

# Interaction between Land Use and Urban Transport

*Addis Abeba  
(SW)*

DEMOGRAPHIA

**CODATU**

27 October 2012  
Wendell Cox  
Demographia

**CODATU  
TRAINING  
PROGRAMME  
COURSES**

Addis Ababa (Ethiopia)  
October 26-27-29, 2012

# OUTLINE

- Perspective
- The Evolving Urban Form
- Transport and the City
- Realities and Challenges



# The Evolving Urban Form

Development Profiles of  
World Urban Areas



DEMOGRAPHIA

Demographia World Urban Areas  
(World Agglomerations)



8<sup>th</sup> Annual Edition  
April 2012



Demographia International Housing Affordability Survey

Los Angeles

## Introduction

Why do cities exist?

Background: Cities and transport through history

Survey of modern world urbanization

Recent evolution

Population

Land Area

Density

Centralized and dispersed commercial development

Examples (Addis Abeba and others)

Transport in the modern era

Transport, economic growth and affluence

The roles of various transport modes

Differences between cities

Trends

Measuring performance

Planning in the modern era

Public policy goals

Differing planning perspectives

Impact on the quality of life and cost of living

The challenges ahead



*Chongqing*

# PERSPECTIVE & RESOURCES

**The Evolving Urban Form**

Development Profiles of  
World Urban Areas



DEMOGRAPHIA

# Demographia World Urban Areas (World Agglomerations)



8<sup>th</sup> Annual Edition: Version 2  
July 2012

# RESOURCES

- DEMOGRAPHIA WORLD URBAN AREAS (9<sup>TH</sup> EDITION 2013)
  - <http://demographia.com/db-worldua.pdf>
- THE EVOLVING URBAN FORM
  - <http://www.newgeography.com/category/story-topics/evolving-urban-form>
- THE NEW GEOGRAPHY
  - <http://www.newgeography.com/>
- DEMOGRAPHIA INTERNATIONAL HOUSING AFFORDABILITY SURVEY (9<sup>TH</sup> EDITION 2013)
  - <http://www.demographia.com/dhi.pdf>
- WEBSITE
  - <http://demographia.com/>

# History of Humanity

## ETHIOPIA: BIRTHPLACE OF “LUCY”

Economist Steven Landsburg (2007):

- Modern humans first emerged about 100,000 years ago. For the next 99,800 years or so, nothing happened. Well, not quite nothing. There were wars, political intrigue, the invention of agriculture – but none of that stuff had much effect on the quality of people’s lives. Almost everyone lived on the modern equivalent of \$400 to \$600 a year, just above the subsistence level. True there were always aristocracies who lived far better, but numerically, they were quite insignificant ... .
- <http://online.wsj.com/article/SB118134633403829656.html>



# Highest National GDPs: 1500-2000

650 BC TO PRESENT

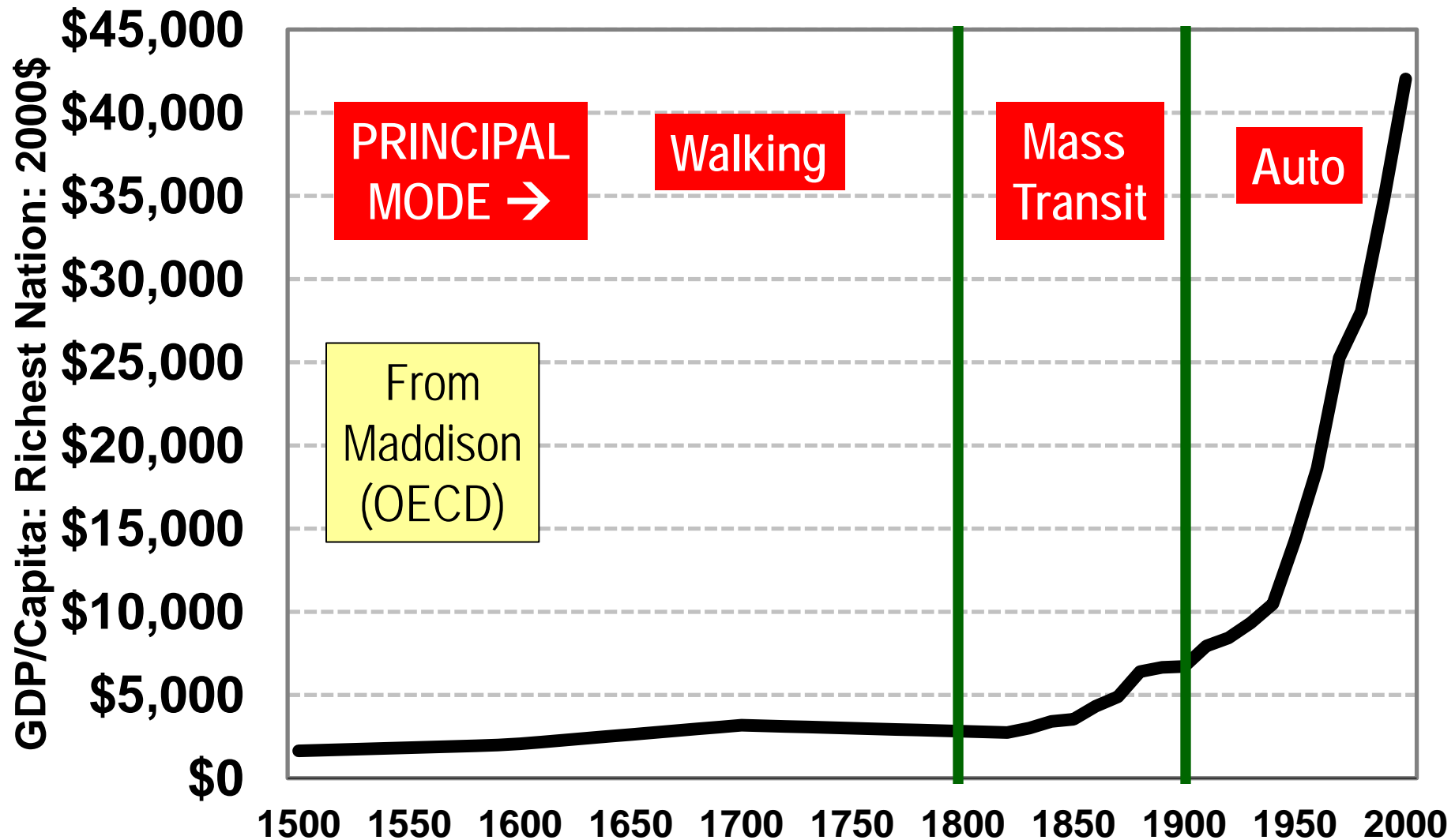
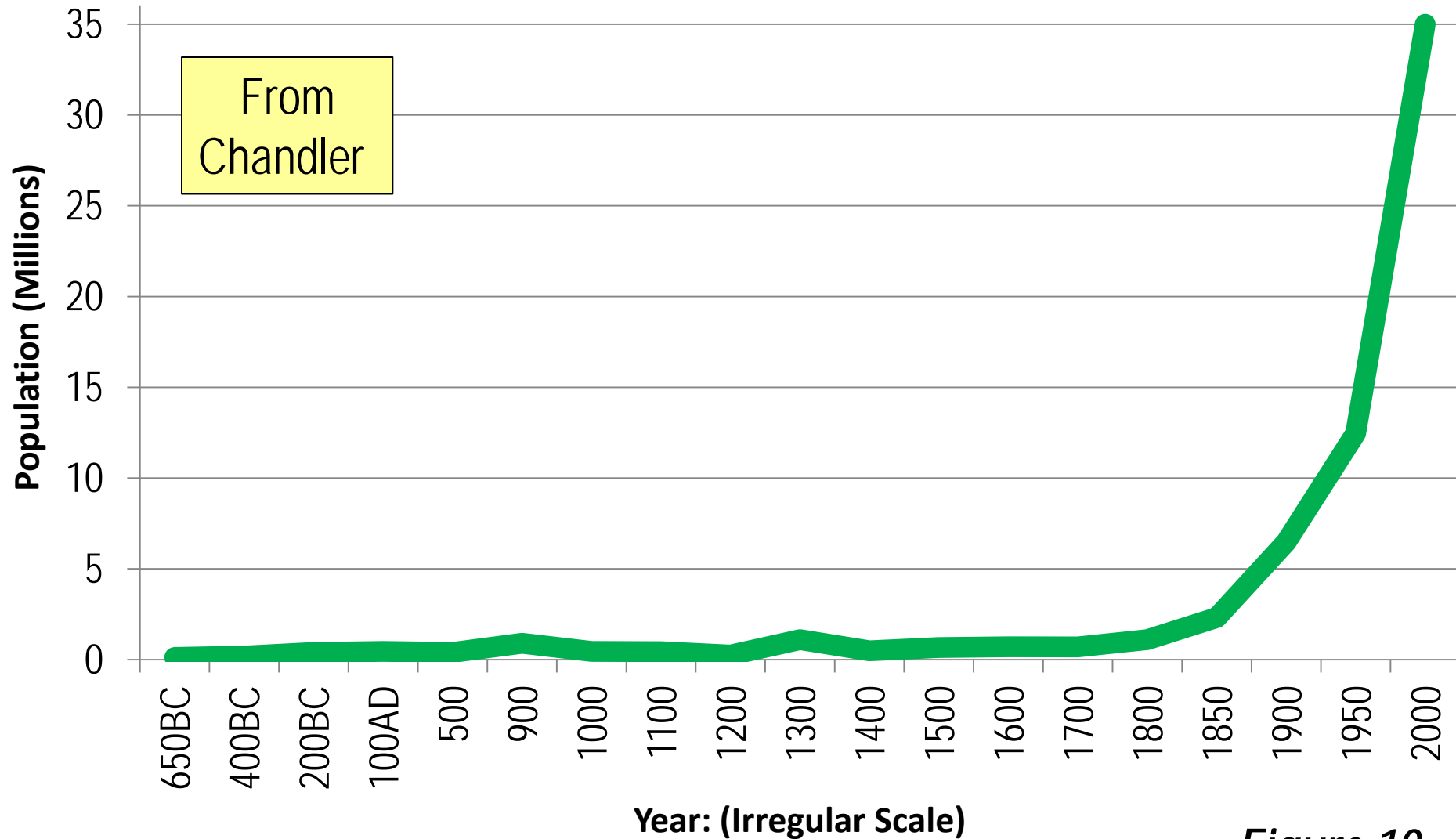


Figure 9

# World's Largest Cities (Urban Areas)

## 650 BC TO PRESENT



*Figure 10*

Table 1

Largest Cities in the World (Urban Areas) 1750-2012

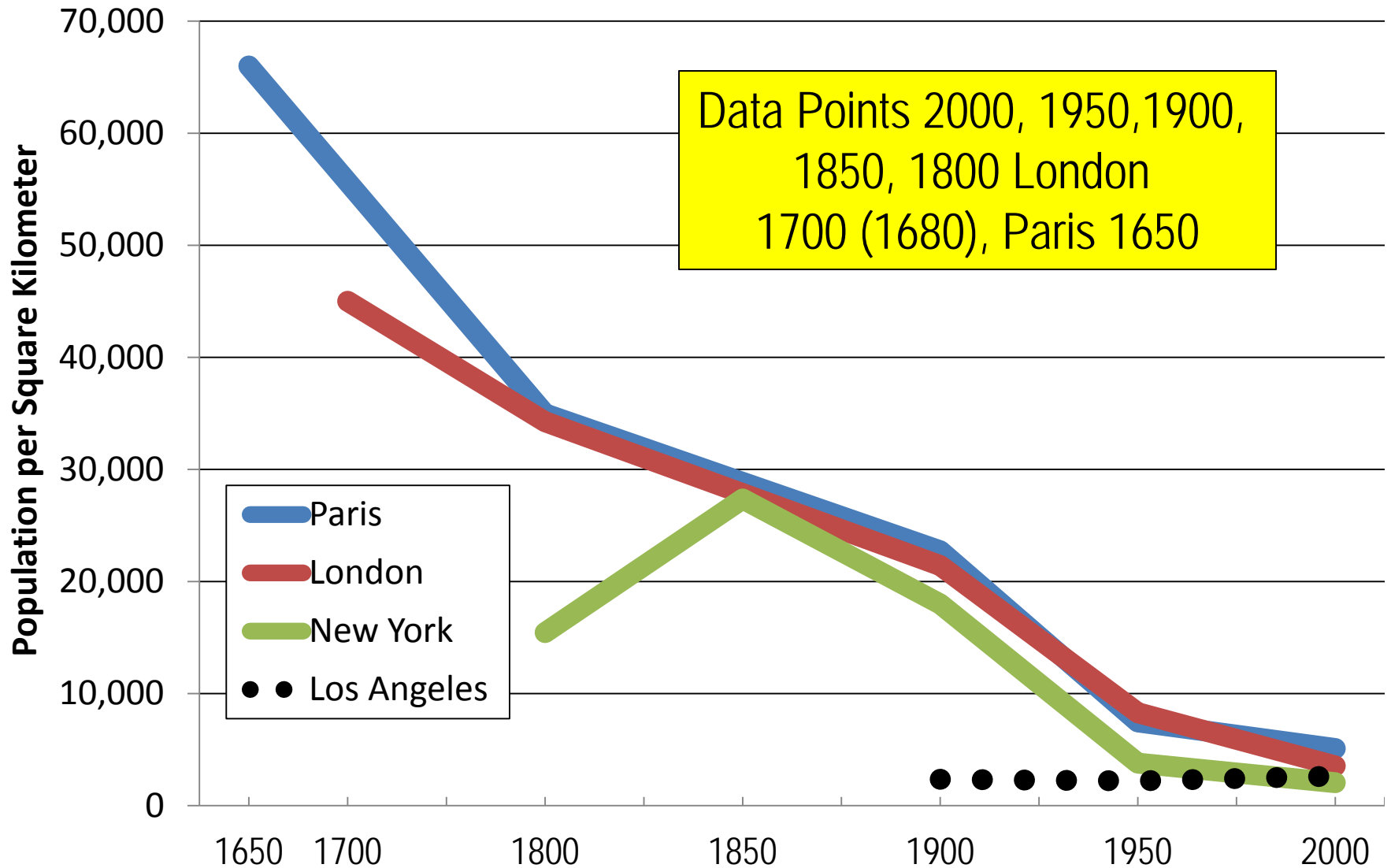
Year	1,000,000 & Over	6,000,000 & Over	10,000,000 & Over (Megacities)
1750	0	0	0
1800	1	0	0
1900	16	1	0
2012	449	53	26

Sources: Chandler (1987) and Demographia (2012)



# Urban Areas: Densities from 17<sup>th</sup> Century

PARIS, LONDON, NEW YORK & LOS ANGELES



*Dubai*

# THE PURPOSE OF CITIES

# Why Cities (Urban Areas) Exist

## THE PURPOSE OF CITIES

Urban areas exist  
because of the  
economic opportunities  
they provide.

The purpose of urban  
areas is to improve the  
affluence of their  
residents





# Purpose of Cities is Economic

PEOPLE MOVE THERE FOR BETTER LIVES



Shanghai

# Why Cities Grow (Their Purpose)

ALAIN BERTUAD, FORMER WORLD BANK PLANNER

- *The raison d'être of large cities is the increasing return to scale inherent to large labor markets. The cities' economic efficiency requires, therefore, avoiding any spatial fragmentation of labor markets.*



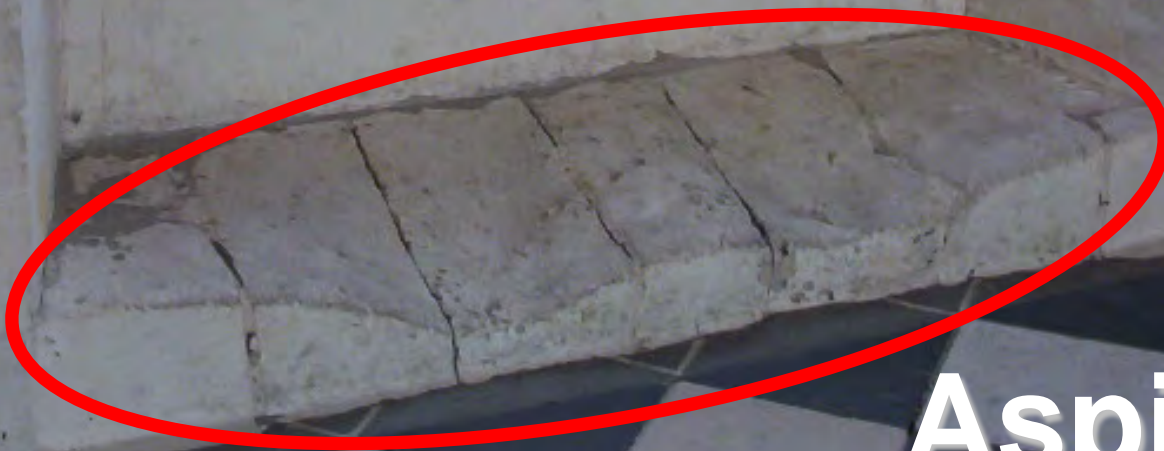


# Global Scaling Research

*Double city  
size, 15%  
productivity  
improvement*



Chenonceaux



**Aspiration**

*Shenyang*



# THE EVOLVING URBAN FORM

City  
(Urban Organism)

```
graph TD; A[City (Urban Organism)] --> B[Metropolitan Area or Labor Market (Functional Expanse)]; A --> C[Urban Area or Agglomeration (Physical Expanse)];
```

Metropolitan Area or  
Labor Market  
(Functional Expanse)

Urban Area or  
Agglomeration  
(Physical Expanse)



# Definition of Urban Terms

## PARIS METROPOLITAN AREA (AIRE URBAINE)

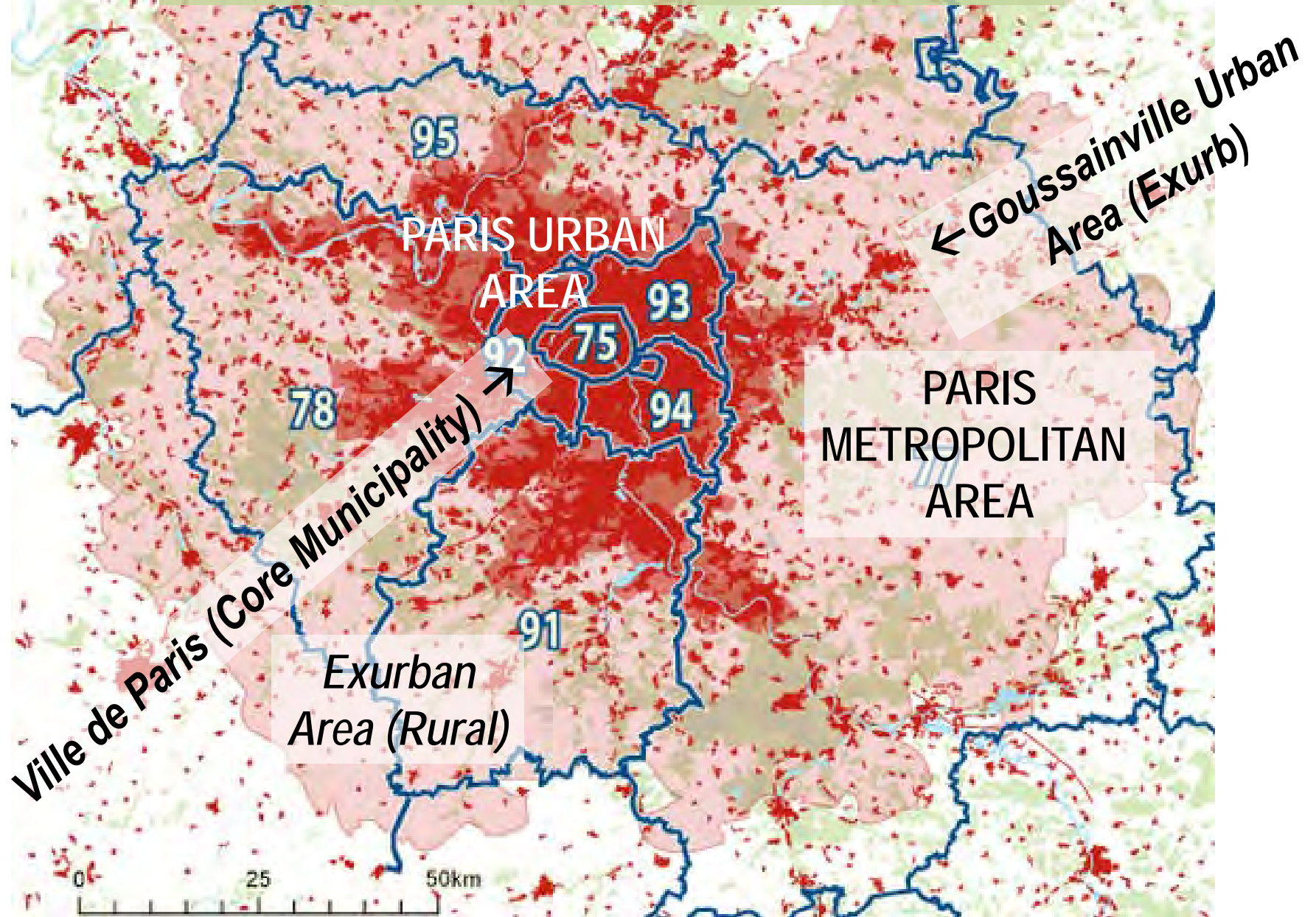


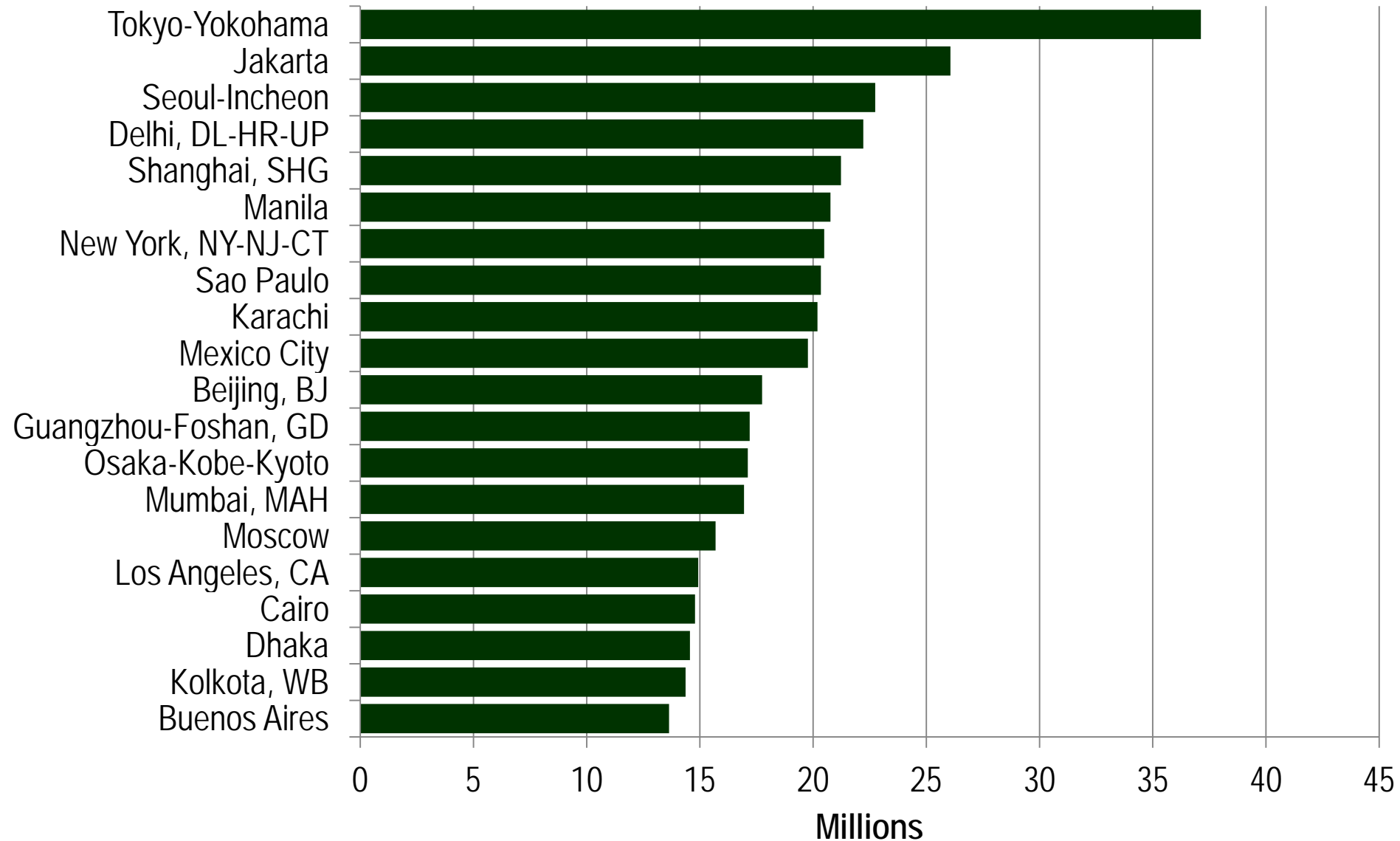
Table 2  
Comparison of Kinshasa & Paris  
Ville, Urban Area & Metropolitan Area

	Kinshasa	Paris
VILLE (MUNICIPALITY)		
Area (SKM)	9,965	105
Population	10,500,000	2,200,000
Density	1,100	21,000
URBAN AREA		
Area (SKM)	583	2,845
Population	9,100,000	10,300,000
Density	15,600	3,600
METROPOLITAN AREA		
Area (SKM)	NA	17,145
Population	NA	12,100,000
Density	NA	700

Sources: Census Authorities & *Demographia World Urban Areas* (2012) & author's estimates

# Largest Urban Areas in the World

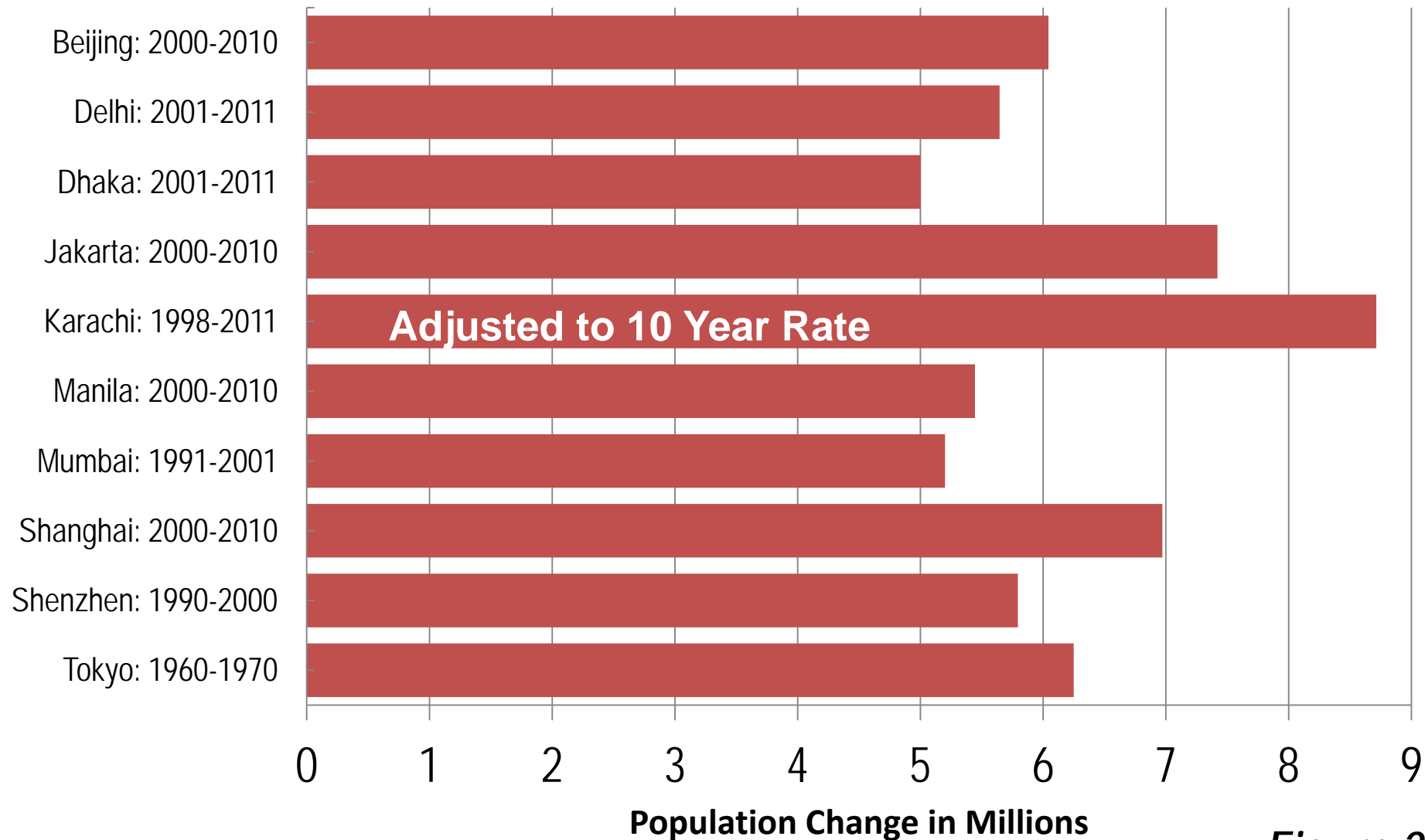
POPULATION: 2012





# Largest 10 Year Historical Growth Rates

## WORLD METROPOLITAN REGIONS



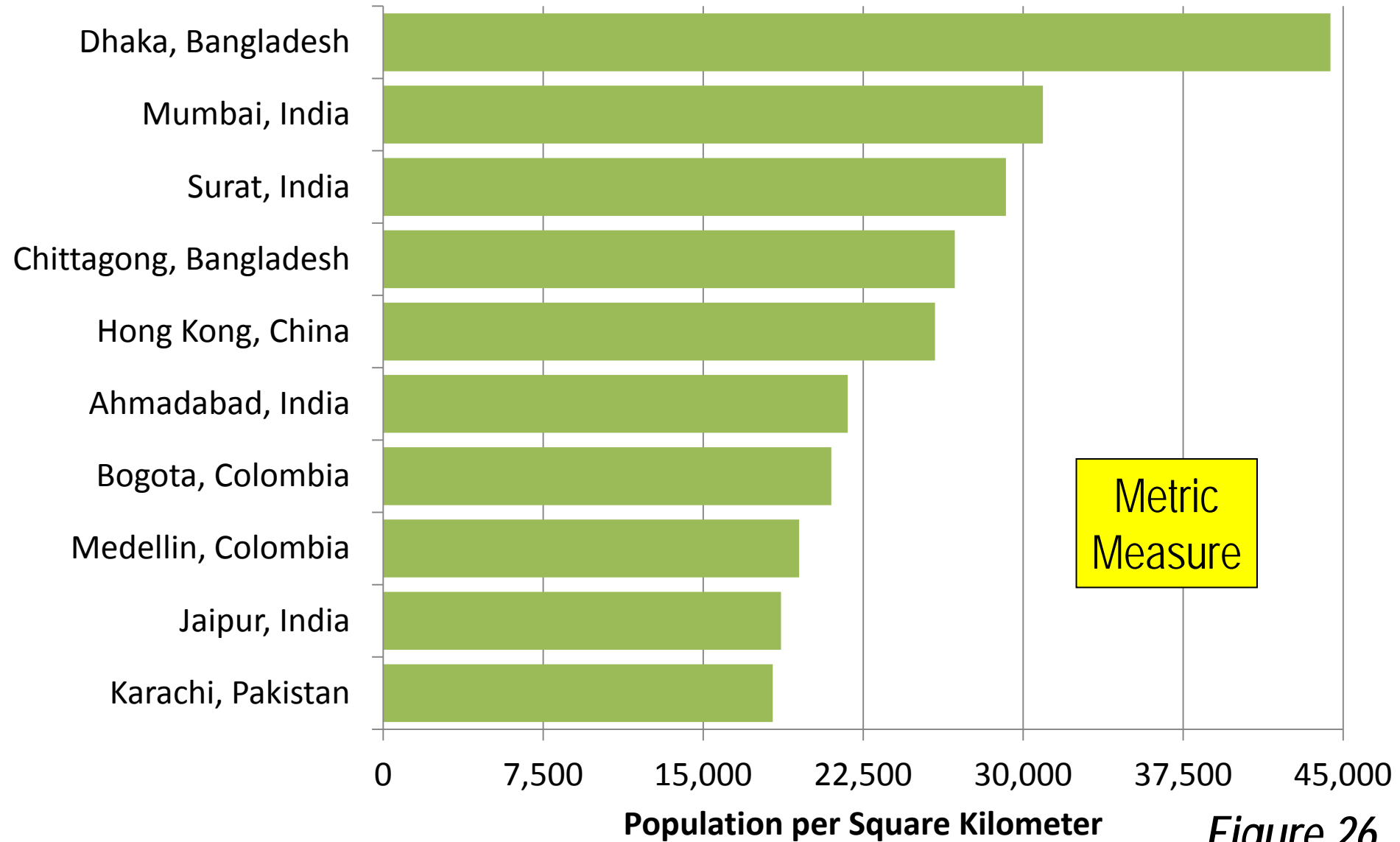
*Figure 24*

Table 3  
Traffic Congestion Averages

	Cases	Population	Density (Population per KM2)	Traffic Congestion Index
Canada	5	1,679,000	3,042	18.8
Europe	82	2,834,000	2,081	17.6
United States	100	2,015,000	1,009	8.8

