

Studying the Relationship between IP, Innovation and Economic Performance: Adequate Data and Empirical Approaches

Christian Helmers

U Oxford

May 2010

Joint WIPO-INPI Seminar on
IP, Industrial Strategy, and Economic Development
Rio de Janeiro

Overview

Brazilian manufacturing firms suffer from limited technological investment, lack of larger investments in R&D and are extremely centered in the acquisition of embodied technology in machines and equipments. (Kannebley et al., 2010)

Overview

Brazilian manufacturing firms suffer from limited technological investment, lack of larger investments in R&D and are extremely centered in the acquisition of embodied technology in machines and equipments. (Kannebley et al., 2010)

- ▶ What is the evidence base? What is the role of IP?

Overview

Brazilian manufacturing firms suffer from limited technological investment, lack of larger investments in R&D and are extremely centered in the acquisition of embodied technology in machines and equipments. (Kannebley et al., 2010)

- ▶ What is the evidence base? What is the role of IP?
 - ▶ Data

Overview

Brazilian manufacturing firms suffer from limited technological investment, lack of larger investments in R&D and are extremely centered in the acquisition of embodied technology in machines and equipments. (Kannebley et al., 2010)

- ▶ What is the evidence base? What is the role of IP?
 - ▶ Data
 - ▶ Empirical work

Overview

Brazilian manufacturing firms suffer from limited technological investment, lack of larger investments in R&D and are extremely centered in the acquisition of embodied technology in machines and equipments. (Kannebley et al., 2010)

- ▶ What is the evidence base? What is the role of IP?
 - ▶ Data
 - ▶ Empirical work
- ▶ **Challenge:** Expand evidence base — data & empirical strategy to inform policy-making in Brazil

Overview

Brazilian manufacturing firms suffer from limited technological investment, lack of larger investments in R&D and are extremely centered in the acquisition of embodied technology in machines and equipments. (Kannebley et al., 2010)

- ▶ What is the evidence base? What is the role of IP?
 - ▶ Data
 - ▶ Empirical work
- ▶ **Challenge:** Expand evidence base — data & empirical strategy to inform policy-making in Brazil
- ▶ This presentation:

Overview

Brazilian manufacturing firms suffer from limited technological investment, lack of larger investments in R&D and are extremely centered in the acquisition of embodied technology in machines and equipments. (Kannebley et al., 2010)

- ▶ What is the evidence base? What is the role of IP?
 - ▶ Data
 - ▶ Empirical work
- ▶ **Challenge:** Expand evidence base — data & empirical strategy to inform policy-making in Brazil
- ▶ This presentation:
 - ▶ Broad Overview of existing data and analysis (non-exhaustive)

Overview

Brazilian manufacturing firms suffer from limited technological investment, lack of larger investments in R&D and are extremely centered in the acquisition of embodied technology in machines and equipments. (Kannebley et al., 2010)

- ▶ What is the evidence base? What is the role of IP?
 - ▶ Data
 - ▶ Empirical work
- ▶ **Challenge:** Expand evidence base — data & empirical strategy to inform policy-making in Brazil
- ▶ This presentation:
 - ▶ Broad Overview of existing data and analysis (non-exhaustive)
 - ▶ Overview of existing data and analysis in Brazil (non-exhaustive)

Overview

Brazilian manufacturing firms suffer from limited technological investment, lack of larger investments in R&D and are extremely centered in the acquisition of embodied technology in machines and equipments. (Kannebley et al., 2010)

- ▶ What is the evidence base? What is the role of IP?
 - ▶ Data
 - ▶ Empirical work
- ▶ **Challenge:** Expand evidence base — data & empirical strategy to inform policy-making in Brazil
- ▶ This presentation:
 - ▶ Broad Overview of existing data and analysis (non-exhaustive)
 - ▶ Overview of existing data and analysis in Brazil (non-exhaustive)
 - ▶ Suggestions for further research

Data: What are we looking for?

[I]nnovation - the attempt to try out new or improved products, processes or ways to do things - is an aspect of most if not all economic activities. (Fagerberg et al., 2009:1)

Data: What are we looking for?

[I]nnovation - the attempt to try out new or improved products, processes or ways to do things - is an aspect of most if not all economic activities. (Fagerberg et al., 2009:1)

- ▶ How do we measure this?

Data: What are we looking for?

[I]nnovation - the attempt to try out new or improved products, processes or ways to do things - is an aspect of most if not all economic activities. (Fagerberg et al., 2009:1)

- ▶ How do we measure this?
 - ▶ R&D, Innovation Surveys, IPRs, academic publications, etc...

Data: What are we looking for?

[I]nnovation - the attempt to try out new or improved products, processes or ways to do things - is an aspect of most if not all economic activities. (Fagerberg et al., 2009:1)

- ▶ How do we measure this?
 - ▶ R&D, Innovation Surveys, IPRs, academic publications, etc...
- ▶ What does it tell us?

Data: What are we looking for?

[I]nnovation - the attempt to try out new or improved products, processes or ways to do things - is an aspect of most if not all economic activities. (Fagerberg et al., 2009:1)

- ▶ How do we measure this?
 - ▶ R&D, Innovation Surveys, IPRs, academic publications, etc...
- ▶ What does it tell us?
 - ▶ Not that much...in isolation - above all IPRs (give right of **exclusion of third parties**)

Existing integrated data sets: An Overview

- ▶ OECD WPIA micro-data project: Finland, France, Germany, Spain, Sweden, Switzerland, UK, US

Existing integrated data sets: An Overview

- ▶ OECD WPIA micro-data project: Finland, France, Germany, Spain, Sweden, Switzerland, UK, US
 - ▶ France: French Business Registers, fiscal files and INPI/PATSTAT (Lelarge, 2009)

Existing integrated data sets: An Overview

- ▶ OECD WPIA micro-data project: Finland, France, Germany, Spain, Sweden, Switzerland, UK, US
 - ▶ France: French Business Registers, fiscal files and INPI/PATSTAT (Lelarge, 2009)
 - ▶ UK: FAME with PATSTAT, trademarks and community designs (Helmers and Rogers, 2009)

Existing integrated data sets: An Overview

- ▶ OECD WPIA micro-data project: Finland, France, Germany, Spain, Sweden, Switzerland, UK, US
 - ▶ France: French Business Registers, fiscal files and INPI/PATSTAT (Lelarge, 2009)
 - ▶ UK: FAME with PATSTAT, trademarks and community designs (Helmets and Rogers, 2009)
 - ▶ US: NBER Patent data project (Hall et al., 2001; Cockburn et al., 2009); trademark data with US Business Register and Longitudinal Business Database (Klimek and Krizan, 2009)

Existing integrated data sets: An Overview

- ▶ OECD WPIA micro-data project: Finland, France, Germany, Spain, Sweden, Switzerland, UK, US
 - ▶ France: French Business Registers, fiscal files and INPI/PATSTAT (Lelarge, 2009)
 - ▶ UK: FAME with PATSTAT, trademarks and community designs (Helmets and Rogers, 2009)
 - ▶ US: NBER Patent data project (Hall et al., 2001; Cockburn et al., 2009); trademark data with US Business Register and Longitudinal Business Database (Klimek and Krizan, 2009)
- ▶ PATSTAT & USPTO with Amadeus: ~11 mio. firms across 41 European countries (Thoma and Torrisi, 2007; Thoma et al., 2010)
Comment: Lack of R&D data in Amadeus

Existing integrated data sets: An Overview

- ▶ OECD WPIA micro-data project: Finland, France, Germany, Spain, Sweden, Switzerland, UK, US
 - ▶ France: French Business Registers, fiscal files and INPI/PATSTAT (Lelarge, 2009)
 - ▶ UK: FAME with PATSTAT, trademarks and community designs (Helmets and Rogers, 2009)
 - ▶ US: NBER Patent data project (Hall et al., 2001; Cockburn et al., 2009); trademark data with US Business Register and Longitudinal Business Database (Klimek and Krizan, 2009)
- ▶ PATSTAT & USPTO with Amadeus: ~11 mio. firms across 41 European countries (Thoma and Torrisi, 2007; Thoma et al., 2010)
Comment: Lack of R&D data in Amadeus
- ▶ Eurostat Community Innovation Survey (CIS) (Abramovsky et al., 2004; and Griffith et al., 2006) **Comment:** Reliance on self-reporting by firms; data access an issue

