

RIETI BBL Seminar Handout

“Adoption of Information Technology in
Healthcare Services”

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<https://www.rieti.go.jp/jp/index.html>

Adoption of IT in Healthcare Services



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Work-in-progress

Health Information Technology (HIT)

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- Mid-2000s, US lagged other countries in HIT adoption
 - Mainly those with National healthcare systems
- We study factors that influenced adoption of HIT in US **before** the Federal and State policies fundamentally changed to incentivize adoption.
- Gives us insights into market-based processes for adoption and diffusion.

International HIT Adoption Rates

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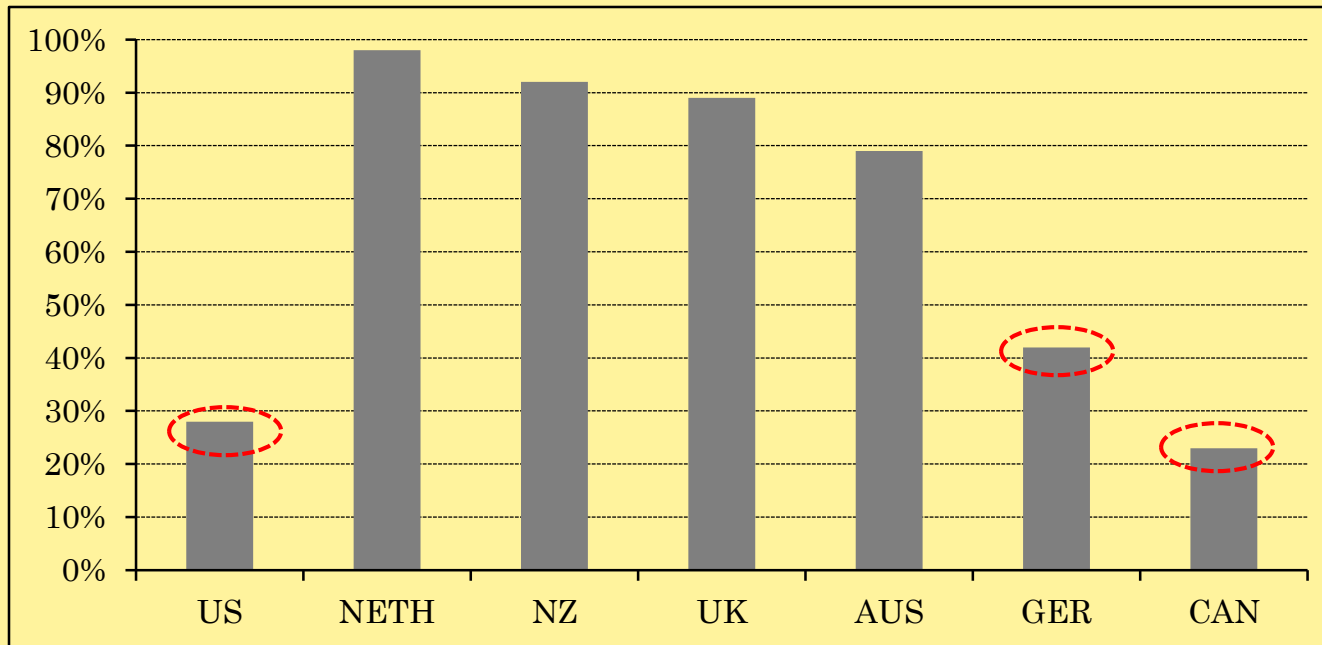


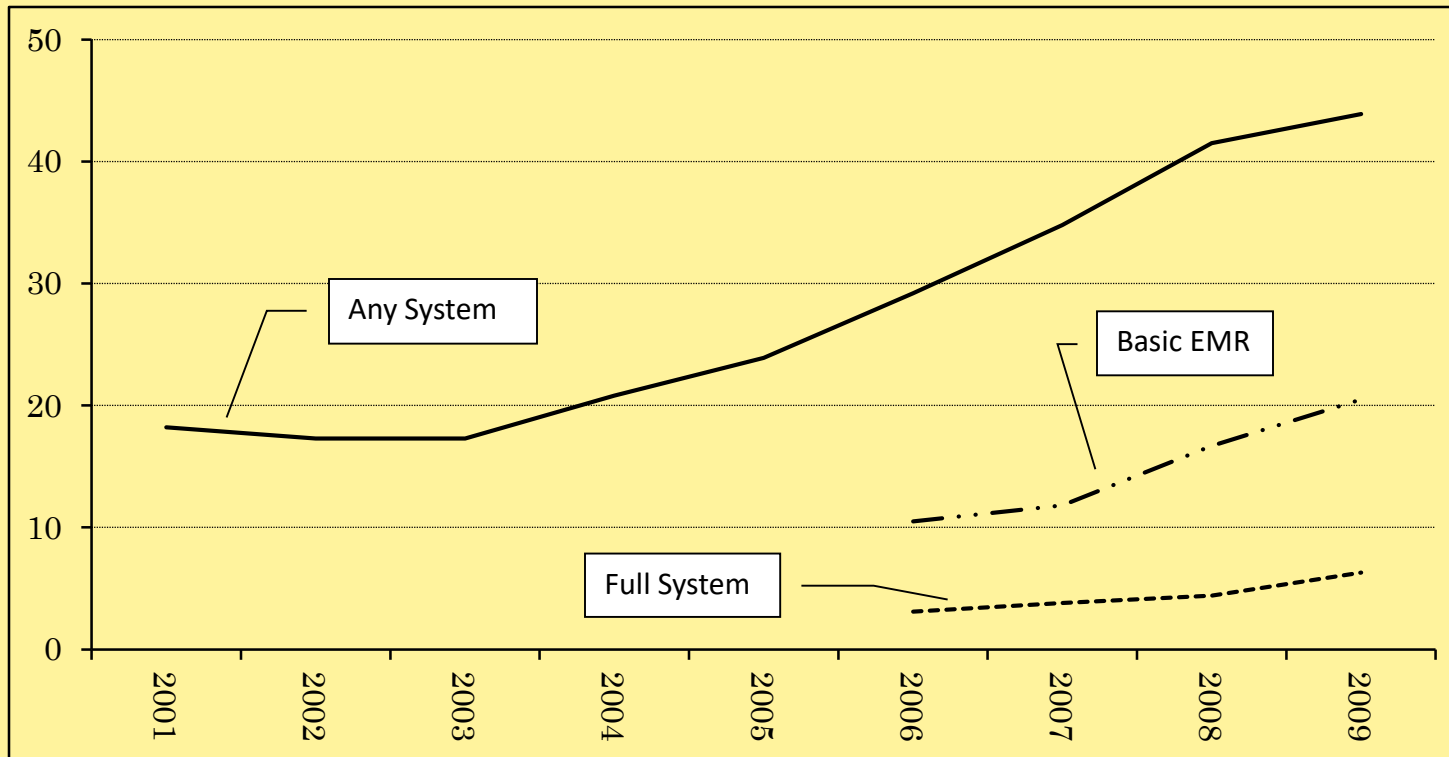
Figure 5. Primary Care Clinics: Country (2006, 2009).

