The Geography of Structural Transformation: Implications for Women's Work

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The process of structural transformation, in which production shifts away from agriculture to manufacturing and services, is linked to the emergence of new types of labor market opportunities. New job opportunities are, however, not distributed equally across space. The degree to which individuals are able to access jobs in emerging modern sectors thus depends crucially on their ability to migrate or commute to where the new jobs are. In this paper, I test the hypothesis that gender - a key predictor of mobility frictions[1] - plays an important role in shaping individuals' decision to participate in the labour market in the face of changing access to jobs in modern sectors. I study this in the context of India, where women's labour force participation (LFP) rate started declining relative to men in the mid-2000s, just as structural transformation started taking off.

I have in mind a model where households are fixed in space and workers make commuting decisions.[2] As the spatial distribution of economic activity changes, workers weigh up the costs (determined by commuting frictions) and benefits (wage) of staying in the labour force or not. If women face larger commuting frictions than men, it follows immediately that women would be more likely to leave the labour force than men in response to shocks that

*Email: sarthak.joshi@warwick.ac.uk. There does not exist a working paper for this project yet. Please also see the slides at the end of this extended abstract to get a complete picture.

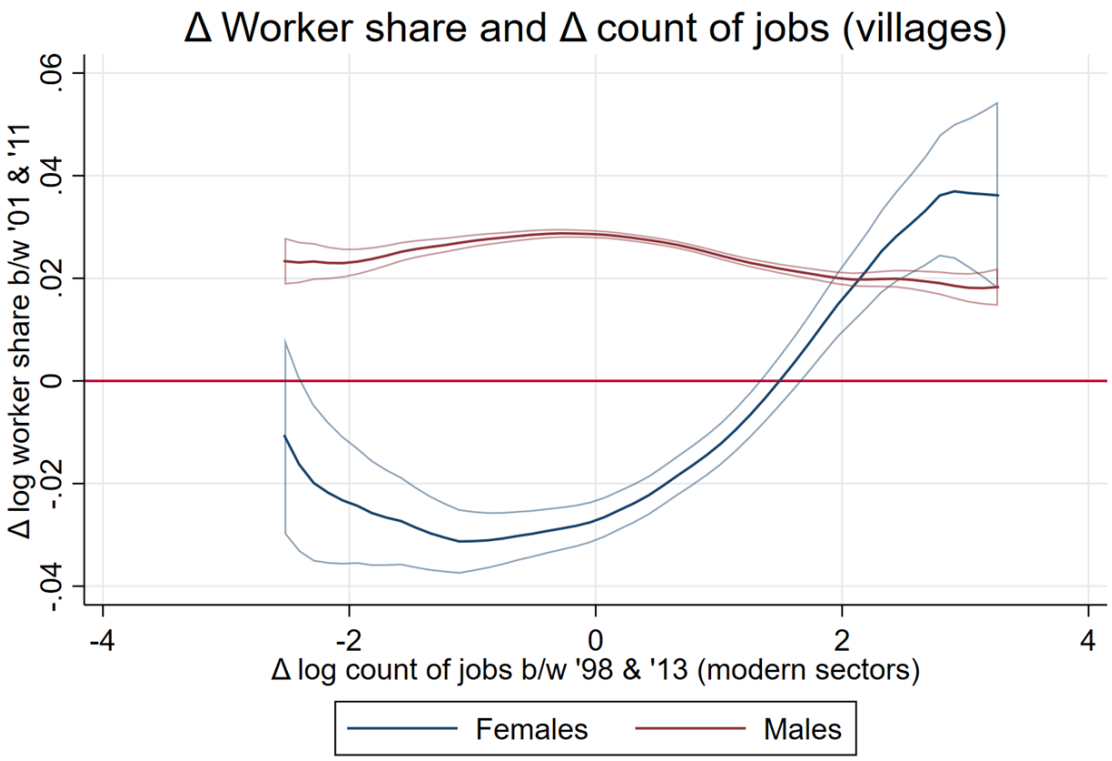
[1] The fact that women face higher commuting costs, or, equivalently, have a lower revealed willingness for commuting than men is a near-universal finding in the literature.

[2] The assumption that household can't migrate is not controversial in the Indian context. A cross national comparison of internal migration rates over a five year interval between the years 2000 and 2010 (Bell et al., 2015) shows that India ranks last in a sample of 80 countries. In 2001, rates of inter-state migration in India was only 1 percent in India, compared to 4.7 percent in China and almost 10 percent in the U.S.. The rate of urbanization in India was only 33 percent in 2016, compared to 39 percent in Sub-Saharan Africa, 86 percent in Brazil, and 56 percent China in the same year (Ritchie and Roser, 2018)

reduces the number of jobs available in one's immediate vicinity.

Data from the economic census of India - which contains the location of all manufacturing and service sector firms in the country (informal and formal) - shows that 31% of villages and 30% of towns lost jobs in the modern sectors between 1998 and 2013, a period that saw rapid structural transformation at the national level.[3] Figure 1 uses village-level[4] panel data to plot changes in average LFP rates between 2001 and 2011 (defined here as the share of men or women who report ever working in the last year in census data) as a flexible function of changes in the count of modern sector jobs between 1998 and 2013 across nearly 500,000 villages in India.

Figure 1: Women respond more to changes in job access



Source: Economic Census (1998 and 2013) and Population Census (2001 and 2011).

The fact that women's elasticity of change in LFP with respect to change in job access

[3] This is not due to a decline in population - most municipalities that lost jobs experienced positive population growth.

[4] I focus on villages here since the decline in female FLP rate is largely a rural phenomenon, where it fell by 25 percentage points between 2004-2018. The FLFP rate in urban India remained nearly stagnant at around 20 percent during this time (Deshpande and Singh, 2021).

is much larger than men's is indicative of binding mobility frictions for women.[5] The graph also makes clear that the relative decline in the women's aggregate LFP rate between 2001 and 2011 is driven entirely by villages that either lost jobs or added relatively fewer jobs in modern sectors over time. Women's relative LFP rate actually increased in villages that added a relatively high number of jobs. Using different measures of job counts - like jobs per capita or jobs per squared KM - leaves this general pattern unchanged.

Motivated by these facts, I ask the following research question - can changing spatial distribution of economic activity in the presence of gendered spatial frictions explain why LFP rates amongst women declined relative to men after the mid-2000s?

To answer this question empirically, I combine multiple source of data to construct a panel of all villages and towns in India over between 2001 and 2013 that contains information on population and worker counts (from population census data) and firm and employee counts (from economic census data). I use the road network of India in 2001 to construct commuting zones (i.e. local labour markets) around key urban centers with high density of modern sector jobs across the country.[6]

With this data in hand, I study the impact of the negative labour demand shock induced by China's entry into the WTO in 2001 on the observed labour supply decisions of men and women across commuting zones in India. Studying the impact of the China shock is ideal for my purposes. Not only does it delivers exogenous variation in how many modern sector jobs (especially manufacturing) are available across different local labour markets, but it is also unlikely to be correlated with improvements in household-level incomes. This is important so that my explanation can be disentangled with supply-side explanations that posit that women are leaving the labour force in India due to a negative income effect (Neff et al., 2012; Mehrotra and Parida, 2017).[7] I generate variation in the degree of exposure

[5] The fact that women respond strongly to greater access to modern sector jobs is also indicative of significant unmet demand for work amongst women in rural India. This is in line with evidence from National Sample Survey (NSS) data (2011) that points to large unmet demand for work amongst women who are out of the labour force (Fletcher et al., 2017).

[6] To the best of my knowledge, this is the first paper to attempt the construction commuting zones in the Indian context. The average commuting zone in my data contains 110,000 people (median = 64,000) in 2001. This represents a much finer level of aggregation than, say, districts which had an average of 1.7 million people in 2001.

[7] This line of explanation is also in line with the "big picture" theory that women's LFP follows a U-shaped pattern with respect to structural transformation (Boserup, 1970) and (Goldin, 1995), according to which

to Chinese import penetration across commuting zones using a shift-share argument that combines industry-level employment shares before 2001 in each commuting zone with changes in the national-level dollar import value at the industry-level (Autor et al., 2013).

I establish two key results. First, a one-log point increase in Chinese import penetration between 1998 and 2011 is associated with a 0.13 percentage point decline in overall share of individuals who report ever working in the last year. The negative impact is entirely driven by women - men show no significant change. This result is somewhat surprising given that the China shock was more likely to impact industries with high male employment share at baseline. Second, firm-level data shows that increasing Chinese import penetration had a significant negative impact on the manufacturing sector, with both average count of firms and average employees per firm (both men and women) declining over time. However, there was also a positive impact on "other service" (a large residual category), with this sector expanding both in terms of count of firms and average employees per firm (but only for men).

Although both men and women lose jobs in manufacturing sectors as a result of the negative labour demand shock induced by increased Chinese import penetration after 2001, men quickly find work in other sectors but women do not. These findings indicate the presence of gendered frictions in the Indian labour market. In the last part of the paper, I provide evidence to suggest that these frictions are likely spatial in nature (see the attached presentation for details).

I offer a new explanation for declining female LFP rates in rural India that combines a supply-side stylized fact (women face higher commuting costs than men) with demand-side trends (changing spatial distribution of economic activity causes commute distance to change). In general, my findings contribute to the growing view that changes in demand-side factors are more important in explaining the fall in Indian women's LFP, rather than changes in supply-side constraints that keep women indoors (Afridi et al., 2022; Chatterjee and Vanneman, 2022; Deshpande and Singh, 2021).

Note that this work is preliminary in nature. In future work, I intend to (i) provide ad-

women retreat from the LF initially due to a negative income effect but return with the emergence of a strong service sector.

ditional evidence in support of gendered spatial frictions as the key mechanism and against other potential explanations (ii) construct a GE model which can be used to analyze counterfactuals where commuting costs are equalized across genders.

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The Geography of Structural Transformation: Effects on Women's Work

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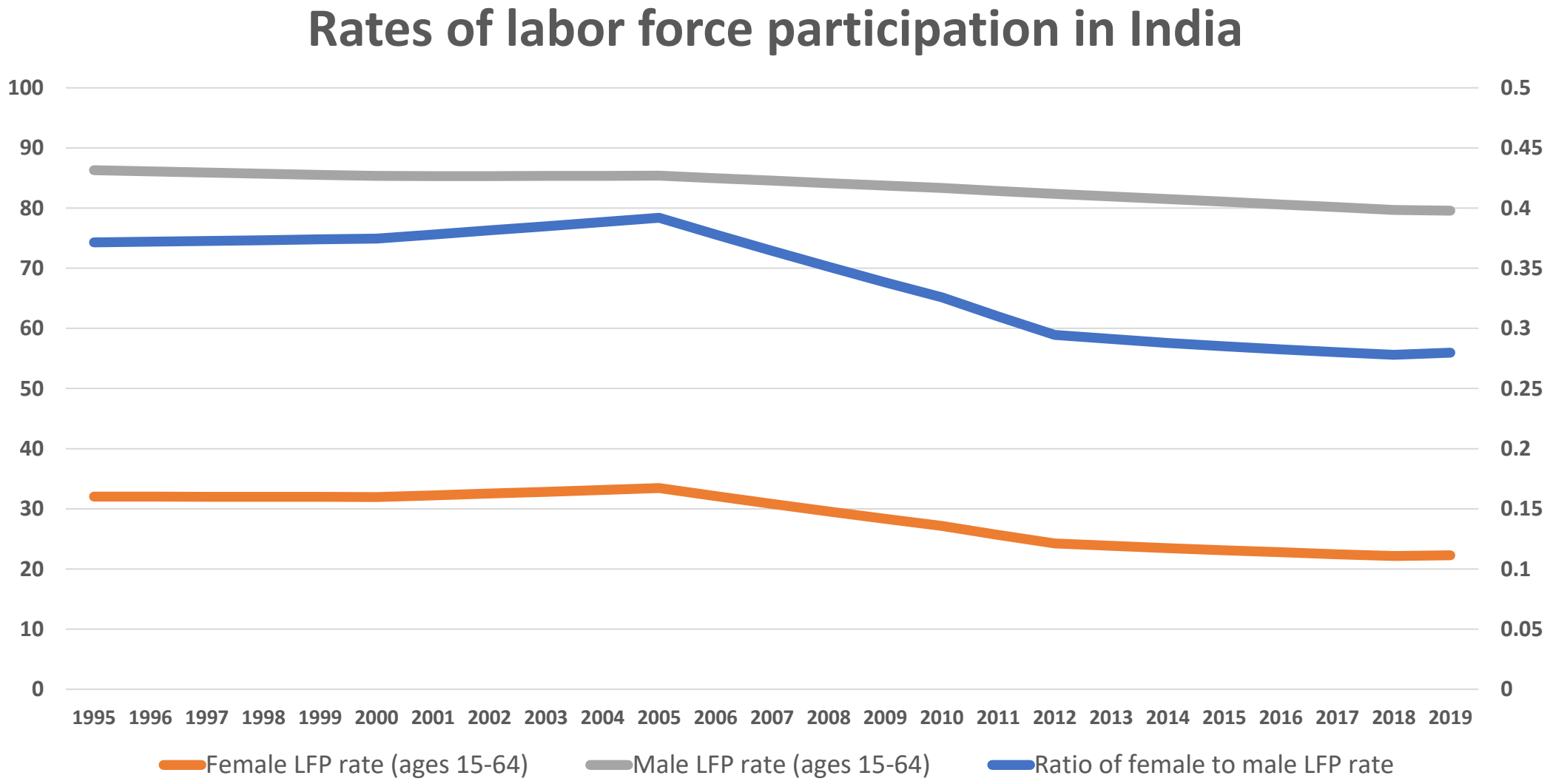
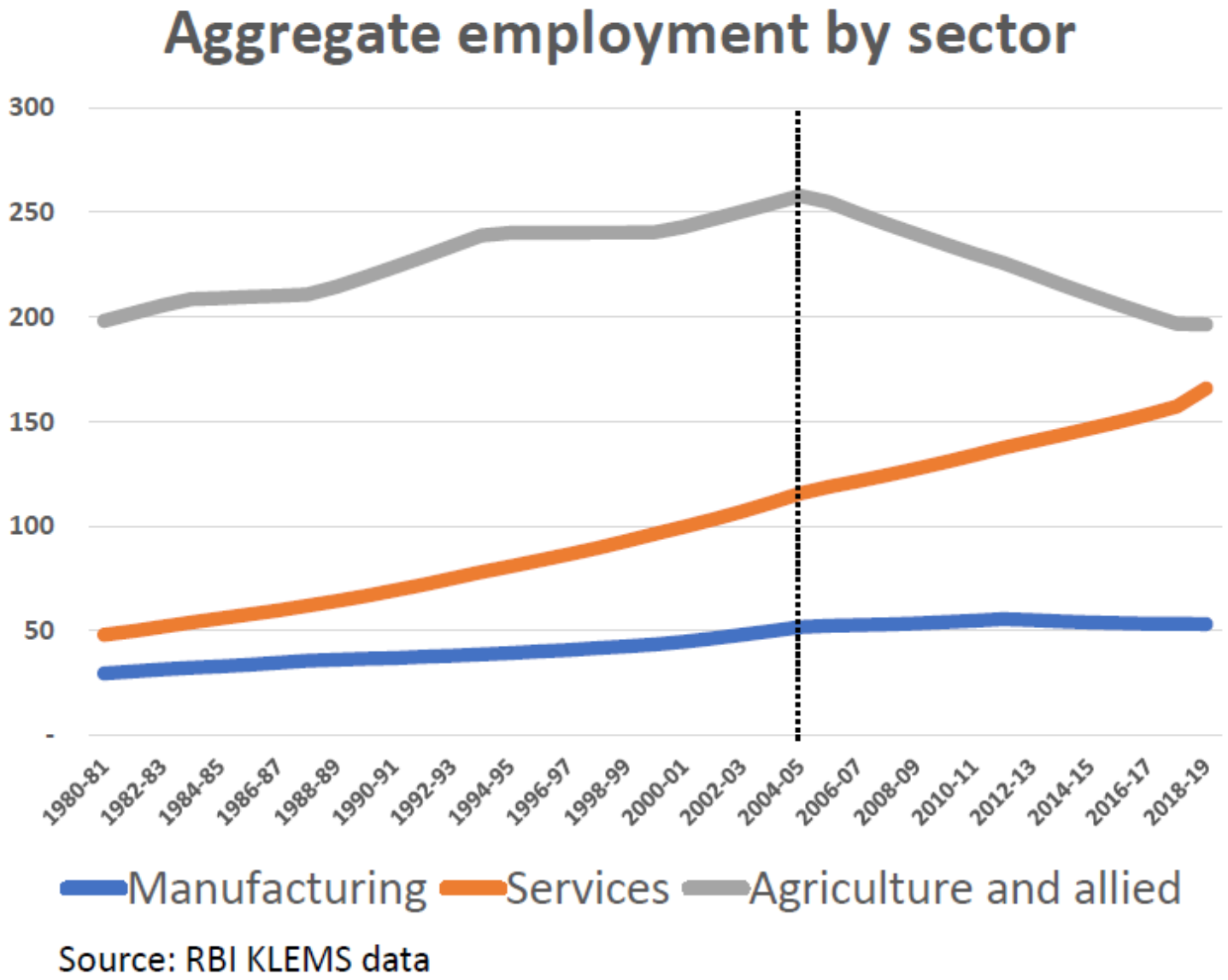
Female LFP rate declined in India after 2005…



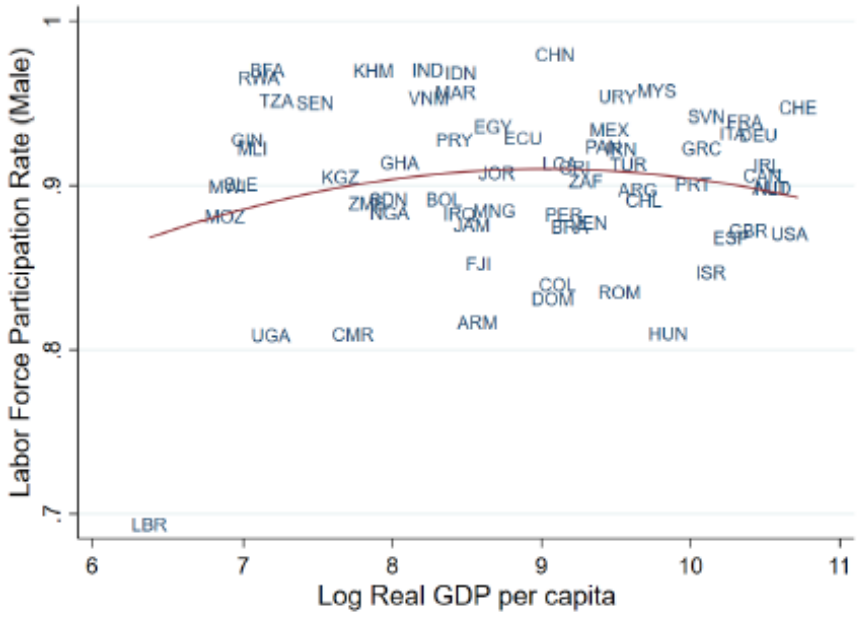
…just as structural transformation took off.



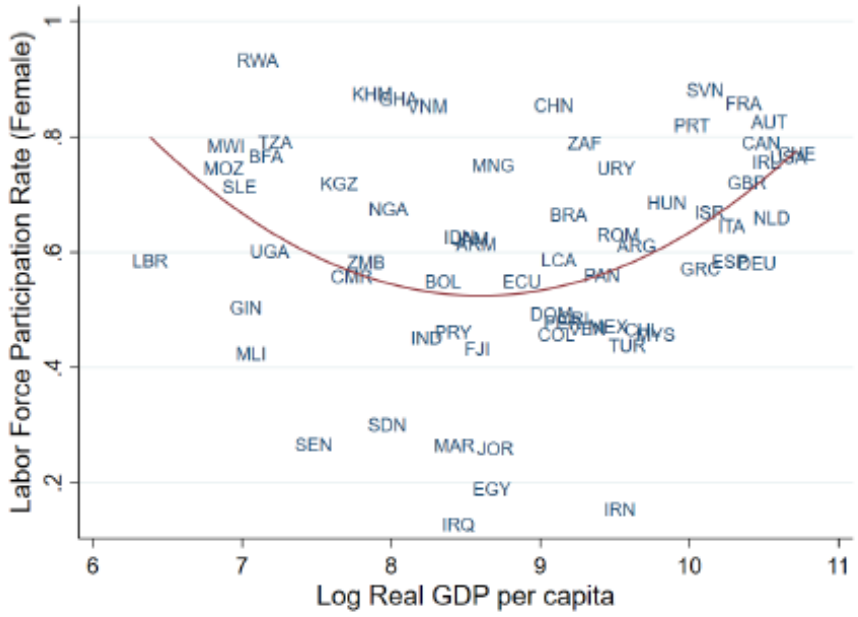
Source: RBI KLEMS data

Structural transformation and female LFP

- A “U-shaped” relationship between FLFP and economic development has long been theorized (Goldin, 1995) using a simple framework – as HHs become richer, women retreat from the LF initially **(negative income effect)** but return with the emergence of a strong service sector **(positive substitution effect)**.



(a) Men



(b) Women

This paper – contribution 1

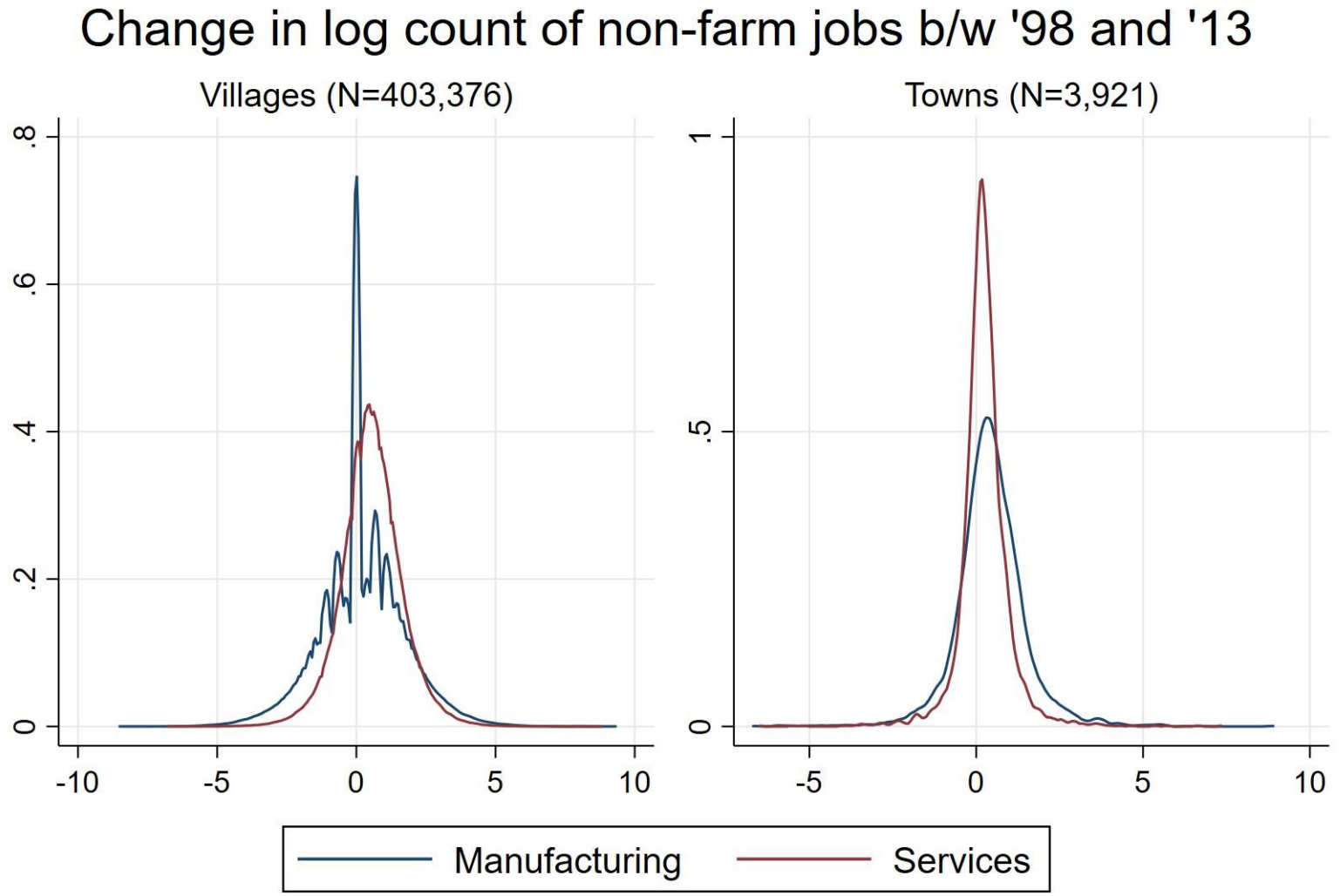
- A new explanation for the downward part of “U-shape”:

  (i) Spatial distribution of economic activity in modern sectors changes during the process of structural transformation.

