

Unraveling decentralization of warehousing and distribution centers

A case study of four metropolitan areas in California

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Research Objective

Warehousing location change and its implications

Question 1:

Why should we care about warehousing location change?

Question 2:

How can we systematically measure warehousing location change?

Question 3:

Are there consistent trends across metropolitan areas?

Question 1

Why should we care about warehousing location change?

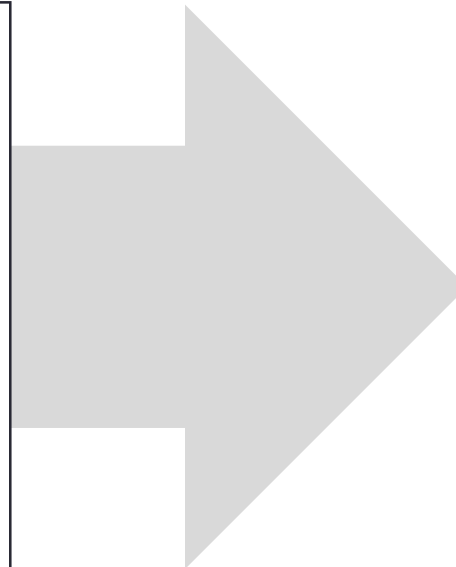
Why should we be concerned?

Warehousing Location Change Implication

**'To the urban
periphery'**

Suggests

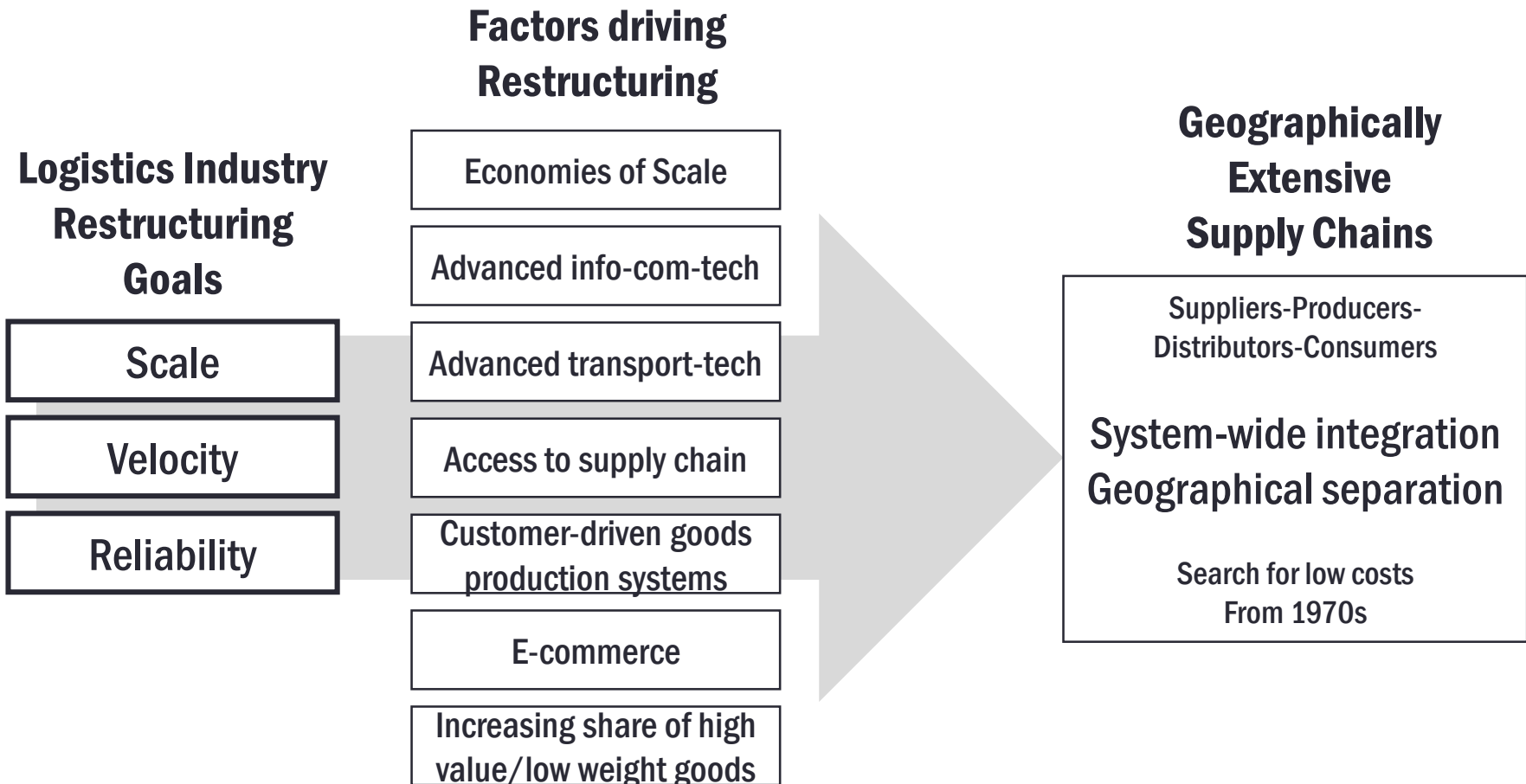
**More freight
movements**



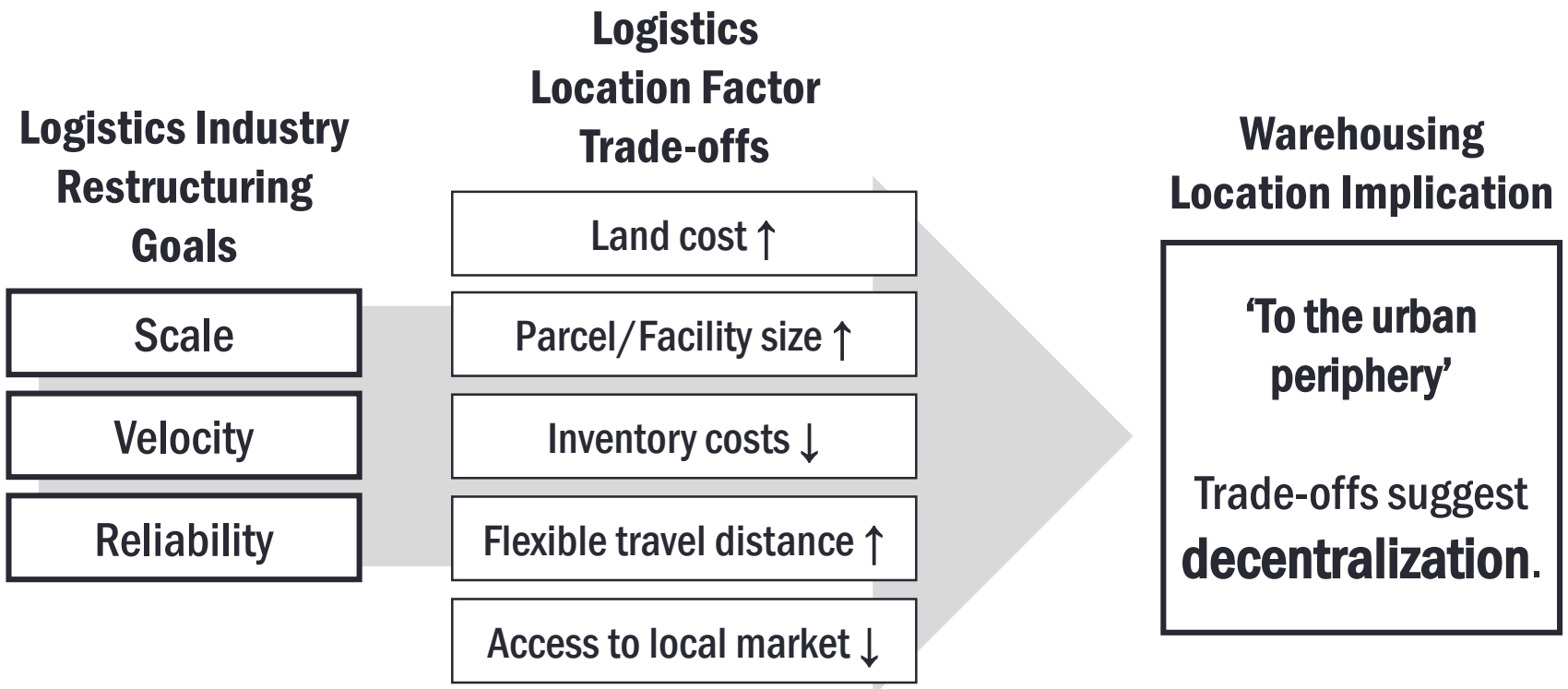
**More
Truck travel
in metro areas**

**More potential
negative externalities
on communities**

Supply Chain Expansion & Restructuring



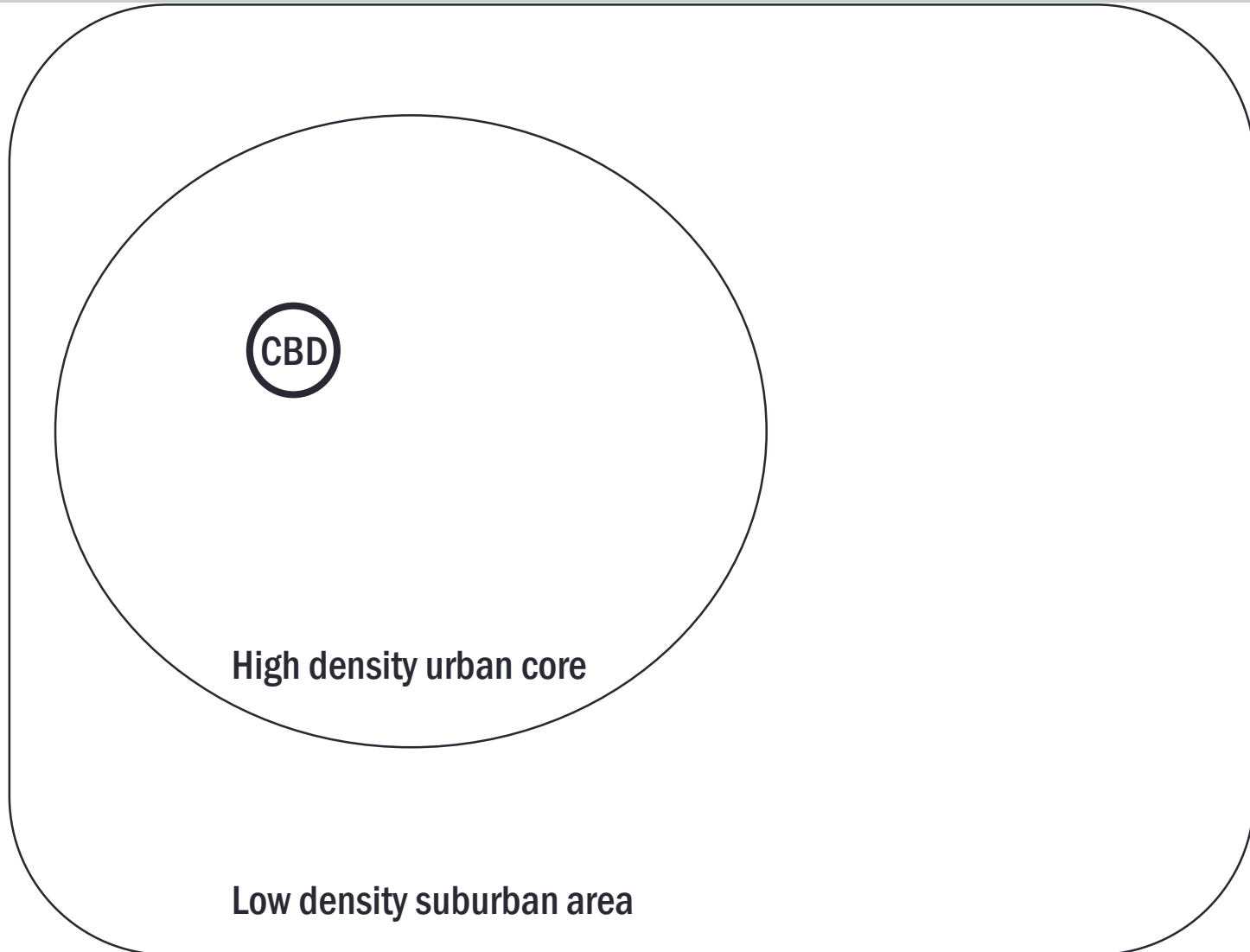
Metropolitan-level Supply Chain Restructuring



