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Product leasing – a strategy to allow manufacturers and customers to benefit from elongation of product life.

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Abstract:

International development means that the number of people who can be considered as consumers is projected to triple by 2030. This is good news but if we consume goods in the same way as people did in the 20th Century it will lead to an unsustainable rise in industrial greenhouse gas emission and contribute towards material scarcities. The old axioms of maintaining profits by high turnover of low profit margins goods, and boosting demand by releasing new models need to be reconsidered for a sustainable future. The key point is that people's needs are met by using goods not just acquiring them. One way of reducing the demand for new goods is to use old ones for longer. This study looked at second hand car data and concluded that cars are scraped when they have a low market value not when they are worn out. It follows that if the second hand value can be raised, cars could potentially be used for longer. One way of increasing the value of a second hand item to a business is to value it as a future profit generator as well as its market value. A long term lease model has been considered and found to be potentially beneficial to both the supplier and customer.

Introduction

There is agreement amongst governments that Green House Gas (GHG) emissions need to be reduced (UN, 2012). The International Energy Agencies 450 scenario (IEA, 2013) shows the emission trajectories needed to limiting the rise global temperature to 2° C by 2100. It call for a 5% reduction in industrial emissions (excluding those associated with electricity use) from 2010 levels by 2035. It has been estimated that the number of people who will be wealthy enough to enjoy a developed world lifestyle will rise from 1.8 billion in 2009 to 4.9 billion in 2030 (Kharas,2010). Assuming this results in a proportionate increase in the demand for goods, the emissions per unit of production in 2030 (E_{2030}) will have to meet the following condition for the emission target to be met:

$$E_{2030} = \frac{1.8}{4.9}\frac{95}{100} E_{2010} = 0.35E_{2010} \quad \text{Equation 1}$$

An alternative strategy is to get more use out of the goods we produce so we need less of them (Cooper, 2005). This can be done by either by sharing them between users or by making them last longer. This paper considers the second of these options. It does so by examining car use in the UK. This sector has been chosen as it uses an energy and material intensive product. With 2 million new cars registered in the UK each year (DFT,2013) the GHG emissions associated with manufacturing and maintaining of cars accounts for 1.5% of the UK's total annual consumption based GHG emissions (House of Commons Energy and Climate Change Committee, 2012).

The analysis indicates that cars are likely to be scrapped when the owner thinks that the investment necessary to maintain and repair them may not be reflected in their market value. A long term leasing model is proposed as a way of revaluing old cars that will make it

more likely for them to remain in service for longer.

How long do cars last

Cars change owners around 4 times during their life (Cooke, 2013). Consequently most new car buyers have little interest in the length of time that the car is designed to last for so it is not included in sales literature. Car lives taken form Life Cycle Assessment (LCA) reports vary widely from for 150,000 to 310,000 km (Schweimer, 2000; MacLean, 2003; Wang, 2012). The Department for Transport (DFT) published the odometer readings for a sample of cars that pass their MOT test (UK's statutory roadworthiness test for vehicles over 3 years old) in 2012 (DFT, 2013). The sample size gives an indication of the number of cars that are still in use. It has been adjusted to take into account the differences in the number of cars registered each year and is plotted along with the median, first and ninth decile odometer reading for distance travelled by the cars in Figure 1. Figure 1 shows no sign of an inherent age cut off on vehicle life. The median and ninth decile figures increase linearly with age up to 8 years when they then appear to plateau with the ninth decile approaches 280,000 km. So it appears that cars have a potential life of 280,000 km. The plateau in the median curve is consistent with higher millage cars being scrapped. The drop of in the sample size for older cars supports this theory.

The Automobile Association (AA) estimate that private cars in the UK cover an average of 14,800 km/year so cars should last an average of 19 years if they were all driven for their operational life.

The DFT publish data on the numbers of cars that are registered for use on the roads by year of registration (DFT,2013). This has been used to calculate the fraction of cars produced in a given year that are still in use which is shown in Figure 2. The percentage in use curve shows that 50% of cars are no longer taxed for use on the roads when they are 13 years old.

The other curves on Figure 2 are the upper and lower market values of an average car expressed as a percentage of its new list price. This was produced by generating depreciation curves for eight car models shown in Table 1, using dealers asking prices from the online multi dealer car sales web sites "auto trader" (http://www.autotrader.co.uk) and "carpages" (www.carpages.co.uk). A geographic search radius was set so that around 70 cars of each model were included in the data. These prices were used to produce depreciation curves for each model. Dealer asking prices were used as these are likely to be consistent. However, the actual sales price is likely to be lower as will the price that an owner could sell the car for. The impact of this error is reduced by normalising the data with the dealers' new car asking price. It was found that all models depreciate at an exponential rate with the values given in Table 1. It was noticed that for asking prices varied by up to ± 30% of the value given by the depreciation curve. This variation was not strongly correlated with car millage so it was concluded that the variation reflected the condition of the car and any accessories fitted to it. The top and bottom market price curves were generated using the average depreciation rate with a ± 30% price range.

