

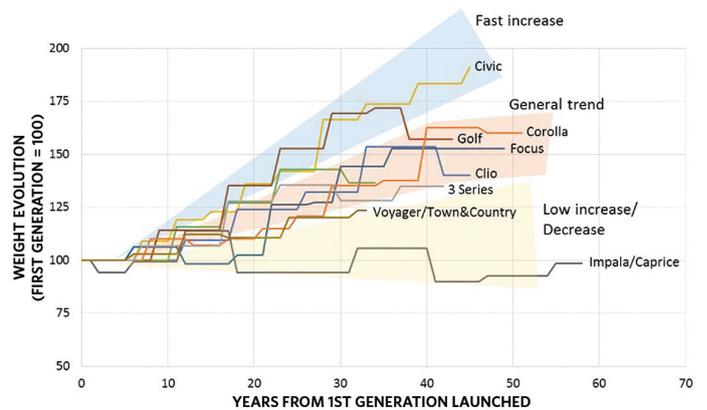
# GFEI Working Paper 17: Wider, taller, heavier: Evolution of light duty vehicle size over generations

GFEI working paper 17 examines global trends in vehicle size and weight over time, and explores the implications for fuel economy policy. It finds that vehicles are getting larger, potentially counteracting many fuel economy benefits from lighter materials and improved aerodynamics.

## Vehicles have got heavier over the past 50 years

Analysis by model (Figure 1) shows that over 50 years, vehicle weight has been the parameter that increased the fastest generation after generation. Most of the models in the analysis increased in weight by more than 50% over about 40 years. The Honda Civic has increased in weight by more than 90% since its market introduction in 1972 for the last generation launched in 2017. Designers of some models, such as the VW Golf, deployed weight-reduction strategies for the last generation that partly compensated for the more significant weight increases of previous generations.

FIGURE 1: WEIGHT EVOLUTION FROM MARKET INTRODUCTION OF TYPICAL LONG-LASTING MODEL NAMES

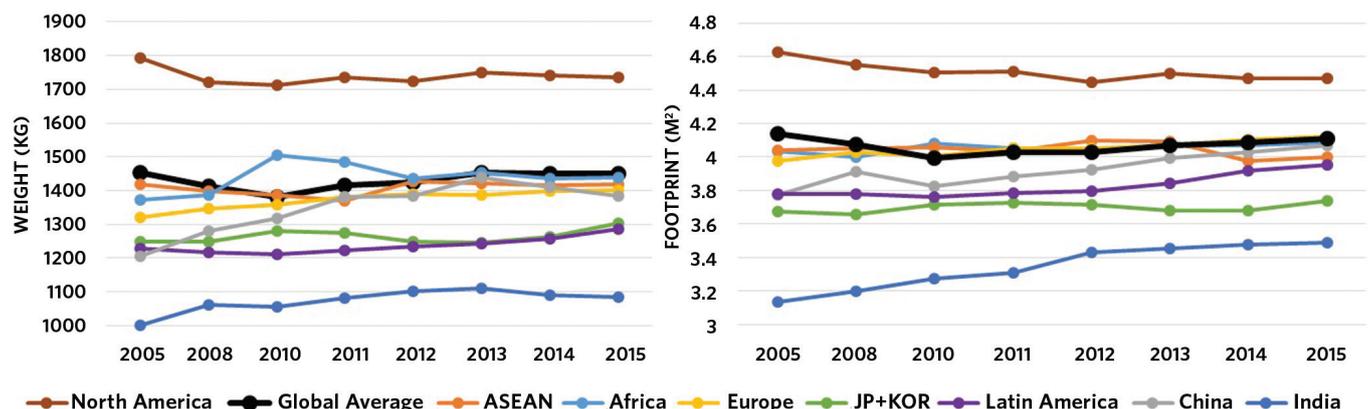


## Average light-duty vehicle weight and size varies between regions

Analysis of GFEI's database of 70 million new vehicles reveals that the average new vehicle increased in weight by 5% and increased in footprint by 3% between 2010 and 2015. This is in part driven by trends in the Chinese market, which has the highest annual vehicle sales. In China, the average weight has increased by 30% in a decade, and footprint increased by 20%, to move in line with European averages. Indian-made vehicles are on average the smallest and lowest-powered, while the US market is the largest, heaviest and most over-powered. The average US-made vehicle in 2015 was 30% larger, 60% heavier, and 180% more powerful than the average Indian vehicle.

In North America, vehicles are on average the largest and heaviest of any region - although the average vehicle did get slightly lighter and smaller over the decade. However, in India and Latin America vehicles are getting heavier - albeit from a smaller and lighter starting point (Figure 2).

FIGURE 2: CHANGES IN WEIGHT AND FOOTPRINT BY REGION (2005-2015)



# There has been a dramatic increase in demand for SUVs

Vehicle size is a key parameter in car purchase decisions. There has been a dramatic increase in demand for SUV body styles in recent years, shifting markets towards larger, taller and heavier vehicles (Figure 3). SUVs have similar footprints to sedan vehicles, but are taller and heavier. As fuel economy certification test cycles use a lower average speed than drivers typically travel, they do not fully capture the aerodynamic load of SUVs, which tend to have a bigger frontal area because of the height - a preferential treatment.

Technical innovations to improve fuel economy have been used to limit fuel consumption growth that would have otherwise occurred because of substantial weight increases. Light-weighting is starting to be deployed on a large scale in some models through a variety of approaches depending on the manufacturer - such as substituting lighter materials, or design modifications.

However, evidence also suggests battery electric vehicles still have a 'weight penalty' because of the battery pack. Currently most BEV makers prefer to use improvements in the power density and specific power of the batteries to increase vehicle range, rather than to reduce vehicle weight.

The report concludes:

- Interior size should not be used as a vehicle size metric
- Harmonised worldwide definitions for vehicle segments would reduce confusion and improve policies. Definitions should be developed by an authoritative independent body at the global level. A UN framework would be an appropriate arena for defining and maintaining such a classification scheme.
- Real-life fuel economy measurements complementing laboratory tests should be implemented to better capture real-life driving conditions.
- Corporate average weight reduction targets should be considered to encourage to weight-reduction strategies, and would decrease the need for high engine power.

FIGURE 3: GLOBAL MARKET SHARE BY BODY STYLE, 2005 TO 2015

