

Economics 742 Lecture 1: Introduction

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Welcome to Economics 742

- Adam Guren
 - guren@bu.edu, Room 406
 - Office Hours: W 3:30-5, M 9-10:30 (before Spring Break), Tu 11-12:15 (after Spring Break), and by appointment
 - Email me ahead of time to let me know you are coming so I can stagger students.
- Research Interests:
 - Macro models and questions with micro data and methods.
 - Housing and the macroeconomy.
- When you email me about class, please **put “Ec 742” in the subject line.**

Two Topics I Will Cover

- Overarching subject: Micro data in macroeconomics.
1. Micro Variation in Macro (7 Classes)
 - 1.1 Housing and Macro
 - 1.2 Other Sources of Micro Variation: Bartik, Monetary Shocks, Firm-Level (Collateral and Bank) Shocks, Role of Credit in Great Recession
 - 1.3 Aggregation of Micro Estimates
 2. Heterogenous Agent New Keynesian Models
(6 Classes, 2.5 Lecture, 3.5 Reading Group)

Bonus Material On Web Site

- I used to cover several topics that got left out this year.
- 1. Regional Equilibria and Evolutions
(1 Lecture)
- 2. Macro Labor
(5 Lectures)
- 3. Information in Macro as it Relates to Micro Variation in Macro
(1 Lecture)
- 4. Aggregate Nominal Rigidity and Micro Price Adjustment
(4 Lectures)
- I am posting my slides from prior years on the course website.
- I am happy to talk about this material in office hours!

Course Info

- I care a lot about teaching.
 - PLEASE let me know how you think the course is going.
 - Particularly with reference to speed and usefulness for (1) understanding the literature and (2) finding research topics.
- PLEASE ask questions, challenge my conclusions, etc.
 - I want the class to be a discussion.
 - Add your opinions in class and read papers with an eye towards what they *don't* do! Finding questions is half the battle.
- There will be typos. Please point them out and I will repost clean versions of my slides.

My Philosophy

- Combine breadth and depth in one class.
- I want to give you the “lay of the land” of the literature.
 - Useful for understanding data sources, identification strategies, related applications, identifying gaps for research, etc.
 - To that end, the reading list is very long – a literature guide.
- And then focus on a few papers (2-3 per class) in detail.
 - Read these double-starred readings carefully before class.
 - I will announce these ahead of time.
- Gesture towards interesting “open questions.”
- Show you some of the best JMPs of the last several years.

Course Requirements: Enrolled Students

1. Required Readings and Class Participation (20% per half)
 - 1.1 Next 8 Classes: Summary sides on key papers due via email
3pm day before class as indicated on last page of reading list.
 - One slide summarizing article.
 - One slide presenting analysis (see end of this lecture).
 - 1.2 Last 4 Classes: HANK Reading Group
 - Class structured as reading group; heavy on discussion.
 - Each student will present a paper to class for 25 mins, which we will then discuss for 10 mins.
 - Everyone should do the reading (but no summary slides).
Read intro of all key papers, focus on one in detail.
 - Send me slides 48 hours before so we can revise, post. Look at related papers to augment your slides so your presentation is on the literature surrounding the topic not just one paper.
2. Research Proposal (60%): See syllabus for details.
 - Goal: Kickstart second year paper (see guidelines in syllabus).
- Students should attend macro seminar and lunch, DV lectures.

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 - Goal: Kickstart second year paper (see guidelines in syllabus).
 - Initial meetings 2/9 2:30-5 pm, send 3 ideas by 2/7.
 - 2 Page Research Topic Memo: 2/20, then meet with adviser.
 - Research Proposal: 3/5 9-10:45 in class.
 - Research Results: 4/30 8:30-10:50 in class.
 - Meetings with project adviser as indicated on syllabus.
- Students should attend macro seminar and lunch, DV lectures.

