

World Bank Research on Air Transport Connectivity

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Principal

Any opinions expressed are those of the presenter only, not the World Bank Group.

Outline

1. Policy interest in connectivity
2. Development of a metric
3. External validation
4. Possible future directions in policy work

Policy interest in connectivity

- ▶ Transport networks help businesses move goods and services across borders.
 - ▶ Air transport moves only 10% of world exports by volume, but 30% by value.
- ▶ When those networks breakdown, the economic costs can be huge, particularly in developing countries.
 - ▶ The Icelandic volcano eruption of April 2009 shut down much of the European air transport network...
 - ▶ ...And cost Kenyan exporters of fresh food and flowers \$4m per day.

Policy interest in connectivity

- ▶ Trade facilitation focuses on reducing the transaction costs associated with international movements of goods, including transport costs.
- ▶ New generation trade facilitation initiatives (e.g., APEC) focus on connectivity.

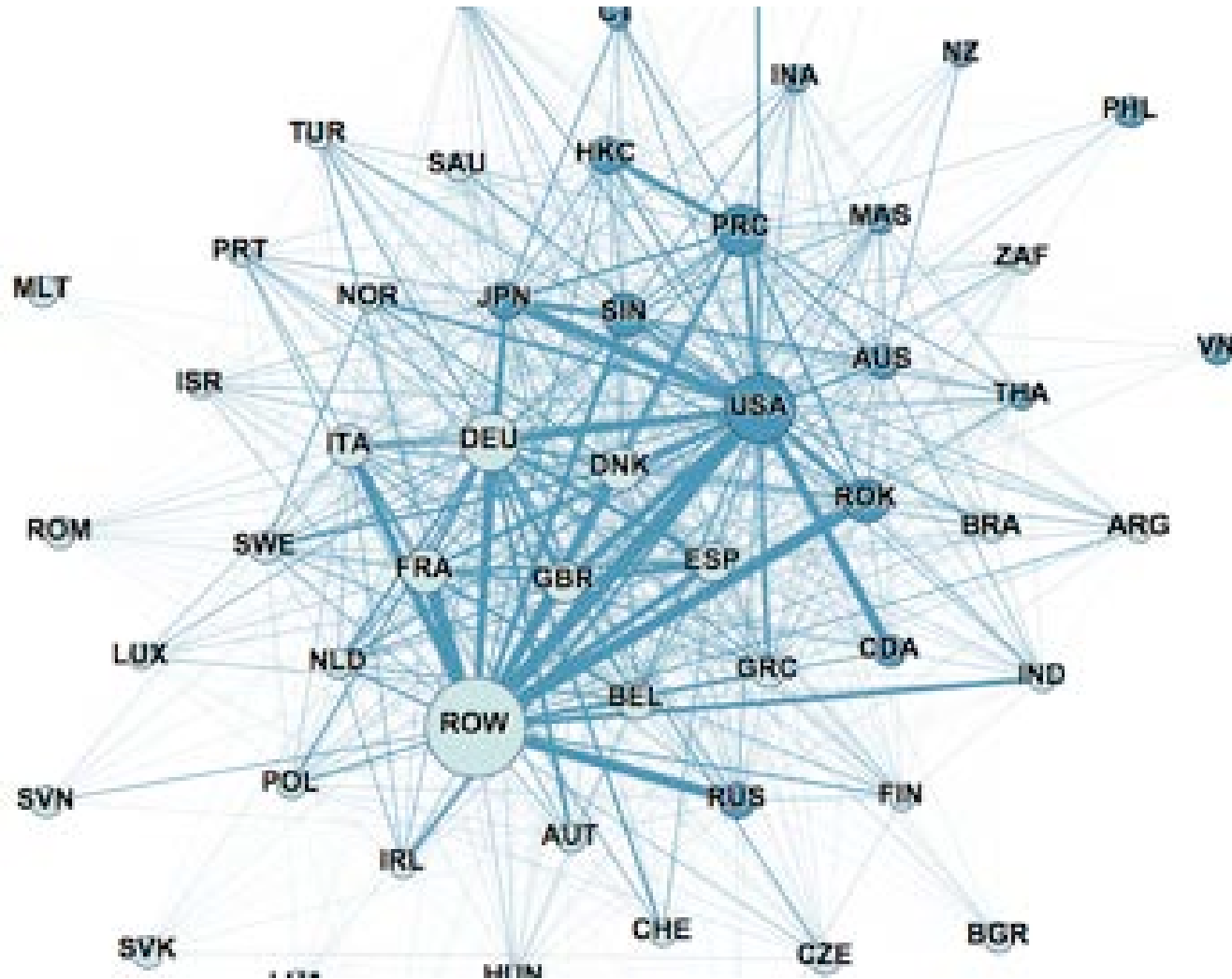
Policy interest in connectivity

- ▶ For the trade policy community, what is connectivity?
 - ▶ Network phenomenon, not about point-to-point transactions.
 - ▶ Closely linked with rise of Global Value Chains (GVCs).
 - ▶ APEC's Connectivity Blueprint, building on ASEAN's model, highlights three areas of policy focus for connectivity:
 - ▶ Physical.