# Most Dense World Urban Areas

## OVER 2.5 MILLION POPULATION: 2012

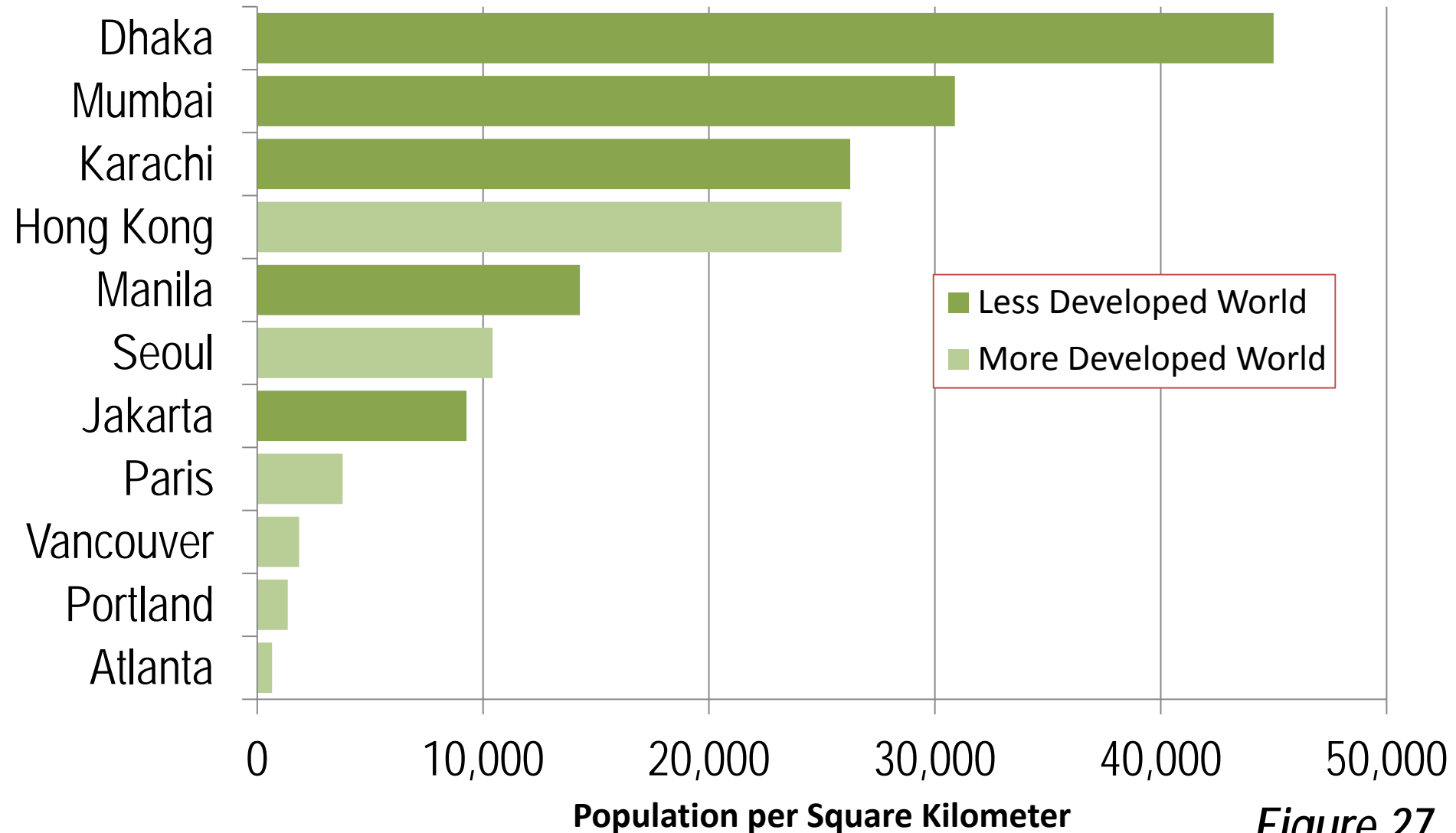


*Figure 26*



# Urban Area Average Population Densities

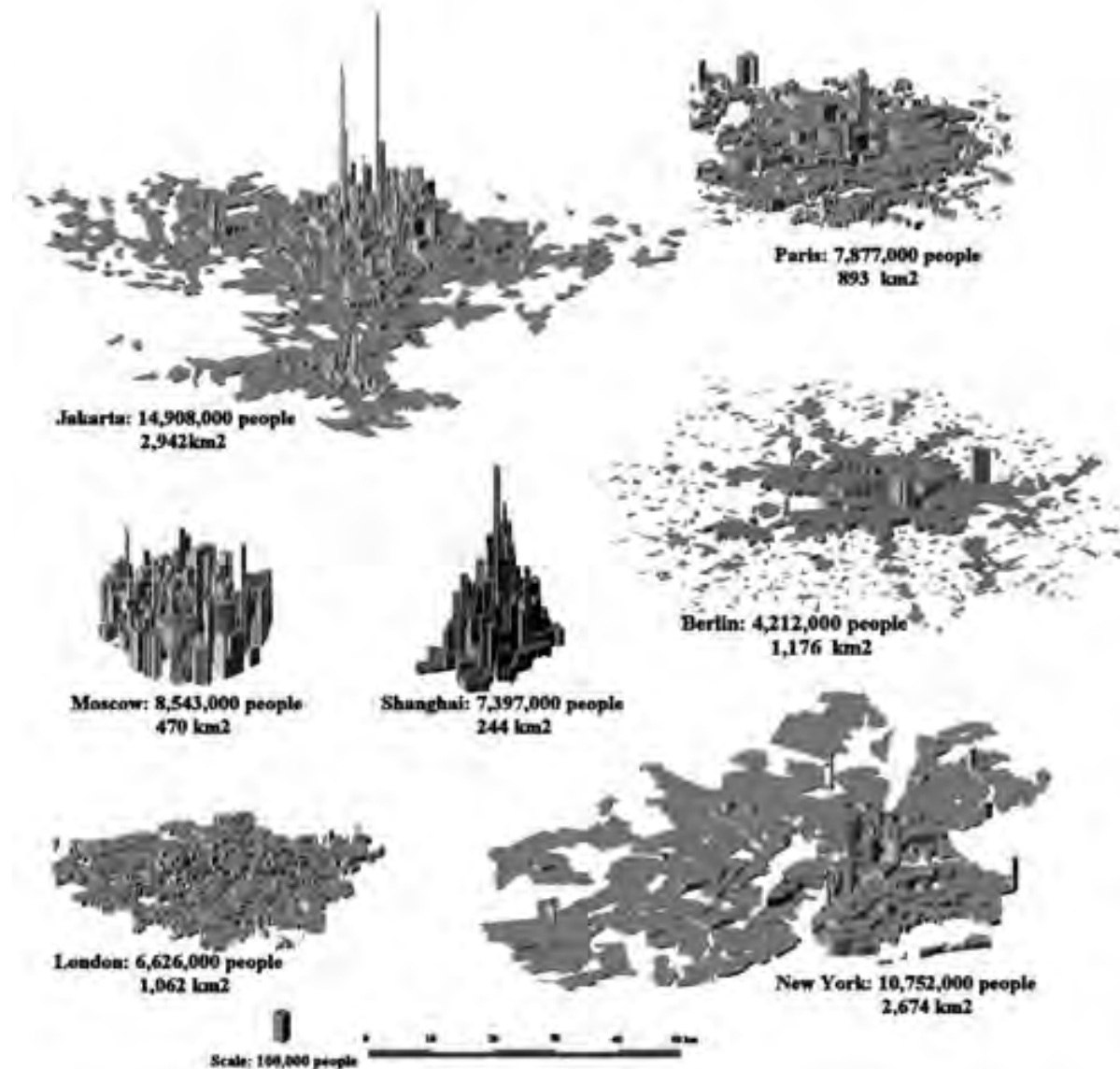
## DHAKA & SELECTED (METRIC MEASURE)



*Figure 27*

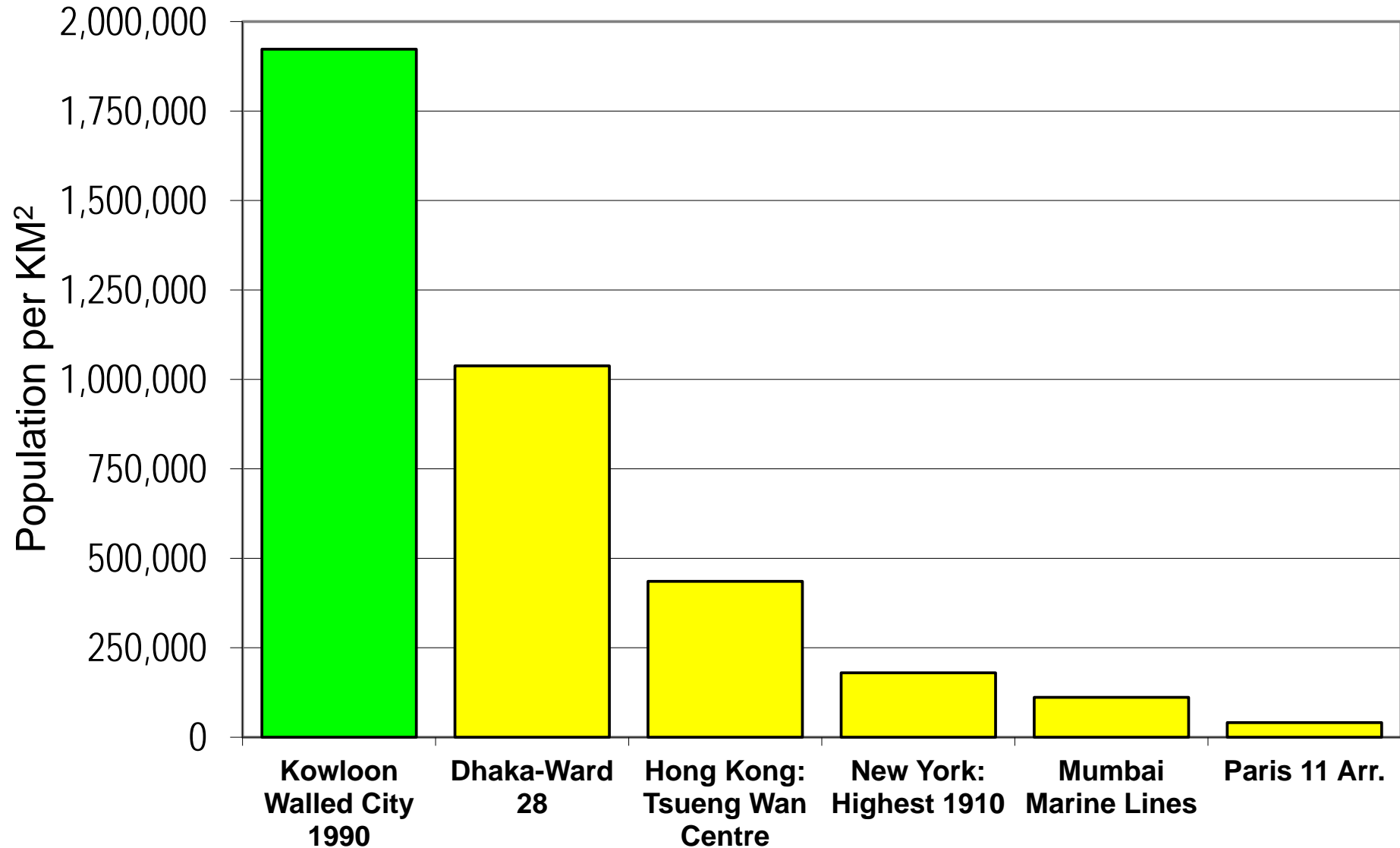
# Density Profiles at the Same Scale

7 METROPOLITAN AREAS: BERTAUD, 2003



# Neighborhood Densities: Examples

(WITHIN CITIES)







Kowloon Walled City  
(Hong Kong)

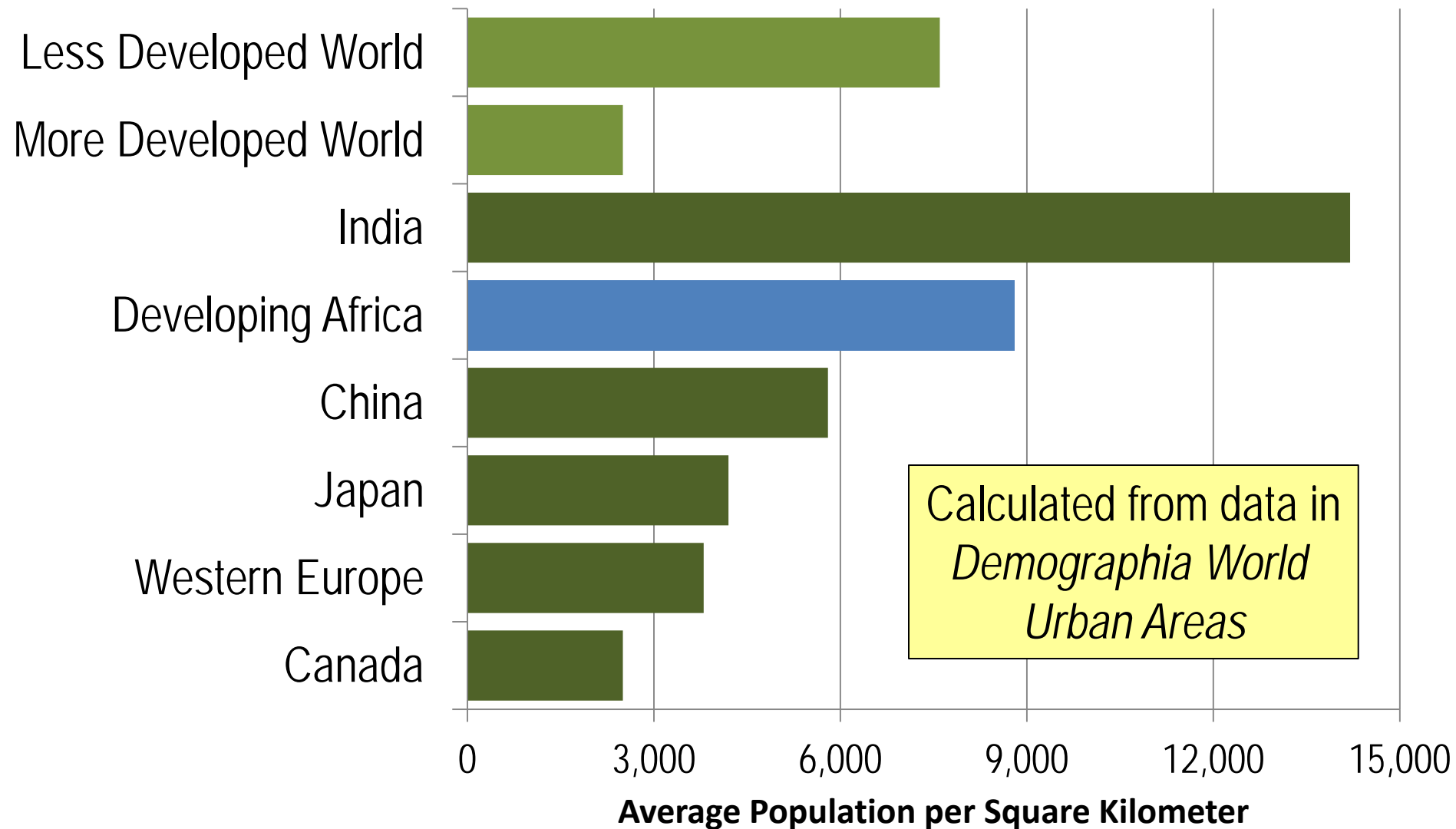




Slum  
(Dhaka)

# Average Population Densities: 2012

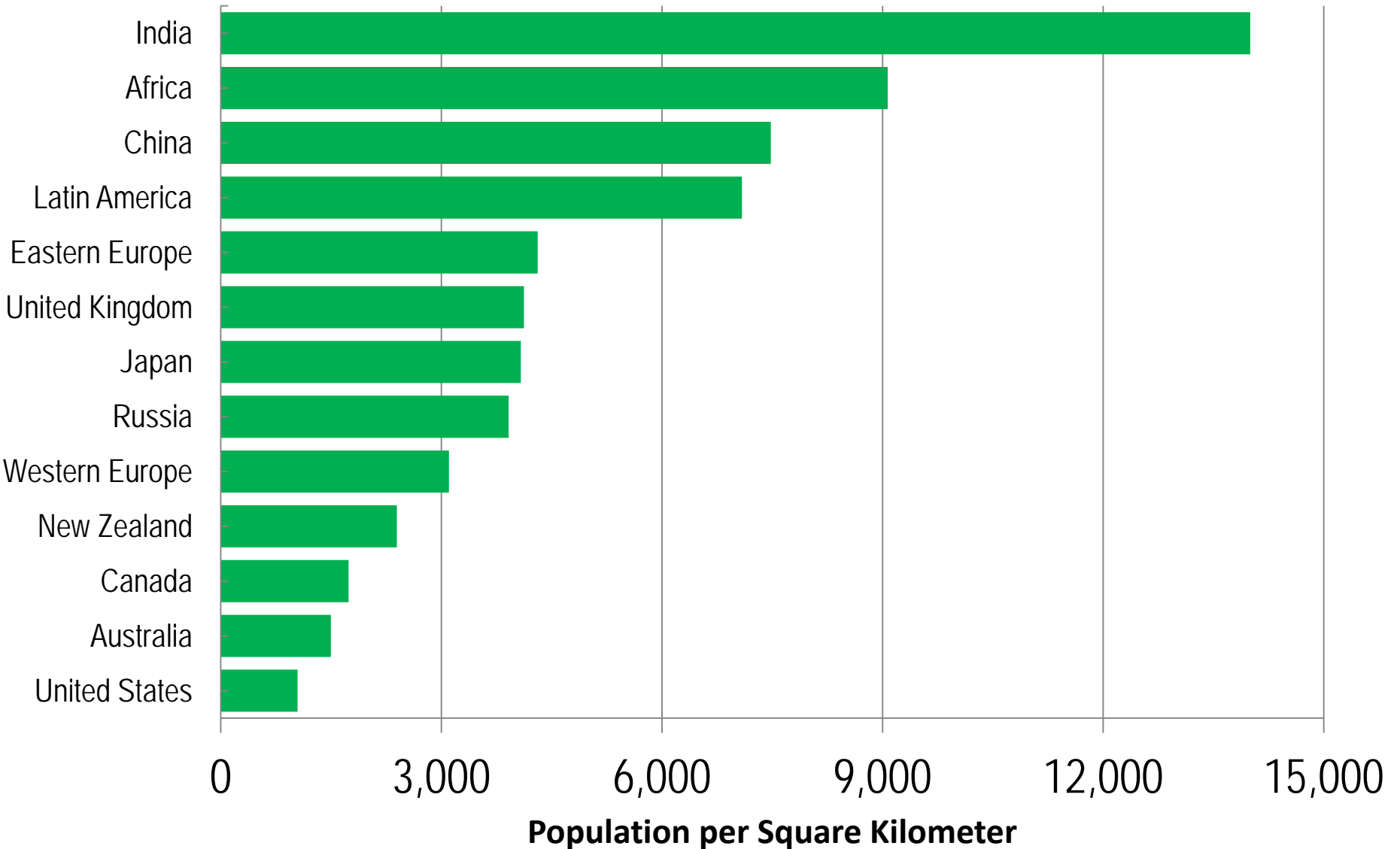
URBAN AREAS OVER 2.5 MILLION: SUB-SAHARAN AFRICA



*Figure 32*

# Urban Areas 500,000+: Density

## AVERAGE URBAN DENSITY (REGIONAL): 2012





# Planet of Cities



SHLOMO ANGEL

## Coming to Terms with Global Urban Expansion

**The Evolving Urban Form**

Development Profiles of  
World Urban Areas





**As Cities  
Become  
Larger  
They Become  
Less Dense**



# Addis Abeba Urban Area: Evolution

1972-2010

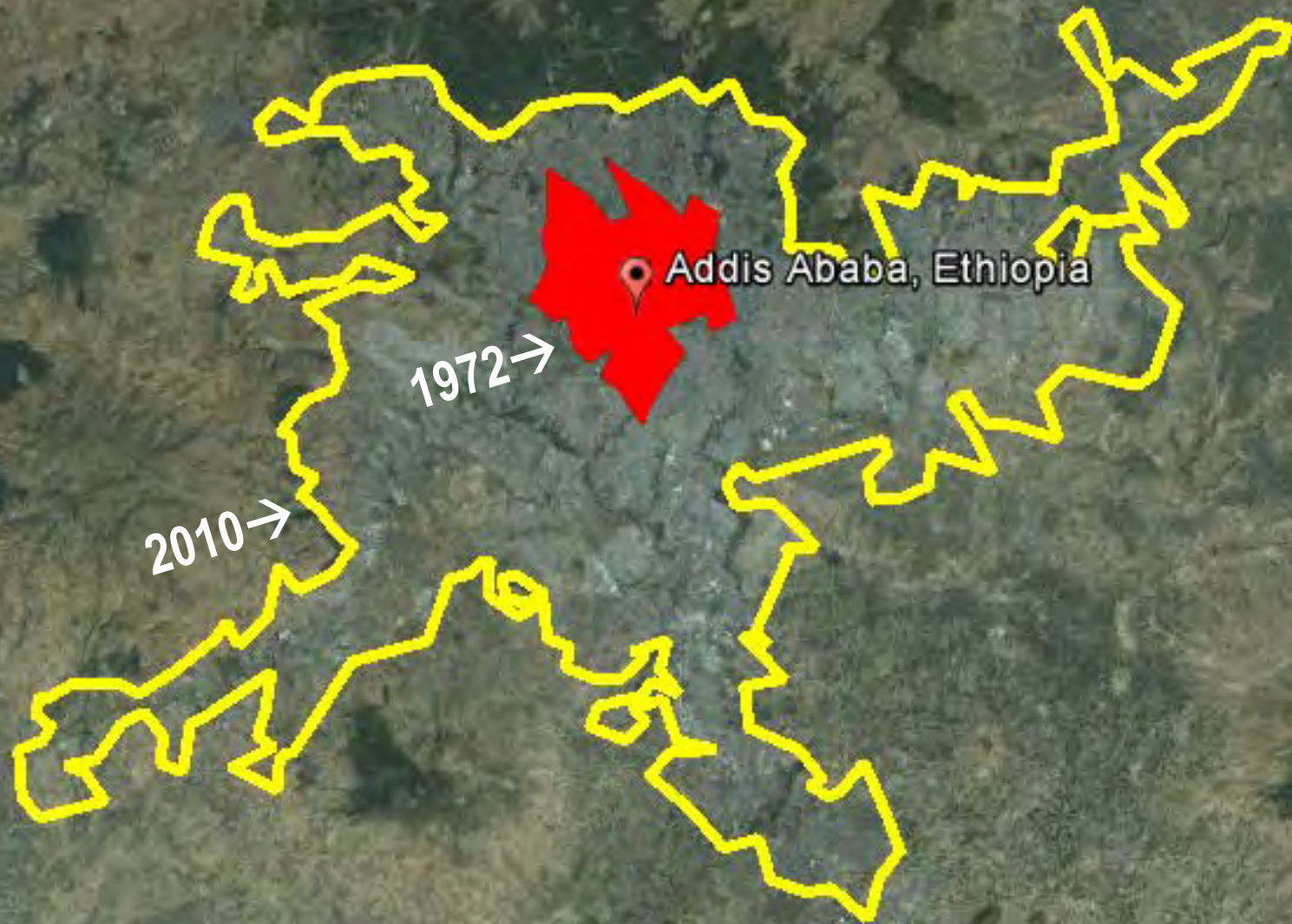


Table 3  
Developing Africa Urban Areas 2.5+ Million Population & 2025 Projection

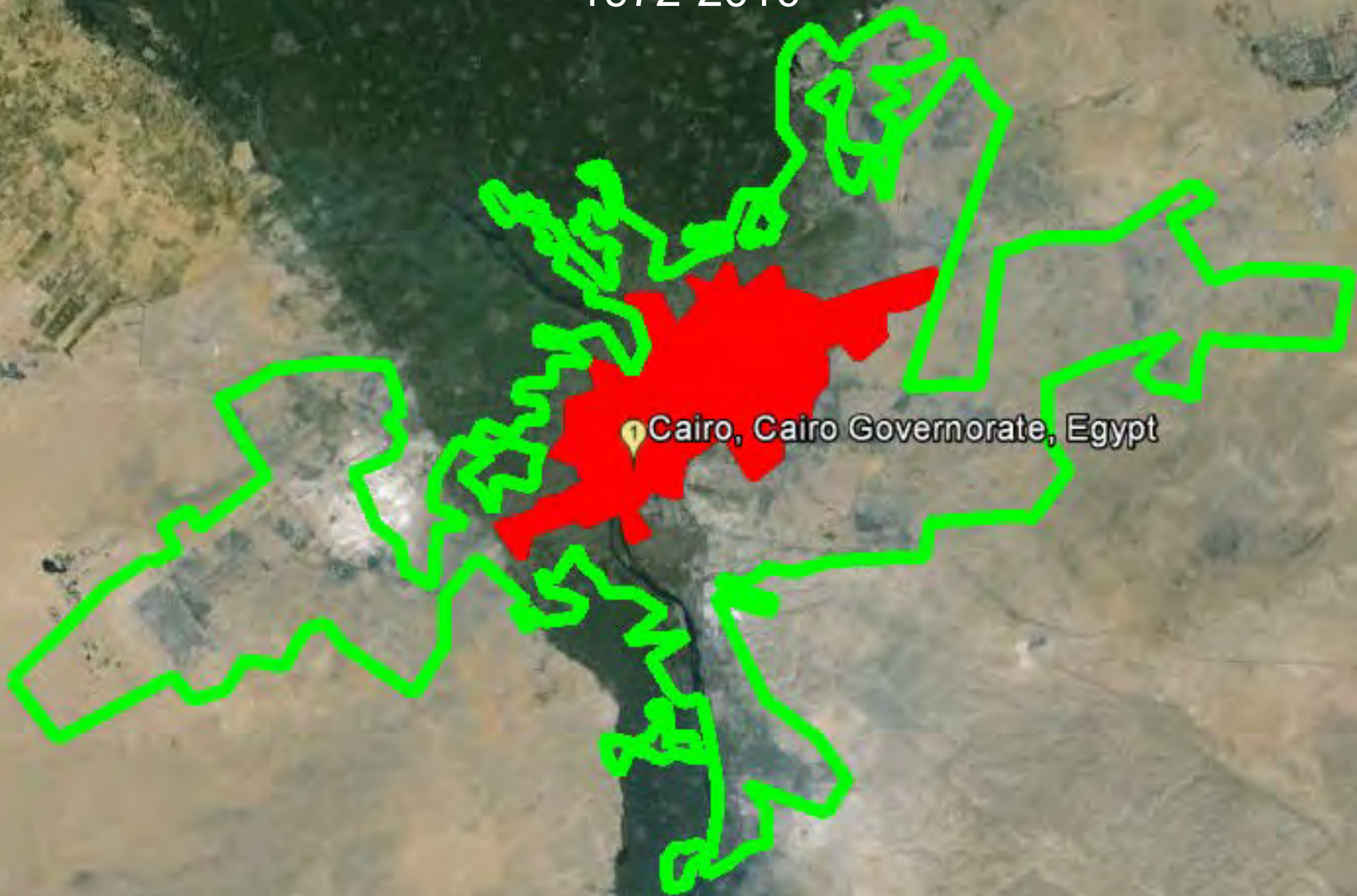
Urban Area	Population 2012	Urban Land Area (KM2)	Density	Population 2025	Change
Lagos	11.6	907	12,900	25.5	119%
Kinshasa	9.1	583	15,500	14.9	64%
Luanda	5.2	767	6,800	12.4	139%
Khartoum	4.8	930	5,100	9.0	88%
Abidjan	4.4	324	13,700	9.2	107%
Nairobi	4.3	557	7,700	8.6	102%
Accra	3.8	945	4,000	7.1	86%
Dar es Salaam	3.5	570	6,200	10.9	208%
Kano	3.5	251	14,000	7.7	119%
Dakar	3.2	194	16,200	6.8	116%
Addis Abeba	3.1	337	9,200	6.1	95%
Ibadan	3.1	389	7,900	6.8	121%
Kumasi	2.9	337	8,600	6.9	139%
Maputo	2.6	414	6,300	5.4	107%
Douala	2.5	205	12,300	5.3	110%
Yaounde	2.5	231	10,800	5.3	114%
Total	70.1	7,940	8,800	147.8	111%

*Sources: Demographia World Urban Areas & UN Urban Growth Rates*



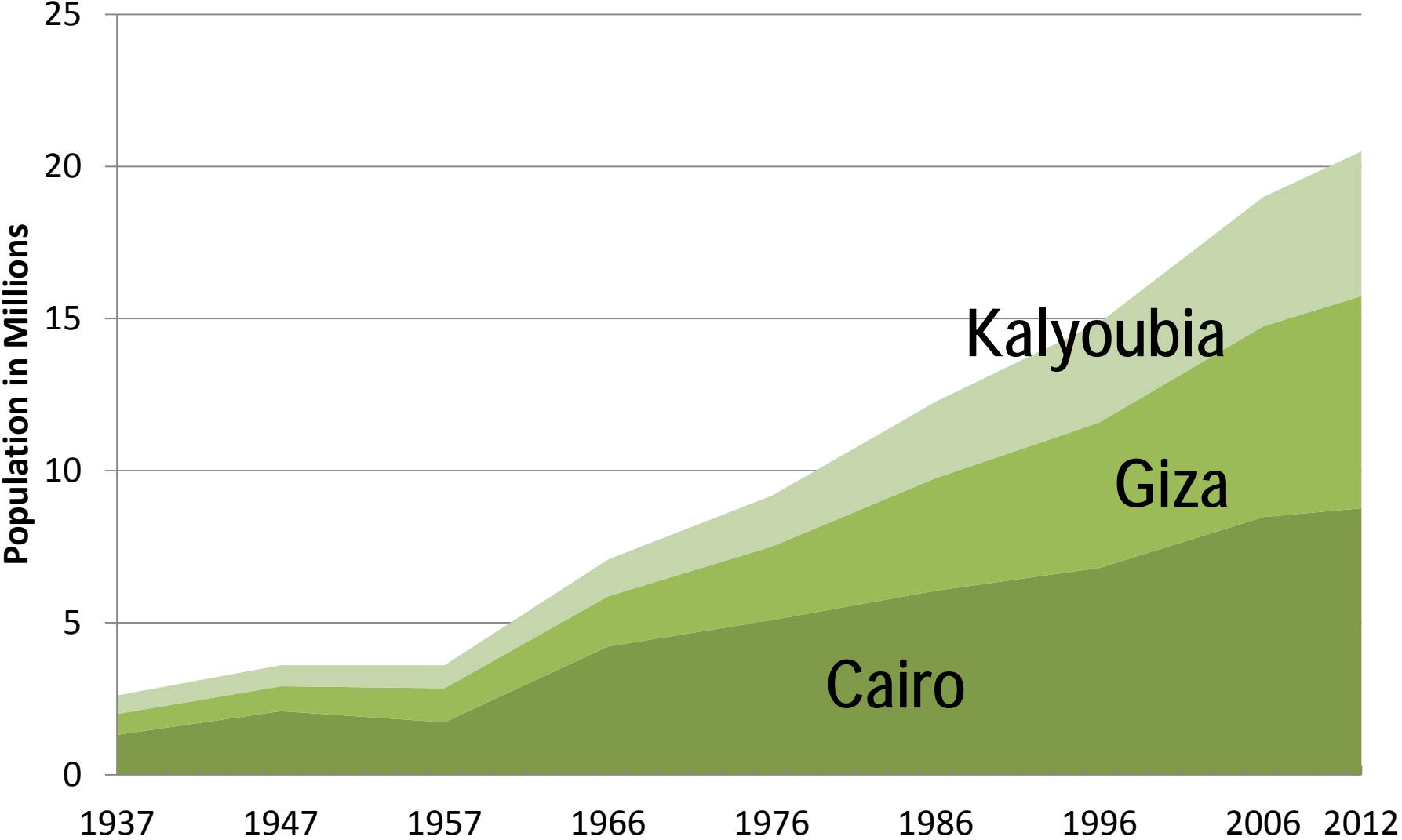
# Cairo Urban Area: Evolution

1972-2010



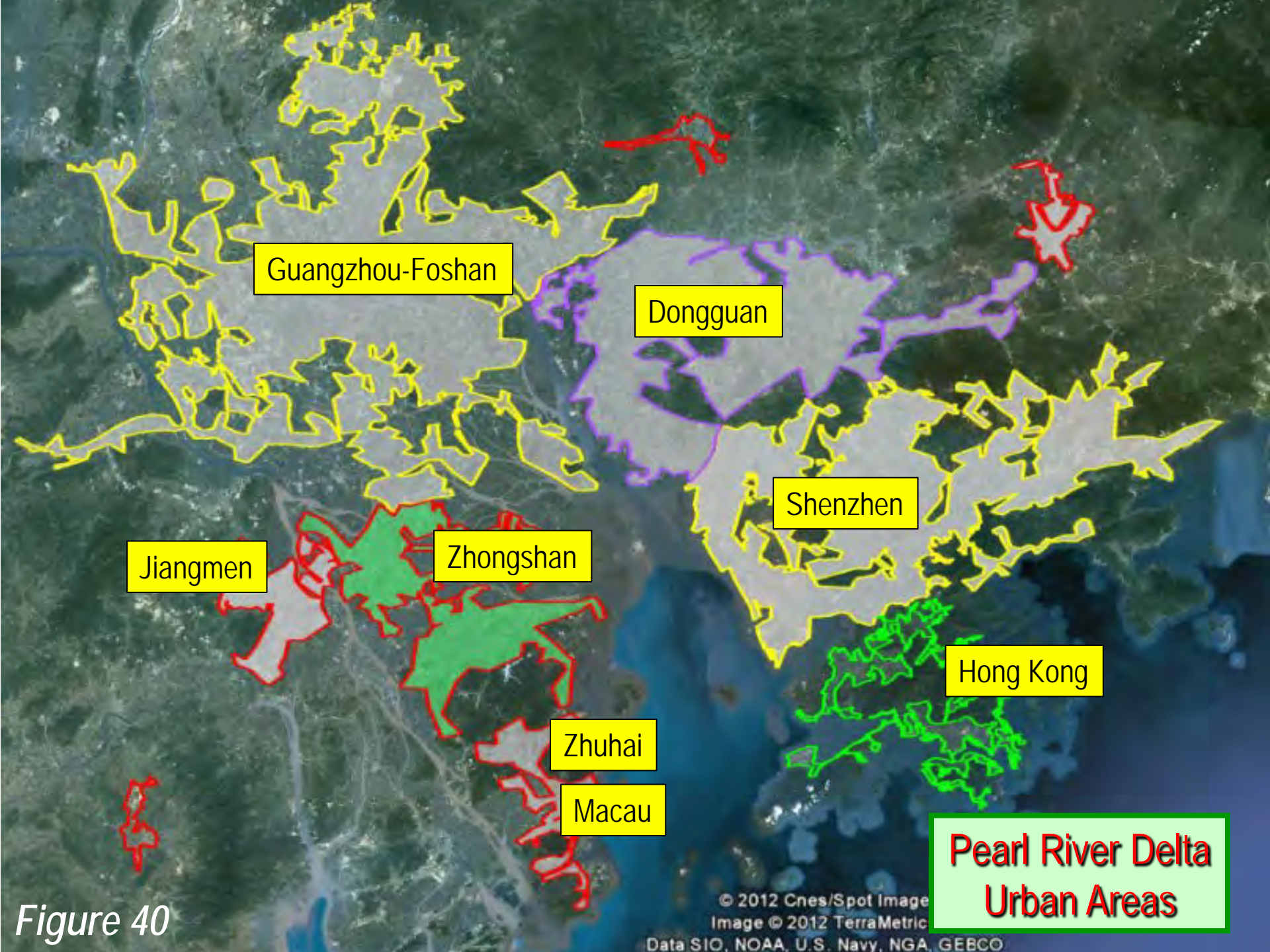
# Cairo Population by Governate: 1937-2012

