Digital servitization in manufacturing firms

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Background

- Manufacturing firms have different options to commercialize their knowledge and competencies:
  - Product and process innovation
  - Technology licencing
  - Spin-offs and corporate venture capital

- Product-related services (Baines et al. 2009; Kowalkowski et al. 2017; Raddats et al. 2019)
  - complement or substitute the physical products of the firm
The benefits of servitization

Firms can derive three benefits from servitization (Mathieu 2001):

- **Financial benefits,**
  - in particular new income sources and more stable revenue

- **Marketing benefits,**
  - in particular a more intense relationship with clients
  - interaction with customers as a source of information for the firm

- **strategic benefits**
  - product differentiation and stronger customer loyalty
Service turnover in different manufacturing sectors, 2009

[Bar chart showing service turnover for various manufacturing sectors, with direct and indirect service share indicated.]
Why is servitization so difficult?

- Customers are not willing to pay for services (Eggert et al., 2014; Neely, 2008; Witell and Löfgren, 2013)
  - Change from services as an add-on to a source of revenue difficult
  - Services are sold as product-service bundles (operator models, pay-by-hour, ..)

- Services are difficult to scale up, lack economies of scale
  - They are often based on the competencies of people

- No transition to a service-centered company (Gebauer et al., 2005; Vargo and Lusch, 2008)
  - manufacturing firms lack accompanying investments and do not adapt appropriate business models and a service-dominant logic
Digitalization

- Digital manufacturing technologies (aka IoT, Industrie 4.0) include sensors, networked production, cyber-physical systems, 3D printing, advanced robotics, Big Data …
- These technologies are seen by many as the most important driver for future productivity growth (OECD 2017, UNCTAD 2017).
- Another hope: new data as the basis for new services
  - ‘digital servitization’ (Paschou et al. 2018, OECD 2018 and others)
How can digitalization help to overcome these challenges?

- Digitalization allows new services based on data and technology
- these new services are also more scalable

- Digitalization provides new revenue models, such as outcome-based, or usage-based or transaction-based revenue models
  - These may help firms to make the value of the service more visible

- **H1: The degree of servitization is positively related with the intensity of use of digital production technologies.**
Digital servitization helps firms in innovation

- Information collected from customers can help manufacturers to design better products (Mey Goh and McMahon, 2009)
- Digitalization provides real-time data on product usage, while before digitalization, servitized manufacturers had to rely on personal interaction with the client (Rymaszewska et al. 2017)

➢ **H2:** The degree of servitization is positively related to the propensity of firms to introduce new products and the use of digital production technologies.
Data

- I use data from the European Manufacturing Survey
- EMS is a firm-level survey that investigates product, process, service and organisational innovation in European manufacturing.

- The EMS includes detailed information
  - digital production technologies
  - service turnover and new product-related services
  - innovation input and output
  - a number of control variables such as firm size, exports, the position of the firm in the value chain, or characteristics of the main product and of the production process.

- We use firm-level data for 230 manufacturing companies from Austria, reference year is 2018
## Technologies

<table>
<thead>
<tr>
<th>Groups</th>
<th>Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cyber-physical systems (CPS)</strong></td>
<td>Products with interactive interfaces</td>
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<tr>
<td></td>
<td>Connected products for automated data exchange</td>
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<tr>
<td></td>
<td>Products with sensors</td>
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<tr>
<td><strong>Logistics</strong></td>
<td>Products with identification tags</td>
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<td></td>
<td>Mobile devices for programming and controlling</td>
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<td></td>
<td>Solutions to transfer drawing, schedules etc. directly to the shop floor</td>
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<td></td>
<td>Enterprise resource planning (ERP)</td>
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<td></td>
<td>Digital exchange of data with suppliers / customers</td>
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<td></td>
<td>Near real-time production control systems</td>
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<td></td>
<td>Product-lifecycle-management systems</td>
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<td></td>
<td>Systems for automation of internal logistics</td>
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<td></td>
<td>Near real-time production control systems</td>
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<td><strong>Additive Manufacturing</strong></td>
<td>Additive Manufacturing for prototyping</td>
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<td></td>
<td>Additive Manufacturing for production</td>
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<tr>
<td><strong>‘Old’ robotics</strong></td>
<td>Industrial robots for manufacturing</td>
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<td>Industrial robots for handling</td>
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<td>Autonomous industrial robots</td>
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<tr>
<td><strong>‘New’ robotics</strong></td>
<td>Collaborating industrial robots</td>
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<td>Mobile industrial robots</td>
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<td>Equipment that automatically stores data</td>
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</table>
Empirical model

- Dependent variables:
  - H1: Share of services on turnover (metric), new services introduced (dummy)
  - H2: product innovation (dummy)

- Independent variables:
  - Firm size
  - Industry dummies
  - Digitalization intensity (technologies employed by the firm aggregated in an index OR aggregated in technology groups)
  - Service share on turnover (H2)

- OLS and probit estimation
Some descriptive results

- 80% of all firms offer some type of service,
- but only 30% generate revenue with these services

- The share of services on total turnover is around five percent on average
- Service turnover is higher in more technology-intensive sectors

- 18% of all firms have introduced a new service in the last two years,
- compared to 58% which have introduced a new physical product to the market
Digitalization and servitization

H1: The degree of servitization is positively related with the intensity of use of digital production technologies.

- I find a positive association between digitalization intensity and service turnover share only at an error level of 10% or more and with a very small coefficient.
- However, there is a significant and positive association between digitalization intensity and service innovation (new services introduced).

- Digital technologies seem to be related only to new services, and not with total service turnover of firms.
Digitalization and servitization

- At the level of technologies:
  - A positive association with the service turnover share only exists for ‘Cyber-physical systems’ (products with sensors, automated data exchange)
  - There is even a negative association between ‘new robotics’ (collaborative, mobile robots) and service turnover (distinct strategies in digitalization?)
Servitization and product innovation

H2: The degree of servitization is positively related to the propensity of firms to introduce new products and the use of digital production technologies

- There is a significant and positive association between product innovation and service turnover
- However, there seems to be no association between product innovation and the digitalization index or individual technologies, which the exception of ‘new robotics’

- The information function of services is still largely a result of the interaction of employees with customers in the process of service generation, not of digitalization!
Conclusions

- Servitization can be a viable strategy for manufacturing firms to commercialize their knowledge.
- However, digital servitization is still in a premature stage.
  - Early stage of development of the underlying technologies. Another reason may be that digital servitization is not only a matter of technology, but also requires investments in skills and new capabilities by the firms.
- What policy can do
  - I believe that technology is not the bottleneck for digital servitization.
  - Rather, it is the lack of business models, and a lack of examples how firms can monetarize data.
  - We need more promotion of these types of innovation.
  - R&D tax incentives has shifted the focus of innovation policy back to R&D and technological innovation.
That's it, thanks a lot for your attention

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