity.

• Let us look now at this correlation (allocation efficiency)
Allocation Efficiency in Services

Resource Allocation Efficiency
(Median among countries and industries)

- Allocation efficiency only contributes to 1.5% of the aggregate productivity in LAC, whereas allocation efficiency contributes to 19.2% in manufacturing (USA 25%).
- The problem is those services whose allocation efficiency contribution to aggregate productivity is negative! (USA 7%)
- If service sector workers in a typical LAC country were assigned at random to firms within the same sector, the aggregate productivity of the sector would increase by 11%.
- There are big gains to be had if this correlation can be transformed into something positive.

Source: Crespi et al. (2013, in preparation).
The problem is generalized to the majority of the service sectors, particularly construction, ground transportation, IT services, and wholesale trade.

The contribution of retail trade is also low (4%) when in the USA it is 22%.

We do not understand entirely what is behind all of this. What we do know is these are not general aspects of the business climate but instead are deeper conditions relating to how factor markets (especially financing) and competition function in these sectors.

Source: Crespi et al. (2013, in preparation).
CONCLUSIONS

• The weight of the service sector in the economy is substantial and its productivity is not taking off. This affects aggregate productivity. The low productivity of services also affects the productivity of other tradable sectors.

• The rationale behind public policies in services is the same as it is for manufactures (externalities, information asymmetries, coordination, competition, etc.), but there could be a higher incidence in services due to the very nature of the sector (intangibility, interaction, low openness, etc.).

• The inputs for innovation are not traditional (R&D, equipment) and the type of innovation that predominates is non-technological.

• There is a bias in the instrument matrix toward technological innovation and supply, which could affect the participation of services, especially traditional services.

• There are serious problems in the allocation of resources, which is an additional factor that could inhibit innovation in these sectors.
CONCLUSIONS

• There must be a deepening of the measurement agenda. The measurement agenda for innovation in services in the region is behind when compared with that of manufactures.

• Not all countries ask. Those that ask do not necessarily ask the same sectors or the same size of firms, which reduces comparability across countries.

• There must be improvements made against the “other activities” category of innovation.

• We do not know how much is being invested in “soft” innovations (organizational change, marketing, etc.)

• There are no good questions being asked around intellectual property and protection strategies.

• Improving the quality of surveys for the evaluation of policies and, in particular, exploring surveys with records are important next steps.
Participating Institutions

Inter-American Development Bank (IDB)

Established in 1959, the Inter-American Development bank (IDB) is the most important regional development bank and the largest source of multilateral financing for the socioeconomic development of Latin America and the Caribbean.

International Development Research Centre (IDRC)

Key institution of Canada’s international aid program since 1970. It supports research in developing countries to promote growth and development and the exchange of knowledge between the public sector and researchers.

Centro de Investigaciones Económicas (CINVE)

An independent private academic institution in Uruguay that began its activities in 1975. Its objectives are to promote and conduct economic research and contribute to the development of economic sciences.
Firm Productivity

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- One hypothesis is that LAC firms innovate little, especially in services-- taking the notion of innovation broadly, looking at more than just R&D and technological or non-technological innovation.
A simple Framework

- Let us assume that innovation ($\Delta A$) is the only production input. Let us also assume that the innovation production function $F(.)$ is homogenous of degree 1, so that $\Delta A$ depends on: R&D per worker ($r$), firm knowledge base as captured by human capital per worker ($h$) and access to others’ knowledge per worker ($k$):

- $\Delta A = F(r, h, k)(1)$
A simple Framework

- In order to innovate the firm should be able of investing in innovation \( (r) \) and appropriating at least a fraction \( (\Theta) \) of this investment. So, we can expand (1) to write:

\[
\Delta A = F(\Theta r, h, k)(2), \ 0<\Theta<1;
\]

- Firms can also get a subsidy \( (S) \) as a fraction of their investment in innovation. And in order to innovate firms also should pay a fixed cost. \( (f) \) (e.g. having an R&D lab)
A simple Framework

- So firms profits are given by:
  \[ \pi = F(\theta r, h, k) - (1 - s)r - f(2) \]
- Assuming that h and k are predetermined and that s is exogenous, we can solve for the optimum \( r^* \):
  \[ r^* = \frac{G(\theta, h, k)}{1-s} \quad (3) \]
  \[ r^* = R(\theta, h, k, s) \quad (4) \]
- Firm investment in innovation is a growing function of \( \Theta, h, k \) and s. The fixed costs do not
A simple Framework

- Plugging (3) into (2) we get firms profits:
  \[ \pi^* = F(\theta r^*, h, k) - (1 - s)r^* - f \]
- So the profits of investing in innovation are:
  \[ \pi^* = H(\theta, h, k, s) - f(5) \]
- Where \( H() \) is a growing function of \( \Theta, h, k, s \) and a declining function of \( f \). A firm will be indifferent between investing or not on innovation when profits are zero:
A simple Framework

- So the government can induce a firm to invest in innovation by setting the subsidy to a level ($S'$) where the profit function is zero:
  
  $$s' = j(\theta, h, k, f)$$  

- $S'$ is a decreasing function of $\Theta$, $h$ and $k$ and a growing function of $f$. Given that by (4) there is a unique relationship between $r$ and $s$, we can define the level of $r$ that makes the firm indifferent between investing or not.
A simple Framework

- By replacing $S'$ into (4) we get:
- $r' = F(\theta, h, k, f)$ (7)
- $D$ is a growing function of $f$.
- Equations (4) and (7) are our key functions for the CDM. Both can be log-linearized to get:
  - $lnr^* = \beta_1 ln\theta + \beta_2 ln h + \beta_3 ln k + \beta_4 s$ (8)
  - $lnr' = \alpha_1 ln\theta + \alpha_2 ln h + \alpha_3 ln k + \alpha_5 ln f$ (9)
- A firm will spend in innovation if:
A simple Framework

- If we define a dummy variable \(Y\) equal to 1 if the firm spends on innovation and 0 otherwise, we get the following type-2 Tobit model:

\[
y = 1[\delta_1 \ln \theta + \delta_2 \ln h + \delta_3 \ln k + \delta_4 s + \delta_5 \ln f > 0]
\]

\[
y = \begin{cases} \ln r^* & \text{if } y = 1 \\ 0 & \text{if } y = 0 \end{cases}
\]

- Where the \(\delta_i = \beta_i - \alpha_i\) for \(i=1,\ldots,5\).

- So it is clear that the probit part of the Tobit must include extra variables different from the ones in the investment equation: the proxy for the fixed