 - ▶ Institutional.
 - ▶ People to people.

Policy interest in connectivity

- ▶ Economists (as usual?) are playing catch up.
- ▶ Existing work on:
 - ▶ Network effects in some industries (e.g., telecoms).
 - ▶ Networks in international trade (e.g., diasporas).
 - ▶ Links between financial institutions through lending and borrowing.
- ▶ Now a burgeoning area due to the Global Financial Crisis and subsequent Great Trade Collapse.
 - ▶ Analyzing the network structure of trade.
 - ▶ Developing simple metrics to summarize position.
 - ▶ Analyzing the propagation of shocks.

Policy interest in connectivity



Development of a metric

- ▶ Air transport was selected as a pilot sector by the World Bank's trade policy practice to examine the application of network analysis methods.
- ▶ Tasks we set ourselves:
 - ▶ Development of a simple metric to measure a country's connectivity in the global air transport network.
 - ▶ External validation of that metric by:
 - ▶ Expert feedback.
 - ▶ Comparison with input indicators.
 - ▶ Comparison with outcome indicators.

Development of a metric

- ▶ Network analysis provides a suite of off-the-shelf indicators that measure network centrality.
- ▶ But none of the available metrics do a particularly good job of capturing the essential characteristics of the air transport network.
- ▶ Some do not work well with bilaterally balanced flows (eigenvector centrality).
- ▶ Some are local rather than global (clustering coefficients).

