Automobility in Brazil, Russia, India, and China

A collaborative study by the RAND Corporation and the Institute for Mobility Research

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Presentation to the Konrad Adenauer Foundation
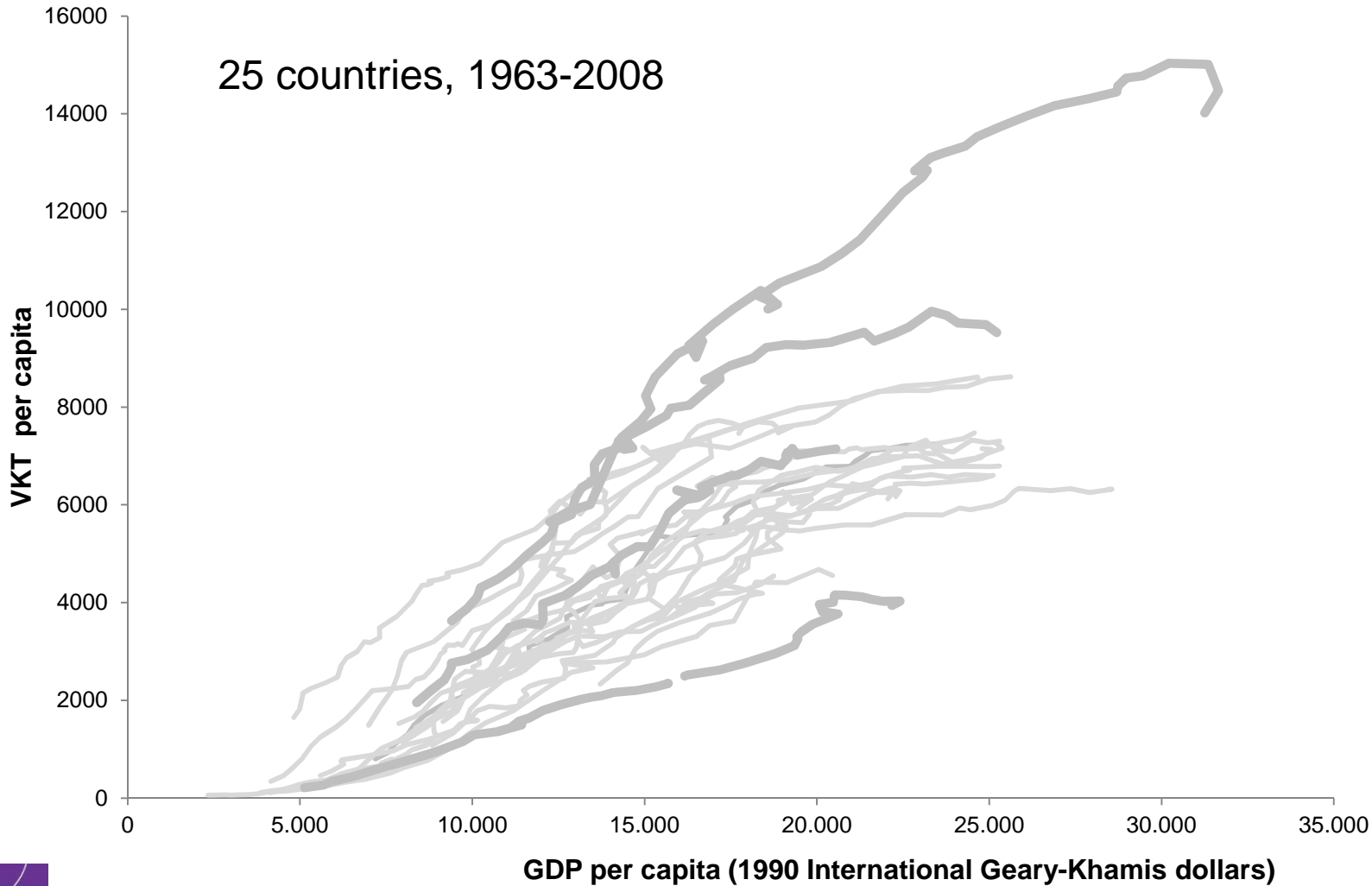
18 February 2015
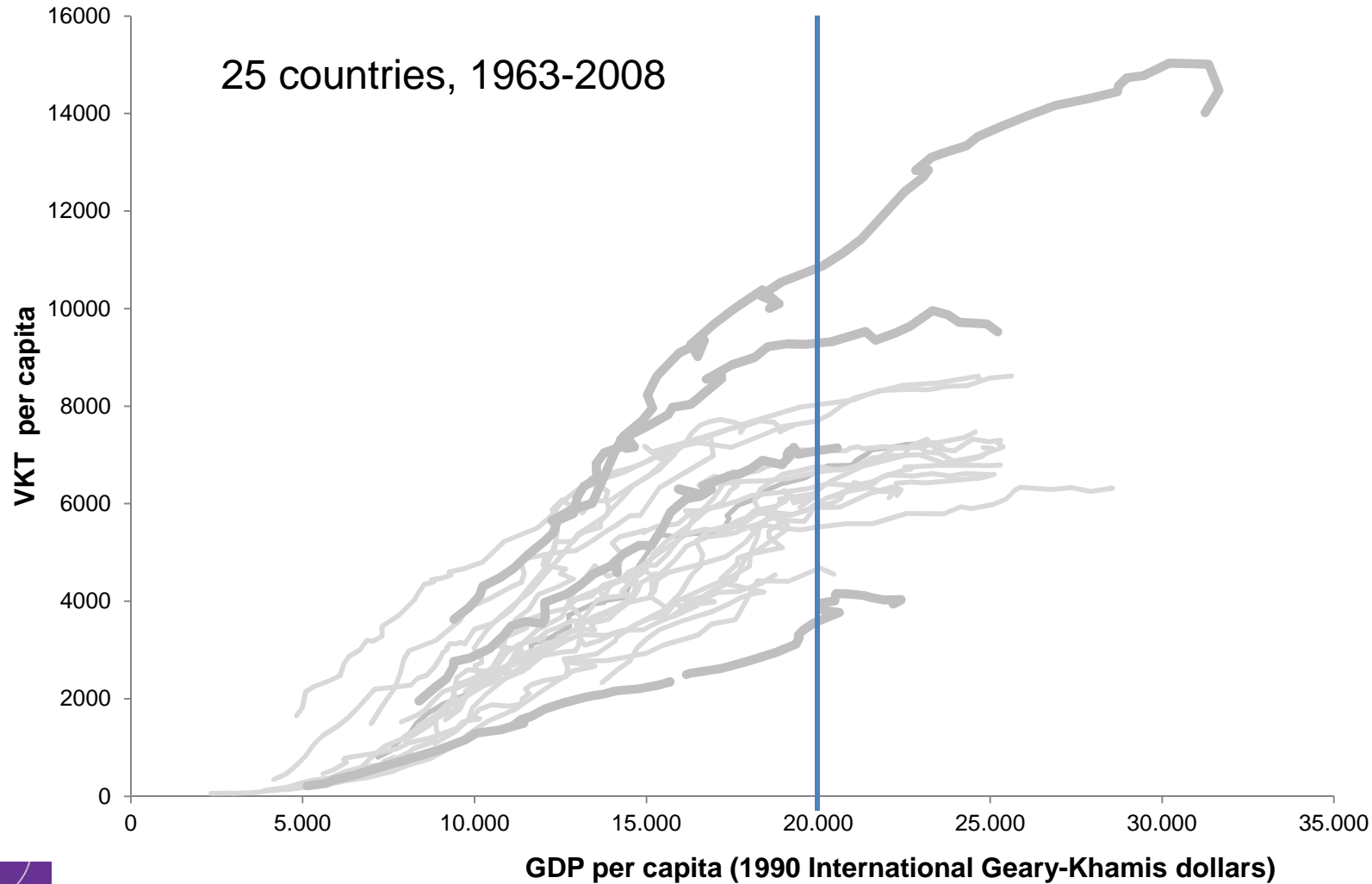
What do we know about automobility?