Existing integrated data sets: An Overview

- ▶ OECD WPIA micro-data project: Finland, France, Germany, Spain, Sweden, Switzerland, UK, US
 - ▶ France: French Business Registers, fiscal files and INPI/PATSTAT (Lelarge, 2009)
 - ▶ UK: FAME with PATSTAT, trademarks and community designs (Helmers and Rogers, 2009)
 - ▶ US: NBER Patent data project (Hall et al., 2001; Cockburn et al., 2009); trademark data with US Business Register and Longitudinal Business Database (Klimek and Krizan, 2009)
- ▶ PATSTAT & USPTO with Amadeus: ~11 mio. firms across 41 European countries (Thoma and Torrisi, 2007; Thoma et al., 2010)
Comment: Lack of R&D data in Amadeus
- ▶ Eurostat Community Innovation Survey (CIS) (Abramovsky et al., 2004; and Griffith et al., 2006) **Comment:** Reliance on self-reporting by firms; data access an issue
- ▶ Intangibles approach (Corrado, Hulten, and Sichel, 2006)

Empirical Approach: Observational data

- ▶ **Descriptive approaches:** Distribution of object of interest presented directly or modeled in 'naive' ways

Empirical Approach: Observational data

- ▶ **Descriptive approaches:** Distribution of object of interest presented directly or modeled in 'naive' ways
 - ▶ Comment: Observed distribution of IP across firms not random

Empirical Approach: Observational data

- ▶ **Descriptive approaches:** Distribution of object of interest presented directly or modeled in 'naive' ways
 - ▶ Comment: Observed distribution of IP across firms not random
 - > Firms choose (not) to use IP - Selection Problem

Empirical Approach: Observational data

- ▶ **Descriptive approaches:** Distribution of object of interest presented directly or modeled in 'naive' ways
 - ▶ Comment: Observed distribution of IP across firms not random
 - > Firms choose (not) to use IP - Selection Problem
 - > Firm's performance influences IP - Simultaneity Problem

Empirical Approach: Observational data

- ▶ **Descriptive approaches:** Distribution of object of interest presented directly or modeled in ‘naive’ ways
 - ▶ Comment: Observed distribution of IP across firms not random
 - > Firms choose (not) to use IP - Selection Problem
 - > Firm’s performance influences IP - Simultaneity Problem
 - >>> Limited insight wrt **causal** determinants of observed equilibrium outcome

Empirical Approach: Observational data

- ▶ **Descriptive approaches:** Distribution of object of interest presented directly or modeled in ‘naive’ ways
 - ▶ Comment: Observed distribution of IP across firms not random
 - > Firms choose (not) to use IP - Selection Problem
 - > Firm’s performance influences IP - Simultaneity Problem
 - >>> Limited insight wrt **causal** determinants of observed equilibrium outcome
- ▶ **Structural approaches:** Employ underlying economic theory to model distributions

Empirical Approach: Observational and Experimental Data

- ▶ **Treatment literature:** Isolate treatment effect

Empirical Approach: Observational and Experimental Data

- ▶ **Treatment literature:** Isolate treatment effect

Empirical Approach: Observational and Experimental Data

- ▶ **Treatment literature:** Isolate treatment effect
- ▶ **Natural and Quasi-Experiments:** Exogenous variation introduced through policy intervention or idiosyncratic shocks

Empirical Approach: Observational and Experimental Data

- ▶ **Treatment literature:** Isolate treatment effect
 - ▶ **Natural and Quasi-Experiments:** Exogenous variation introduced through policy intervention or idiosyncratic shocks
- Comment:** Credibility of (non-falsifiable) exogenous variation in observational data and external validity of results

Empirical Approach: Observational and Experimental Data

- ▶ **Treatment literature:** Isolate treatment effect
- ▶ **Natural and Quasi-Experiments:** Exogenous variation introduced through policy intervention or idiosyncratic shocks
Comment: Credibility of (non-falsifiable) exogenous variation in observational data and external validity of results
- ▶ **Experimental data:** Random allocation of an intervention ensures that individuals or firms do not self-select into treatment

Empirical Approach: Observational and Experimental Data

- ▶ **Treatment literature:** Isolate treatment effect
- ▶ **Natural and Quasi-Experiments:** Exogenous variation introduced through policy intervention or idiosyncratic shocks
Comment: Credibility of (non-falsifiable) exogenous variation in observational data and external validity of results
- ▶ **Experimental data:** Random allocation of an intervention ensures that individuals or firms do not self-select into treatment
Comment: Externalities and general equilibrium effects, changes in behavior induced by intervention, external validity

Summary of Methodological Issues: Data & measurement:

- ▶ How to measure innovation – across sectors (services)

Summary of Methodological Issues: Data & measurement:

- ▶ How to measure innovation – across sectors (services)
- ▶ Qualitative vs. quantitative measurement of innovation

Summary of Methodological Issues: Data & measurement:

- ▶ How to measure innovation – across sectors (services)
- ▶ Qualitative vs. quantitative measurement of innovation
- ▶ Well-documented issues related to name-matching (Chesher and Nesheim, 2006; Ridder and Moffitt, 2007)

Summary of Methodological Issues: Data & measurement:

- ▶ How to measure innovation – across sectors (services)
- ▶ Qualitative vs. quantitative measurement of innovation
- ▶ Well-documented issues related to name-matching (Chesher and Nesheim, 2006; Ridder and Moffitt, 2007)
- ▶ Information on directors necessary if IP held by individuals

Summary of Methodological Issues: Data & measurement:

- ▶ How to measure innovation – across sectors (services)
- ▶ Qualitative vs. quantitative measurement of innovation
- ▶ Well-documented issues related to name-matching (Chesher and Nesheim, 2006; Ridder and Moffitt, 2007)
- ▶ Information on directors necessary if IP held by individuals
- ▶ Firm name changes over time

Summary of Methodological Issues: Data & measurement:

- ▶ How to measure innovation – across sectors (services)
- ▶ Qualitative vs. quantitative measurement of innovation
- ▶ Well-documented issues related to name-matching (Chesher and Nesheim, 2006; Ridder and Moffitt, 2007)
- ▶ Information on directors necessary if IP held by individuals
- ▶ Firm name changes over time
- ▶ Transfer/assignment of patents

Summary of Methodological Issues: Data & measurement:

- ▶ How to measure innovation – across sectors (services)
- ▶ Qualitative vs. quantitative measurement of innovation
- ▶ Well-documented issues related to name-matching (Chesher and Nesheim, 2006; Ridder and Moffitt, 2007)
- ▶ Information on directors necessary if IP held by individuals
- ▶ Firm name changes over time
- ▶ Transfer/assignment of patents
- ▶ Ownership structure of firms (important as evidence from Pintec suggests that innovative firms belong to groups)

Summary of Methodological Issues: Data & measurement:

- ▶ How to measure innovation – across sectors (services)
- ▶ Qualitative vs. quantitative measurement of innovation
- ▶ Well-documented issues related to name-matching (Chesher and Nesheim, 2006; Ridder and Moffitt, 2007)
- ▶ Information on directors necessary if IP held by individuals
- ▶ Firm name changes over time
- ▶ Transfer/assignment of patents
- ▶ Ownership structure of firms (important as evidence from Pintec suggests that innovative firms belong to groups)
- ▶ Item non-response – information not missing at random

Summary of Methodological Issues: Data & measurement:

- ▶ How to measure innovation – across sectors (services)
- ▶ Qualitative vs. quantitative measurement of innovation
- ▶ Well-documented issues related to name-matching (Chesher and Nesheim, 2006; Ridder and Moffitt, 2007)
- ▶ Information on directors necessary if IP held by individuals
- ▶ Firm name changes over time
- ▶ Transfer/assignment of patents
- ▶ Ownership structure of firms (important as evidence from Pintec suggests that innovative firms belong to groups)
- ▶ Item non-response – information not missing at random
- ▶ Sample attrition (due to sampling, failure, M&A)

Summary of Methodological Issues: Identification & estimation

- ▶ Model strategic behavior (single-agent models restrictive) - but identification difficult (Helmers, 2010a; Helmers and Patnam, 2010)

Summary of Methodological Issues: Identification & estimation

- ▶ Model strategic behavior (single-agent models restrictive) - but identification difficult (Helmers, 2010a; Helmers and Patnam, 2010)
- ▶ Can we ignore spillovers when estimating private returns (Eberhardt, Helmers, and Strauss, 2010)?