  (ii) Women face greater mobility frictions than men (due to own preference/stigma around working outside the home).

  → Relative female LFP rate can decline *without an income effect.*

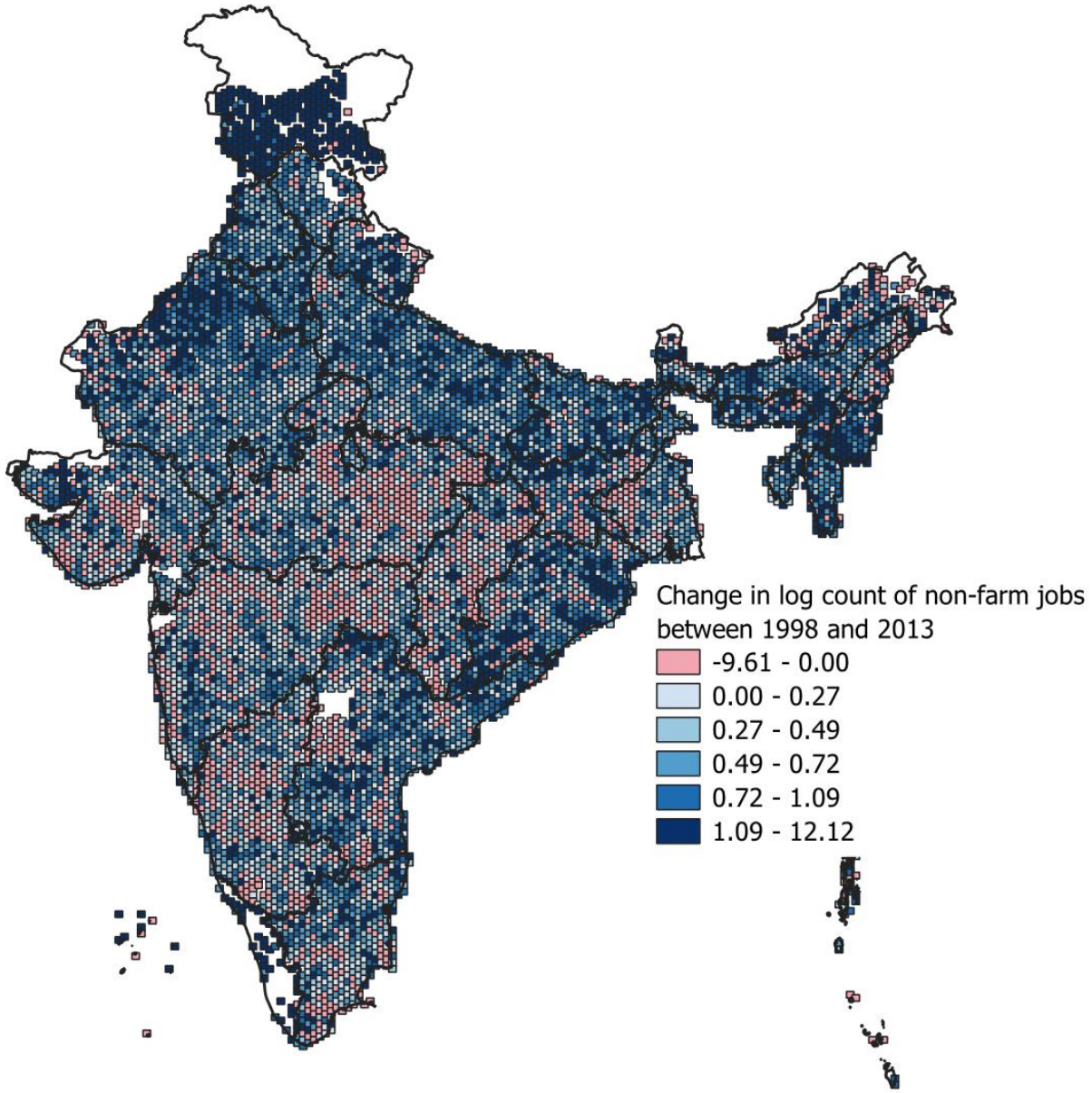
Changing spatial distribution of economic activity



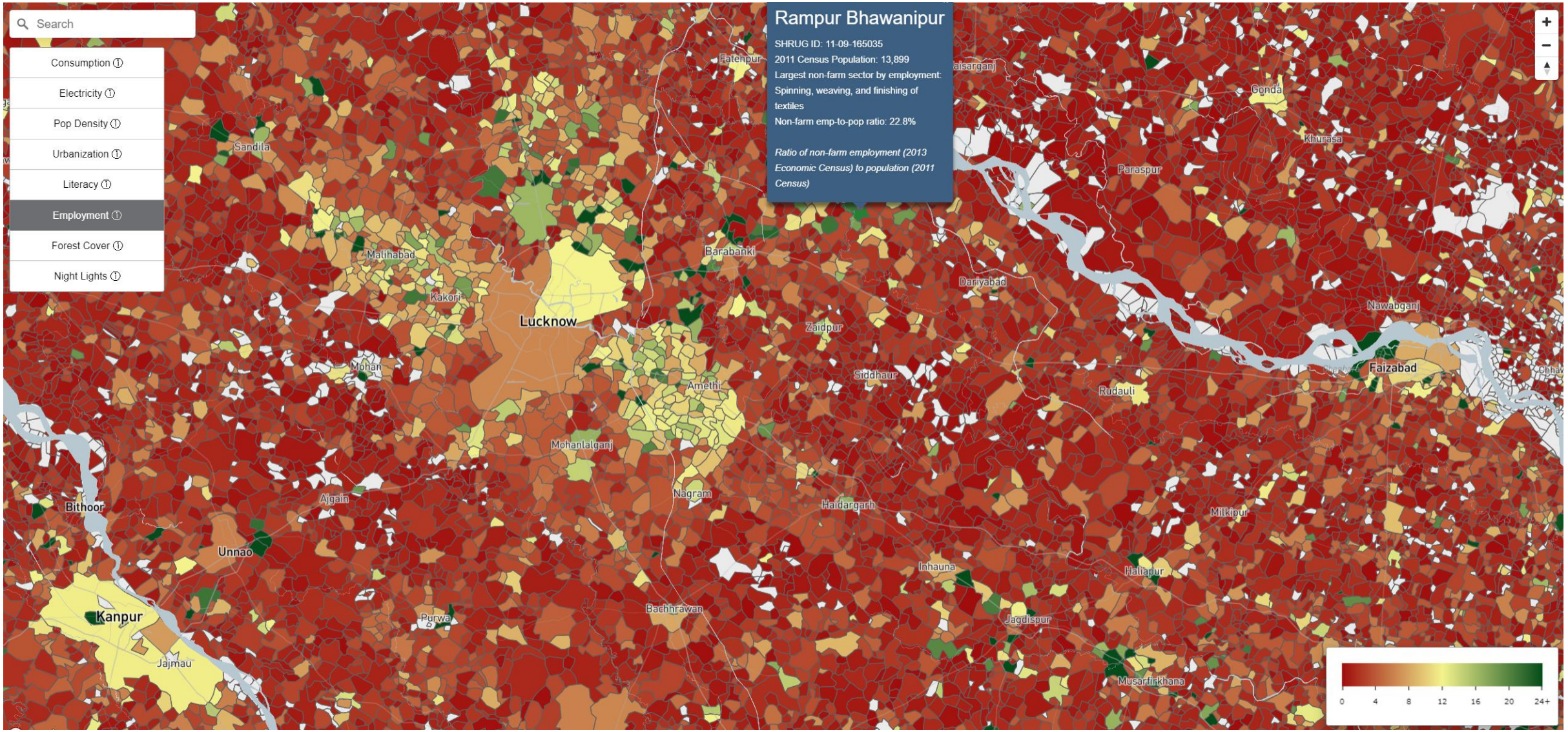
Note: Village/town as defined in the 2001 census
Source: Economic Census (1998 and 2013)

- Between 1998 and 2013, a large share of villages and towns experienced a net decline in the count of jobs in non-farm sectors.

Changing spatial distribution of economic activity

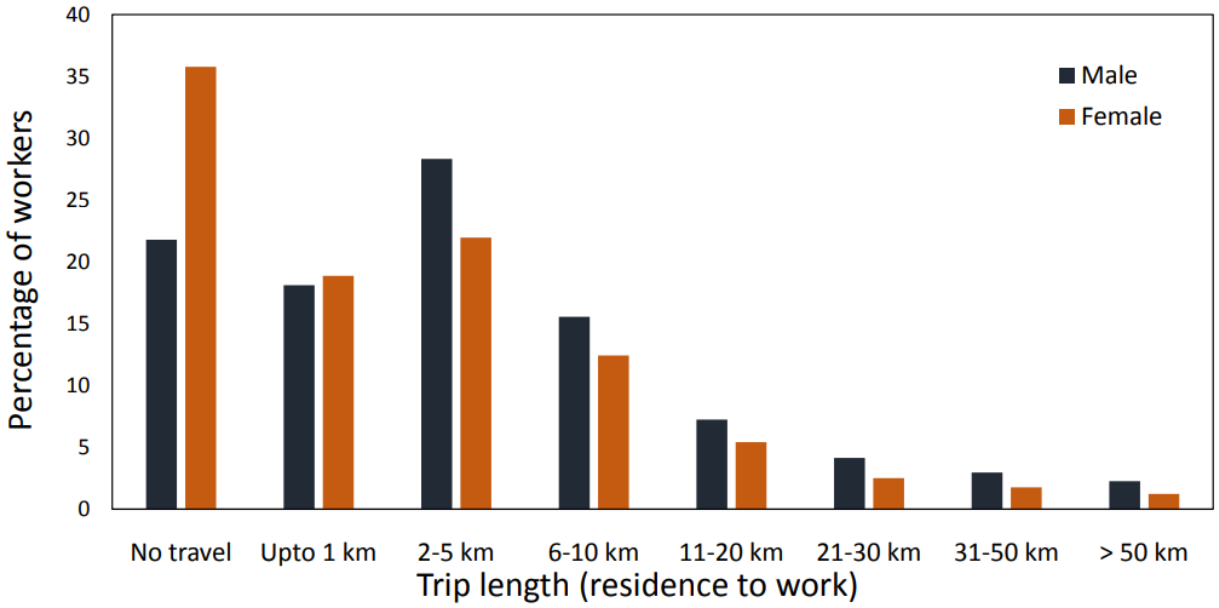


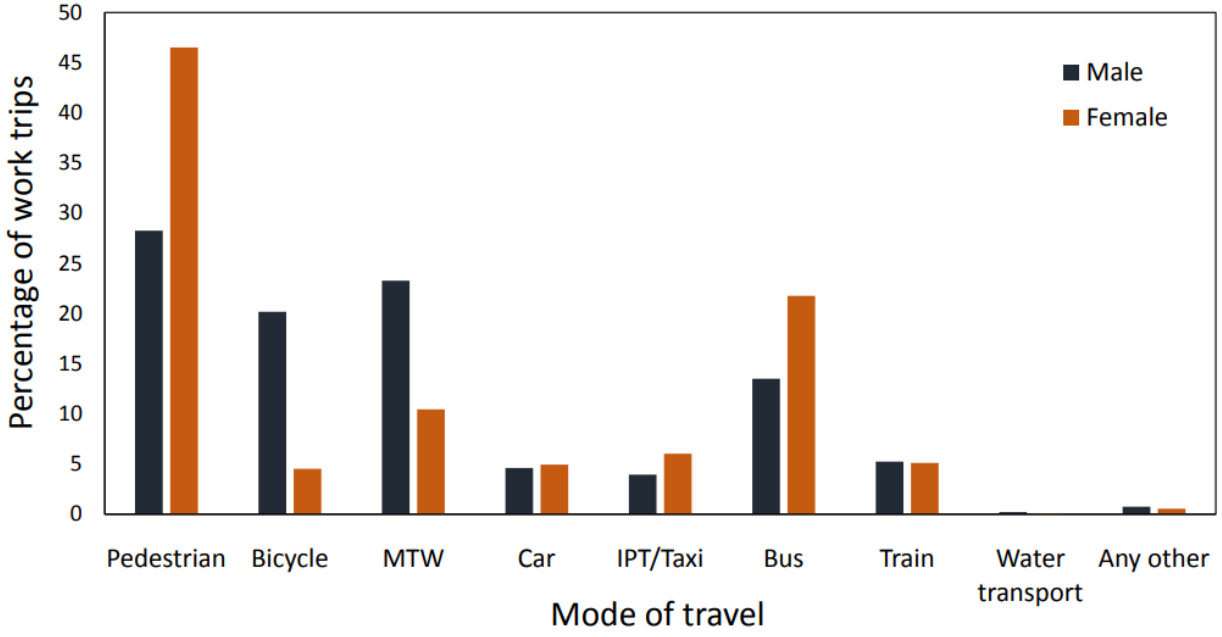
Non-farm jobs are spatially concentrated (2013)



Source: SHRUG Atlas

Distance to work is a larger friction for women



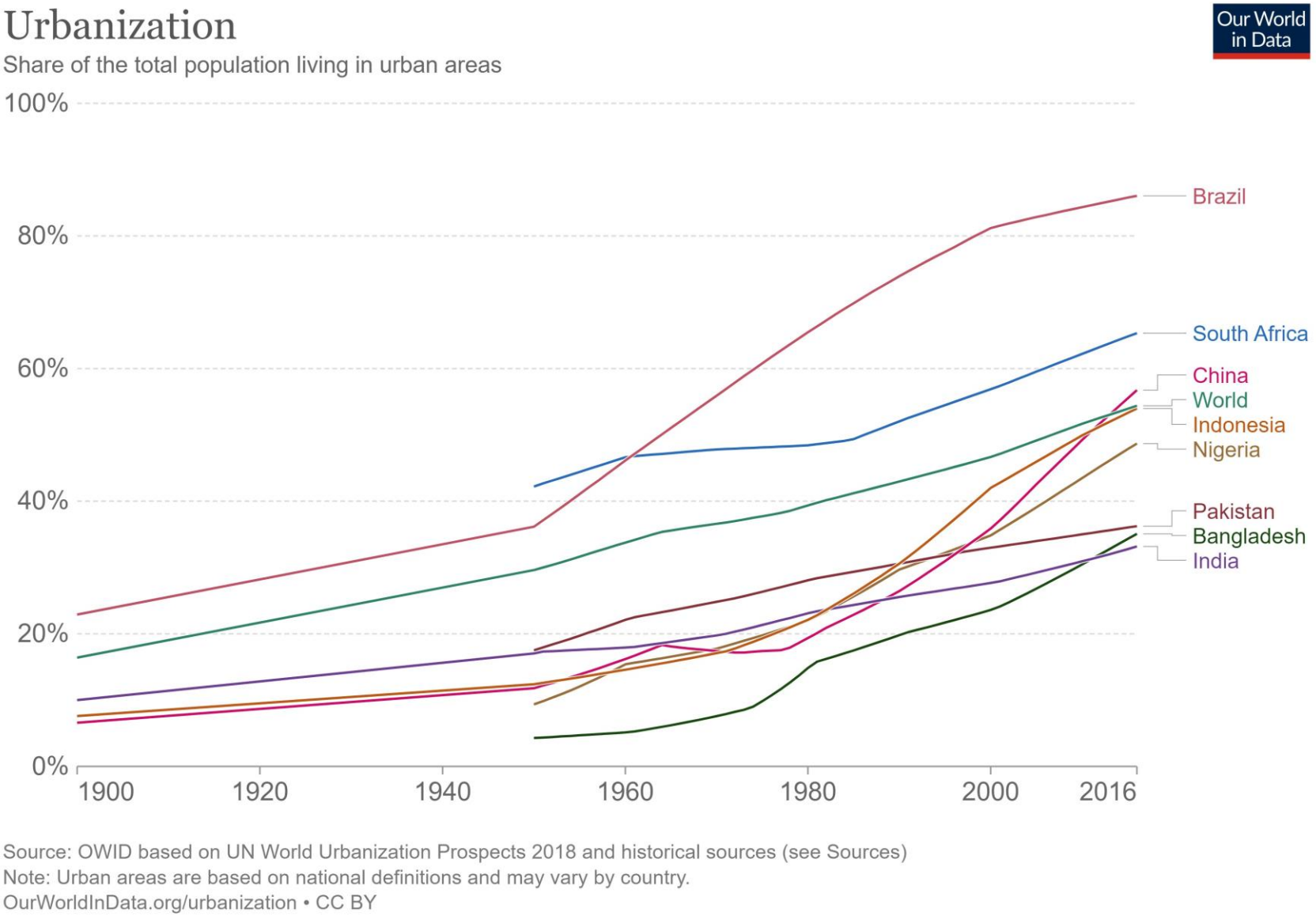


Source: 2011 census data

Focus on commuting

- Assume HHs are fixed in space, ignore migration for now:
  - Inter-state migrants represented only 4% of population in India in the 2011 census, a rate almost unchanged since 2001. Five-year rate = 1% (China = 5%; USA=10%).
  - Imbert and Papp (2020) find that seasonal migrants in India prefer to earn 35 percent less working in local public works rather than incur the cost of migrating.
  - Munshi and Rosenzweig (2016) argue that caste-based rural insurance networks hold people back in rural areas.

Most Indians still live in rural areas



This paper – contribution 2

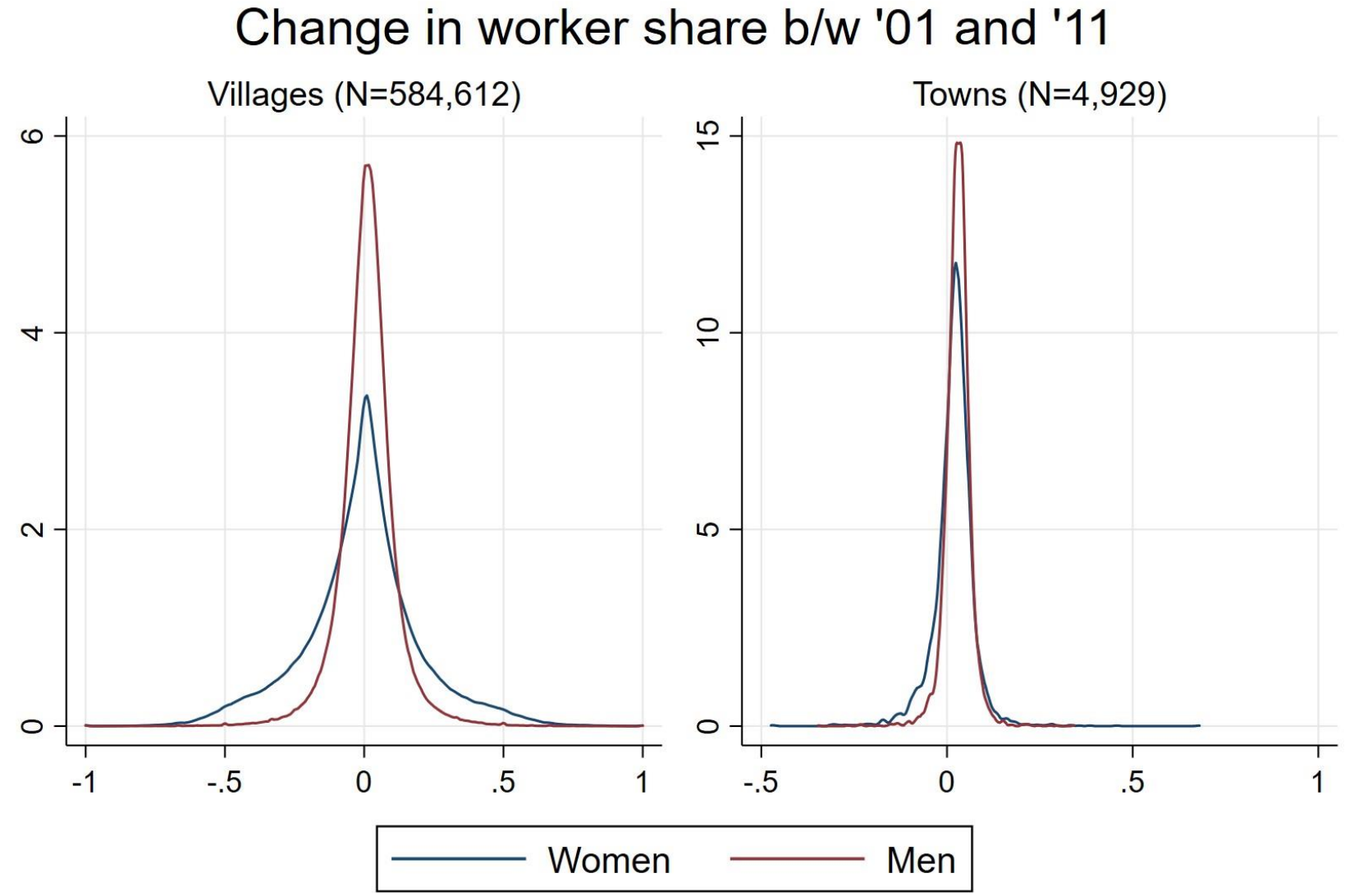
- New prediction: if the spatial story is important (independently of income effects), women's relative LFP rate should:

  (i) decrease in areas that lose job density

  (ii) increase in areas that gain job density

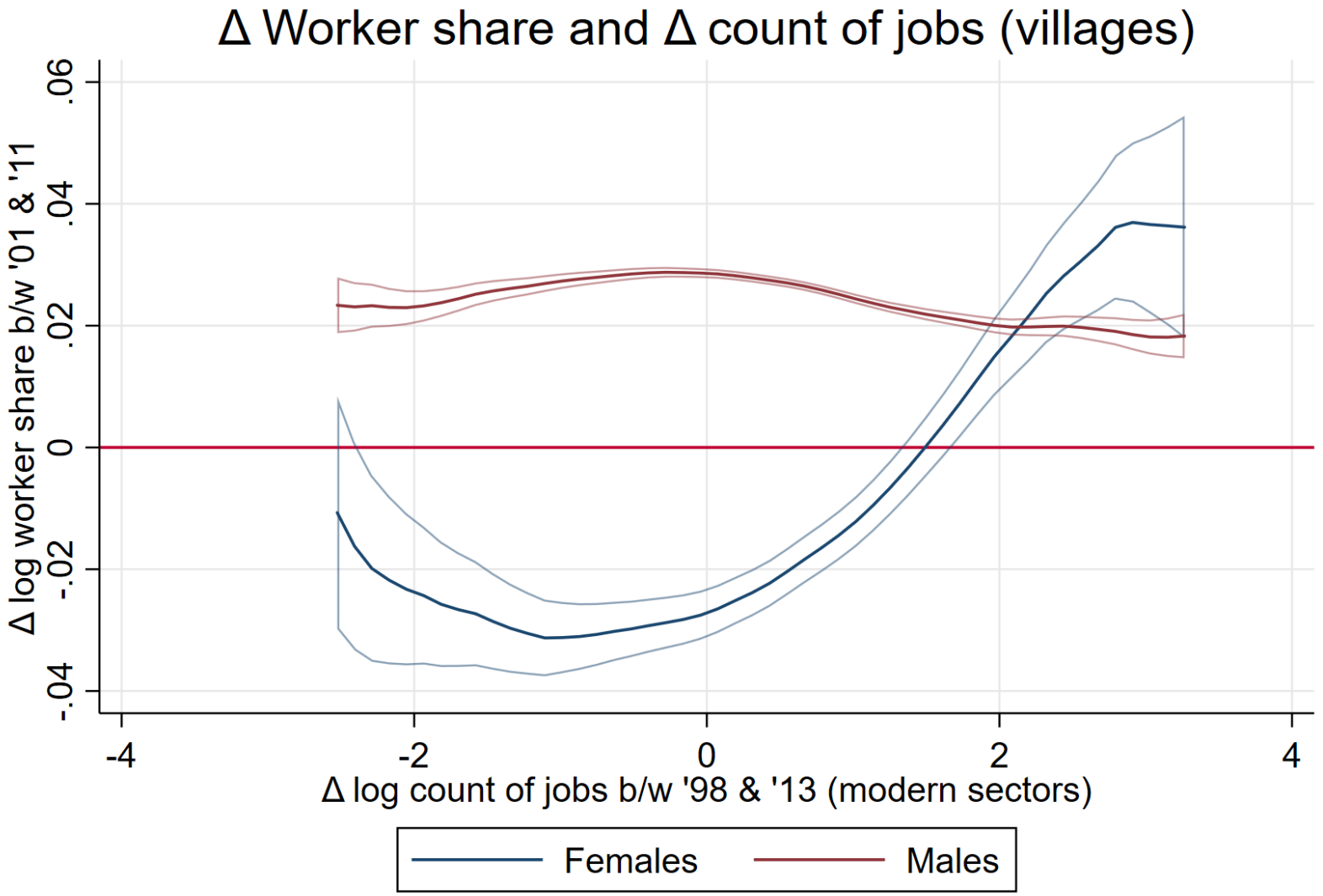
  → Change in women's LFP rate should display large heterogeneity across space depending on whether job density is gained or lost.