US (28%, 42%); CAN (23%, 37%); GER (42%, 72%);

NETH (98%, 99%); UK (89%, 96%); NZ (92%, 97%); AUS (79%, 95%).

US HIT Trajectory

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Initial part of *S-shaped* diffusion path

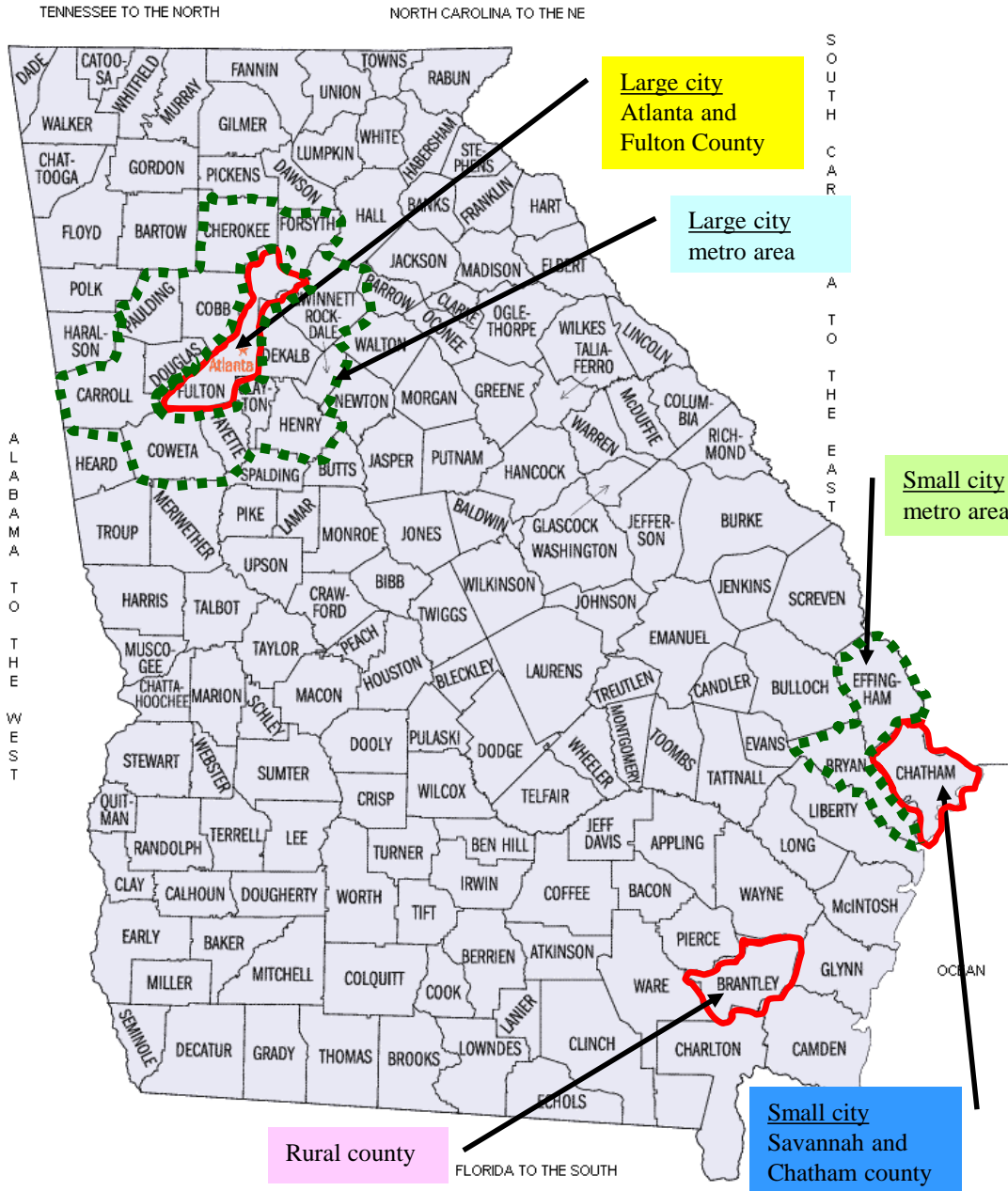
Figure 4. US adoption rates (%) of HIT systems by system capability.