Summary of Methodological Issues: Identification & estimation

- ▶ Model strategic behavior (single-agent models restrictive) - but identification difficult (Helmers, 2010a; Helmers and Patnam, 2010)
- ▶ Can we ignore spillovers when estimating private returns (Eberhardt, Helmers, and Strauss, 2010)?
- ▶ Lots of heterogeneity - need to account for heterogeneity rather than ignore or eliminate

Summary of Methodological Issues: Identification & estimation

- ▶ Model strategic behavior (single-agent models restrictive) - but identification difficult (Helmers, 2010a; Helmers and Patnam, 2010)
- ▶ Can we ignore spillovers when estimating private returns (Eberhardt, Helmers, and Strauss, 2010)?
- ▶ Lots of heterogeneity - need to account for heterogeneity rather than ignore or eliminate
- ▶ Conditional mean not always most interesting object of interest (Helmers, 2010b)

Summary of Methodological Issues: Identification & estimation

- ▶ Model strategic behavior (single-agent models restrictive) - but identification difficult (Helmets, 2010a; Helmets and Patnam, 2010)
- ▶ Can we ignore spillovers when estimating private returns (Eberhardt, Helmets, and Strauss, 2010)?
- ▶ Lots of heterogeneity - need to account for heterogeneity rather than ignore or eliminate
- ▶ Conditional mean not always most interesting object of interest (Helmets, 2010b)
- ▶ Need to separate persistence due to unobserved heterogeneity and state dependence (in patenting/R&D)

Existing research on Brazil: An Overview

[In Brazil] firm-level studies became possible only after 2002, when the Brazilian Institute of Geography and Statistics (IBGE) released a survey on technological innovation at the firm level (PINTEC) (Worldbank, 2007: 70)

Existing research on Brazil: An Overview

[In Brazil] firm-level studies became possible only after 2002, when the Brazilian Institute of Geography and Statistics (IBGE) released a survey on technological innovation at the firm level (PINTEC) (Worldbank, 2007: 70)

- ▶ What has been published using Brazilian data?

Existing research on Brazil: An Overview

[In Brazil] firm-level studies became possible only after 2002, when the Brazilian Institute of Geography and Statistics (IBGE) released a survey on technological innovation at the firm level (PINTEC) (Worldbank, 2007: 70)

- ▶ What has been published using Brazilian data?
- ▶ Review organized by data rather than methods

Existing research on Brazil: An Overview

[In Brazil] firm-level studies became possible only after 2002, when the Brazilian Institute of Geography and Statistics (IBGE) released a survey on technological innovation at the firm level (PINTEC) (Worldbank, 2007: 70)

- ▶ What has been published using Brazilian data?
- ▶ Review organized by data rather than methods
 - ▶ Patents

Existing research on Brazil: An Overview

[In Brazil] firm-level studies became possible only after 2002, when the Brazilian Institute of Geography and Statistics (IBGE) released a survey on technological innovation at the firm level (PINTEC) (Worldbank, 2007: 70)

- ▶ What has been published using Brazilian data?
- ▶ Review organized by data rather than methods
 - ▶ Patents
 - ▶ PINTEC Innovation Survey

Existing research on Brazil: An Overview

[In Brazil] firm-level studies became possible only after 2002, when the Brazilian Institute of Geography and Statistics (IBGE) released a survey on technological innovation at the firm level (PINTEC) (Worldbank, 2007: 70)

- ▶ What has been published using Brazilian data?
- ▶ Review organized by data rather than methods
 - ▶ Patents
 - ▶ PINTEC Innovation Survey
 - ▶ PAEP Innovation Survey

Existing research on Brazil: An Overview

[In Brazil] firm-level studies became possible only after 2002, when the Brazilian Institute of Geography and Statistics (IBGE) released a survey on technological innovation at the firm level (PINTEC) (Worldbank, 2007: 70)

- ▶ What has been published using Brazilian data?
- ▶ Review organized by data rather than methods
 - ▶ Patents
 - ▶ PINTEC Innovation Survey
 - ▶ PAEP Innovation Survey
 - ▶ World Bank Investment Climate Survey

Existing research on Brazil: An Overview

[In Brazil] firm-level studies became possible only after 2002, when the Brazilian Institute of Geography and Statistics (IBGE) released a survey on technological innovation at the firm level (PINTEC) (Worldbank, 2007: 70)

- ▶ What has been published using Brazilian data?
- ▶ Review organized by data rather than methods
 - ▶ Patents
 - ▶ PINTEC Innovation Survey
 - ▶ PAEP Innovation Survey
 - ▶ World Bank Investment Climate Survey
 - ▶ Other

Patents

- ▶ Fally, Paillacar, and Terra (2010): this paper is **not** about innovation (it's about the relation between trade costs and wage disparity)

Patents

- ▶ Fally, Paillacar, and Terra (2010): this paper is **not** about innovation (it's about the relation between trade costs and wage disparity)
- ▶ Data: manufacturing sector worker-, firm-, industry-level for 1999

Patents

- ▶ Fally, Paillacar, and Terra (2010): this paper is **not** about innovation (it's about the relation between trade costs and wage disparity)
- ▶ Data: manufacturing sector worker-, firm-, industry-level for 1999
 - ▶ Annual Report of Social Information (RAIS) Ministry of Labor and Employment

Patents

- ▶ Fally, Paillacar, and Terra (2010): this paper is **not** about innovation (it's about the relation between trade costs and wage disparity)
- ▶ Data: manufacturing sector worker-, firm-, industry-level for 1999
 - ▶ Annual Report of Social Information (RAIS) Ministry of Labor and Employment
 - ▶ Annual Survey of Manufacturing firms (PIA) IBGE

Patents

- ▶ Fally, Paillacar, and Terra (2010): this paper is **not** about innovation (it's about the relation between trade costs and wage disparity)
- ▶ Data: manufacturing sector worker-, firm-, industry-level for 1999
 - ▶ Annual Report of Social Information (RAIS) Ministry of Labor and Employment
 - ▶ Annual Survey of Manufacturing firms (PIA) IBGE
 - ▶ Balance sheet data IBRE-FGV

Patents

- ▶ Fally, Paillacar, and Terra (2010): this paper is **not** about innovation (it's about the relation between trade costs and wage disparity)
- ▶ Data: manufacturing sector worker-, firm-, industry-level for 1999
 - ▶ Annual Report of Social Information (RAIS) Ministry of Labor and Employment
 - ▶ Annual Survey of Manufacturing firms (PIA) IBGE
 - ▶ Balance sheet data IBRE-FGV
 - ▶ **Patent data** by INPI

Patents

- ▶ Fally, Paillacar, and Terra (2010): this paper is **not** about innovation (it's about the relation between trade costs and wage disparity)
- ▶ Data: manufacturing sector worker-, firm-, industry-level for 1999
 - ▶ Annual Report of Social Information (RAIS) Ministry of Labor and Employment
 - ▶ Annual Survey of Manufacturing firms (PIA) IBGE
 - ▶ Balance sheet data IBRE-FGV
 - ▶ **Patent data** by INPI
- >>> Matched by firm's identification number (CNPJ) (including patents?!)

Patents

- ▶ Fally, Paillacar, and Terra (2010): this paper is **not** about innovation (it's about the relation between trade costs and wage disparity)
- ▶ Data: manufacturing sector worker-, firm-, industry-level for 1999
 - ▶ Annual Report of Social Information (RAIS) Ministry of Labor and Employment
 - ▶ Annual Survey of Manufacturing firms (PIA) IBGE
 - ▶ Balance sheet data IBRE-FGV
 - ▶ **Patent data** by INPI
- >>> Matched by firm's identification number (CNPJ) (including patents?!)
 - ▶ Industry-region-level trade data and state-level characteristics

IBGE PINTEC – Overview (IBGE, 2002, 2005, 2007)

- ▶ Pintec: 2000, 2003, 2005, 2008 (following the Eurostat CIS model)

IBGE PINTEC – Overview (IBGE, 2002, 2005, 2007)

- ▶ Pintec: 2000, 2003, 2005, 2008 (following the Eurostat CIS model)
 - ▶ Pintec 2000: 72,005 manufacturing firms with >10 employees

IBGE PINTEC – Overview (IBGE, 2002, 2005, 2007)

- ▶ Pintec: 2000, 2003, 2005, 2008 (following the Eurostat CIS model)
 - ▶ Pintec 2000: 72,005 manufacturing firms with >10 employees
 - ▶ Pintec 2003: 84,000 manufacturing firms with >10 employees

IBGE PINTEC – Overview (IBGE, 2002, 2005, 2007)