- In industrialised countries the growth of car ownership and use has started to slow
- But a surge in "automobility" probably lies ahead for numerous emerging economies, including the BRIC countries: Brazil, Russia, India and China
- What can we learn from the industrialised countries about possible future growth in the BRICs?

Car travel increases with income, but the levels vary across countries

25 countries, 1963-2008

VKT per capita (y-axis: 0 to 16000)

GDP per capita (1990 International Geary-Khamis dollars) (x-axis: 0 to 35.000)

Car travel increases with income, but the levels vary across countries

25 countries, 1963-2008

VKT per capita

GDP per capita (1990 International Geary-Khamis dollars)

We seek to understand the non-economic factors that influence automobility
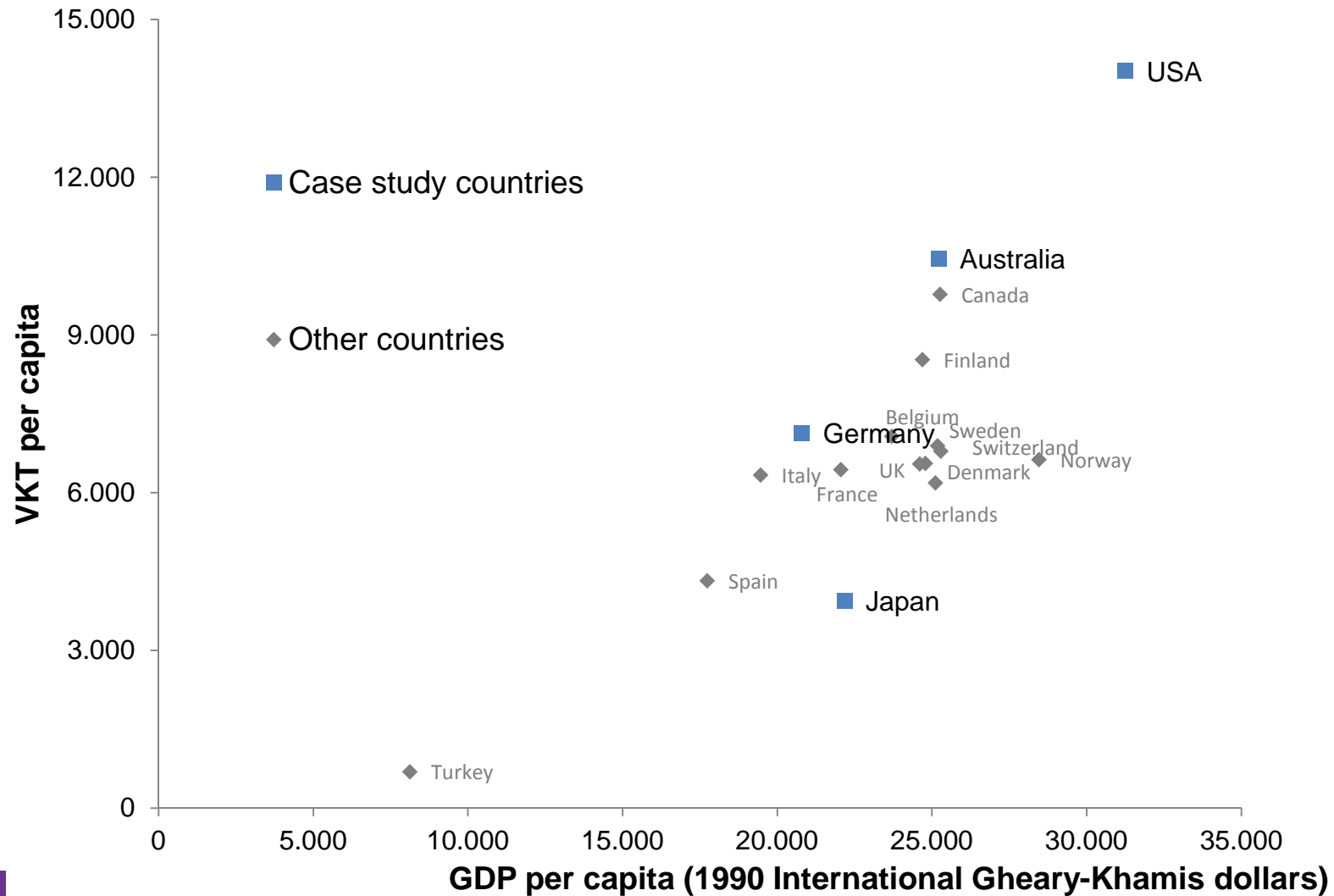
QUANTITATIVE