From Figure 2, 80% of cars are still in service when the bottom market price approaches 10% of the new car price but only 20% are in service when their top price falls below 10%. It may be argued that as cars get older they become less reliable and this is why owners scrap them. However if this was the case it should be reflected in the cost of break down insurance. Although some providers do have car age limits on their policies, both the AA and RAC offer breakdown insurance that are not dependent on the cars age. Consequently it can be concluded that older cars need not be significantly less reliable than newer ones. It would appear from this that owners scrap cars rather than investing in repairing them when their market value drops below 10%. Therefore one option to increasing the life of a car is to reduce its depreciation rates.

Depreciation in the used car market is a complex topic (Engers,2009; Gilmore,2013) and it cannot be changed by decree. But it is possible to value cars for the service they provided. If the car was owned by a business who charged for its use it could be valued as an income generator as well as an asset.

Life Long Leasing model

Existing car leasing schemes are designed to allow drivers access to new cars without having to pay for them up front. As such they are used by manufacturers to increase sales. These schemes typically last around 3 years with the ex-lease cars being sold on the open market (Andrikopoulos, 2014; Lamar, 2012). This injection of cars into the second-hand market could accelerate depreciation.

An alternative approach is for a company to lease a car out on series of leases over its life. A basic financial feasibility check has been conducted by comparing the non-fuel cost on a Net Present Value basis (NPV) to the owners of a typical car and the similar cost that they may experience by leasing a car instead. The NPVs are then annualized to take into account the different car life and compared. A discount factor of 3.5% was used to be consistent with UK government project appraisal criteria (H M Treasury,2008).

Assumptions common to both models

Loans are subject to a competitive interest rate of 4.9% (taken from financial services comparison web site http://www.money.co.uk/loans/car-loans.htm).

The annual non-fuel and non-finance running cost for a £20,000 petrol car covering an average distance of 14,850 km a year were taken from AA(2014).

Assumptions for multiple owner case

It was assumed that the car changed hands every 3 years in line with common practice (Cooke, 2013). The first three owners paid a 33% deposit and financed the rest of their purchase by 3 year loans. The 4th and 5th owners paid cash for the car.

At the end of their three year ownership period each owner part exchanges the car for 70% of the dealers selling list price as suggested on an Insurance web site , (http://www.churchill.com/car-insurance/tips/car-part-exchange). The car is scrapped after 14 years at no cost to the owner in compliance with the vehicle end of life directive (DFT, 2005).

Assumptions for Life-long lease case

The company would buy the car with a 100% loan paid back over 6 years.

A fixed target annual service fee was added to each year's cost.

The current UK tax law allows the asset value of low emission cars to be fully depreciated in one year, other cars are depreciated at 8% a year (HMG,2014). Consequently the car is depreciated at 8% a year. The value of the future fees are added to the asset value of the car to produce the total value of the car to the lease company.

It was assumed that keeping a car for more than 14 years would incur some additional repair cost. An additional allowance of £500/ year has been added to the annual cost for cars over 14 years old (based on reported maintenance cost taken from the consumer web site (http://www.whatprice.co.uk/car/price.html).

Financial results

The annualized NPV for the multiple owner case was found to be 14.8% of new purchase price a year over the 14 year car life. It was found that the lease company fee could be as high as 4.43% of new purchase price per year to produce the same annualized NPV for the client. This gives a maximum total fee NPV of 62% over the 18 year life of the vehicle.

Advantages for the driver

The driver enjoys the following advantages:

- no need to find cash deposits
- maintenance and repairs are paid for
- no risk of being without the use of a car

Advantages for the industry

The globalized car industry has concentrated production in a few capital intensive facilities. It operates with EBIT (earnings before interest and taxes) to sales margins of 6-10% Statista (2013). This profitability is dependent on maintaining high sales volumes. These are subject to factors outside of the control of the manufacturers like interest rates and taxation. To reduce external risk manufacturers are increasingly refocusing their activities into selling services rather than goods (Deloitte Research,2006; Visnjic; 2011; Foresight,2013). This servitization of business gives a company a continuing relationship with

their customers, smoother cash flows and frequently less exposure to external risk (as more of the value added activities are internal to the company). The multi lease models described in this paper offers a servitization options for alliances between the manufacturer, financial service and servicing agents to work together in a new business model that could potentially reduce cost and increase profits whilst offering a lower cost option to their customers.

By extending the life of cars the growing demands for use of cars can be met without the need for a proportional increase in production facilities. This would reduce the need for considerable investment in new production plants.

Environmental Consideration

It has been argued that there may be an environmental advantage in shortening a product's life (Intlekofer, 2010) so that it would be replaced by a more efficient model. However from the experience of car scrappage schemes this only happens where the replacement vehicle has very low emissions (Brand, 2013; Kagawa, 2013). Emissions associated with a car can be split into embodied emissions (those associated with its manufacture and primary material production) and operational (those associated with driving it). Both need to be considered when evaluating the consequences of increasing a cars life on emission (N. van Nes, 2006).

The key question is how far do you have to drive a new car in a year before the emission savings achieved by driving it rather than an old one are more than the annualized embodied emissions of the new car.