## CAIRO METROPOLITAN AREA



*Figure 39*





Guangzhou-Foshan

Dongguan

Shenzhen

Jiangmen

Zhongshan

Hong Kong

Zhuhai

Macau

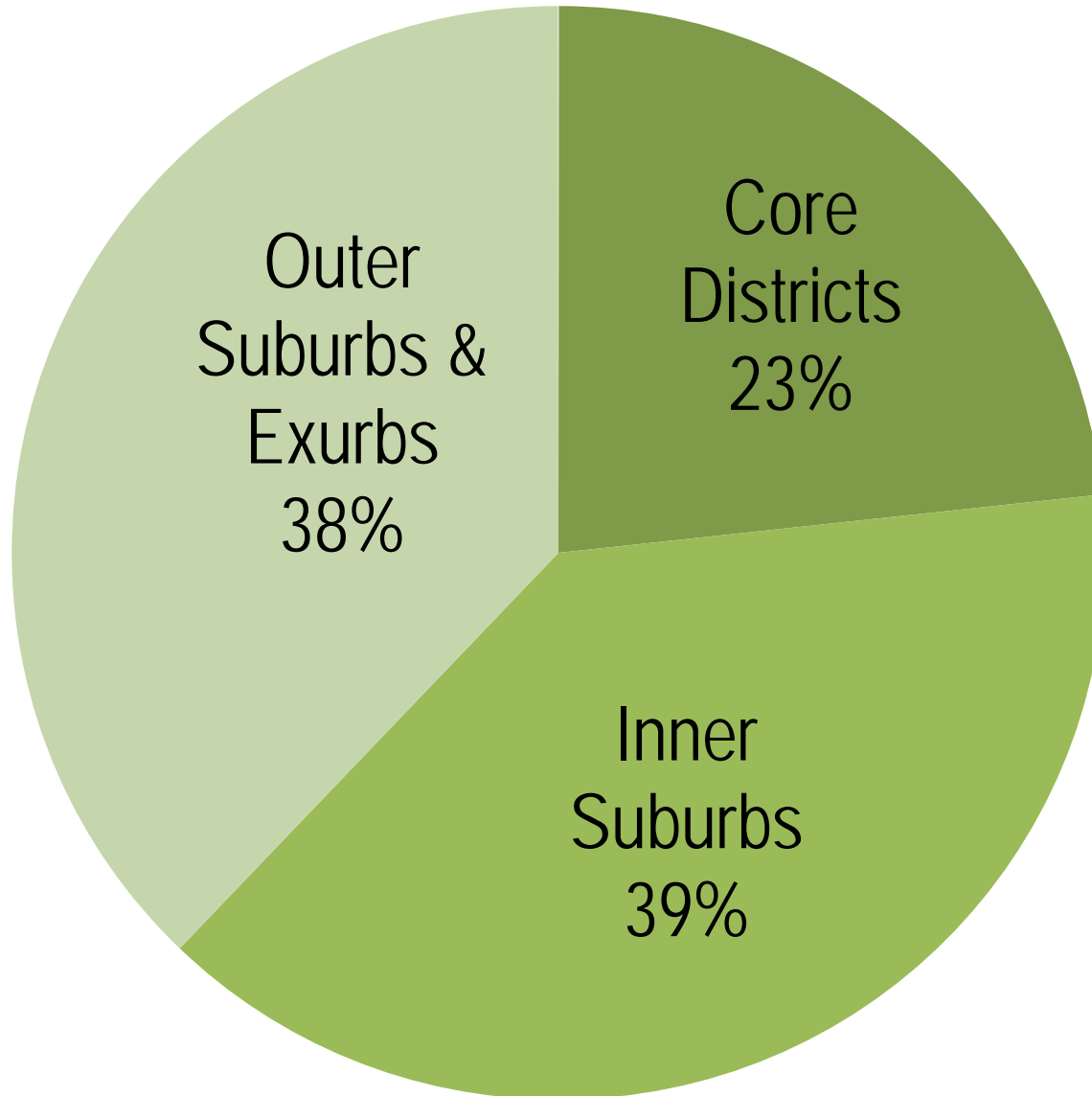
Pearl River Delta  
Urban Areas

Figure 40

© 2012 Cnes/Spot Image  
Image © 2012 TerraMetric  
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

