

AH Economics – Introduction - Candidate 1 (p2-3)

PROJECT TITLE: What will be the impact of banning new diesel and petrol cars and vans in the UK by 2040?

Introduction

Over the last twenty years the number of vehicles in the UK has increased by 42%. By the end of March 2017 there were 37.5 million vehicles licensed for use on roads in Great Britain. 31.1 million of these were cars¹. The huge increase in the number and use of motor vehicles means they have grown to become a significant contributor to pollution in the UK and thus global warming. Also utilising fossil fuels which are finite resources. The UK government has a target to reduce greenhouse gas emissions by 80% of the 1990 levels by 2050².

Road transport is the largest contributor to pollution in major UK cities³ and the detrimental impact of harmful emissions from vehicles has been in the news recently because of this, and also because of the diesel cars emissions scandal. There has been a move to diesel cars from petrol to try and reduce emissions, but diesel cars have shown to be more polluting than petrol cars. This issue was brought to the public's attention through the VW emissions testing scandal in 2016. However the problem emanates from all internal combustion vehicles. It's the combined use that creates the polluted air. It's estimated that around 40,000 lives have been shortened due to heart or lung problems as a direct link from air pollution³. The negative externalities that diesel and petrol fumes are having on human lives and the desire to move to more sustainable energy sources creates a sense of urgency for action to be taken. The UK government has announced a ban on all new diesel and petrol car sales after 2040.

¹ Dark, M (2017). Vehicle Licensing Statistics: Quarter 1 (Jan - Mar) 2017, page 5. [ONLINE] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/620223/revised/licensing-quarter1-to-march-2017.pdf [Accessed 10 Dec 2017]

² Committee on Climate Change. UK regulations: the Climate Change Act. [ONLINE] Available at: <https://www.thccc.org.uk/tackling-climate-change/the-legal-landscape/the-climate-change-act/> [Accessed 10 Dec 2017]

³ Herrabin, R (2017). How bad is air pollution in the UK. [ONLINE] BBC. Available at: <http://www.bbc.co.uk/news/science-environment-38979754> [Accessed 10 Dec 2017]

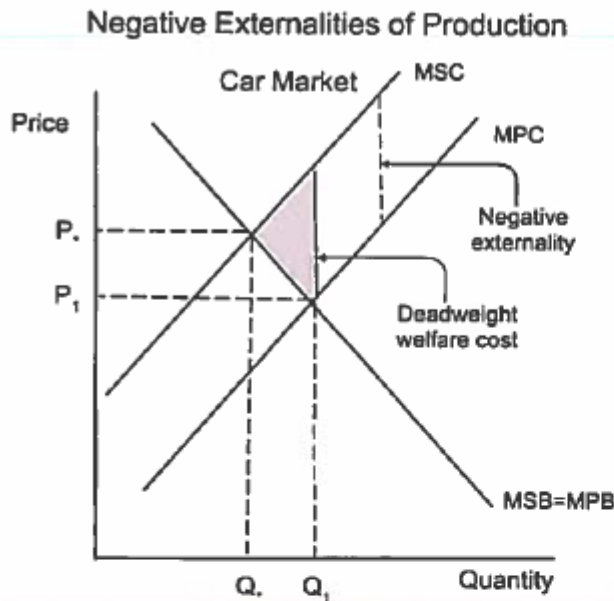
In 2016 1.7 million cars were manufactured in the UK⁴. The car industry supports over 800,000 jobs in the UK economy⁵. The internal combustion engine (ICE) car has been around for well over 100 years and the timeframe for the change to a new form of car is very short.

In this dissertation I will outline the current contribution to the economy and the negative externalities of the existing petrol and diesel cars. Then I will look at the necessary factors to transition to electric cars and the impact this will have on aspects of the economy and finally the possibility of a more radical change than switching your car from one model to the other. Finally I will conclude whether the potential benefits to the economy outweigh the negatives.

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Figure 4



It is clear that cars have both negative externalities to consumption and of production; the fumes the car releases for the former and the production of the fuel for the car for the latter. Negative externalities of production are described as the production of a good, i.e a car, that creates external costs that are damaging to third parties. These negative externalities can also be

explained by a graph. The firm are paying their private costs however in the production process they are creating external costs, in this case when the crude oil, which is a fossil fuel, is burned CO₂ is released, polluting the environment. The Marginal Private Cost (MPC) is less than the the Marginal Social Cost (MSC) and the MSC curve includes the private costs of production as well as the costs to society i.e the pollution it brings.