HANK Lectures

1. February 13: Heterogenous Agent New Keynesian Models: Intro and Estimation
 - Kaplan-Moll-Violante "Monetary Policy According to HANK"
 - Auclert-Rognlie-Straub "Micro Jumps, Macro Humps: Monetary Policy and Business Cycles in an Estimated HANK Model"
 - Auclert-Bardoczy-Rognlie-Straub: "Using the Sequence-Space Jacobian to Solve and Estimate Heterogenous Agent Models"
 - Start early at 9am!
2. February 15: Inspecting the Mechanism: Redistribution and Incomplete Markets
 - Auclert "Monetary Policy and the Redistribution Channel"
 - Werning "Incomplete Markets and Aggregate Demand"
 - Auclert-Rognlie-Straub "The Intertemporal Keynesian Cross"
3. February 29 (Second Half of Class): Empirical Evidence on HANK
 - Stitching together two themes in my part of the class.

HANK Papers For Reading Group

1. February 20: Mortgage Refinancing and Durables in HANK
 - Berger-Milbradt-Tourre-Vavra "Mortgage Prepayment and Path-Dependent Effects of Monetary Policy"
 - McKay-Wieland "Lumpy Durable Consumption Demand and Limited Ammunition of Monetary Policy"
 2. February 22: Investment and HANK
 - Kekre-Lenel "Monetary Policy, Redistribution, and Risk Premia"
 - Ottonello-Winberry "Financial Heterogeneity and the Investment Channel of Monetary Policy"
 3. February 27: Labor Markets and HANK, Optimal Policy in HANK
 - Alves-Violante: "Some Like it Hot: Monetary Policy Under Okun's Hypothesis"
 - Davila-Schaab: "Optimal Monetary Policy With Heterogenous Agents: Discretion, Commitment, and Timeless Policy"
 4. February 29: Misallocation and Monetary Policy
 - Baqaee-Farhi-Sangani "The Supply-Side Effects of Monetary Policy"
- Email me ranking of 4 papers by next class and I will assign

Summary of Important Course Dates

1. Initial meetings: February 9 2:30-5
Send 3 ideas by February 7 at 5pm via email
 2. Topic memo: Due February 20
 3. HANK Reading Group Student Presentations (with Adam):
February 20-29
 - Send me preferences by next class
 4. Research proposals (with Bob and Adam): March 5 9-10:45
 - 8 minute presentation with at most six slides
 - Early start!
 5. Final presentations (with Bob and Adam): April 30 8:30-10:50
 - 12 minute presentation with at most eight slides
 - Early start!
- Bob's part: See syllabus for key dates (last page)

Seminar, Lunch, and DVs

- Attending seminar and lunch is an important part of your PhD
 - Allows you to see cutting edge research, help improve peer's research, become part of research community.
 - Knowledge production in action!
 - In grad school I learned a lot from others' questions.
- This semester we have a great seminar from 2/29 to 5/2!
 - Seegmiller, Kleinman, Eberly, Valchev, Caicedo, Mongey, Guerriero, Castillo-Martinhez.
- BU also has a very unique distinguished visitor program.
 - Big name people who visit for a week, give a seminar and several lectures geared towards PhD students.
 - This semester: Adrien Auclert (April 16-18).
 - Adrien will teach computational methods to solve heterogenous agent models and will be part of 742 during class.
- If macro is a secondary field, fine to only attend seminar, lunch, DVs for your primary field. But should attend something!

Some Brief Advice on Becoming a Researcher

- Becoming a researcher is hard.
 - Requires learning by doing. Only so much one can explain.
- Three key skills:
 1. Communication.
 - Both presenting and writing.
 - Clarity and concision is absolutely essential.
 - Overlooked, underemphasized. Spend time on this!
 2. Idea Generation
 - Part technical (the easier part).
 - Part creative (the harder part).
 3. Developing an Idea Into a Paper
 - Proving concept quickly or discarding.
 - Maintaining perspective, seeing the “big picture.”
 - Knowing what to do next. Requires thinking ahead, which comes with really understanding data / models.
 - Discipline, drive, motivation.
 - Technical skill.
- Need to understand your “production function.”

