

# FUNDAMENTALS

## Global passenger car penetration: Grid lock!

Population density and the implications of growing congestion in emerging market urban areas could limit growth in vehicle penetration.

Usage rates are likely to peak at levels significantly below the developed world. We believe consensus forecasts are too optimistic about the long-run growth in emerging market car fleets. The implications for oil demand could be significant as forecasts become increasingly sensitive to the rate of electric vehicle adoption.

### THE FUTURE OF THE GLOBAL CAR FLEET

In our previous fundamentals “Whatever happened to peak oil?” we highlighted the implications of peak oil demand on global energy markets. Overly-optimistic fuel efficiency improvements assumed in oil demand forecasts led us to draw the conclusion that peak demand is still some way off. Notwithstanding potential volatility in the short to medium term, oil producing companies and countries should remain a credible counterpart in the opportunity set for long-term investors.

In this article we will dive deeper into the implications of car

penetration on peak demand, with a particular focus on usage rates in the emerging world which play a pivotal role in forecasting the size of the future global car fleet.

Failing to factor in the effects from population density and congestion in emerging market urban areas has led to forecasters overstating demand growth expectations for the global car fleet over the very long term.

The consequences of this are significant, potentially leading to oil demand from the mid-2020s onwards to become extremely sensitive to assumptions about the rate of adoption of electric vehicles.

### REACHING SATURATION POINT

Buying a car for the first time is often a significant and symbolic step in life. People in developing countries are increasingly taking this step for the first time, however vehicle ownership rates remain materially below the levels observed across developed market peers. Whilst penetration levels vary among developed markets, even using less

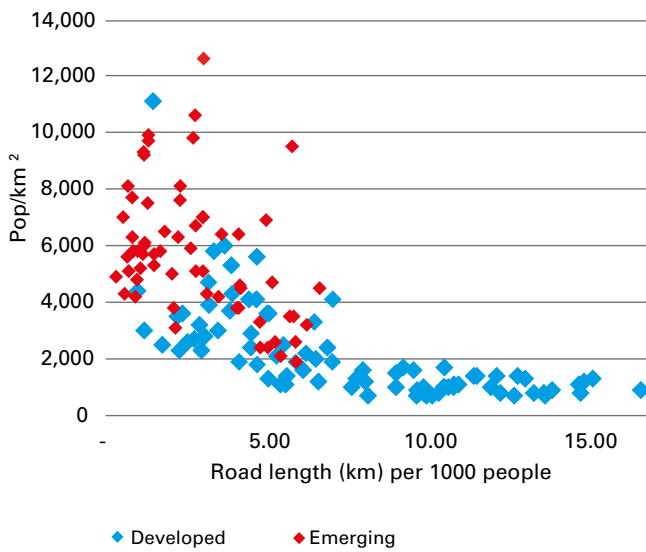


vehicle-dense developed market countries as a benchmark implies that the growth potential from the emerging market car fleet could be significant.

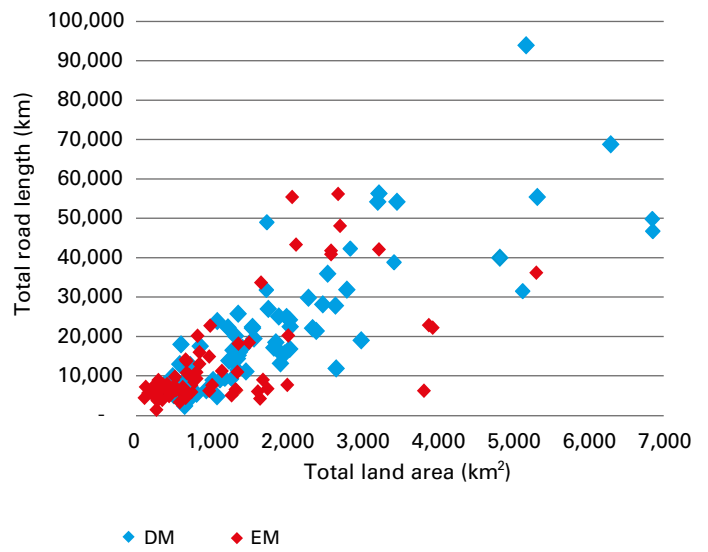
However, a critical utility to owning a car is the ability to drive it and just as importantly the ability to park it. Anyone who has visited large emerging market cities like Beijing and Mexico City will know traffic congestion is a major issue for urban areas in the developing world. Generally speaking, cities in emerging market countries have higher population densities than their developed market counterparts. They also have less available road space, both in per capita terms and relative to total land area.