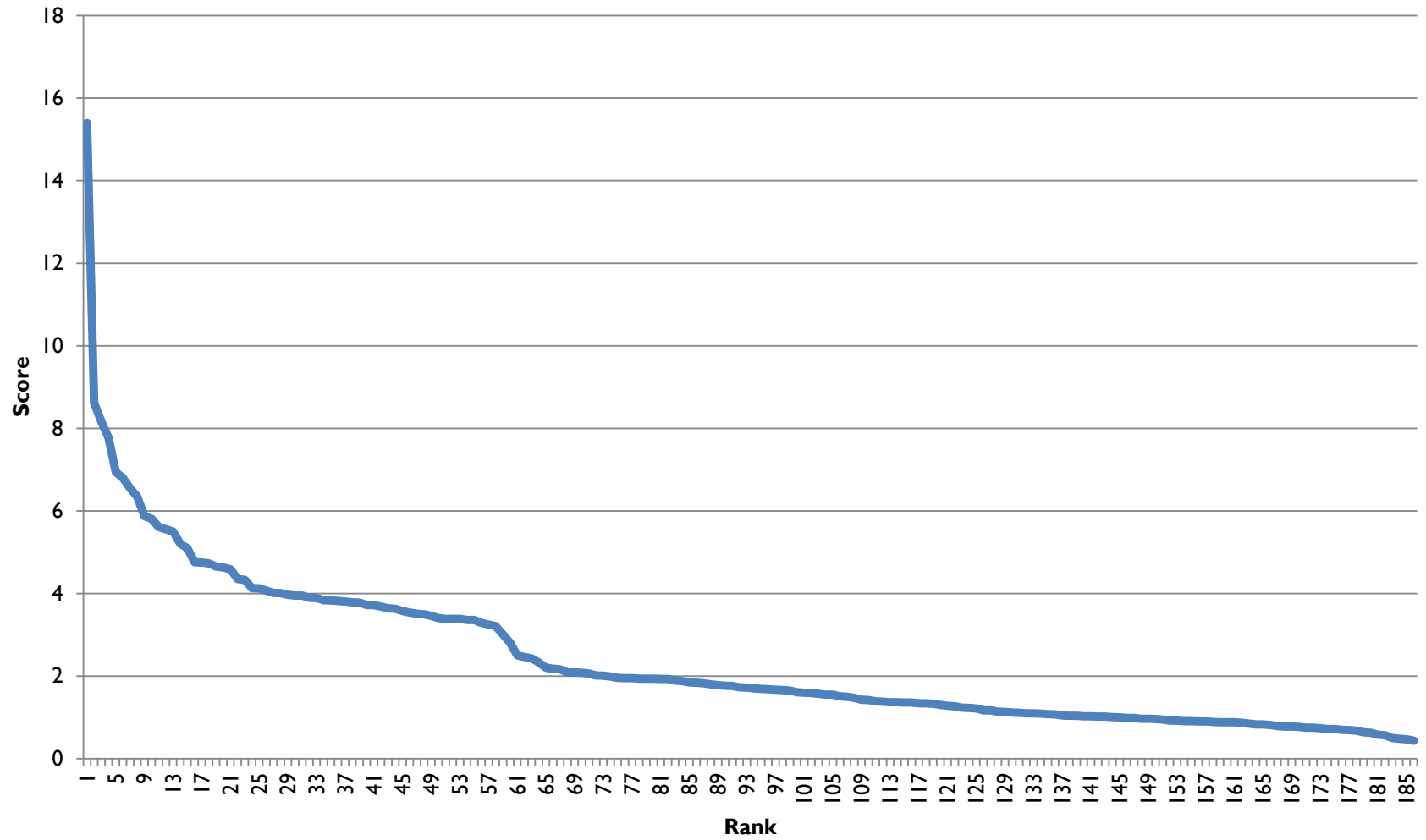
Development of a metric

- ▶ In a 2011 World Bank Policy Research Working Paper, J-F Arvis and I develop a new metric that satisfies a number of criteria:
 - ▶ Realistic, in the sense of being based on a model of transportation flow well-known from various parts of the economics literature.
 - ▶ Intensive, in the sense of being independent of a country's size, at least in any direct way.
 - ▶ Dimensionless and normalized, in the sense that the indicator is a number on a finite scale.
 - ▶ Global, in the sense that it accounts for all network interactions, not just immediate ones.

Development of a metric

- ▶ Our metric starts from the common gravity model of spatial interactions.
 - ▶ Larger economy pairs have larger flows.
 - ▶ More distant economy pairs have smaller flows.
- ▶ Each country in the model has a “potential”, which represents its pull from, or push towards, the whole network.
- ▶ Rearranging and normalizing those potentials gives us the Air Connectivity Index.
 - ▶ Initially for 2007.
 - ▶ Currently being expanded by the Purdue team to 2008-2012.