Some Brief Advice on Becoming a Researcher

- Research is slow and gradual, occurs in fits and starts.
- *Persistence* is a key.
 - Every paper hits a roadblock that initially appears fatal.
 - Every idea is related to something else and has a moment where someone says “that sounds like [insert citation here].”
 - Every researcher has days (or weeks or months) where they work extremely hard and have nothing to show for it.
- Waking up and working just as hard and being just as dogged on the 10th day (or 30th or 100th) as you were on the first.
 - Work on something you love that motivates you.
 - Every paper has boring parts or frustrating parts.
Learn to love the challenge.
 - Do not fear the hardest parts – learn to tackle them first.
- Take care of yourself: mental health matters.
 - Excellent Guide To Doing Research from Paul Niehaus (UCSD):
<https://medium.com/@paul.niehaus/doing-research-18cb310529e0>

Learning From Your Peers

- I personally love to work in teams.
 - More fun.
 - Fewer dead ends, less of an echo chamber.
 - Motivate each other, give each other deadlines.
- For some reason, I think BU PhD students coauthor less than they should, especially early in the program.
- You will learn as much from your peers as from the faculty.
 - Get to know each other! It's hard because of COVID, but it's crucial!
 - Help each other with research. Workshop ideas. Talk economics. Have fun together.
 - My PhD classmates are some of my best friends. I hope they will be for you as well!

Presentation Advice

- Since presentations are requirements (and seminars soon)...
- Introduction (3-5 *concise* slides, 5-7 minutes)
 - Introduces and motivates your question.
 - Makes clear how you answer it.
 - Previews results, intuitions, headline numbers.
 - Outlines rest of talk (an argument – should be structured).
- Signpost religiously.
- Simplify, simplify, simplify!
 - *Every* slide and bullet should be *outstanding* and *necessary*.
 - Doubly so for equations and figures.
 - Can you make everything clear with one equation or graph?
 - Fewer slides with more white space are better!
 - Clear intuition is better than math.
- Extensive presentation advice slides on course website.
 - Main Message: Spend more time on the presentation!

How To Come Up With Ideas

- Most difficult part of research.
- DON'T just sit there waiting for an idea.
 - Work on something. You will bump into things.
- Talk to others! Often papers come out of conversations.
 - Research is not a solo activity, even though it may seem like it.
- Read a lot, and read critically.
 - Look for connections between topics.
 - Look for holes in literature, reasons to doubt papers.
- Play with data, look for facts.
- Go through *lots* of ideas. Discard aggressively.
 - When you do come up with something, ask: “What is the best case scenario for this paper if everything works out?”
 - If not good enough, move on.
- Work on what you love.

Proceeding From The Initial Idea

- It takes a while to figure out how the pieces fit together.
 - The process is part of what makes it fun.
- The best researchers ask the best questions.
 - “Good at being confused.”
 - Learn from questions asked in seminar.
- *Don't be afraid to change the paper!*
 - Sometimes a change in pitch or focus.
 - But sometimes abandoning your original idea altogether for something better.
 - Being able to put aside something to focus on something you have invested in better is hard, but necessary.
 - It is a sunk cost.
- Make slides of what you have to create an outline.
 - Will help sharpen and organize the paper, force you to constantly “see the forest” rather than getting lost in details.
 - Continually evaluate best case scenario is for the project.
 - What is the project's option value?
- Work hard on communicating your work in writing and talks.

Topic 1: Micro Variation in Macro

How To Use Micro Data For Macro?

