

# **Labour productivity in Vertically Integrated Sectors**

**An empirical study for the case of  
Brazil: 2000-2008**

# Brazil in the 2000's

- After two decades of sluggish economic growth, GDP per capita increased at an average rate of 2.7% p.a. between 2000 and 2008.
- 1980's was -0.4% p.a. and 0.9%p.a. in the 90's.
- The combination of favourable international conditions with policies of income redistribution and expansion of credit introduced especially after 2004 produced the conditions for an acceleration of the economic growth, which was further enhanced by an expansive fiscal policy.

# Brazil in the 2000's

- 17 million new jobs were created resulting in a falling unemployment rate.
- Permeating this macroeconomic situation, a topic that was present in the debate was the performance of the manufacturing sector.
- Although the sector was presenting consistent positive growth rate gross and net output, with increasing employment rates,
- A decline in traditional labour productivity indexes (when measured through the concept of value added) of -0.3% p.a. between 2000 and 2008.
- A decline in the share of manufacturing output in GDP, when measured in current prices, produced concerns with hypotheses that a deindustrialization process was occurring in the Brazilian economy.

# Conventional Labour Productivity Measures:

- The usual measures within the conventional horizontal perspective are:
  - (i) Direct Labour Productivity (DLP): division of the gross output by the number of workers (or hours worked) in the sector, or
  - (ii) Apparent Labour Productivity (LPa): division of value added by the number of employees (or hours worked).
- However, both measures have weaknesses:
  - The (i) captures the outsourcing process as a productivity increase in the firm (or sector).
  - While (ii) suffers from relative price variations between the value added by the sector and the intermediate consumption (De Juan and Febrero, 2000).

# Vertically Integrated Sectors (Subsystems)

- The measurement of labour productivity in terms of Vertically Integrated Sectors (VIS) circumvents the two issues:
  - When a activity of low productivity is outsourced, this is positive for the productivity of the outsourced sector, but this does not automatically change the productivity of the VIS, as it also considers the indirect labour requirements.
  - The change in relative prices between intermediate consumption and value added by the sector is nullified, since both are considered as part of the same Subsystem. Thus, only one reallocation of the margins occurs within the same value chain.

# Analysing the production process through VIS:

- The logic behind this is to classify each industry based on its final good, identifying the contribution of each industry to the production process of each final good.
- As such, a VIS can be defined as the total activities used directly and indirectly in the productive process of a good or final service, which leads some authors to refer to the VIS as "final product concept" (Schettkat and Russo, 1999).

# Analysing the production process through VIS:

*“Such sectors are hypothetical constructions, built by the theorist, whilst actual investment decisions relate to investment in actual, individual industries and even in specific production processes. (...)*

*Similarly, technical change actually occurs at the level of quite particular production activities and, while the theorist can calculate the consequent changes at the vertically integrated level, the result is just that – a calculated, accounting magnitude. There is no such real thing as a way of acting to reduce some vertically integrated production coefficient. Any such reduction is only an ex-post statistical artefact.”*

(Steedman, 2004, p. 359 e 360)