Figure 1: Average road length versus population density

Road length per 1000 people vs population density



Road length per km² vs total land area



Source: Demographia, TomTom Traffic Index

Our analysis suggests developed market cities have an average road length of 7.69km per 1,000 people compared to just 2.78km in emerging market cities. For the largest 18 cities in China we observed that the average road length per 1,000 people is a diminutive 1.03km (figure 1).

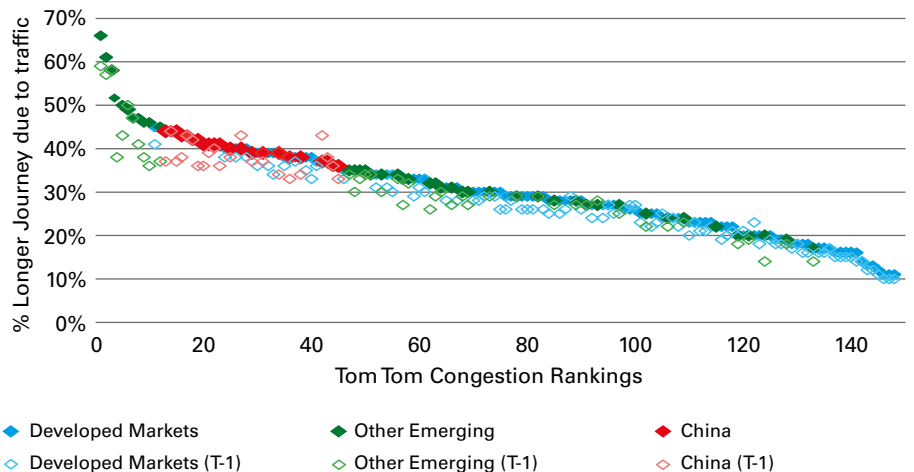
Unsurprisingly, cities with the largest per capita road lengths are found in the United States and Australia, countries where vehicle ownership rates are among the highest in the world.

Twenty-three of the top twenty-five most-congested cities in the world are located in developing nations, with 10 of the top twenty-five in China alone (figure 2). Furthermore, the largest year on year increases in congestion have generally occurred in the cities already suffering from the worst traffic problems.

Many of these cities suffer from antiquated urban planning and were not designed for today's volume of motor vehicle traffic. The Chinese road network grew just 30% over the last decade while the number of vehicles on those roads quadrupled<sup>1</sup>. Unless government authorities invest heavily in road infrastructure these cities will remain structurally under-developed relative to their population size.

We are already starting to see the effects of congestion impact vehicle sales in China, which is now the world's largest passenger car market. In 2015, vehicle sales to customers in Tier 1 cities in China fell by 9.1% despite continued growth in per capita GDP, with car penetration rates now less than half of those in Western Europe.

Figure 2: Traffic congestion effects on journey time



Source: LGIM Analysis, TomTom Traffic Index 2016. The full index is 390 cities across 48 countries, however we filtered out cities with population <800,000 leaving a sample size of 148 cities across 35 countries, ranked by the average additional time it takes to travel relative to non-congested conditions using real-time passenger data