Our Study

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- Examine determinants of HIT adoption by clinics
- **Focus: primary care and related types of clinics**
- Data from clinics in five States: Florida, Georgia, Texas, Illinois and New York
 - Reasonable cross-section of States with varying characteristics
- Clinic-specific characteristics
 - Type of clinic; number of physicians; age of clinic; does it use HIT; when it started using HIT
- Market-specific characteristics
 - Location; demographic; income; education; health status; pollution levels; among others
- Up to 2007 HIMSS survey

Geographic Area



Five geographic dummies

1. large city county;
2. large city metropolitan area counties;
3. small city county;
4. small city metropolitan area counties; and
5. rural county.

Significant variation in wide range of characteristics

Technology Adoption: Theory



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- **Stoneman (2002)** relates technology diffusion to firm-specific characteristics. Firms in the industry:
 - know of the existence of a new technology
 - face the same cost of adopting the new technology at a point in time
 - are heterogeneous in their characteristics which leads to each firm having a different level of benefits from adopting new technology
- Diffusion results from two mechanisms
 - cost of adoption could be decreasing over time for same technology
 - quality of the new technology could be improving over time implying that the benefits from adopting change over time
- Key result: **adoption increases with firm size**
- In our case of HIT adoption by clinics
 - scale economies could arise from indivisibilities in hiring IT personnel, purchasing software and hardware
 - clinics may reap economies of scale from being part of a **chain**

Technology Adoption: Theory



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- **Gotz (1999)** examines competition and adoption
 - monopolistic competition
 - price of the new technology is decreasing over time
- **Key results**
 - if the level of residual demand for the differentiated product increases, the proportion of firms which have adopted at any point in time will increase
 - increase in competition will lead to faster diffusion/adoption
- In the context of our study, monopolistic competition is a reasonable characterization of competition between physician clinics
 - clinics have some market power from selling differentiated product/service

Technology Adoption: Evidence

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- Examining different markets and industries, many papers find higher rates of IT and other types of technology adoption by **larger** firms
- Evidence on the link between **competition** and adoption appears to be more mixed

HIT Adoption: Some Predictions



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- Larger clinics are more likely to adopt
- Clinics that are part of **chains**, more likely to adopt
- Clinics that operate in relatively more competitive product markets are more likely to adopt
- With time, as the gap between the clinics' marginal costs of operating with the old technology (e.g., paper records) and the new technology (HIT) increases, the proportion of clinics that would have adopted will increase

Benefits and Costs of Adopting HIT



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- Clinic-level **benefits**
 - decrease in administrative staff hours
 - decreased billing errors
 - decrease in transcription costs
 - better capture of charges
 - improved utilization of radiology and other tests
 - increased coding levels for treatments from better documentation of services performed
 - improvements in several quality areas especially in drug related reminders, data organization, accessibility, and legibility
 - potential increase in visits due to reduced physician time per patient
 - ✦ **but no new patients may walk in !**

Benefits and Costs of Adopting HIT



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- Clinic-level **costs** – (Wang, 2005)
 - software costs of \$1,600 per physician per year
 - implementation costs of \$3,400 per physician per year
 - ongoing maintenance and support costs of \$1,500 per physician per year;
 - hardware costs of \$6,600 per provider every 3 years;
 - temporary loss of productivity equal to \$11,200 in first year.

Benefits and Costs of Adopting HIT



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- Clinic-level **costs** – Miller (2005)
 - Initial cost of an HIT system at \$44,000, which includes;
 - ✦ \$22,000 to buy the software
 - ✦ \$13,000 in hardware costs
 - ✦ \$7,000 in immediate productivity loss upon switching to EMR
 - Ongoing costs of \$8,500 per year (91% of this is due to contracted IT staff, maintenance and support, and hardware replacement)

Benefits and Costs of Adopting HIT

- Net effect?
- On average, estimates indicate that HIT investments are profitable about 3 years out
- Miller (2005)
 - takes clinics 2.5 years on average to recover initial investment
 - followed by \$33,000 net profit per year
 - projects a net profit of \$82,500 over five years
- HIT investments have somewhat different profile than many other types of technologies
 - Time horizon for replacement of hardware and ongoing maintenance of hardware
 - Software upgrading and maintenance