- ▶ Pintec: 2000, 2003, 2005, 2008 (following the Eurostat CIS model)
 - ▶ Pintec 2000: 72,005 manufacturing firms with >10 employees
 - ▶ Pintec 2003: 84,000 manufacturing firms with >10 employees
 - ▶ Pintec 2005: 96,000 manufacturing firms & 4,000 service firms (telecom, IT, R&D) with >10 employees

IBGE PINTEC – Overview (IBGE, 2002, 2005, 2007)

- ▶ Pintec: 2000, 2003, 2005, 2008 (following the Eurostat CIS model)
 - ▶ Pintec 2000: 72,005 manufacturing firms with >10 employees
 - ▶ Pintec 2003: 84,000 manufacturing firms with >10 employees
 - ▶ Pintec 2005: 96,000 manufacturing firms & 4,000 service firms (telecom, IT, R&D) with >10 employees
- ▶ Range of data on innovation: R&D, product and process innovations (and scope within firm or market)

IBGE PINTEC – Overview (IBGE, 2002, 2005, 2007)

- ▶ Pintec: 2000, 2003, 2005, 2008 (following the Eurostat CIS model)
 - ▶ Pintec 2000: 72,005 manufacturing firms with >10 employees
 - ▶ Pintec 2003: 84,000 manufacturing firms with >10 employees
 - ▶ Pintec 2005: 96,000 manufacturing firms & 4,000 service firms (telecom, IT, R&D) with >10 employees
- ▶ Range of data on innovation: R&D, product and process innovations (and scope within firm or market)
- ▶ ‘New to the firm’ includes imitation

IBGE PINTEC – Overview (IBGE, 2002, 2005, 2007)

- ▶ Pintec: 2000, 2003, 2005, 2008 (following the Eurostat CIS model)
 - ▶ Pintec 2000: 72,005 manufacturing firms with >10 employees
 - ▶ Pintec 2003: 84,000 manufacturing firms with >10 employees
 - ▶ Pintec 2005: 96,000 manufacturing firms & 4,000 service firms (telecom, IT, R&D) with >10 employees
- ▶ Range of data on innovation: R&D, product and process innovations (and scope within firm or market)
- ▶ ‘New to the firm’ includes imitation
- ▶ Stratified sampling

IBGE PINTEC – Overview (IBGE, 2002, 2005, 2007)

- ▶ Pintec: 2000, 2003, 2005, 2008 (following the Eurostat CIS model)
 - ▶ Pintec 2000: 72,005 manufacturing firms with >10 employees
 - ▶ Pintec 2003: 84,000 manufacturing firms with >10 employees
 - ▶ Pintec 2005: 96,000 manufacturing firms & 4,000 service firms (telecom, IT, R&D) with >10 employees
- ▶ Range of data on innovation: R&D, product and process innovations (and scope within firm or market)
- ▶ ‘New to the firm’ includes imitation
- ▶ Stratified sampling
- ▶ *The [...] most problematic issue regards the ability of the [innovation] surveys to [...] describe innovation beyond the “success stories”. In the Brazilian case the answer is negative: there is a bias towards very large and innovative firms.*
(Bogliacino et al., 2009: 7)

Pintec – Type and Rate of Innovation among Brazilian Firms (in % of firms with >10 employees)

	1998-2000	2001-03
Innovation rate		
Product	6.3	6.4
Process	13.9	12.9
Product and process	11.3	14.0
Any of the above type of innovation	31.5	33.3
Innovation rate by size of firms		
Product innovation rate		
Small firms (10-49 employees)	14.1	19.3
Large firms (>500 employees)	59.4	54.3
Process innovation rate		
Small firms (10-49 employees)	21.0	24.8
Large firms (>500 employees)	68.0	64.4

Notes:

Source: Worldbank (2007), data from PINTEC.

Pintec – Core reference

- ▶ De Negri and Salerno (2005): ‘Inovações, Padrões Tecnológicos e Desempenho das Firms Industriais Brasileiras,’ IPEA.

Pintec – Core reference

- ▶ De Negri and Salerno (2005): ‘Inovações, Padrões Tecnológicos e Desempenho das Firms Industriais Brasileiras,’ IPEA.
- ▶ Core data - integrated data set:

Pintec – Core reference

- ▶ De Negri and Salerno (2005): ‘Inovações, Padrões Tecnológicos e Desempenho das Firms Industriais Brasileiras,’ IPEA.
- ▶ Core data - integrated data set:
 - ▶ Technological Innovation Survey of Manufacturing Firms (Pintec) – IBGE

Pintec – Core reference

- ▶ De Negri and Salerno (2005): ‘Inovações, Padrões Tecnológicos e Desempenho das Firms Industriais Brasileiras,’ IPEA.
- ▶ Core data - integrated data set:
 - ▶ Technological Innovation Survey of Manufacturing Firms (Pintec) – IBGE
 - ▶ Annual Survey of Manufacturing firms (PIA) – IBGE

Pintec – Core reference

- ▶ De Negri and Salerno (2005): ‘Inovações, Padrões Tecnológicos e Desempenho das Firms Industriais Brasileiras,’ IPEA.
- ▶ Core data - integrated data set:
 - ▶ Technological Innovation Survey of Manufacturing Firms (Pintec) – IBGE
 - ▶ Annual Survey of Manufacturing firms (PIA) – IBGE
 - ▶ Foreign trade data (SECEX) – Ministry of Development, Industry and Foreign Trade (MDIC)

Pintec – Core reference

- ▶ De Negri and Salerno (2005): ‘Inovações, Padrões Tecnológicos e Desempenho das Firms Industriais Brasileiras,’ IPEA.
- ▶ Core data - integrated data set:
 - ▶ Technological Innovation Survey of Manufacturing Firms (Pintec) – IBGE
 - ▶ Annual Survey of Manufacturing firms (PIA) – IBGE
 - ▶ Foreign trade data (SECEX) – Ministry of Development, Industry and Foreign Trade (MDIC)
 - ▶ Annual Report of Social Information (RAIS) – Ministry of Labor and Employment

Pintec – Core reference

- ▶ De Negri and Salerno (2005): ‘Inovações, Padrões Tecnológicos e Desempenho das Firms Industriais Brasileiras,’ IPEA.
- ▶ Core data - integrated data set:
 - ▶ Technological Innovation Survey of Manufacturing Firms (Pintec) – IBGE
 - ▶ Annual Survey of Manufacturing firms (PIA) – IBGE
 - ▶ Foreign trade data (SECEX) – Ministry of Development, Industry and Foreign Trade (MDIC)
 - ▶ Annual Report of Social Information (RAIS) – Ministry of Labor and Employment
 - ▶ Foreign Capital Census (CCE) and Brazilian Capital Abroad (CBE) – Brazilian Central Bank (BACEN)

Pintec – Core reference

- ▶ De Negri and Salerno (2005): ‘Inovações, Padrões Tecnológicos e Desempenho das Firms Industriais Brasileiras,’ IPEA.
- ▶ Core data - integrated data set:
 - ▶ Technological Innovation Survey of Manufacturing Firms (Pintec) – IBGE
 - ▶ Annual Survey of Manufacturing firms (PIA) – IBGE
 - ▶ Foreign trade data (SECEX) – Ministry of Development, Industry and Foreign Trade (MDIC)
 - ▶ Annual Report of Social Information (RAIS) – Ministry of Labor and Employment
 - ▶ Foreign Capital Census (CCE) and Brazilian Capital Abroad (CBE) – Brazilian Central Bank (BACEN)
 - ▶ Government purchases (ComprasNet) of Ministry of Planning, Budget, and Public Administration (MPOG)

Pintec – Core reference

- ▶ De Negri and Salerno (2005): ‘Inovações, Padrões Tecnológicos e Desempenho das Firms Industriais Brasileiras,’ IPEA.
- ▶ Core data - integrated data set:
 - ▶ Technological Innovation Survey of Manufacturing Firms (Pintec) – IBGE
 - ▶ Annual Survey of Manufacturing firms (PIA) – IBGE
 - ▶ Foreign trade data (SECEX) – Ministry of Development, Industry and Foreign Trade (MDIC)
 - ▶ Annual Report of Social Information (RAIS) – Ministry of Labor and Employment
 - ▶ Foreign Capital Census (CCE) and Brazilian Capital Abroad (CBE) – Brazilian Central Bank (BACEN)
 - ▶ Government purchases (ComprasNet) of Ministry of Planning, Budget, and Public Administration (MPOG)
- >>> Matched by firm’s identification number (CNPJ)