1. Bloomberg industries

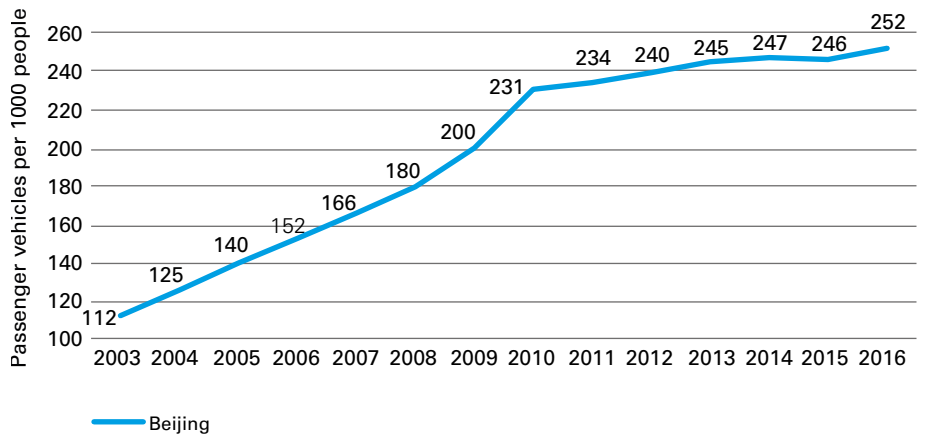
**A CASE STUDY – VEHICLE OWNERSHIP IN BEIJING**

Many Chinese cities have also implemented vehicle restrictions driven by pollution concerns and road congestion. A lottery system implemented in Beijing in 2010 has grown increasingly competitive, leaving prospective car buyers with just a 1-in-783 chance of being awarded a license plate in the final round of 2016. The impact from the lottery on the growth rate of car penetration in Beijing is quite clear from the data presented in figure 3. Some eastern cities in China are even piloting programs to grant preferential license allocations to new energy efficient vehicles, which is particularly concerning for the gasoline demand outlook.

Chinese cities that have implemented or considered implementing car sales restrictions have an average vehicle penetration of 220 cars per 1,000 people. If we extrapolate this experience across China using 220 cars per 1,000 as a threshold for implementing similar policy changes, car fleet growth begins to slow by 2022. By 2035 we estimate that the Chinese car fleet would be over 108 million cars smaller than it would be without car sales restrictions. This translates into a reduction in oil demand of over 2.5mb/d of static fuel efficiency. Of course, not all of China will be heavily urbanized, so a countrywide penetration rate of 250 per 1,000 people is probably more reasonable to allow higher penetration rates in rural areas, and smaller cities with lower density and fewer public transportation options. Even so, using 250 cars per 1,000 as a threshold would see fleet growth begin to slow by 2024, and by 2035 the car fleet would

**Figure 3: Beijing car penetration**

Passenger vehicles per 1,000 inhabits



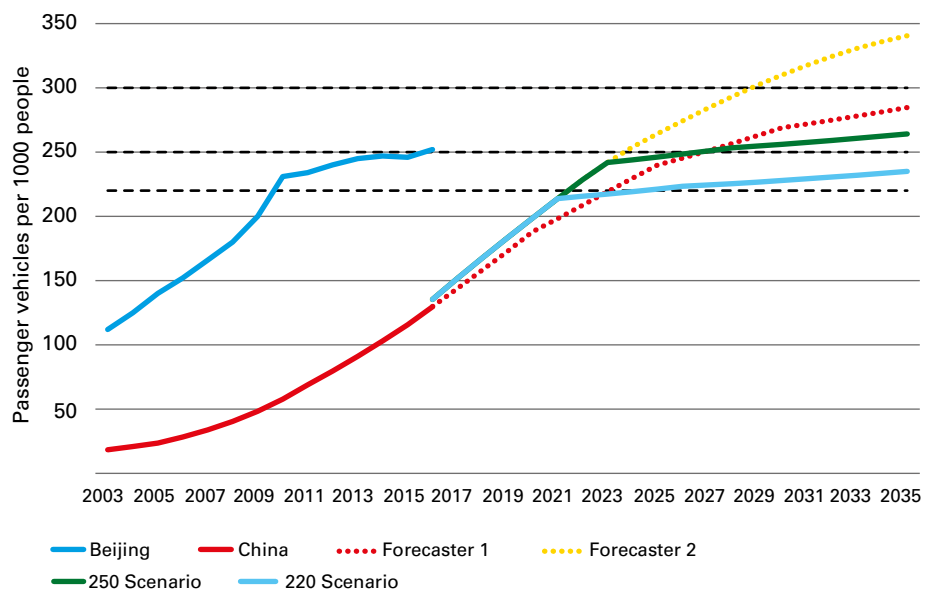
Source: LGIM Analysis, Bernstein Research

be nearly 68 million cars lighter, resulting in oil demand destruction of nearly 1.6mb/d (see figure 4).

