Interregional capital flow tables for Brazil

A data-driven approach using electronic invoices

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Motivation: The Challenge of Understanding Investment

Gross Fixed Capital Formation (GFCF) is a cornerstone for analyzing economic growth.

The Problem: Historically, a detailed data gap has existed.

- Capital Flow Tables (CFTs) for Brazil are relatively rare.
- Previous studies relied on harmonizing diverse and often limited data sources.

The Consequence: An incomplete understanding of the country's investment structure, both sectorally and regionally.

Our Contribution: A New Data Frontier

This work develops an **interregional capital flow table** for Brazil with an unprecedented level of detail.

The Innovation: We use, for the first time, microdata from the **Electronic Invoice (Nota Fiscal Eletrônica, NF-e)** system to estimate Brazil's CFT.

This allows us to answer key questions:

- What is the structure of capital flows between sectors and states?
- How does this new view compare to previous estimates?

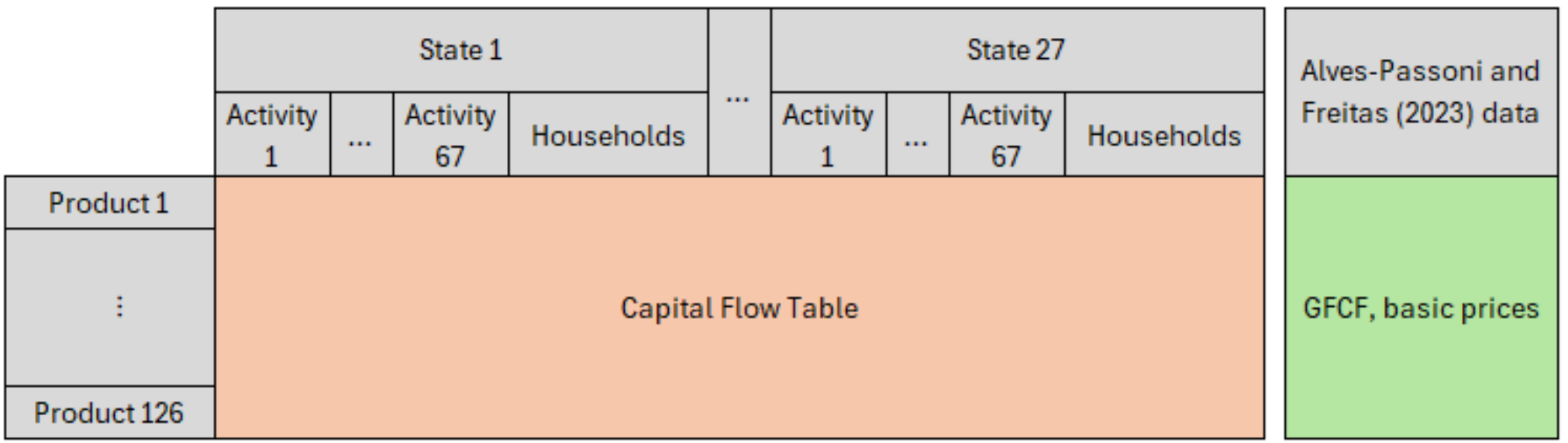
The Solution: The Power of the Electronic Invoice (NF-e)

The NF-e system is the foundation of our analysis.

- **What is it?** A mandatory electronic invoicing system for most industrial B2B transactions in Brazil.
- **What does it contain?** Detailed information on:
  - Seller and Buyer (sector, state)
  - Product (NCM code, compatible with the Harmonized System)
  - Values, taxes, freight
- **The Result:** A fiscal "Big Data" that can be used to provide a granular view of the economy.

Methodology: The Main Goal

Our goal is to **disaggregate** the official GFCF vector: from a vector 126×1 to a matrix $126 \times 1,836$.



Methodology: A Three-Part Approach

Of the 34 products that make up GFCF, we address the data gap in 3 ways.

Product Classification	# of Products	Primary Data Source
Available in NF-e	16	**Electronic Invoice (NF-e)**
Unitary Allocation	11	National / Regional Accounts (IBGE)
General Allocation	7	National / Regional Accounts (IBGE)

Most of the value of industrial capital goods comes directly from NF-e data, requiring few simplifying assumptions.

Available products in NF-e

Classification	Code	Description
Available in NF-e	01921	Cattle and other live animals, animal products, hunting and services
	01923	Pigs
	25001	Metal products, excluding machinery and equipment
	26002	Office machines and computer equipment
	26003	Electronic material and communications equipment
	26004	Optical and electromedical measuring, testing and control equipment
	27001	Electrical machines, devices and materials
	27002	Home appliances
	28001	Tractors and other agricultural machinery
	28002	Machines for mineral extraction and construction
	28003	Other mechanical machinery and equipment
	29911	Cars, vans and utility vehicles
	29912	Trucks and buses, including cabins, bodies and trailers
	30001	Aircraft, vessels and other transport equipment
	31801	Furniture
	31802	Products from various industries

Methodology: Filling the Gaps

For the 18 products not captured by the NF-e:

1. Unitary Allocation:

- Products with specific sectoral demand (e.g., coffee beans for agriculture).
- Investment demand is distributed based on the production of that specific sector.