- Roughly speaking, two approaches:
 1. Classical Approach: Micro data for moments to match or model parameters.
 - Upside: Can say a lot.
 - Downside: Very model dependent.
 2. New Approach: Use applied micro style identification with rich micro data to answer questions of macro relevance.
 - Upside: More convincing.
 - Downside: Less directly relevant for macro, raises important issues of aggregation.
- This section is on the new approach.
- Today:
 1. Overview of Common Identification Strategies
 2. Identification in Macro: Nakamura and Steinsson (2018)
 3. Example: Huber (2018)

Common Identification Strategies

- All about *causality*.
- Gold standard is always a truly-random experiment.
 - In macro, not realistic.
 - But always begin by asking, “what is the ideal experiment?”
 - Will help you figure out what is feasible.
- Common “quasi-experimental” research designs:
 1. OLS and Selection on Observables
 2. Instrumental Variables
 3. Differences-in-Differences or Triple Difference
 4. Regression Discontinuity
 5. Others: Matching estimators, event study, bunching, regression kink, quantile regression, etc.
- ALWAYS clearly and fully state identification condition (preferably formally), test to best of ability.
- Best Book: *Mostly Harmless Econometrics*

OLS: Selection on Observables

- Assumption for causal interpretation: Random once we condition on observables.
 - Formally, error term is independent of “main” regressor conditional on observables.
 - This is why researchers often use new and more elaborate control variables, fixed effects, etc.
 - Worry is often about unobservables or omitted variables bias.
- Useful to ask yourself “what is wrong with OLS?”
 - Will motivate where to go next.
 - If something does not show up in OLS, want to understand why it is biased and how fancier procedure fixes bias.

Instrumental Variables

- Instrumental Variables / Generalized Method of Moments relies on an instrument Z that is:
 1. Relevant (Correlated with X).
 2. Satisfies Exclusion Restriction (uncorrelated with error term, or equivalently only correlated with Y through X).
 - Hard to test, but do the best possible.
- IV gives us a *Local Average Treatment Effect* (LATE).
 - That is a treatment effect *for the variation induced by the instrument and the population affected by the variation*.
- Nonlinear IV is hard. Think hard before you do it.
 - You need *one instrument per endogenous variable*.
 - Cannot instrument X and X^2 with Z using TSLS!
 - You need two instruments for two endogenous variables:

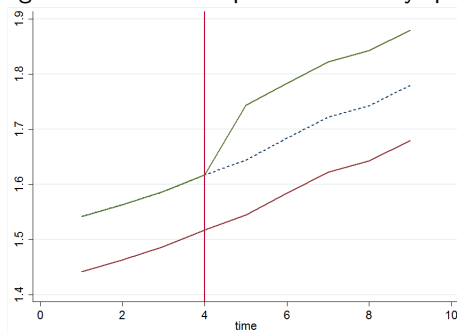
$$Y = \beta_0 + \beta_1 X + \beta_2 X^2 + \varepsilon$$

$$X = \Gamma_0 + \Gamma_1 Z + \Gamma_2 Z^2 + \nu$$

$$X^2 = \omega_0 + \omega_1 Z + \omega_2 Z^2 + \eta$$

Differences-in-Differences

- Compare response of treated relative to untreated to determine causal effect when do not have true treatment and control.
 - Difference out business cycle, etc.
- Key assumption is *parallel trends*.
 - Assuming that if untreated, treated population would follow same trajectory as untreated population.
 - Make a figure if have a true panel with many “pre” periods:



Differences-in-Differences Regressions

- Basic diff-in-diff is β in:

$$Y_{i,t} = \alpha + \omega D_i + \gamma Post_t + \beta D_i Post_t + \varepsilon_{i,t}$$

- Extend to panel with two-way fixed effects:

$$Y_{i,t} = \xi_i + \zeta_t + \beta D_i Post_t + \varepsilon_{i,t}$$

- Need to be careful about estimating in differences or levels!
- Difference: Is ξ_i controlling for a level or a time trend?
- What if units receive binary treatments at different points in time?