Examination of automobility development in industrialised countries with different mobility paths and country characteristics
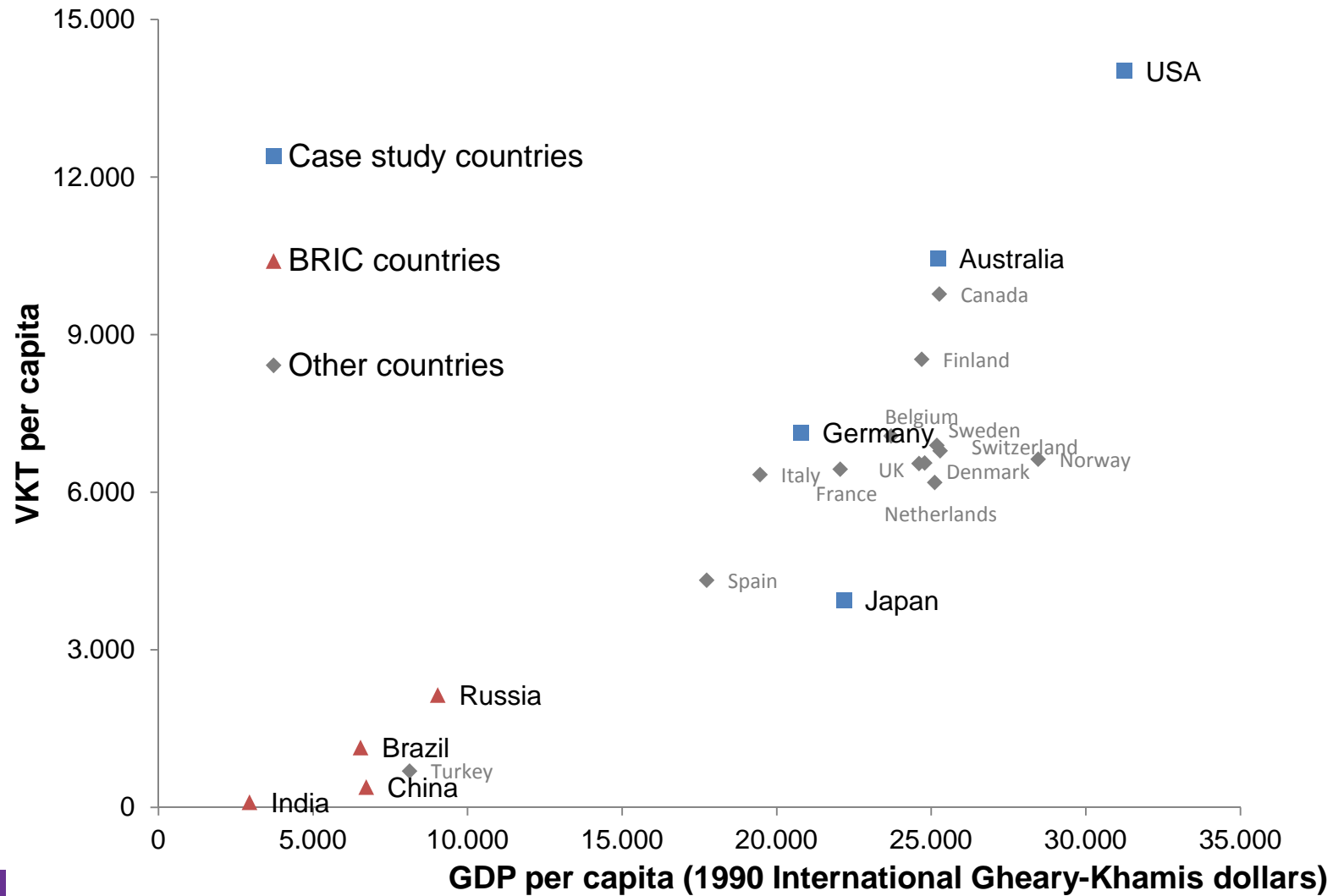
QUALITATIVE

Expert views on how automobility was shaped in the industrialised countries and how factors may affect development in BRICs

We studied four case study countries reflecting a range of automobility levels

Scatter plot. X-axis: GDP per capita (1990 International Gheary-Khamis dollars), ranging from 0 to 35.000. Y-axis: VKT per capita, ranging from 0 to 15.000.