2. General Allocation:

- Broadly used products, such as **construction**.
- Demand is distributed using the gross production value of the activities as a weight.

For both cases, the **IBGE Regional Accounts** were used for disaggregation among the 27 states.

Products with unitary allocation

Classification	Code	Description
Unitary allocation	01917	Orange
	01918	Coffee beans
	01919	Other permanent crop products
	01924	Birds and eggs
	02801	Products from forestry and silviculture
	06801	Oil, natural gas and support services
	16001	Wooden products, excluding furniture
	24912	Semi-finished, flat rolled, long and steel tubes
	26001	Electronic components
	33001	Maintenance, repair and installation of machinery and equipment
	71802	Architectural and engineering services

Products with general allocation

Classification	Code	Description
General allocation	41801	Buildings
	41802	Infrastructure works
	41803	Specialized services for construction
	45801	Wholesale and retail trade
	49001+50001	Cargo transport (land and water)
	62801	Development of systems and other information services
	71801	Research and development

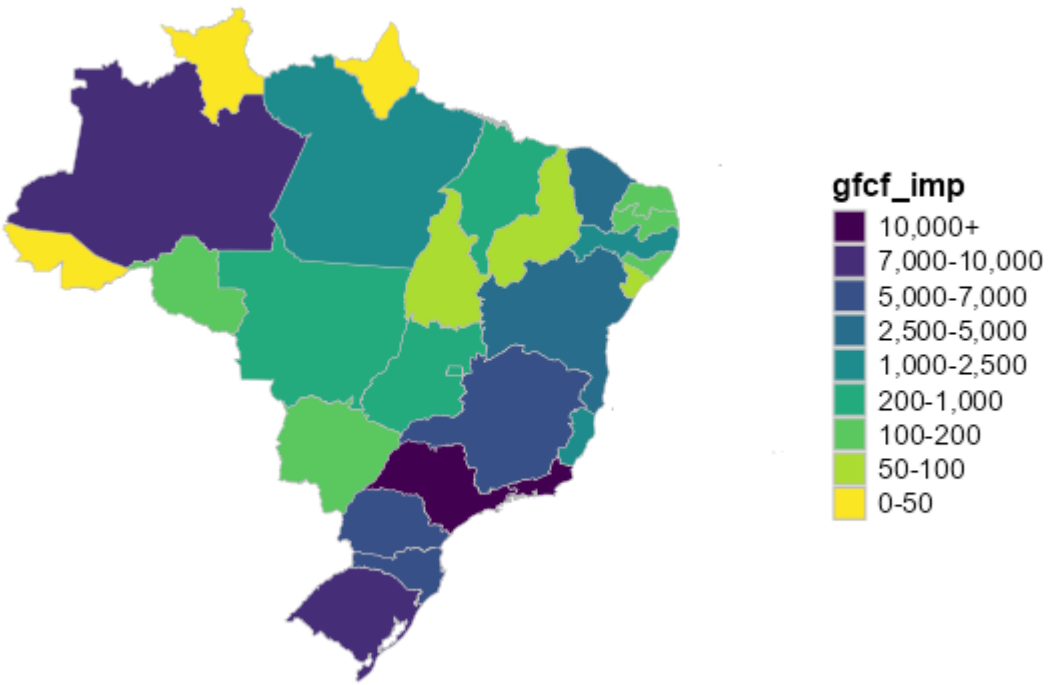
Results: Demand for Domestic Capital Goods

Demand for domestically produced capital goods by state, 2018, BRL billions

Observations:

- Strong concentration in the **Southeast** and **South** regions.
- Highlights for **Midwest** (agribusiness) and **Northeast** states.
- Lowest investment levels in the **North** region.

Results: Demand for Imported Capital Goods



Demand for imported capital goods by state, 2018, BRL millions

Observations:

- The pattern is generally similar to that of domestic goods.
- **Main exception:** The state of **Amazonas.**

The Case of Amazonas: The Power of Granularity

Why does Amazonas stand out so much in imports?

The **Manaus Free Trade Zone**.

- An industrial hub with strong tax incentives.
- It concentrates high value-added industries (electronics, motorcycles).
- These industries are **highly dependent** on imported machinery and equipment.

This is an insight that only the granularity of NF-e data allows us to observe clearly.

Conclusion & Next Steps

What we achieved:

- We developed an innovative methodology to build regional CFTs using NF-e data.
- We created the most detailed view of Brazil's investment structure to date.
- We simplified the estimation process, increasing accuracy.

Limitations & Future:

- **Main Limitation:** The NF-e does not capture goods and services related to **construction** well.
- **Next Steps:**
  - Develop proxies for construction demand using other NF-e indicators.
  - Apply the CFT data in dynamic economic models for public policy analysis.

Thank You!

Questions?

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