Data: Clinic Characteristics

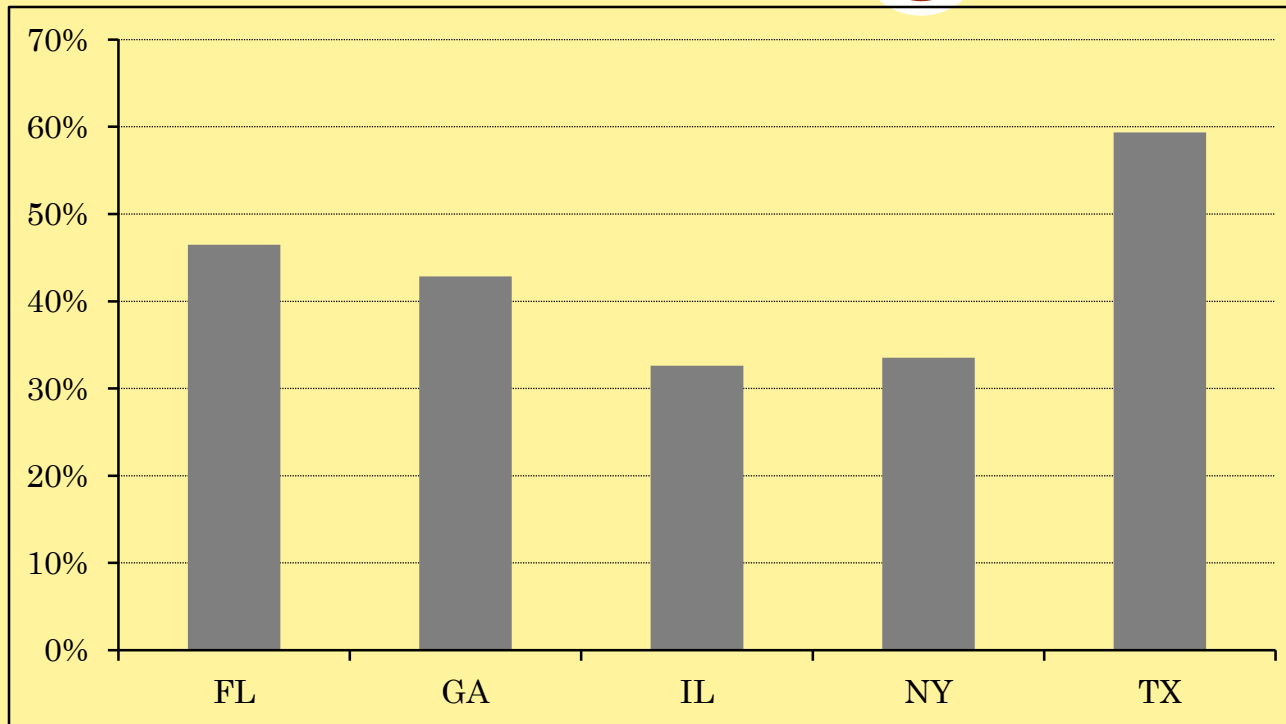
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- Clinic size measured by the number of physicians
- Clinic type – primary care, internal medicine, women’s clinic, urgent care, etc
 - Some clinics see patients more frequently, others less
- Year clinic opened
- Does clinic have HIT
- If yes, when was it adopted
- Chain status
 - **Comment on data collection for this**

Data: Clinic Characteristics



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There have been some
State level initiatives

Privacy laws

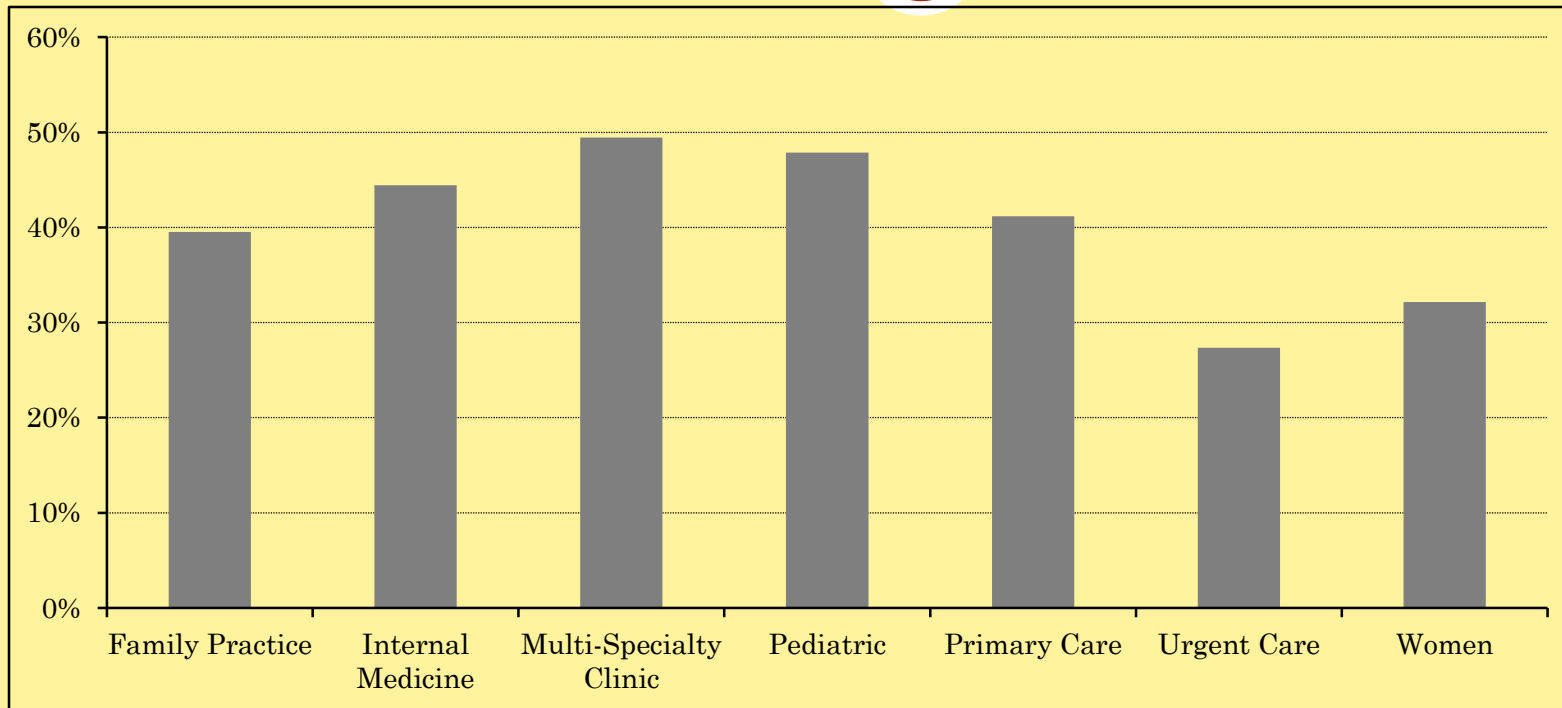
Figure 7. Percent of clinics automated by State.
FL, 46%; GA, 43%; IL, 32%; NY, 33%; TX, 59%.

