The aim of this talk

- Why productivity?
  - Source of economic growth
  - Measure of living standard

- Productivity measures the ability to use resources efficiently and to produce more

- Different methods & data sources give insights into different sources of productivity growth

- The measurement of productivity is challenging
Outline of this talk

1. Definition of productivity
2. Drivers of productivity
3. The study of productivity in Luxembourg:
4. Measures based on aggregate data
5. Measures based on firm-level data
6. The evolution of productivity in Luxembourg
7. Challenges of measuring productivity
8. The research ahead
Productivity is not working harder but working smarter! (OECD)

- Productivity expresses how well countries/industries/firms use their resources.
- Measured as ratio of output to inputs used to produce those output.
- It is a relative concept.
Productivity measures

- Partial vs. total factor productivity measures:
  - Labour productivity compares output to the labour input.
  - Total Factor Productivity (TFP) compares output to the stock of capital and labour.

- They are related: \( \Delta \left( \frac{GDP}{L} \right) = \Delta \left( \frac{K}{L} \right) + \Delta (TFP) \)
  
  Labour prod. growth = capital deepening + TFP growth
the best restaurant in the world..

Source: http://www.osteriafrancescana.it/
Drivers of productivity

What explains productivity? Why productivity differ?

- Efficiency, technical progress, factor allocation.
- Internal drivers:
  - Quality of inputs.
  - Intangible assets: know-how, organisation, reputation.
  - Knowledge capital: skills, management, HR practices.
  - Innovation and R&D.
  - More recently: workers’ incentives, job satisfaction.
- External drivers:
  - Technological spillovers, trade, market structure.
Productivity and efficiency

Concepts of efficiency:

- **Productive efficiency**: ability of a producer to obtain maximal output from a given level of inputs use.

- **Allocative efficiency**: state of an industry where resources employed by most productive producers.
How we study productivity

Several data sources and methods to analyse **productive efficiency** and **allocative efficiency**.

Two projects:
- **LuxKLEMS**: National Accounts data to compute productivity indices at national and industry level.
- **LuxPROD**: firm-level data to investigate issues:
  - Productivity, mark-ups and international trade.
  - Resource mis-allocation and productivity slowdown in Luxembourg.
National Accounts framework:

- Countries use resources to produce goods and services:
  - Stock of capital \((K)\), Labour \((L)\), Energy \((E)\), Materials \((M)\), and purchased Services \((S)\).

- Use aggregate data for many countries and industries.

- Objective: comparative indices of Total Factor Productivity (TFP).

- Analyse productive efficiency and technical progress.
Productive efficiency

\[ GDP \]

\[ K/L \]

Efficient frontier

\[ D_i \]

\[ C_i \]
Technical progress

Changes in TFP = changes in eff. + tech. progress
TFP evolution in Luxembourg

Source: Penn world tables.
TFP evolution: country comparison

Source: Penn world tables.
Technical progress and efficiency in Luxembourg

Source: Penn world tables.
LuxKLEMS: the work ahead

Need to adapt LuxKLEMS to the new data framework:

- New European System of National Accounts (ESA2010):
  - Implemented by EU countries in 2014;
  - Major data revisions for all years;
  - R&D recorded as investment expenditure.

- New industry classification NACE Rev.2.
New topics

- Quality of life: does \textit{well-being} matter to productivity?
- Quality of environment: \textit{environmental efficiency}.
Productivity in Luxembourg: a summary

Productivity reflects economic cycle and structural changes:

- Fall in GDP during crisis due to fall in TFP.
- Fall in productivity is persistent.
- Luxembourg productivity slow-down preceded the crisis.
- Similar patterns across countries.
- Aggregate conceals industry and within-industry variations.
Studies on firm-level data: Allocative efficiency

- Aggregate productivity depends on **efficiency in the allocation of resources** across producers.
  - State of an industry where (important portion of) resources are employed by most productive producers.

- Micro data inform on how industries responded to the negative productivity shock.

- Data: Structural Business Statistics & Business Register.
Entry, exit and size

Sources of allocative efficiency:

- Some firms become more productive (within);
- More productive firms become larger in size (between);
- Exit of inefficient producers;
- Entry of new firms.

Next: some results on labour productivity in Luxembourg industries.

Source: Business Register data.
Sources of labour productivity growth

- Manufacturing
- Construction
- Wholesale and Retail Trade
- Transportation and Storage
- Accommodation and Food Service
- Prof., Sci. and Tech. Activities
- Administrative Activities

Source: U. Kilinc on BR data.
Entry and exit

Source: U. Kilinc on BR data.
Some new results based on macro data:

TFP in service industries

(very preliminary)

Source: CH Di Maria on NA data.
Some new results based on macro data: TFP in manufacturing industries

Source: CH Di Maria on NA data.
Strengths of our approach

Combines different data sources:

- LuxKLEMS: productivity indices based on minimal assumptions;
- Robust to availability of new data (obviously not to sample-wide revisions);
- Evidence based on micro-data allows robustness checks and explains aggregate outcomes;
- Firm-level and national-level data give insights into sources of productivity growth.
Challenges of measuring productivity

- **Data availability.**
  - Coverage, transmission lags, revisions;

- **Inputs** to production are often estimated or proxied.
  - Capital stock: cumulated investment by asset type;
  - Human capital highly problematic.

- **The measurement of productivity in services is difficult.**
  - **Output** of services is hard to define and measure.
  - **Financial services:** FISIM to capture implicitly priced services of banks.
Take-homes:

- Productivity compares output to inputs to production.
- Different methods give insights into sources of productivity growth: productive efficiency; allocative efficiency; changes in technology.
- A key issue in the analysis of productivity is the definition and measurement of inputs and output(s).
- Why is this important?
  - Apparent slow-down in Luxembourg’s productivity.
  - The results have policy implications.
Further research

- Continue the current work to produce up-to-date figures.
- Continue research effort on productivity drivers.
- Measures of productivity in key industries.
- New important issues (well-being, environment).
- We need data!


References