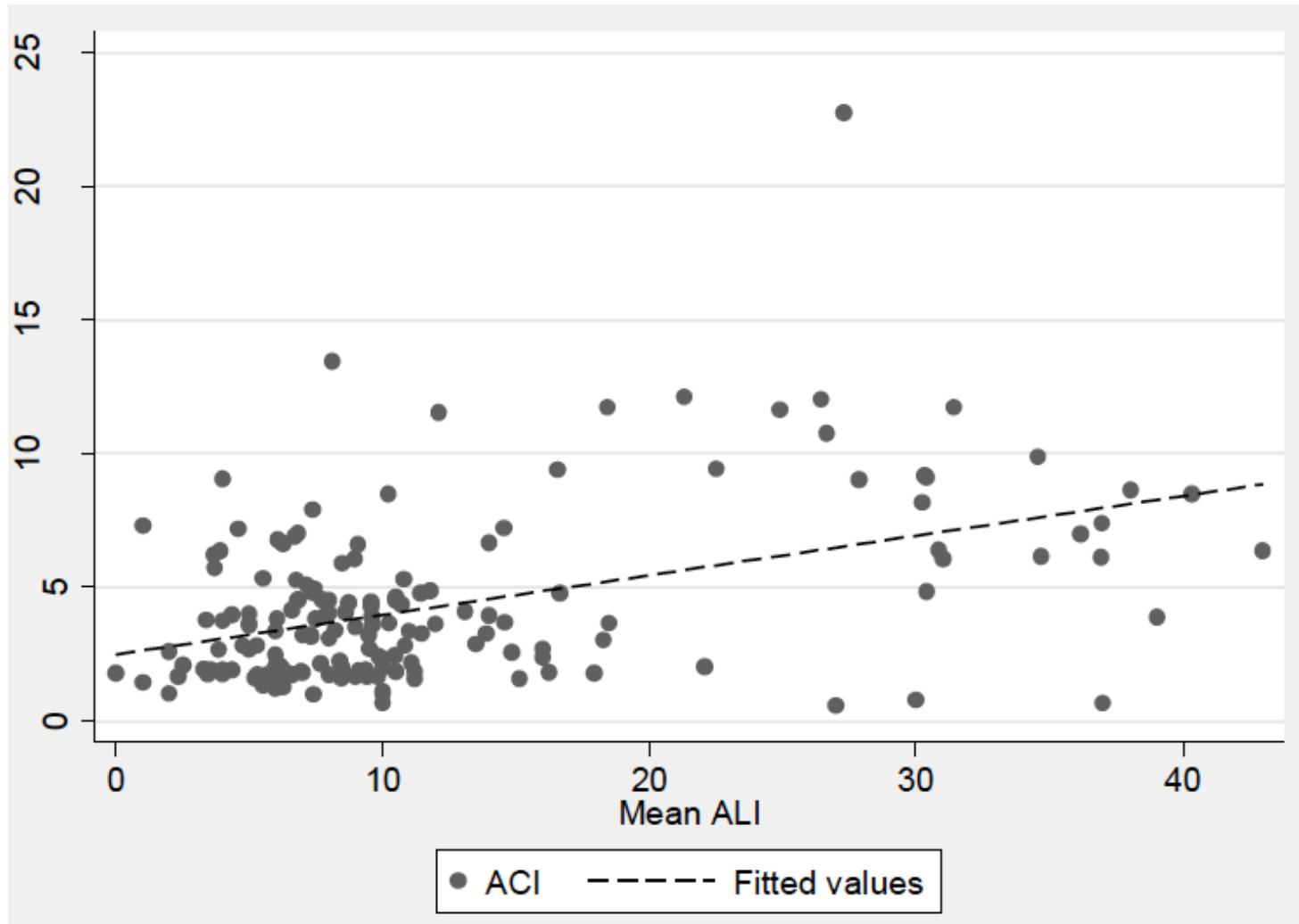
Development of a metric



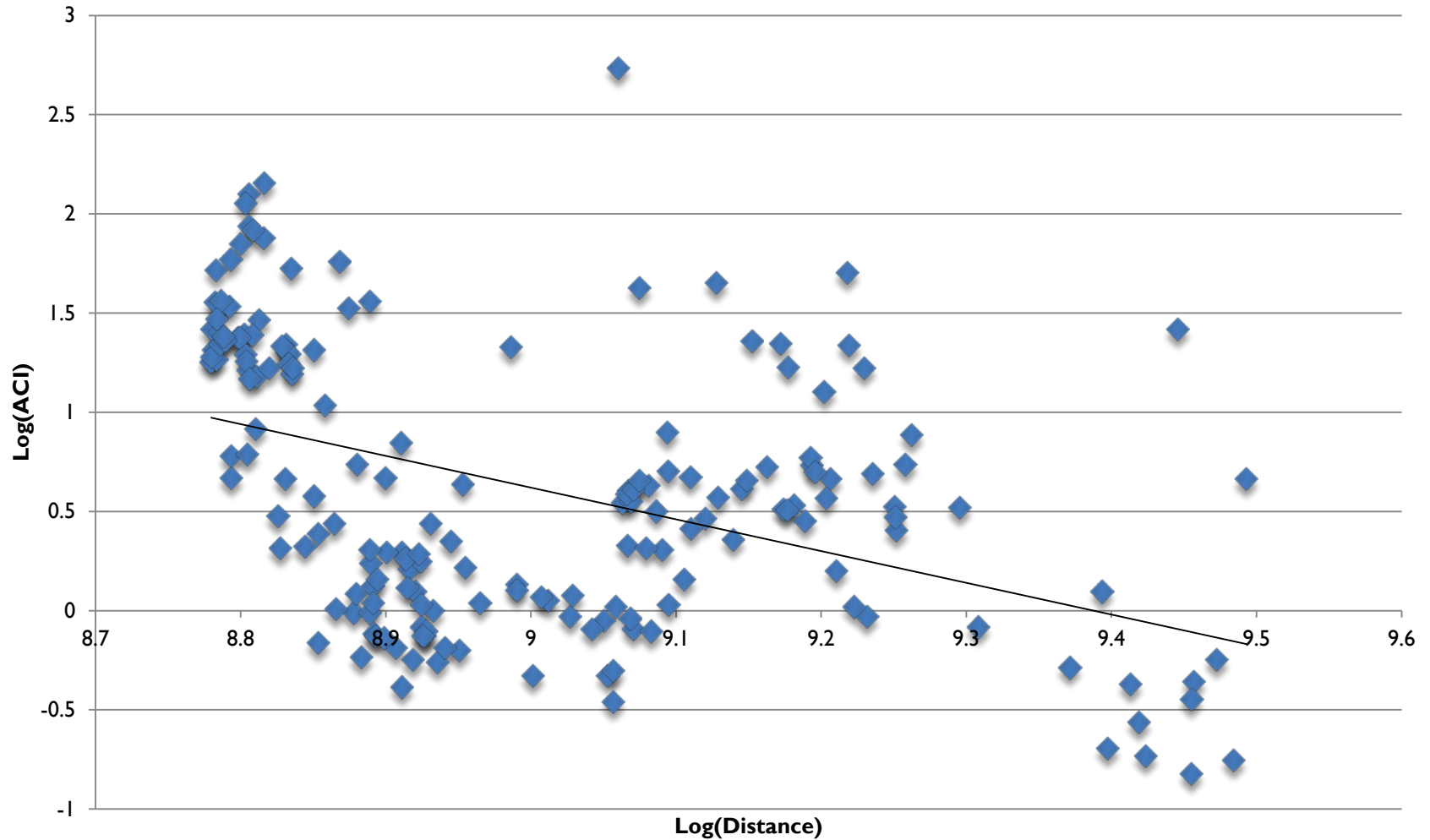
External validation

- ▶ As the ACI moves towards eventually becoming a World Bank data product, it is important to ensure the results correlate in a sensible way with other indicators.
- ▶ Input indicators: Factors we expect to boost or inhibit connectivity.
- ▶ Output indicators: Outcomes we expect to see affected by a country's degree of connectivity.