Pintec – Core reference

- ▶ De Negri and Salerno (2005): ‘Inovações, Padrões Tecnológicos e Desempenho das Firms Industriais Brasileiras,’ IPEA.
- ▶ Core data - integrated data set:
 - ▶ Technological Innovation Survey of Manufacturing Firms (Pintec) – IBGE
 - ▶ Annual Survey of Manufacturing firms (PIA) – IBGE
 - ▶ Foreign trade data (SECEX) – Ministry of Development, Industry and Foreign Trade (MDIC)
 - ▶ Annual Report of Social Information (RAIS) – Ministry of Labor and Employment
 - ▶ Foreign Capital Census (CCE) and Brazilian Capital Abroad (CBE) – Brazilian Central Bank (BACEN)
 - ▶ Government purchases (ComprasNet) of Ministry of Planning, Budget, and Public Administration (MPOG)
- >>> Matched by firm’s identification number (CNPJ)
 - ▶ Covers 1996-2002 (extended to 2005)

Pintec – Descriptive use

- ▶ Associação Nacional de Pesquisa e Desenvolvimento das Empresas Inovadoras (ANPEI) (2004, 2006, 2009)

Pintec – Descriptive use

- ▶ Associação Nacional de Pesquisa e Desenvolvimento das Empresas Inovadoras (ANPEI) (2004, 2006, 2009)
- ▶ Worldbank (2007): most important source of innovation purchases of capital goods; positive correlation between productivity and innovation

Pintec – Descriptive use

- ▶ Associação Nacional de Pesquisa e Desenvolvimento das Empresas Inovadoras (ANPEI) (2004, 2006, 2009)
- ▶ Worldbank (2007): most important source of innovation purchases of capital goods; positive correlation between productivity and innovation
- ▶ Kannebley, Porto, and Pazello (2005): Pintec 2000

Pintec – Descriptive use

- ▶ Associação Nacional de Pesquisa e Desenvolvimento das Empresas Inovadoras (ANPEI) (2004, 2006, 2009)
- ▶ Worldbank (2007): most important source of innovation purchases of capital goods; positive correlation between productivity and innovation
- ▶ Kannebley, Porto, and Pazello (2005): Pintec 2000
 - ▶ Characteristics of innovating firms, determinants of firm being a product/process innovator accounting for scope of innovation (firm, market)

Pintec – Descriptive use

- ▶ Associação Nacional de Pesquisa e Desenvolvimento das Empresas Inovadoras (ANPEI) (2004, 2006, 2009)
- ▶ Worldbank (2007): most important source of innovation purchases of capital goods; positive correlation between productivity and innovation
- ▶ Kannebley, Porto, and Pazello (2005): Pintec 2000
 - ▶ Characteristics of innovating firms, determinants of firm being a product/process innovator accounting for scope of innovation (firm, market)
 - ▶ Predictors of innovation: export orientation, firm size, foreign-owned, industry-specific effects

Pintec – Cross-country comparisons

- ▶ Kannebley and de Negri (2008): Mexico, Argentina, Brazil (11,818 Brazilian, 3,502 Argentinean, 1,824 Mexican manufacturing firms for 1998-2001; ≥ 50 employees)

Pintec – Cross-country comparisons

- ▶ Kannebley and de Negri (2008): Mexico, Argentina, Brazil (11,818 Brazilian, 3,502 Argentinean, 1,824 Mexican manufacturing firms for 1998-2001; ≥ 50 employees)
Compare low- and high-tech sectors

Pintec – Cross-country comparisons

- ▶ Kannebley and de Negri (2008): Mexico, Argentina, Brazil (11,818 Brazilian, 3,502 Argentinean, 1,824 Mexican manufacturing firms for 1998-2001; ≥ 50 employees)

Compare low- and high-tech sectors

Findings: substantial differences across firms in innovation (firm vs. market), exporting, size, foreign ownership, part of group; substantial differences in innovation inputs and outputs

Pintec – Cross-country comparisons

- ▶ Kannebley and de Negri (2008): Mexico, Argentina, Brazil (11,818 Brazilian, 3,502 Argentinean, 1,824 Mexican manufacturing firms for 1998-2001; ≥ 50 employees)

Compare low- and high-tech sectors

Findings: substantial differences across firms in innovation (firm vs. market), exporting, size, foreign ownership, part of group; substantial differences in innovation inputs and outputs

Issue: **Comparing the comparable?**

Pintec – Cross-country comparisons

- ▶ Kannebley and de Negri (2008): Mexico, Argentina, Brazil (11,818 Brazilian, 3,502 Argentinean, 1,824 Mexican manufacturing firms for 1998-2001; ≥ 50 employees)

Compare low- and high-tech sectors

Findings: substantial differences across firms in innovation (firm vs. market), exporting, size, foreign ownership, part of group; substantial differences in innovation inputs and outputs

Issue: **Comparing the comparable?**

- ▶ Gonçalves, Lemos, De Negri (2007): Argentina and Brazil

Pintec – Cross-country comparisons

- ▶ Kannebley and de Negri (2008): Mexico, Argentina, Brazil (11,818 Brazilian, 3,502 Argentinean, 1,824 Mexican manufacturing firms for 1998-2001; ≥ 50 employees)

Compare low- and high-tech sectors

Findings: substantial differences across firms in innovation (firm vs. market), exporting, size, foreign ownership, part of group; substantial differences in innovation inputs and outputs

Issue: **Comparing the comparable?**

- ▶ Gonçalves, Lemos, De Negri (2007): Argentina and Brazil
- ▶ Raffo, Lhuillery, and Miotti (2008): France, Spain, Switzerland, Argentina, Brazil, Mexico

Pintec – Cross-country comparisons

- ▶ Kannebley and de Negri (2008): Mexico, Argentina, Brazil (11,818 Brazilian, 3,502 Argentinean, 1,824 Mexican manufacturing firms for 1998-2001; ≥ 50 employees)

Compare low- and high-tech sectors

Findings: substantial differences across firms in innovation (firm vs. market), exporting, size, foreign ownership, part of group; substantial differences in innovation inputs and outputs

Issue: **Comparing the comparable?**

- ▶ Gonçalves, Lemos, De Negri (2007): Argentina and Brazil
- ▶ Raffo, Lhuillery, and Miotti (2008): France, Spain, Switzerland, Argentina, Brazil, Mexico
- ▶ Araújo and Messa Silva (2007): Brazil & 7 European countries

Pintec – Analysis: Kannebley, Sekkel, and Araújo (2010)

- ▶ Pintec 2000 – Do Brazilian innovative firms exhibit superior economic performance than non-innovators?

Pintec – Analysis: Kannebley, Sekkel, and Araújo (2010)

- ▶ Pintec 2000 – Do Brazilian innovative firms exhibit superior economic performance than non-innovators?
- ▶ Observational data: 5,624 innovators and 5,473 non-innovators

Pintec – Analysis: Kannebley, Sekkel, and Araújo (2010)

- ▶ Pintec 2000 – Do Brazilian innovative firms exhibit superior economic performance than non-innovators?
- ▶ Observational data: 5,624 innovators and 5,473 non-innovators

Pintec – Analysis: Kannebley, Sekkel, and Araújo (2010)

- ▶ Pintec 2000 – Do Brazilian innovative firms exhibit superior economic performance than non-innovators?
- ▶ Observational data: 5,624 innovators and 5,473 non-innovators
- ▶ Identification:
 1. Timing assumptions: pre-innovation -> innovation -> impact
 2. Selection on observables (propensity score matching)
 3. Time-invariant unobservables
 4. Exit rule

Pintec – Analysis: Kannebley, Sekkel, and Araújo (2010)

- ▶ Pintec 2000 – Do Brazilian innovative firms exhibit superior economic performance than non-innovators?
- ▶ Observational data: 5,624 innovators and 5,473 non-innovators
- ▶ Identification:
 1. Timing assumptions: pre-innovation -> innovation -> impact
 2. Selection on observables (propensity score matching)
 3. Time-invariant unobservables
 4. Exit rule
- ▶ Underlying theoretical model: Stackelberg game but empirical implementation as single agent model

Pintec – Analysis: Kannebley, Sekkel, and Araújo (2010)

- ▶ Pintec 2000 – Do Brazilian innovative firms exhibit superior economic performance than non-innovators?
- ▶ Observational data: 5,624 innovators and 5,473 non-innovators
- ▶ Identification:
 1. Timing assumptions: pre-innovation -> innovation -> impact
 2. Selection on observables (propensity score matching)
 3. Time-invariant unobservables
 4. Exit rule
- ▶ Underlying theoretical model: Stackelberg game but empirical implementation as single agent model
- ▶ Results: Positive correlation between innovation and employment growth (11-12%), net revenue growth (18-22%), labor productivity growth (11-12%), capital productivity growth (12%), and growth of market share (20-24%)

