

Logistics Performance Monitoring from Micro Data

Presentation at UNECE Seminar

April 25, 2016

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Performance monitoring

- Look at specific gateways (e.g. ports) or trade route (e.g. trade corridors)
- Logistics performance indicators should take the perspective of impact on ultimate users (traders), not just partial outputs (e.g. metric for individual processes).
- Hence should assess performance of a full supply chain (e.g. port logistics) in terms of generalized total logistics costs for the user.
- Total logistics costs include:
 1. Actual expenses paid for transport and other logistics services, plus internal costs (administration of the supply chain)
 2. Value of time
 3. Monetary equivalent of lack of reliability
- Performance monitoring should at least take the perspective of 2 and 3, as time and reliability are actually directly impacted by logistics reforms, and easier to monitor.

Where we stand

- The situation is much better today than it used to be even five years ago.
- Data is widely available for most important processes so it is possible to do monitoring of port logistics or trade route from actual shipment level data (container, truck).
- Already port community systems over the World are consolidating port logistics micro-data and producing extremely valuable indicators.
- There are several frameworks to help take the total logistics cost perspective
 1. UNESCAP: time distance graphs
 2. OECD
 3. World Bank (TLC formula by Arvis-Raballand-Marteau 2010)

What we know

- There have been a lot of experimenting with actual shipment level data over the last ten years (not really consolidated).
- Some patterns are quite universal and well known
 - Long tail in delay distributions
 - Behavioral patterns and the possible role of the agents in explaining apparent lag in performance (e.g.
 - How the different components of total logistics costs compare across country (time and reliability are more critical in developing countries)
 - Attribution and separation may not be possible: for instance time distance graphs may make sense not distance costs)
 - Market structure of logistics services matter (most TTF measures work only under competitive environment)

What we do not know

- There are important gaps and challenges:
 - Understanding commodity specific effects with value of time
 - Link micro-performance performance and macro-economic outcome (e.g. trade), nothing really credible on the table.
- Comparability over time for the same channel is easier than comparability between places or supply chains:
 - Too specific and not comparable supply chains (e.g. inland facilities, geography...)
 - Data and methodologies idiosyncratic (no harmonization even for commonly used concepts such as dwell time)
 - No repository of micro-level data and derived indicators (e.g. Dwell-time)
 - So far no simple way to do cross comparisons between countries with monetary or time data => reliance on coarse grain indicators (e.g. LPI) for international comparisons in logistics performance.

Total Logistics Costs

Inventory model (Baumol 70). Reference: a truckload or 40' container

Total transit cost=Administrative costs

+(fixed truck cost)× (truck use in days per shipment) → efficient

or $\frac{\text{fixed truck cost}}{(\text{rotations allocated per truck per unit time}) \times \text{load factor}}$ → cartel_or_syndicate.

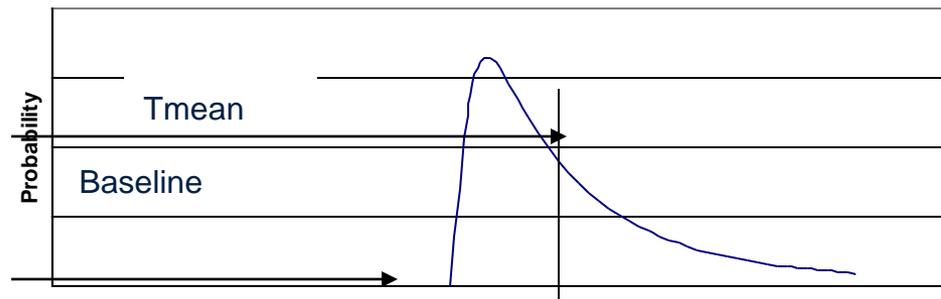
+ $\frac{\text{variable truck cost}}{\text{load factor}} \times \text{Distance}$

+(value of time)×T(γ)×(Value of shipment)

Where $\gamma = \left(\frac{\text{cost stockout}}{\text{inventory cost}} \right) > 1$