# Guangzhou-Foshan Population

## 2000-2010: SHARE OF METROPOLITAN GROWTH

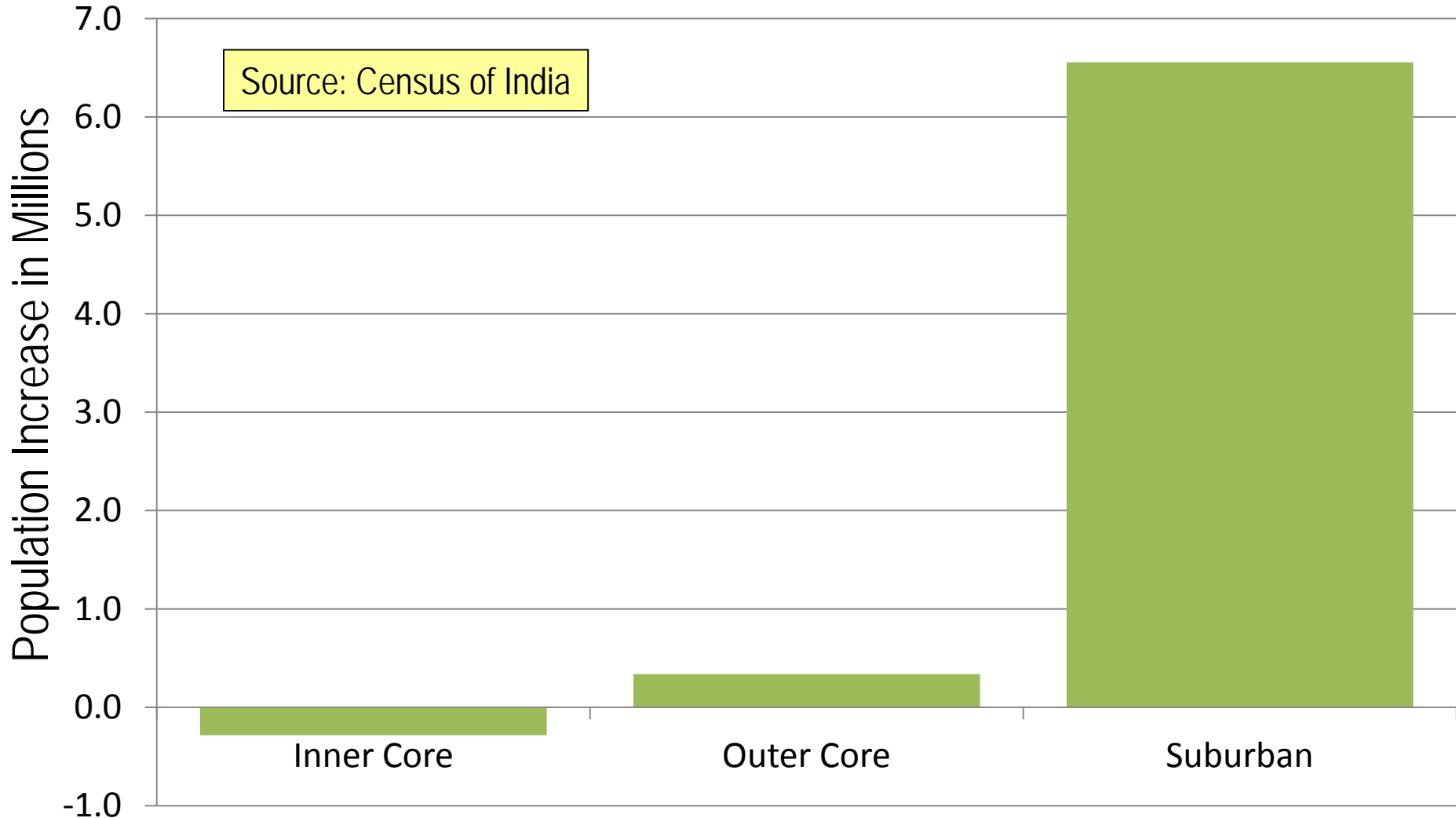


*Figure 41*



# Shanghai Population by Sector

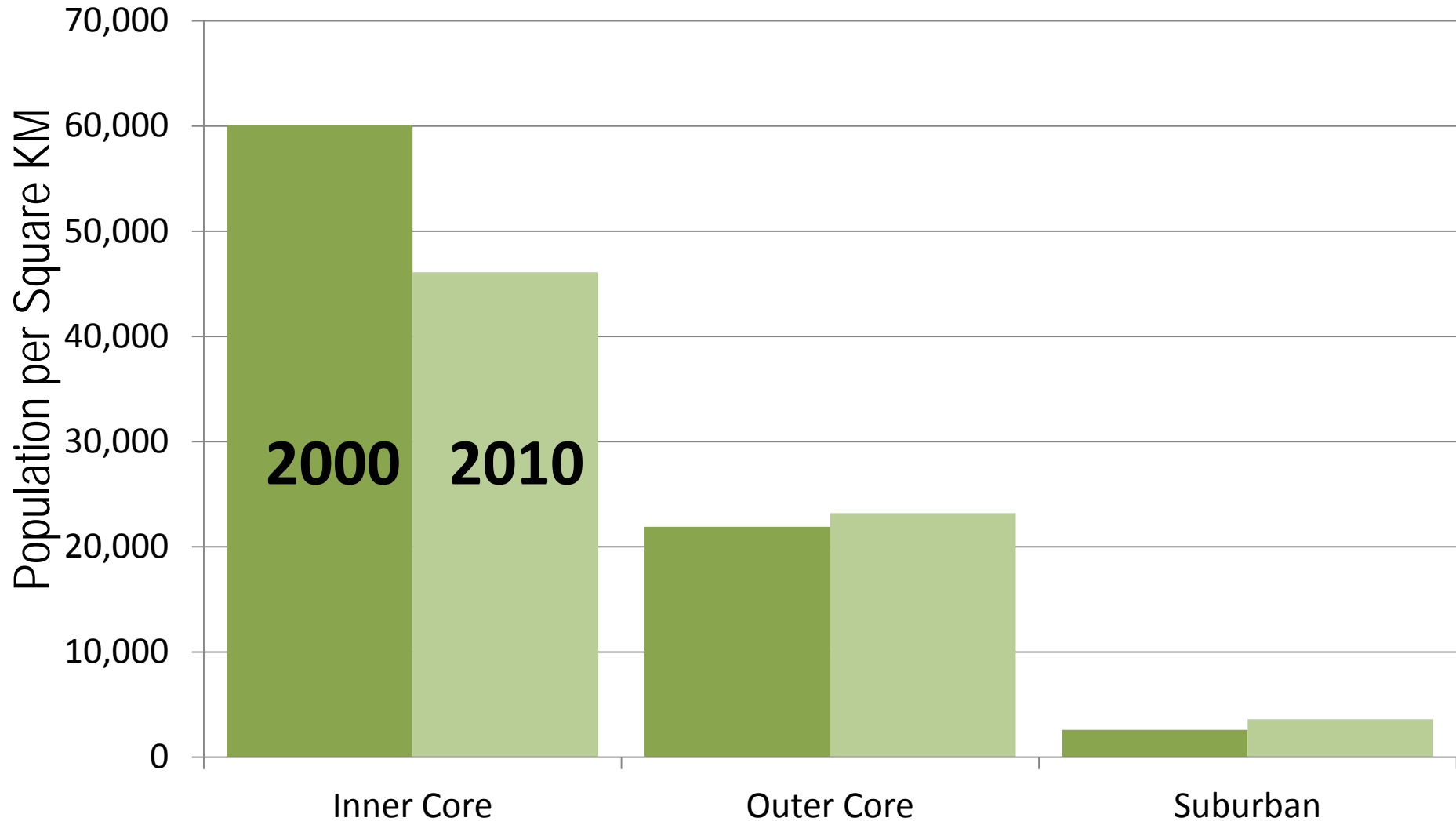
CHANGE: 2000-2010



*Figure 42*

# Shanghai Population Density by Sector

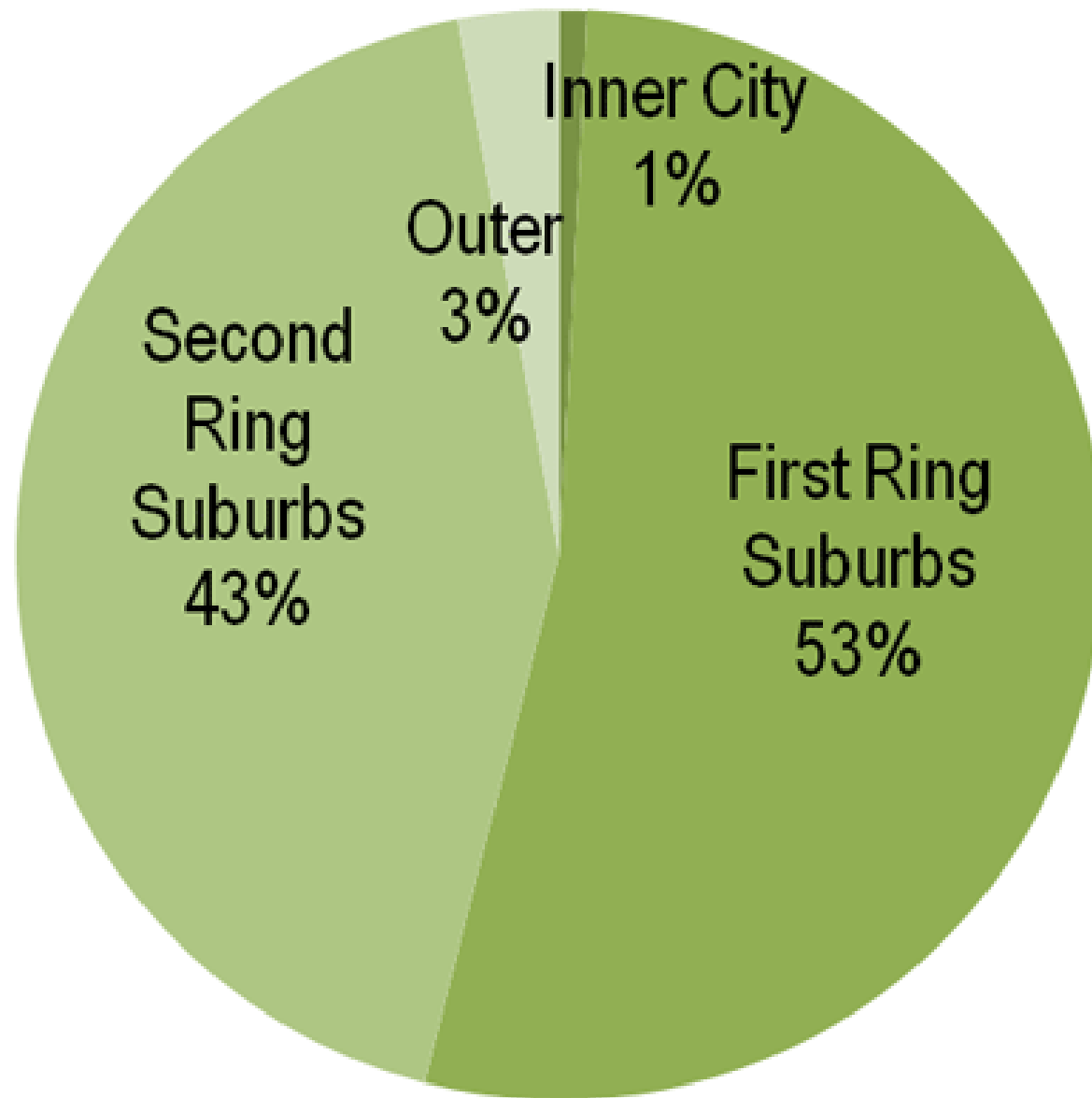
CHANGE: 2000-2010



*Figure 43*

# Beijing: Population Growth by Sector

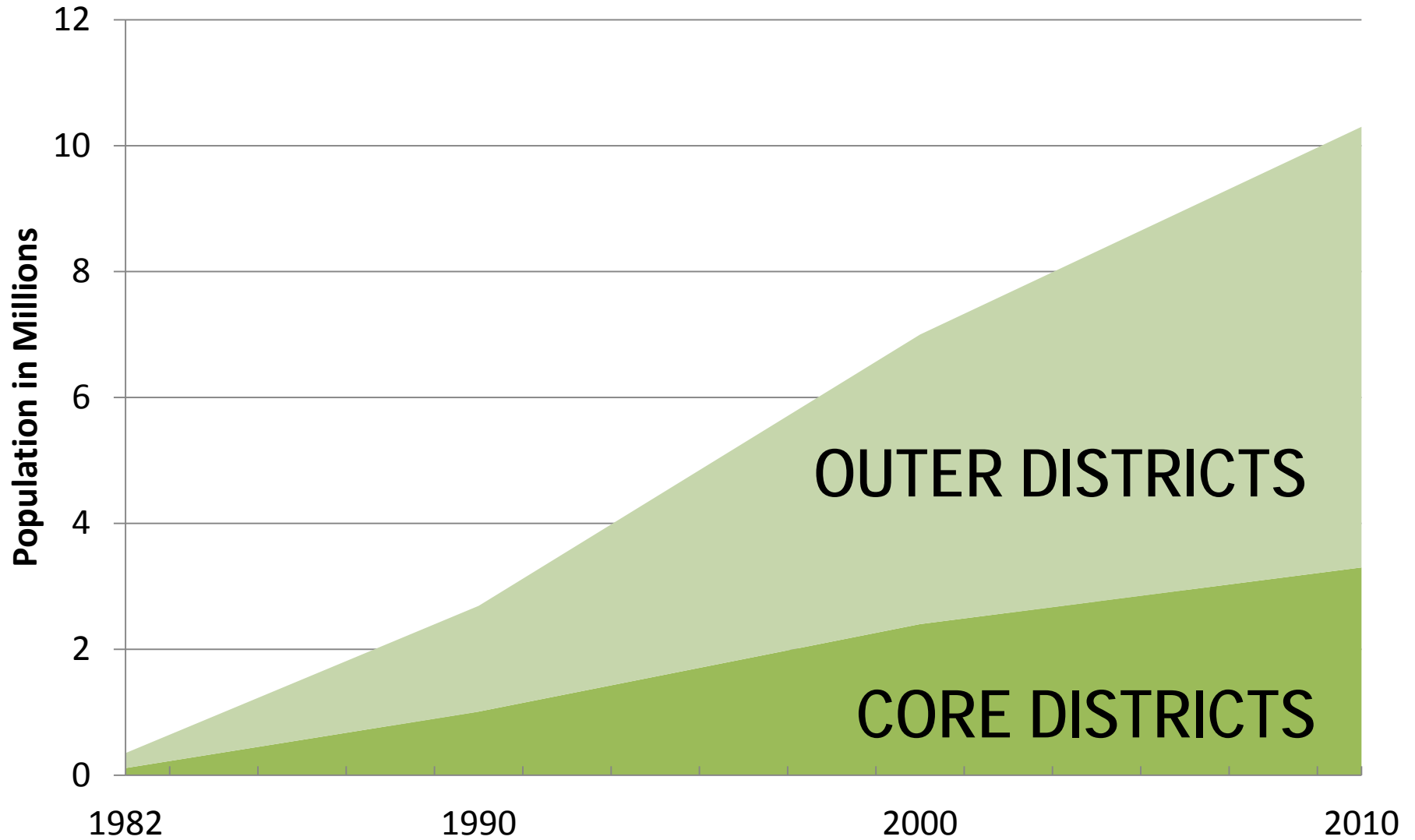
2000-2010



*Figure 1*

# Shenzhen Inner & Outer Area Population

## 1982 - 2010

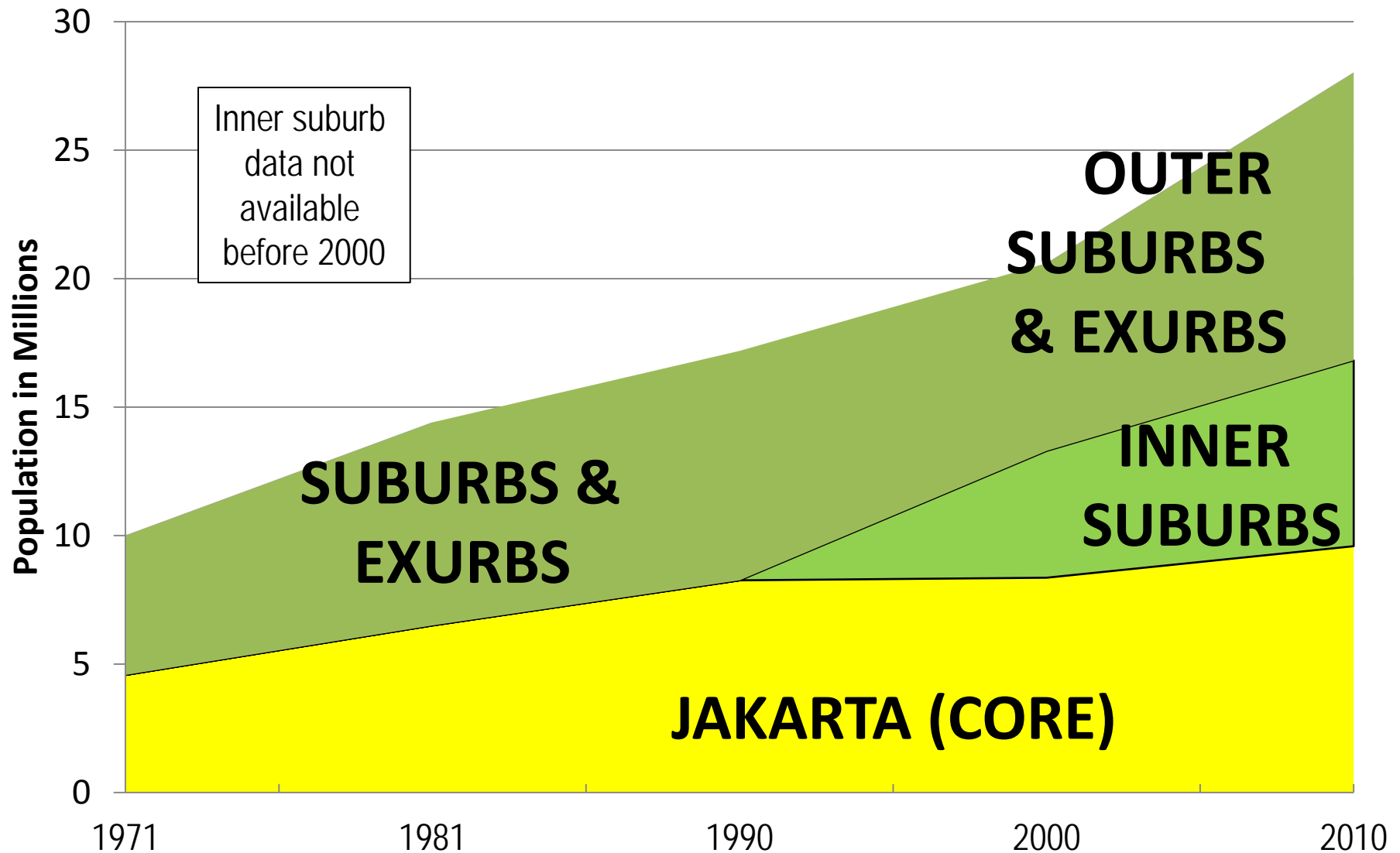


*Figure 45*



# Jakarta: Population: 1971-2010

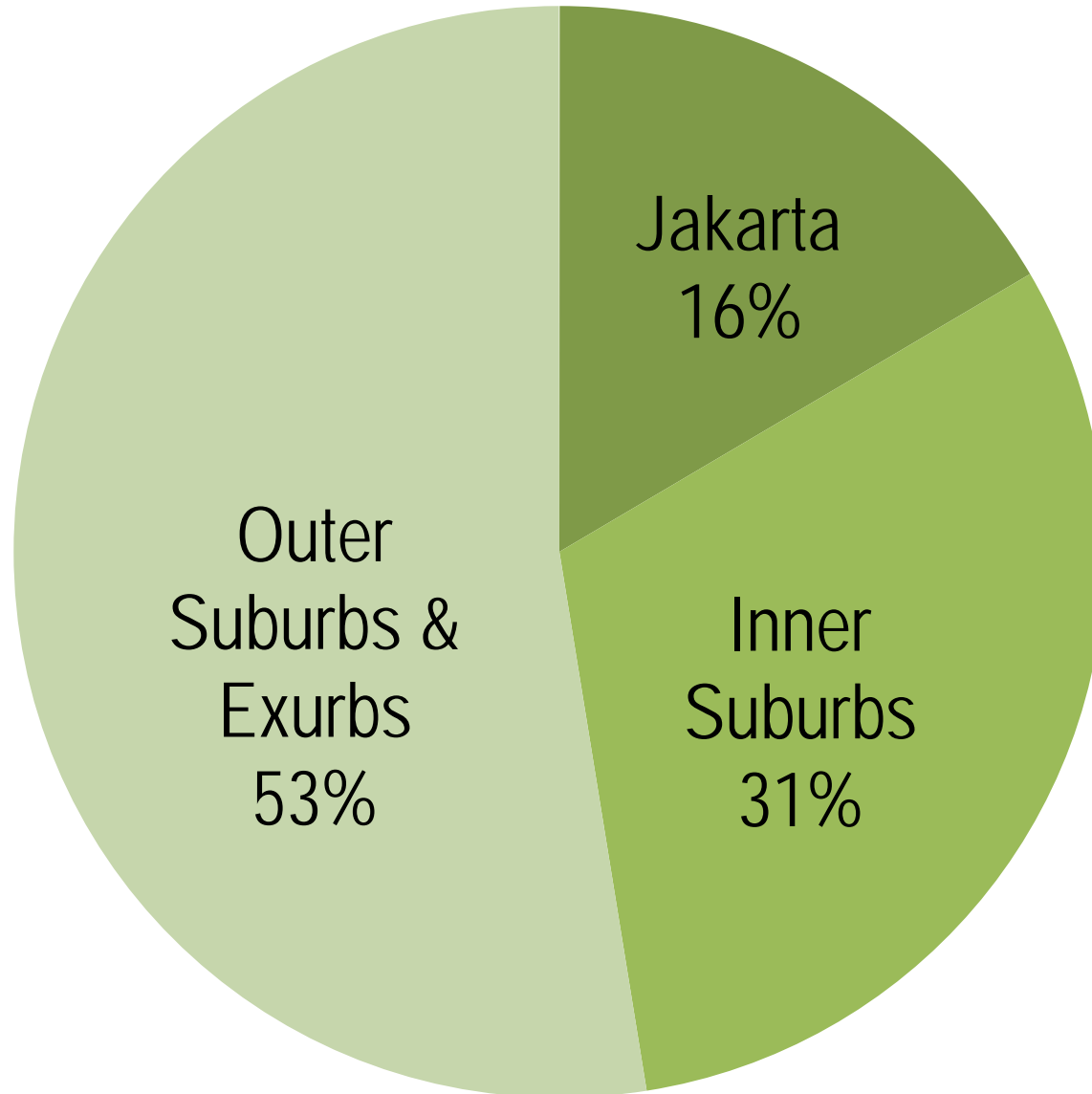
## CORE & SUBURBAN POPULATION



*Figure 46*

# Jakarta: Growth by Sector

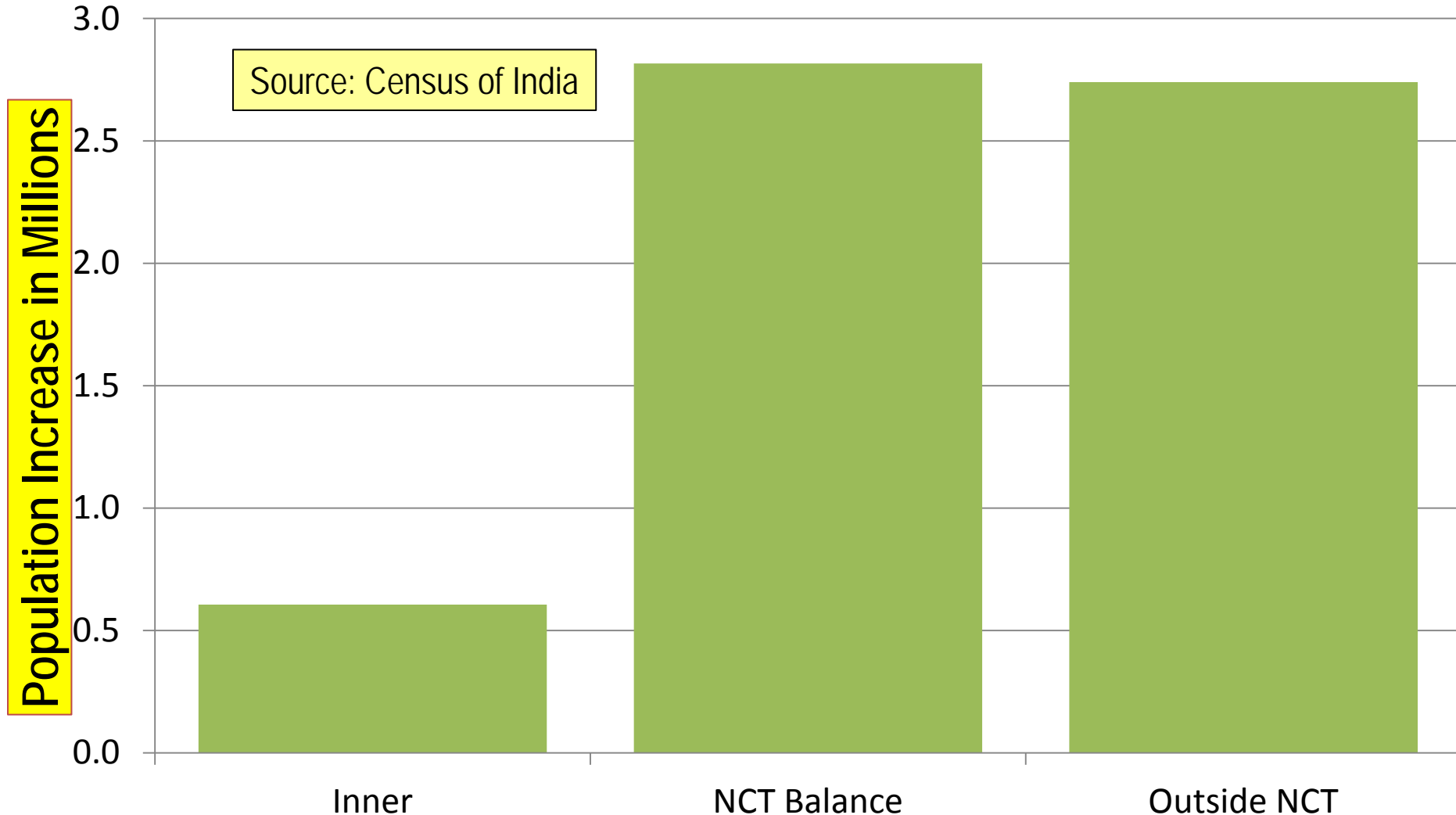
2000-2010



*Figure 47*

# Delhi Urban Area Population by Sector

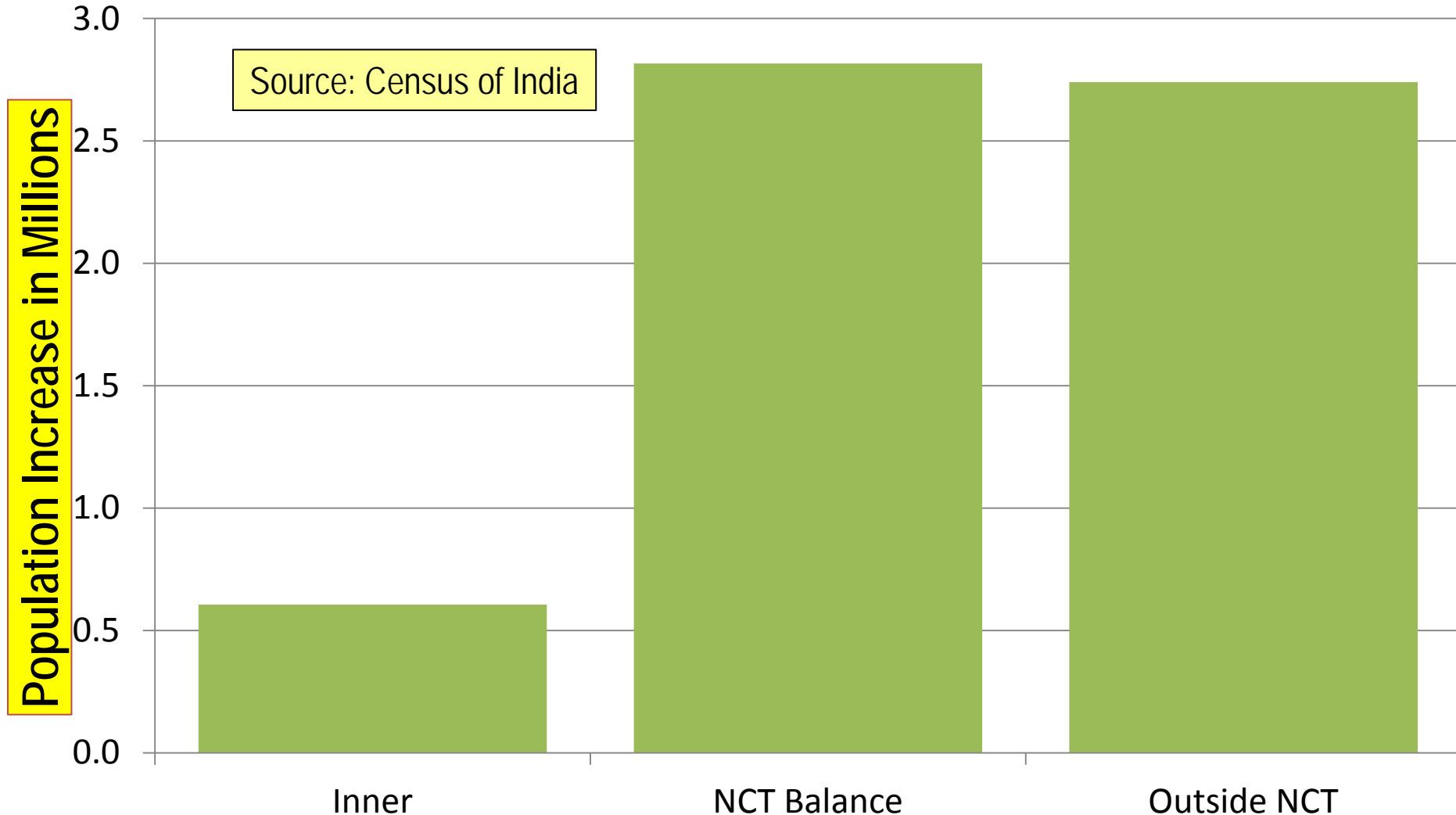
CHANGE: 2001-2011



*Figure 48*

# Delhi Urban Area Population by Sector

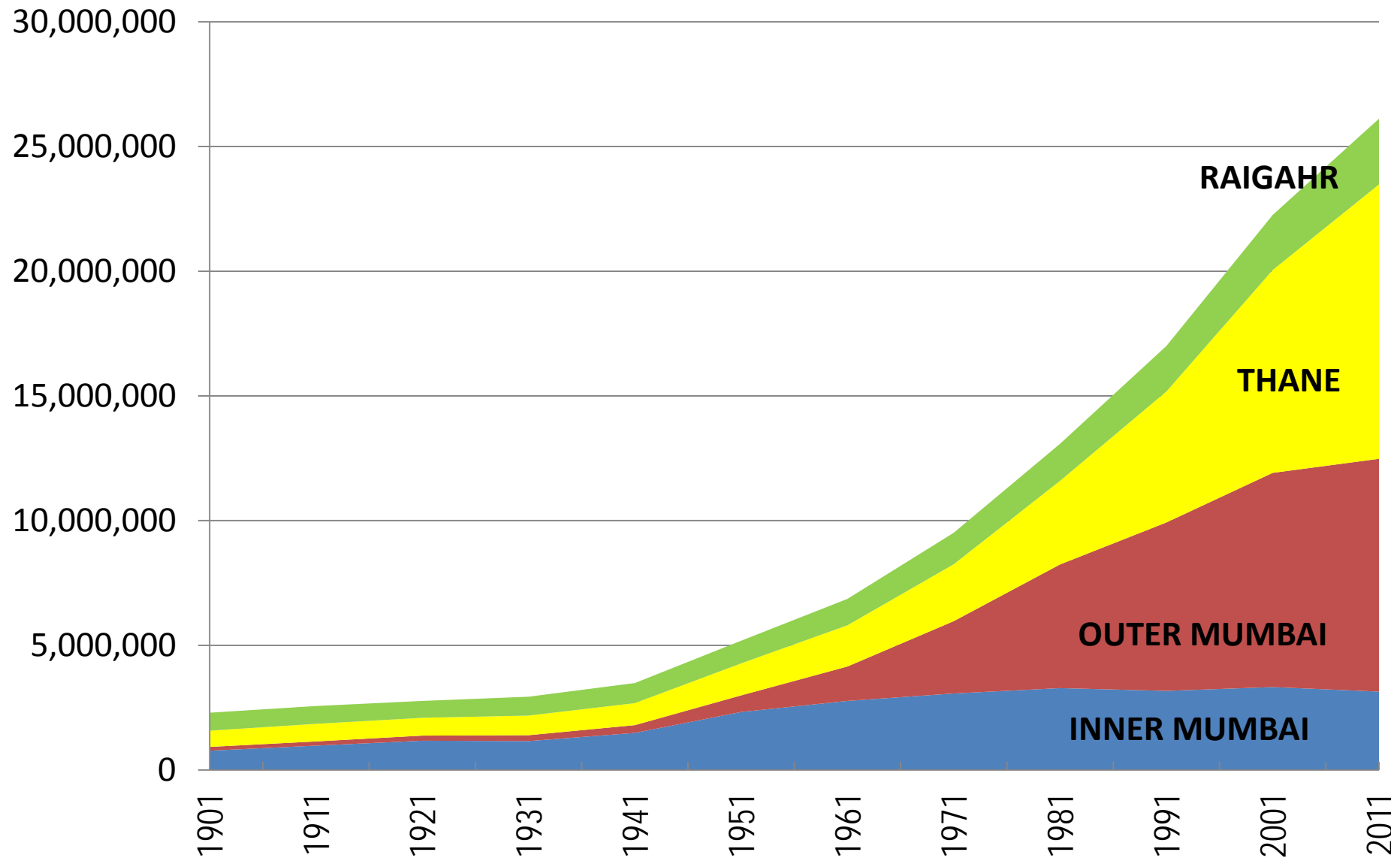
CHANGE: 2001-2011



*Figure 49*

# Population by District: 1901-2011

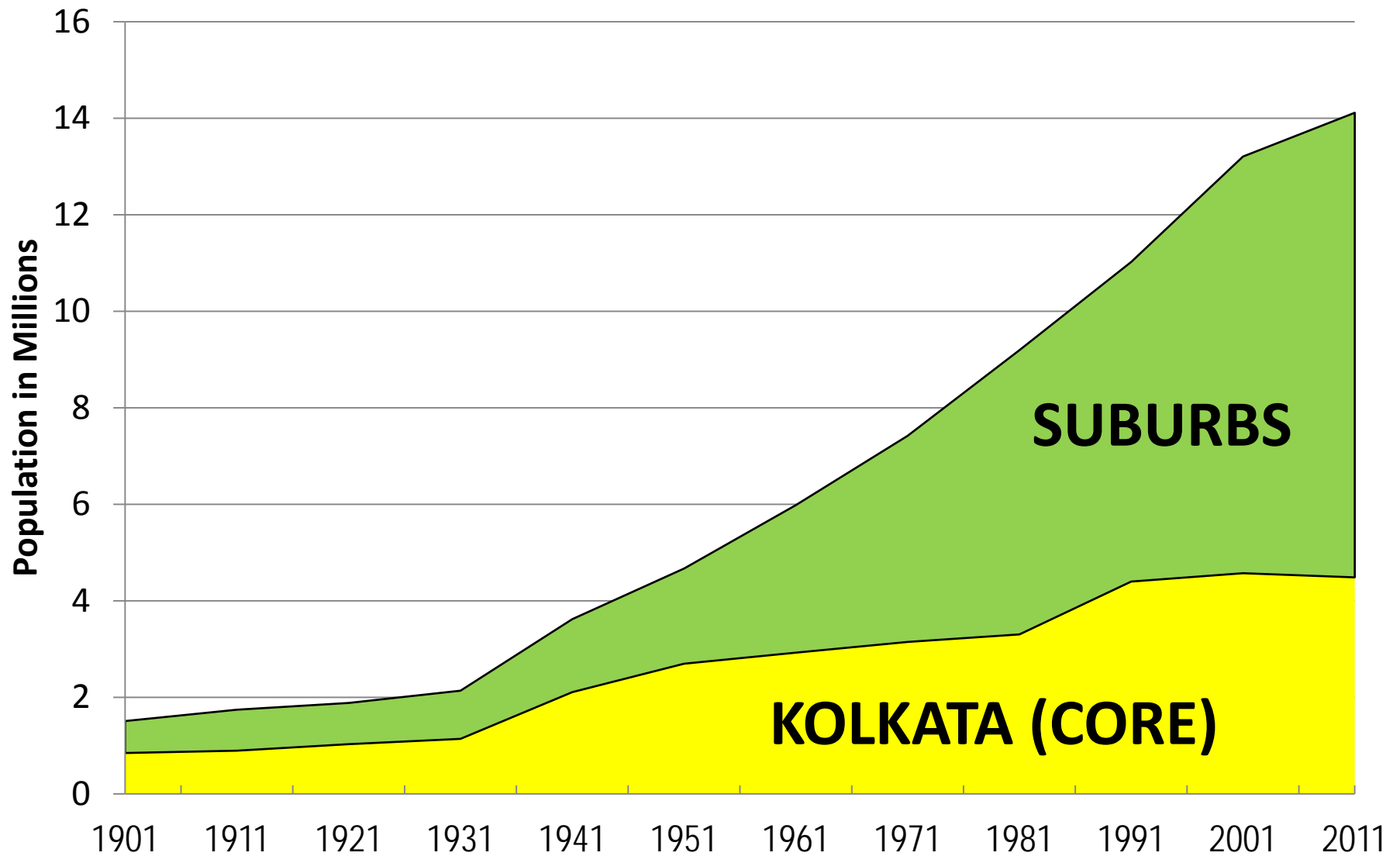
## MUMBAI METROPOLITAN REGION





# Kolkata Urban Area: 1901-2011

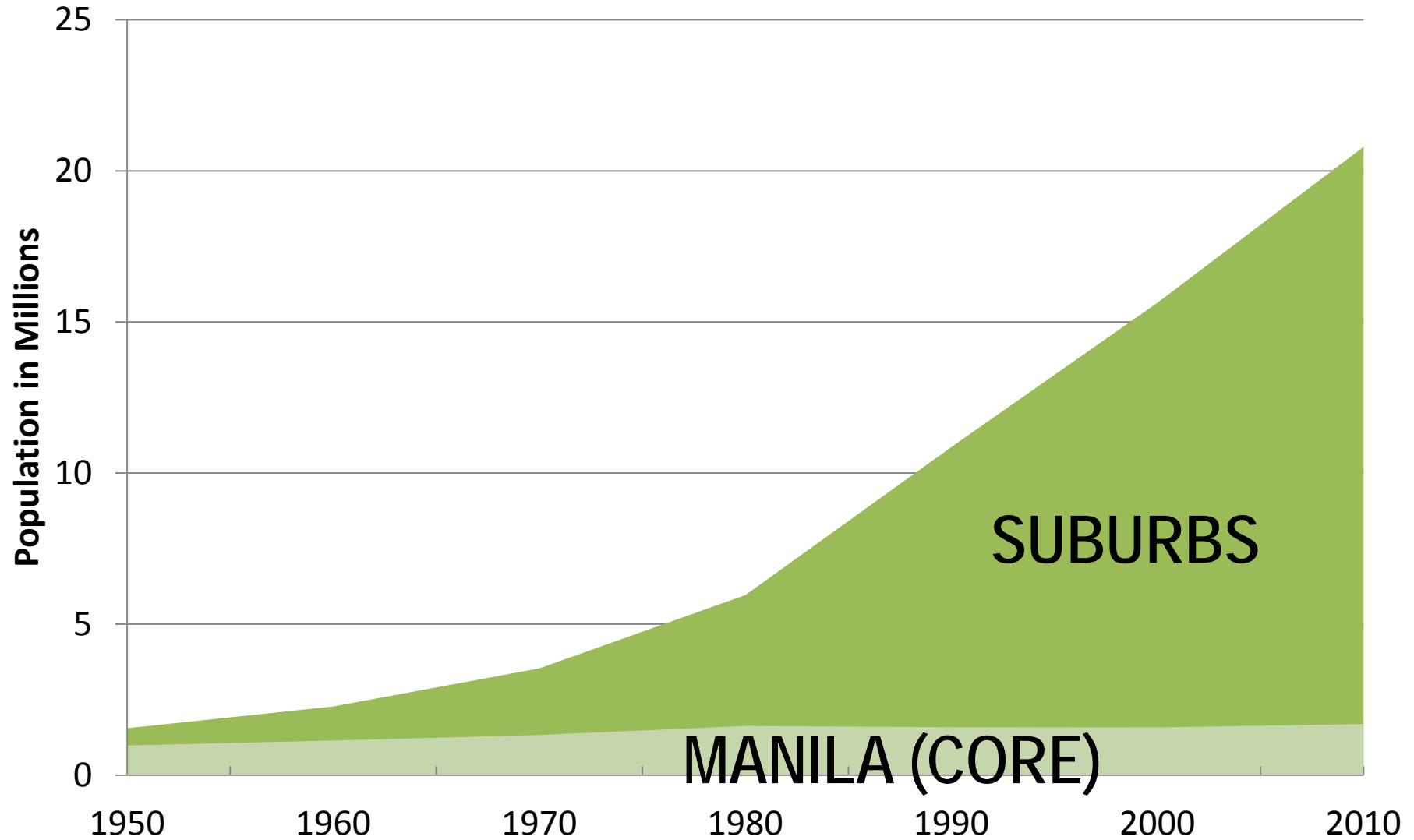
## CORE & SUBURBAN POPULATION



*Figure 51*

# Core & Suburban Population: 1950-2010

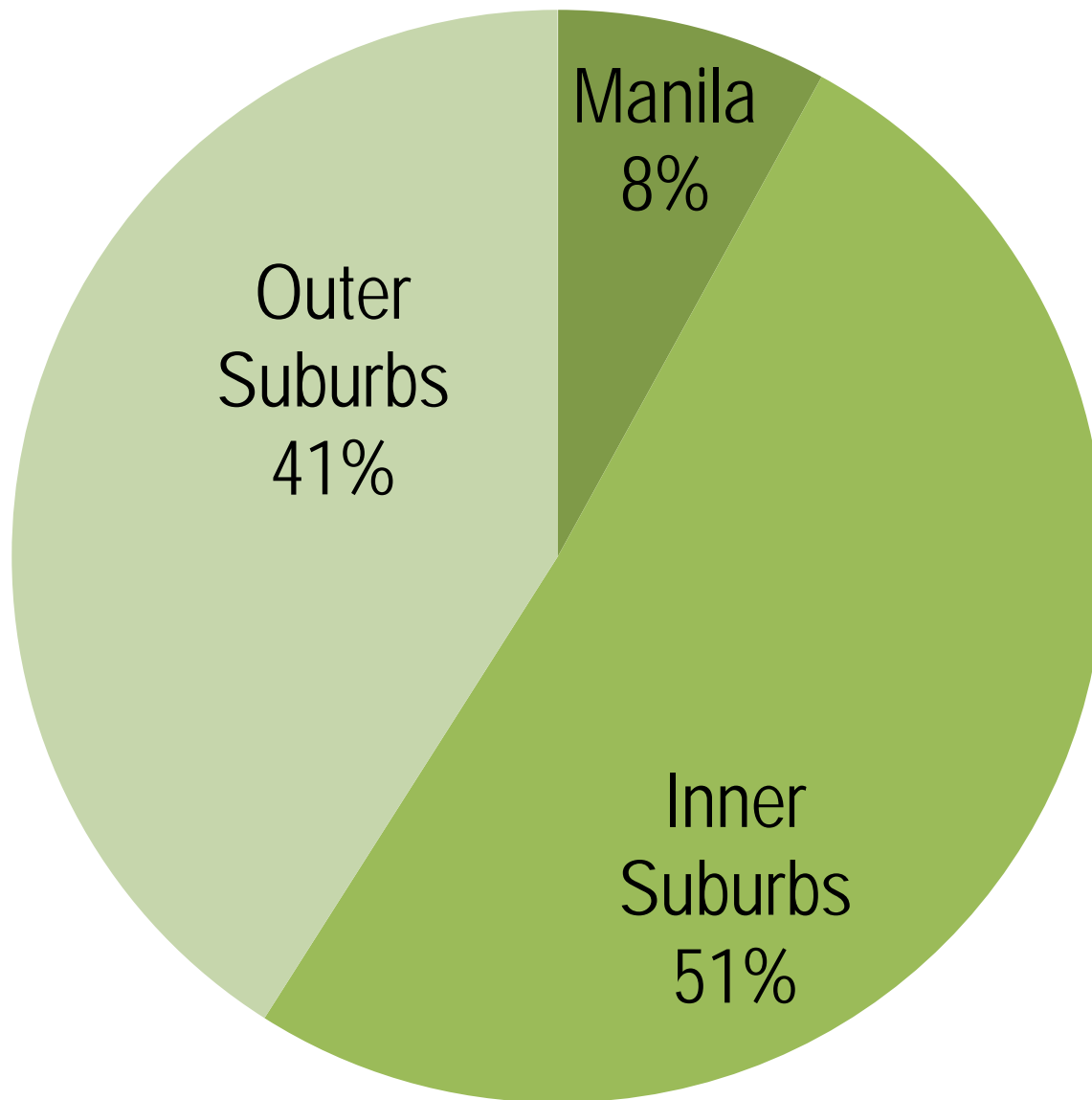
## MANILA URBAN AREA



*Figure 52*

# Manila Urban Area Population by Sector

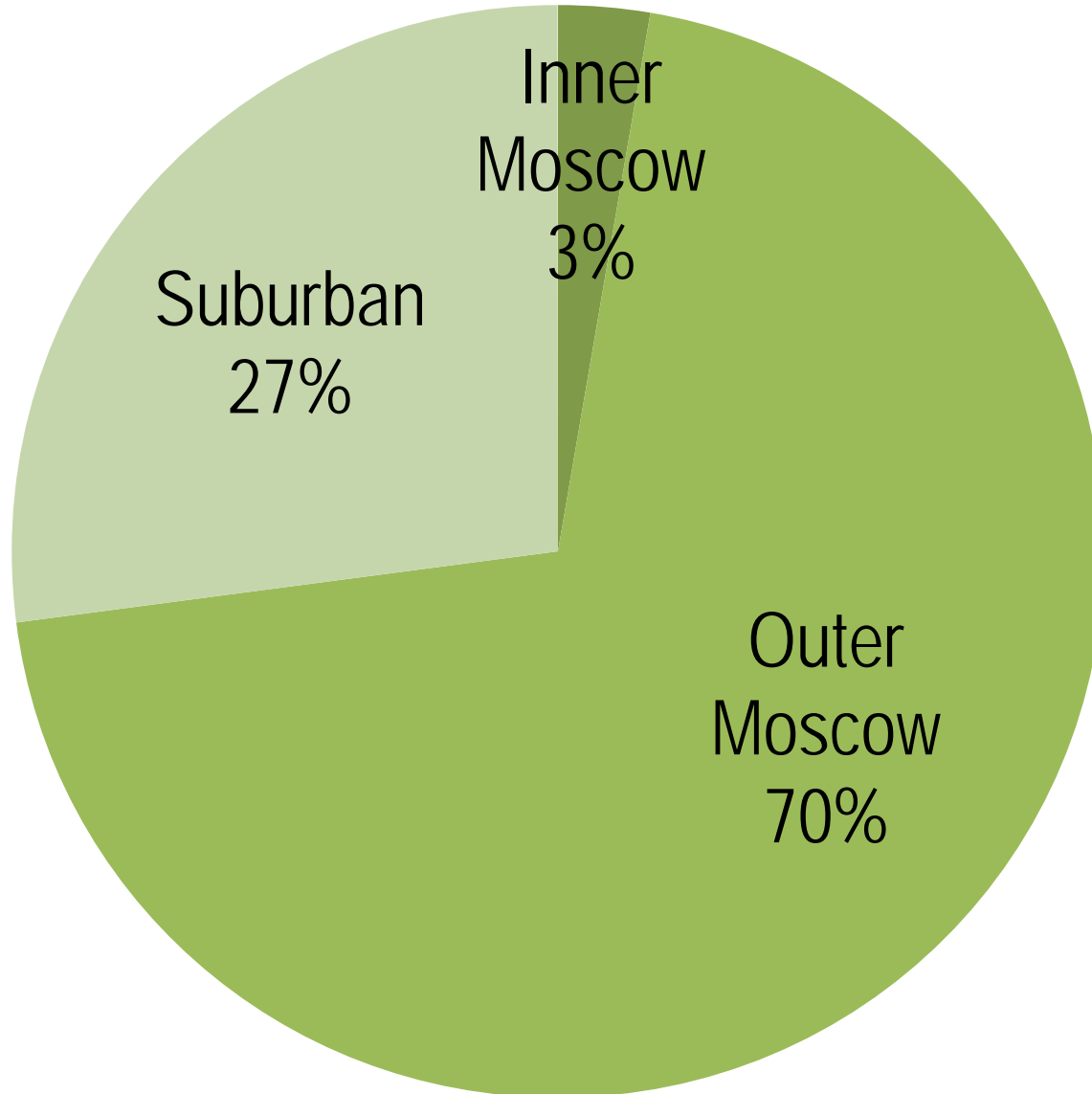
ESTIMATED : 2010



*Figure 53*

# Moscow Area Population Growth by Sector

2002-2010

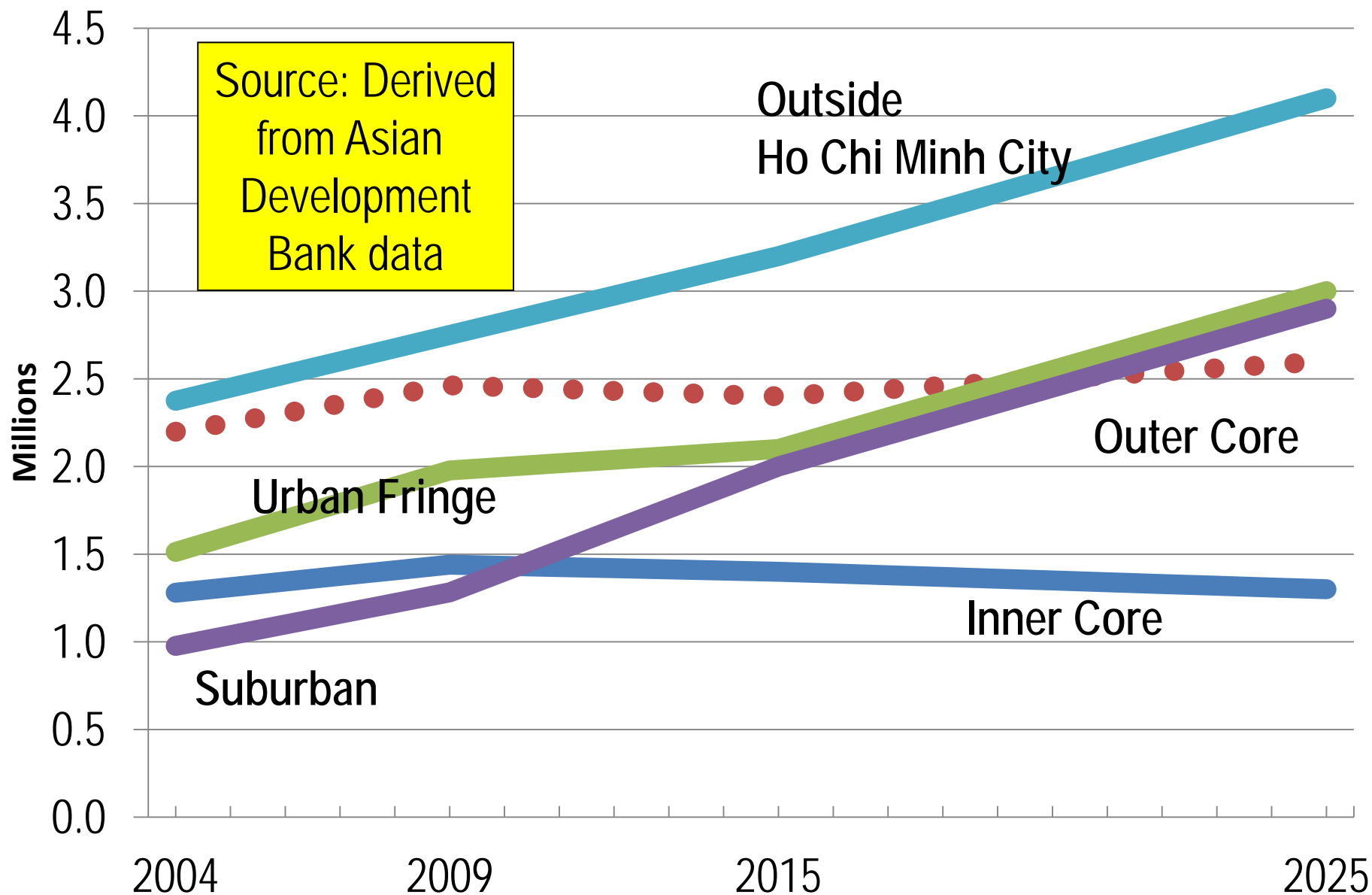


*Figure 54*



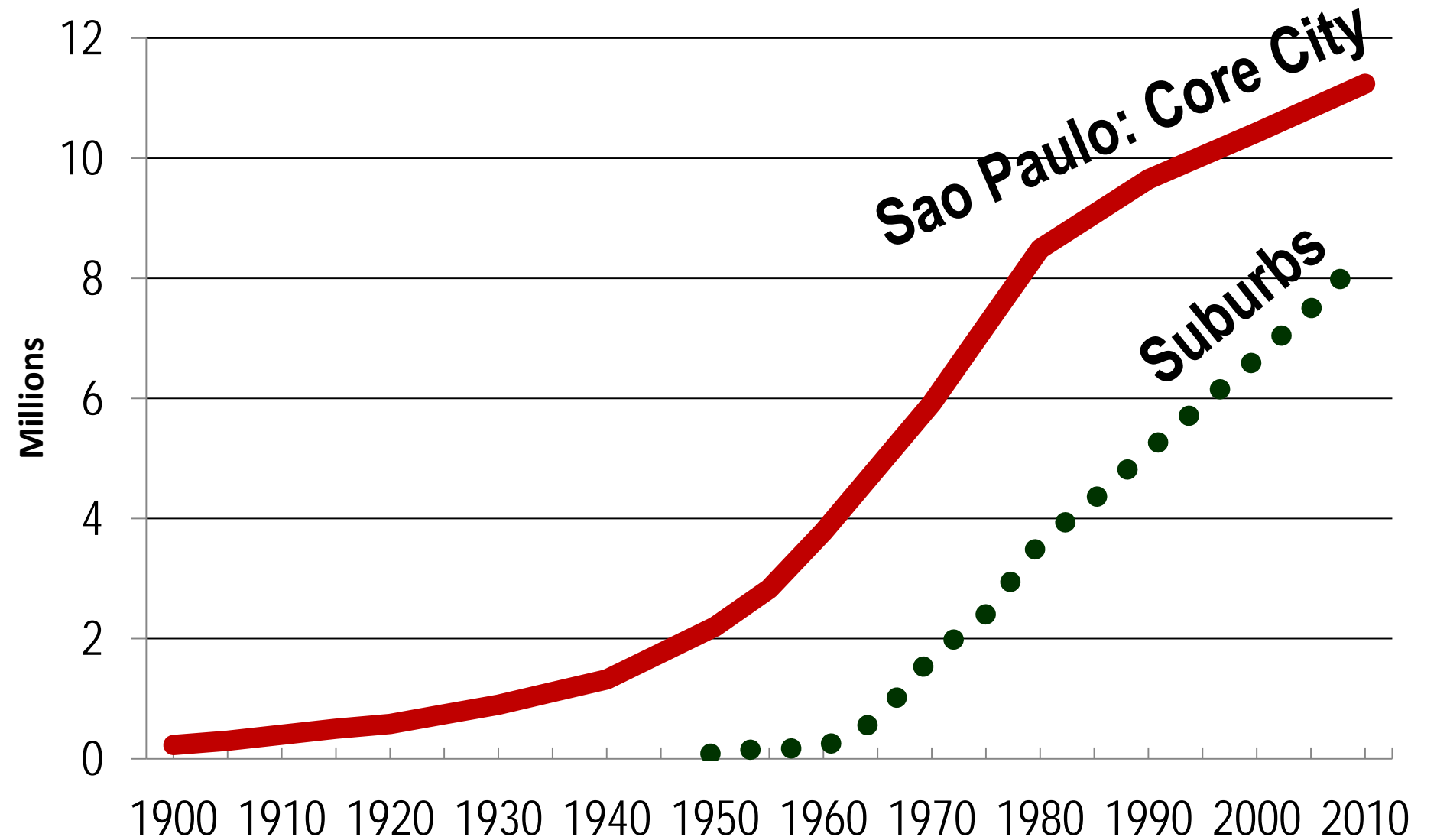
# Ho Chi Minh City Population by Sector

## PAST AND PROJECTED



# Sao Paulo Urban Area Population

1900-2010: CORE CITY AND SUBURBS

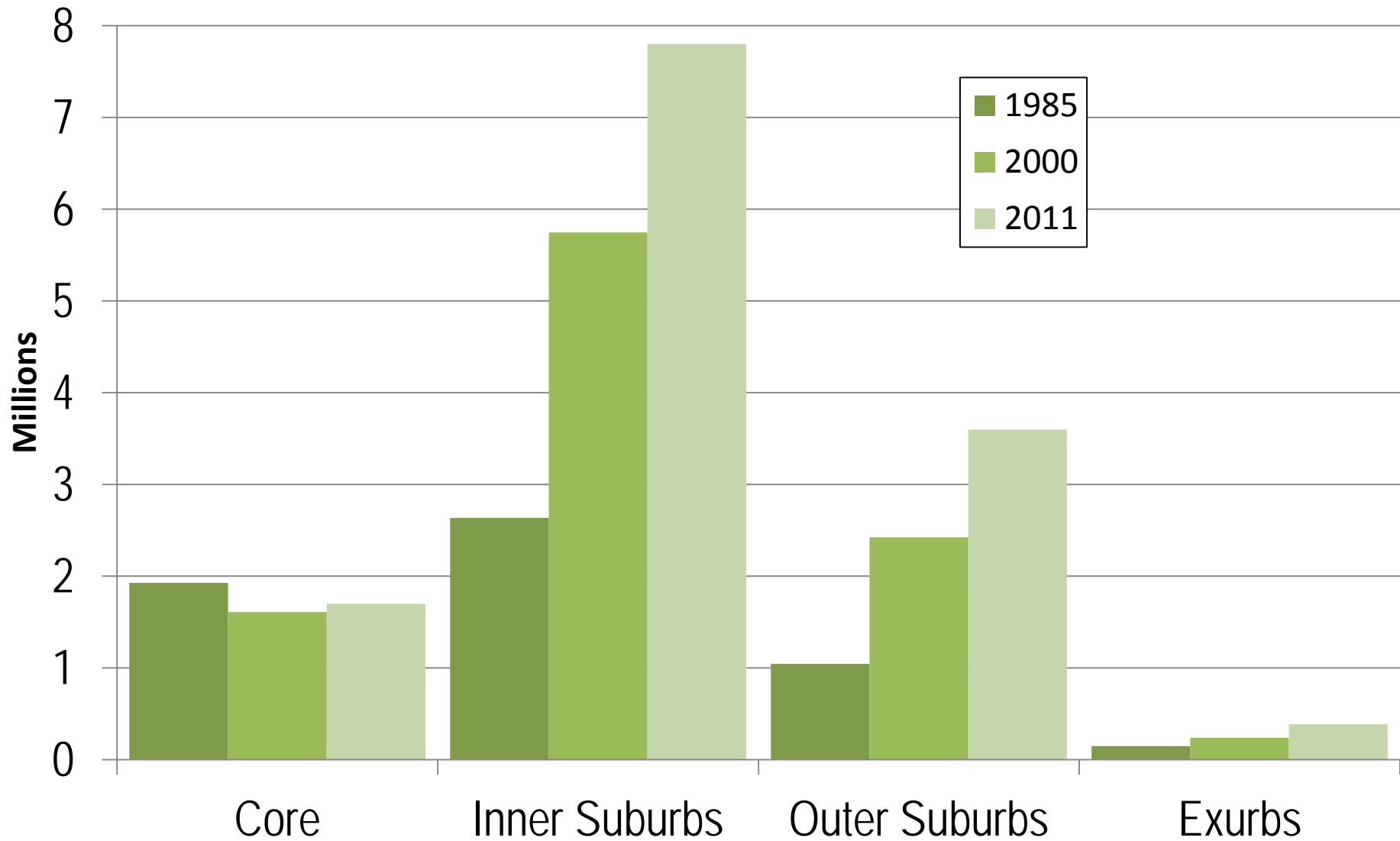


*Figure 56*



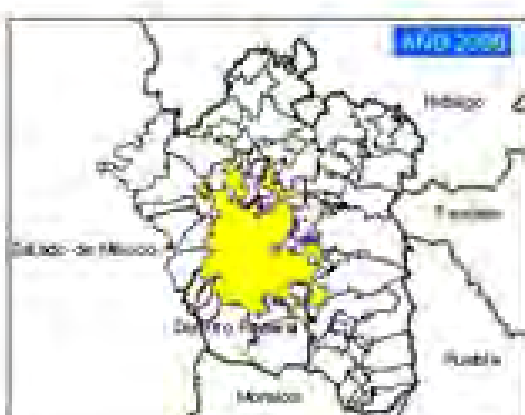
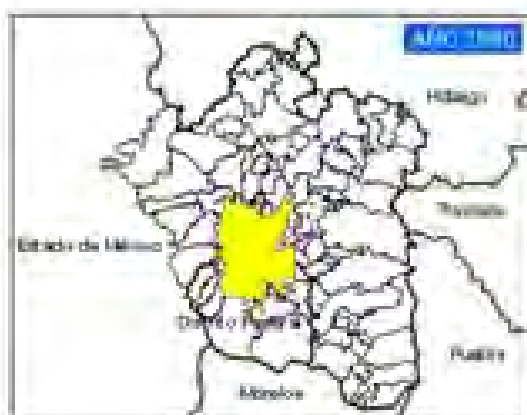
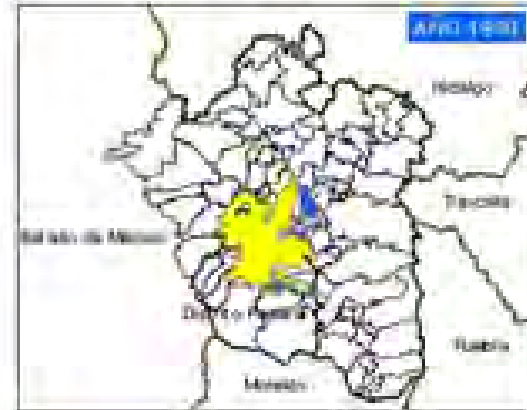
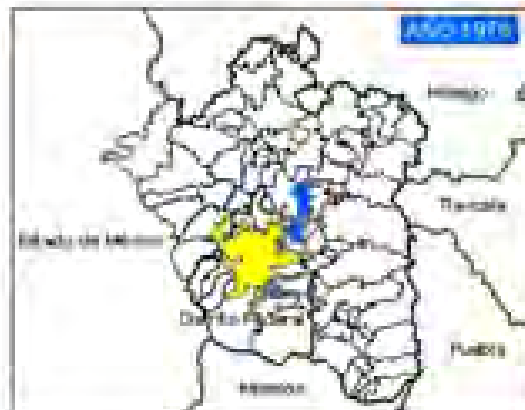
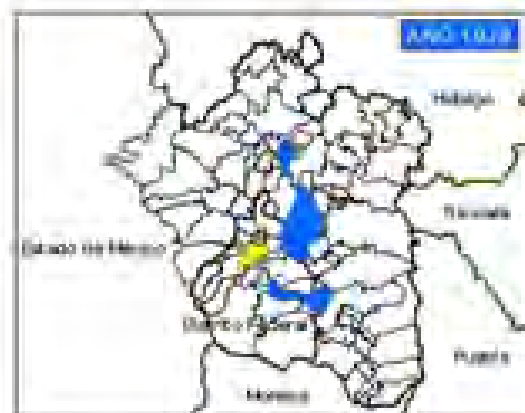
# Istanbul: Population by Sector