$$Y_{i,t} = \xi_i + \zeta_t + \beta D_{it} + \varepsilon_{i,t}$$

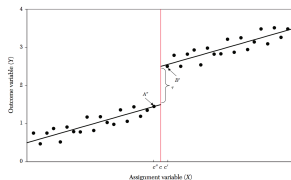
Staggered Diff-In-Diff

$$Y_{i,t} = \xi_i + \zeta_t + \beta D_{it} + \varepsilon_{i,t}$$

- Problematic with heterogenous treatment effects interpreting β as weighted average treatment effect.
 - Intuition: Leads to “forbidden comparisons” between groups treated in a period and groups treated *earlier*.
 - Can lead to negative weights on some treated groups, spurious identification of long-run treatment effects.
- Fast growing literature on how to fix.
 - Borusyak, Jaravel, and Spiess (2024): Imputation procedure where fixed effects are estimated on untreated only.
 - Other estimators and ways to fix (e.g., Athey and Imbens, 2001; Roth and Sant’Anna, 2023; de Chaisemartin and D’Haultfoeuille, 2023; Sun and Abraham, 2021, etc.).
 - Recent survey: Arkhangelsky and Imbens (2023).
- Also recent papers on how to deal with parallel trend violations e.g. Rambachan and Roth (2022).

Regression Discontinuity

- Have “running variable” where treatment kicks in at threshold.
- Fit flexible regression on each side.
- Discontinuity at threshold is causal effect.
- Identifying Assumption: Which side of treatment threshold you are on is random as you get close to threshold.



- Can do with “sharp” or “fuzzy” treatment.
- Concern: Manipulation. Not random who is on which side.
 - Plot observables and show they do not vary at treatment point.
 - Show density of “running variable” is smooth (McCrary Test).
- Picture is key! Reference is Lee and Lemieux (2010, JEL).

An Indispensable Tool: Binscatter

- Raj Chetty has created an indispensable tool: “binscatter”
 - “ssc install binscatter” in Stata.
- Binscatter bins the X variable into equal quantiles, and plots the mean of Y vs. the mean of X in each bin.
 - Allows you to “visualize” the relationship in the data.
 - Is it linear? Are outliers driving? Or a smooth relationship?
 - Basically a cleaned-up scatter plot.
- But much more powerful than simple example!
 - Can do by group!
 - Can do regression discontinuity plots!
 - Can do diff-in-diff figures!
 - Can “control” for FE and observables using Frisch-Waugh!
 - And much more! (See binscatter help).
- I use this constantly in exploring data sets and in creating compelling figures. You should too.

Nakamura-Steinsson (2018, JEP): Identification In Macro¹

- What is the purpose of identification in macro?
 - Quasi-experimental identification is a dominant approach in applied micro.
 - But less heavily used in macro.
 - Why?
 - What is purpose / role of identification in macro?

¹These slides build on slides by Emi Nakamura and Jon Steinsson

Why Identification in Macro Is Hard

1. Few convincing natural experiments.
2. Even when there are, we rarely see exactly the experiment we want, raising questions of external validity.
3. Macro is about aggregates and GE effects.
 - Imagine have micro-level data (across firms, households, regions, etc.). Run regression:

$$Y = \beta_0 + \beta_1 X + \varepsilon$$

- We identify β_1 using quasi-experimental variation in X .
- Where are the GE effects?
- What can we say about aggregates? Do cross-sectional responses answer key aggregate questions?
- What is the value of a “back of the envelope” calculation?

External Validity of Identified Parameters

1. Term structure of shocks is heterogenous.
 - Some only affect short run, others also/only affect long run.
 2. Policy endogeneity
 - E.g., fiscal shock depends on monetary response,.
 3. Policy response depends on state of the economy.
 - Degree of slack, openness, ZLB, etc.
 4. Policy response depends on information content of shock
 - Impulse response to monetary “surprise” may be different from endogenous response.
- Even clean natural experiments only give partial answers about how future shocks and policy will affect the economy.

Calibration / Structural Estimation

- Goal: Use data moments to narrow set of admissible models.
 - Affect posterior over state of models.
 - Calibration is “simply informal GMM or SMM without standard errors.”
 - “Macroeconomists tend to be more worried about ‘model error’ than sampling error compared to researchers in other subfields of economics (e.g., IO).”
 - Issue of selecting which moments to use.
- Examples of moments that yield powerful inference:
 - Equity premium, wages, hours worked.
- But often viewed as completely separate from causal inference.