Pintec – Analysis: Kannebley, Sekkel, and Araújo (2010)

- ▶ Pintec 2000 – Do Brazilian innovative firms exhibit superior economic performance than non-innovators?
- ▶ Observational data: 5,624 innovators and 5,473 non-innovators
- ▶ Identification:
 1. Timing assumptions: pre-innovation -> innovation -> impact
 2. Selection on observables (propensity score matching)
 3. Time-invariant unobservables
 4. Exit rule
- ▶ Underlying theoretical model: Stackelberg game but empirical implementation as single agent model
- ▶ Results: Positive correlation between innovation and employment growth (11-12%), net revenue growth (18-22%), labor productivity growth (11-12%), capital productivity growth (12%), and growth of market share (20-24%)
- ▶ See also de Negri, Esteves, and Freitas (2007) and Correa, Sanchez, and Singh (2005)

Fundação SEADE PAEP:

- ▶ PAEP (Pesquisa de Atividade Econômica Paulista): 1996, 2001 (following the Eurostat CIS model and OECD) – stratified sample confined to State of São Paulo

Fundação SEADE PAEP:

- ▶ PAEP (Pesquisa de Atividade Econômica Paulista): 1996, 2001 (following the Eurostat CIS model and OECD) – stratified sample confined to State of São Paulo
 - ▶ PAEP 1996: 22,000 firms in manufacturing, commerce, information services, banks, construction (different size cut-offs)

Fundação SEADE PAEP:

- ▶ PAEP (Pesquisa de Atividade Econômica Paulista): 1996, 2001 (following the Eurostat CIS model and OECD) – stratified sample confined to State of São Paulo
 - ▶ PAEP 1996: 22,000 firms in manufacturing, commerce, information services, banks, construction (different size cut-offs)
 - ▶ PAEP 2001: 41,000 manufacturing, 21,000 service, 11,000 commerce firms, and 194 banks (different size cut-offs)

Fundação SEADE PAEP:

- ▶ PAEP (Pesquisa de Atividade Econômica Paulista): 1996, 2001 (following the Eurostat CIS model and OECD) – stratified sample confined to State of São Paulo
 - ▶ PAEP 1996: 22,000 firms in manufacturing, commerce, information services, banks, construction (different size cut-offs)
 - ▶ PAEP 2001: 41,000 manufacturing, 21,000 service, 11,000 commerce firms, and 194 banks (different size cut-offs)
- ▶ Range of data on innovation: product and process innovations (and scope within firm or market), ICT diffusion

Fundação SEADE PAEP:

- ▶ PAEP (Pesquisa de Atividade Econômica Paulista): 1996, 2001 (following the Eurostat CIS model and OECD) – stratified sample confined to State of São Paulo
 - ▶ PAEP 1996: 22,000 firms in manufacturing, commerce, information services, banks, construction (different size cut-offs)
 - ▶ PAEP 2001: 41,000 manufacturing, 21,000 service, 11,000 commerce firms, and 194 banks (different size cut-offs)
- ▶ Range of data on innovation: product and process innovations (and scope within firm or market), ICT diffusion
- ▶ Selan and Kannebley (2007): PAEP-2001

Fundação SEADE PAEP:

- ▶ PAEP (Pesquisa de Atividade Econômica Paulista): 1996, 2001 (following the Eurostat CIS model and OECD) – stratified sample confined to State of São Paulo
 - ▶ PAEP 1996: 22,000 firms in manufacturing, commerce, information services, banks, construction (different size cut-offs)
 - ▶ PAEP 2001: 41,000 manufacturing, 21,000 service, 11,000 commerce firms, and 194 banks (different size cut-offs)
- ▶ Range of data on innovation: product and process innovations (and scope within firm or market), ICT diffusion
- ▶ Selan and Kannebley (2007): PAEP-2001
- ▶ Bernardes, Bessa, and Kalup (2005) for analysis of service firms

World Bank Investment Climate Survey (ICS):

- ▶ **Not** an innovation survey, but information on innovation and R&D [**Note:** no matched patent data] but interview-based

World Bank Investment Climate Survey (ICS):

- ▶ **Not** an innovation survey, but information on innovation and R&D [**Note:** no matched patent data] but interview-based
- ▶ Single-country analysis: Goedhuys (2007) for Brazil

World Bank Investment Climate Survey (ICS):

- ▶ **Not** an innovation survey, but information on innovation and R&D [**Note:** no matched patent data] but interview-based
- ▶ Single-country analysis: Goedhuys (2007) for Brazil
 - ▶ ICS for 2003 - 1,642 manufacturing firms with ≥ 10 workers, 13 states (most firms in São Paulo and Minas Gerais – note heterogeneity)

World Bank Investment Climate Survey (ICS):

- ▶ **Not** an innovation survey, but information on innovation and R&D [**Note:** no matched patent data] but interview-based
- ▶ Single-country analysis: Goedhuys (2007) for Brazil
 - ▶ ICS for 2003 - 1,642 manufacturing firms with ≥ 10 workers, 13 states (most firms in São Paulo and Minas Gerais – note heterogeneity)
 - ▶ Objective: relationship between productivity and innovation at the firm-level and firm growth (measured as sales)

World Bank Investment Climate Survey (ICS):

- ▶ **Not** an innovation survey, but information on innovation and R&D [**Note:** no matched patent data] but interview-based
- ▶ Single-country analysis: Goedhuys (2007) for Brazil
 - ▶ ICS for 2003 - 1,642 manufacturing firms with ≥ 10 workers, 13 states (most firms in São Paulo and Minas Gerais – note heterogeneity)
 - ▶ Objective: relationship between productivity and innovation at the firm-level and firm growth (measured as sales)
 - ▶ Information on innovation: product innovation, R&D dummy — but not process innovation (!?)

World Bank Investment Climate Survey (ICS):

- ▶ **Not** an innovation survey, but information on innovation and R&D [**Note:** no matched patent data] but interview-based
- ▶ Single-country analysis: Goedhuys (2007) for Brazil
 - ▶ ICS for 2003 - 1,642 manufacturing firms with ≥ 10 workers, 13 states (most firms in São Paulo and Minas Gerais – note heterogeneity)
 - ▶ Objective: relationship between productivity and innovation at the firm-level and firm growth (measured as sales)
 - ▶ Information on innovation: product innovation, R&D dummy — but not process innovation (!)
 - ▶ Findings: larger firms innovate more; some findings hard to interpret – process innovations negatively correlated, R&D and product innovation insignificant

World Bank Investment Climate Survey (ICS):

- ▶ **Not** an innovation survey, but information on innovation and R&D [**Note:** no matched patent data] but interview-based
- ▶ Single-country analysis: Goedhuys (2007) for Brazil
 - ▶ ICS for 2003 - 1,642 manufacturing firms with ≥ 10 workers, 13 states (most firms in São Paulo and Minas Gerais – note heterogeneity)
 - ▶ Objective: relationship between productivity and innovation at the firm-level and firm growth (measured as sales)
 - ▶ Information on innovation: product innovation, R&D dummy — but not process innovation (!)
 - ▶ Findings: larger firms innovate more; some findings hard to interpret – process innovations negatively correlated, R&D and product innovation insignificant
- ▶ Strength in cross-country analysis: Almeida and Fernandez (2008) for 43 developing countries including Brazil; Goedhuys et al. (2008) for Brazil, Ecuador, South Africa, Tanzania, and Bangladesh

Other

- ▶ **ANPEI:** Jensen et al. (2004) - R&D data for 1500 firms for 1994-1998

Other

- ▶ **ANPEI:** Jensen et al. (2004) - R&D data for 1500 firms for 1994-1998
Superseded by Pintec

Other

- ▶ **ANPEI:** Jensen et al. (2004) - R&D data for 1500 firms for 1994-1998
Superseded by Pintec
- ▶ **Economática:** Crisóstomo (2009) - balance sheet data on 289 publicly trade firms for 1995-2006

Other

- ▶ **ANPEI:** Jensen et al. (2004) - R&D data for 1500 firms for 1994-1998

Superseded by Pintec

- ▶ **Economática:** Crisóstomo (2009) - balance sheet data on 289 publicly trade firms for 1995-2006

Only innovation-related study on Brazil (I'm aware of) that uses commercial firm-level data set – remember that most research on US and Europe conducted with commercial firm-level data

Conclusion - Summary

- ▶ Large number of existing integrated data sets for developed economies
- but all observational and allocation of IPRs across units not random