Considerable cross-state variation

Data: Clinic Characteristics



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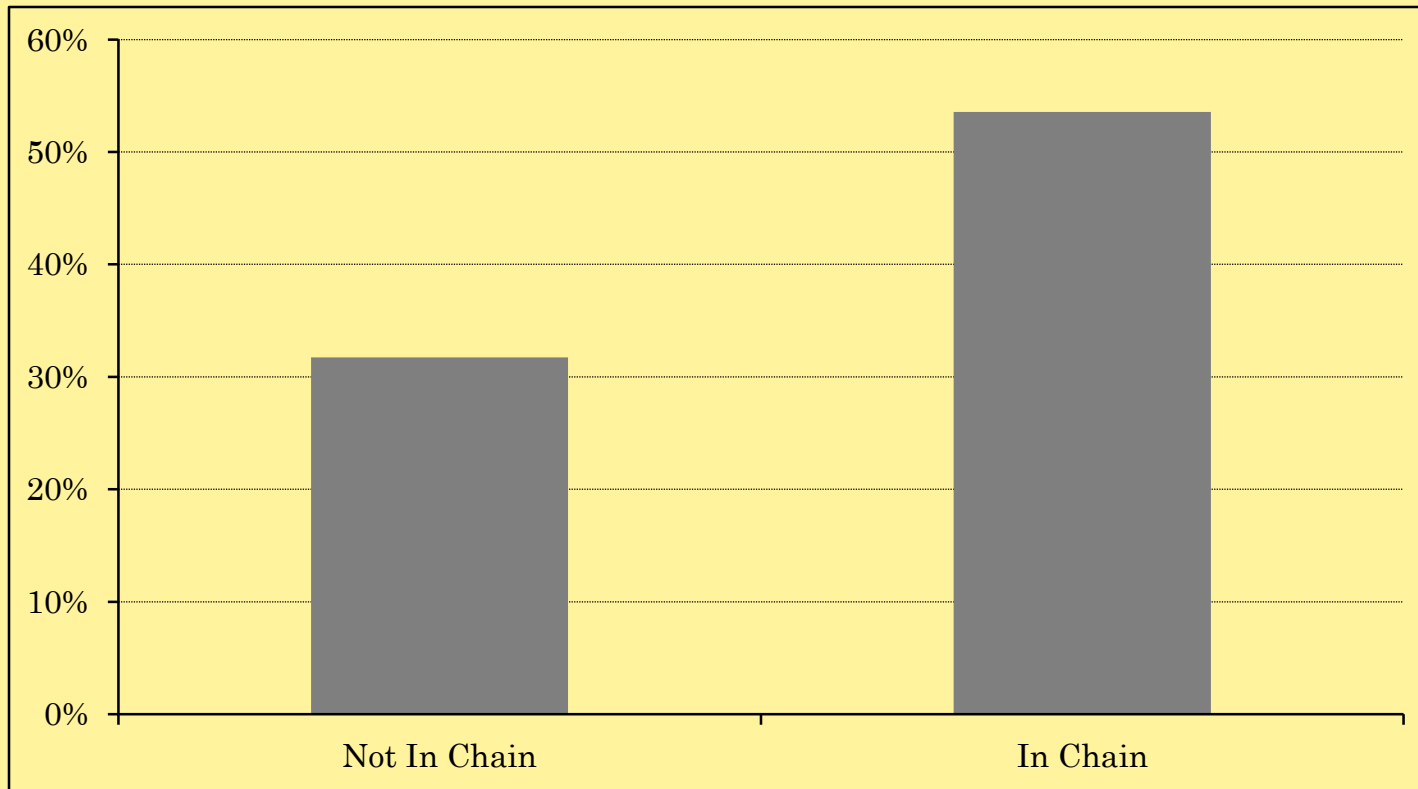
Prior on why differences.

Nature and type of care and patient interaction

Meaningful variation in adoption across type of clinic

Data: Clinic Characteristics

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Significant
Difference.

What may be the
driving forces?

Figure 9. Percent of clinics adopting HIT by chain status; not-in-chain 32%, and in-chain 53%.