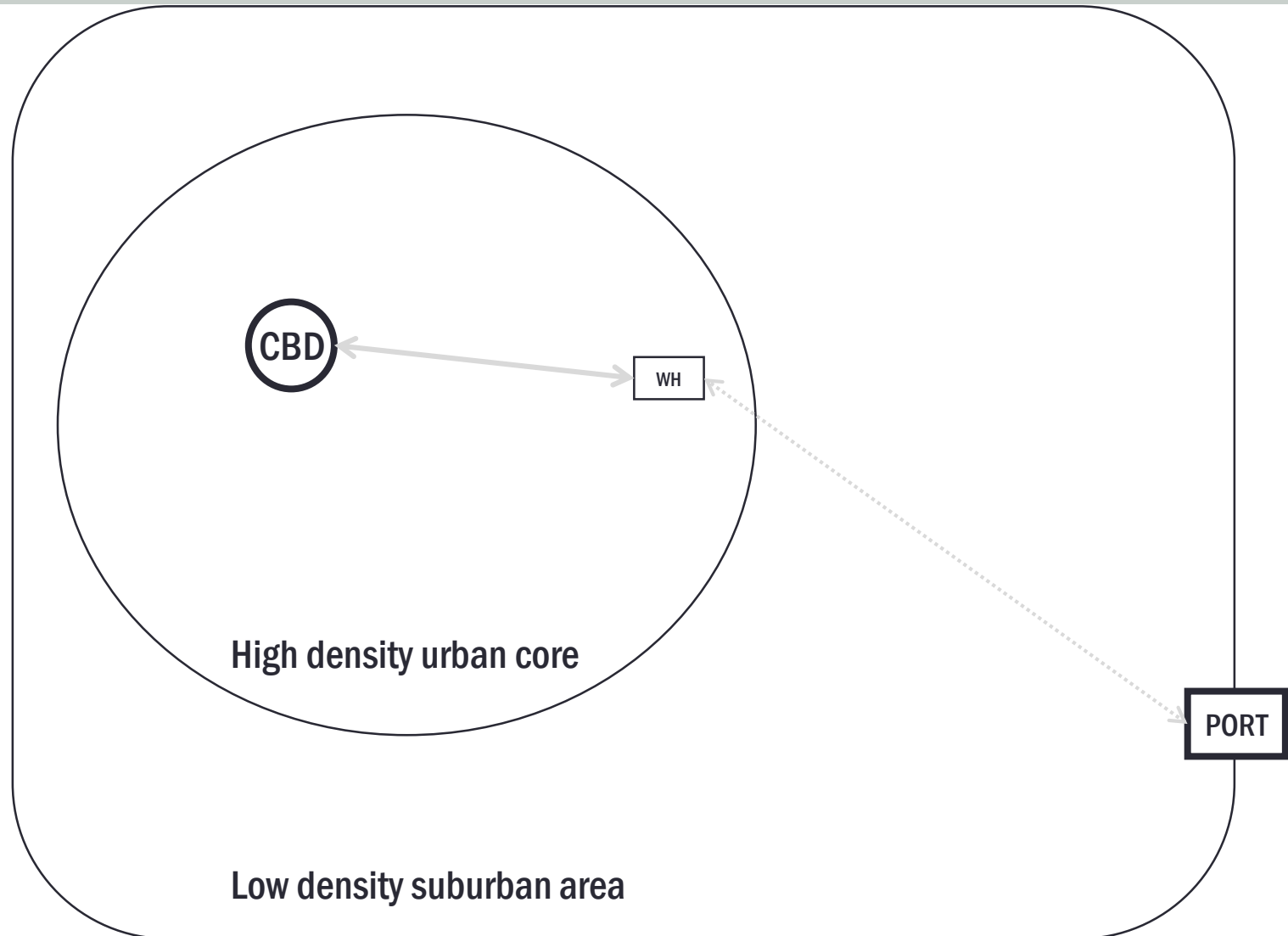
Question 2

How can we systematically measure warehousing location change?