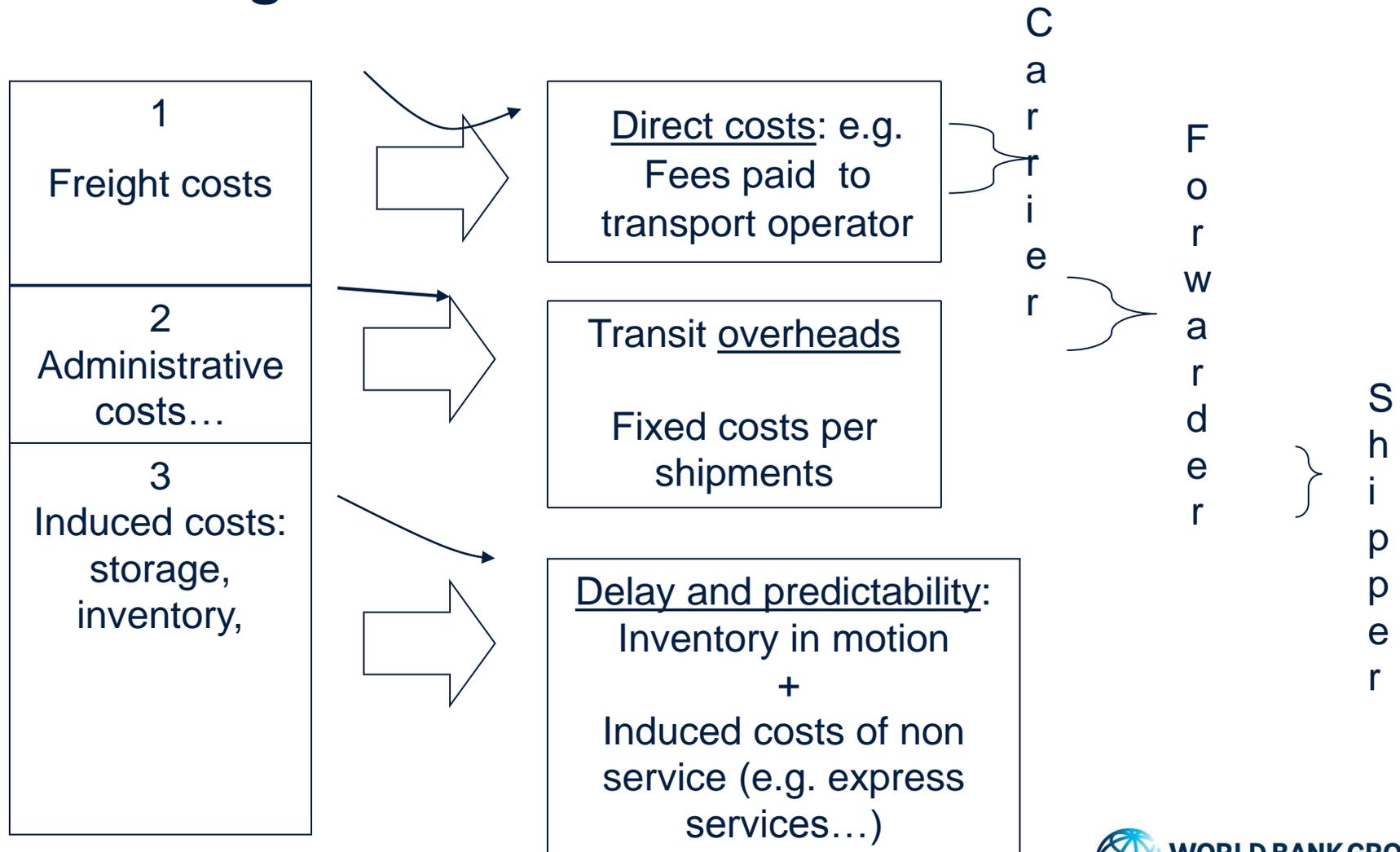
$$T(\gamma) = \frac{1}{\gamma} \int_T^{\infty} tP(t)dt \quad \text{where} \quad \text{Prob}(t > T) = \int_T^{\infty} P(t)dt = \frac{1}{\gamma}$$