## 1985, 2000 & 2012



*Figure 58*





-  **Area Urbanizada**
-  **Vasos Lacustres**
-  **Estados**





## Quanzhou (Fujian) Population Trend by Sector

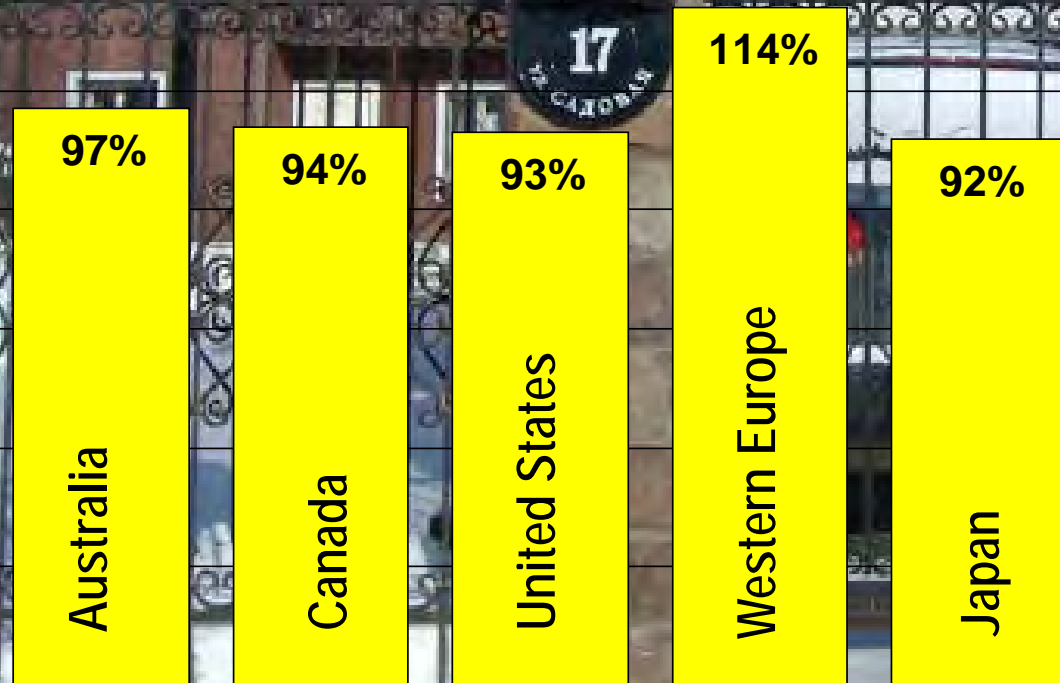
Sector	2000	2010	Change	% Change
<i>Jurisdictions with Substantial Urbanization</i>				
Historic Core: Licheng & Fengze	690,000	898,000	208,000	30%
Near Urban (Jin Jiang & Shi Shi)	1,978,000	2,660,000	682,000	34%
Outer Urban & Exurban	2,785,000	2,864,000	79,000	3%
Balance of Prefecture (Principally Rural)	1,830,000	1,719,000	(111,000)	-6%
Total	7,283,000	8,141,000	858,000	12%

Note: Urban extent estimated at over 4.5 million in 2010

In Situ  
Urbanisation

# High Income World: 1960s-2000s

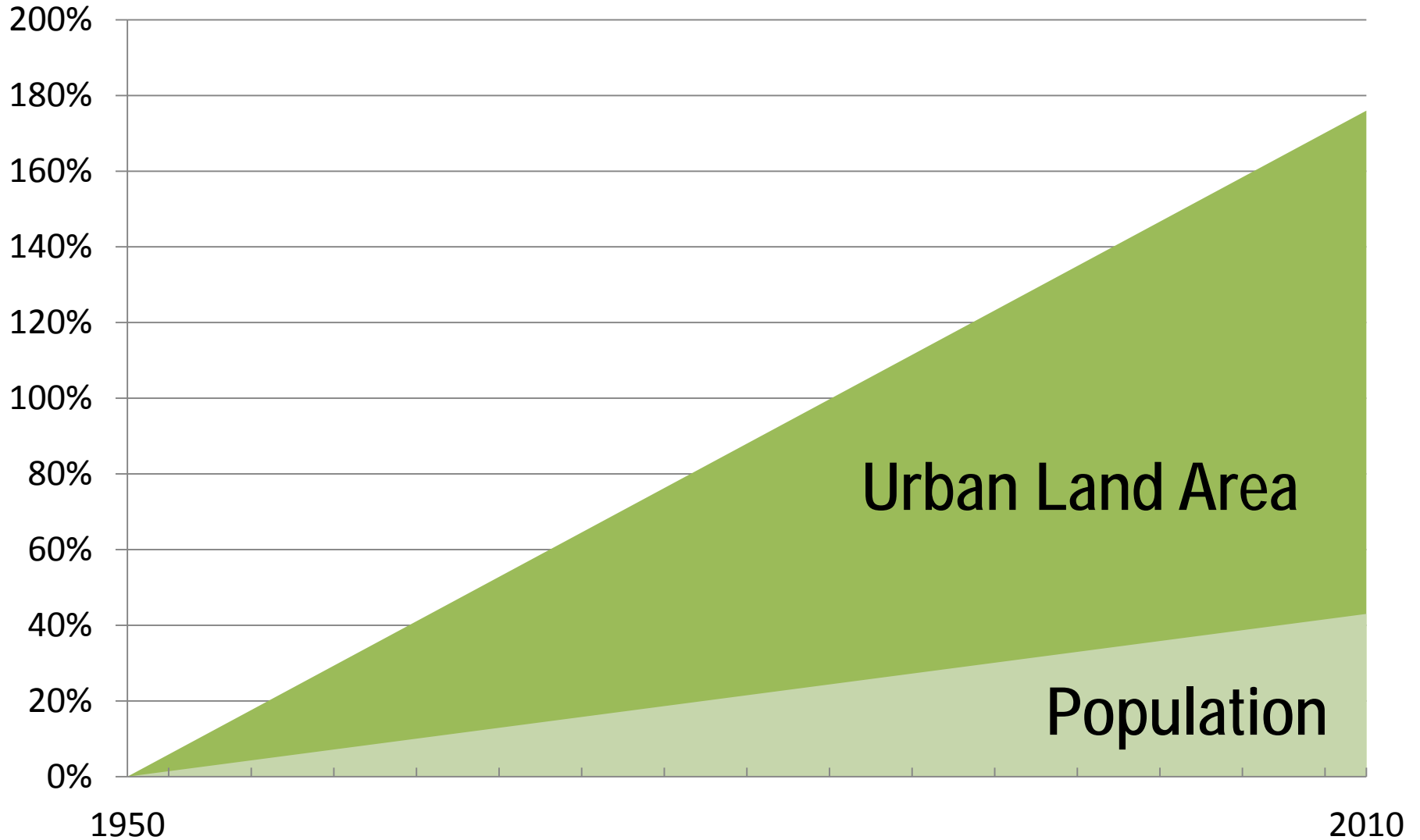
NEARLY ALL URBAN GROWTH IN SUBURBS: 35+YEARS



*Moscow*

# New York Urban Area Expansion

## POPULATION & URBAN LAND AREA 1950 - 2010

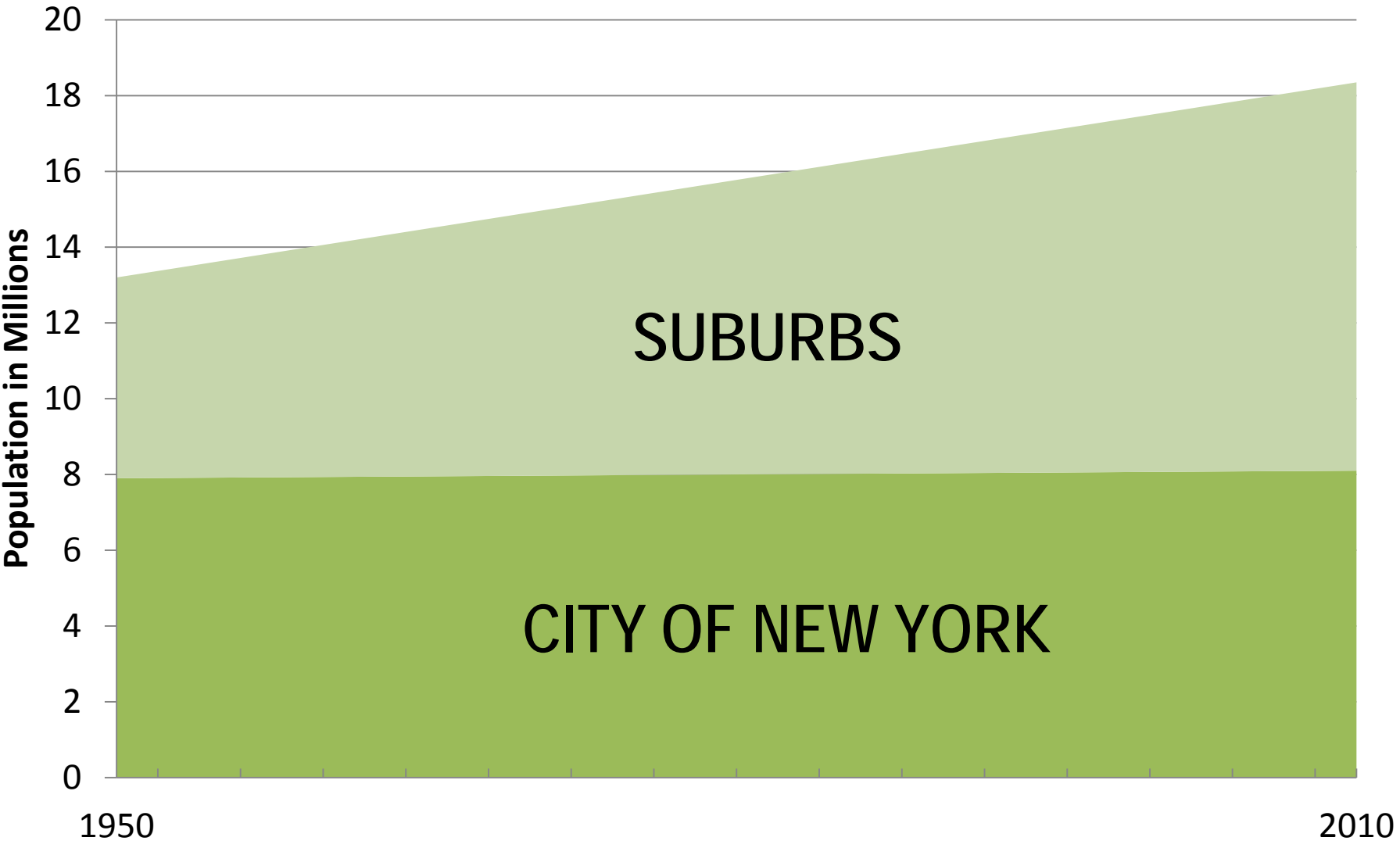


*Figure 62*



# New York Urban Area Population Growth

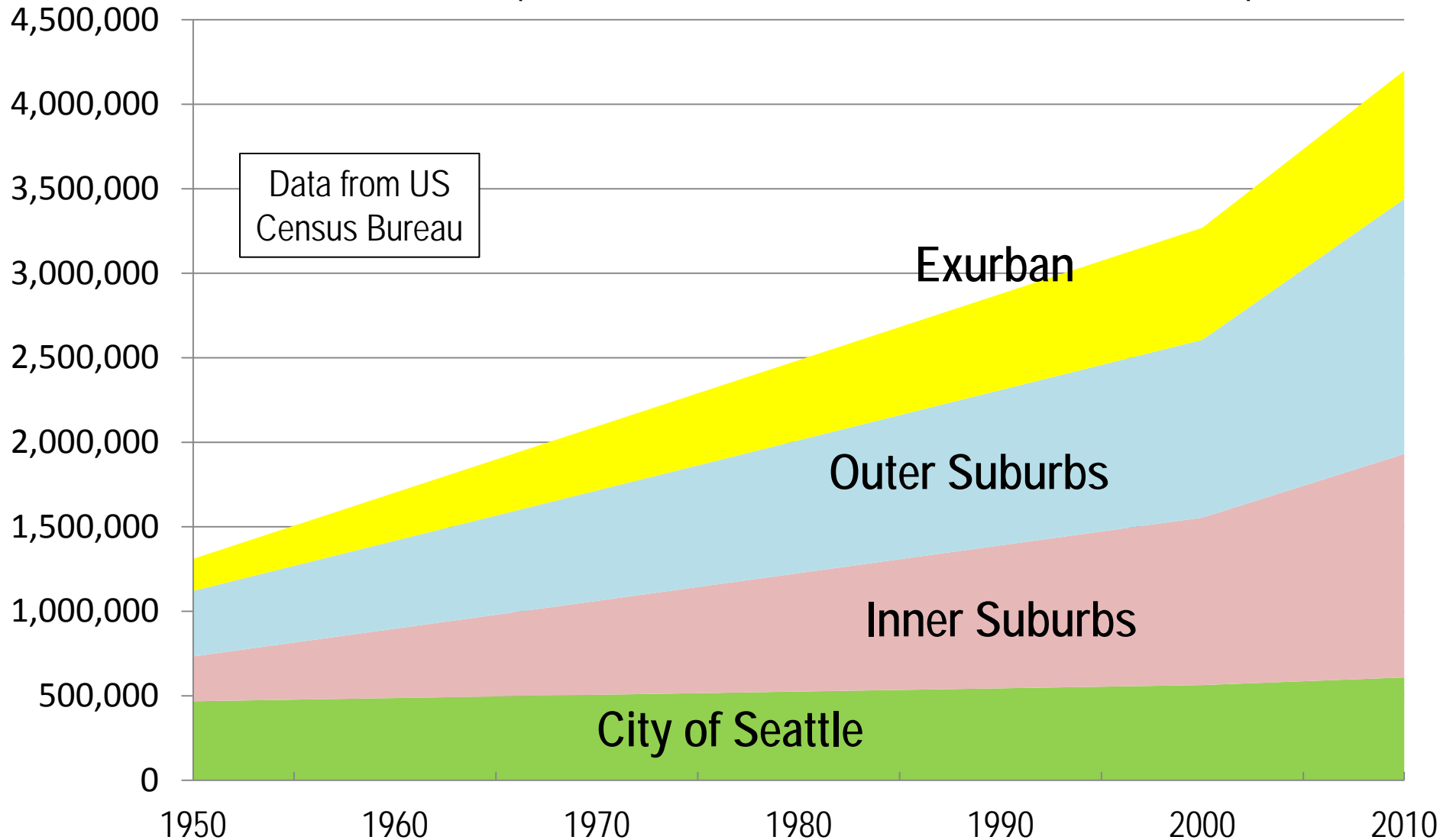
1950 - 2010



*Figure 63*

# Seattle Metropolitan Region: 1950-2010

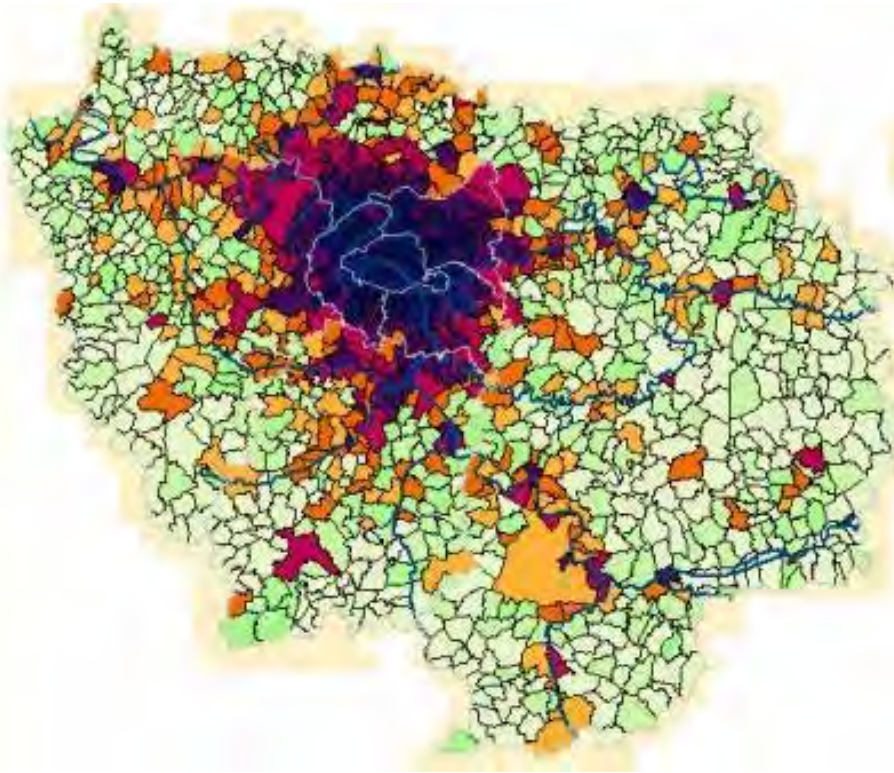
POPULATION (COMBINED STATISTICAL AREA)