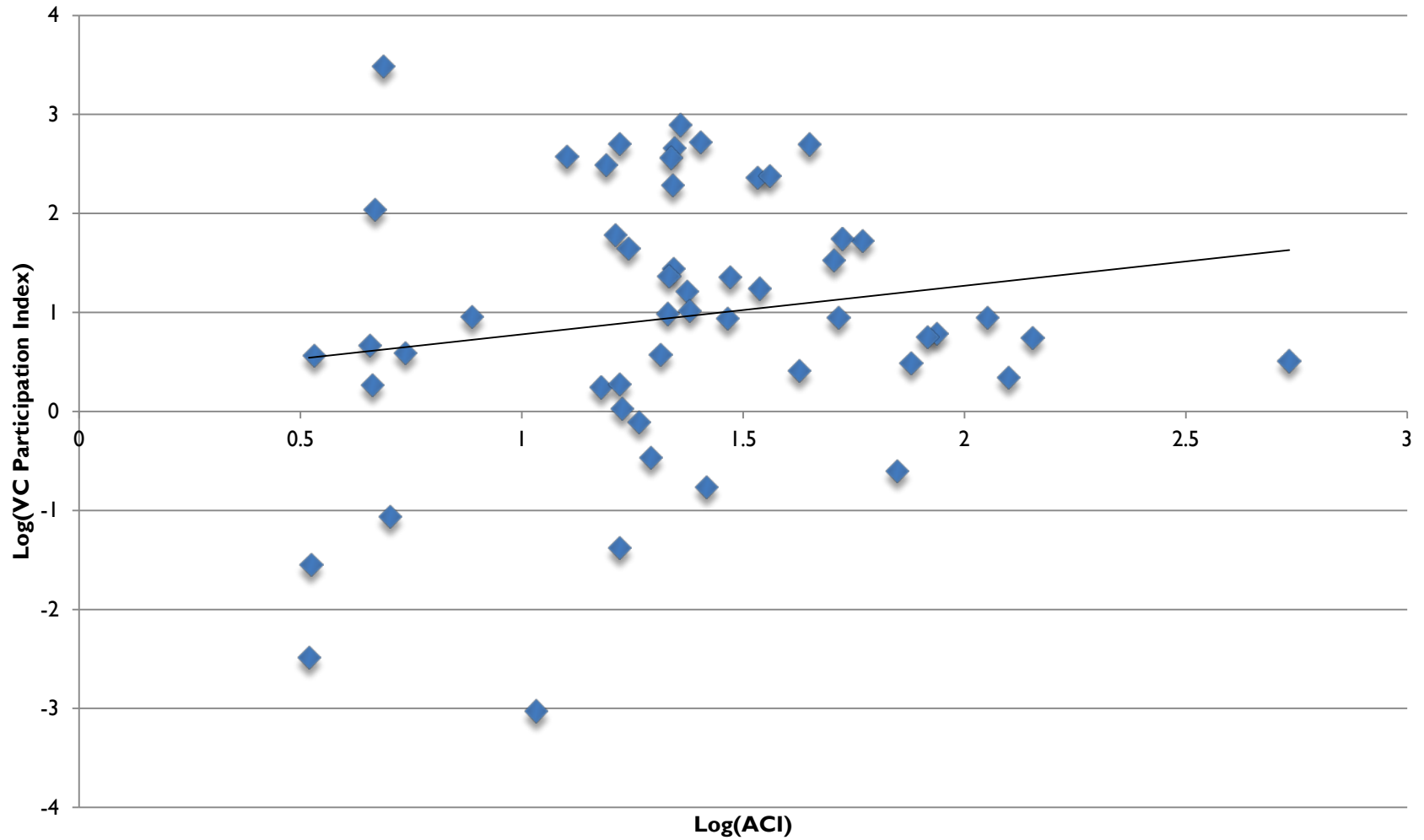
External validation



External validation



External validation



Possible future directions in policy work

- ▶ One role of the ACI is informational: letting countries know where they stand in relation to others.
- ▶ The ACI is also a potential tool in research on trade costs and facilitation.
- ▶ It can inform current and future connectivity initiatives around the world.

Possible future directions in policy work

- ▶ One avenue that remains to be explored is the ACI's potential role in informing project development.
 - ▶ Infrastructure upgrading.
 - ▶ Reform of air transport regulations.
 - ▶ Advice on sectoral upgrading.
- ▶ Can the ACI be used for counterfactual analysis? If so, based on what sorts of models, and with implications for which types of variables?
 - ▶ Network flow patterns?
 - ▶ Trade outcomes?
 - ▶ Economic welfare?

Possible future directions in policy work

- ▶ The original ACI project is being continued through a partnership with Purdue University.
- ▶ The Purdue team is currently working on extending the ACI temporally, so that coverage will be 2007-2012.
- ▶ Also developing new insights on methodology and outcomes, as well as possible applications.