Legend: ■ Case study countries; ◆ Other countries

- USA (~31.000, ~14.000)
- Australia (~24.500, ~10.500)
- Canada (~25.000, ~9.700)
- Finland (~24.500, ~8.500)
- Belgium
- Sweden
- Germany (~20.500, ~7.100)
- Switzerland
- Norway (~28.500, ~6.600)
- Italy (~19.500, ~6.300)
- UK
- Denmark
- France
- Netherlands
- Spain (~17.500, ~4.400)
- Japan (~22.000, ~3.900)
- Turkey (~8.000, ~800)

We studied four case study countries reflecting a range of automobility levels

Scatter plot of VKT per capita versus GDP per capita (1990 International Gheary-Khamis dollars). Legend: Case study countries (blue square), BRIC countries (red triangle), Other countries (gray diamond). Countries shown: USA, Australia, Canada, Finland, Belgium, Germany, Sweden, Switzerland, Norway, Italy, UK, Denmark, France, Netherlands, Spain, Japan, Russia, Brazil, Turkey, China, India.

We identified nine non-economic factors that may influence automobility

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Transport policy factors

Car infrastructure, quality and quantity of roads, parking supply etc.	Inexpensive fuel, cost of fuel relative to income	'Pro-car' policies, e.g. taxation, regulations, etc.	Lack of alternatives, i.e. how car-focused the transport supply is in a country

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We identified nine non-economic factors that may influence automobility

Exogenous policy factors

Active population, proportion of population that are economically active

Presence of domestic oil
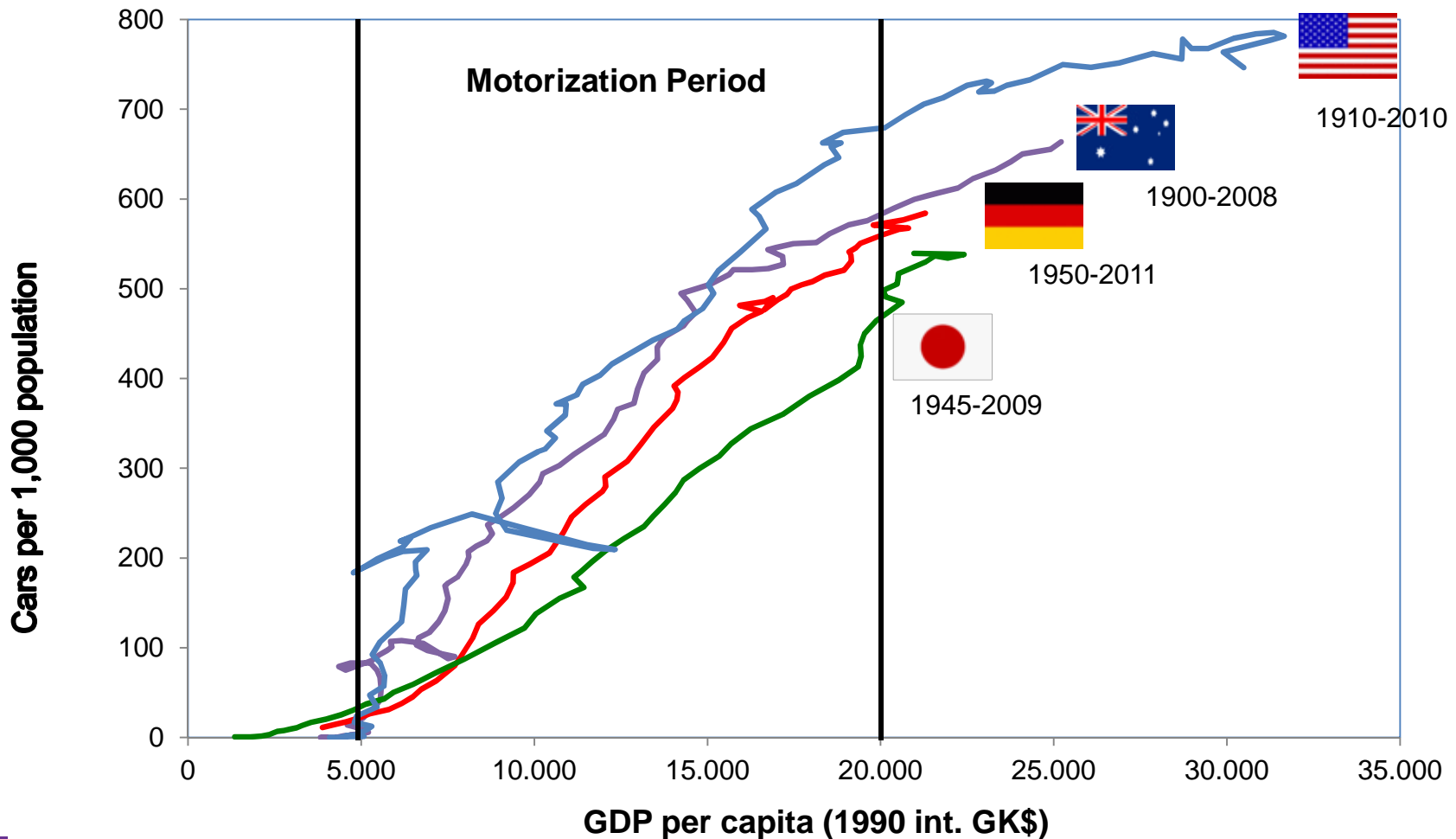
Presence of a domestic car industry