Women's distribution of Δ(LFP rate) has higher variance



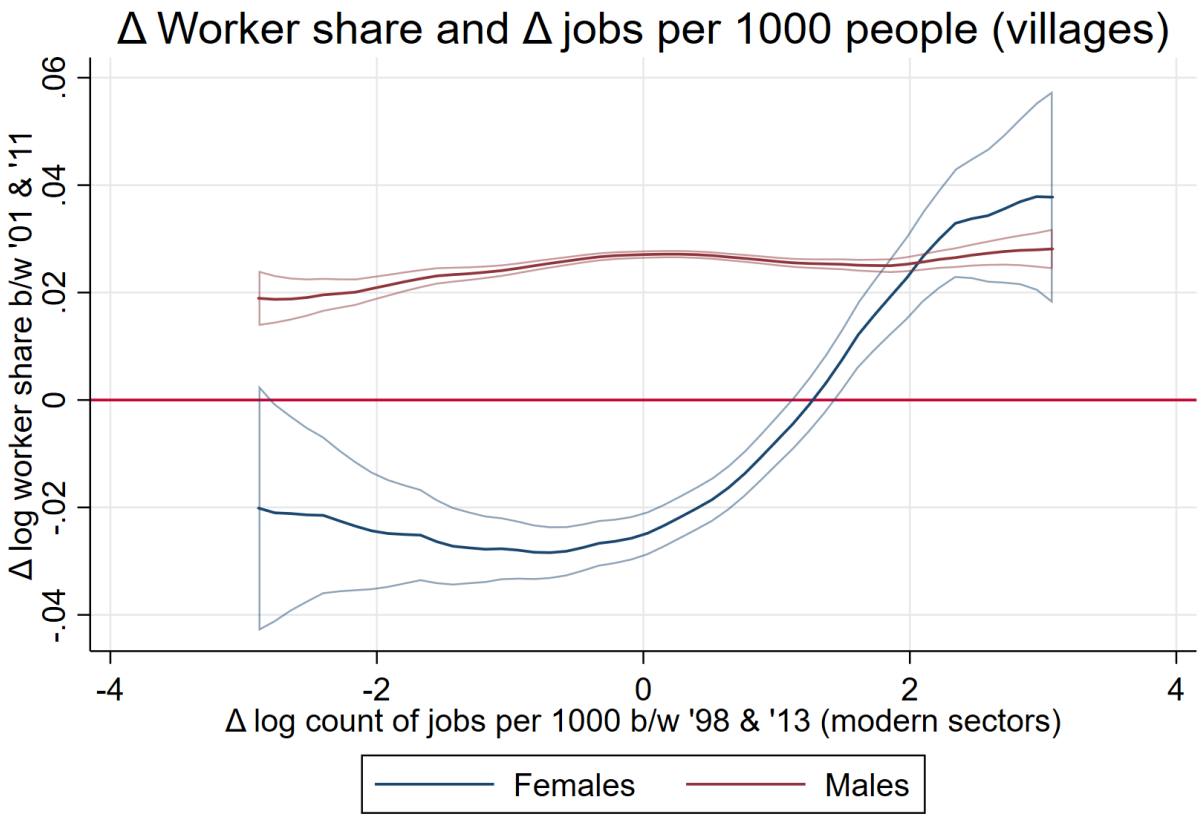
Note: Village/town as defined in the 2001 census
Source: Population Census (2001 and 2011)

Women respond more to increased job density

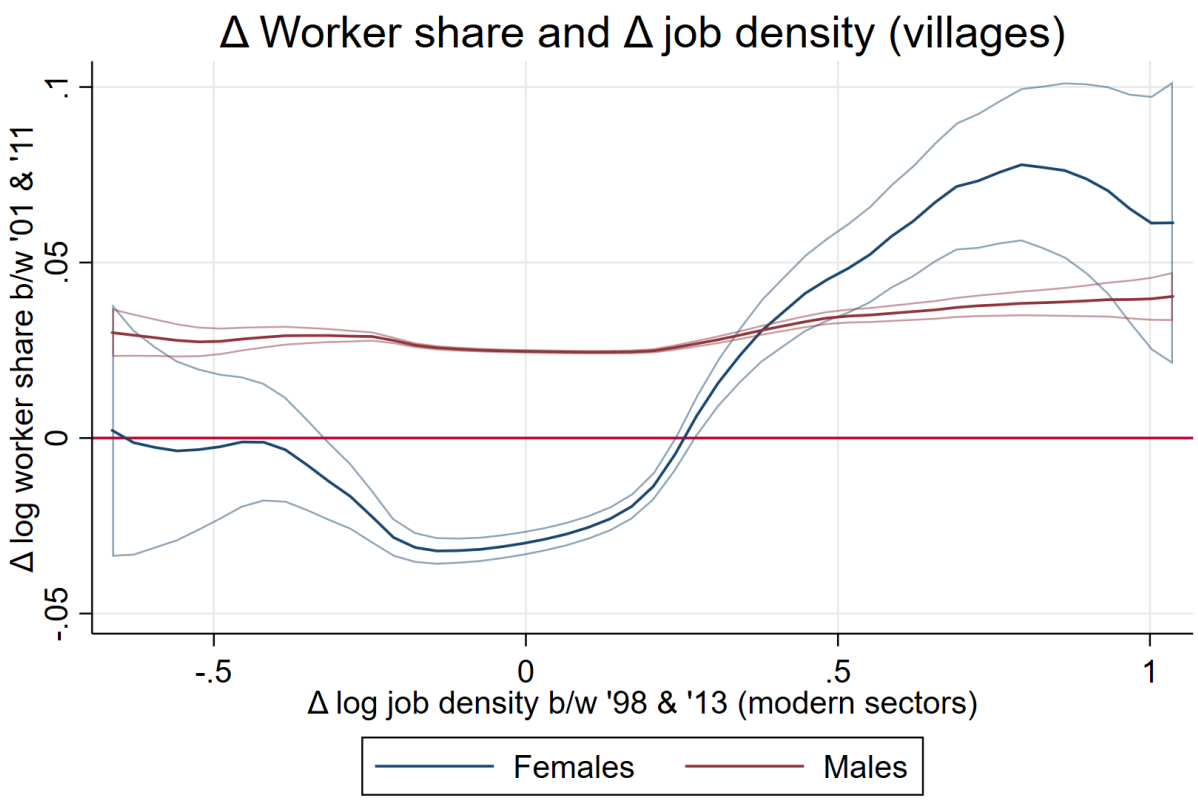


Source: Economic Census (1998 and 2013) and Population Census (2001 and 2011).

Women respond more to increased job density



Source: Economic Census (1998 and 2013) and Population Census (2001 and 2011).



Note: Log job density = ln(1+non-ag jobs per square KM).
Source: Economic Census (1998 and 2013) and Population Census (2001 and 2011).

Research Questions

1. **Can the changing *spatial* distribution of economic activity explain the decline in female LFP after 2005 (independently of a positive income effect)?**

    - Intuition: study a shock that reduces non-farm job density; estimate impacts on LFP for men and women; provide evidence that differential impacts are driven by gendered spatial frictions.

2. **How did the spatial distribution of jobs in the modern sector evolve during the process of structural transformation in India? Can this explain the decline in aggregate female LFP rate?**

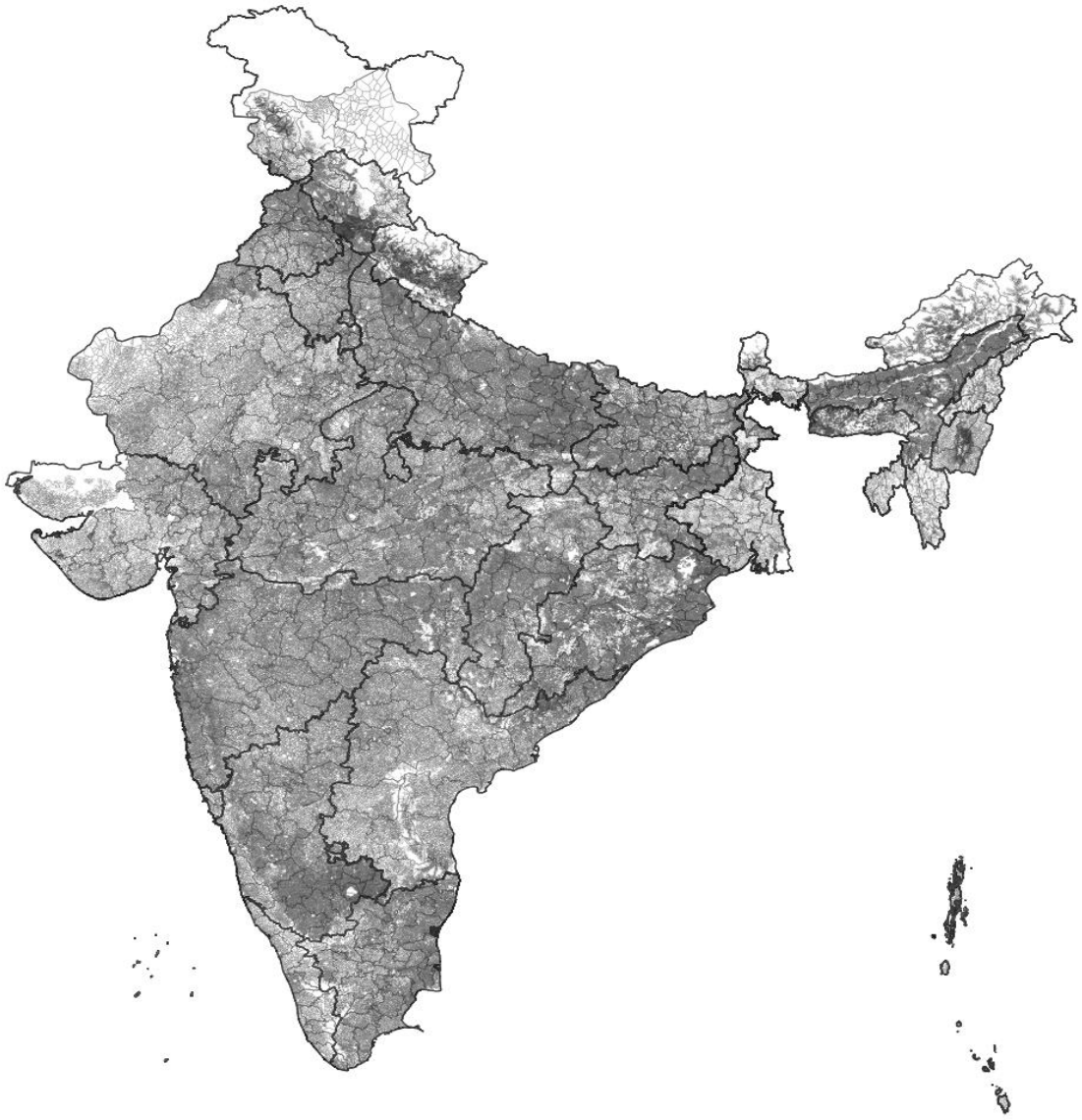
    - Intuition: increase in average distance to job + gendered mobility frictions can explain why aggregate female LFP rate declined

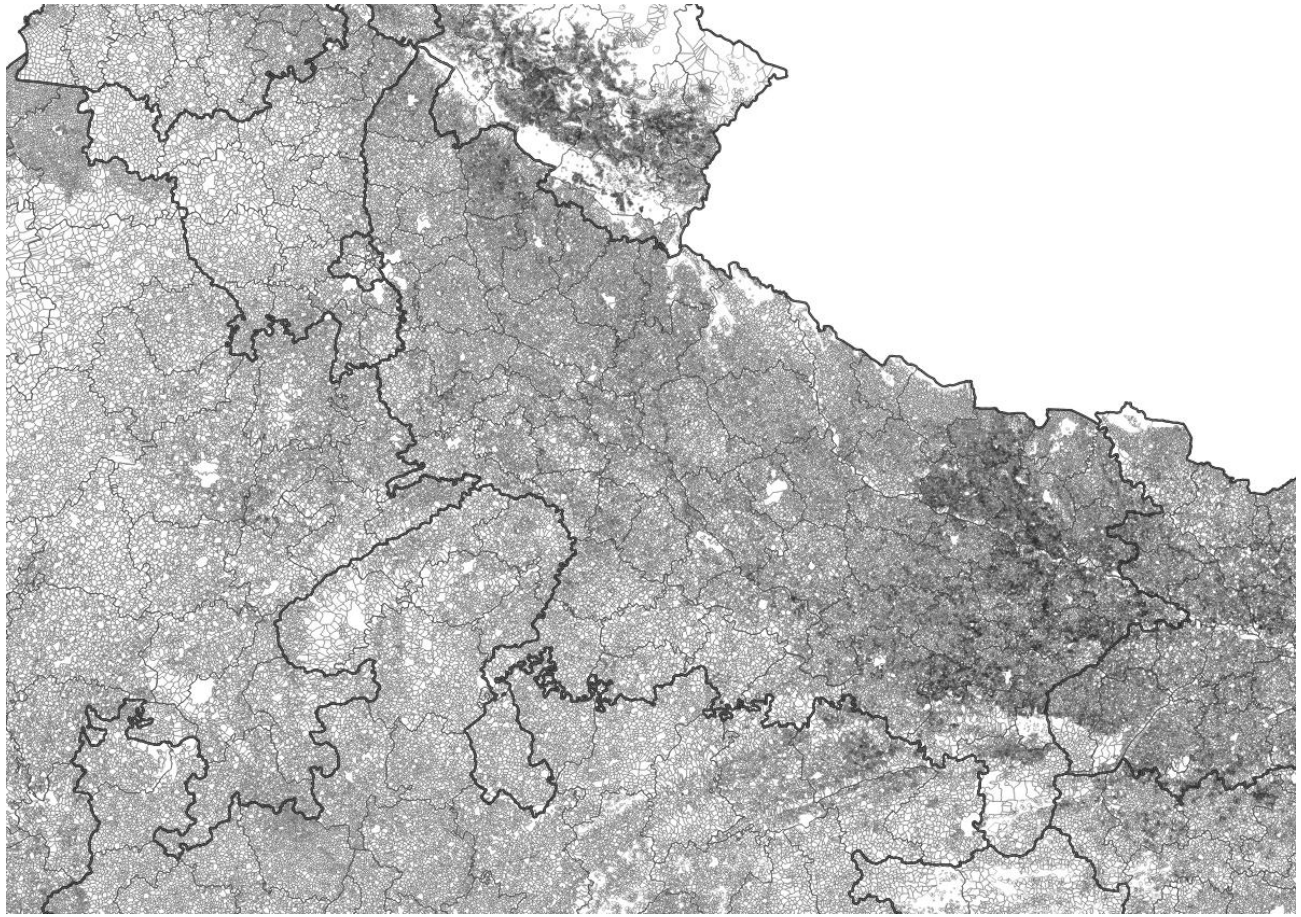
Data

Municipality-level data

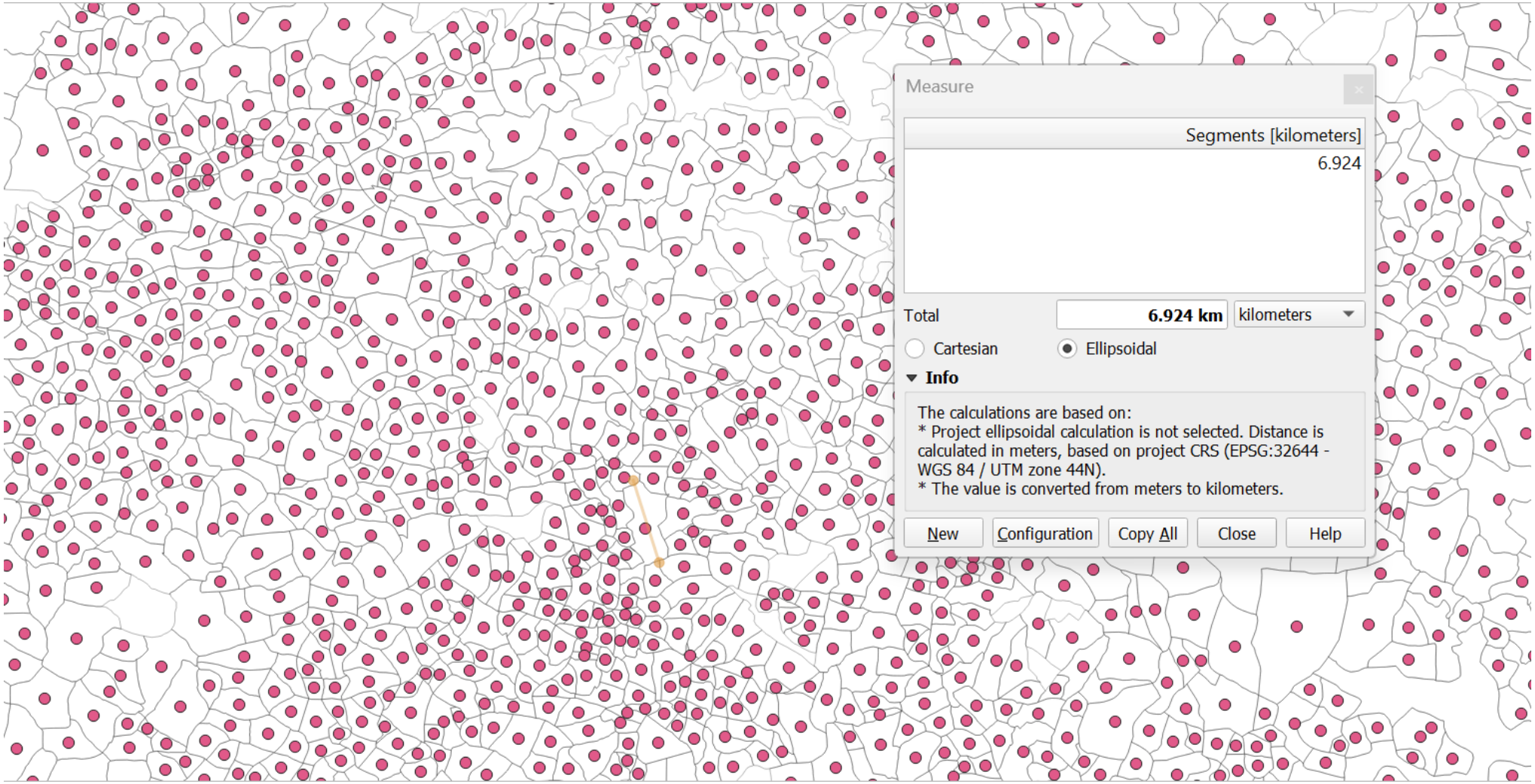
1. Economic census: 1998, 2005, 2013
   - Count of all non-farm firms in every town and village. Includes formal and informal, private and public.
   - One row per firm: industry code, count of employees (by gender and hired/non-hired). No information on costs and profits.
2. Population census: 1991, 2001, 2011
   - Count of all individuals in every town and village.
   - One row per municipality: population, count of workers and non-workers (by gender).
3. SHRUG data
   - Consistent municipality-level identifiers used to construct (i) municipality-level panel, (ii) municipality x industry-level panel

Defining “commuting zones”

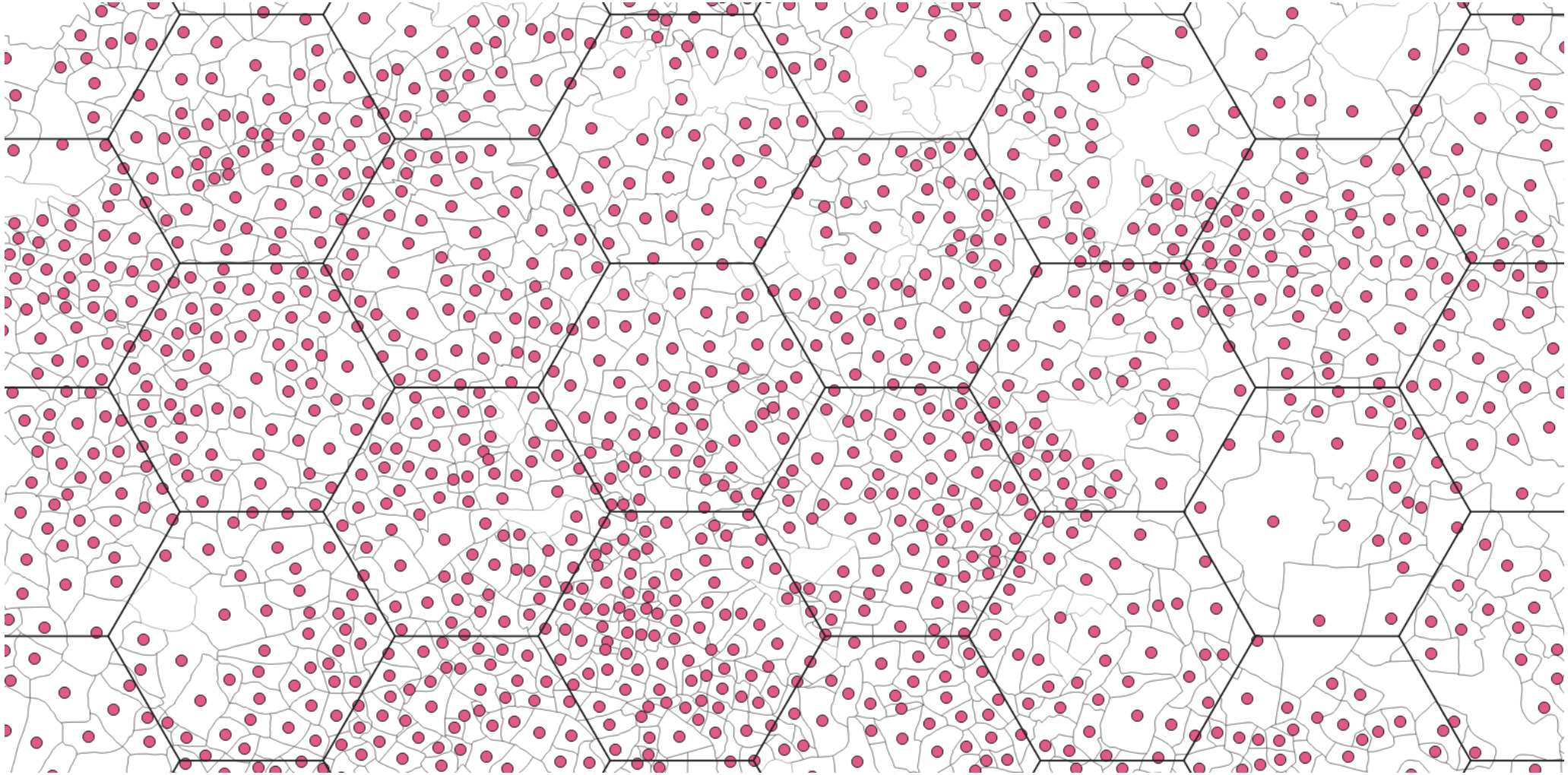




Defining “commuting zones”



Hexagons with radius = 10 km



Descriptives

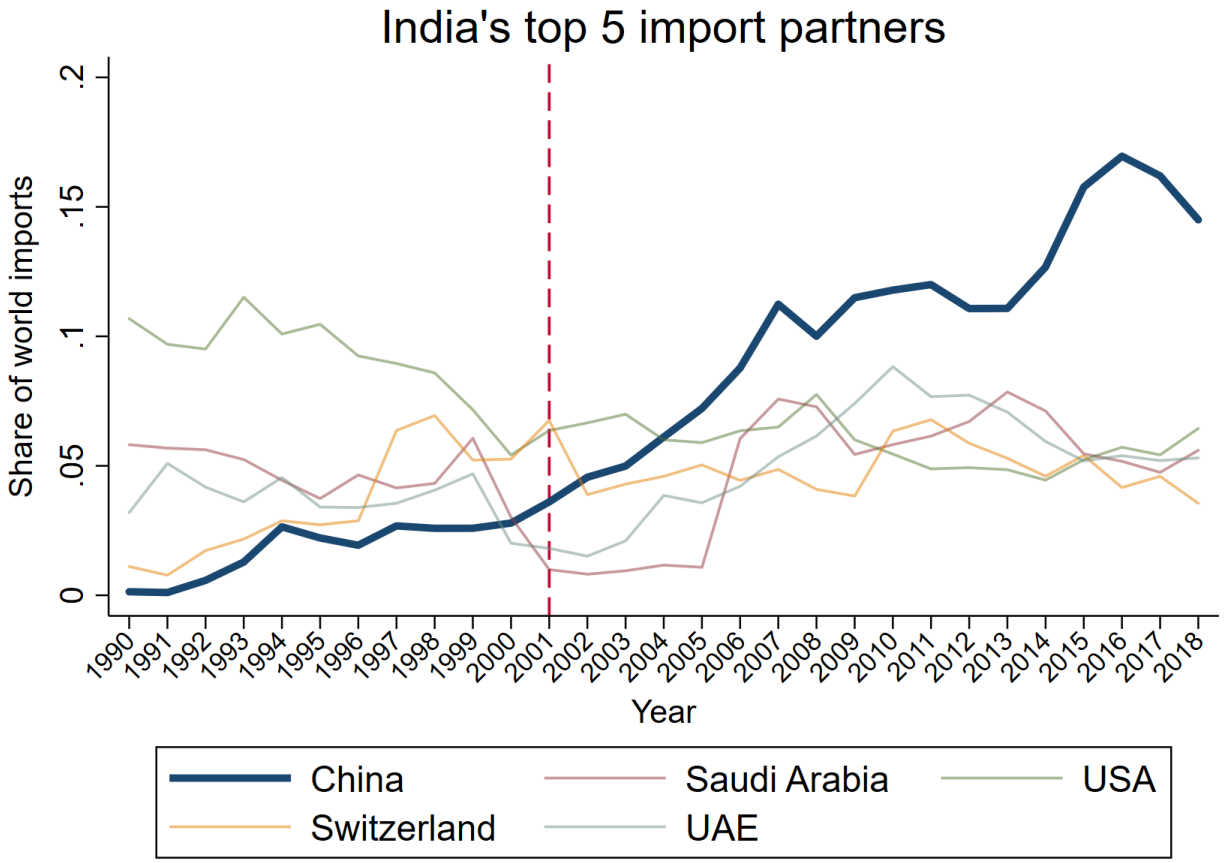
- N=9,184 hexagons spread across 28 states and 7 UTs.
- The average hexagon has 0.8 towns and 67 villages; median hexagon has 0 towns and 47 villages.