Nakamura-Steinsson: Identified Moments are Better

- Idea: Estimates of causal effects are particularly informative moments for distinguishing between competing structural models and parameterizing structural models.
 - Identified moment: Estimate of response to identified structural shocks.
 - Should be key part of calibration / structural estimation!
- Why are they better?
 - “Provide evidence on a specific causal mechanism” (or at least PE effect of mechanism).
 - These moments are often closer to what model is meant to do well (e.g., counterfactual of interest).
 - “Insensitive to other aspects of the economy.”
 - That is, more model independent than things like unconditional variances and covariances.

Examples of Useful Identified Moments

- Christiano-Eichenbaum-Evans SVAR matching exercise.
- Gali (1999) Basu-Fernald-Kimball (2006) responses of output and hours to identified productivity shock reject RBC.
- MPC out of tax rebates useful to discipline “consumption block” of models.
- Labor supply elasticity.
 - This micro moment has been used for a long time because it directly maps to a parameter.
 - What’s wrong with identified moments that do not map to a single parameter?

Example We Will See Soon: Fiscal Multiplier

- Explosion of research on “local multipliers.”
 - If government spends additional dollar in one place not another, does that place do relatively better?
 - NOT same as aggregate multiplier.
 - States do not pay for spending.
 - Monetary policy at national level.
 - Spillovers, etc.
 - So initial reaction was that this is not so useful because it does not answer right question.
- Nakamura and Steinsson (2014) argue that local multiplier is powerful statistic for helping distinguish between competing models (e.g., RBC vs. NK)
 - Useful for discriminating between models and calibrating the best one for the “right” question.

Separating Out Aggregation

- A key question is what we can say about aggregates.
 - How useful are “back of the envelope” calculations?
 - Can we get GE effects? What structure do we need to do so?
 - Can we use identified moments to discriminate between models?
- Approach
 - Lectures 2 - 4.5: Housing and Macro
 - My specialty!
 - Lecture 4.5 - 6.5: Other sources of micro variation in macro (Bartik, firm shocks, government spending multipliers)
 - Lecture 6.5 - 7: Aggregation.
 - Sometimes revisiting papers.
 - More model-based. Harder.

Outline For “Micro Variation in Macro” Section

1. Housing
 - 1.1 Wealth effects; house price instruments
 - 1.2 Boom and bust
 - 1.3 Stabilization policy
2. Other sources of micro variation in macro
 - 2.1 Bartik
 - 2.2 Monetary Shocks
 - 2.3 Firms:
 - 2.3.1 Granular IV
 - 2.3.2 Collateral and Bank Shocks
 - 2.3.3 Credit in the Great Recession
 - 2.4 Fiscal Multipliers
3. Aggregation of Micro Estimates

Huber (2018)

- Interesting JMP (*AER*) that gets at some of the issues that will be themes of this section.
- Gives me the opportunity to discuss what I am looking for in response slides.
 - One slide summary, one slide analysis.
 - Analysis: either a critique or an idea related to the paper.
 - I prefer critique.
 - Bar for an idea is high (this is *not* the easy way out).
 - Goal is to make you think about the paper, start reading with critical eye.
- You have read this paper.
 - What is the contribution in one slide?
 - How would you critique it?