Spatial dispersion, i.e. degree of urbanisation and urban density

Car culture, i.e. overall cultural environment that favours cars or driving

We focussed on the impact of these factors during the key "motorisation period"

Cars per 1,000 population vs **GDP per capita (1990 int. GK$)**

Motorization Period

- United States: 1910-2010
- Australia: 1900-2008
- Germany: 1950-2011
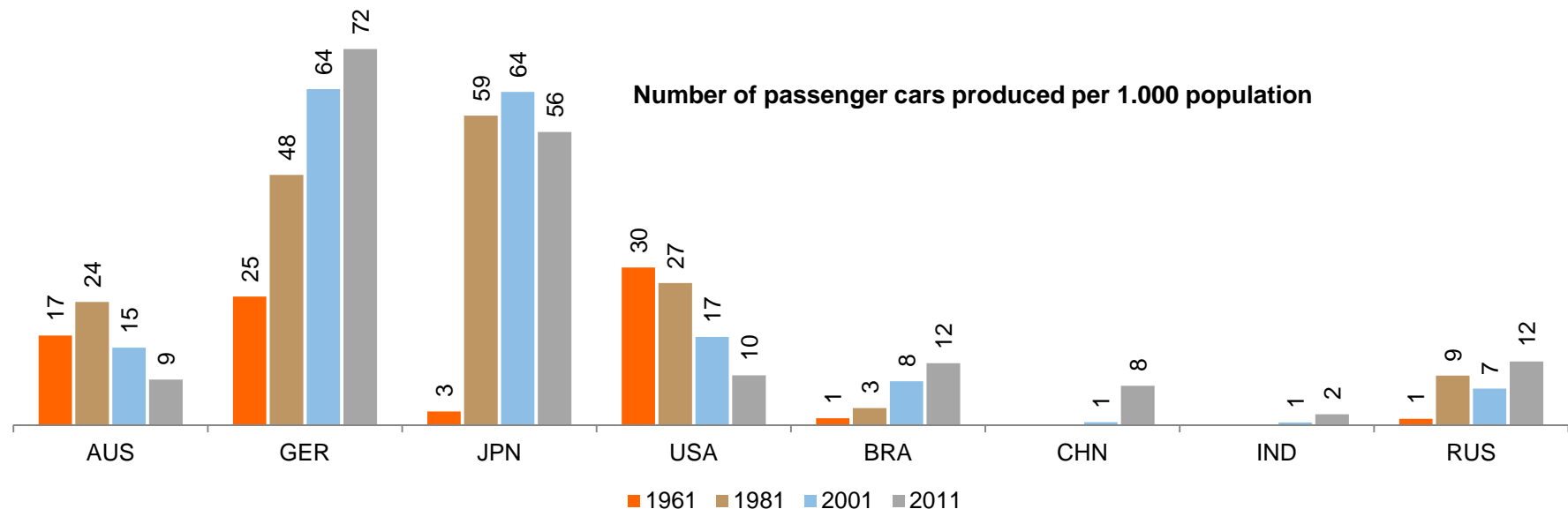- Japan: 1945-2009

Expert elicitation

- A 2-day face-to-face workshop was held with experts from 8 countries
  - 4 case study countries
  - 4 BRIC countries

- Experts were asked to do two tasks:
  - Score the levels of the different factors in their country, both at the start and end of the motorisation period
    - For experts from the BRICs this required some forecasting
  - Indicate the importance of the different factors in terms of automobility

Fact sheets were provided for each factor

Domestic car industry – Fact Sheet & *Reasoning*

Number of passenger cars produced per 1.000 population

Values by country (1961, 1981, 2001, 2011):
- AUS: 17, 24, 15, 9
- GER: 25, 48, 64, 72
- JPN: 3, 59, 64, 56
- USA: 30, 27, 17, 10
- BRA: 1, 3, 8, 12
- CHN: 1, 8 (2001, 2011)
- IND: 1, 2 (2001, 2011)
- RUS: 1, 9, 7, 12

Legend: ■ 1961 ■ 1981 ■ 2001 ■ 2011

Sources: http://www.census.gov/population/international/data/index.html ; national transportation statistics, table 1-23, http://www.rita.dot.gov

OECD Countries:

AUS: In total number, relatively few cars produced

GER: Strong auto industry with *important domestic market and focus on luxury cars*

JPN: Policies support for early auto industry; *car industry aimed at exporting*

USA: First mass production of cars; despite long decline of importance of auto industry world's largest producer until 2009

BRIC Countries:

BRA: *Pro-automobile government policies, e.g. with temporary tax reductions to fuel car sales*

CHN: World's largest car producer since 2009; *production for domestic market; growth will continue*

IND: *Production for domestic market; possibly curbed in the future by restrictive policies; promotion of auto-supply industry for export*

RUS: *Government support for growing car industry in the future; Russian made cars dominate local market;*

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Expert assessment of domestic car industry

has only insignificant domestic car industry

car industry is an important part of national economy

-2 ——————————————————————————— +2

AUS — 1910s

GER — 1950s

JPN — 1960s

USA — 1910s

BRA — 1980s

CHN — 2000s

IND — 2010s

RUS — 1990s

Expert assessment of domestic car industry

has only insignificant domestic car industry

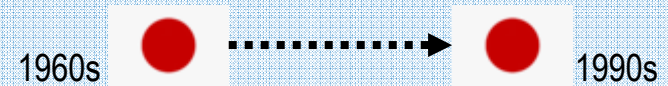*car industry is an important part of national economy*