Data: Clinic Characteristics

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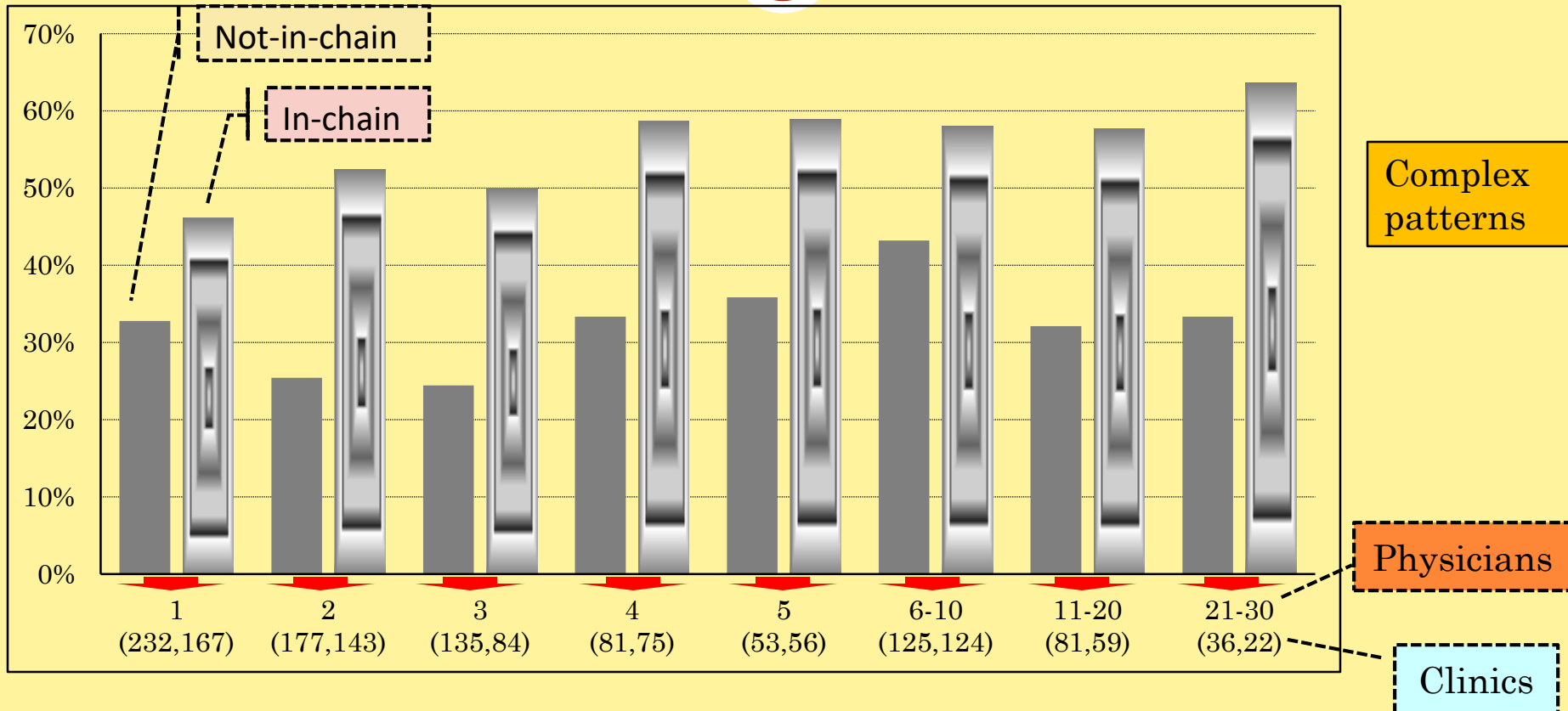


Figure 10. Percentage of clinics adopting HIT by number of physicians and chain status. The number on the horizontal axis denotes the number of physicians, and the number in parentheses denotes the number of clinics.

Data: Clinic Characteristics

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- **Figure 10** provides interesting observations
- Being part of chain leads to higher HIT adoption
 - gradual upward trend in adoption rates as the size (number of physicians) of the in-chain clinic increases
 - scale and scope economies, and easing of financial constraints
- Independent (non-chain) clinics – no clear pattern
 - economies of scale and scope arguments, and financial constraints?
- Economies of scale and scope, and financial strength, seem conferred via chain status, as opposed to growing size within the category of independent clinics

Data: Clinic Characteristics

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- Figure 10 provides interesting observations ...
- Chain network effects?
 - Standardization?
 - What else
- **Organizational structure of clinics?**
 - Sequential or simultaneous presence of physicians?
 - Each physician using IT versus centralized portal
 - These aspects will affect how we think about HIT use and adoption
- Attempting to collect data on this – before doing estimation
 - Called various clinics to get some insights
 - Need to make about 2,000 phone calls !!