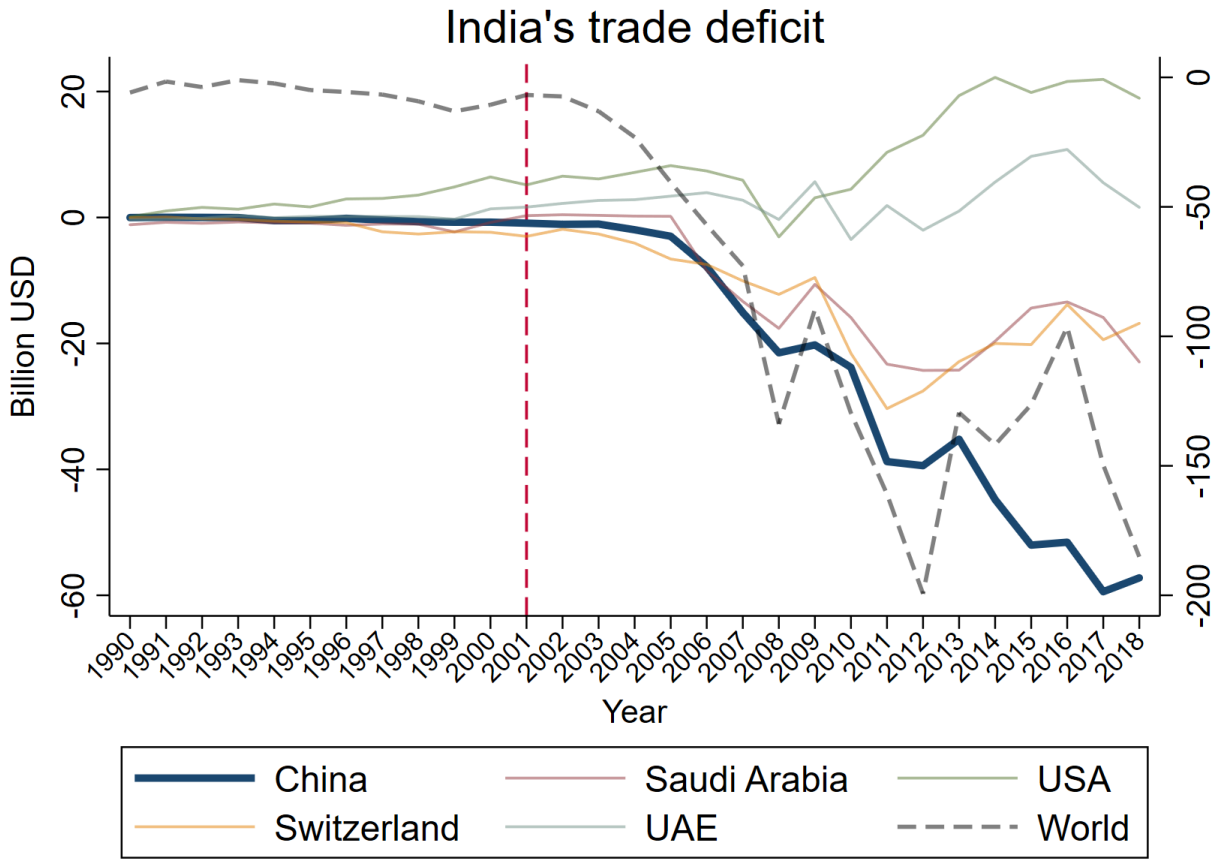
	Indicator	mean	sd	p50
Population Census	Population: 2001	109,721	250,291	65,055
	Population: 2011	128,293	264,715	74,577
	Male worker share: 2001	0.53	0.06	0.53
	Male worker share: 2011	0.55	0.06	0.55
	Female worker share: 2001	0.36	0.14	0.37
	Female worker share: 2011	0.35	0.14	0.36
	Male share of workers in ag: 2001	0.66	0.21	0.72
	Male share of workers in ag: 2011	0.59	0.21	0.64
	Female share of workers in ag: 2001	0.77	0.22	0.86
	Female share of workers in ag: 2011	0.66	0.22	0.71
Economic Census	Male non-farm jobs per 1000: 1998	79.81	150.83	59.47
	Male non-farm jobs per 1000: 2005	81.27	73.06	67.56
	Male non-farm jobs per 1000: 2013	96.17	89.98	77.74
	Female non-farm jobs per 1000: 1998	21.7	123.66	11.76
	Female non-farm jobs per 1000: 2005	24.76	43.86	14.97
	Female non-farm jobs per 1000: 2013	36.99	173.14	23.42

Identification approach:

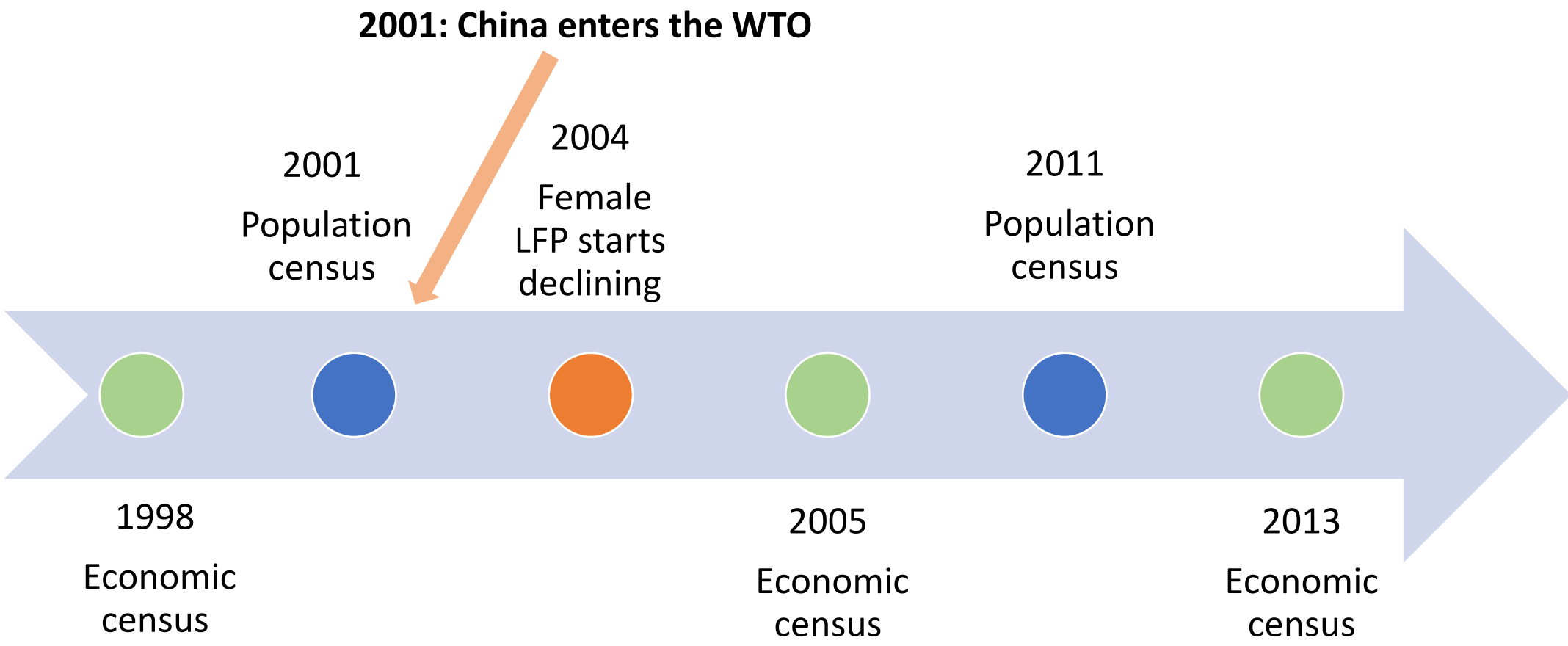
Using China's entry into the WTO as an exogenous negative shock to local labour demand

China entered the WTO in 2001





Data timeline



Constructing hexagon-level shocks

- Following Autor et al. (2013), I construct a measure of change in Chinese import penetration in local labour market i by combining import growth across j industries with each industry's baseline employment share in market i:

  - $\Delta IP_{i\tau}^{CI} = \sum_j \left(\frac{L_{ij1998}}{L_{i2001}} \right) \Delta IP_{j\tau}^{CI}$,where $\Delta IP_{j\tau}^{CI} = \frac{\Delta M_{j\tau}^{CI}}{L_{j1998}}$

- Industries are at the 3-digit level (N~115).

For each hexagon, I define:

$$\Delta \log(worker\ sh)_{i\tau}^{g} = \alpha + \beta^{g}\ \Delta \mathrm{IP}_{i\tau} + \boldsymbol{X}_{i} + state\ FE + \varepsilon_{i}$$

- Main outcome (Y): Change in worker share(total workers/total population) between 2001 and 2011.
- Exogenous negative shock to labour demand (X): Measure of change in Chinese import penetration between 1998 and 2011.
- Controls: share of workers who work in agriculture in 2001, log population in 2001, sum of shares, state fixed effects.
- SEs clustered at the hexagon level.

IV: import growth in Latin American countries

- Threat to identification – unobserved shocks to product demand in India can affect both Indian employment and imports from China.

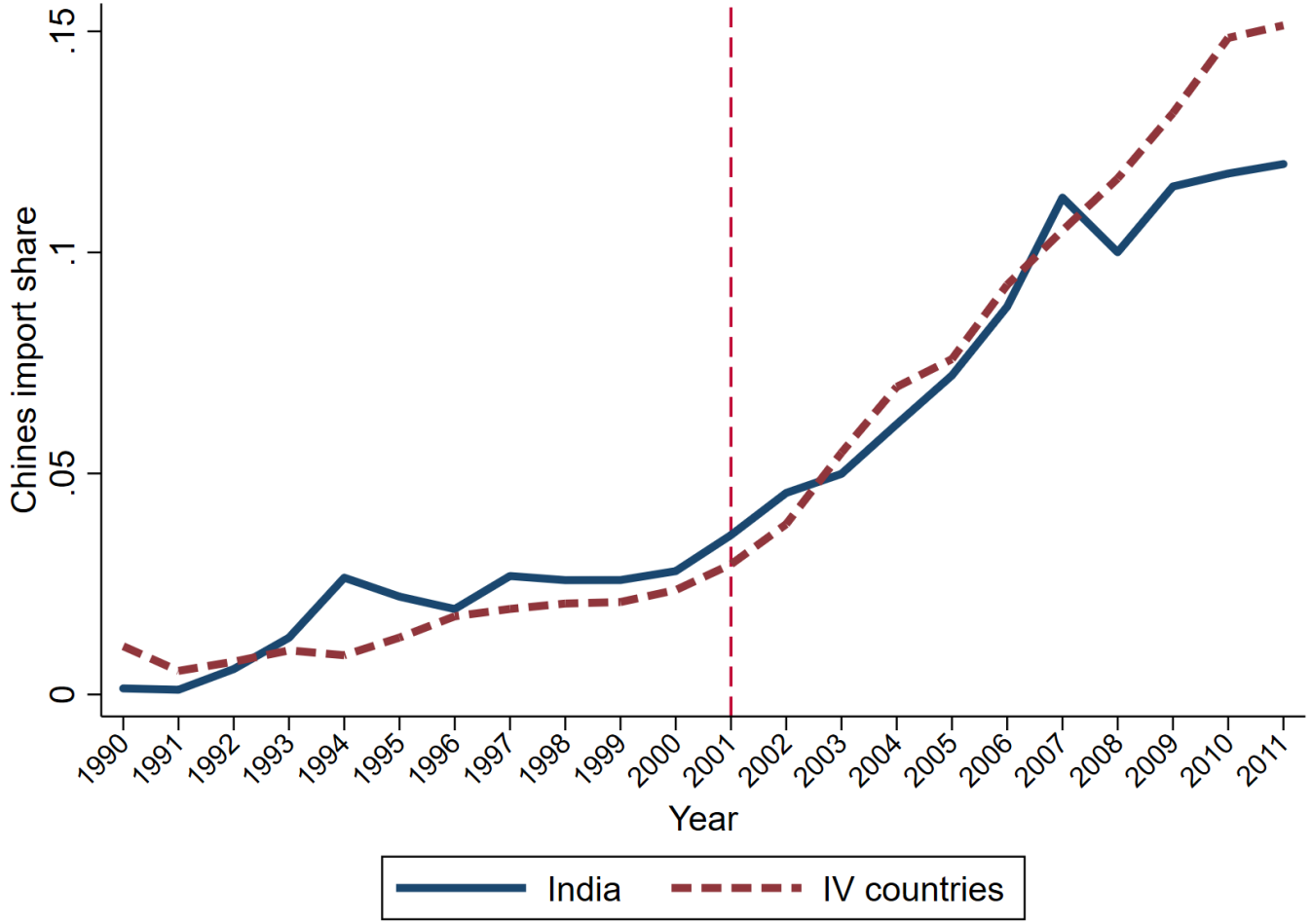
- Following Autor et al. (2013) and Acemoglu et al. (2016), I instrument the growth of Chinese imports to India by the growth and composition of Chinese imports in other countries.

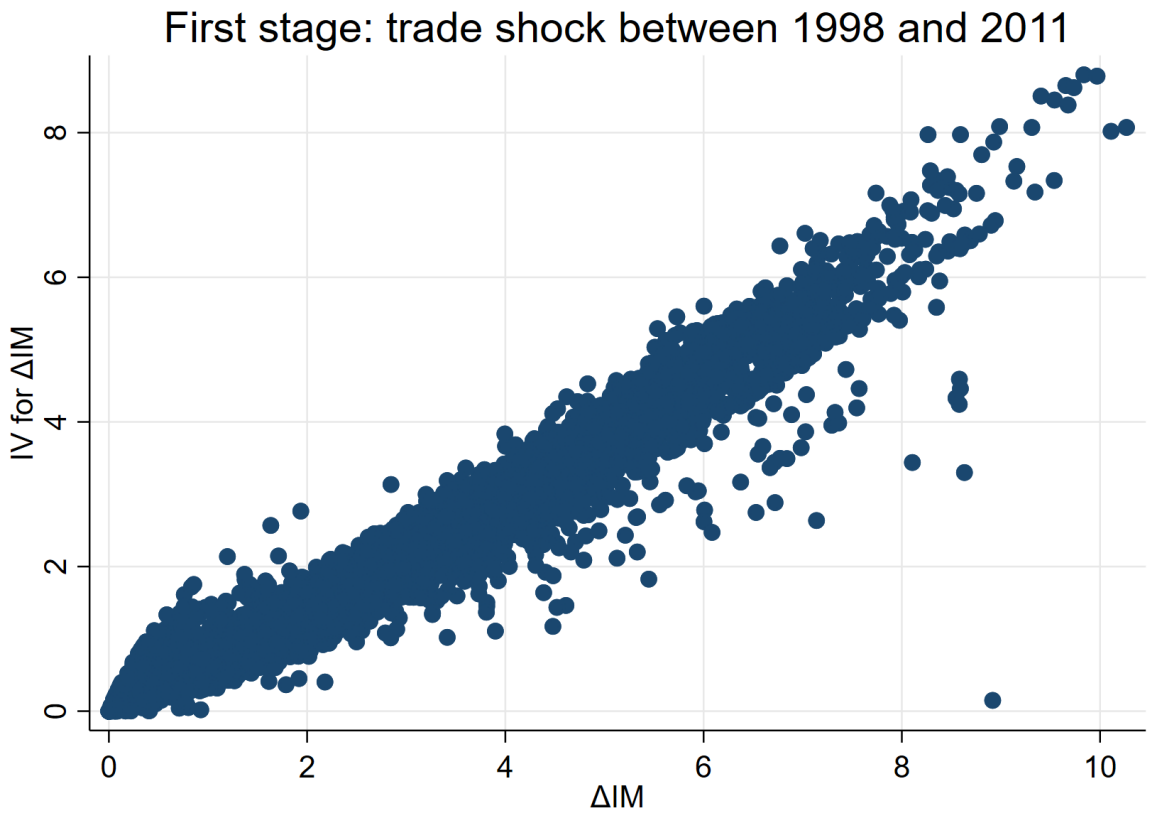
$$\text{IV for } \Delta IP_{i\tau}^{CI} = \Delta IP_{i\tau}^{CO} = \sum_j \left(\frac{L_{ij1998}}{L_{i2001}}\right) \Delta IP_{j\tau}^{CO}, \text{ where } \Delta IP_{j\tau}^{CO} = \frac{\Delta M_{j\tau}^{CO}}{L_{j1998}}$$

- I average industry-level import growth across ten Latin American countries - Argentina, Brazil, Costa Rica, Chile, Colombia, Mexico, Paraguay, Peru, Uruguay, and Venezuela.

First stage

- IV countries experienced similar rise in Chinese imports and import similar basket of goods.





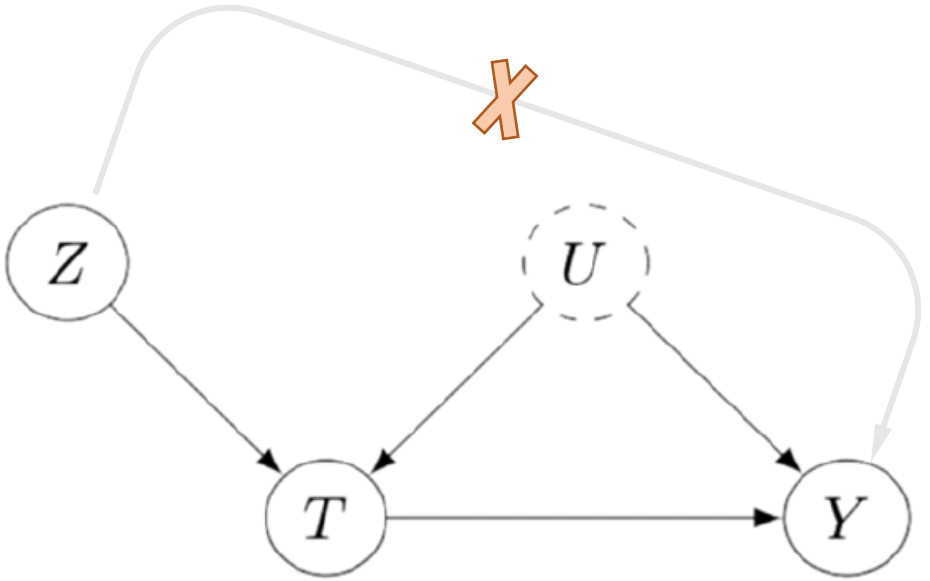
Exclusion restriction

- Assumption: the only common component of import growth in India and in IV countries derives from factors specific to China (entry into the WTO in 2001 following rapid improvement in productivity, rural-urban migration in the 1990s).

- Potential threat: increased global competition from China may hit Indian exports to IV markets (thus impacting Indian employment).

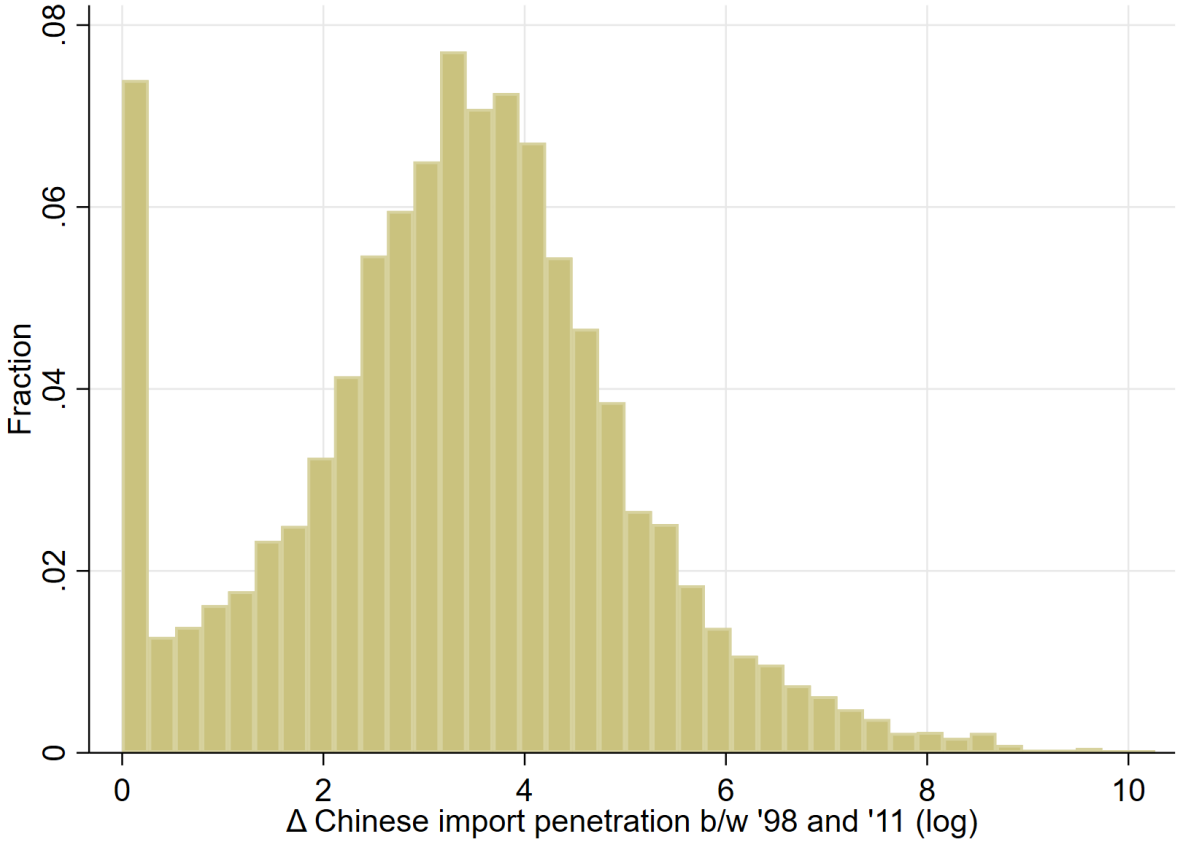
- However, IV countries are not major trade partners with India (less then 3% import/export share between 1990-2011) – so this channel is unlikely to be important.