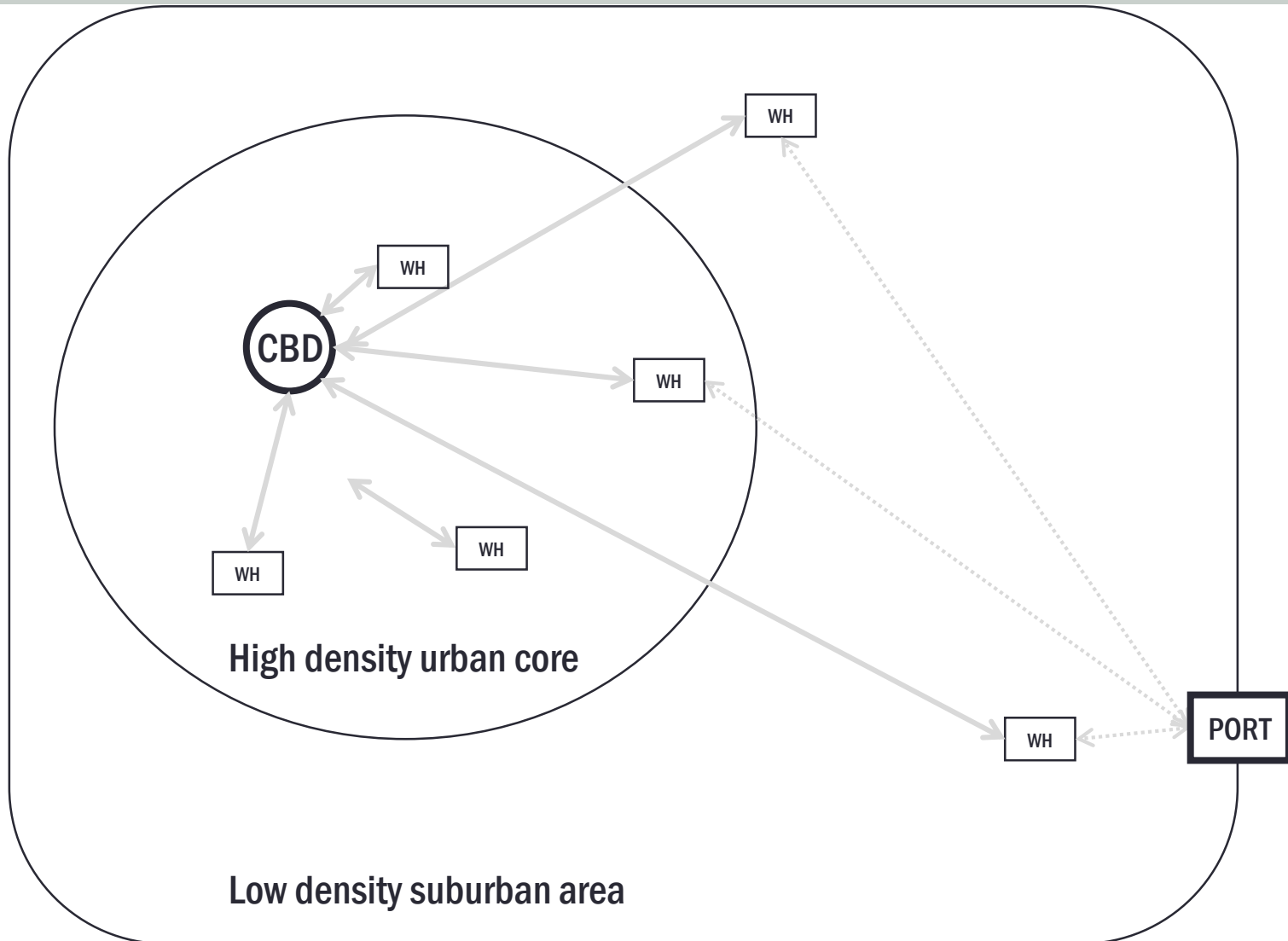
A (very simplified) metro area



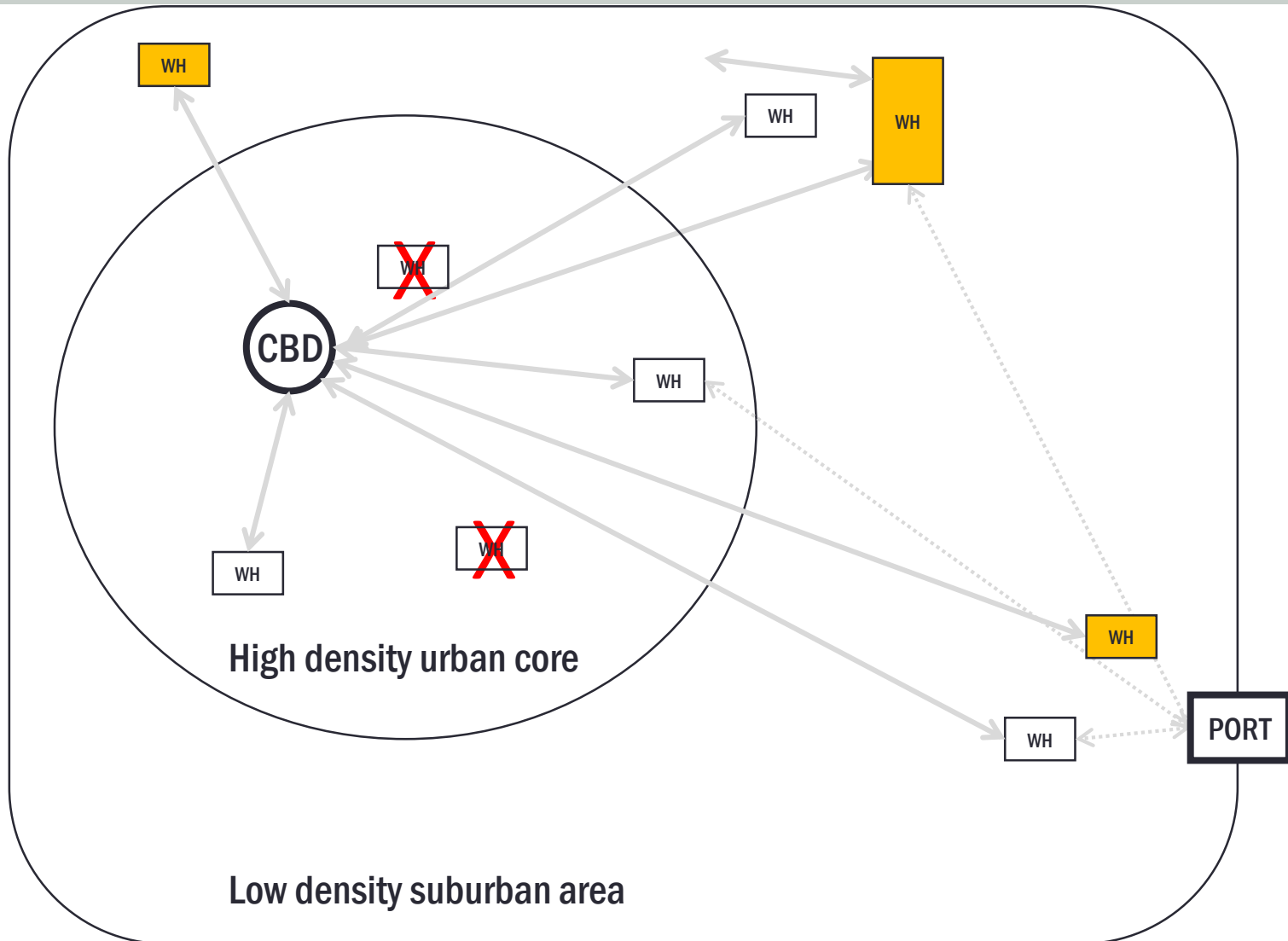
A simple supply chain



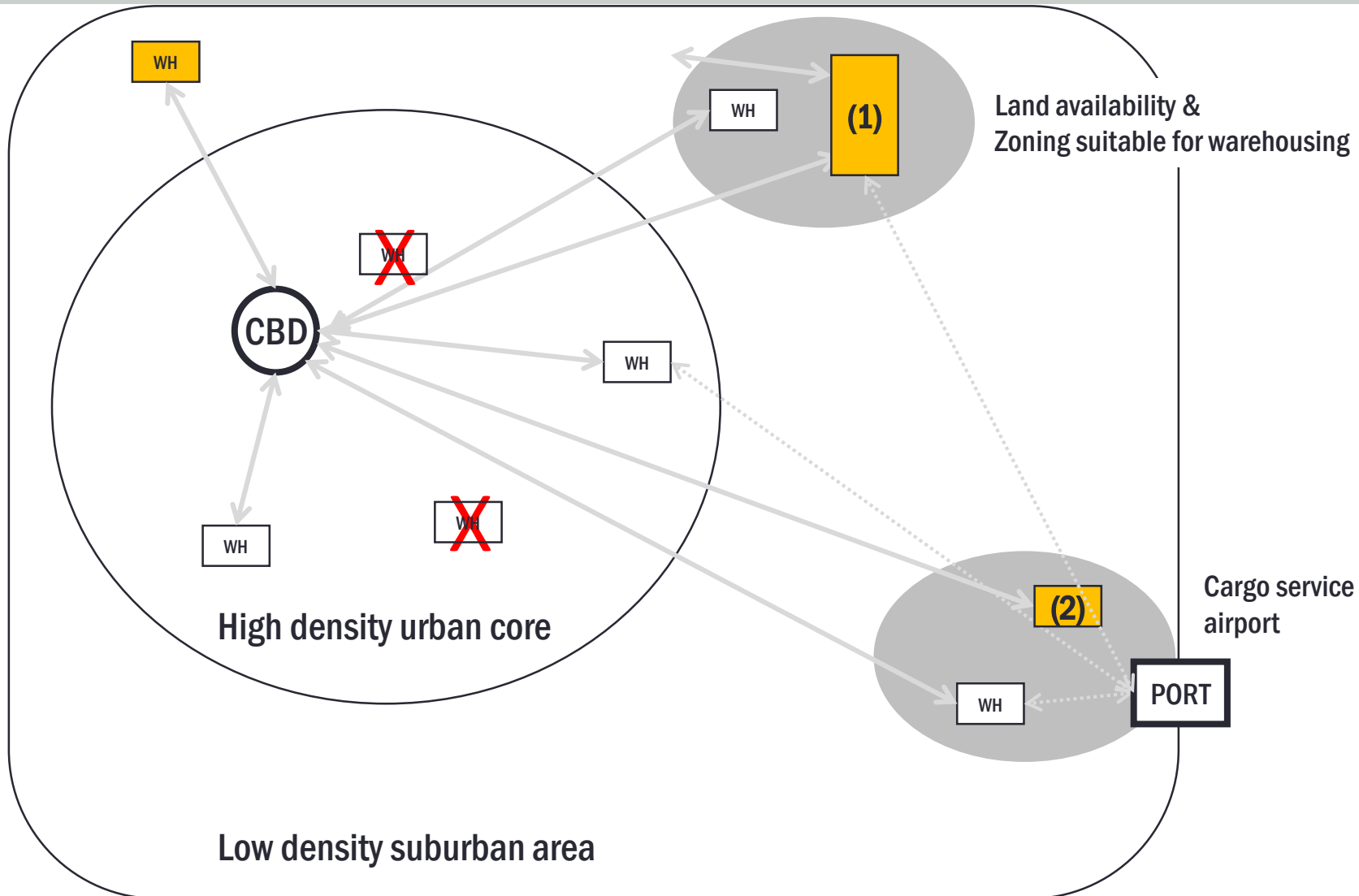