Conclusion - Summary

- ▶ Large number of existing integrated data sets for developed economies - but all observational and allocation of IPRs across units not random
- ▶ Identification is a challenge - need to move beyond merely statistical representations of the data

Conclusion - Summary

- ▶ Large number of existing integrated data sets for developed economies - but all observational and allocation of IPRs across units not random
- ▶ Identification is a challenge - need to move beyond merely statistical representations of the data
- ▶ Many Latin American countries with innovation surveys: Brazil, Argentina, Chile, Mexico, Uruguay, Colombia, Venezuela, etc. (Crespi and Peirano, 2007)

Conclusion - Summary

- ▶ Large number of existing integrated data sets for developed economies - but all observational and allocation of IPRs across units not random
- ▶ Identification is a challenge - need to move beyond merely statistical representations of the data
- ▶ Many Latin American countries with innovation surveys: Brazil, Argentina, Chile, Mexico, Uruguay, Colombia, Venezuela, etc. (Crespi and Peirano, 2007)
- ▶ Existing cross-country studies - but comparing the comparable across countries is difficult

Conclusion - Summary

- ▶ Large number of existing integrated data sets for developed economies - but all observational and allocation of IPRs across units not random
- ▶ Identification is a challenge - need to move beyond merely statistical representations of the data
- ▶ Many Latin American countries with innovation surveys: Brazil, Argentina, Chile, Mexico, Uruguay, Colombia, Venezuela, etc. (Crespi and Peirano, 2007)
- ▶ Existing cross-country studies - but comparing the comparable across countries is difficult
- ▶ Existing integrated data and rich (descriptive) empirical evidence on Brazil using innovation surveys

Conclusion - Summary

- ▶ Large number of existing integrated data sets for developed economies - but all observational and allocation of IPRs across units not random
- ▶ Identification is a challenge - need to move beyond merely statistical representations of the data
- ▶ Many Latin American countries with innovation surveys: Brazil, Argentina, Chile, Mexico, Uruguay, Colombia, Venezuela, etc. (Crespi and Peirano, 2007)
- ▶ Existing cross-country studies - but comparing the comparable across countries is difficult
- ▶ Existing integrated data and rich (descriptive) empirical evidence on Brazil using innovation surveys
- ▶ But **no** empirical work so far on IPRs

Conclusion - Summary

- ▶ Large number of existing integrated data sets for developed economies - but all observational and allocation of IPRs across units not random
- ▶ Identification is a challenge - need to move beyond merely statistical representations of the data
- ▶ Many Latin American countries with innovation surveys: Brazil, Argentina, Chile, Mexico, Uruguay, Colombia, Venezuela, etc. (Crespi and Peirano, 2007)
- ▶ Existing cross-country studies - but comparing the comparable across countries is difficult
- ▶ Existing integrated data and rich (descriptive) empirical evidence on Brazil using innovation surveys
- ▶ But **no** empirical work so far on IPRs

>>> Need to integrate IPRs

Conclusion - More research?

- ▶ Map national and international IP use by firms registered in Brazil

Conclusion - More research?

- ▶ Map national and international IP use by firms registered in Brazil
- ▶ Link it to related questions on firm behavior:

Conclusion - More research?

- ▶ Map national and international IP use by firms registered in Brazil
- ▶ Link it to related questions on firm behavior:
 - ▶ **Market structure** *After controlling for market share, the well-documented positive relationship between size and R&D expenditures per worker does not hold; [...] This implies that market dominance is necessary to undertake the risks and uncertainties associated with R&D. (Worldbank, 2007: 79)*

Conclusion - More research?

- ▶ Map national and international IP use by firms registered in Brazil
- ▶ Link it to related questions on firm behavior:
 - ▶ **Market structure** *After controlling for market share, the well-documented positive relationship between size and R&D expenditures per worker does not hold; [...] This implies that market dominance is necessary to undertake the risks and uncertainties associated with R&D.* (Worldbank, 2007: 79)
 - ▶ **Agglomeration externalities** *Uma das características marcantes do espaço econômico brasileiro é sua heterogeneidade e fragmentação.* (Lemos et al., 2005: 366)

Conclusion - More research?

- ▶ Map national and international IP use by firms registered in Brazil
- ▶ Link it to related questions on firm behavior:
 - ▶ **Market structure** *After controlling for market share, the well-documented positive relationship between size and R&D expenditures per worker does not hold; [...] This implies that market dominance is necessary to undertake the risks and uncertainties associated with R&D.* (Worldbank, 2007: 79)
 - ▶ **Agglomeration externalities** *Uma das características marcantes do espaço econômico brasileiro é sua heterogeneidade e fragmentação.* (Lemos et al., 2005: 366)
 - ▶ **Technology imports and imitation** *Among the various modes of technology adoption, Brazilian firms rely surprisingly little on international technology transfer.* (Worldbank, 2007: 86)

Conclusion - More research?

- ▶ Map national and international IP use by firms registered in Brazil
- ▶ Link it to related questions on firm behavior:
 - ▶ **Market structure** *After controlling for market share, the well-documented positive relationship between size and R&D expenditures per worker does not hold; [...] This implies that market dominance is necessary to undertake the risks and uncertainties associated with R&D.* (Worldbank, 2007: 79)
 - ▶ **Agglomeration externalities** *Uma das características marcantes do espaço econômico brasileiro é sua heterogeneidade e fragmentação.* (Lemos et al., 2005: 366)
 - ▶ **Technology imports and imitation** *Among the various modes of technology adoption, Brazilian firms rely surprisingly little on international technology transfer.* (Worldbank, 2007: 86)
 - ▶ **University-industry tech transfer, Incubators/Science Parks** (ANPROTEC: 400 existing incubators; >40% Federal Universities have incubator; >10 Science Parks)

Conclusion - More research?

- ▶ Analysis of effectiveness of existing support programmes (ANPEI, 2009; PROFINT – de Barros and de Souza, 2010) – *Innovation surveys were not conceived to evaluate and guide innovation policy* (Mairesse and Mohnen, 2010: 29)

Conclusion - More research?

- ▶ Analysis of effectiveness of existing support programmes (ANPEI, 2009; PROFINT – de Barros and de Souza, 2010) – *Innovation surveys were not conceived to evaluate and guide innovation policy* (Mairesse and Mohnen, 2010: 29)
- ▶ Analysis of single companies and their externalities, e.g., Embraer or Petrobras

Conclusion - More research?

- ▶ Analysis of effectiveness of existing support programmes (ANPEI, 2009; PROFINT – de Barros and de Souza, 2010) – *Innovation surveys were not conceived to evaluate and guide innovation policy* (Mairesse and Mohnen, 2010: 29)
- ▶ Analysis of single companies and their externalities, e.g., Embraer or Petrobras
- ▶ Analysis of specific sectors: Nanotechnology (Kay et al., 2009)

Conclusion - More research?

- ▶ Analysis of effectiveness of existing support programmes (ANPEI, 2009; PROFINT – de Barros and de Souza, 2010) – *Innovation surveys were not conceived to evaluate and guide innovation policy* (Mairesse and Mohnen, 2010: 29)
- ▶ Analysis of single companies and their externalities, e.g., Embraer or Petrobras
- ▶ Analysis of specific sectors: Nanotechnology (Kay et al., 2009)
- ▶ Analysis of broad topics: e.g., Climate change related technology and patenting

References

- ▶ Abramovsky L., J. Jaumandreu, E. Kremp, and B. Peters (2004): 'National Differences in Innovation Behaviour: Facts and Explanations,' mimeo. <http://www.eco.uc3m.es/IEEF/documentpapers.html>.
- ▶ Almeida R. and A.M. Fernandes (2008): 'Openness and Technological Innovations in Developing Countries: Evidence from Firm-Level Surveys,' *Journal of Development Studies*, Vol. 44, No. 5, pp. 701-727.
- ▶ ANPEI (2004): 'Como alavancar a inovação tecnológica nas empresas,' Estudo de Fundo.
- ▶ ANPEI (2009): 'A indústria em busca da Competitividade Global,' Estudo de Fundo.
- ▶ ANPEI (2009): 'Os novos instrumentos de apoio à inovação: uma avaliação inicial,' Estudo de Fundo.
- ▶ Araújo B.C. and A.M. Silva (2007): 'A microeconomia do crescimento de empresas industriais e inovação tecnológica: evidências para o Brasil e 7 países europeus,' ANPEC.
- ▶ Bernardes R., V. Bessa, and A. Kalup (2005): 'Serviços na PAEP 2001 reconfigurando a agenda de pesquisas estatísticas de inovação,' *São Paulo em Perspectiva*, Vol. 19(2), pp. 115-134.
- ▶ Bogliacino F., G. Perani, and M. Pianta (2009): 'Innovation in Developing Countries. The Evidence from Innovation Surveys,' Paper for the FIRB conference Research and Entrepreneurship in the knowledge-based economy, Bocconi University, Milan, 7-8 September 2009.
- ▶ Chesher A. and L. Nesheim (2006): 'Review of the Literature on the Statistical Properties of Linked Datasets', DTI Occasional Paper No. 3.
- ▶ Cockburn I., Agrawal A., Bessen J., Graham S., Hall B.H., and MacGarvie M. (2009): 'The NBER Patent Citations Datafile Update'.
- ▶ Corrado C., C. Hulten, and D. Sichel (2006): 'Intangible Capital and Economic Growth,' Federal Reserve Board, Washington, D.C., Working Paper No. 2006-24.
- ▶ Correa P., I.G. Sanchez, and H. Singh (2005): 'Research, Innovation and Productivity: Firm, Level Analysis for Brazil,' mimeo.