# Total Labour Productivity

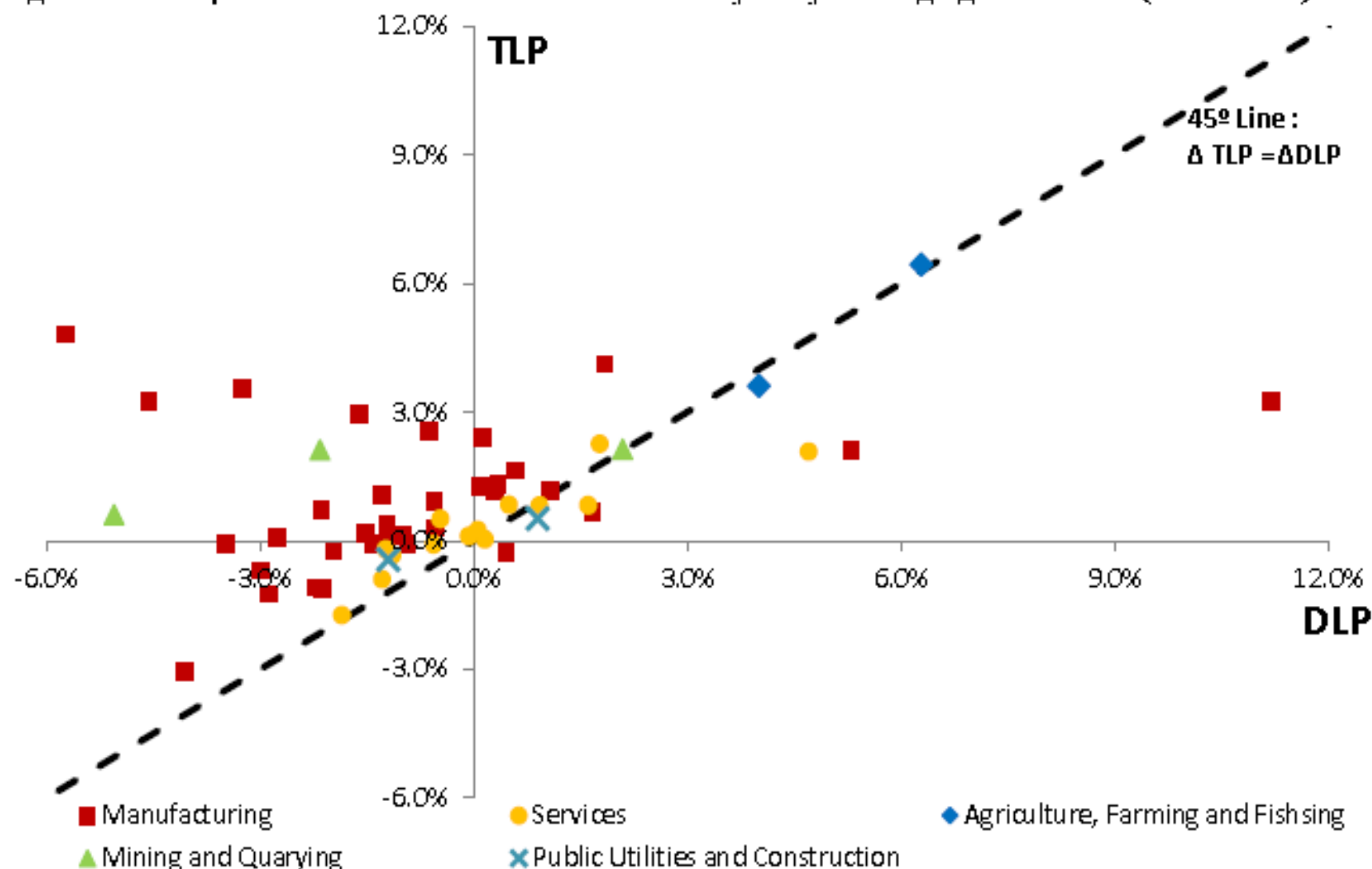
$$tlc = dl (I - A)^{-1}$$

- $dl$  is a line vector that expresses the labour coefficients required directly in the sector per unit of gross product (equivalent to DLP).
- $tlc$  is a line vector that expresses just the total amount of labor needed to produce a final demand unit.
- Total Labour Productivity (TLP) will be the inverse of  $tlc$ :

$$TLP = tlc^{-1}$$



Figure 1: Comparison between the TLP and DLP yearly average growth rate (2000-2008)



Source: Author's own elaboration, based on primary data from Neves (2013) e National Account Systems, reference 2000, IBGE.