-2 ———————————————— +2
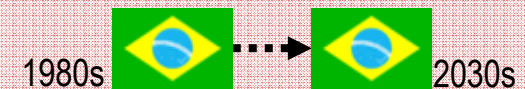
AUS — 1990s ← 1910s

GER — 1950s

JPN — 1960s

USA — 1980s ← 1910s

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Expert assessment of domestic car industry

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AUS
1990s ← 1910s

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1950s → 2000s

JPN
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USA
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BRA
1980s → 2030s
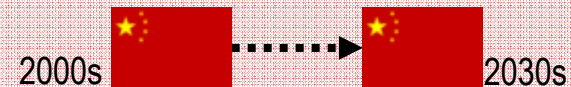
CHN
2000s → 2030s

IND
2010s → 2040s
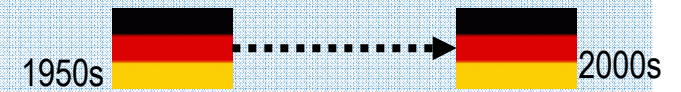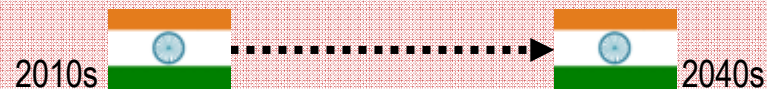
RUS
1990s → 2030s
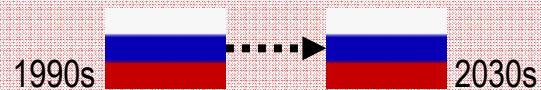
Experts rated the strength of the influence of the factor from 1 to 3

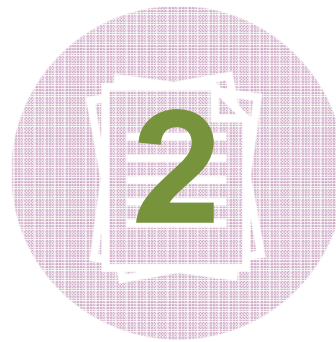## Transport policy factors

3	**2**	**2**	**2**
Car infrastructure, quality and quantity of roads, parking supply etc.	Inexpensive fuel, cost of fuel relative to income	'Pro-car' policies, e.g. taxation, regulations, etc.	Lack of alternatives, i.e. how car-focused the transport supply is in a country

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Exogenous policy factors

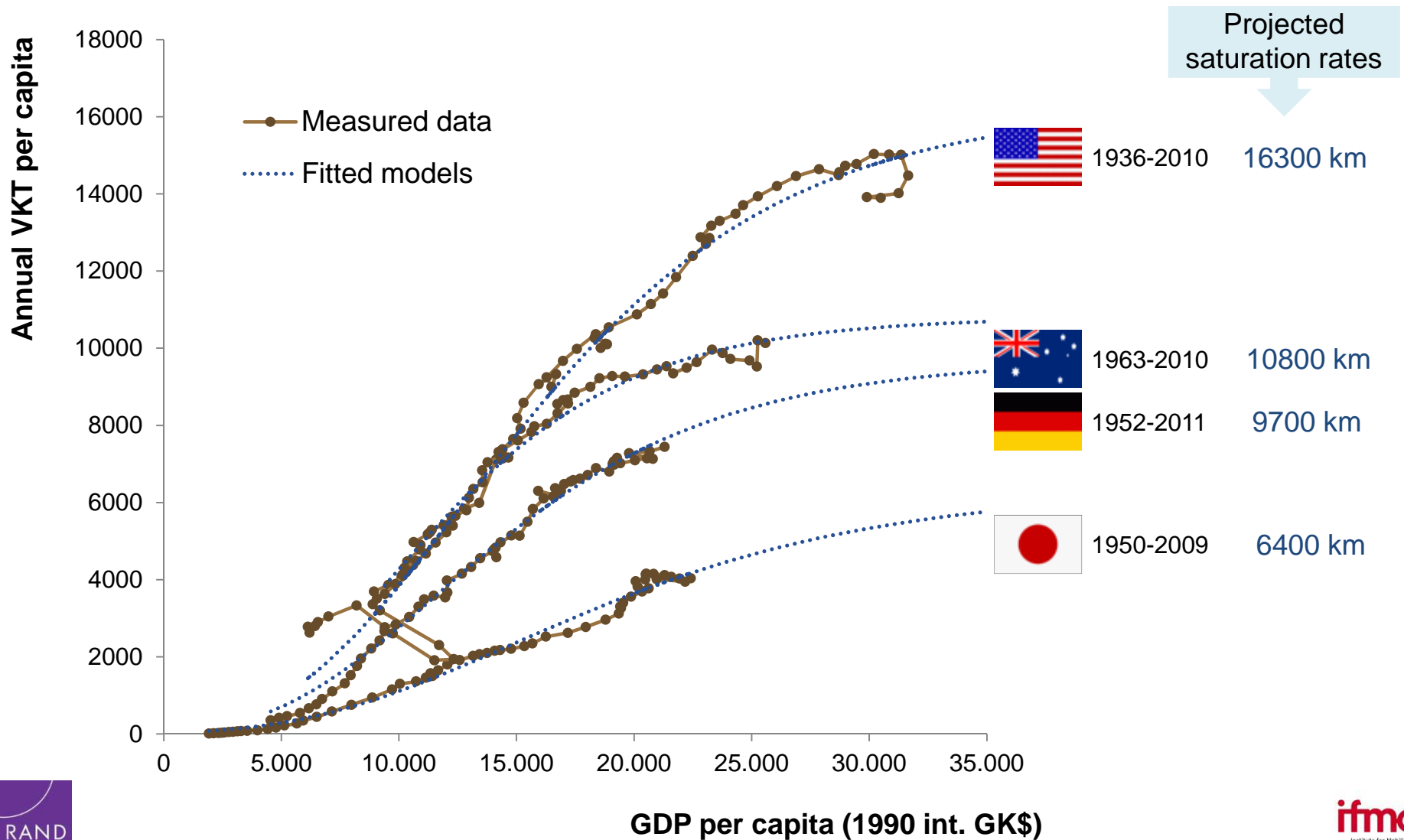| 3	2	2	1	1
Spatial dispersion, i.e. degree of urbanisation and urban density	Presence of a domestic car industry	Car culture, i.e. overall cultural environment that favours cars or driving	Active population, proportion of population that are economically active	Presence of domestic oil