LCA studies show that the major source of GHG emissions is the production of primary materials, consequently the GHG embodied per tonne of car should be used to compare the findings of the studies. The results from 3 LCA studies of cars are given in Table 2. They show a gradual improvements in embodied emissions over time.

The latest of the studies (Wang,2012) give the embodied GHG emission in a 1.3 t car as 7.3 tCO_{2e} which could be annualized as 0.52 tCO_{2e}/y over 14 years.

Emission rates vary considerably between models so the environmental consequences of driving a car for longer or replacing it will be case specific. For example the difference in emission rates between an entry level MK4 and MK7 petrol VW Golf is 45 gCO_2/km (http://www.carfolio.com/specifications/models/car/?car=81169).

Consequently if a 14 year old MK4 Golf was driven for more than 11,000 km/year it would be possible to reduce GHG emissions by replacing it with a new MK7 one. This is close to the average millage covered by a privately owned petrol car in the UK of 10,700 km (DFT,2014). A report into UK car usage (Lucas, 2009) indicates that significant demographic groups are likely to drive less than 11,000 km/yr. Consequently there are groups of motorist who could reduce their cars total GHG emissions by driving them for longer.

GHG emissions are not the only emissions that cause environmental concerns. A LCA study for a Mk 4 VW golf (Schweimer, 2000) show that 75% of particulates, 50% of SO_2 and 40% of NO_2 life time emissions to air and 70% of all emissions to water arise from primary material production and vehicle manufacture. Consequently keeping a car for longer reduces the annualised value of these emissions.

Conclusions

It has been shown that in the UK, cars appear to have an inherent operational life around 280,000 km, but many are scrapped before this as their market value falls below 10% of their new price.

A lease company that adopted a strategy of leasing a car for its full operational life would consider the car as a source of future profits in addition to its asset value. This would make it economically viable for the company to repair an old car rather than scrap it. As a consequence cars would be driven for 18 years rather than an average of 13 years, a life extension of 38%.

Cars in the UK are typically sold 3 to 4 times during their life. This means that a car is likely to be subject to a number of finance deals and part exchange agreements. The lifetime cost of this multiple owner pattern has been compared to the cost for sequential leasing over a longer life and it was found that

sequential leasing could be financially attractive to drivers and leasing companies.

It was thought that if car manufacturers and service agents were partners in the leasing company there could be further reduction in costs.

The environmental consequences of using a car for its full operational life was considered and it was found that this would be beneficial for cars that are driven less than the average millage year.

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Figures and Tables

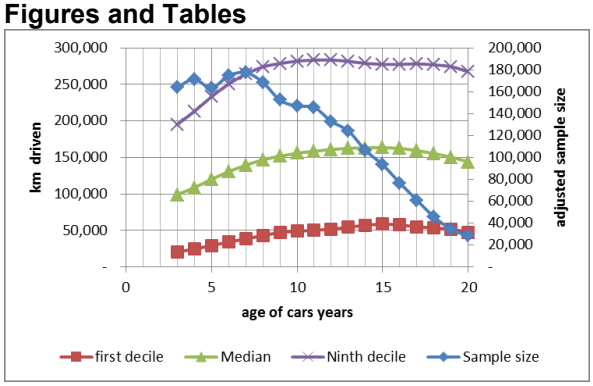

Figure 1. Distance travelled by cars when tested for MOT certificate

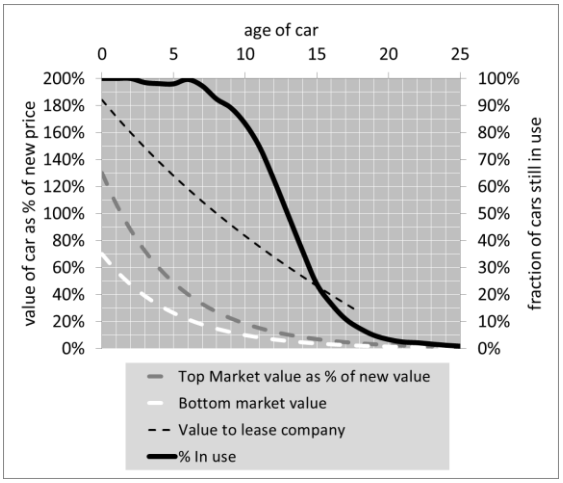

Figure 2. Service life of UK cars

model	exponent	R2	average annual mileage
Golf	-0.184	0.939	8135
Beetle	-0.188	0.937	7995
Fabia	-0.175	0.919	6812
BMW 3	-0.207	0.899	9401
Mercedes E	-0.215	0.919	11465
Mondeo	-0.223	0.909	13878
Focus	-0.181	0.926	8558
Rio	-0.192	0.833	7587
average	-0.196		9229

Table 1 Car price depreciation

study	model	tCO_{2e}	tCO_{2e}/t_{car}
Schweimer (2000)	VW Golf mk4	6.8	6.8
MacLean (2003)	Ford Taurus	10.0	6.6
Wang (2012)	generic petrol	7.3	5.4

Table 2 embodied GHG emissions from LCA studies