Decentralizing warehouses? (Before)



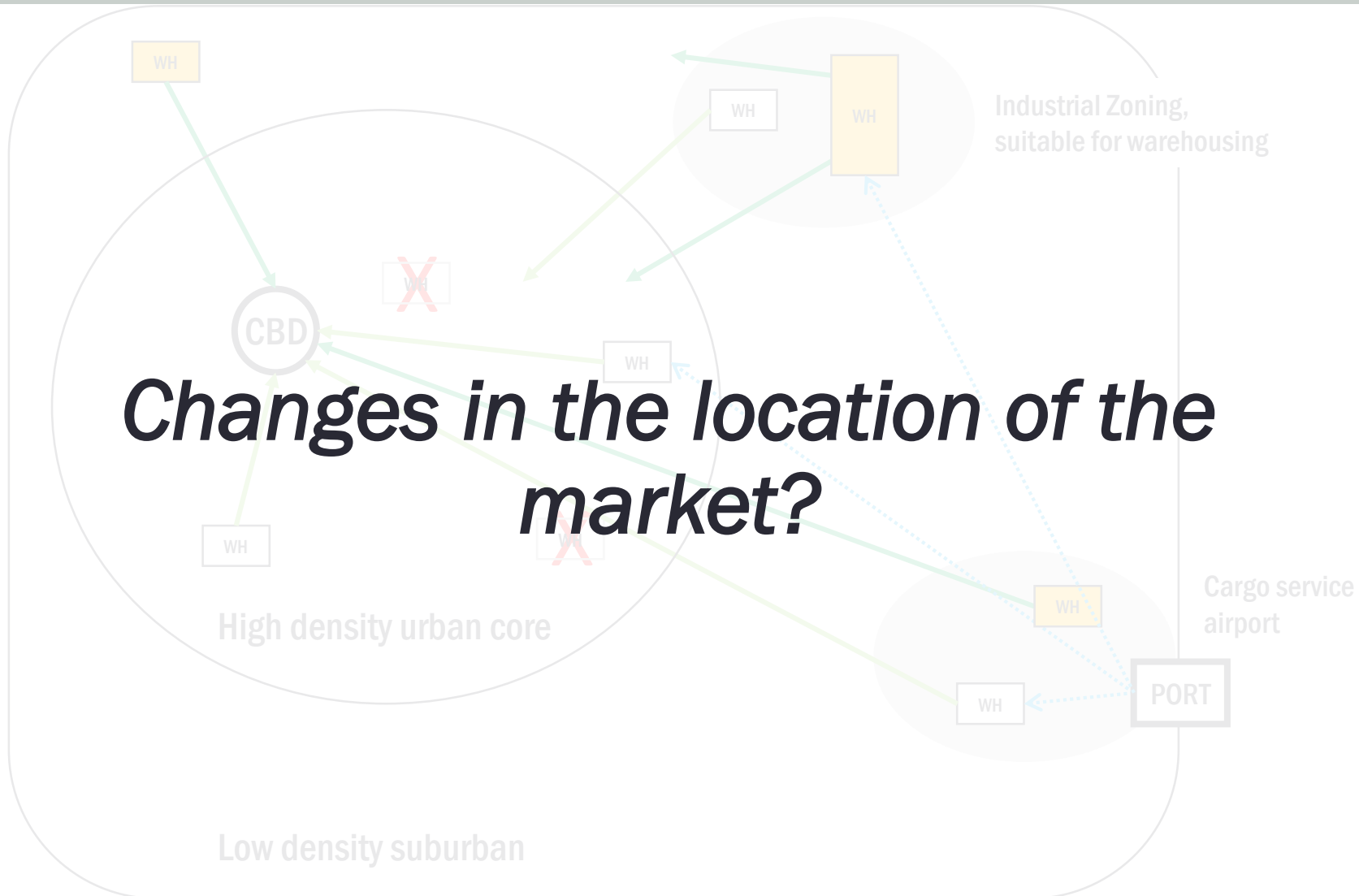
Decentralizing warehouses? (After)



Clustering warehouses?



What if?