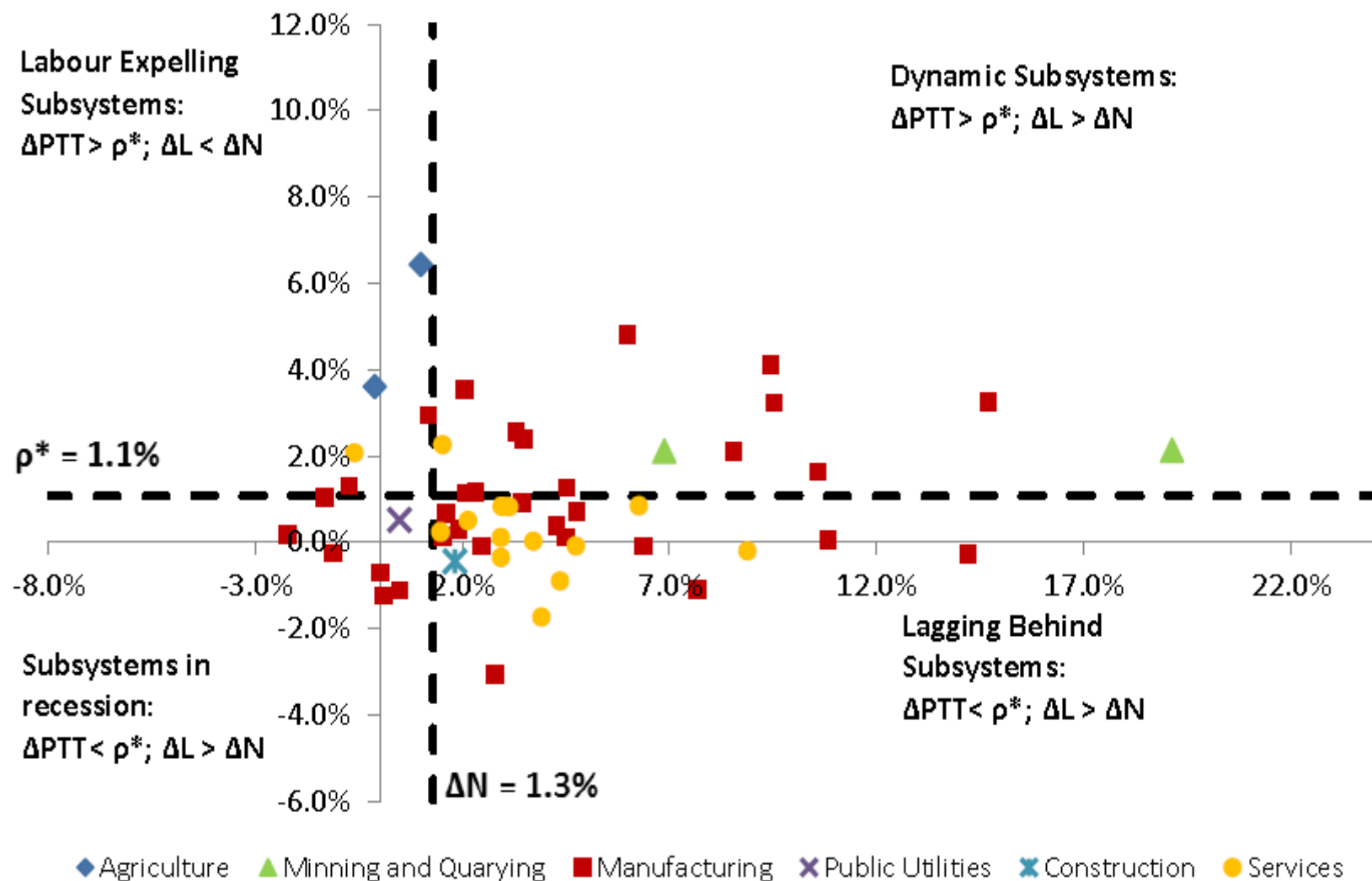
# TLP X DLP

- A total of 13 VIS had a growth of TLP, while the corresponding sectors had decrease of DLP. Of these, 10 registered an increase in the proportion between direct work and total work.
- This fact may help to explain the decline in the DLP of these sectors, since this change may result in an increase in the denominator (labour) without a counterpart in the numerator (output).

As a systematic of presentation of the results for the 55 subsystems we adapt the proposed nomenclature in Garbellini and Wikierman (2014):