and P is the distribution of lead time t



Source: The cost of being landlocked, Arvis et al 2010

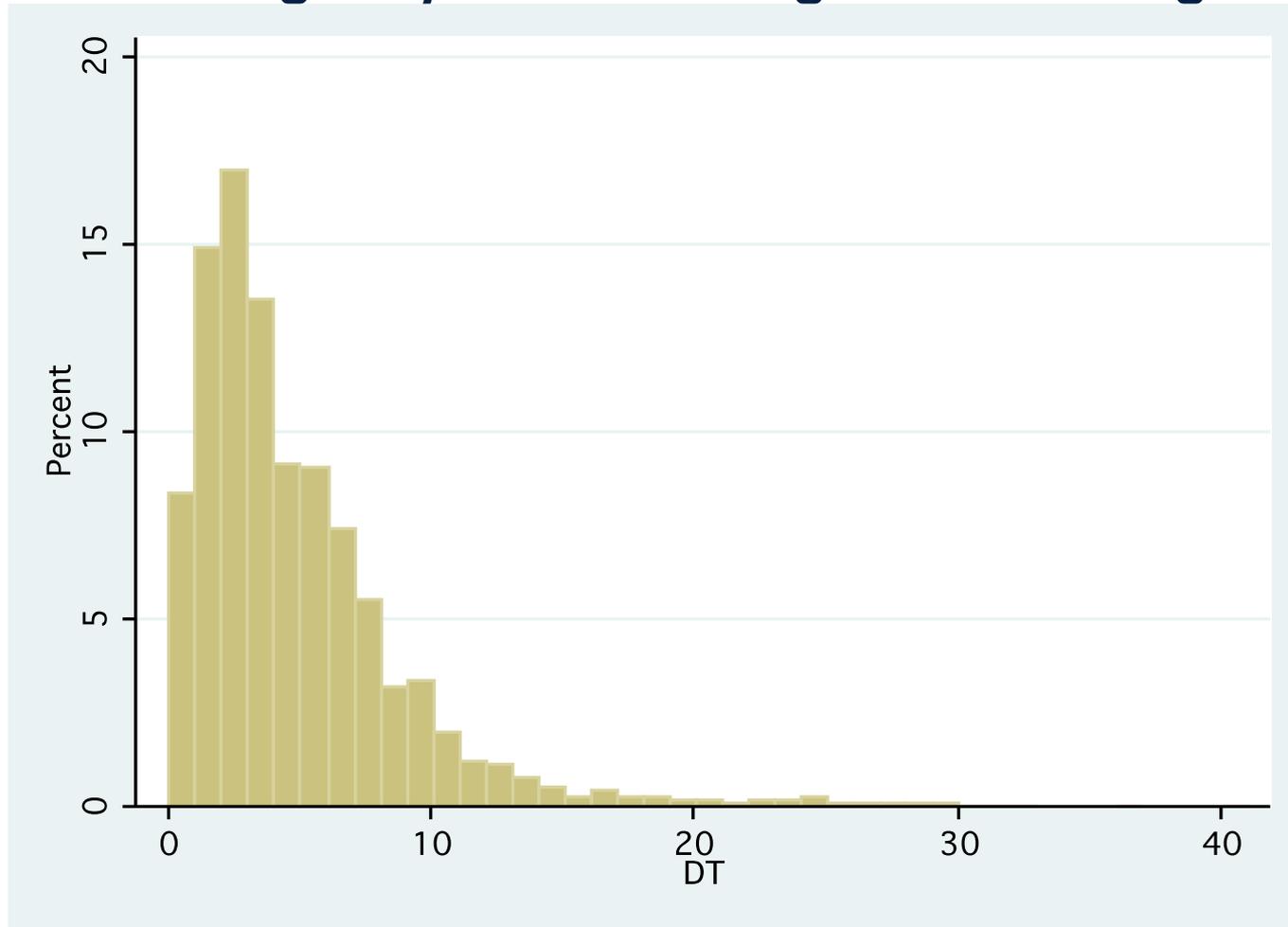
Total Logistics Costs: their trends



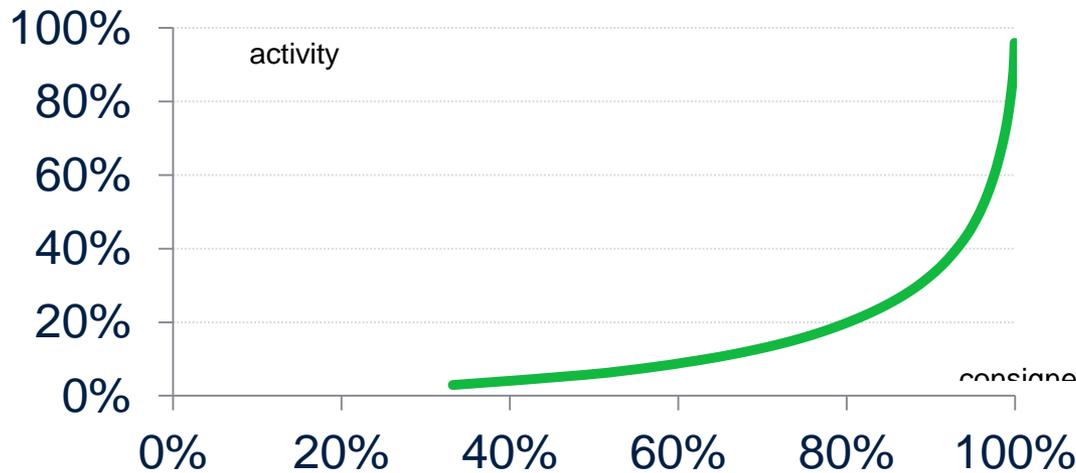
Breaking down



Looking Beyond Averages: the long tail



The role of agents who is to blame



Shippers behavior contribute to dwell time on top of the efficiency of public agencies

Few shippers have a disproportionate contribution to dwell time and occupancy

Some shippers uses voluntarily the port as a storage

Evidence:

- Correlation between phases: some shippers tend to be slower that others
- Direct or statistical evidence that few consignee contribute to occupancy and dwell time more than their activity (number of containers.

=> Critical to look at in low income countries, or commodity dependent

Some thoughts

- Essential to keep to the concept of supply chain (logistics) performance monitoring.
- In contrast normative approach to trade facilitation, may be helpful from a political economy perspective but do not capture performance or do a good job in identifying performance bottlenecks: Time Release Study (WCO), of TFA monitoring tools.
- There will be value in consolidating the existing experiment and provide better guidance to policy makers (role for UN agencies and OECD?):
 - Common definitions (e.g. what is exactly a dwell time)
 - Guidelines on performance monitoring and its breakdown.
 - (The World Bank will issue a Port logistics performance toolkit)
- More research needed to address the gaps, for instance commodity differentiated impact of supply chain performance.
- Big Data in the future ?