Our research suggests that in the wealthiest segments of Chinese society – those with income levels that roughly replicate their middle class peers in the developed world – car ownership levels are already in line with Europe, or the UK. This presents a significant problem to governments in emerging markets like China – social fairness. If not everyone can own a car because of the wealth effect, how are

the authorities going to deal with the perceived inequality between those who were wealthy first, and those who become wealthy later? Lottery systems are useful, but only to a limited extent. Other densely populated countries like Singapore and Hong Kong have managed this problem by substantially and artificially raising both the cost of and utilisation of private car ownership. We suspect this solution is much more palatable in a relatively developed and wealthy economy than in a relatively undeveloped, unequal and growing one.

**Figure 4: Chinese vehicle penetration**



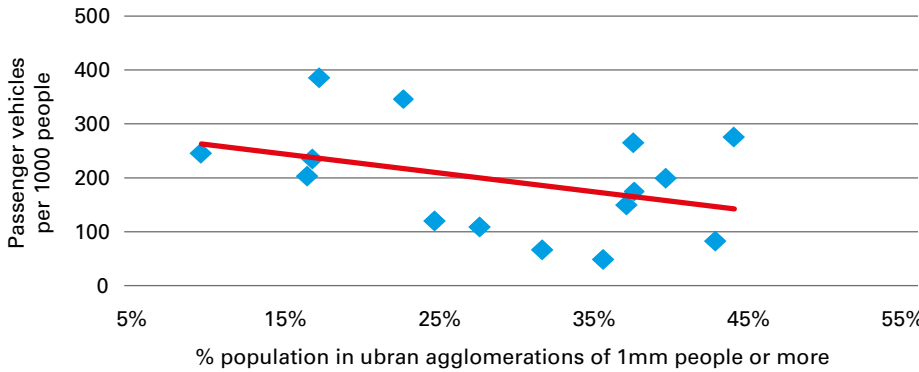
Source: LGIM Analysis, Bernstein Research, Morgan Stanley

In a recent survey<sup>2</sup> Chinese consumers were asked their opinions on car ownership and alternatives to owning cars. Of the respondents, 42% believe that owning a car is less appealing due to high car maintenance costs and deteriorating traffic congestion, whilst 40% believe that they can live without a car and prefer to rent when one is needed. Perhaps equally concerning for optimistic auto penetration forecasters is that 60% of respondents no longer view owning a car as a status symbol.

However, it remains a view by many forecasters that urbanization is expected to be the crucial driver of upward income mobility in emerging markets, as the economic benefit of millions of people moving into cities leads to higher living standards and increased purchasing power. We do not dispute the idea that income growth generally drives higher rates of car ownership, but if income growth is driven by urbanization it means that people migrating into the middle class are also migrating into cities where traffic congestion is reaching unsupportable levels.

Whilst passenger vehicle penetration is highly correlated to a rise in income levels, it tends to decrease as a greater share of the population live in

**Figure 5: Urbanisation versus car penetration**



Source: World Bank

cities where public transport is readily available and the right to drive a car is increasingly under attack through government policies (figure 5).

**BOTTOM LINE**

In our view, many long-term forecasts calling for massive increases in the global car fleet driven by surging vehicle adoption rates in emerging market countries fail to take into account the impediments highlighted in this report. We struggle to believe that per capita vehicle penetration can increase significantly in places like Mexico City, where journey times have increased on average by 66% due to traffic congestion<sup>3</sup>.

Our previous analysis led us to conclude that peak demand is still some way off. However, we believe forecasters have overstated demand

growth expectations for the global car fleet by failing to factor in the impact from population density and congestion in emerging market urban areas. Whilst we remain confident that in the short to medium term, the outlook for oil demand from passenger vehicles remains robust, the picture in the longer term is a lot less clear. The most important consequence of this is that oil demand from the mid-2020s onwards is going to become extremely sensitive to the adoption rate of electric vehicles. We intend to demonstrate in subsequent work that there is significant uncertainty around these forecasts. The outlook for oil markets as we move into the middle and end of the next decade is going to be exceptionally uncertain.

2. 2016 survey by McKinsey and Company - poll based on 3,571 consumers  
 3. Data provided by TomTom

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