Data: Market Characteristics

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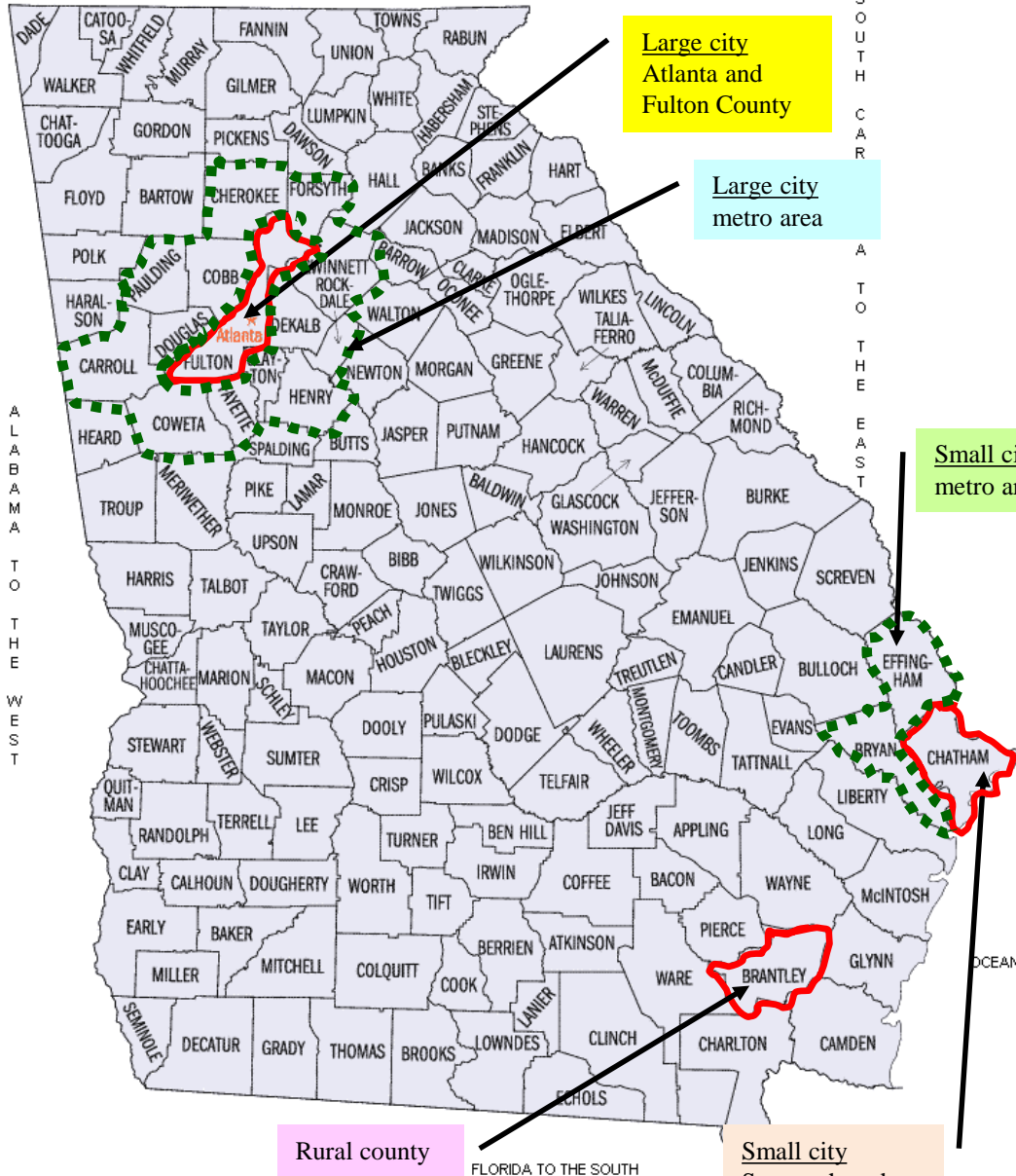
- Define market area for clinics
- Location characteristics
- Wide range of county-level data
 - total population, age distribution of population, gender distribution, ethnic background, race, population density, income, percentage of population living below poverty, high school graduation rate, percentage college graduates, percentage unemployed
 - percentage of the population who smoke, percentage obese, percentage uninsured, number of physicians per 100,000 people
 - pollution – number of particulate matter and ozone days per year
 - wage data for medical assistants – rough benchmark for county-level labor costs faced by clinics

TENNESSEE TO THE NORTH

NORTH CAROLINA TO THE NE

SOUTH CAROLINA TO THE EAST

ALABAMA TO THE WEST



Large city
Atlanta and
Fulton County

Large city
metro area

Small city
metro area

Rural county

Small city
Savannah and
Chatham county

FLORIDA TO THE SOUTH

OCEAN

Geographic Area

Five geographic dummies

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Significant variation in wide range of characteristics

Preliminary Estimation Results

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- Using Logit and Hazard Rate models

Preliminary Estimation Results

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- **Chain status**
- Being part of a chain, in-chain, is **positively** related to the probability that a clinic will adopt a HIT system
- The in-chain effect is highly significant
- Estimates imply that clinics that are in a chain are almost **two** times as likely to adopt than those which are independent
- Possible chain-related economies of scale and scope, and easing of financing constraints.