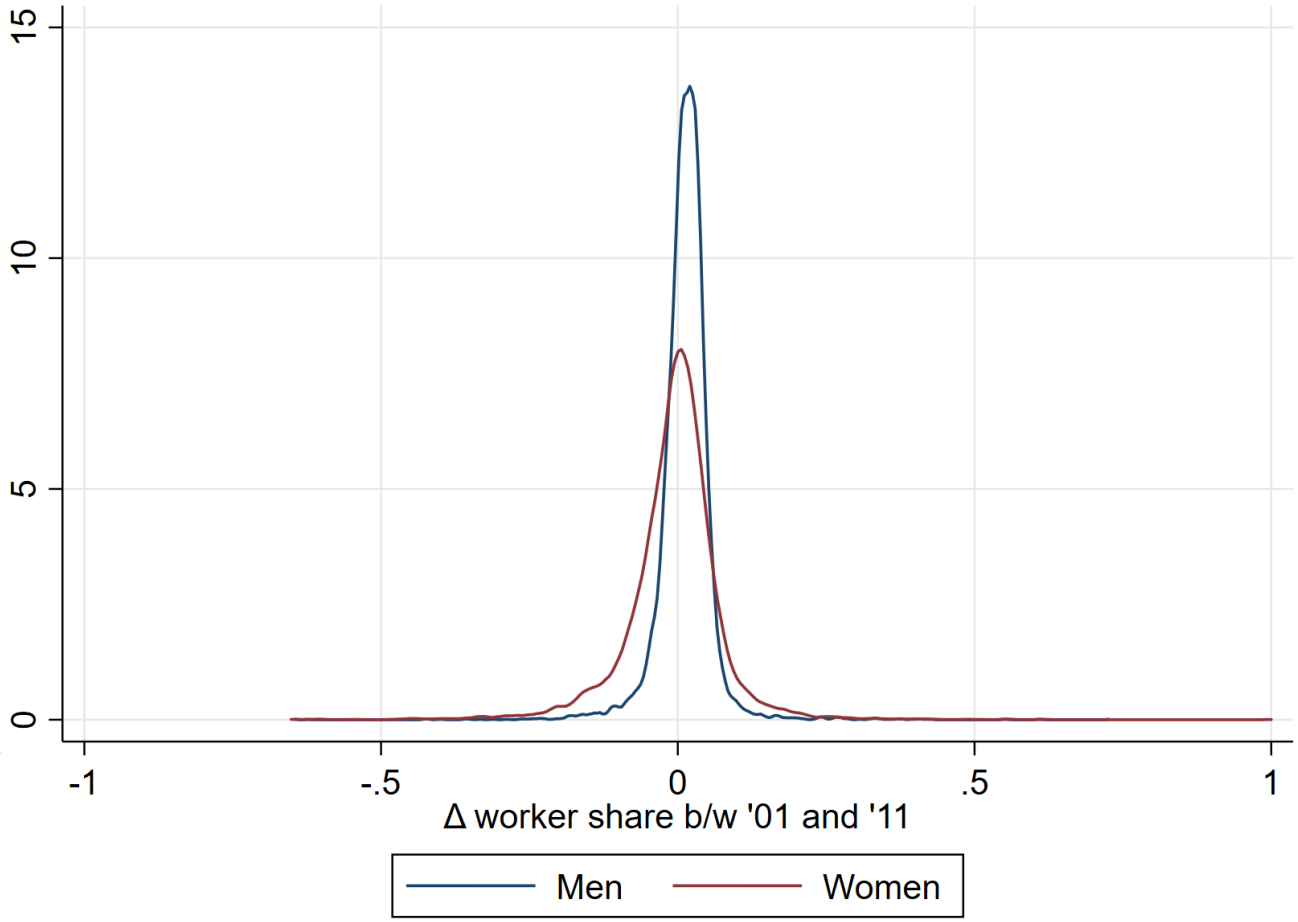
- Corresponds to a shift-share design with quasi-random assignment of shocks, while exposure shares are allowed to be endogenous (Borusyak et al, 2022).



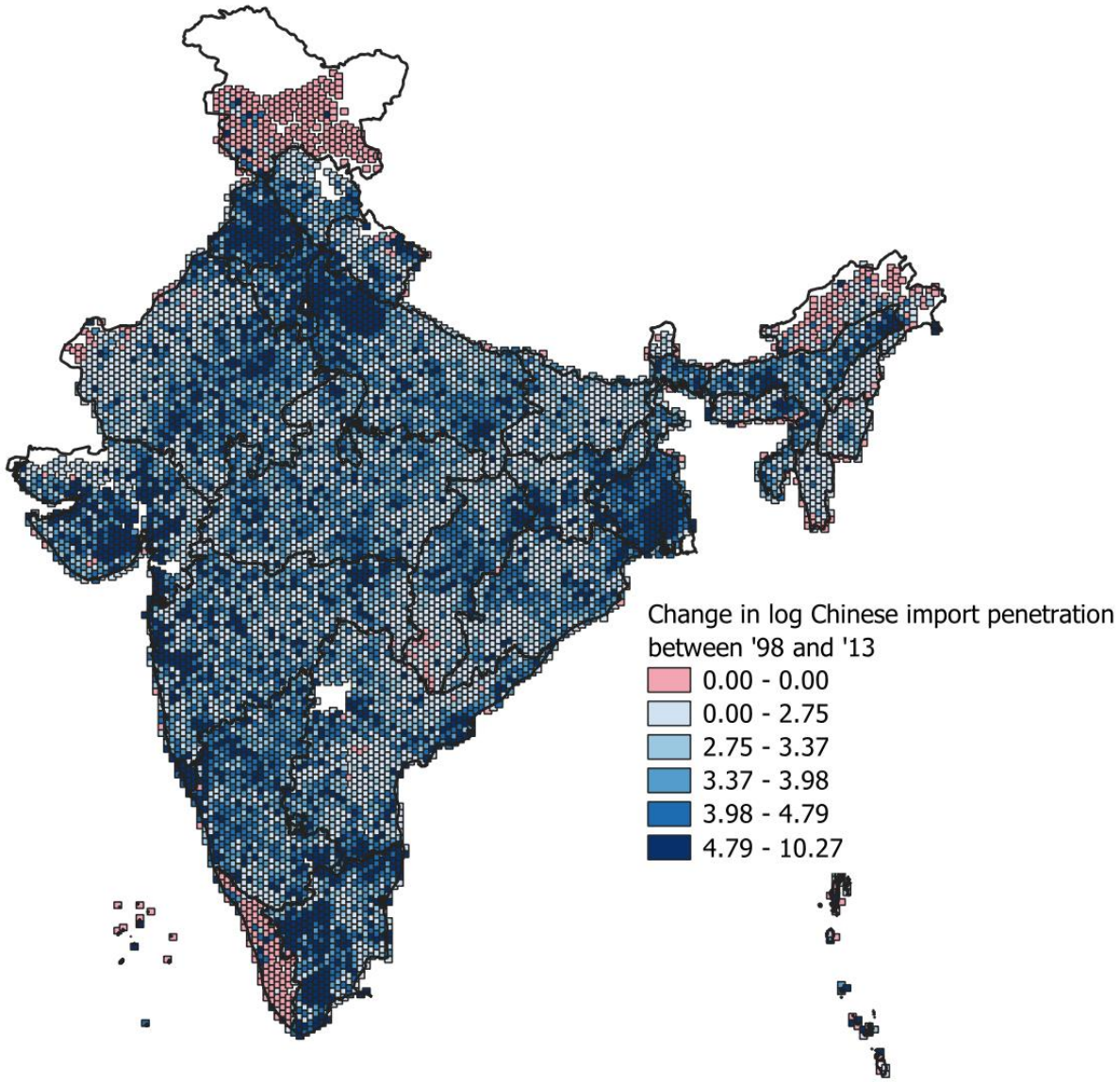
Results

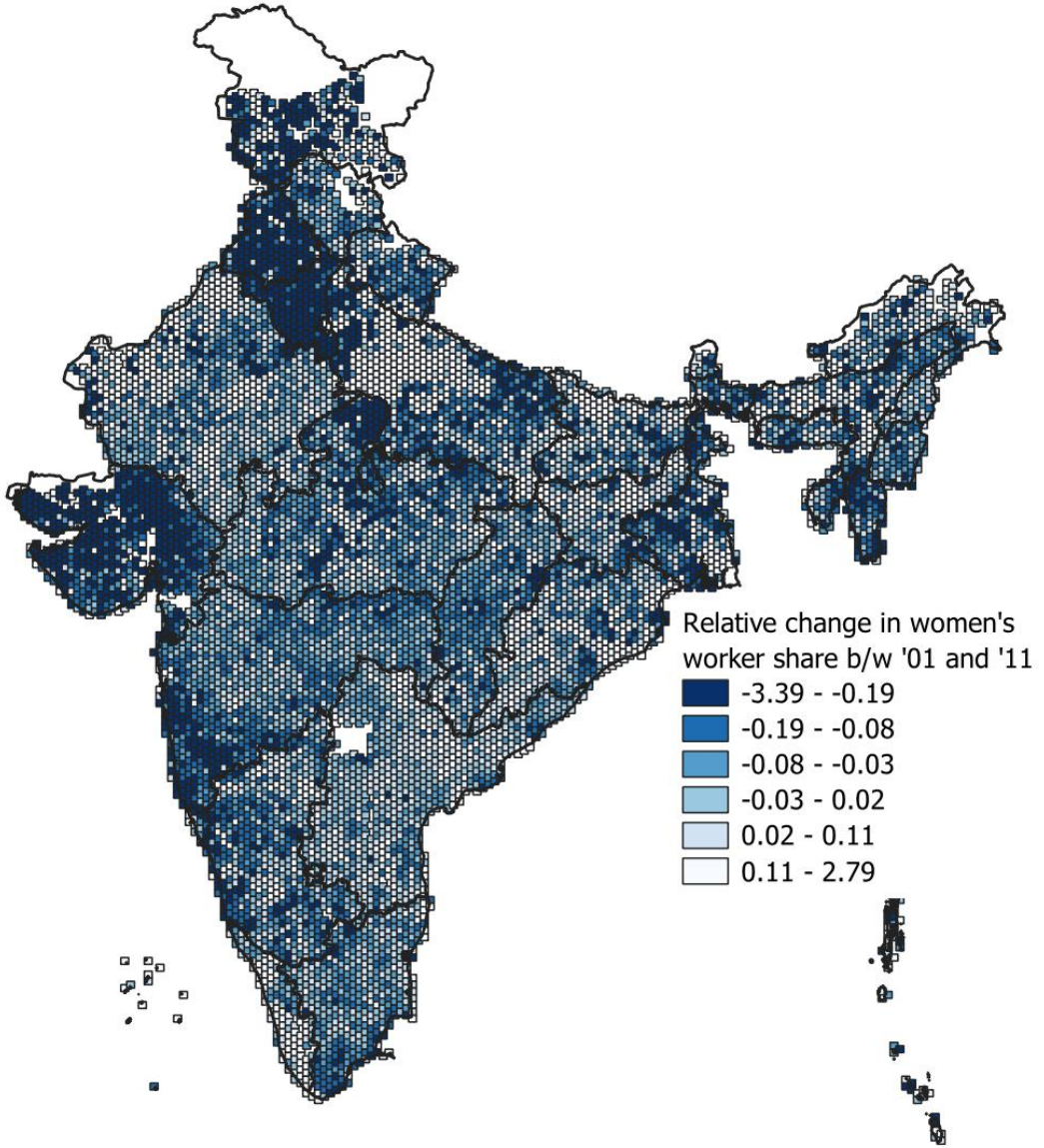
Distribution of X and Y variables



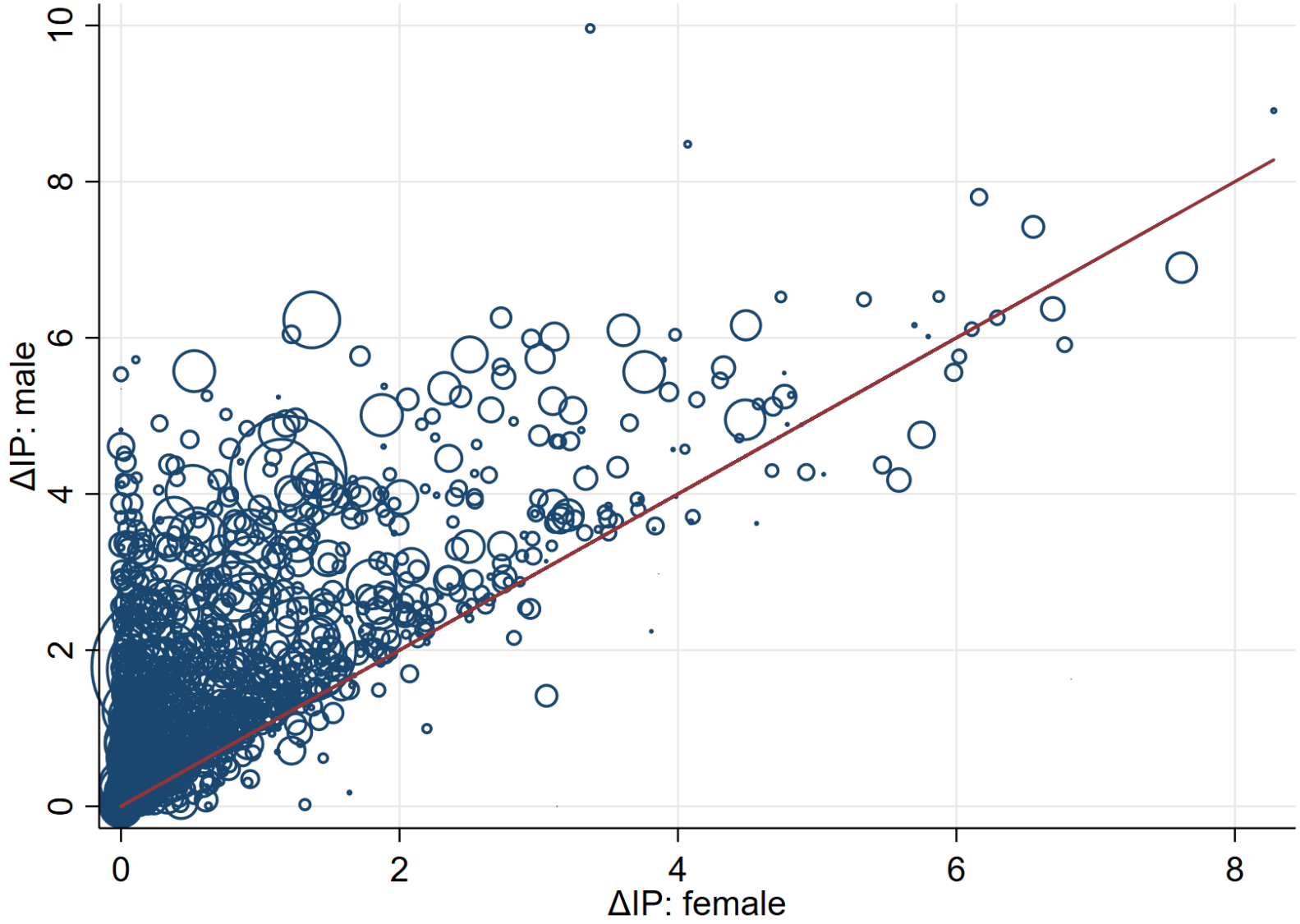


Spatial distribution of X and Y variables:





China shock hit male-dominated industries

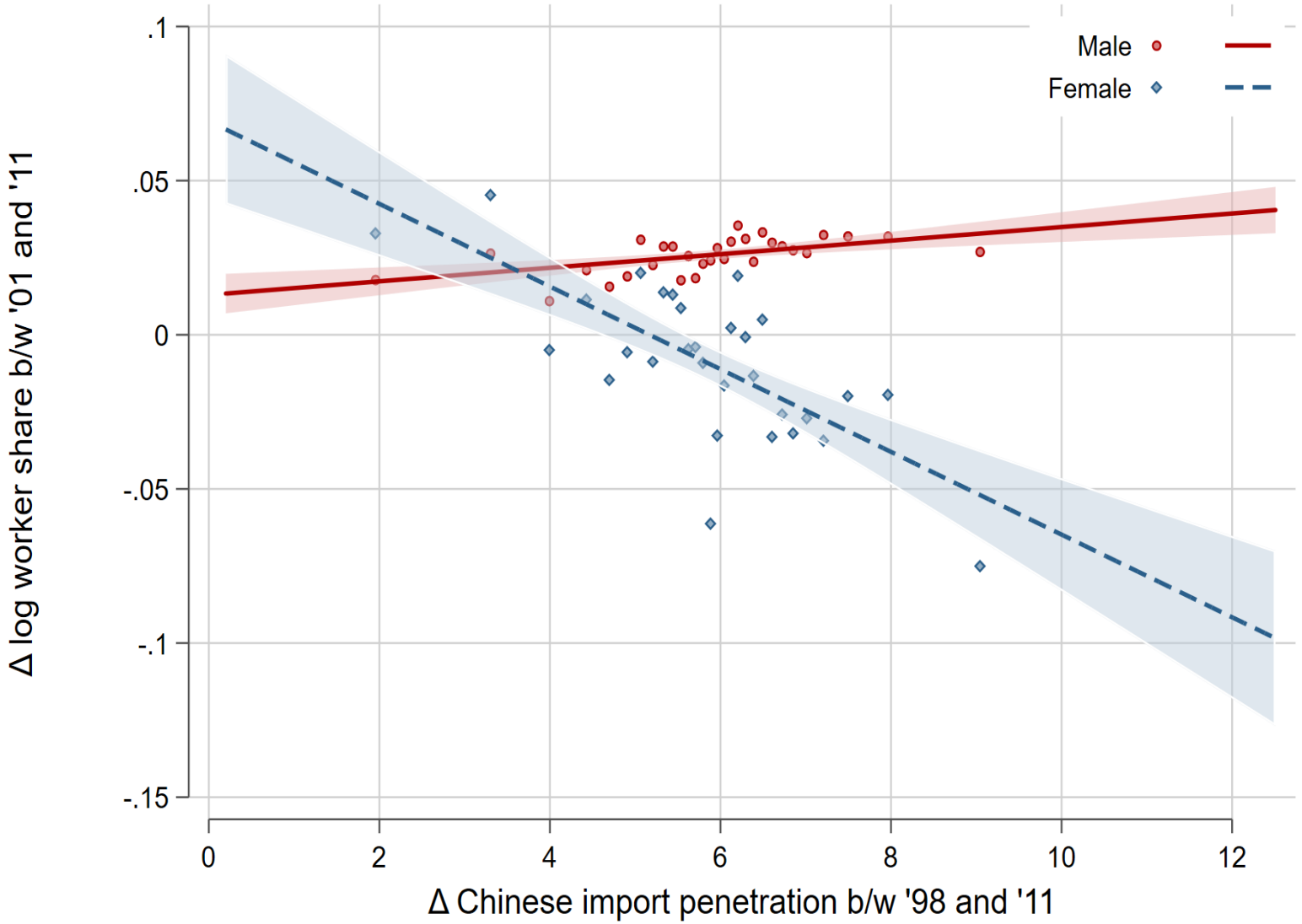


$$\Delta IP_{i\tau}^{female,CI} =$$

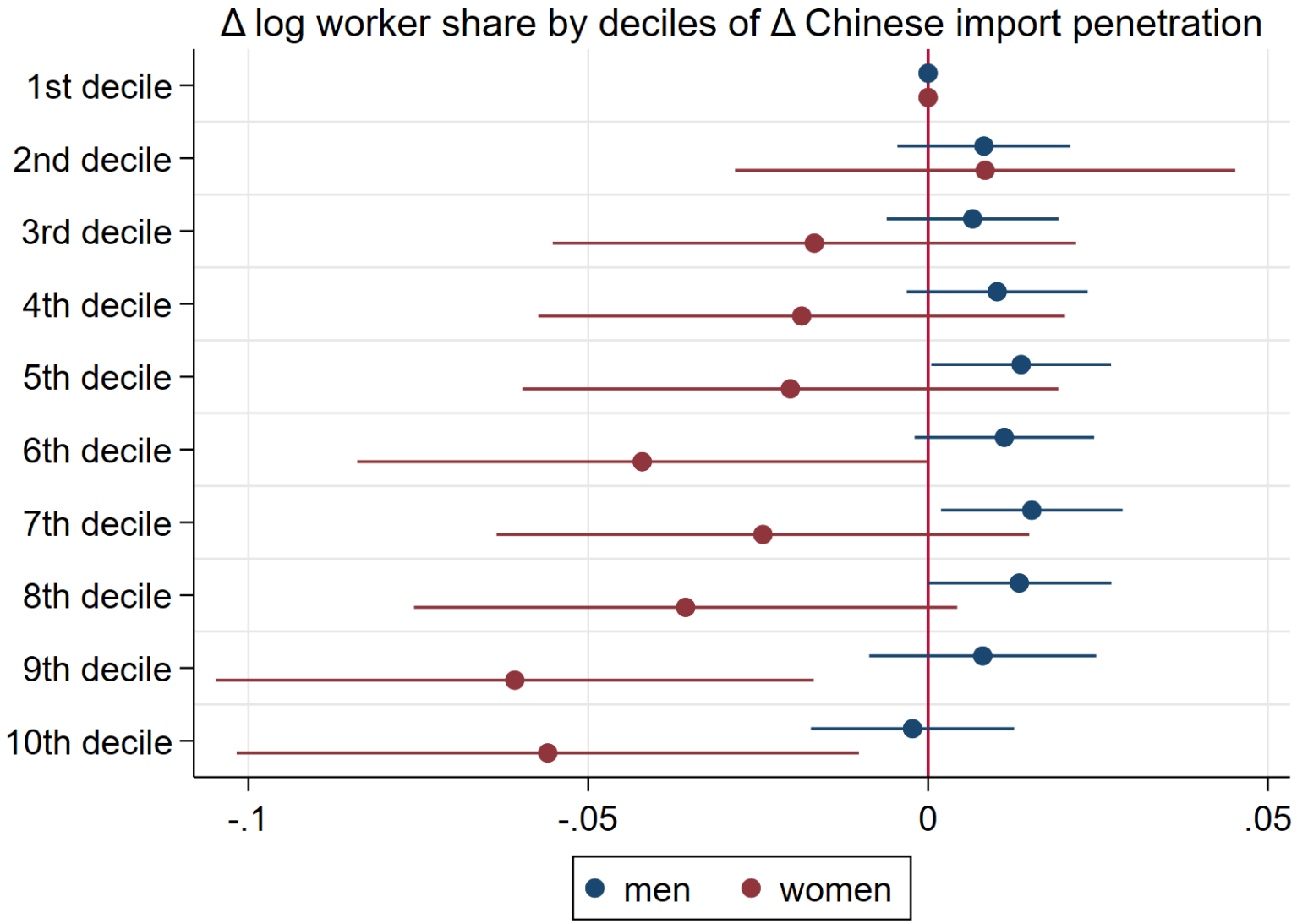
$$\sum_j \left(\frac{L_{ij98}}{L_{i01}}\right) f_{ij98}\, \Delta IP_{j\tau}^{CI}$$

,where f_{ij98}= female share of employment in each hexagon-industry pair ij in 1998.