Research Approach- Spatial Measures

Spatial Structure	Of warehousing establishments Of warehousing employment	With respect to Employment With respect to Population
	Measure 1. Decentralization	Measure 2. Relative decentralization
	<i>Average distance from CBD from geographic center</i>	<i>Average distance to all employment to all population</i>
	Measure 3. Concentration	Measure 4. Relative concentration
	<i>Gini coefficient for warehouses</i>	<i>Gini coefficient difference, between warehousing employment and all employment</i>

- **ZIP code Business Patterns (ZBP) 2003-2013**

- Subset of County Business Patterns (CBP)
- Developed/maintained by Census
- N of establishment available; Employment imputation (quadratic programming)
- Centroids at the locations with the highest concentration of activities
- ZIP code size varies by development density

- **Warehouses?**

- NAICS “493-Warehousing and storage”
- Facilities that store goods, and/or provide logistics services

- **Case study areas**

- Four metro areas in California
 - *Los Angeles CSA, San Francisco CSA, Sacramento CSA, San Diego MSA*
- Vary in size, industry mix and role in global economy

Case study areas: Population, Employment & Area

Metro area	Los Angeles CSA	San Francisco CSA	Sacramento CSA	San Diego MSA
Population	18 M	7 M	3 M	2.5 M
Employment	7 M	3 M	1 M	1 M
Notes	The largest international trade node in the U.S.	A major International trade center in higher value goods	A trade node for the central valley	A hub for cross-border trade and industry

*CSA: Combined Statistical Area

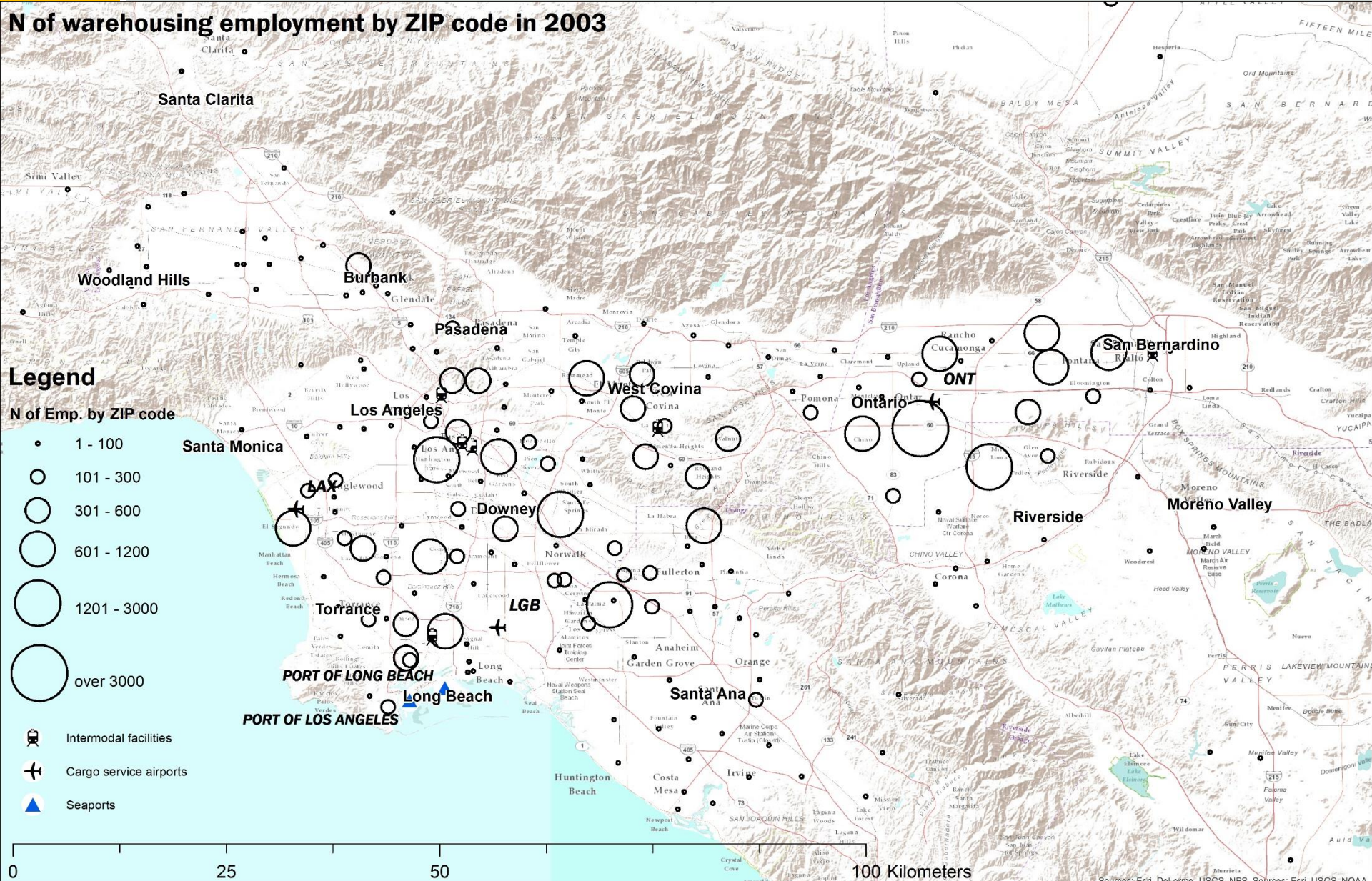
*MSA: Metropolitan Statistical Area

Case study areas: Warehousing Industry

Metro area	Los Angeles CSA		San Francisco CSA		Sacramento CSA		San Diego MSA	
Year	Warehouses	Warehousing employment	Warehouses	Warehousing employment	Warehouses	Warehousing employment	Warehouses	Warehousing employment
2003	775	34,333	257	9,603	80	3,699	84	1,650
2013	1,001	49,266	311	11,476	143	5,641	86	1,720
%Δ	29%	43%	21%	20%	79%	52%	2%	4%