We developed "automobility scores" for each country

- (Σ (Factor weight x factor score at beginning of motorisation period) + Σ (Factor weight x factor score at end of motorisation period)) / 36

- This reflects the "pro-car" orientation of each country; +2 is highly car-oriented and -2 is less car oriented

| -0.51 | -0.49 | --0.35 | -0.26 | 0.03 | 0.23 | 0.46 | 0.87 |

We predicted saturation levels in each case study country…

…regressed the automobility scores against the saturation levels…

JPN
SL: 6,400 km
AS: -.51

GER
SL: 9,700 km
AS: -.26

AUS
SL:10,800 km
AS: .46

USA
SL:16,300 km
AS: .87

Projected Saturation Level for Car Travel VKT/capita]

$y = 6,000*AS + 9,959$
$R^2 = 0.86$

15000

10000

5000

0

-1,00   -0,80   -0,60   -0,40   -0,20   0,00   0,20   0,40   0,60   0,80   1,00

Automobility Score
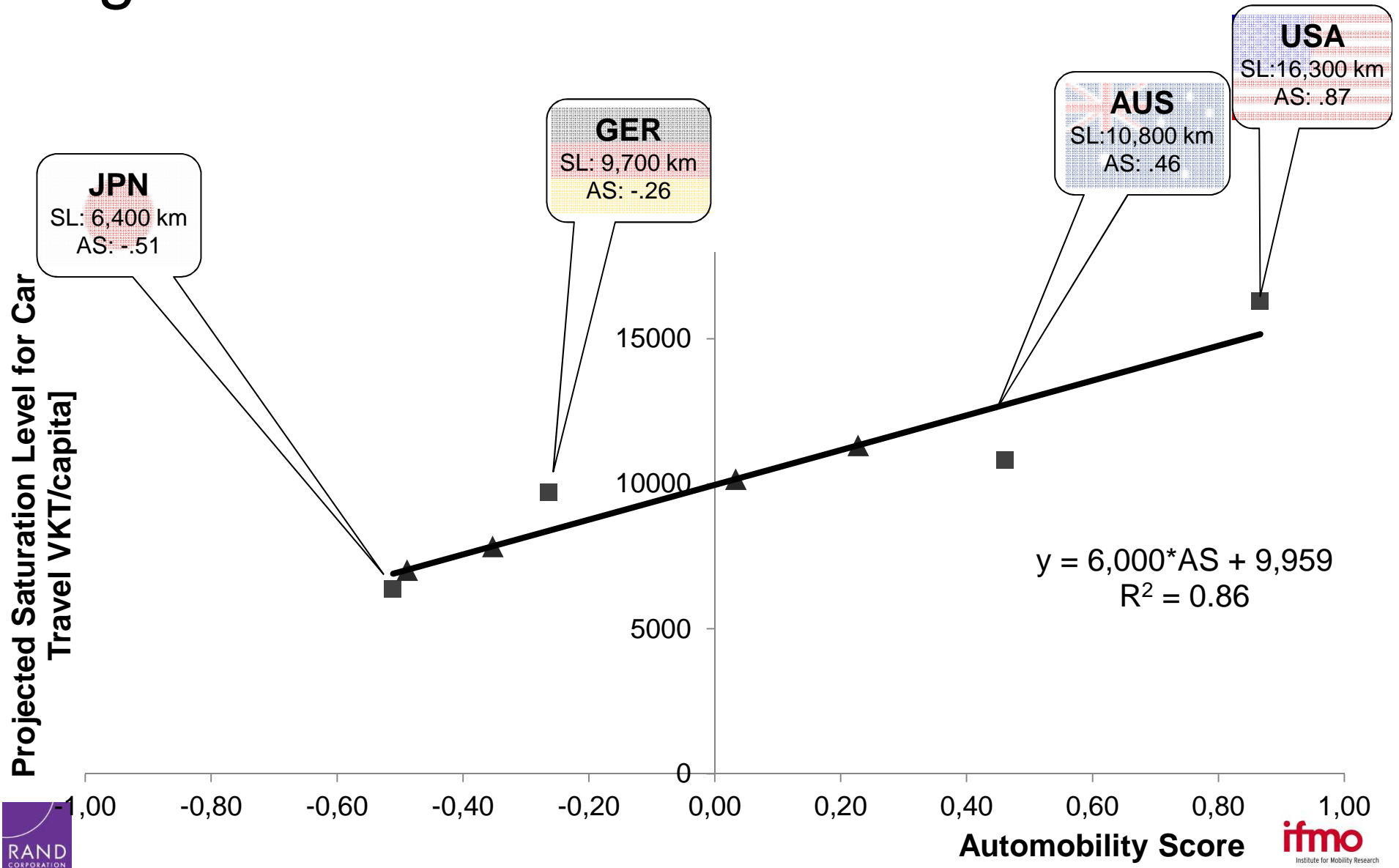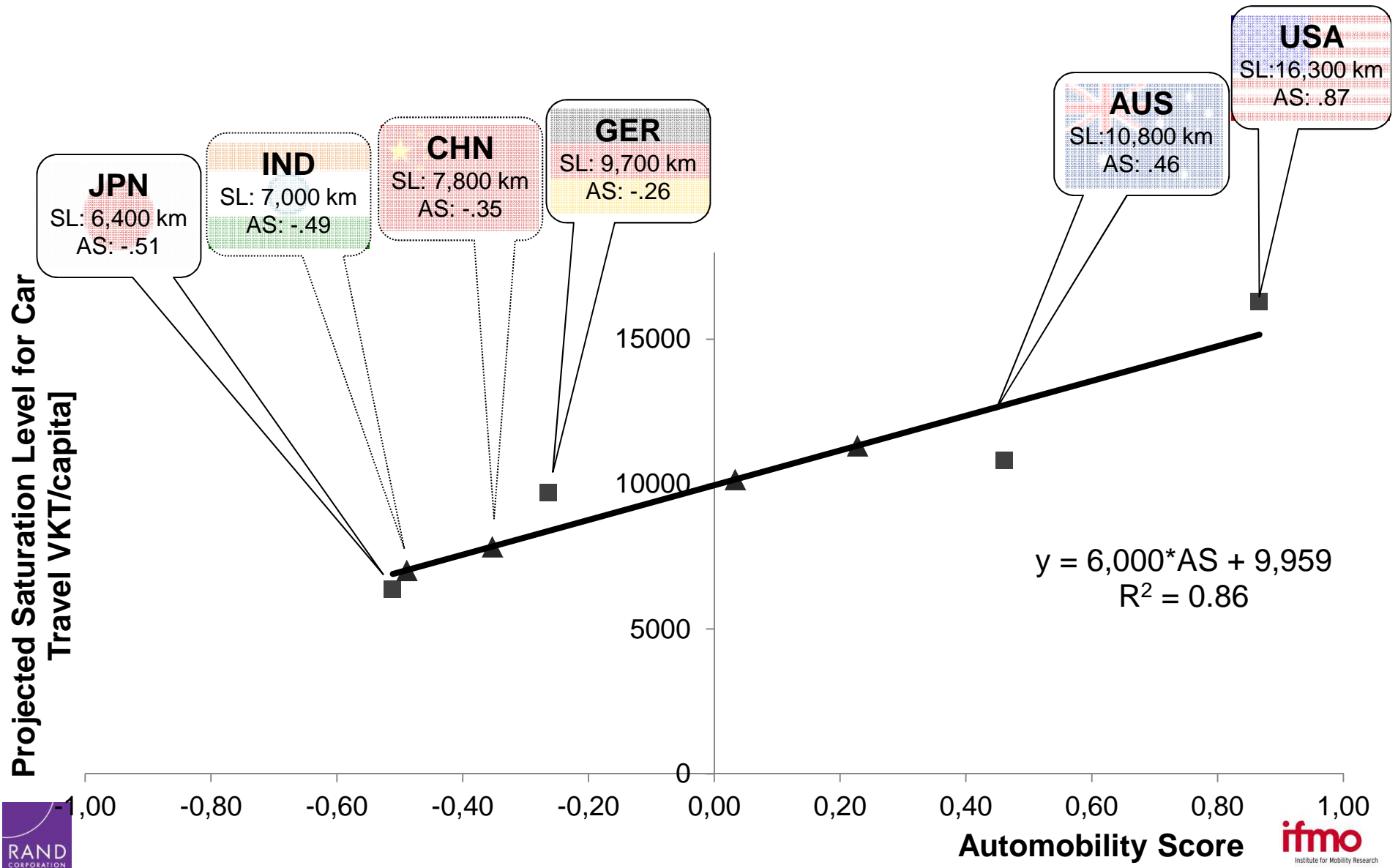
…then used the same model to predict saturation levels in the BRIC countries

…then used the same model to predict saturation levels in the BRIC countries

USA
SL:16,300 km
AS: .87

AUS
SL:10,800 km
AS: .46

RUS
SL:10,200 km
AS: .03

GER
SL: 9,700 km
AS: -.26

CHN
SL: 7,800 km
AS: -.35

IND
SL: 7,000 km
AS: -.49

JPN
SL: 6,400 km
AS: -.51

Projected Saturation Level for Car Travel VKT/capita]

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$y = 6,000*AS + 9,959$
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-1,00   -0,80   -0,60   -0,40   -0,20   0,00   0,20   0,40   0,60   0,80   1,00

Automobility Score

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-1,00   -0,80   -0,60   -0,40   -0,20   0,00   0,20   0,40   0,60   0,80   1,00

Automobility Score

Key findings and conclusions

- Transport policy and other policies have an impact on automobility levels
  - Income is not destiny
- Transport policy interventions that impact automobility levels
  - Quality of infrastructure
  - Fuel prices, fuel tax levels
  - Parking availability / costs
  - Car ownership costs, taxes on new cars, inspection regimes
  - Taxation regimes for company cars
  - Driver license acquisition requirements / costs
  - Fuel economy / GHG emission standards
  - Quality of other alternatives, investment in rail, public transport
  - Land use planning