Yet, women dropped out and men didn't



Gendered effects scale by size of shock



Shock decile	Min	Mean	Max	N
1	0	0.16	0.78	919
2	0.78	1.5	2	918
3	2	2.3	2.6	918
4	2.6	2.8	3	919
5	3	3.2	3.4	918
6	3.4	3.6	3.7	918
7	3.7	3.9	4.1	919
8	4.1	4.3	4.6	918
9	4.6	4.9	5.4	918
10	5.4	6.4	10	918
Total	0	3.3	10	9,183

Point estimates – elasticities

$$\Delta \log(worker\ share)_{i\tau}^{g} = \alpha + \beta^{g}\ \Delta \mathrm{IP}_{i\tau} + \boldsymbol{X}_i + state\ FE + \varepsilon_i$$

OLS

Change b/w '01 and '11: log share of individuals who are…	Overall				Females				Males			
	Mean	Est	SE	p	Mean	Est	SE	p	Mean	Est	SE	p
Non workers	-0.007	0.001	0.002	0.51	0.01	0.004	0.001	0.01	-0.03	0	0.001	0.82
Workers	0.008	-0.004	0.001	0.01	-0.013	-0.012	0.003	0	0.024	-0.001	0.001	0.5
Marginal workers (less than 6 months)	0.045	-0.029	0.006	0	-0.099	-0.033	0.006	0	0.258	-0.024	0.006	0
Main workers (at least 6 months)	-0.039	0.005	0.002	0.04	0.017	0.001	0.005	0.8	-0.049	0.006	0.002	0.01
Agriculture: cultivators	-0.232	-0.002	0.006	0.68	-0.279	-0.011	0.007	0.12	-0.212	-0.001	0.005	0.86
Agriculture: labourers	0.306	-0.021	0.007	0	0.361	-0.025	0.007	0	0.284	-0.016	0.007	0.02
HH-based industry	-0.235	-0.021	0.007	0	-0.17	-0.027	0.009	0	-0.262	-0.020	0.007	0
Other jobs	0.036	0.011	0.004	0	0.301	0.004	0.005	0.49	-0.012	0.011	0.004	0

IV 2SLS

Change b/w '01 and '11: log share of individuals who are…	Overall				Females				Males			
	Mean	Est	SE	p	Mean	Est	SE	p	Mean	Est	SE	p
Non workers	-0.007	0	0.002	0.93	0.01	0.003	0.001	0.09	-0.03	0	0.001	0.93
Workers	0.008	-0.002	0.001	0.1	-0.013	-0.009	0.003	0.01	0.024	-0.001	0.001	0.61
Marginal workers (less than 6 months)	0.045	-0.030	0.006	0	-0.099	-0.030	0.006	0	0.258	-0.027	0.006	0
Main workers (at least 6 months)	-0.039	0.007	0.003	0.01	0.017	0.006	0.005	0.24	-0.049	0.007	0.002	0
Agriculture: cultivators	-0.232	-0.002	0.006	0.8	-0.279	-0.008	0.008	0.33	-0.212	0	0.006	0.95
Agriculture: labourers	0.306	-0.02	0.007	0	0.361	-0.021	0.007	0	0.284	-0.016	0.007	0.02
HH-based industry	-0.235	-0.022	0.008	0	-0.17	-0.023	0.009	0.01	-0.262	-0.026	0.007	0
Other jobs	0.036	0.012	0.004	0	0.301	0.010	0.006	0.07	-0.012	0.011	0.004	0

Point estimates – outcome in percentage points

$$\Delta(worker\ share * 100)_{i\tau}^{g} = \alpha + \beta^{g}\ \Delta \mathrm{IP}_{i\tau} + \boldsymbol{X}_i + state\ FE + \varepsilon_i$$

OLS

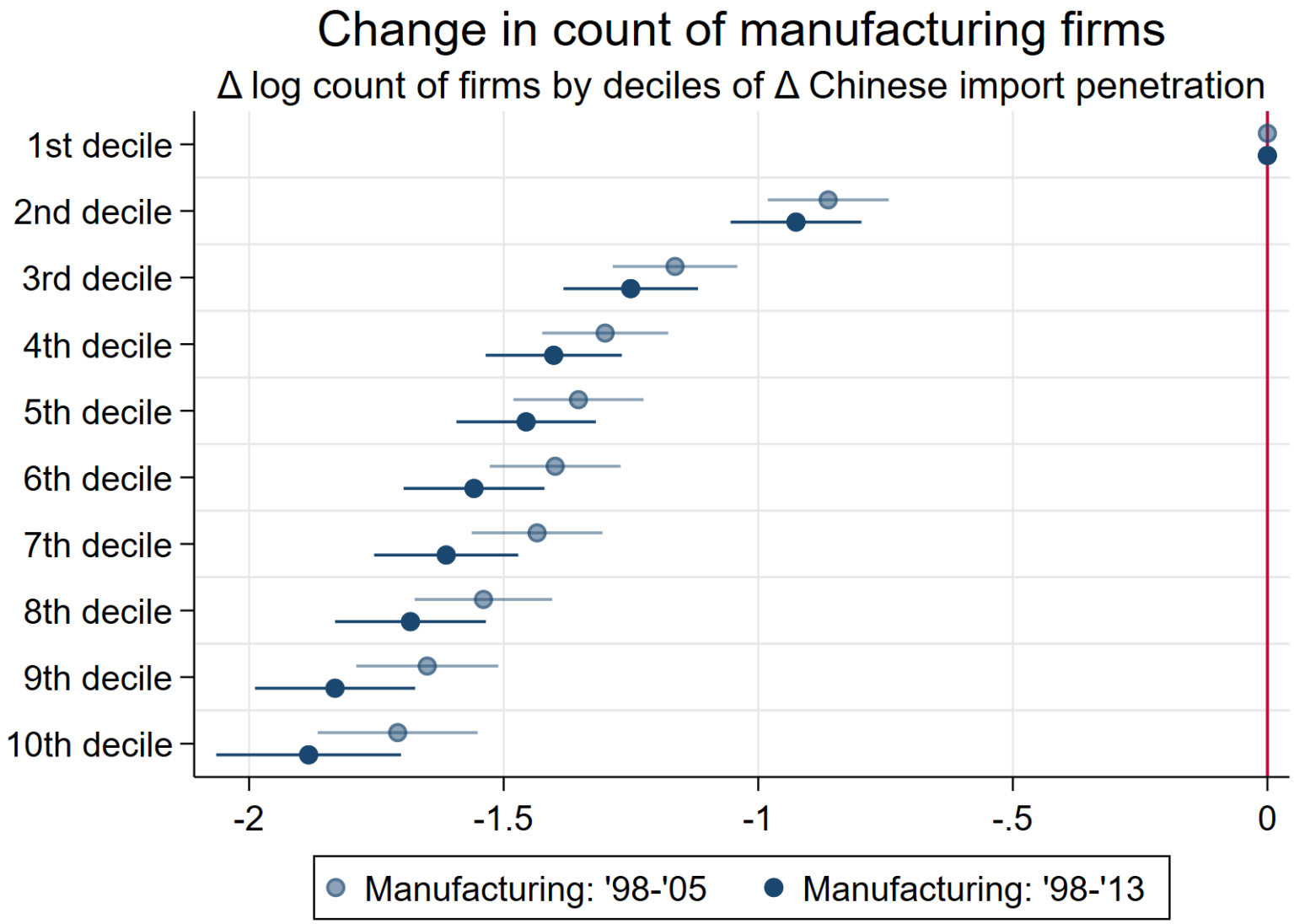
Change b/w '01 and '11: percent of individuals who are…	Overall				Females				Males			
	Mean	Est	SE	p	Mean	Est	SE	p	Mean	Est	SE	p
Non workers	-0.317	0.137	0.056	0	0.64	0.284	0.077	0	-1.307	0.013	0.053	0.8
Workers	0.317	-0.137	0.056	0	-0.64	-0.284	0.077	0	1.307	-0.013	0.053	0.8
Marginal workers (less than 6 months)	1.079	-0.241	0.06	0	-0.84	-0.271	0.085	0	2.873	-0.202	0.057	0
Main workers (at least 6 months)	-0.762	0.104	0.07	0.1	0.199	-0.014	0.086	0.9	-1.566	0.188	0.075	0
Agriculture: cultivators	-2.853	0.043	0.064	0.5	-2.049	0.018	0.074	0.8	-3.549	0.061	0.07	0.4
Agriculture: labourers	1.941	-0.062	0.039	0.1	1.8	-0.099	0.048	0	2.078	-0.038	0.039	0.3
HH-based industry	-0.261	-0.045	0.019	0	-0.196	-0.042	0.032	0.2	-0.318	-0.046	0.018	0
Other jobs	0.411	0.168	0.048	0	0.644	0.11	0.035	0	0.223	0.211	0.067	0

IV 2SLS

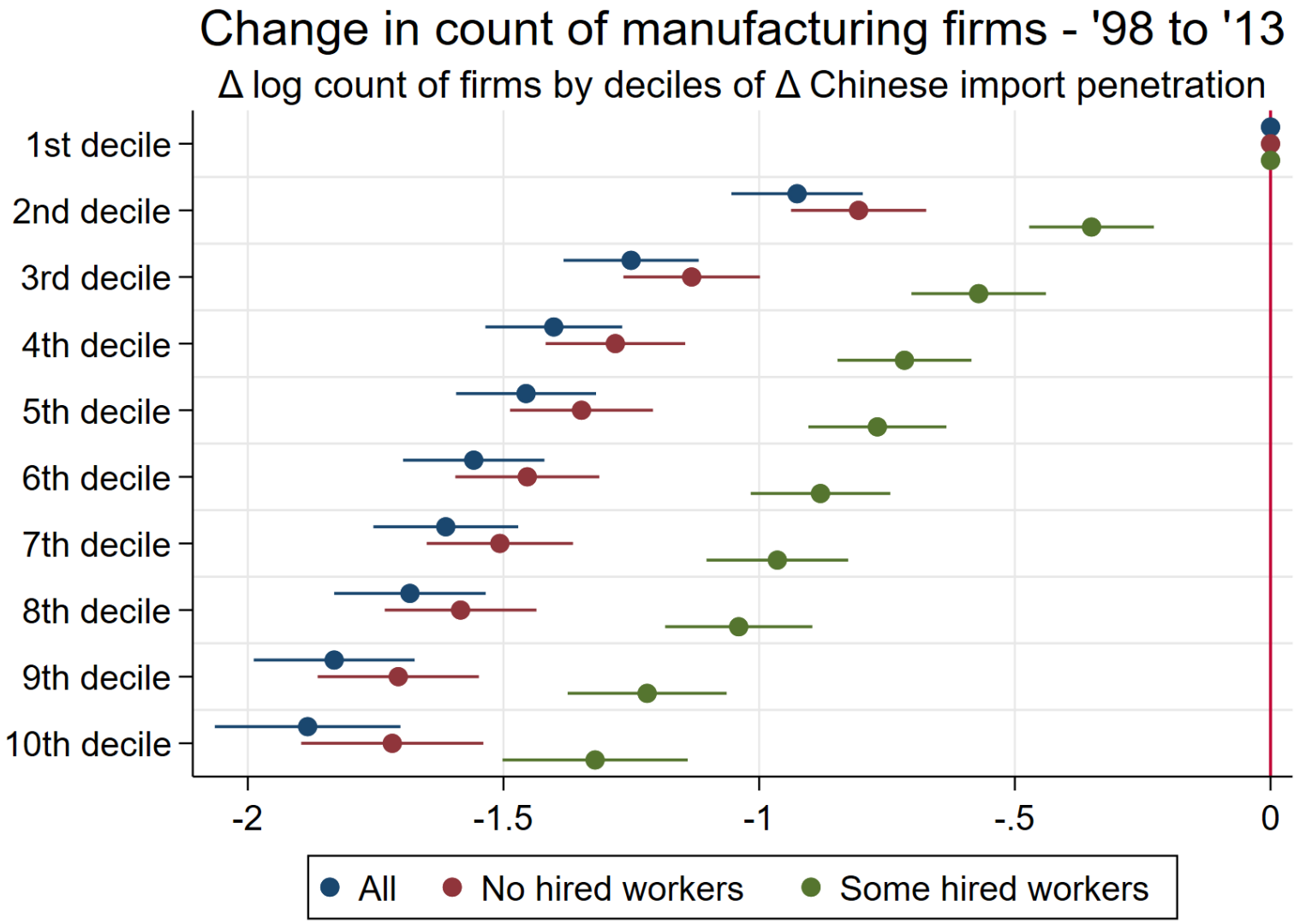
Change b/w '01 and '11: percent of individuals who are…	Overall				Females				Males			
	Mean	Est	SE	p	Mean	Est	SE	p	Mean	Est	SE	p
Non workers	-0.317	0.087	0.06	0.1	0.64	0.202	0.082	0	-1.307	0.003	0.056	1
Workers	0.317	-0.087	0.06	0.1	-0.64	-0.202	0.082	0	1.307	-0.003	0.056	1
Marginal workers (less than 6 months)	1.079	-0.241	0.063	0	-0.84	-0.238	0.089	0	2.873	-0.23	0.059	0
Main workers (at least 6 months)	-0.762	0.154	0.072	0	0.199	0.036	0.09	0.7	-1.566	0.227	0.078	0
Agriculture: cultivators	-2.853	0.048	0.07	0.5	-2.049	0.013	0.078	0.9	-3.549	0.073	0.077	0.3
Agriculture: labourers	1.941	-0.054	0.04	0.2	1.8	-0.087	0.05	0.1	2.078	-0.034	0.041	0.4
HH-based industry	-0.261	-0.044	0.019	0	-0.196	-0.04	0.034	0.2	-0.318	-0.051	0.019	0
Other jobs	0.411	0.205	0.05	0	0.644	0.149	0.036	0	0.223	0.24	0.07	0

Firm-level outcomes

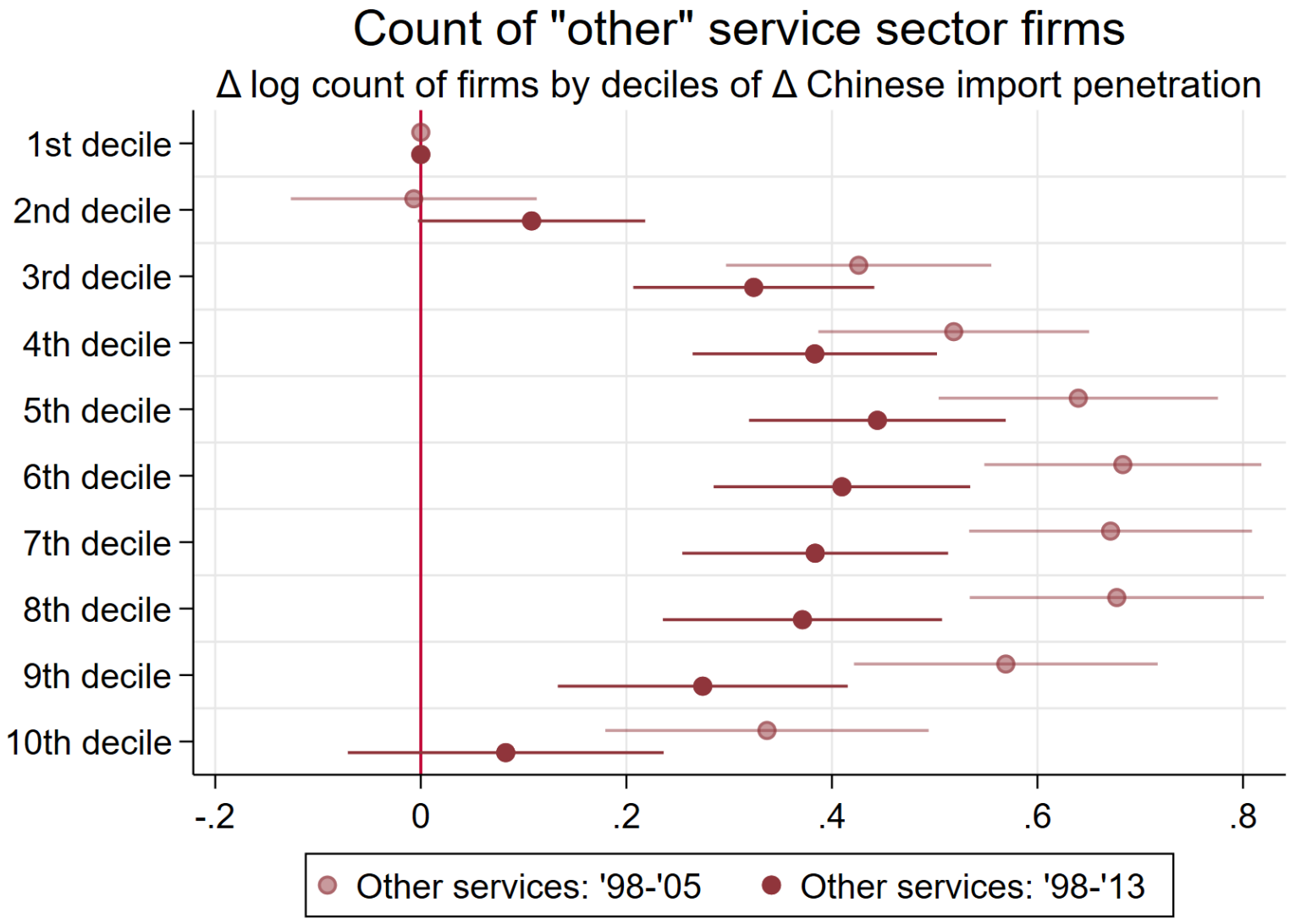
Manufacturing contracted



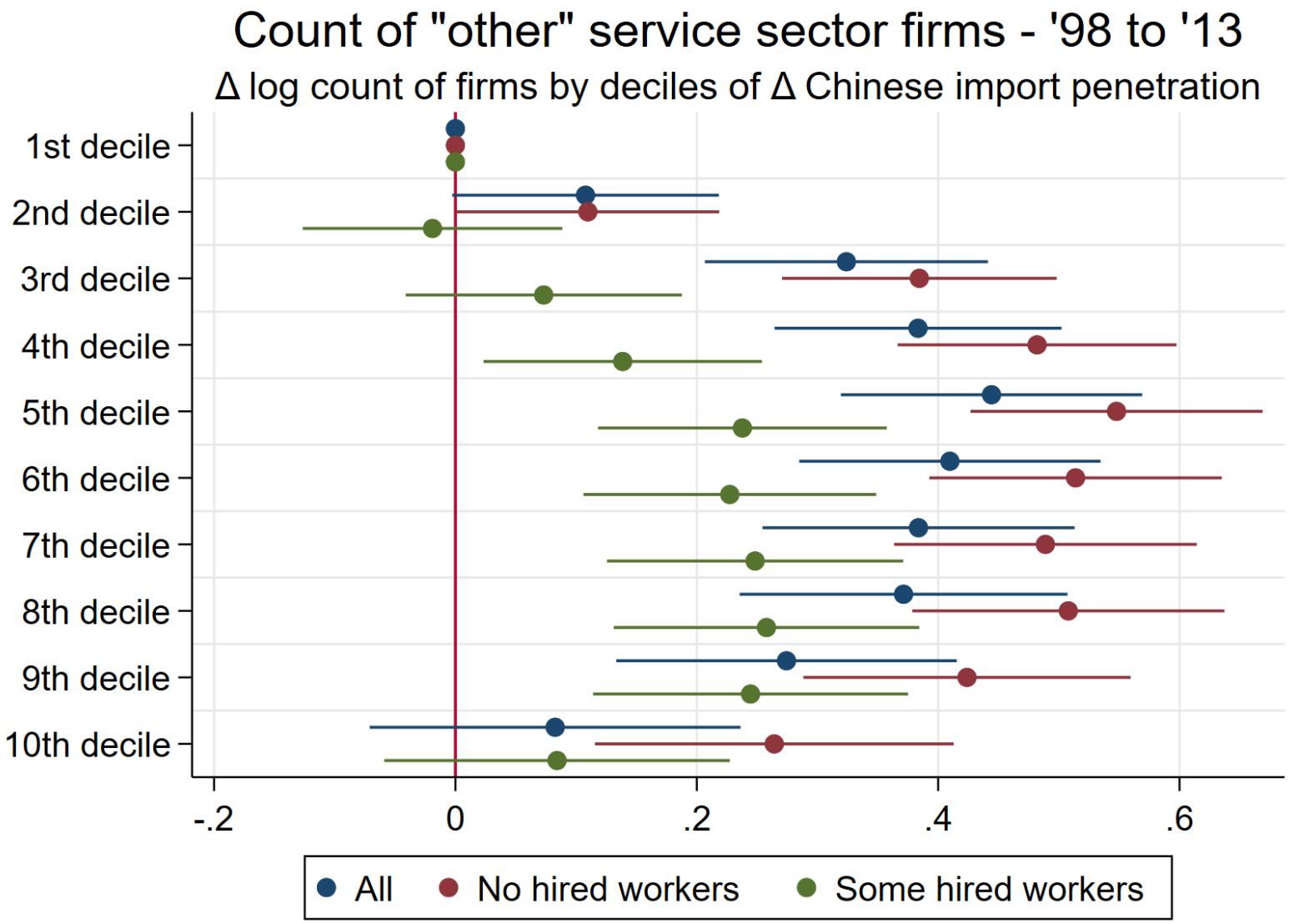
Driven by exit of informal/smaller firms



“Other services” expanded



Driven by entry of informal/smaller firms

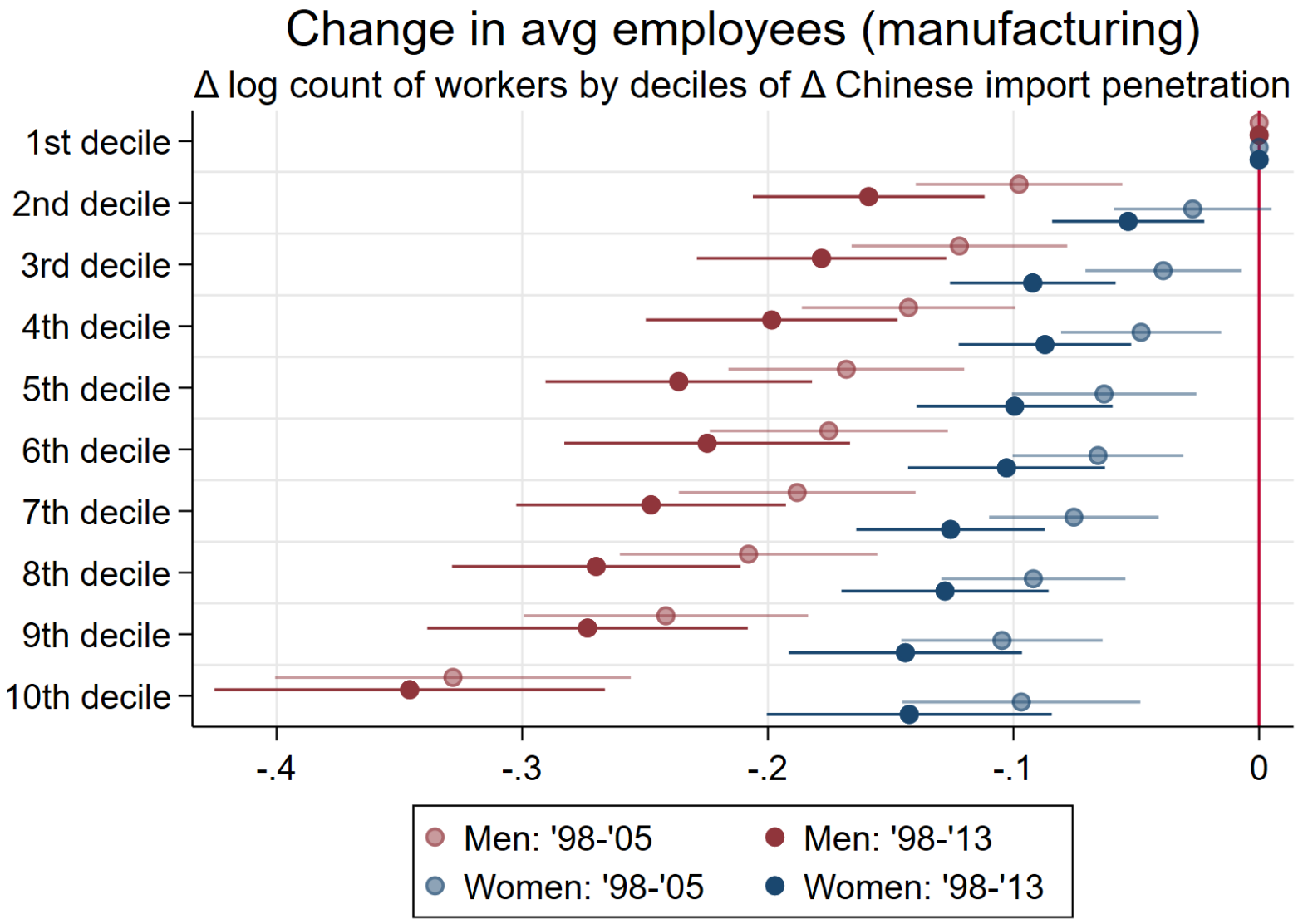


What are “Other services”?