References continued...

- ▶ Crespi G. and F. Peirano (2007): 'Measuring Innovation in Latin America: What we did, where we are and what we want to do,' UNU-Merit.
- ▶ Crisóstomo V.L. (2009): 'Dificuldades das empresas brasileiras para financiar seus investimentos em capital físico e em inovação,' *R. Econ. contemp.*, Vol. 13 (2), p. 259-280.
- ▶ de Barros Wanderley C. and C.G. de Souza (2010): 'Patent Documents as a Source of Technological Information in Brazil: a user study of the Program of Automatic Supply of Technological Information (PROFINT),' *Information Development*, 26(1), pp. 67-78.
- ▶ de Negri J. A. and M.S. Salerno (2005): 'Inovações, Padrões Tecnológicos e Desempenho das Firms Industriais Brasileiras,' IPEA.
- ▶ de Negri J. A., L. Esteves, and F. Freitas (2007): 'Knowledge production and firm growth in Brazil,' Working Paper No. 0020, Department of Economics, Universidade Federal do Paraná.
- ▶ Eberhardt M., Helmers C., and Strauss H. (2010): 'Do Spillovers Matter When Estimating Private Returns to R&D?,' *EIB Economic and Financial Reports* 01/2010.
- ▶ Fagerberg J., M. Srholec and B. Verspagen (2009): 'Innovation and Economic Development,' TIK Working Paper on Innovation Studies No. 20090723, Centre for Technology, Innovation and Culture, Oslo.
- ▶ Fally T., R. Paillacar, C. Terra (2010): 'Economic geography and wages in Brazil: Evidence from micro-data,' *Journal of Development Economics*, Vol. 91, pp. 155-168.
- ▶ Goedhuys M. (2007): 'The impact of innovation activities on productivity and firm growth: evidence from Brazil,' UNU- MERIT Working Paper No. 2007-02.
- ▶ Goedhuys M., N. Janz and P. Mohnen (2008): 'Knowledge-based productivity in 'low-tech' industries: evidence from firms in developing countries,' UNU-MERIT Working Paper 2008-007.
- ▶ Gonçalves E., M.B. Lemos, and J. A. De Negri (2007): 'Drivers of technological innovation in Argentina and Brazil,' in De Negri J. A. and Turchi L. M. (eds.) *Technological innovation in Brazilian and Argentine firms*, IPEA, pp. 177-202.

References continued...

- ▶ Griffith R., E. Huergo, J. Mairesse and B. Peters (2006). Innovation and Productivity across Four European Countries. NBER Working Paper 12722.
- ▶ Hall B.H., A. Jaffe, and M. Trajtenberg (2001): 'The NBER Patent Citations Data File: Lessons, Insights, and Methodological Tools', NBER Working Paper No. 8498.
- ▶ Helmerts C. and M. Rogers (2009): 'Patents, entrepreneurship and performance', Hitotsubashi University Global COE Hi-Stat Discussion Paper.
- ▶ Helmerts C. (2010a): 'The Effect of Market Entry on Innovation - Evidence from UK University Incubators', mimeo Department of Economics, University of Oxford.
- ▶ Helmerts C. (2010b): 'Patents, Spillovers and Firm Performance - Evidence from UK Start-Ups', mimeo Department of Economics, University of Oxford.
- ▶ Helmerts C. and M. Patnam (2010): 'Does the Rotten Child Spoil His Companion? Spatial Peer Effects Among Children in Rural India,' mimeo Department of Economics, University of Oxford.
- ▶ IBGE (2002): 'Pesquisa Industrial de Inovação Tecnológica - PINTEC 2000,' Rio de Janeiro: IBGE.
- ▶ IBGE (2005): 'Pesquisa Industrial de Inovação Tecnológica - PINTEC 2003,' Rio de Janeiro: IBGE.
- ▶ IBGE (2007): 'Pesquisa Inovação Tecnológica - PINTEC 2000, 2003 e 2005,' Rio de Janeiro: IBGE.
- ▶ Jensen J., N. Menezes Filho, and R. Sbragia (2004): 'Os Determinantes dos Gastos em P&D no Brasil: Uma Análise com Dados em Painel,' Est. Econ., Vol. 34 (4), 661-691.
- ▶ Kannebley Jr. S., G. Porto, and E. Toldo Pazello (2005): 'Characteristics of Brazilian innovative firms: An empirical analysis based on PINTEC-industrial research on technological innovation,' *Research Policy*, Vol. 34, pp. 872-893.
- ▶ Kannebley Jr. S. and J. A. de Negri (2008): 'Innovative Activity in Latin America a Comparison between Industries of Low and High Technological Intensity,' Anais do XXXVI Encontro Nacional de Economia, ANPEC.

References continued...

- ▶ Kannebley Jr. S., J.V. Sekkel, and B.C. Araujo (2010): 'Economic Performance of Brazilian manufacturing firms: a counterfactual analysis of innovation impacts,' *Small Business Economics*, Vol. 34, pp. 339-353.
- ▶ Kay L., N. Invernizzi, and P. Shapira (2010): 'The role of Brazilian firms in nanotechnology development,' 2009 Atlanta Conference on Science and Innovation Policy, IEEE Xplore Digital Library.
- ▶ Klimek S. and Krizan C.J. (2009): 'The Patenting and Trademark Activities of U.S. Firms', US Census Bureau.
- ▶ Lelarge C. (2009): 'The Innovative Activity of Firms over their Life Cycle: Evidence from French Micro-Data', mimeo.
- ▶ Lemos M. B., R. Machado Ruiz, S. Moro, E. P. Domingues (2005): 'A organização territorial da indústria no Brasil,' Chapter 9, in de Negri and Salerno (eds.) 'Inovações, Padrões Tecnológicos e Desempenho das Firms Industriais Brasileiras,' IPEA.
- ▶ Mairesse J. and P. Mohnen (2010): 'Using Innovation Surveys for Econometric Analysis,' Chapter for Handbook of the Economics of Innovation, B. H. Hall and N. Rosenberg (eds.), Elsevier.
- ▶ Raffo J., S. Lhuillery, and L. Miotti (2008): 'Northern and southern innovativity: a comparison across European and Latin American countries,' *European Journal of Development Research*, Vol. 20(2), pp. 219-239.
- ▶ Ridder G., Moffit R. (2007): 'The econometrics of data combination', in Heckman J.J. and Leamer (eds.), Handbook of Econometrics, Vol. 6, Elsevier Science, North Holland, Amsterdam.
- ▶ Selan B. and S. Kannebley Jr. (2007): 'Atividade Inovativa Nas Empresas Paulistas: Um Estudo a Partir da Paep-2001,' *Revista Brasileira de Inovação*, Vol. 6, pp. 123-152.
- ▶ Thoma G. and Torrisi S. (2007): 'Creating Powerful Indicators for Innovation Studies with Approximate Matching Algorithms. A test based on PATSTAT and Amadeus databases', CESPRI-Bocconi University WP 211.
- ▶ Thoma G., Torrisi S., Gambardella A., Guellec D., Hall B.H., and Harhoff D. (2010): 'Methods and software for the harmonization and combination of datasets: A test based on IP-related data and accounting databases with a large panel of companies at the worldwide level', NBER Working Paper No. 15851.
- ▶ World Bank (2007): 'Brazil: Knowledge and Innovation for Competitiveness,' Report No. 4011-BR.