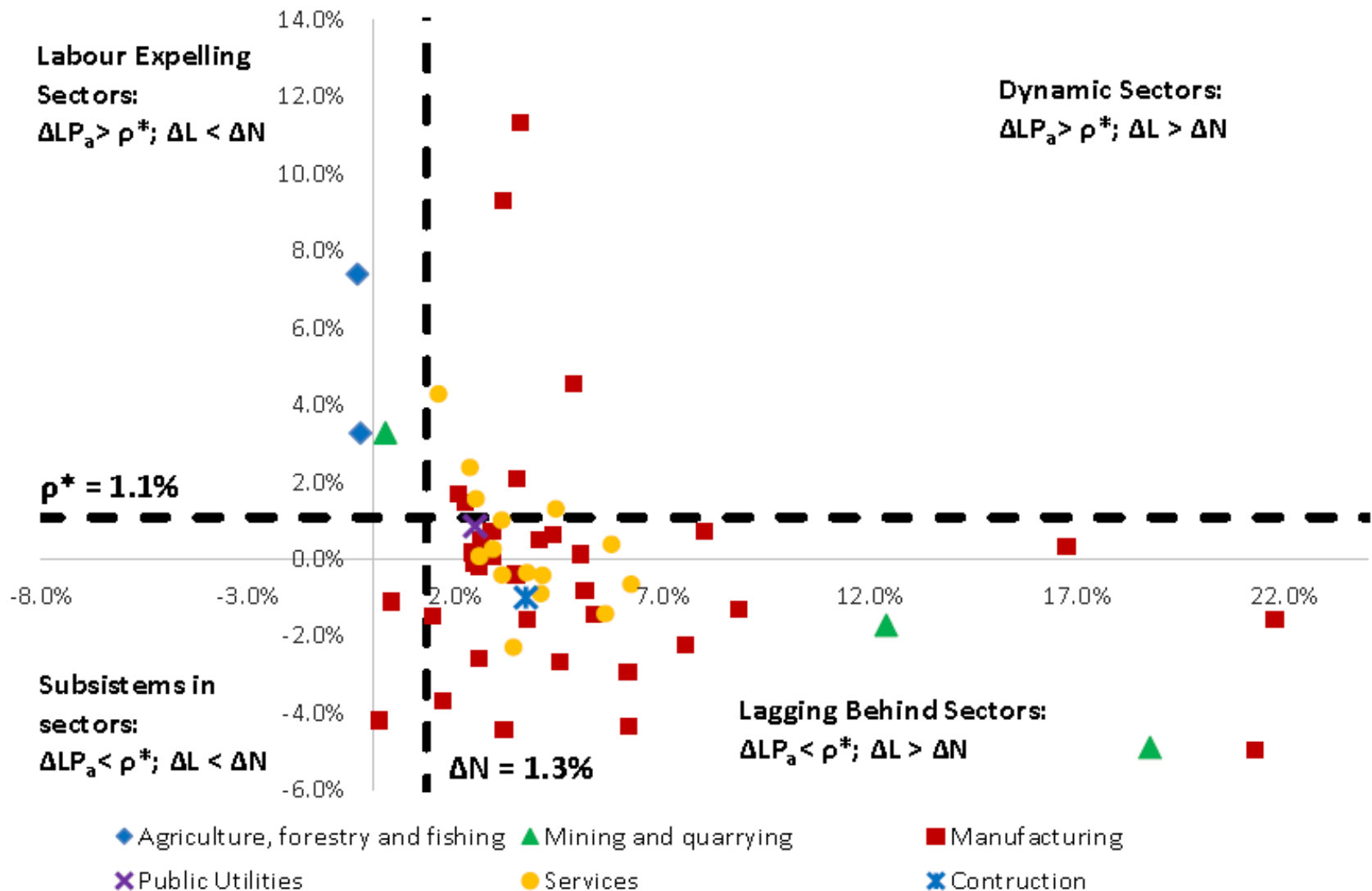
- (i) Dynamic Subsystems:  $TLP_i > \rho^*$  and  $\Delta L > \Delta N$ 
  - 15 subsystems, of which 12 are from Manufacturing. Labour share rose from 10.0% to 10.8%.
- (ii) Labour-expelling Subsystems:  $TLP_i > \rho^*$  and  $\Delta L < \Delta N$ 
  - 5 subsystems. Labour share fell from 23.5% to 20.5%
- (iii) Subsystems lagging behind:  $TLP_i < \rho^*$  and  $\Delta L > \Delta N$ 
  - 28 subsystems, with 14 from Manufacturing.
  - Labour share rises from 63.6% to 66.4%.
- (iv) Subsystems in recession:  $TLP_i < \rho^*$  and  $\Delta L < \Delta N$ 
  - 7 subsystems. Labour share fell from 2.9% to 2.3%

**Figure 2: Comparison between the yearly average growth rates of the TLP and Employment in each VIS, 2000-2008.**



Source: Authors own elaboration, based on raw data produced by Neves (2013) and System of National accounts from IBGE

**Figure 3: Comparison between the yearly average growth rates of the  $LP_a$  and Employment in each Sector of activity, 2000-2008.**



Source: Authors own elaboration, based on raw data produced in Neves (2013) and System of National accounts from IBGE.

# Results

- Subsystems lagging-behind and Subsystems in recession, Subsystems that a TLP growth rate below the average of the economy in the period considered increased their share of total employment by 2.2 p.p., that is from a 66.5% to 68.7%
- This fact reinforces in a VIS perspective, therefore, a proposition already present in Baumol (1967) that if the greater growth of labour productivity in dynamic sectors is not accompanied by an income elasticity of demand higher for the output these sectors than that of technologically stagnant (lagged) sectors, then an increasing share of the labour force will end up engaged in sectors of low productivity growth, which would produce a stagnation trend in the aggregate labour productivity growth.

# Concluding remarks

- The results TLP provides a quite different picture than the results which arises within the conventional horizontal analysis based either on DLP or apparent labour productivity ( $LP_a$ ). In both metrics labour productivity growth in services is higher and in manufacturing lower.
- This highlights an important feature, which has important consequences for the deindustrialization debate – many of the most dynamic activities within the Service sector are linked as suppliers to the manufacturing sector.

# Concluding remarks

- Thus, an increased efficiency in these activities is capable of enhancing competitiveness of domestic production of manufacturing final goods even in the event of no increase in production efficiency within the manufacturing sectors stages of production



# Concluding remarks

*“Essentially, though changes in productivity originate at the industry level, it is quite unlikely that the effects of these changes are all kept to itself. General interdependence makes labour-saving improvement in one industry to induce technical change in all those industries by purchasing the input produced by the technically improving branch. A consistent way of taking into account the cumulative effect of all these interdependencies is to work with sub-systems as the disaggregated unit of analysis.”*

*(Garbellini and Wikierman, 2009)*