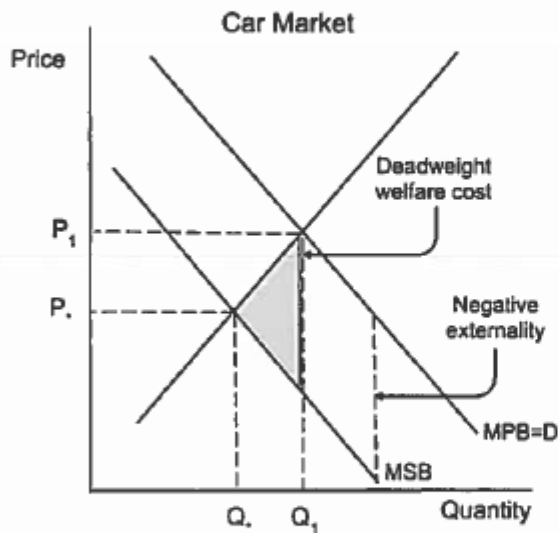
¹² Holder, M (2015) Air Pollution 'costs UK economy £54 billion a year'. [ONLINE] AirQualityNews.com. Available at <https://www.airqualitynews.com/2015/04/28/air-pollution-costs-uk-economy-54-billion-a-year/> [Accessed 4 Jan 2018]

¹³ Harrabin, R (2018). MPs warn of 'poisonous air' emergency costing £20bn a year. [ONLINE] BBC. Available at <http://www.bbc.co.uk/news/uk-politics-43405684> [Accessed 20 March 2018]

The fuel companies are not interested in paying the "pollution" costs so will not produce at the social optimum point ($Q_s = P_s$), instead they will produce at Q_1 , creating a welfare loss

Figure 5

Negative Externalities of Consumption



Negative externalities of consumption are defined as when the consumption of a good causes a harmful effect to a third party. There's a graph to explain this negative externality. Q_1 is output, this is where the MSC is greater than the Marginal Social Benefit (MSB). I.e the cost to of using cars is more than the benefit of them. The ideal point on this graph, social optimum point, occurs at a lower output

where $MSB=MSC$ and ($Q_s = P_s$) on the graph, this is where the social cost in this case the pollution cars create is included in the price of the good. Negative consumption externalities also lead to the situation where the social benefit of consumption is less than the private benefit. The car manufacturers benefit more

than society because they're not paying for the damage these vehicles cause.

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b) Impact on consumers

In 2016 78% of the distances travelled in England were by car²⁸. To keep the UK economy rolling, cars and commercial vehicles need to travel the required distances, reliably. Despite the length of time that companies have worked on developing electric car batteries, there are still significant limitations in terms of range and time to recharge batteries. Currently, according to the Nissan website, a Leaf will do 124 miles between recharges, after which, it will have to be plugged in for a minimum of four hours. Battery technology needs to advance to make electric cars viable, in terms of cost, and practicality to use over long distances. The cost of a lithium-ion battery pack fell 65% from 2010 to 2015 and is expected to fall to below \$100 per kilowatt-hour over the next decade²⁹.

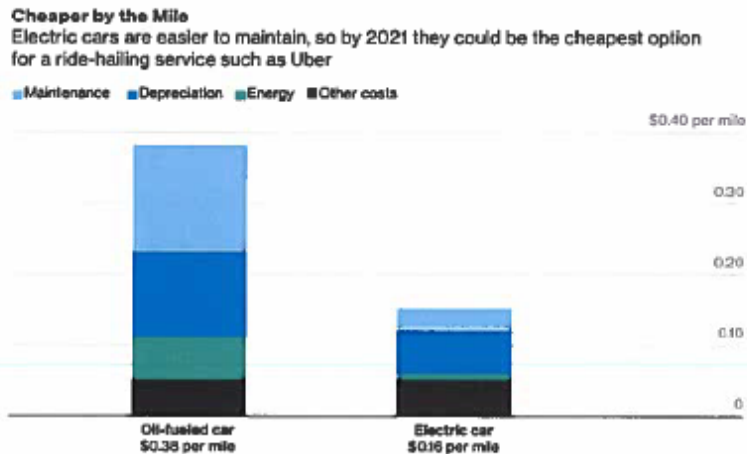
Currently the cost of buying an electric car is high. E.g a Nissan Leaf, electric car, is nearly £30,000 to buy (including a government subsidy of £4,500), whereas an ICE Nissan Micra costs around £12,000 new. The high initial cost of an electric vehicle increases inequalities because it creates a divide between those that can afford to move to the new type of cars and those that cannot.

²⁸ Department of transport, (2017), Transport Statistics Great Britain 2017 Modal Comparisons, page 2 Op cit. [Accessed 22 Jan 2018]

²⁹ McKinsey&Company and Bloomberg New Energy Finance, (2016), An Integrated Perspective on the Future of Mobility, UK, McKinsey&Company page 5. Available at https://www.bhhub.io/bel/sites/4/2016/10/BNEF_McKinsey_The-Future-of-Mobility_11.10.16.pdf [Accessed 22 Jan 2018]

In the long run, even though the initial purchase of an electric car is more expensive than a diesel or petrol car, the running costs of keeping an electric car is cheaper. In

Figure 7



Source: RethinkX

Bloomberg

this bar chart we can see that the average amount spent on maintenance for an ICE is approximately \$0.15 per mile and for an electric car \$0.03 per mile. This is because electric cars have only 3 moving parts where there are 133 in a

four-cylinder ICE. Reduction in complexity in electric cars means costs in maintaining the car are considerably less which is a positive for consumers³⁰. Over the life of the car, given the lower running costs, this will increase the inequality between those that can afford the initial cost and those that cannot, as the total cost of ownership will be less.