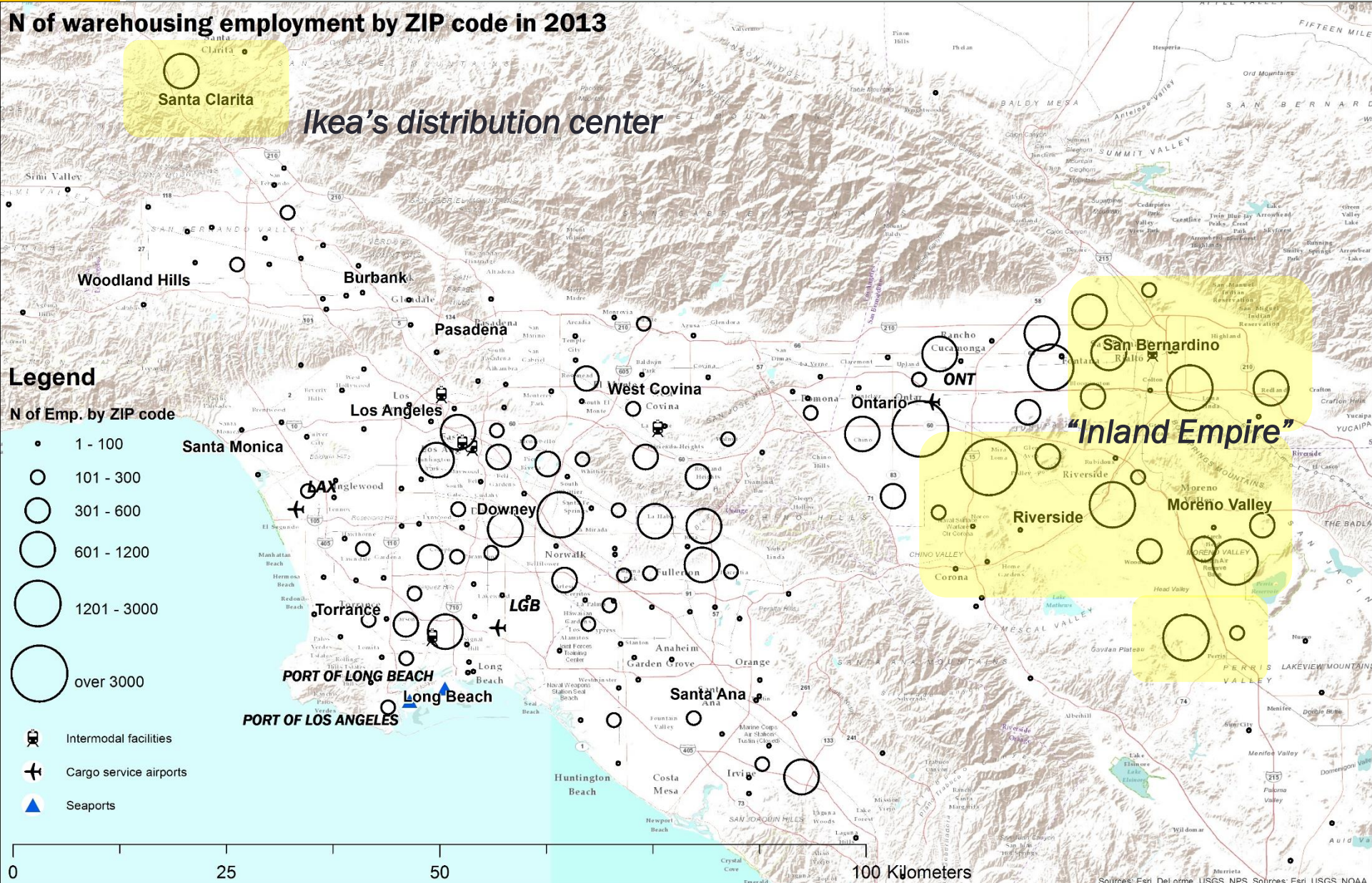
Los Angeles 2003

N of warehousing employment by ZIP code in 2003



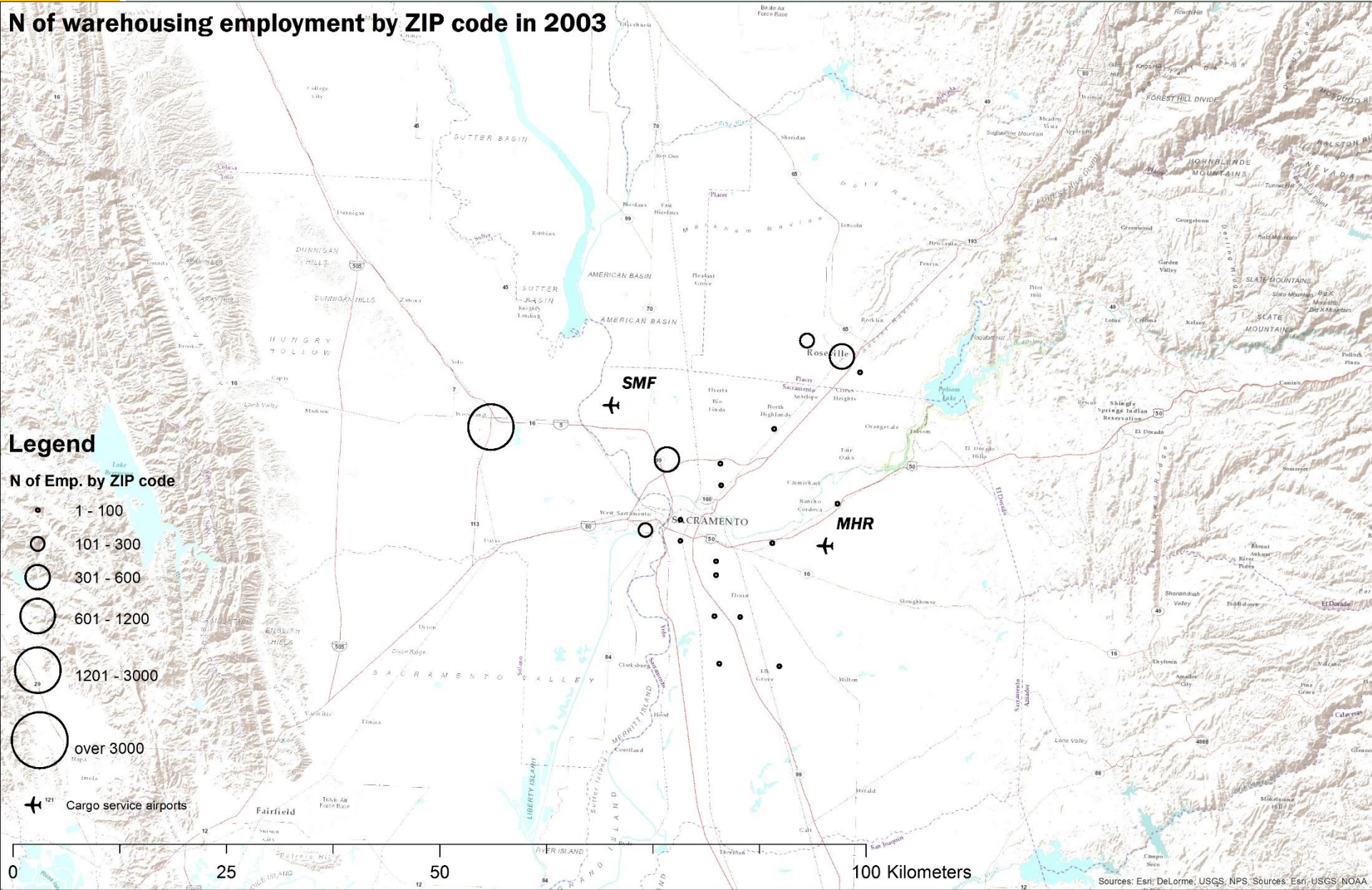
Los Angeles 2013

N of warehousing employment by ZIP code in 2013



Sacramento 2003

N of warehousing employment by ZIP code in 2003



Legend

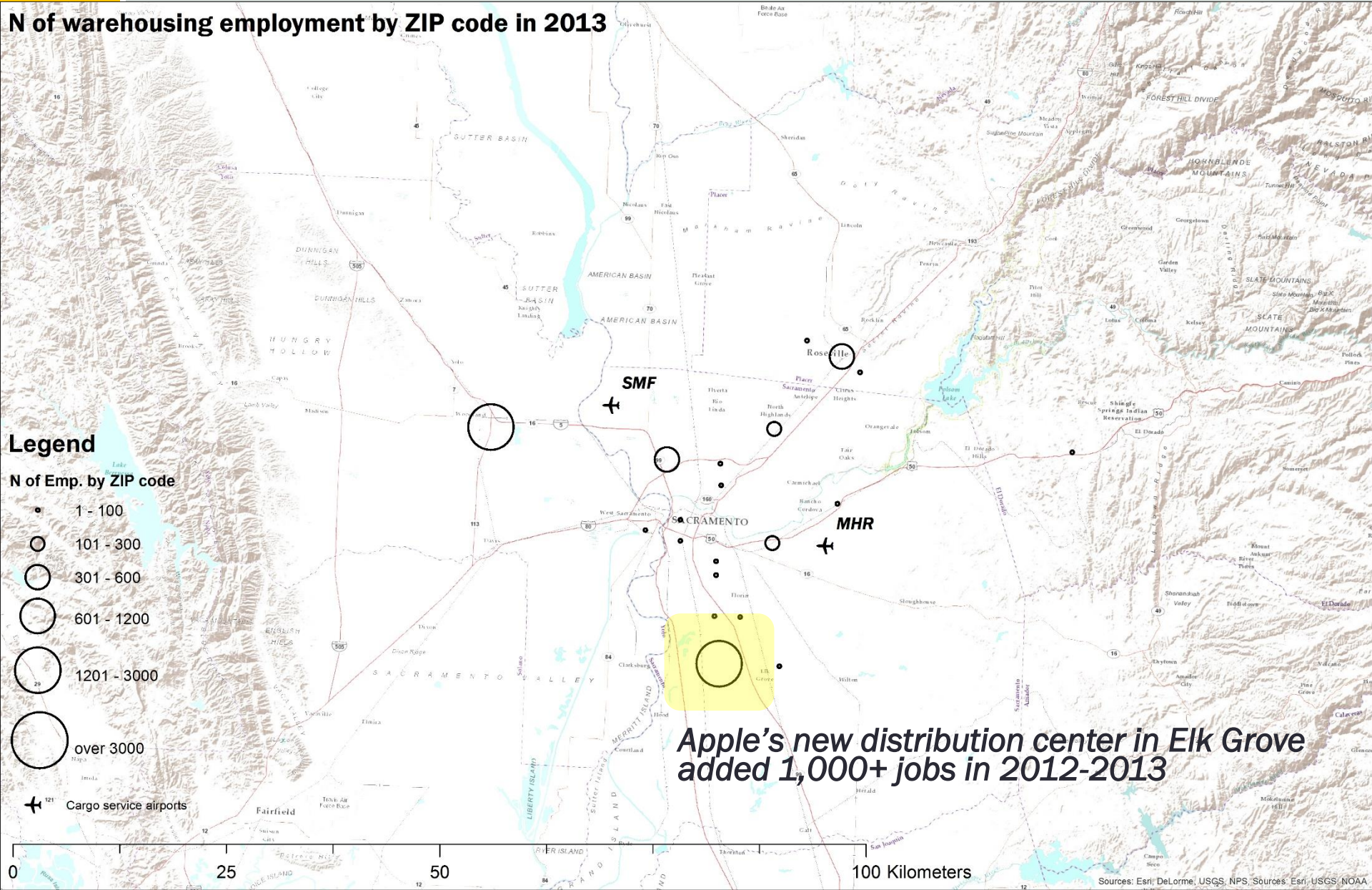
N of Emp. by ZIP code

- 1 - 100
- 101 - 300
- 301 - 600
- 601 - 1200
- 1201 - 3000
- over 3000

✈️ Cargo service airports

Sacramento 2013

N of warehousing employment by ZIP code in 2013



Question 3

Are there consistent trends across metropolitan areas?

Results: M1 Decentralization

Metro area	Measure 1-1 Average distance from CBD		Measure 1-2 Average distance from Geo-Center of Warehouses	
	Warehouses	Warehousing Employment	Warehouses	Warehousing Employment
Changes 2003-2013				
<i>Los Angeles</i>	+	+	+	+
<i>San Francisco</i>	+	+	+	+
<i>Sacramento</i>	+	+	-	+
<i>San Diego</i>	-	+	-	+

* Welch's t-test for statistical significance (unpaired, unequal variance)

Results: M2 Relative Decentralization

Metro area	Measure 2-1 Average distance to All Employment		Measure 2-2 Average distance to All Population	
	Warehouses	Warehousing Employment	Warehouses	Warehousing Employment
Changes 2003-2013				
<i>Los Angeles</i>	+	+	+	+
<i>San Francisco</i>	+	+	+	+