Preliminary Estimation Results

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- **Number of physicians**
- **Not** significantly related to the likelihood of adoption
- For every increase of one physician at a clinic, the odds of the clinic having adopting HIT are increased by 0.5%
- Little/no evidence of economies of scale (or scope) in HIT adoption

Preliminary Estimation Results

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- Year opened
- **Older** clinics are more likely to have adopted HIT than more recently opened clinics
- No obvious explanation
- One plausible explanation is that older clinics, ones that have survived longer, could be more stable **financially** with steady and more predictable stream of revenues
- Do not have data on clinic balance sheets to examine this

Preliminary Estimation Results

- **Clinic type**
- Compared to Urgent Care and Women's clinics, general practice categories (Family Practice, Primary Care, Internal Medicine) have higher probabilities
- Argument: clinics that examine patients who are more likely to be frequent/regular visitors, have a greater incentive to automate due to better record-keeping abilities and efficiencies of patient management
- Urgent care facilities are probably less likely to see repeat patients which would argue for HIT being relatively less important

Preliminary Estimation Results

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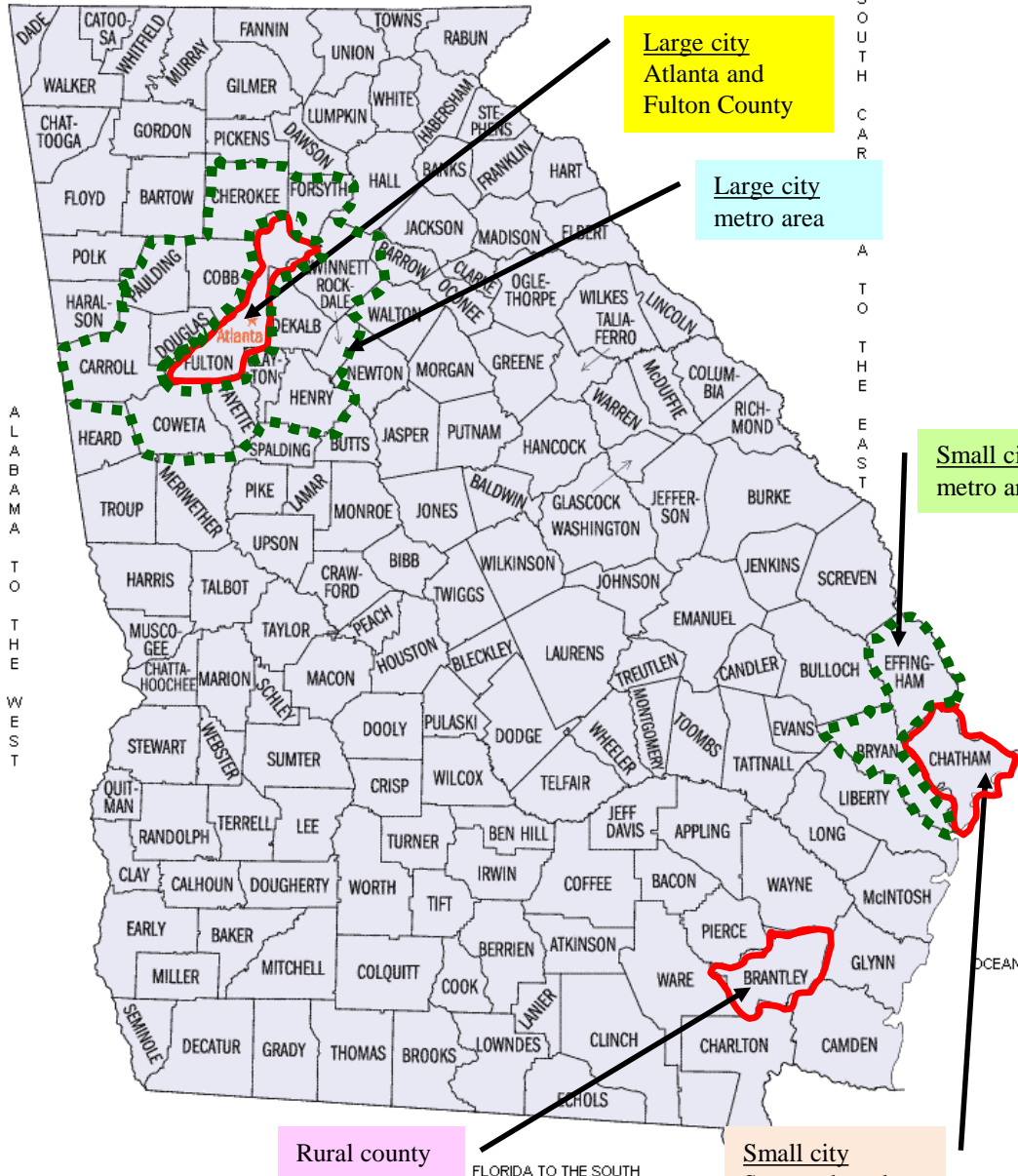
- **Location of clinic**
- Clinics located in large city and large city metropolitan area counties have a much greater likelihood of adopting HIT – about two times as large
- Clinics located in rural area have much lower likelihood
- Big city and neighboring markets have significantly different characteristics than smaller city markets and rural counties
- Effects of
 - Demand
 - Competition

TENNESSEE TO THE NORTH

NORTH CAROLINA TO THE NE

SOUTH CAROLINA TO THE EAST

ALABAMA TO THE WEST



Large city
Atlanta and
Fulton County

Large city
metro area

Small city
metro area

Rural county

Small city
Savannah and
Chatham county

FLORIDA TO THE SOUTH

Geographic Area

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Preliminary Estimation Results

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- **Location of clinic**
- With location dummies included, most of the other market-specific characteristics are not significant
- If we omit the location dummies, more of the market-specific effects are significant, but both quantitative effects and significance levels are marginal

Preliminary Estimation Results

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- **Location of clinic**
- Significant correlation across core demographic, income, education and other variables in urban v. rural areas.
- Implies that even if the location dummies are not included, the underlying data still is strongly influenced by the urban versus rural differences