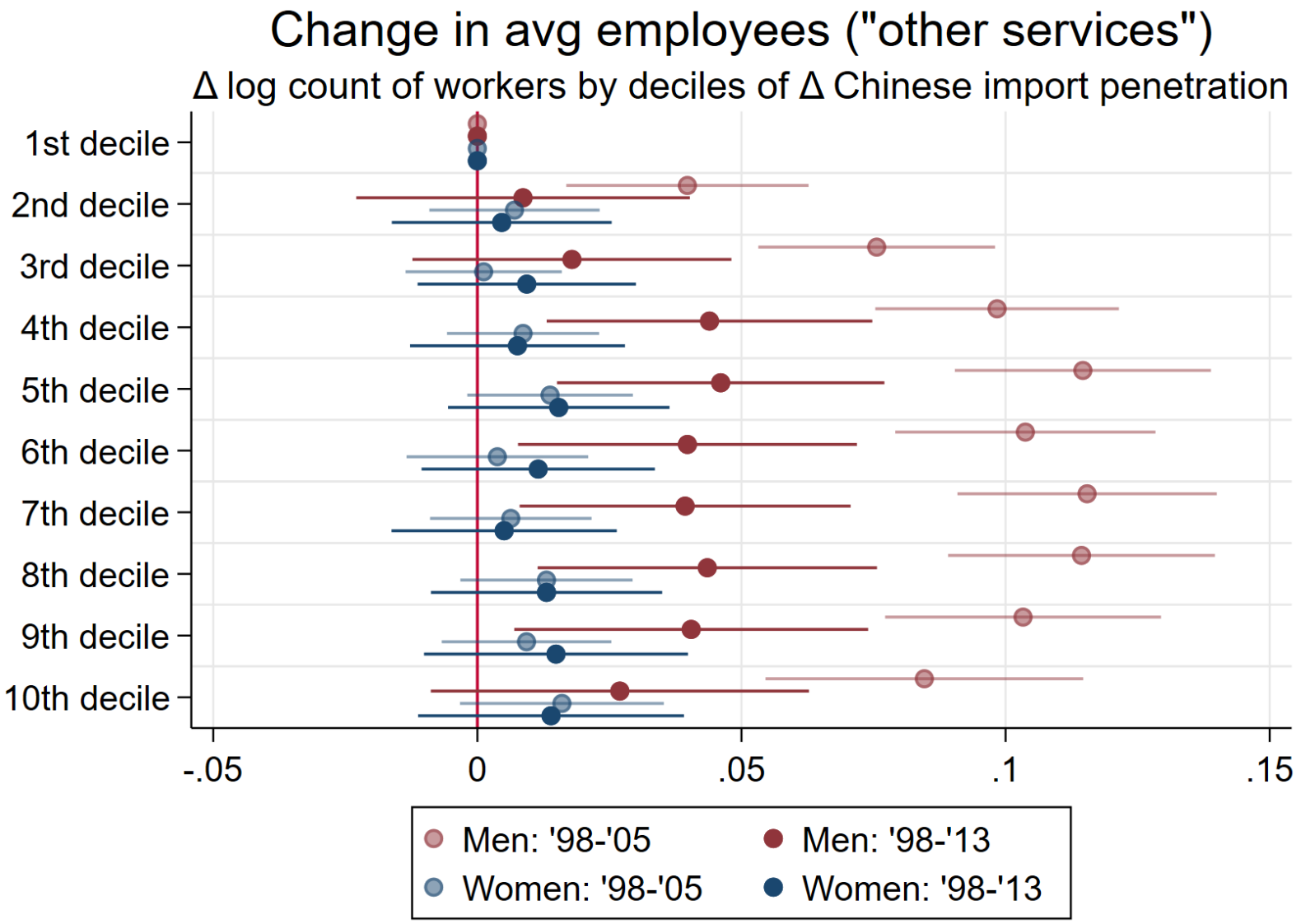
- Large residual category for now - needs more data cleaning

Firm counts by sector across hexagons (2013 data)	Mean	sd	p50
All non-ag	4,818.30	19,997.3	1,987
Manufacturing	1,099.89	4,526.7	384
All services	3,718.40	15,861.7	1,566
Mining and quarrying	9.10	39.8	2
Utilities	25.43	115.5	7
Construction	103.52	564.5	18
Retail, hotels and restaurants	2,168.77	9,302.6	862
Transportation	318.15	1,713.3	81
Business related services	300.11	1,803.7	79
Education, health and other social services	350.51	1,135.6	208
Other services	442.80	1,610.7	194

Average employment - manufacturing

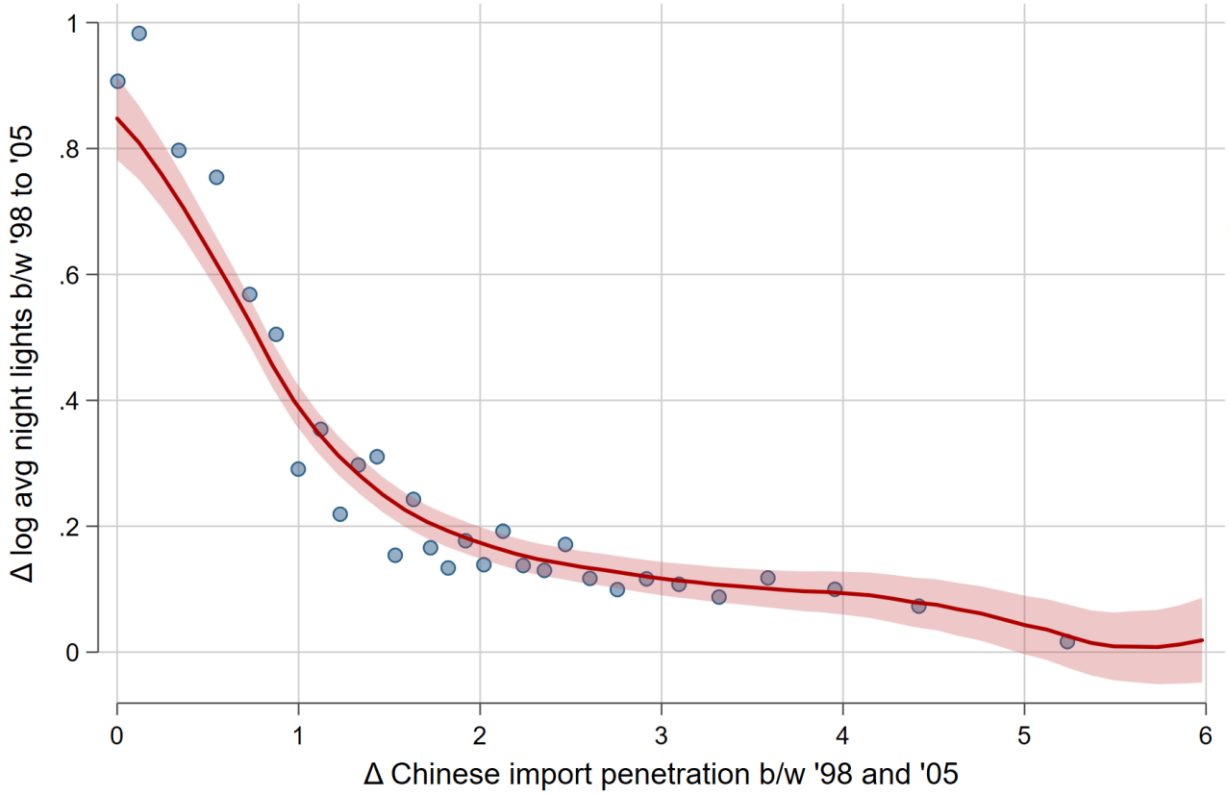


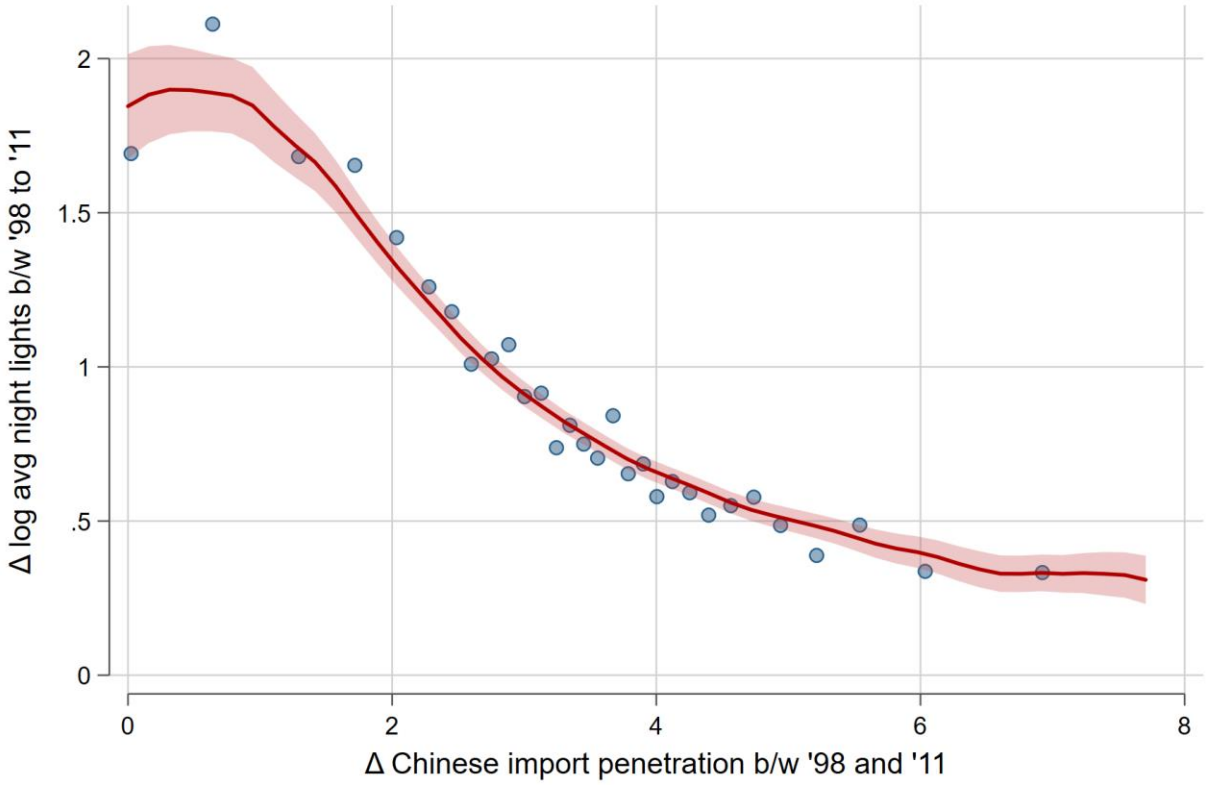
Average employment – “other services”



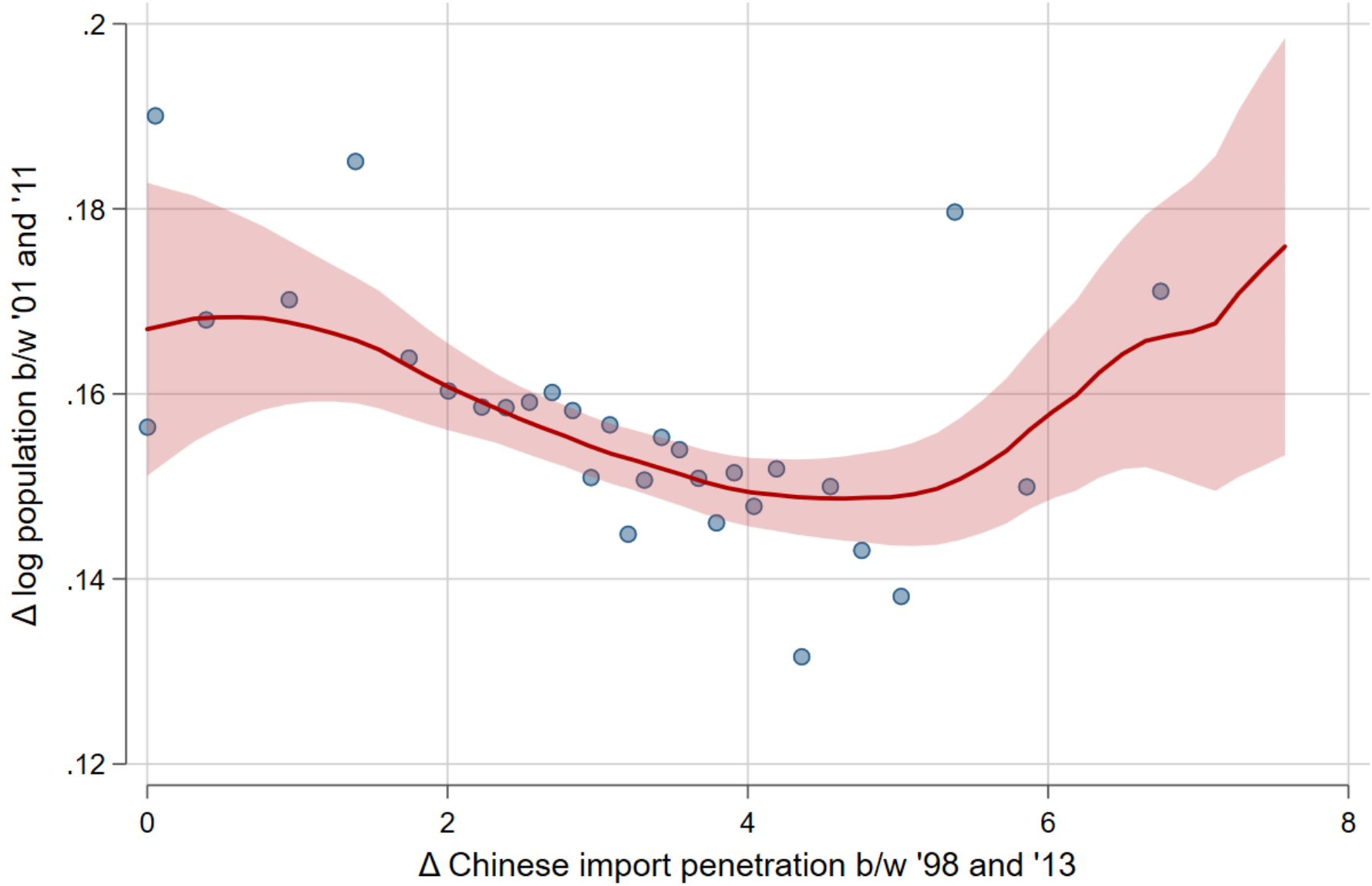
Night lights

- The China shock constitutes a negative income shock → the negative income effect explanation for the downward part of the U-shape doesn't apply.





Non-linear impact on population growth



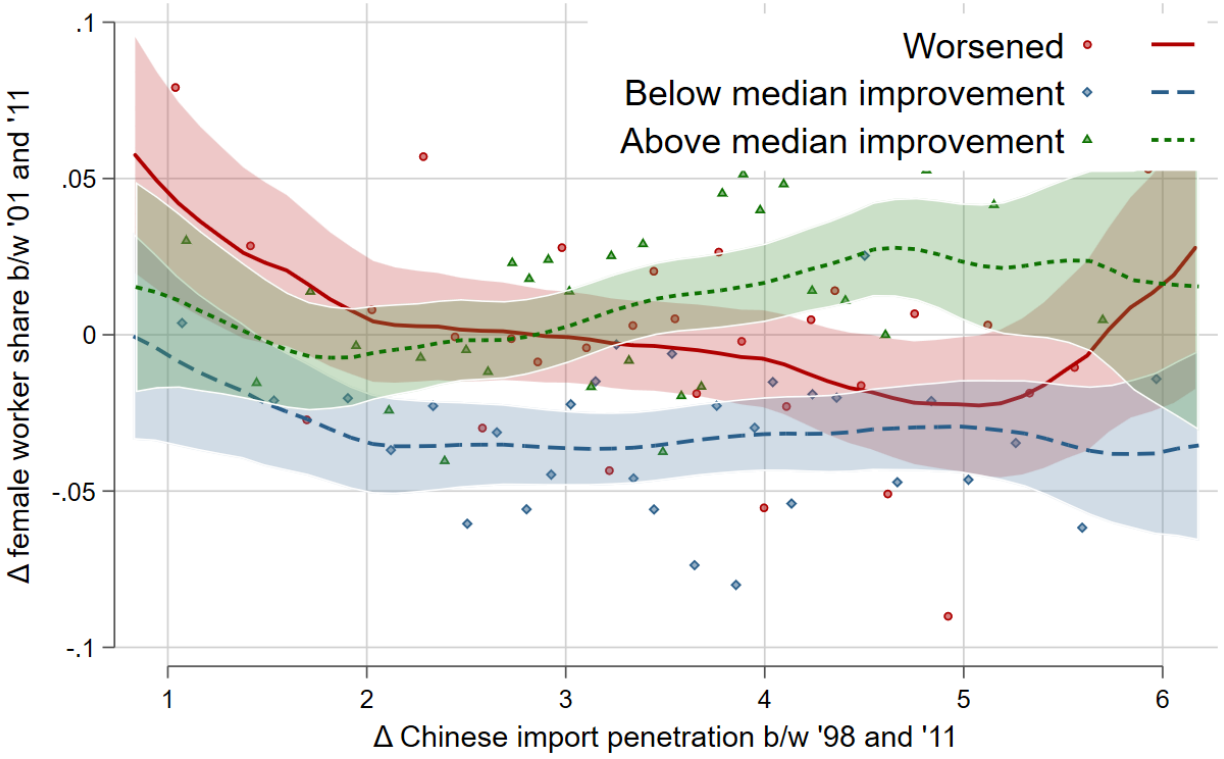
Summary so far

- A negative shock to labour demand that hit male-dominated industries caused women to leave the labor force, but not men.
- Although both men and women lose jobs in manufacturing, only men are able to find jobs in the few sectors that expand (“other” services).
- This indicates the presence of gendered labour market frictions.
- Are these frictions related to mobility?

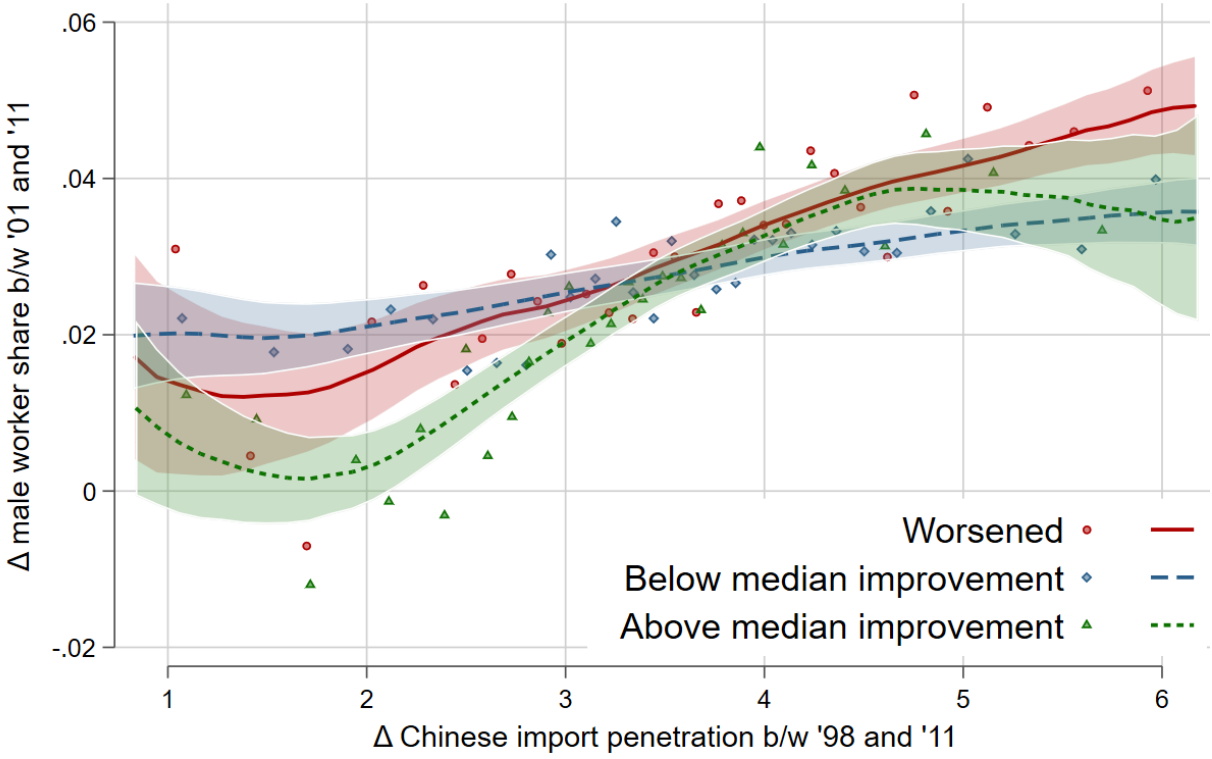
Evidence for gendered spatial frictions

1. Heterogeneity by degree of road improvement

- The share of villages with a paved all-weather road increased from 53% in 2001 to 63% in 2011.

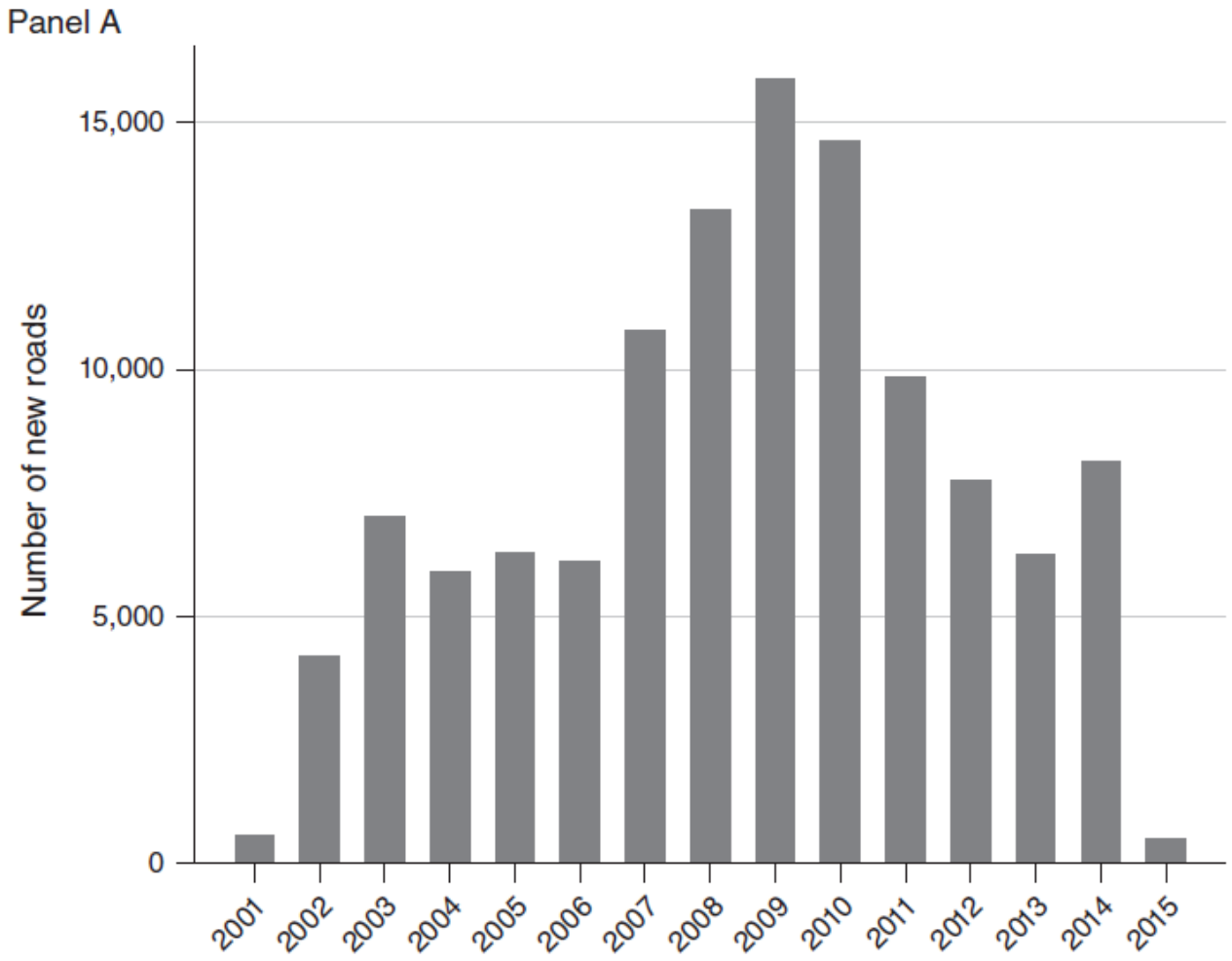


Note: Improvement in road access is measured by the change in share of villages that have a tar road.