Huber (2018): My One Slide Summary

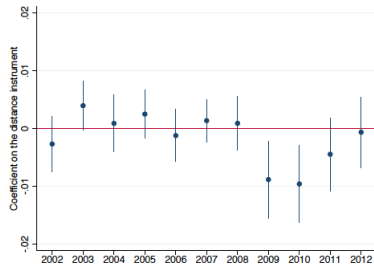
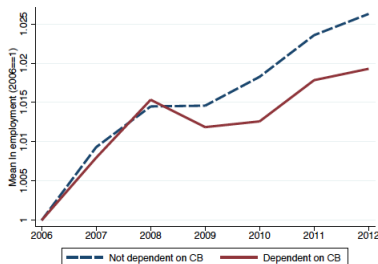
- Extends literature on bank shocks propagating to firms that borrow from them by analyzing:
 1. **Spillovers** to non-treated firms.
 2. **Mechanisms** underlying persistence of lending shocks.
- Identification: Firm-level exposure to Commerzbank (CB).
 - Losses due to exposure to U.S. mortgages.
 - IV CB's geographic presence with post-WW II policy orthog to county economic characteristics, household debt in GR.
- Findings:
 - **Direct Effect:** Fully dependent \Rightarrow 5.3% lower emp growth.
 - **Indirect “Local GE” Effect:** Increasing CB exposure of other firms in county holding direct exposure fixed.
 - 1 SD (6pp) greater CB dependence \Rightarrow 1% lower emp growth.
 - Indirect accounts for 2/3-3/4 of total local effect.
 - Concentrated in non-tradeables and high-innovation firms.
 - **Persistent Responses** to temporary lending cut due to innovation and productivity response.

Huber (2018): Notes on My One Slide Summary

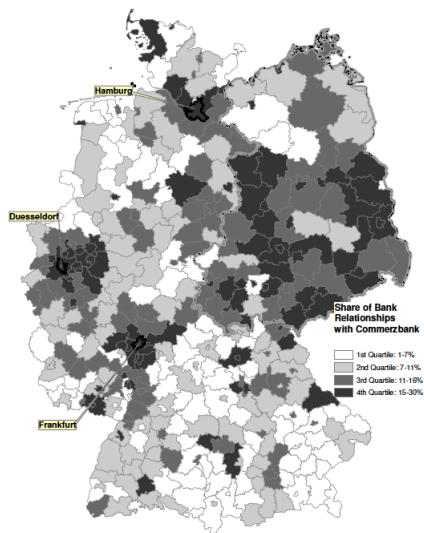
- Highlights:
 1. Contribution (first bullet points), bolded sections.
 2. Intuitions (here identification but could be theory).
 3. Findings with key numbers.
- Wrote it long, cut a lot.
 - Took out 5.3% consistent with literature (Chodorow-Reich).
 - Took out that non-tradeables and high-innovation implies agglomeration and agg demand effects dominate.
 - Took out numbers on persistent responses (CB dependent firm has 55% fewer patents) because numbers less important.
 - Tinkered with wording to limit each bullet to two lines max.
 - Used indentation and bolding to emphasize things.
- You do not have to fill to brim, but here could not avoid.

Huber (2018): Key Figures

- When appropriate, feel free to add a second slide to summary with one or two figures that show key message.



Huber (2018): Critiques I: Identification



Huber (2018): Critiques I: Identification

- Initially concerned that IV of county distance to closest CB HQ correlated with omitted variables.
 - Would violate ID assumption that IV orthog to error term.
- Appendix Table A.IV shows controlling for distance to each HQ city eliminates correlations for observables.
- But what is the residual variation?
 - Odd to IV with $\min(A, B, C)$ controlling for A , B , and C
 - Would want more texture here. Where is the power coming from?
 - Map showing $\min(A, B, C) | A, B, C$.
 - Results excluding some regions. East Germany? Controlling for distance to French and East German border?

Huber (2018): Critiques II: Mechanisms

- The discussion of evidence for agglomeration seemed somewhat hand wavy to me.
- Fact that stronger at “high innovation firms” could mean a lot of different “agglomeration” explanations are at work.
- Can we differentiate more?
 - Is this stronger when high innovation industries are more prevalent? (Industry spillover story)
 - Is this stronger when more high-skilled workers? (Skill story)
 - Is this increasing with density?
- Similarly, a bit skeptical of TFP numbers and using patents to determine causes of persistence.
 - Declines in patents are enormously sharp.
 - Lots of assumptions about how calculate TFP. A bit heroic.