<i>Sacramento</i>	-	+	-	+
<i>San Diego</i>	+	+	+	+

Results: M3 & M4 Concentration

Metro area	Measure 3 Gini Coefficient		Measure 4 Relative Gini Coefficient Difference	
	Warehouses	Warehousing Employment	Warehouses	Warehousing Employment
Changes 2003-2013				
<i>Los Angeles</i>	+	+	n/a	+
<i>San Francisco</i>	+	-	n/a	+
<i>Sacramento</i>	-	+	n/a	+
<i>San Diego</i>	+	+	n/a	+

*Gini: Jackknife standard error for statistical significance

Discussion

- 1. Little evidence of consistent warehousing decentralization across four metropolitan areas.**
 - Los Angeles: decentralization + concentration true for all measures
 - San Francisco: weak decentralization
 - Sacramento: dispersed centralization
 - San Diego: clustered centralization
- 2. How you measure matters.**
- 3. Multiple measures provide more information on the nature of the spatial change.**
- 4. Warehousing employment seems more flexible with respect to spatial change than warehouses due to land use regulation.**

5. Factors that might drive warehousing decentralization

- Land rent & availability
- Role in international trade
- Local market size – population, industry size and composition
- Costs of congestion and delay
- Land use regulation and tax policy
- Local labor pool

Question?

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