Note: Improvement in road access is measured by the change in share of villages that have a tar road.

2. Using the roll out of a road building policy



Source: Asher and Novosad (2020)

- The Pradhan Mantri Gram Sadak Yojana (PMGSY) was launched in 2000 with the goal of providing all-weather road access to unconnected villages across India.
- Connected nearly 200,000 villages at a cost of almost $40 billion by 2015.
- Asher and Novosad (2020) find muted effects on local economic development. Some evidence that men were more likely than women to exit agriculture due to new roads.

2. Using the roll out of a road building policy

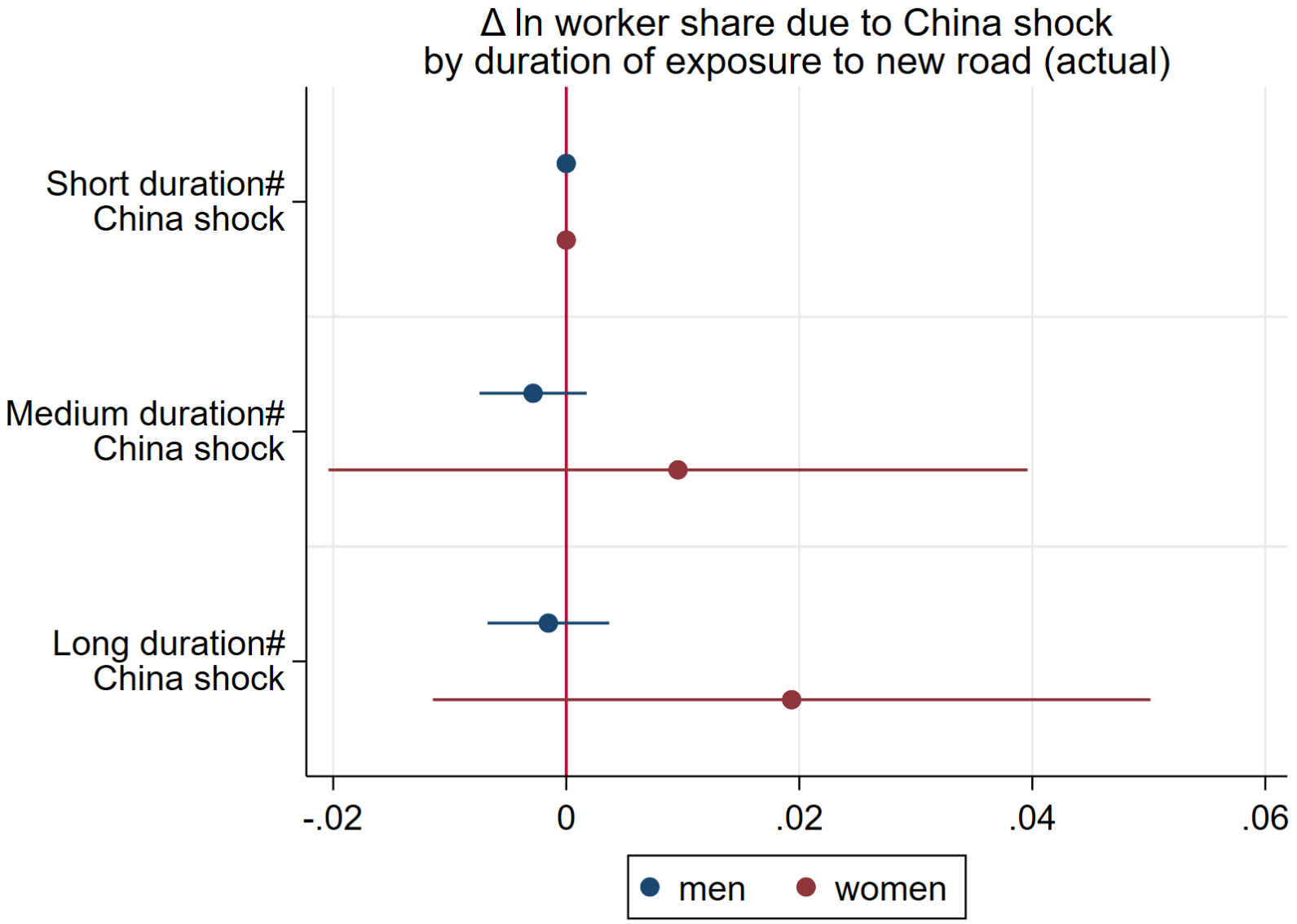
- Retrospective analysis: focus on the subset of villages that had no road in 2001 but received one by 2011 under PMGSY (N=22,748). Split villages into three groups based on length of exposure to new road:

Duration of exposure	mean	min	max	N
Short duration	1.5	1	2	8,327
Med duration	3.8	3	5	8,061
Long duration	7.2	6	10	6,360

- I run the following regression using village-level data:

$$\Delta \log(worker\ sh)_{v\tau}$$
$$= \alpha_0 + \alpha_1 \Delta \mathrm{IP}_{i\tau} + \alpha_2 Dur_v + \beta(\Delta \mathrm{IP}_{i\tau} \# Dur_v) + \boldsymbol{X}_v + state\ FE + \varepsilon_v$$

2. Using the roll out of a road building policy



Next steps

- Create “real” commuting zones – progressive larger circles around each village; account for proximity to urban centers/coast.

- To explore mechanisms, show heterogeneity by:
  1. Actual road connectivity (create market access measure).
  2. Baseline share in agriculture: regions with higher share are more exposed to congestion as structural transformation occurs.
  3. Availability of schooling (easier to transition to new industry).

- Think more about how to build a tighter link with structural transformation.

What else could be going on?

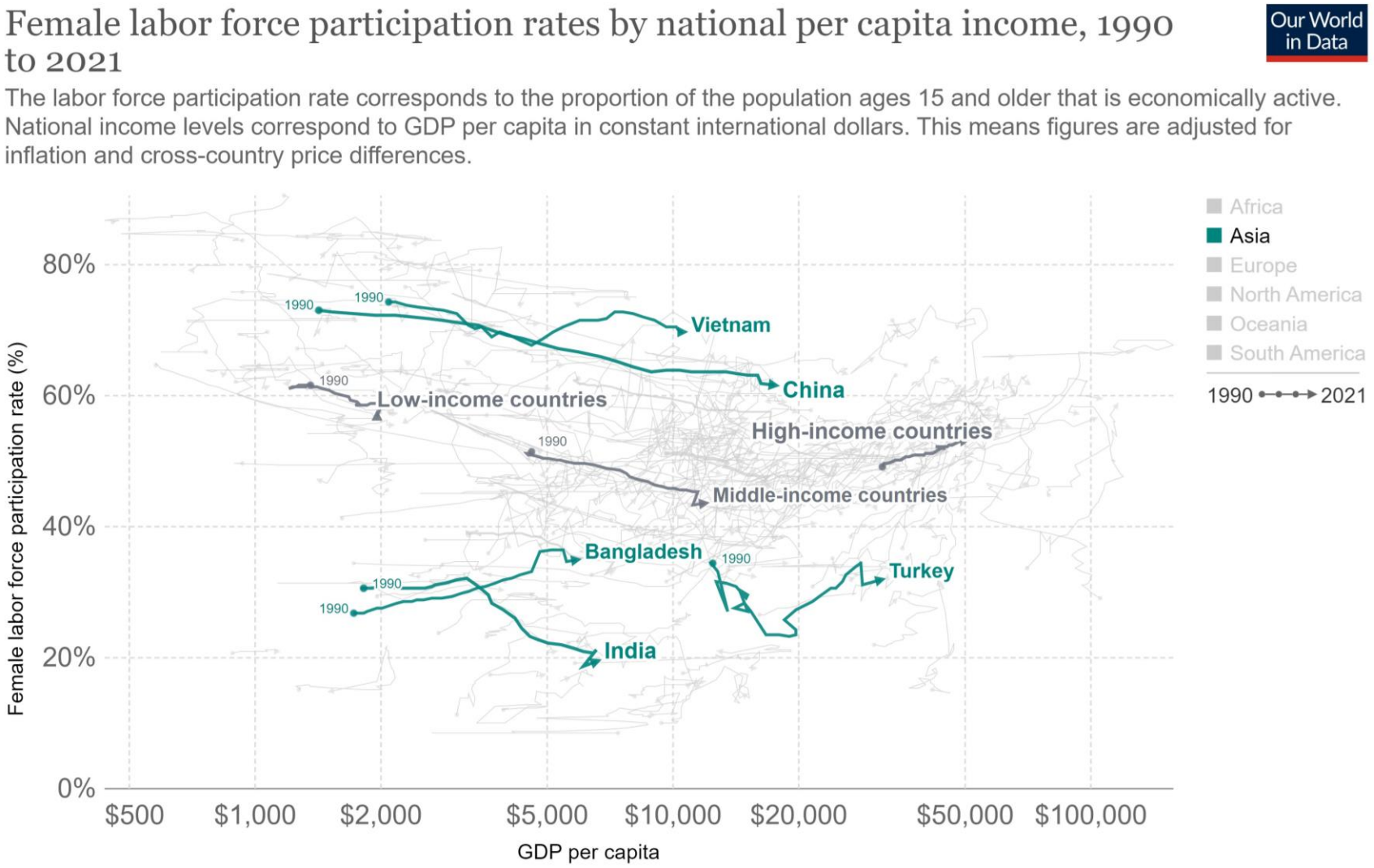
- China shock also reduced wages → women may choose to withdraw from the labour force if they have a higher reservation wage.

- China shock also reduced prices → potential positive HH-income effect.

- Individual vs HH-level optimization: Marriage is near-universal in India. A negative shock to labour demand may cause the husband to specialize in market work (that now requires longer travel + work hours), forcing the wife specializes in home production/care work.

Extra slides

The “U-shape” across the world



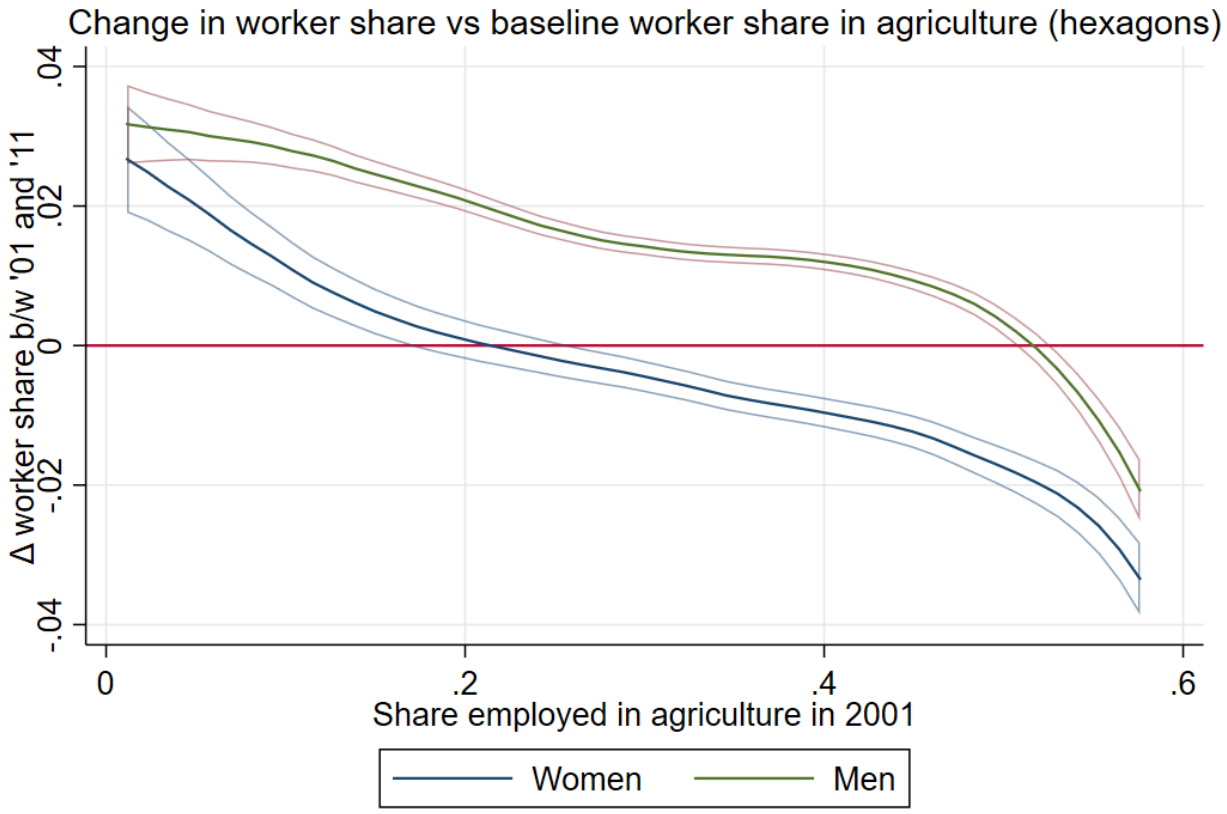
Economic Census data

1998 (N=26,862,790)	mean	p25	p50	p75	p99	Total employees	Share
Total employees	2.8	1	1	2	20	76,529,367	1.00
Hired employees	1.6	0	0	1	19	42,357,468	0.55
Female employees	0.45	0	0	0	5	12,139,783	0.16

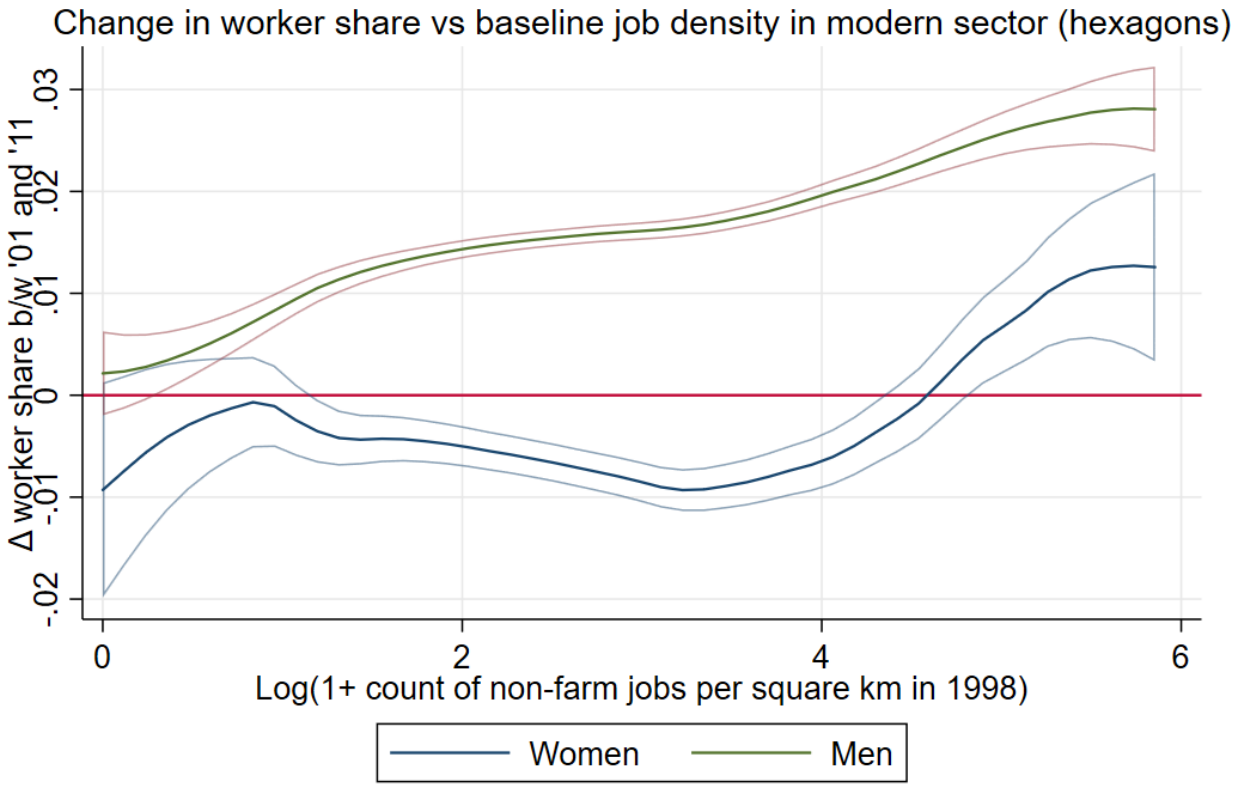
2005 (N=35,216,600)	mean	p25	p50	p75	p99	Total employees	Share
Total employees	2.4	1	1	2	13	84,569,964	1.00
Hired employees	1.3	0	0	1	12	46,866,434	0.55
Female employees	0.44	0	0	0	4	15,390,557	0.18

2013 (N=45,363,786)	mean	p25	p50	p75	p99	Total employees	Share
Total employees	2.4	1	1	2	13	108,411,367	1.00
Hired employees	1.2	0	0	1	11	54,736,006	0.50
Female employees	0.53	0	0	1	5	24,149,757	0.22

Which BL characteristics predict change in worker share?



Note: Worker and population counts from census data (2001 and 2011).



Note: Count of non-farm jobs from the 1998 Economic census.
Worker and population counts from census data (2001 and 2011).

Estimates – district level without state FE

$$\Delta \log(LFP\ rate)_{i\tau}^{g} = \alpha + \beta^{g}\ \Delta \mathrm{IP}_{i\tau} + \boldsymbol{X}_i + \varepsilon_i$$

OLS

Change b/w '01 and '11: log share of individuals who are…	Overall				Females				Males			
	Mean	Est	SE	p	Mean	Est	SE	p	Mean	Est	SE	p
Non workers	-0.01	0.005	0	0.1	0.01	0.011	0	0	-0.03	-0	0	0.4
Workers	0.01	-0.009	0	0	-0.02	-0.04	0.01	0	0.03	0.002	0	0.5
Marginal workers (less than 6 months)	0.088	-0.059	0.01	0	-0.08	-0.07	0.01	0	0.309	-0.04	0.01	0
Main workers (at least 6 months)	-0.04	0.008	0	0.1	0.012	-0.03	0.01	0	-0.04	0.014	0	0
Agriculture: cultivators	-0.25	-0.004	0.01	0.6	-0.3	-0.04	0.01	0	-0.23	0.001	0.01	0.9
Agriculture: labourers	0.242	-0.013	0.02	0.4	0.293	-0.02	0.02	0.4	0.225	-0.02	0.02	0.3
HH-based industry	-0.14	-0.004	0.01	0.8	-0.08	-0.02	0.02	0.3	-0.17	0.003	0.01	0.9
Other jobs	0.065	0.001	0.01	0.8	0.327	-0.04	0.01	0	0.025	0.011	0.01	0.1

IV 2SLS

Change b/w '01 and '11: log share of individuals who are…	Overall				Females				Males			
	Mean	Est	SE	p	Mean	Est	SE	p	Mean	Est	SE	p
Non workers	-0.01	0.006	0	0	0.01	0.012	0	0	-0.03	-0	0	0.3
Workers	0.01	-0.01	0	0	-0.02	-0.05	0.01	0	0.03	0.002	0	0.4
Marginal workers (less than 6 months)	0.088	-0.074	0.01	0	-0.08	-0.08	0.01	0	0.309	-0.05	0.01	0
Main workers (at least 6 months)	-0.04	0.01	0	0	0.012	-0.03	0.01	0	-0.04	0.017	0	0
Agriculture: cultivators	-0.25	-0.002	0.01	0.8	-0.3	-0.04	0.02	0	-0.23	0.004	0.01	0.6
Agriculture: labourers	0.242	-0.011	0.02	0.5	0.293	-0.02	0.02	0.2	0.225	-0.01	0.02	0.5
HH-based industry	-0.14	-0.002	0.01	0.9	-0.08	-0.02	0.02	0.3	-0.17	0.005	0.01	0.7
Other jobs	0.065	0.002	0.01	0.8	0.327	-0.05	0.02	0	0.025	0.012	0.01	0

Estimates – district level with state FE

$$\Delta \log(LFP\ rate)_{i\tau}^{g} = \alpha + \beta^{g}\ \Delta \mathrm{IP}_{i\tau} + \boldsymbol{X}_i + state\ FE + \varepsilon_i$$

OLS

Change b/w '01 and '11: log share of individuals who are…	Overall				Females				Males			
	Mean	Est	SE	p	Mean	Est	SE	p	Mean	Est	SE	p
Non workers	-0.01	0.001	0	0.5	0.01	0.004	0	0.1	-0.03	-0	0	0.1
Workers	0.01	-0.001	0	0.7	-0.02	-0.01	0.01	0.2	0.03	0.003	0	0.1
Marginal workers (less than 6 months)	0.088	-0.033	0.01	0	-0.08	-0.04	0.01	0	0.309	-0.03	0.01	0
Main workers (at least 6 months)	-0.04	0.011	0	0	0.012	0.001	0.01	0.9	-0.04	0.013	0	0
Agriculture: cultivators	-0.25	0.007	0.01	0.4	-0.3	-0	0.02	0.9	-0.23	0.006	0.01	0.4
Agriculture: labourers	0.242	-0.009	0.01	0.5	0.293	0	0.02	1	0.225	-0.01	0.01	0.4
HH-based industry	-0.14	0	0.01	1	-0.08	0.009	0.02	0.6	-0.17	-0	0.01	0.9
Other jobs	0.065	0.009	0.01	0.1	0.327	-0.01	0.02	0.4	0.025	0.014	0.01	0

IV 2SLS

Change b/w '01 and '11: log share of individuals who are…	Overall				Females				Males			
	Mean	Est	SE	p	Mean	Est	SE	p	Mean	Est	SE	p
Non workers	-0.01	0.001	0	0.8	0.01	0.003	0	0.3	-0.03	-0	0	0.1
Workers	0.01	-0.001	0	0.8	-0.02	-0.02	0.01	0.2	0.03	0.003	0	0.1
Marginal workers (less than 6 months)	0.088	-0.037	0.01	0	-0.08	-0.04	0.02	0	0.309	-0.03	0.01	0
Main workers (at least 6 months)	-0.04	0.012	0	0	0.012	0.003	0.01	0.9	-0.04	0.013	0	0
Agriculture: cultivators	-0.25	0.008	0.01	0.3	-0.3	0.002	0.02	0.9	-0.23	0.007	0.01	0.4
Agriculture: labourers	0.242	-0.014	0.01	0.3	0.293	-0.01	0.02	0.6	0.225	-0.02	0.01	0.3
HH-based industry	-0.14	0.003	0.01	0.8	-0.08	0.019	0.02	0.2	-0.17	-0	0.01	0.9
Other jobs	0.065	0.011	0.01	0.1	0.327	-0.01	0.02	0.7	0.025	0.015	0.01	0