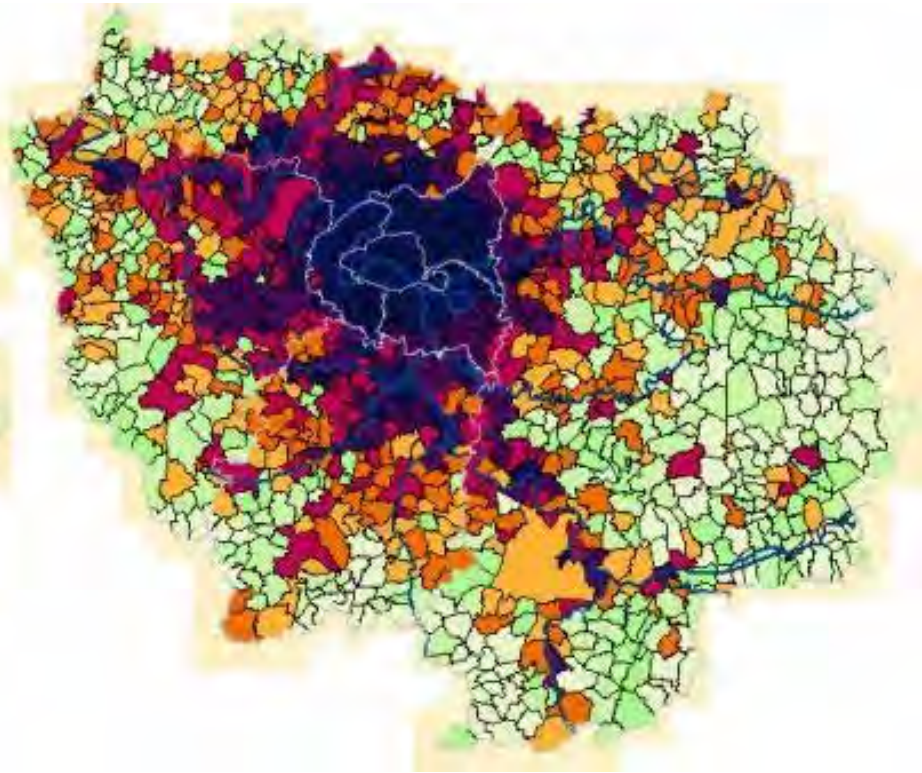
*Figure 64*

# Paris Urban Area Expansion

1954 - 1999



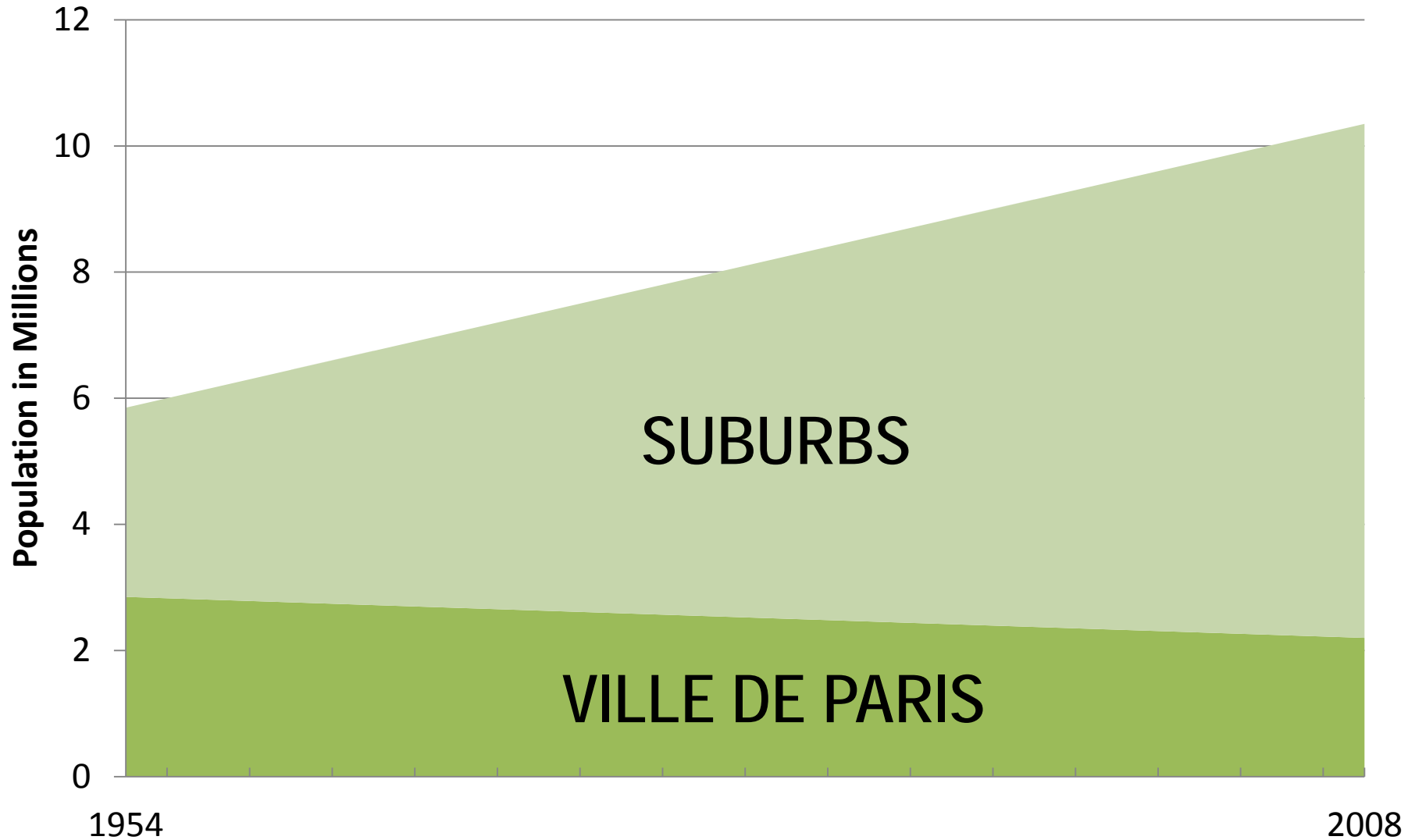
1954



1999

# Paris Urban Area Population Growth

1950 - 2010

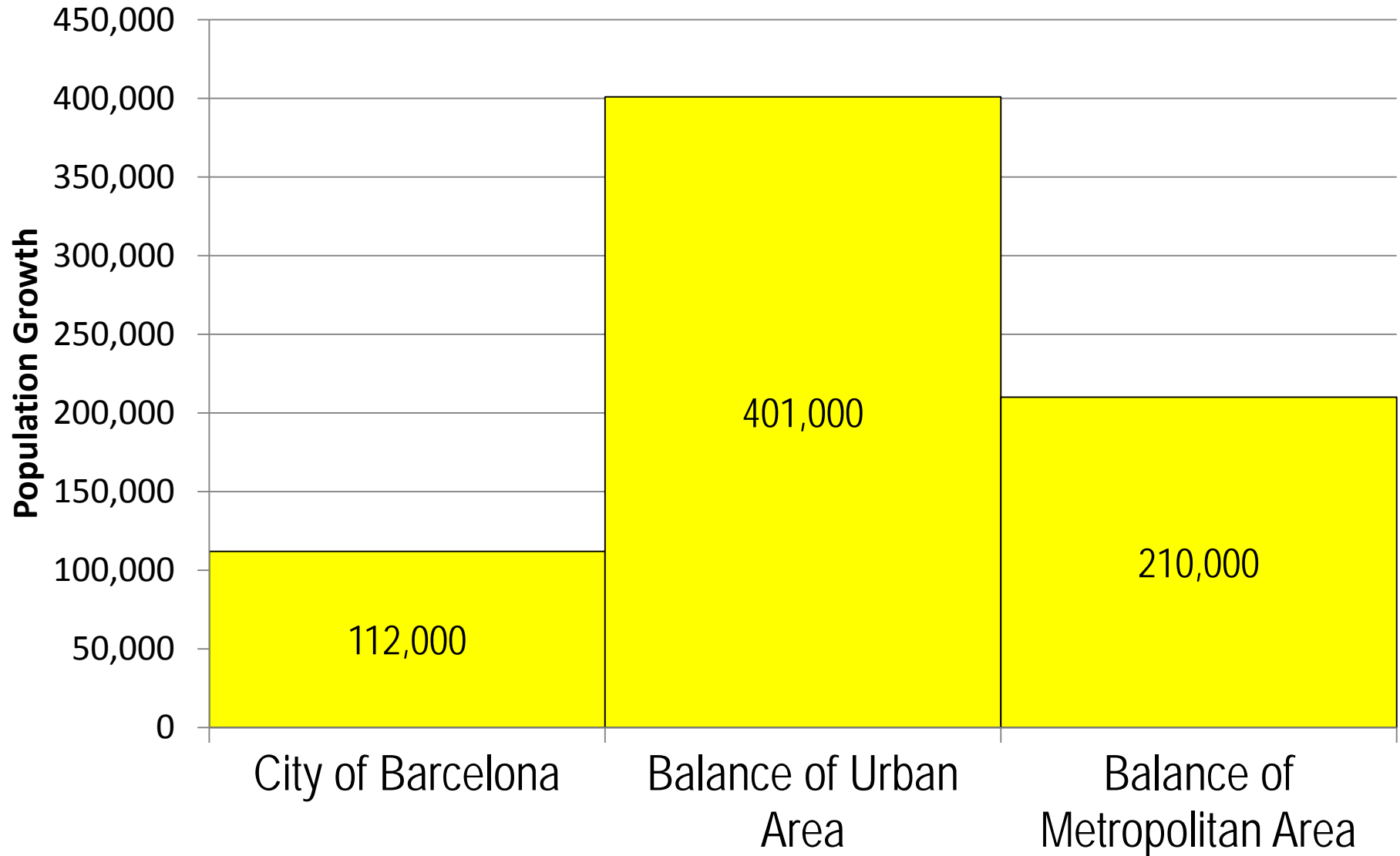


*Figure 66*



# Barcelona: Growth By Sector

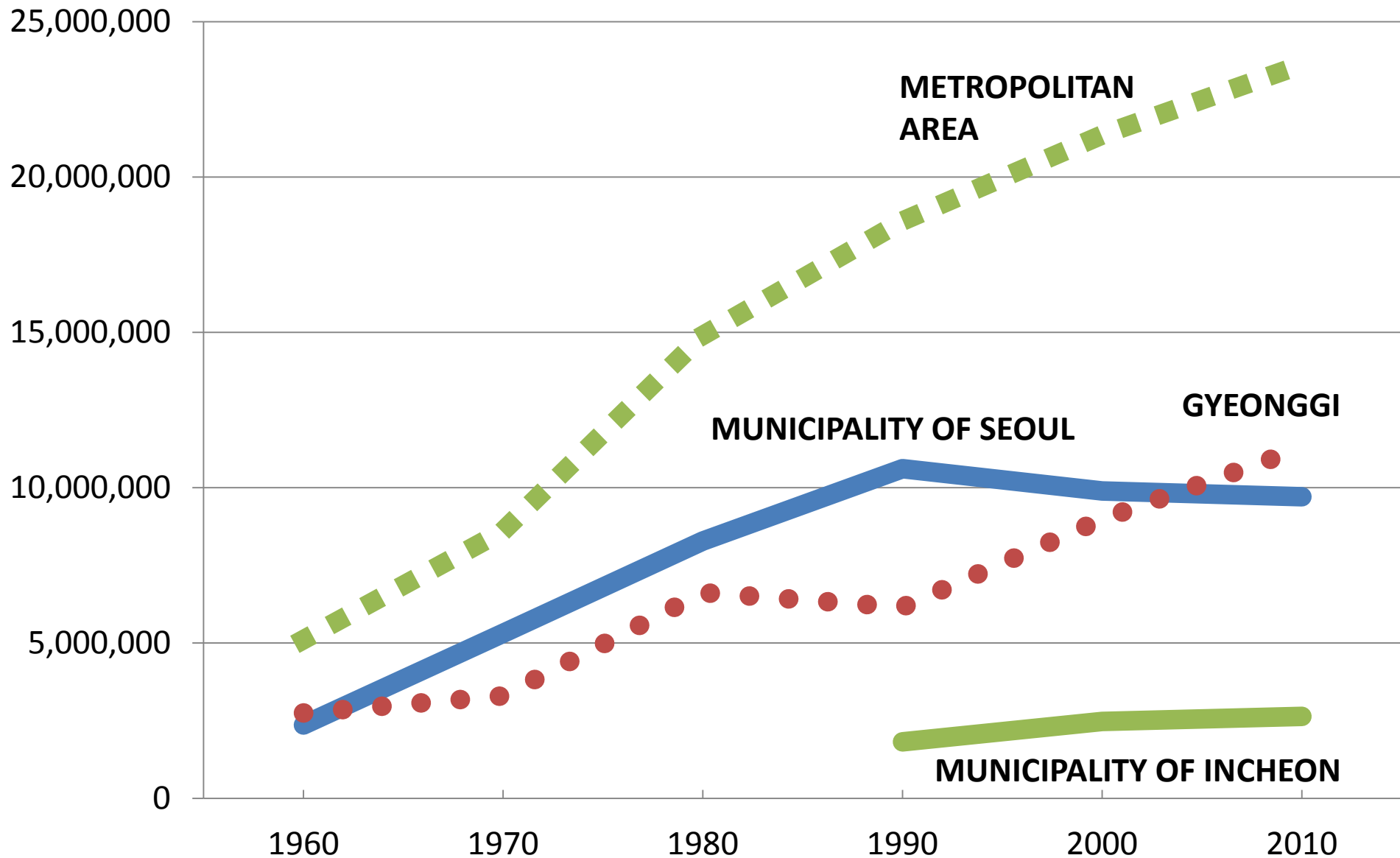
## 2001-2011



*Figure 67*

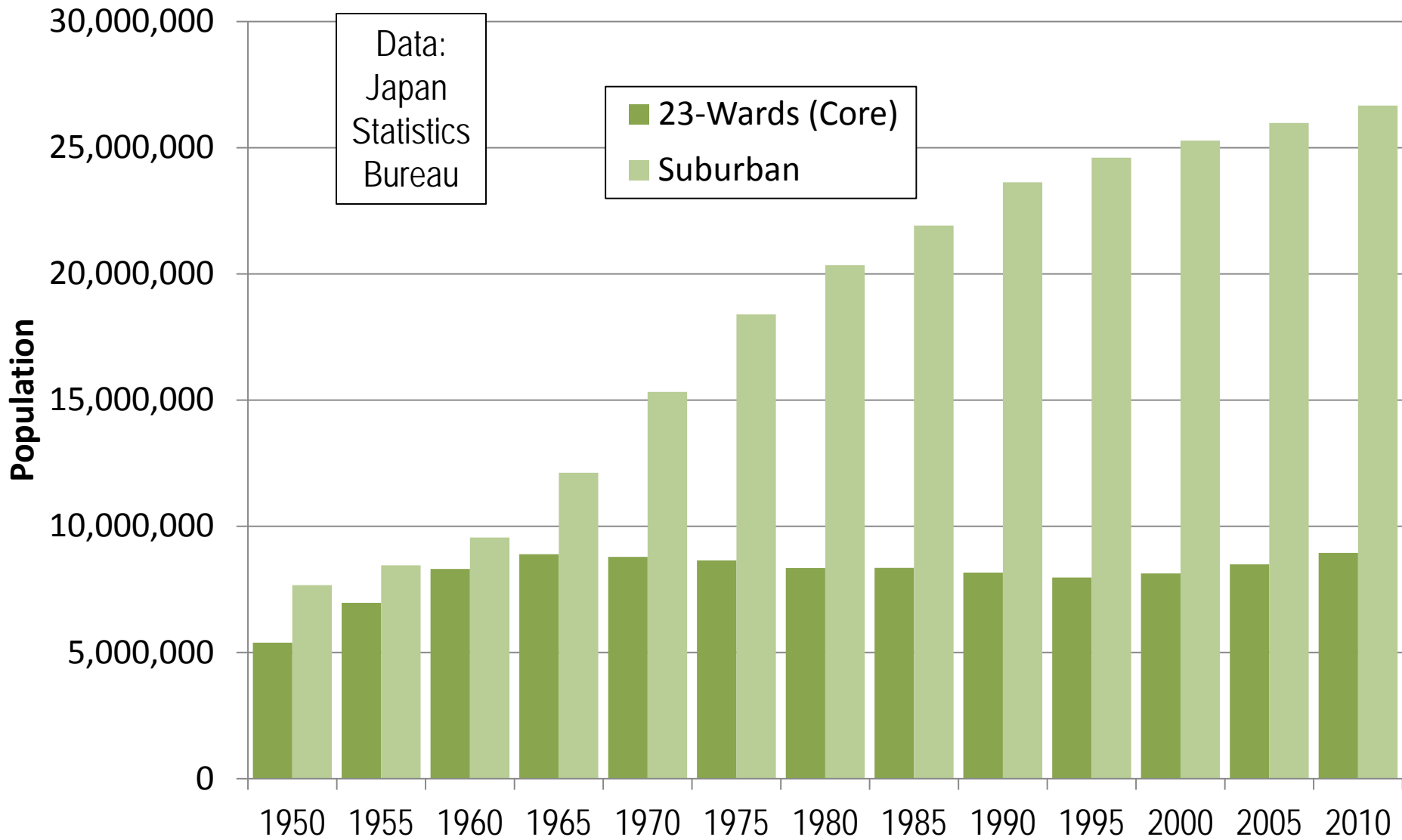
# Seoul Metropolitan Area: 1960-2010

## POPULATION BY PROVINCIAL LEVEL JURISDICTION



# Tokyo Core & Suburban Population

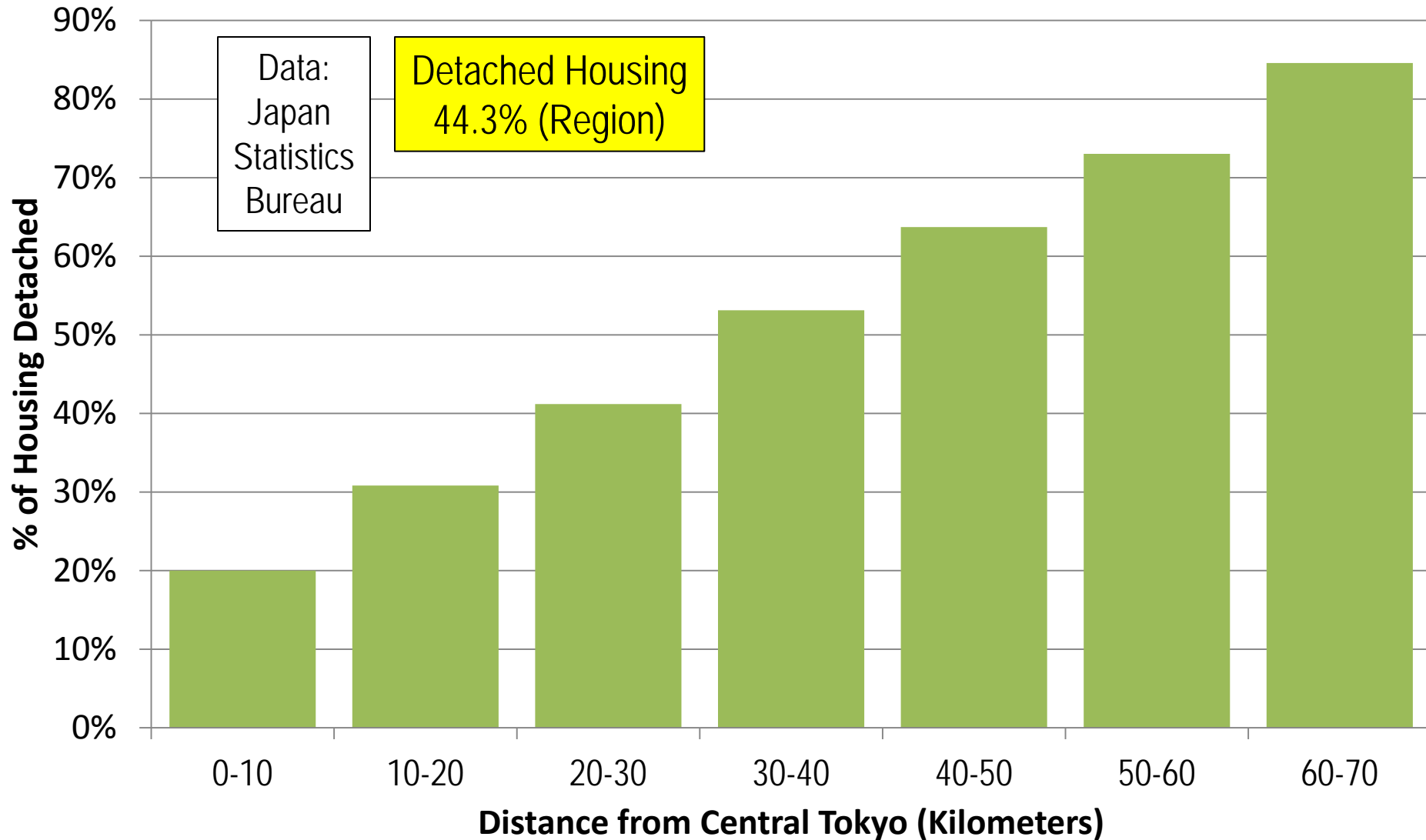
## 1920-2010



*Figure 69*

# Tokyo: Detached Housing Share: 2006

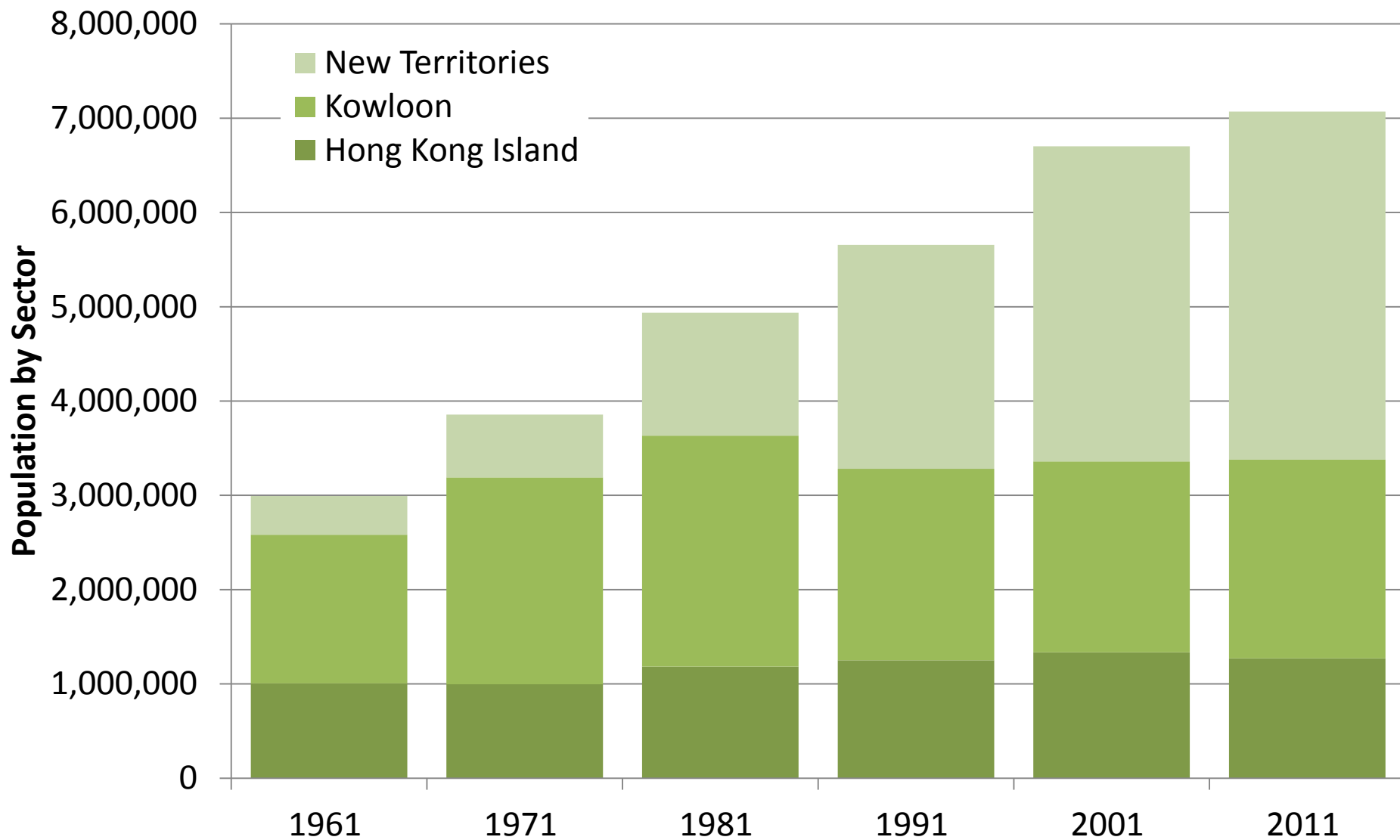
## BY DISTANCE FROM CENTRAL TOKYO: 2006



*Figure 70*

# Hong Kong Population by Sector

## 1961-2011

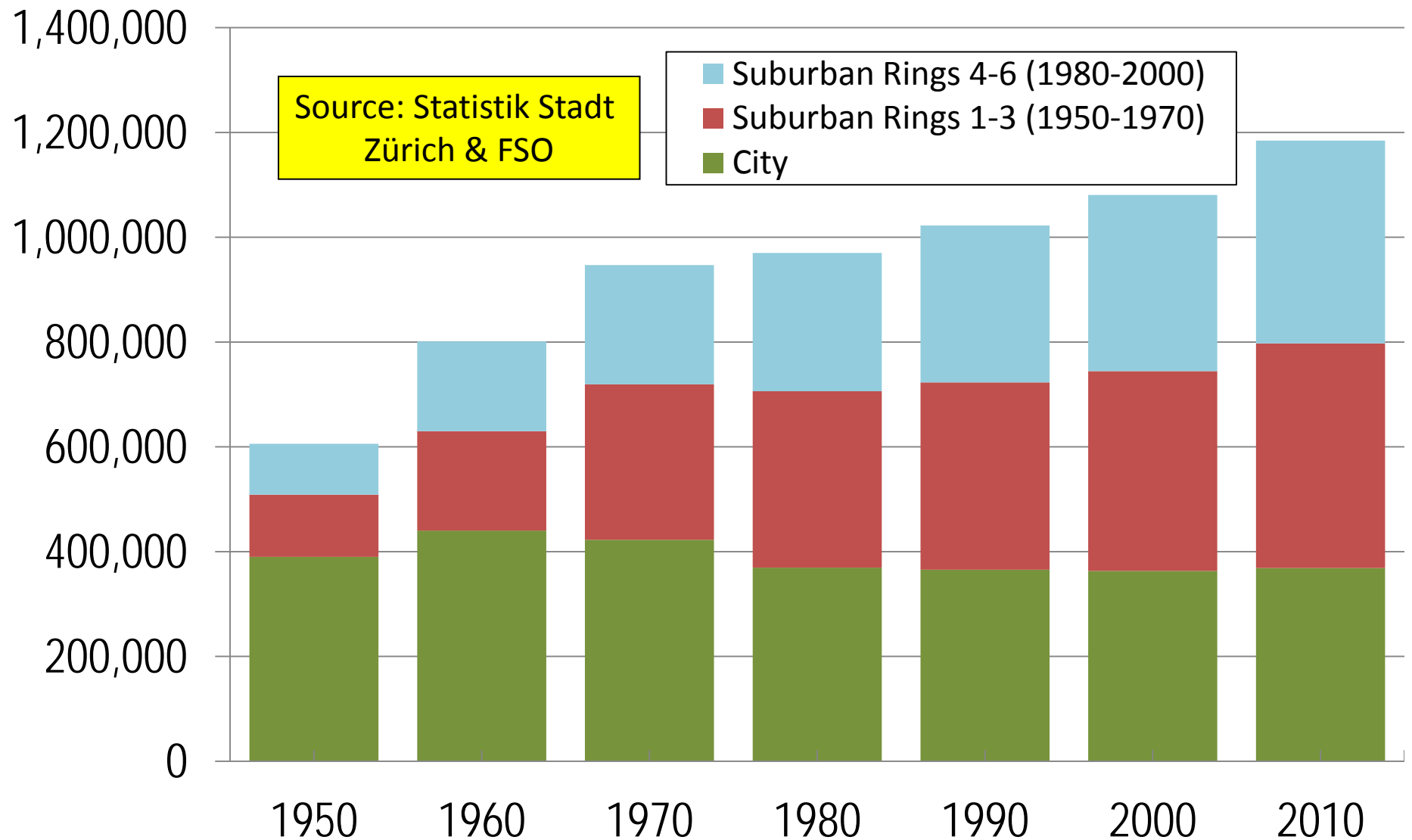


*Figure 71*



# Zürich Urban Area Population Growth

## CITY & SUBURBAN RINGS: 1950-2010



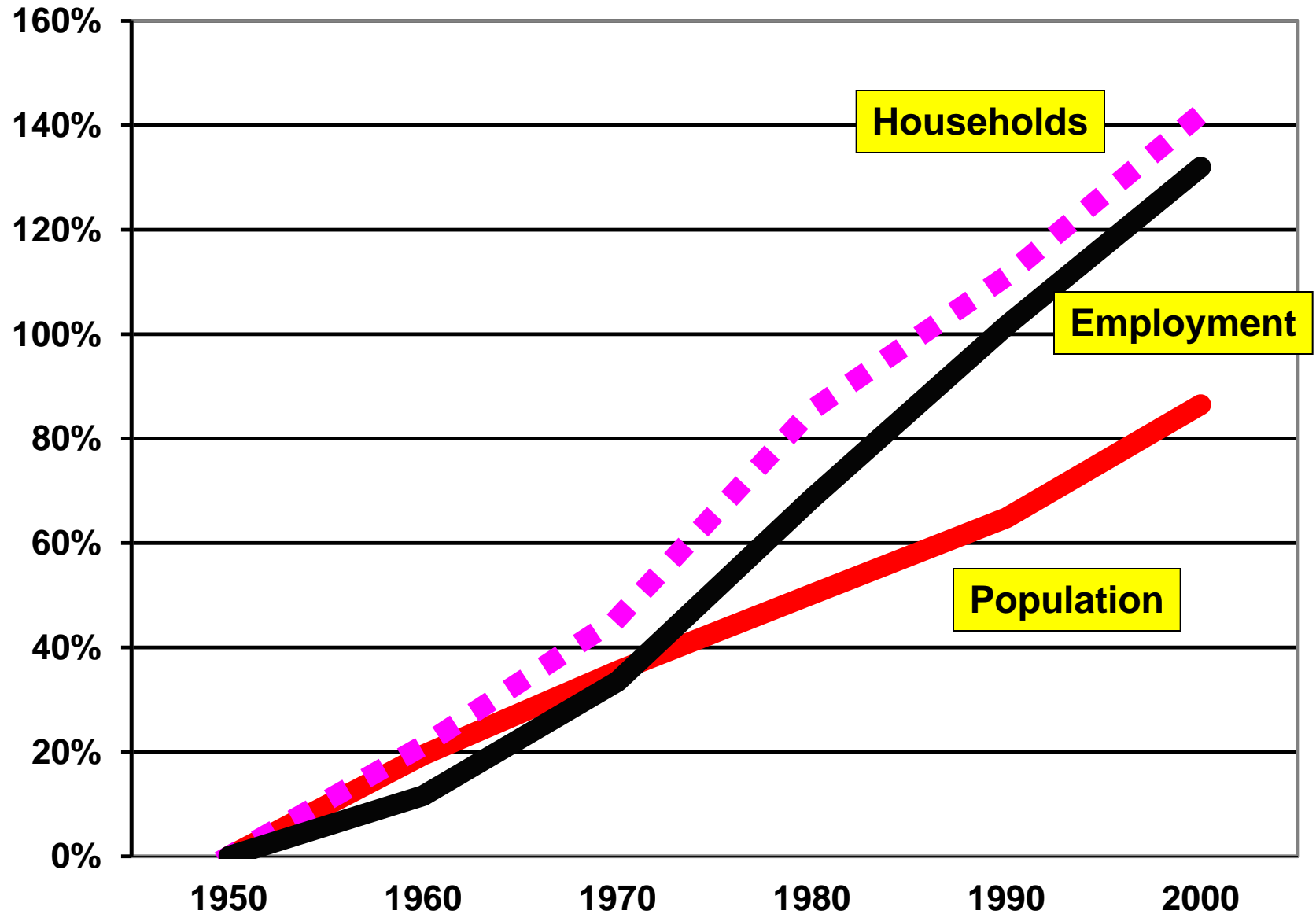
*Figure 72*

# Why Urban Expansion Happens

- Natural growth & migration
- Migrants are lower income
- Price of land on periphery is less
- Transport improvements

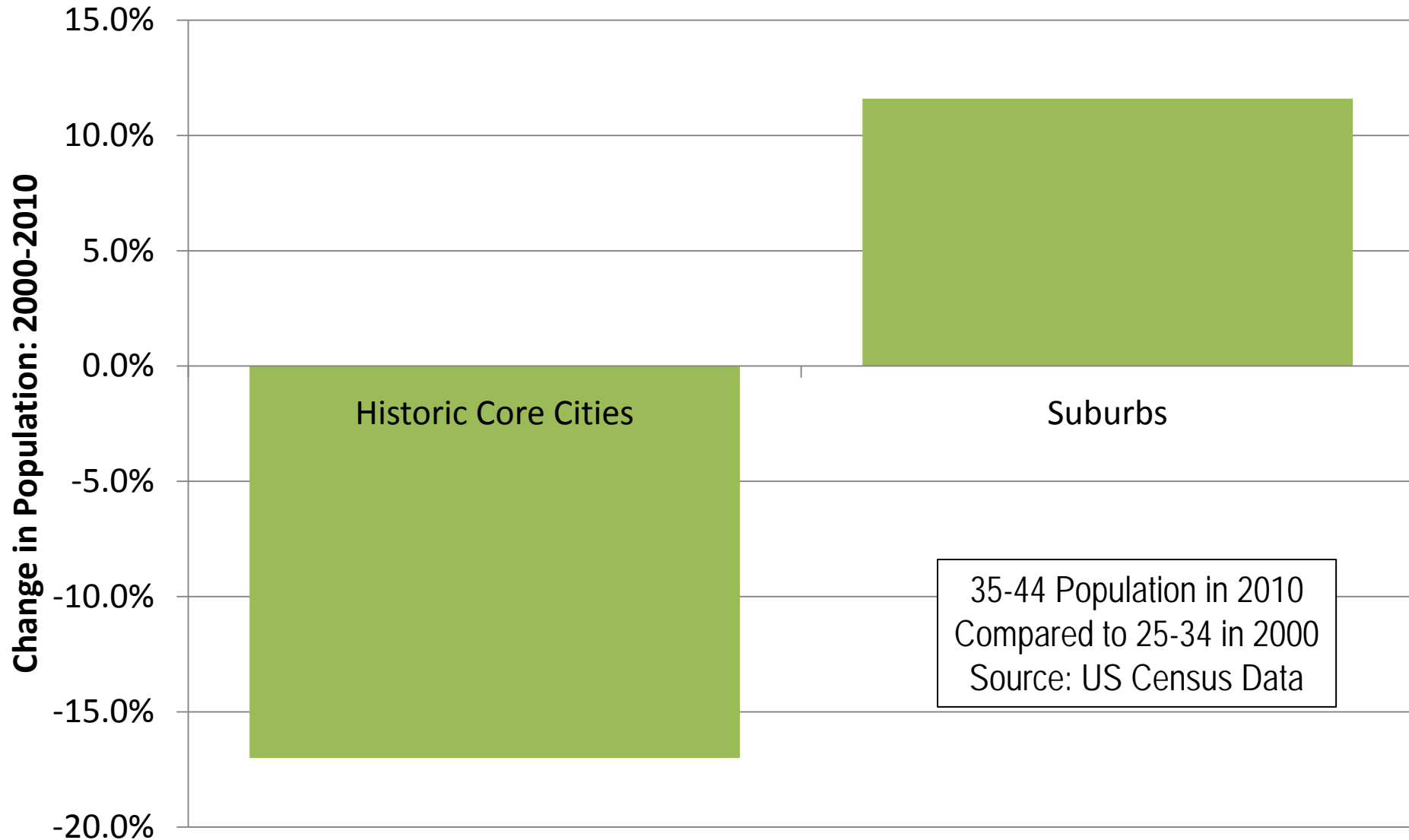
# Population, Households & Employment

U.S. CHANGE: 1950-2000



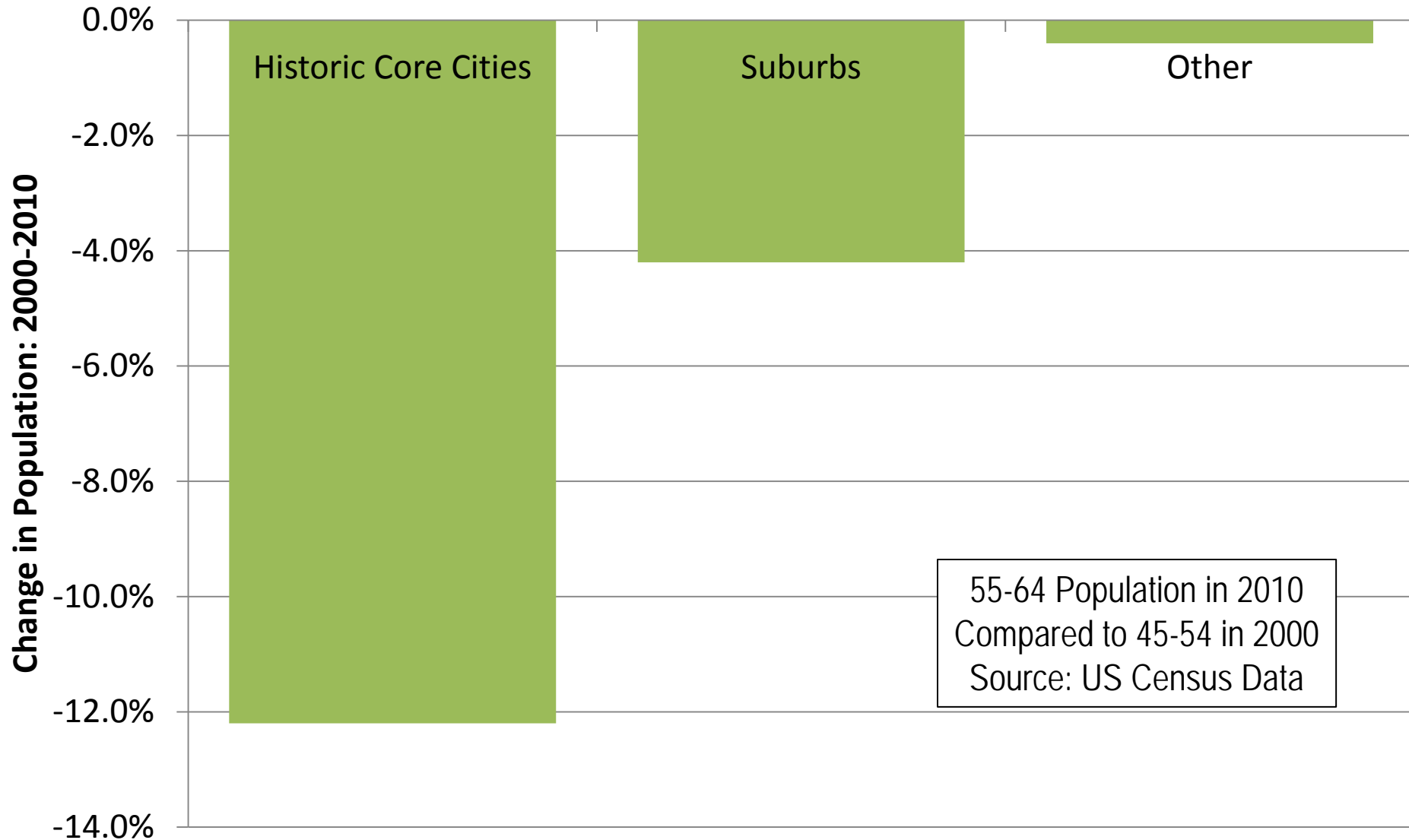
# US: Age 25-34 in 2000: Change by 2010

MAJOR METROPOLITAN AREAS: CORE & SUBURBAN



# US: Age 55-64 in 2000: Change by 2010

## MAJOR METROPOLITAN AREAS: CORE & SUBURBAN







# Largest Employment Centre in Canada

## PEARSON AIRPORT AREA

355,000 Employees, 120 KM<sup>2</sup> (<10% Transit)  
Downtown Toronto: 325,000 - 6 KM<sup>2</sup> (67% Transit)  
Downtown Montreal 240,000 - 5 KM<sup>2</sup> (59% Transit)



Difficult for  
Public Transport  
To Compete  
With Auto  
To Such Locations

Luis Berini Center  
(Peripheral Center)



Sao Paulo: Edge City

*Cairo*

A low-angle, upward-looking photograph of the Great Pyramid of Giza. The pyramid's surface is composed of numerous small, weathered stone blocks, creating a textured, golden-brown appearance. The pyramid's apex is centered in the upper third of the frame. The background is a vast, clear blue sky with a few wispy clouds near the horizon. The foreground shows a sandy, desert floor.

# TRANSPORT AND THE CITY



# Democratization of Prosperity

## ASSOCIATION BETWEEN MOBILITY & AFFLUENCE

Chicago

*"Time is  
Money"*

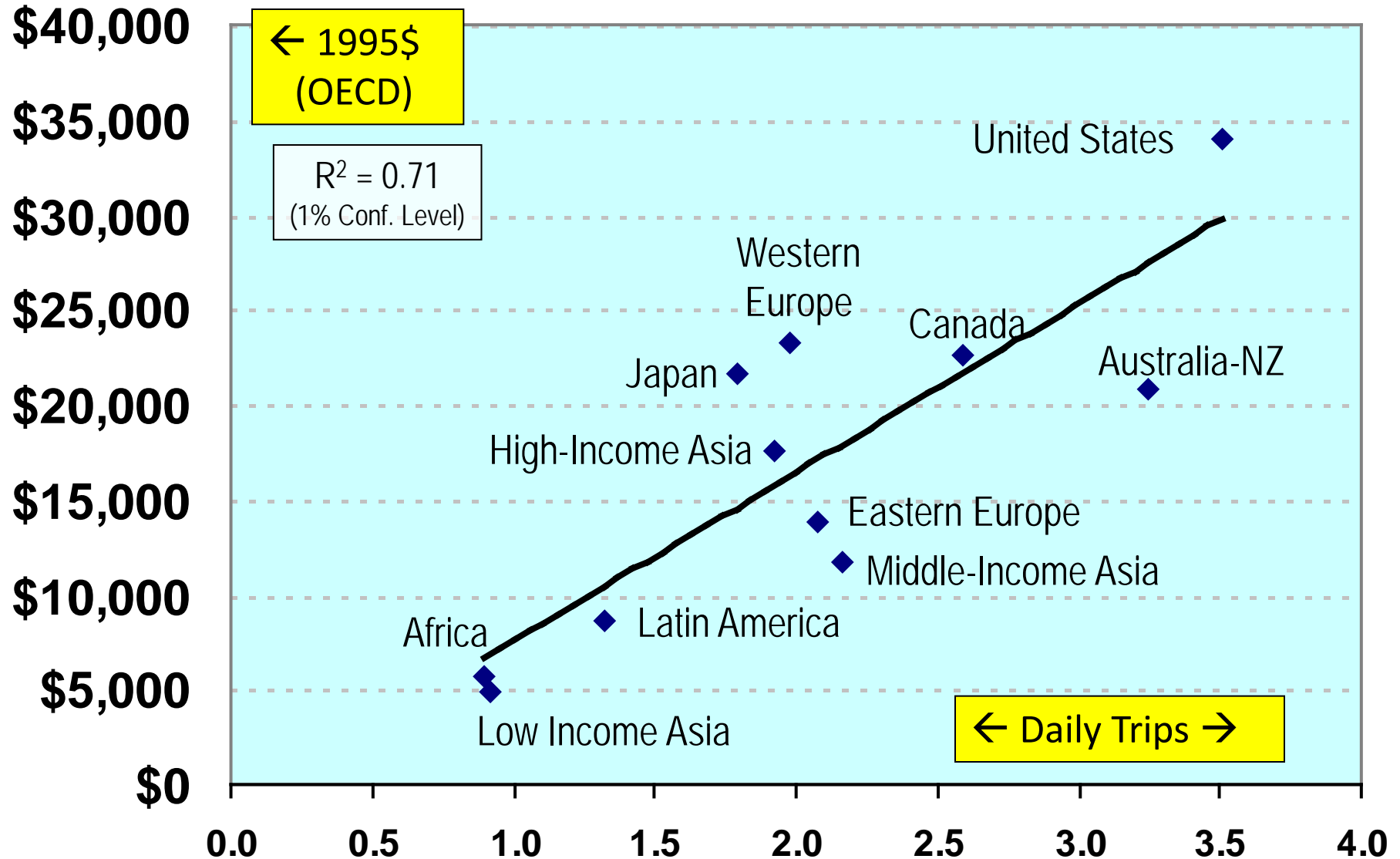
Reduced Minority  
Unemployment  
With Cars  
*U. of California*

PRUD'HOMME  
Mobility Improves  
Productivity  
*U. Of Paris*

HARTGEN-FIELDS  
Mobility Improves  
Productivity

# Daily Motorized Trips & GDP/Capita

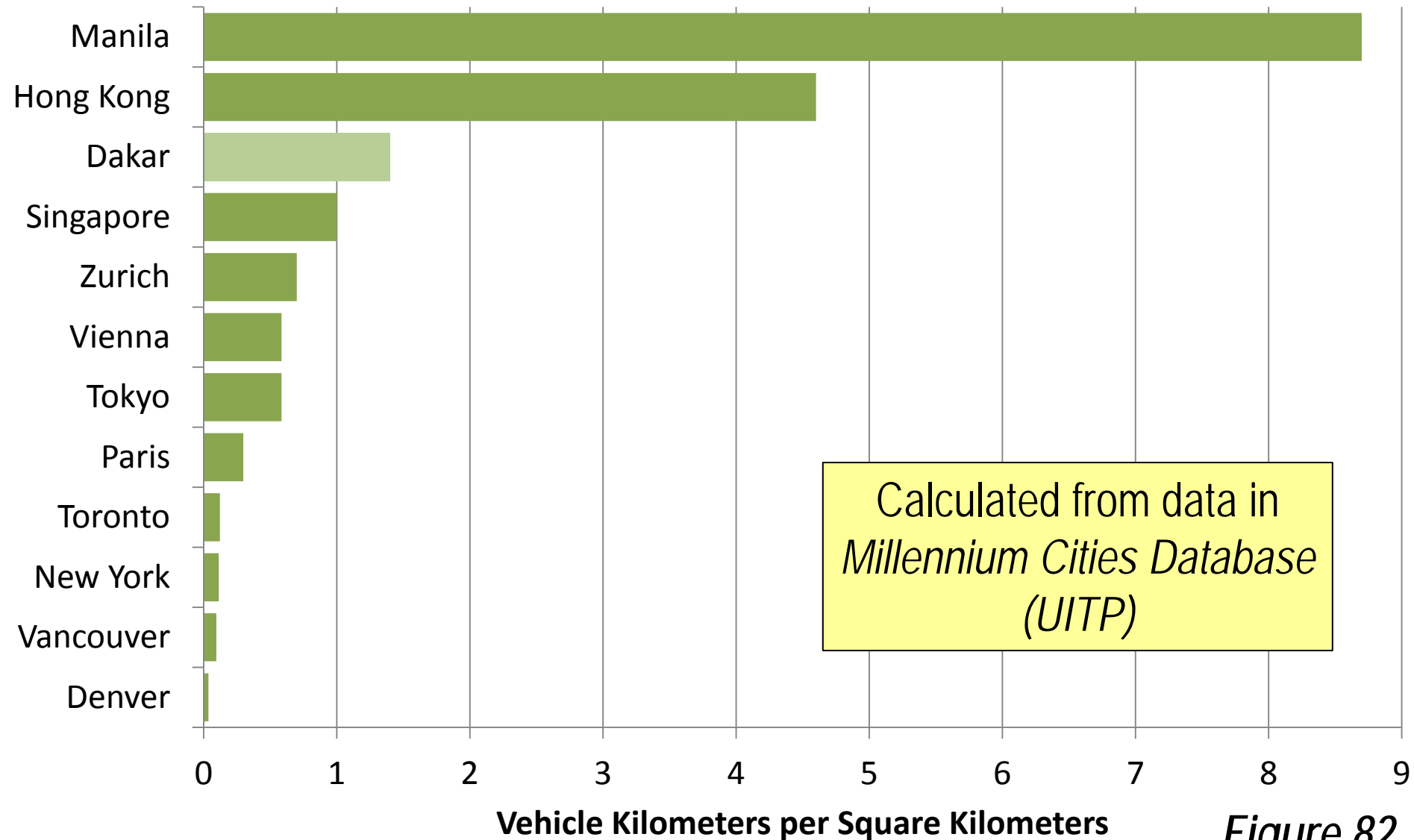
1995 DATA





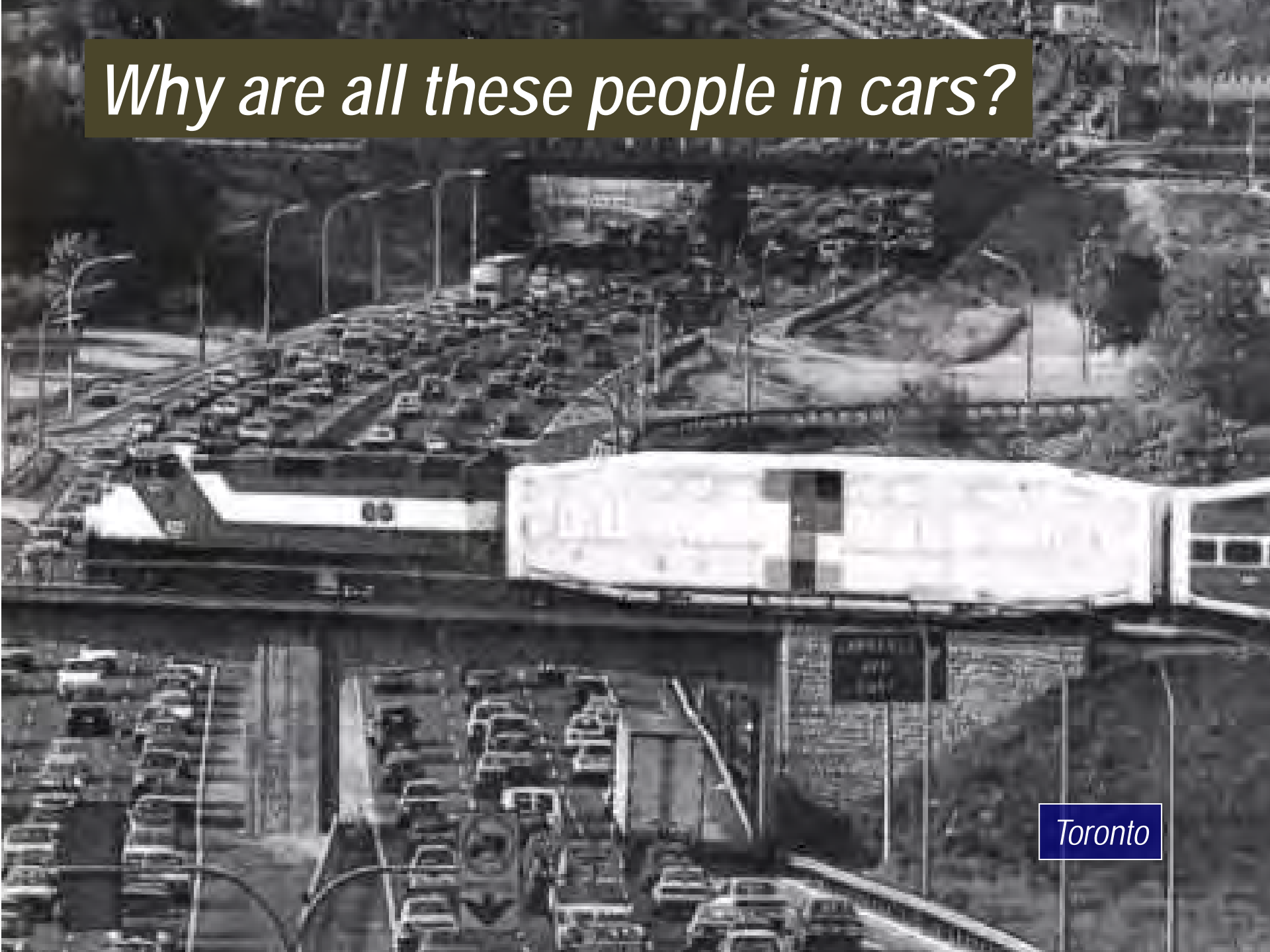
# Mass Transit Service Densities

MILLENNIUM CITIES DATABASE: 1995



*Figure 82*

*Why are all these people in cars?*

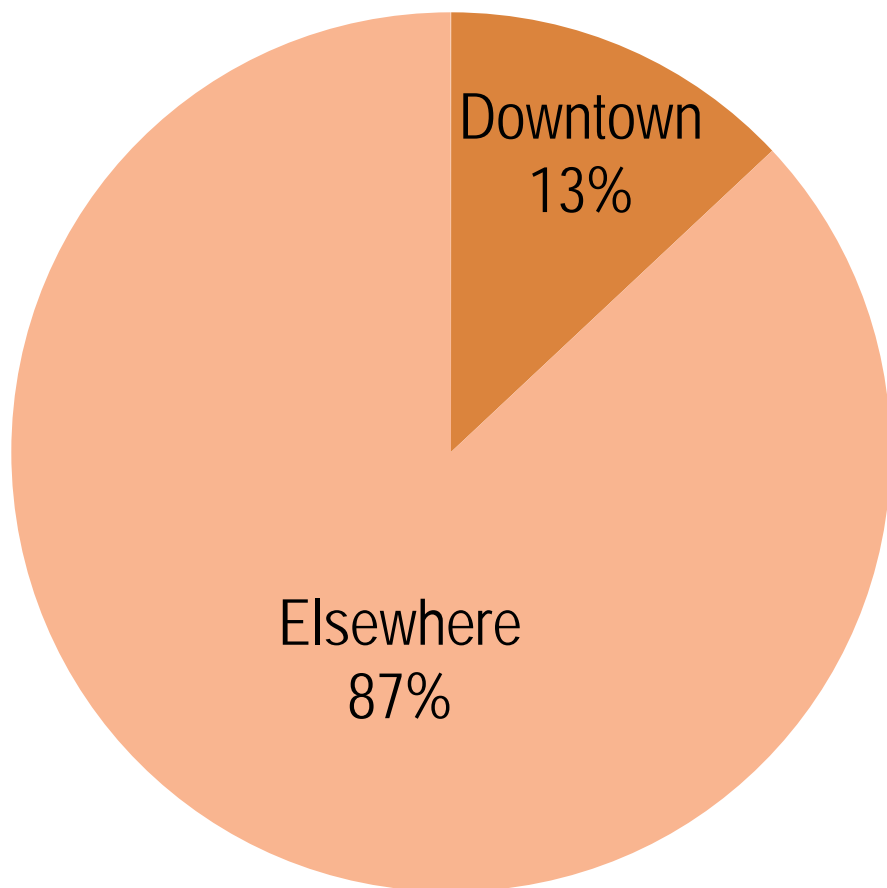


Toronto

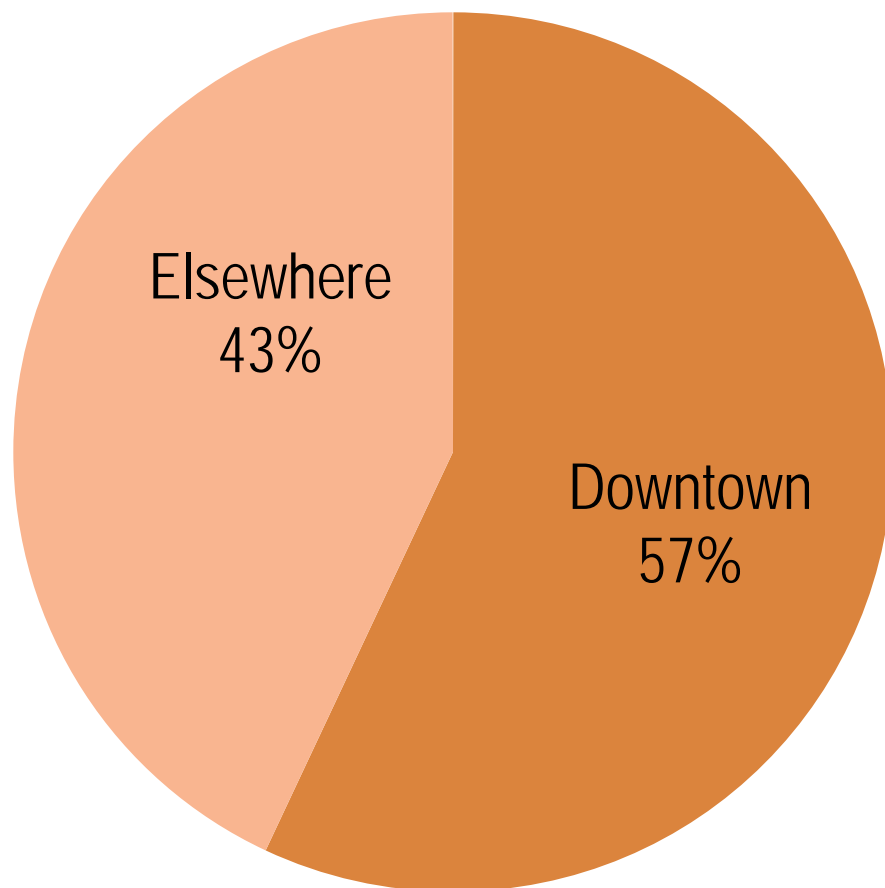
# Transit: Strong Downtown: Weak Elsewhere

SEATTLE URBAN AREA: 2000

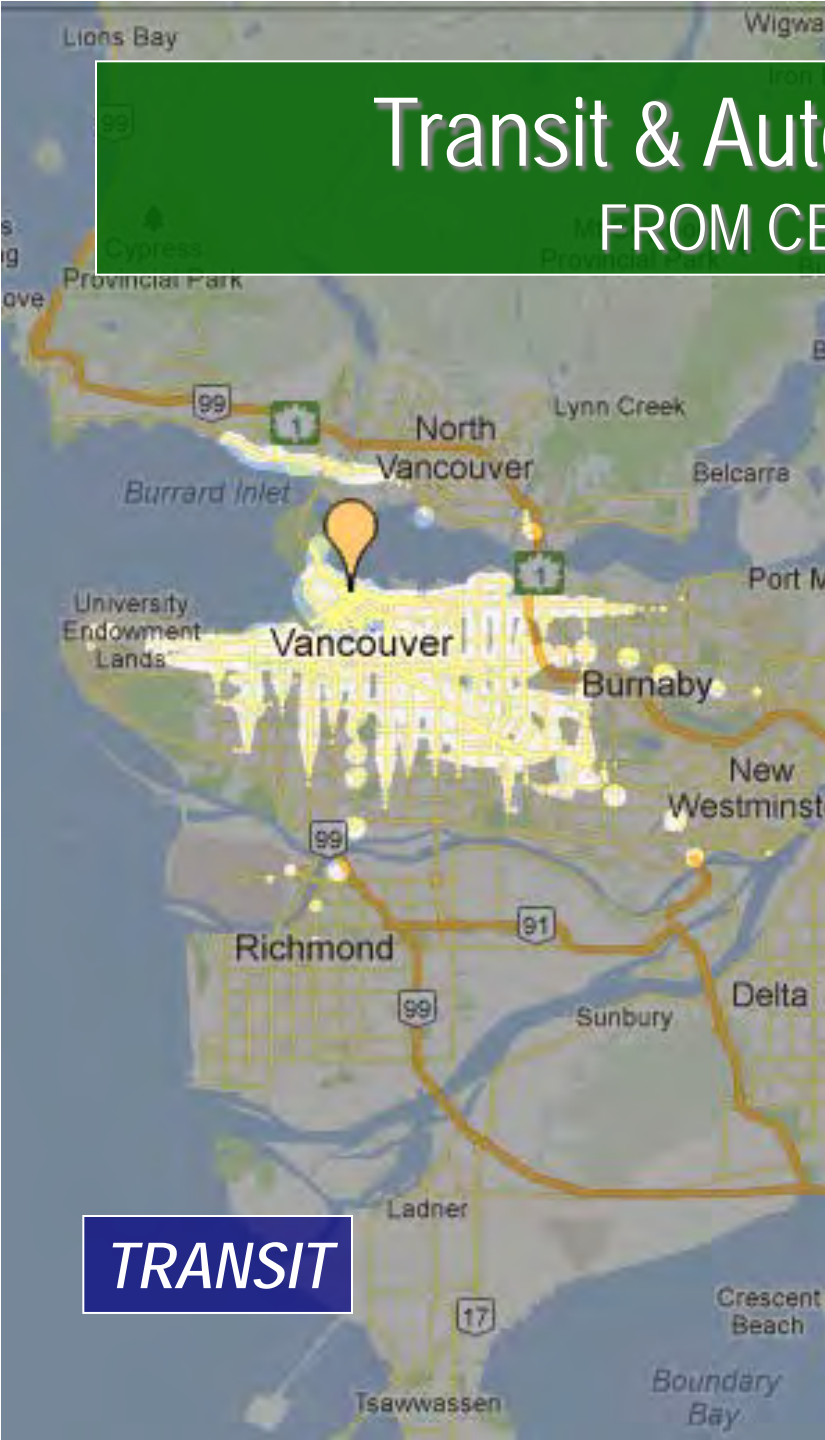
## EMPLOYMENT



## # OF TRANSIT COMMUTERS



# Transit & Auto Access: 30 Minutes FROM CENTRAL VANCOUVER



**TRANSIT**



**AUTO**

# Travel by Transit Takes Longer

## 6 MAJOR METROPOLITAN AREAS: CANADA

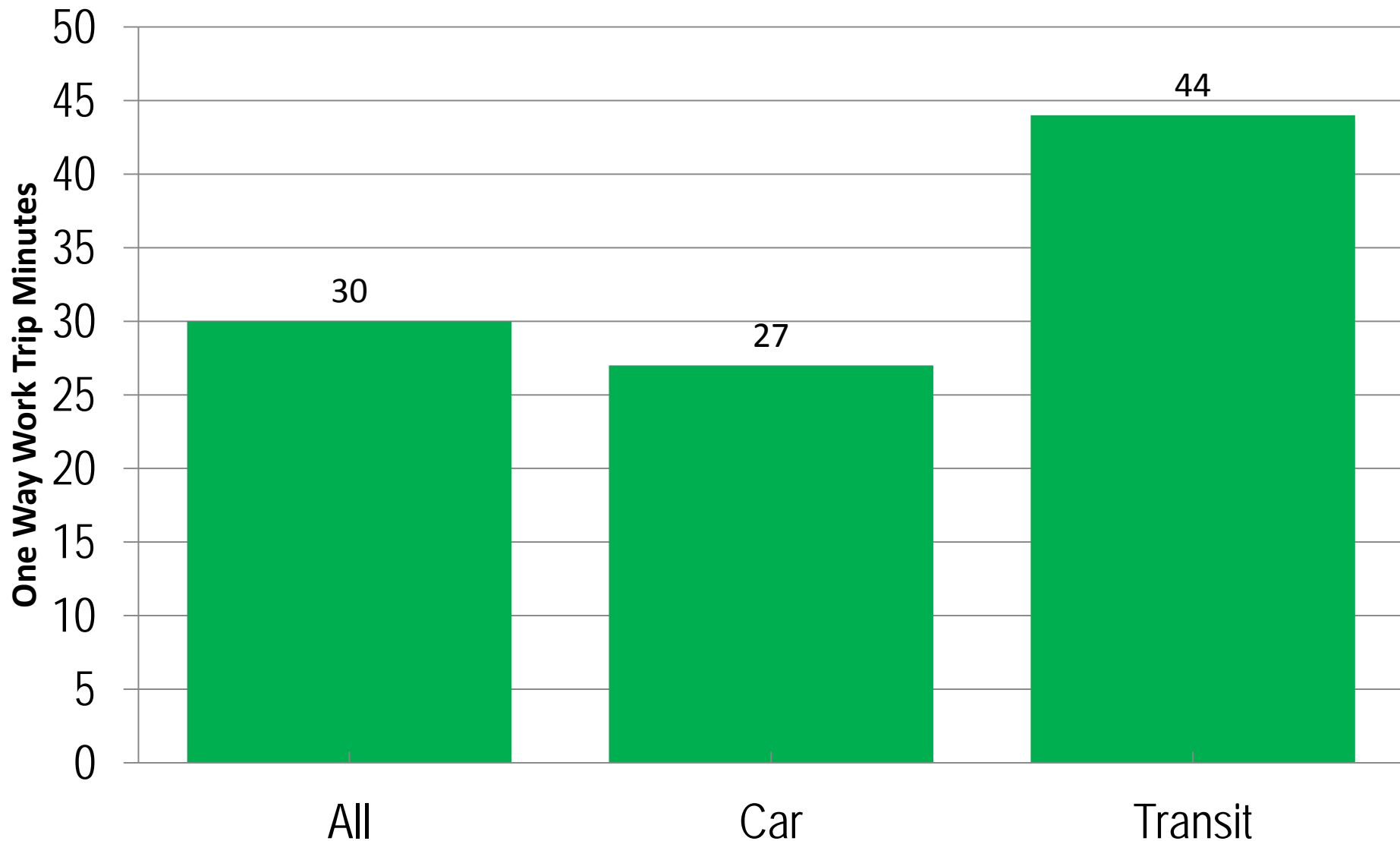




Table 4

## Motorized Urban Transport in 8 Cities of Developing Africa

More Formal: Collective (Generally Large Bus)	13%	
Less Formal	87%	
Collective (Generally Smaller Vehicle)	64%	
Minibus		51%
Taxi		13%
Private	23%	
Car		8%
2-Wheeler		15%

Abidjan, Accra, Addis Abeba, Dakar, Dar es Salaam, Douala,  
Lagos, Nairobi

2-Wheeler shown as personal, though there is collective use of an  
unknown volume

Calculated from Kumar & Barrett (2008) & Gonzales et al (2009)

A photograph of a city street in Perth, Australia. The image shows a tall, modern skyscraper with a glass facade and a distinctive spire, prominently displaying the 'st.george' logo near the top. To its left is a shorter building with a 'RYDGES' sign. The street in the foreground has several cars and a modern building with a large orange wall. The sky is clear and blue.

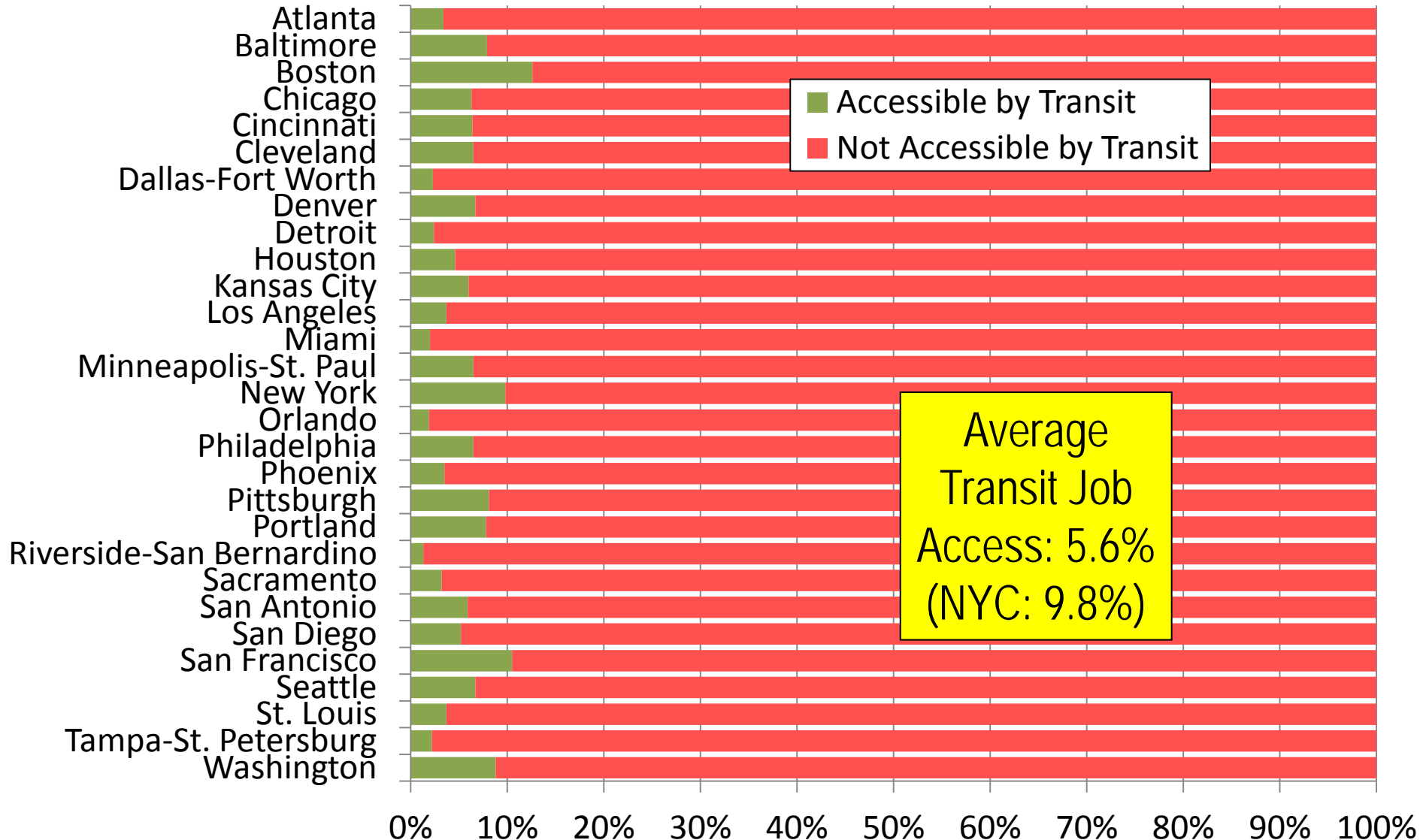
Perth

# Western Europe, United States & the West

*There is no  
practical  
mass transit for  
most trips*

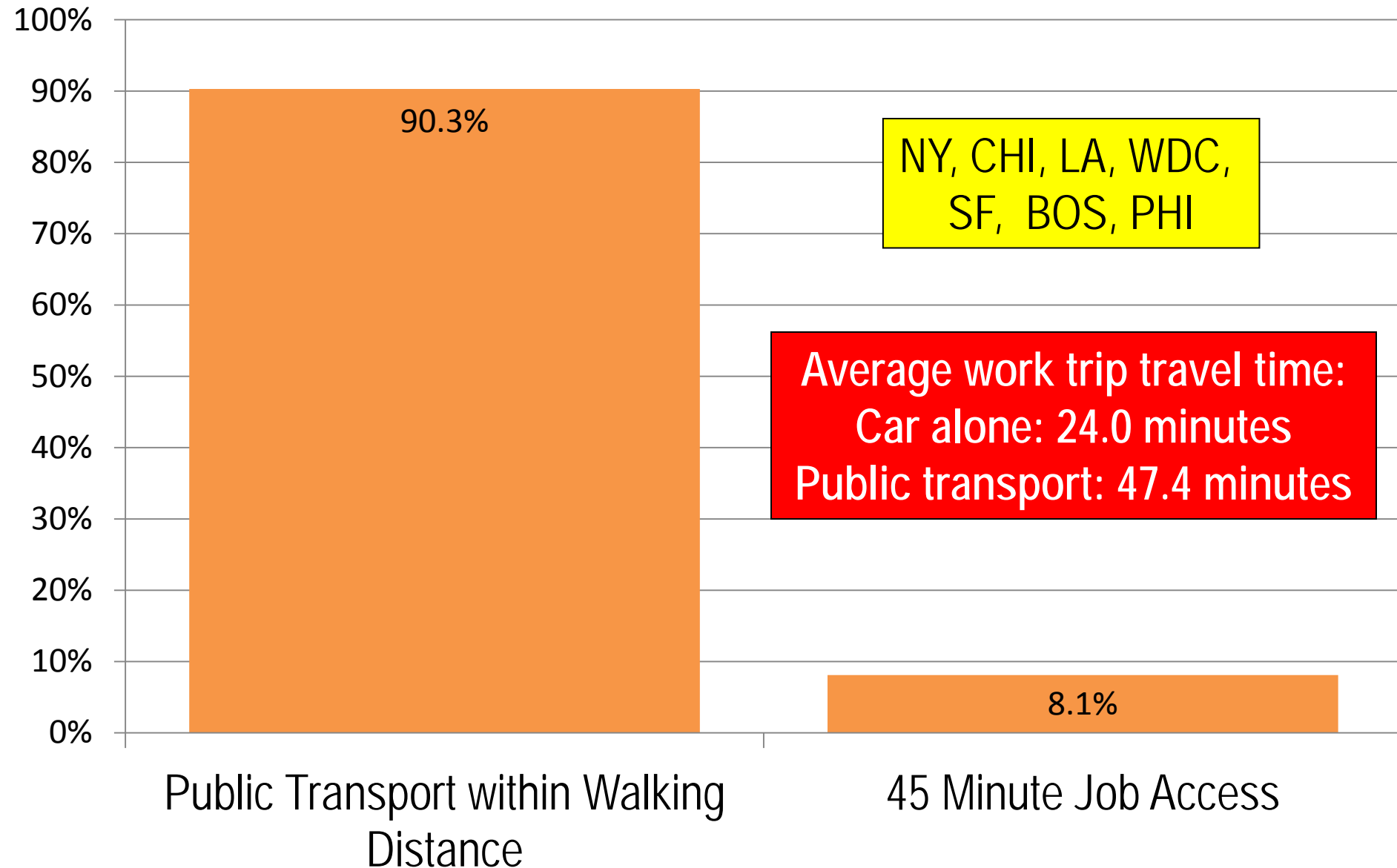
# Capability of Transit: 45 Minute Job Access

METROPOLITAN AREAS OVER 2,000,000: 2008



# Public Transport: 7 US Largest Markets

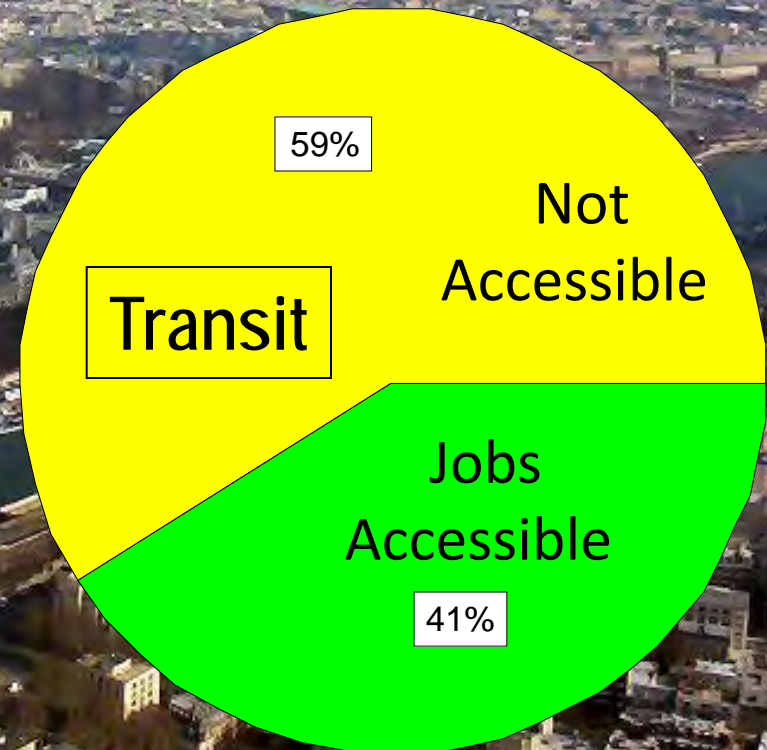
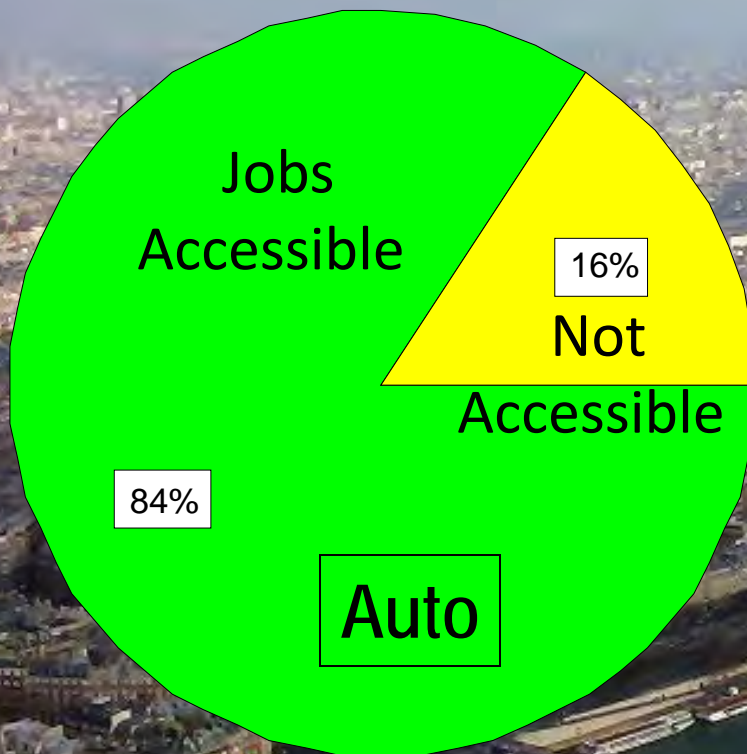
## ACCESS TO TRANSIT STOPS/ACCESS TO JOBS



# Paris Suburbs: Cars Provide Quicker Travel

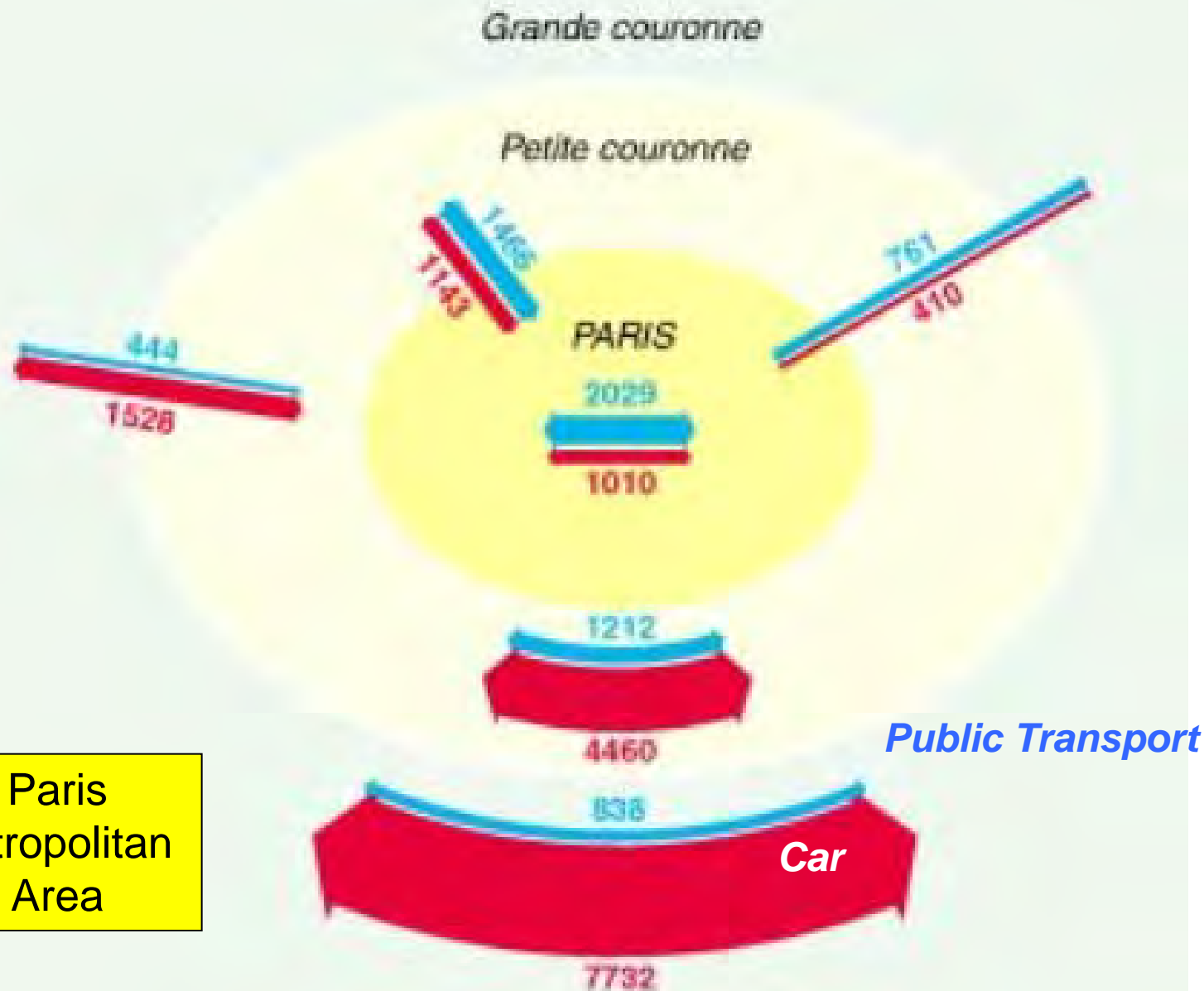
FROM MAJOR SUBURBAN RAIL STATIONS: 1 HR TO JOBS

*Paris*





# Public Transport & Auto Market Shares





# Transit's “Last Kilometer” Problem

## ELSEWHERE TRANSIT IS SLOWER FOR MORE TRIPS

Annual Cost:  
More than gross  
annual income of  
metropolitan area

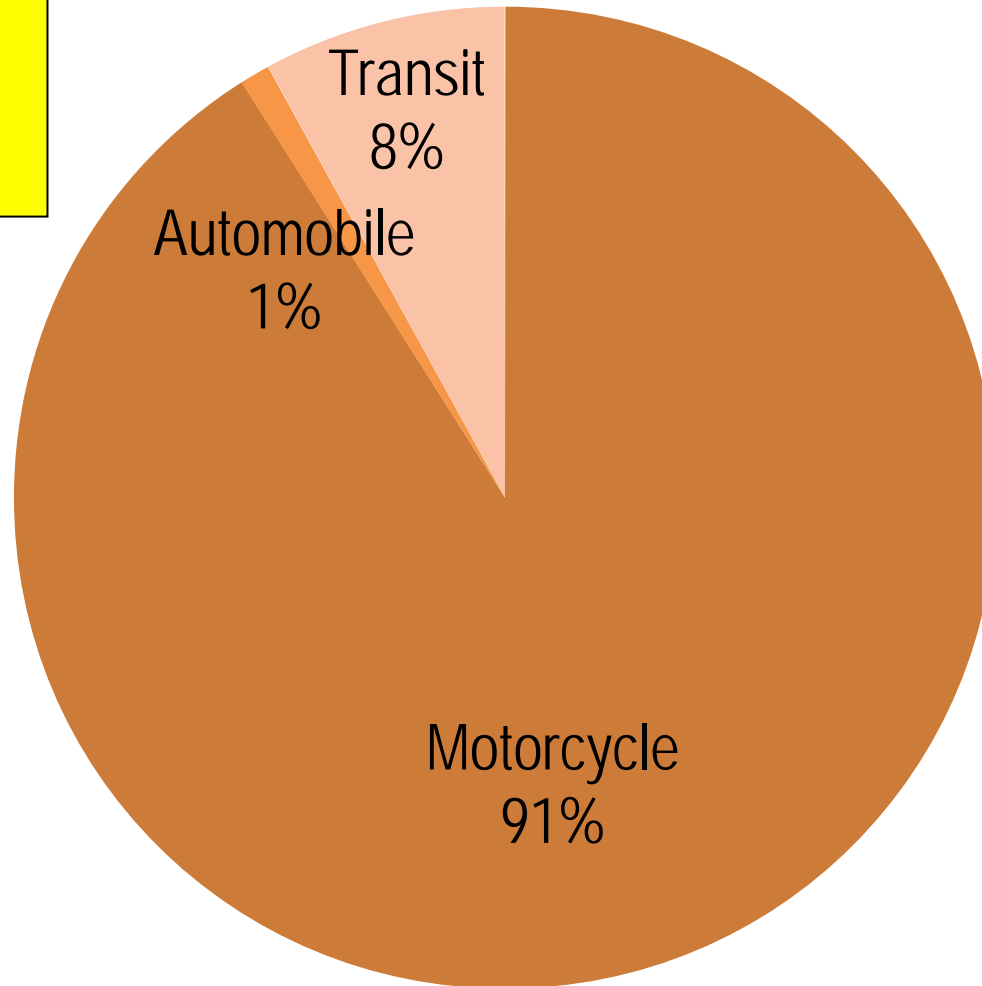
An auto competitive  
system for Portland?  
800 Meter Metro  
Grid Required

Table 3				
Automobile Competitive Public Transport: Cost				
Income Category & Urban Area	Skeletal Cost per Capita: Underground Metro	Skeletal Cost per Capita: Elevated Metro	GDP Share: Underground Metro	GDP Share: Elevated Metro
<b>LOW INCOME</b>	<b>\$4,900</b>	<b>\$3,300</b>	<b>1.69</b>	<b>1.14</b>
Cairo	\$5,600	\$3,700	1.44	0.95
Delhi	\$5,100	\$3,400	1.55	1.03
Dhaka	\$2,900	\$1,900	1.38	0.90
Jakarta	\$9,700	\$6,400	2.69	1.78
Karachi	\$4,800	\$3,200	2.00	1.33
Kolkata	\$4,500	\$2,900	1.36	0.88
Lagos	\$4,800	\$3,200	3.43	2.29
Mumbai	\$2,100	\$1,400	0.64	0.42
<b>MIDDLE INCOME</b>	<b>\$10,000</b>	<b>\$6,700</b>	<b>1.18</b>	<b>0.79</b>
Beijing	\$15,700	\$10,300	2.31	1.51
Buenos Aires	\$13,400	\$8,800	1.02	0.67
Istanbul	\$8,000	\$6,800	0.98	0.83
Manila	\$4,700	\$3,100	0.92	0.61
Mexico City	\$7,900	\$5,200	0.79	0.52
Moscow	\$15,900	\$10,400	1.43	0.94
Rio de Janeiro	\$8,200	\$5,400	0.98	0.64
Sao Paulo	\$6,300	\$4,300	0.75	0.51
Shanghai	\$12,600	\$8,300	1.85	1.22
Shenzhen	\$6,800	\$4,500	1.00	0.66
<b>HIGH INCOME</b>	<b>\$17,400</b>	<b>\$11,500</b>	<b>0.53</b>	<b>0.35</b>
Los Angeles	\$24,000	\$15,800	0.57	0.38
New York	\$33,200	\$21,800	0.79	0.52
Osaka-Kobe-Kyoto	\$11,600	\$7,700	0.37	0.24
Paris	\$16,800	\$11,100	0.56	0.37
Seoul-Incheon	\$5,600	\$3,700	0.27	0.18
Tokyo-Yokohama	\$13,100	\$8,600	0.42	0.27
<b>ALL</b>	<b>\$9,700</b>	<b>\$6,700</b>	<b>0.76</b>	<b>0.53</b>

# Ho Chi Minh City Area: Travel Share

## 2007

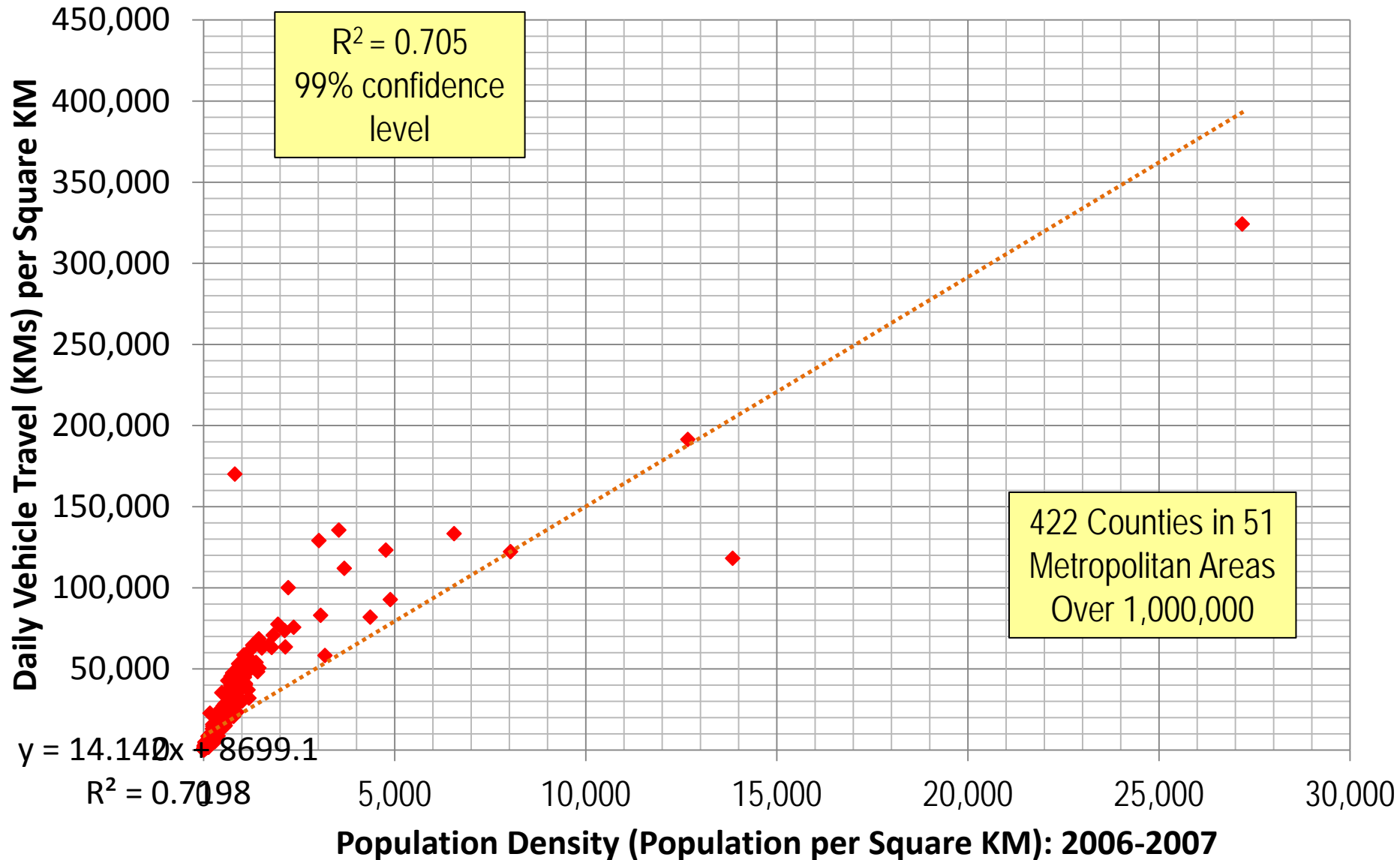
Source: Derived  
from Asian  
Development  
Bank data





# Density & Roadway Travel

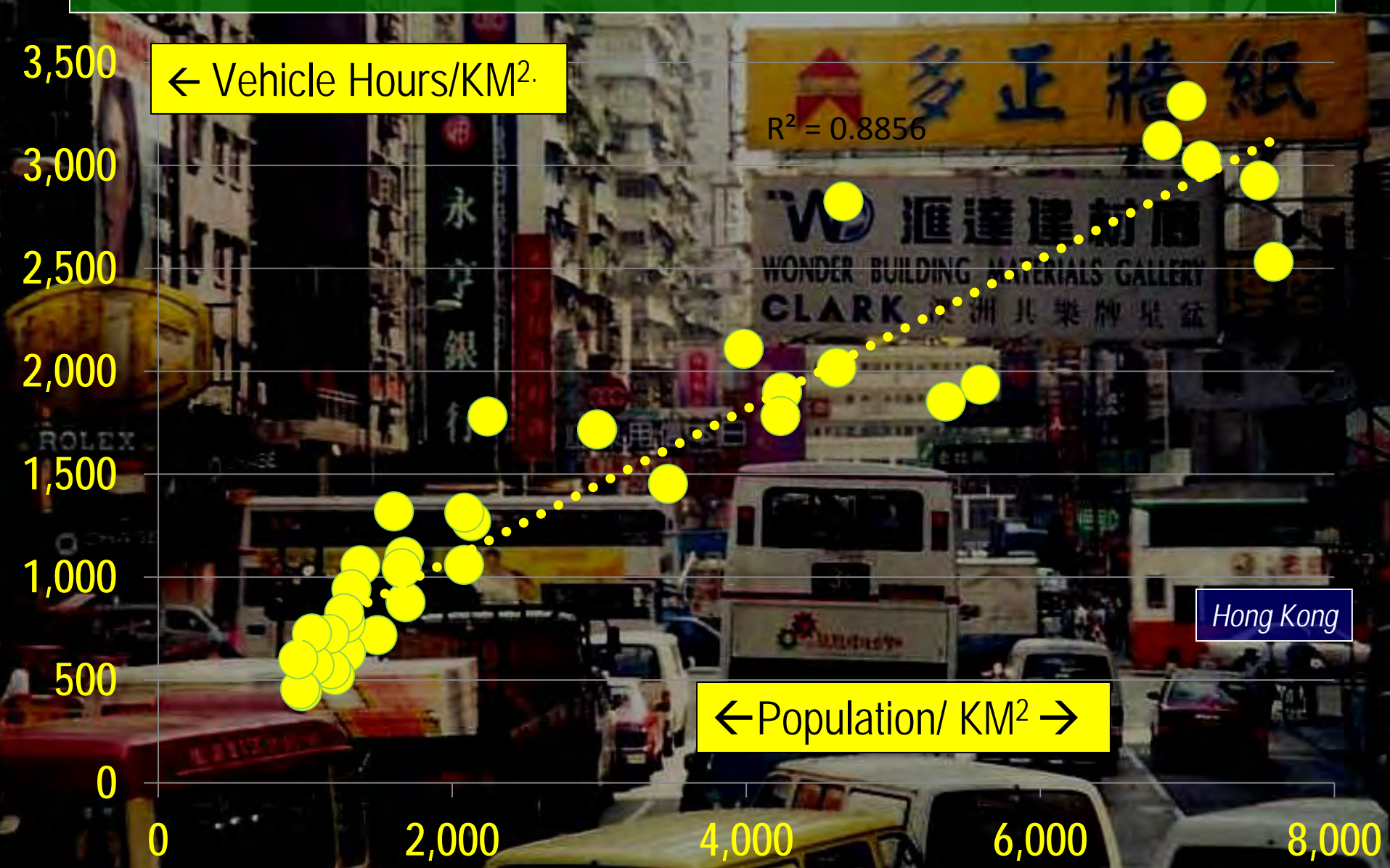
## ROAD VEHICLES: MAJOR METROPOLITAN COUNTIES





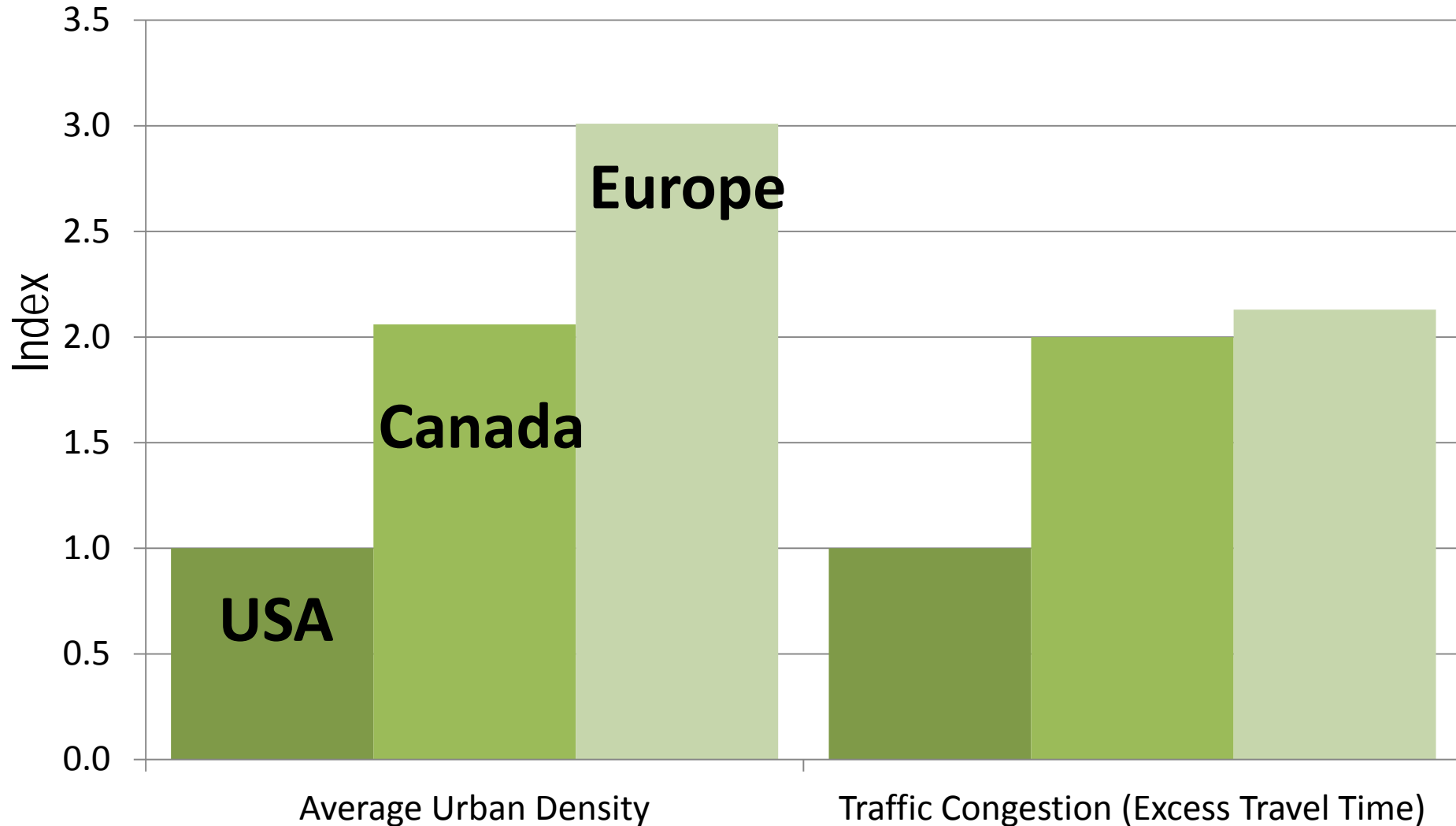
# Higher Density Means More Traffic Congestion

DENSITY & TRAFFIC VOLUMES: INTERNATIONAL



# Density & Traffic Congestion

## UNITED STATES, CANADA & EUROPE



*Figure 98*

# Automobile Market Penetration

0.75 AUTOS PER HOUSEHOLD

Nation	Year
United States	1930
Canada	1955
Australia	1965
France	1970
United Kingdom	1980
Japan	1985

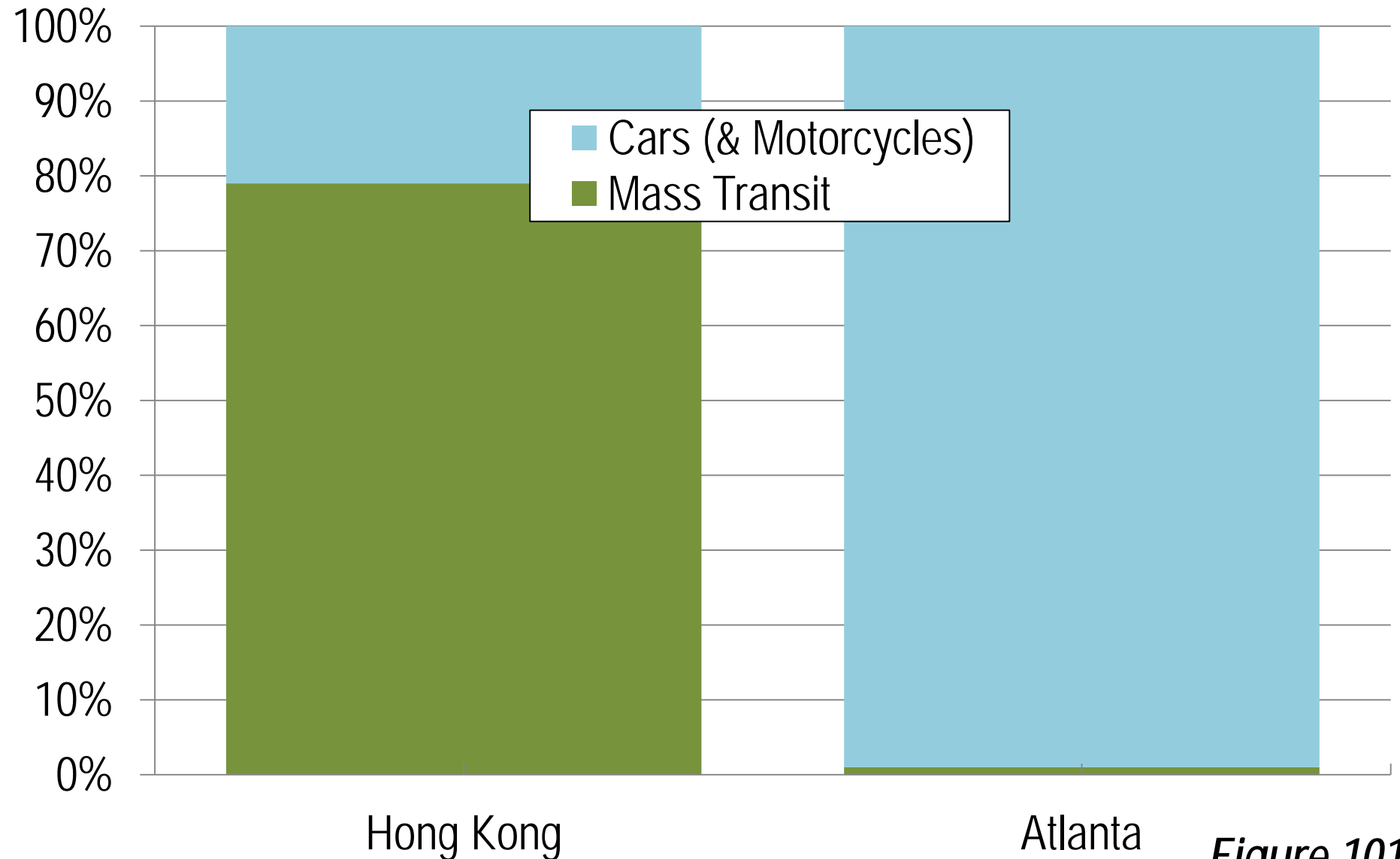
# Comparing Toronto & Dallas-Fort Worth

## URBAN AREAS COMPARED (2010 & 2011)

	Toronto	Dallas-Ft. Worth	Toronto/ DFW
Population (Population Centre/Urban Area)	5,132,794	5,121,892	0.2%
Land Area (KM <sup>2</sup> )	1,751	4,606	-62.0%
Density	2,931	1,112	163.6%
One Way Work Trip Reach Work in 30 Minutes	33 48%	26 59%	26.9% -18.6%
Median Multiple (House Price/Household Income)	5.5	2.9	89.7%
Transit Work Trip Share	21%	2%	935.0%

# Hong Kong & Atlanta: Motorized Travel

## MASS TRANSIT & AUTO MARKET SHARE



*Figure 101*





Shenzhen

A well governed city delivers:

Mobility & economic growth

Lower cost of living  
(housing affordability)

# REALITY & CHALLENGES (CONCLUSION)

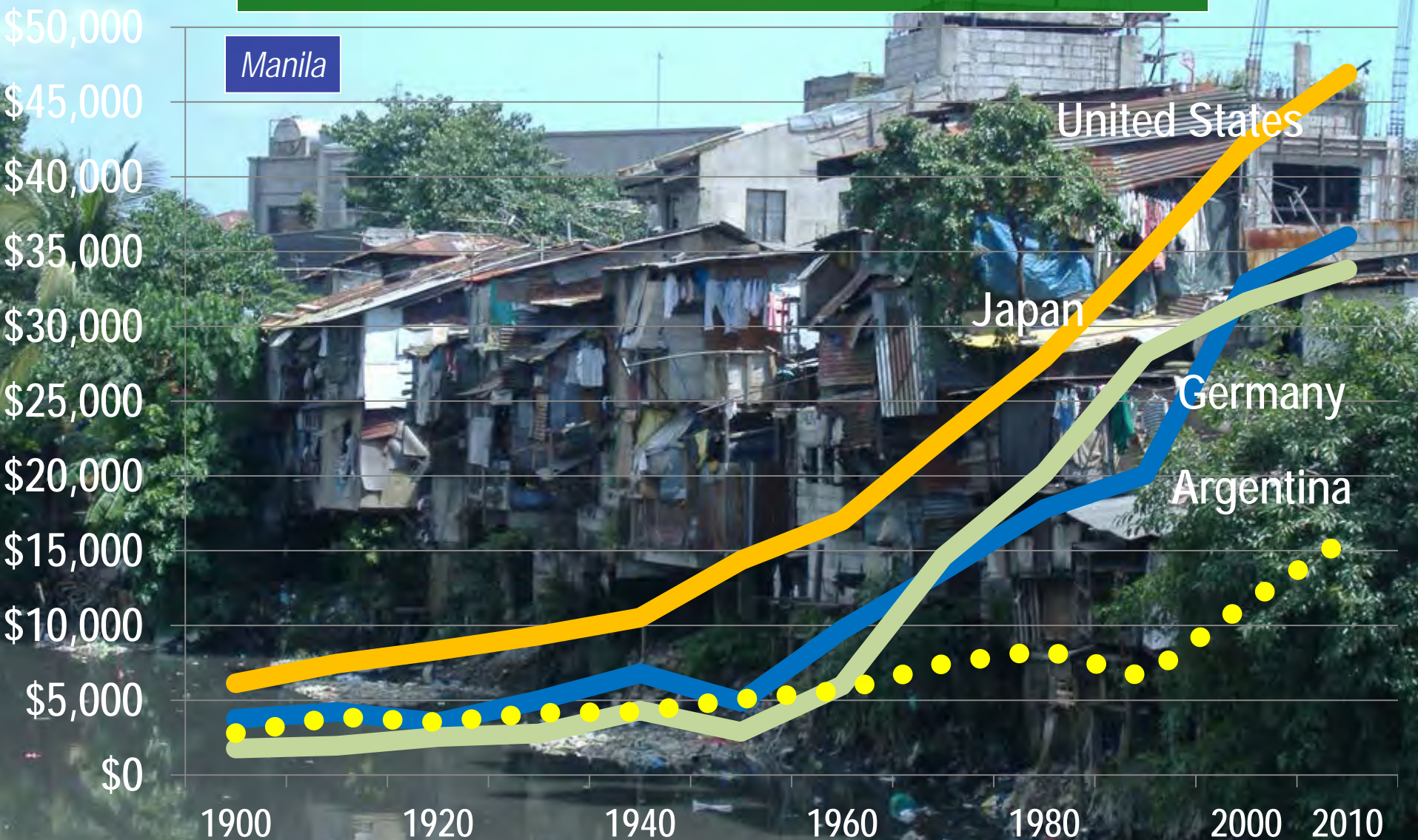


*Kolkata*



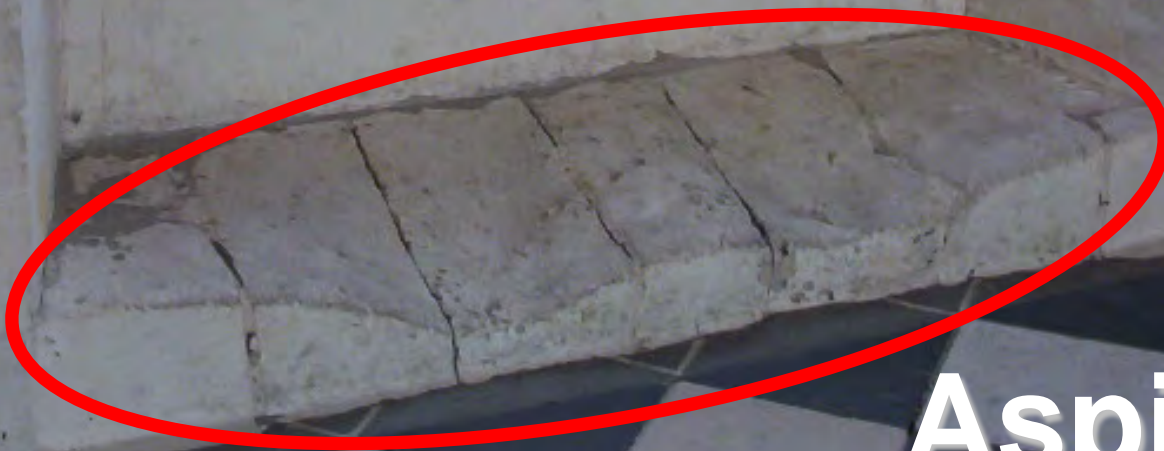
# Prosperity is not Guaranteed

## ECONOMIC POLICIES MATTER





Chenonceaux



Aspiration

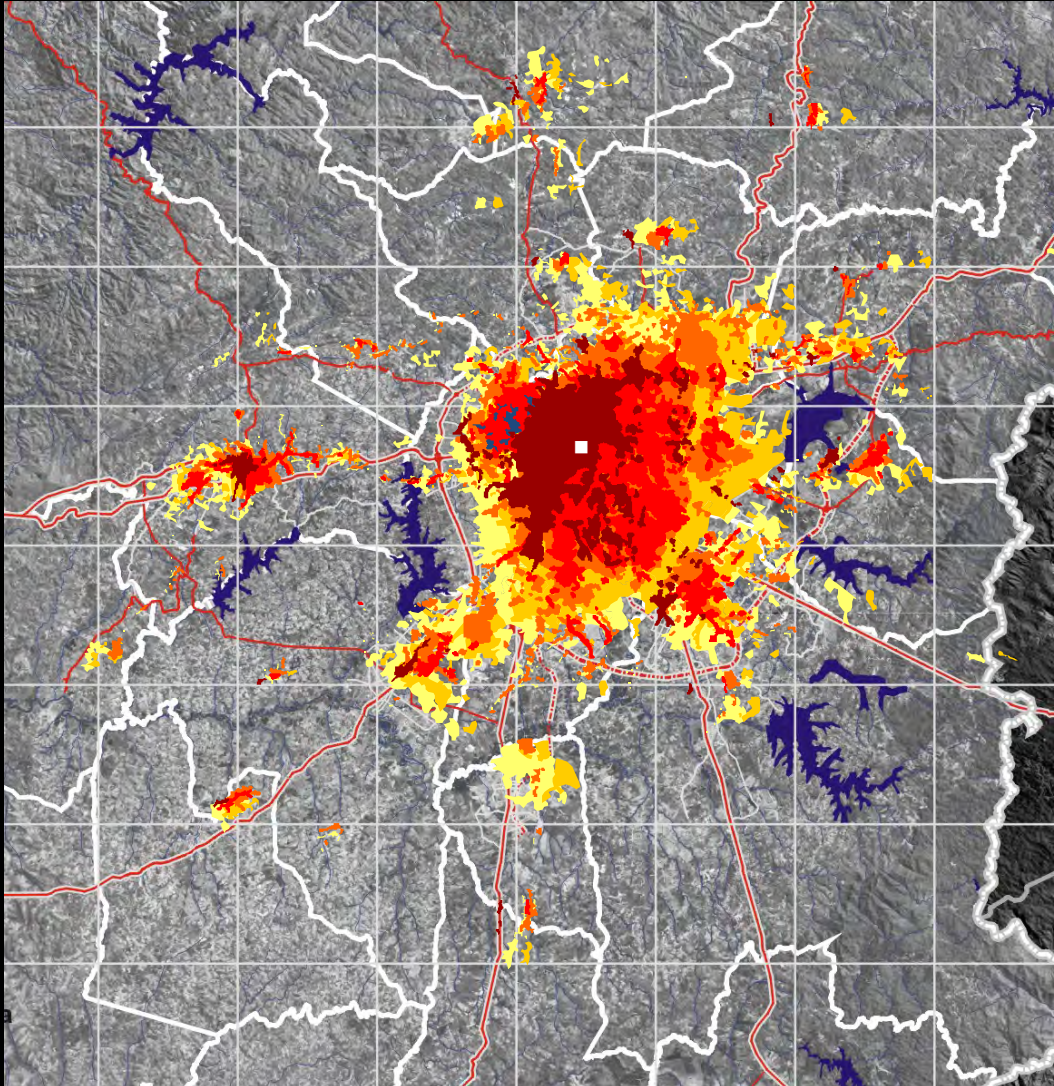
# Increasing Motorization



Bucharest



# Evolution of Urban Growth



## Curitiba and Metropolitan Region

YEAR	POPULATION
1955	360.000
1965	550.000
1975	1.140.000
1985	1.700.000
2000	2.700.000
2010	3.224.286
2020	3.758.358



BENJAMIN M. FRIEDMAN

THE MORAL CONSEQUENCES  
OF ECONOMIC GROWTH



ECONOMIC  
GROWTH:

REQUIRED  
FOR  
SOCIAL  
COHESION