There is also concern that the access to charging points will be different for people in different classes; 57% of UK households have access to off street parking³¹, which will mean they have the advantage of being able to install their own charging point and make use of the best time to charge their vehicle, whereas those that don't have that option may have to pay higher costs or find charging a vehicle less convenient. There will need to be an investment in UK infrastructure, with the building of charging points, and it's yet to be determined how this will be addressed.

³⁰ Shankleman, J and Warren, H (2017) Op cit. [Accessed 18 Jan 2018]

³¹ Elmirst, O (2017). Our Energy Insights - Forecourt thoughts: Mass fast charging of electric vehicles, page 2. [ONLINE] National grid Available at: http://fes.nationalgrid.com/media/1281/forecourt-thoughts_v12.pdf [Accessed 26 Jan 2018]

AH Economics – Analysis and Evaluation - Candidate 2 (p5-7)

PROJECT TITLE: What are the economic impacts of new technologies such as Artificial Intelligence and Robotics on the UK economy?

Thus, income inequality is expected to increase; *“Company owners and officers will enjoy significantly improved profit margins and far less overhead. But what of the armies of secretaries, accountants, marketers, and HR staff? The number of jobs available to them*

⁷ Barber, L. (2017) *Artificial Intelligence and robots are one of the biggest technological risks in the world* (online) Available at: <http://www.cityam.com/256813/artificial-intelligence-and-robots-one-biggest-risks-world> (Accessed 6 Nov. 2017)

⁸ Chen, A. (2017) *Computer and Information Tecchnology Occupations* (online) Available at: <https://www.bls.gov/careeroutlook/2017/data-on-display/projections-occupational-group.htm> (Accessed 9 Jan. 2018)

will diminish over time, magnifying income inequality.”⁹ Evidently, the poorest, unskilled workers are predicted to become poorer as they lose their jobs and are unable to be employed due to occupational mobility. Richer, skilled workers benefit from the technology they are able to interact with and invest in, such as analysts and nurses. As technology is more efficient, it will increase wages and profits due to higher productivity for those involved whereas lower skilled work will be phased out, hence exacerbating the income inequality gap.

Income inequality has been increasing in many developed economies since the 1970s; ‘Capital’ by Thomas Piketty claims this is because “labour’s share of GDP in wages is falling in contrast to GDP of the wealthier as interest, profit and rent which is increasing”.

¹⁰ Governments target equity demonstrated by the Lorenz Curve; it is a representation of income/wealth distribution as a cumulative income curve, shown below. The line at 45 degrees shows equity whereas the actual distribution of income is shown on the other line, showing that more bowed the curve is, the more unequal distribution of income. The most recent UK Lorenz Curve is shown in the Appendices¹¹ as **Graph 2, Appendix 2**.

It can be seen that the Lorenz Curve is bowed outwards, away from equality. The lowest 38% of individuals have zero property wealth with the top 10% owning 50%. Financial wealth has the greatest degree of inequality; 60% of households have debt greater than savings with the top 10% owning 80% of financial wealth. New technologies are likely to push the Lorenz Curve further outwards, demonstrating more inequality. This is because those with money will be able to invest in the technology and reap its benefits as discussed in terms of productivity, growth, wages and profits as Thomas Piketty discussed, whereas others could be at loss if gains aren’t distributed fairly.

Many Economists have taken the view of a need to counteract a ‘post-work’ society; job-destroying technology has been a fear since industrialisation, regarded by economists as the ‘lump-of-labour fallacy’ which suggests there is only a certain amount of work available (the lump), thus if machines do more of the work, less is available. However, this is indeed a fallacy, as when technology displaces labour, it rewards those who remain in employment benefited by technology, who will spend their gains on goods and services that will in turn create employment for those workers at loss, as businesses eventually grow and take on new workers, which we must ensure are skilled to do such jobs. The jobs created from new technology could be filled by low-skilled workers for example, a new study by ‘Cognizant’s Centre for the Future of Work’ suggests new jobs such as ‘Machine Manager’ which simply

⁹ Penn, C. (2017) *Why AI presents a potential inequality problem* (online) Available at: <http://www.christopherspenn.com/2017/08/why-ai-presents-a-potential-income-inequality-problem/> (Accessed 6 Jan 2018)

¹⁰ Rees, A. (2015) *Thomas Piketty’s ‘Capital’ summarised in four paragraphs* (online) Available at: <https://www.economist.com/blogs/economist-explains/2014/05/economist-explains> (Accessed 9 Feb 2018)

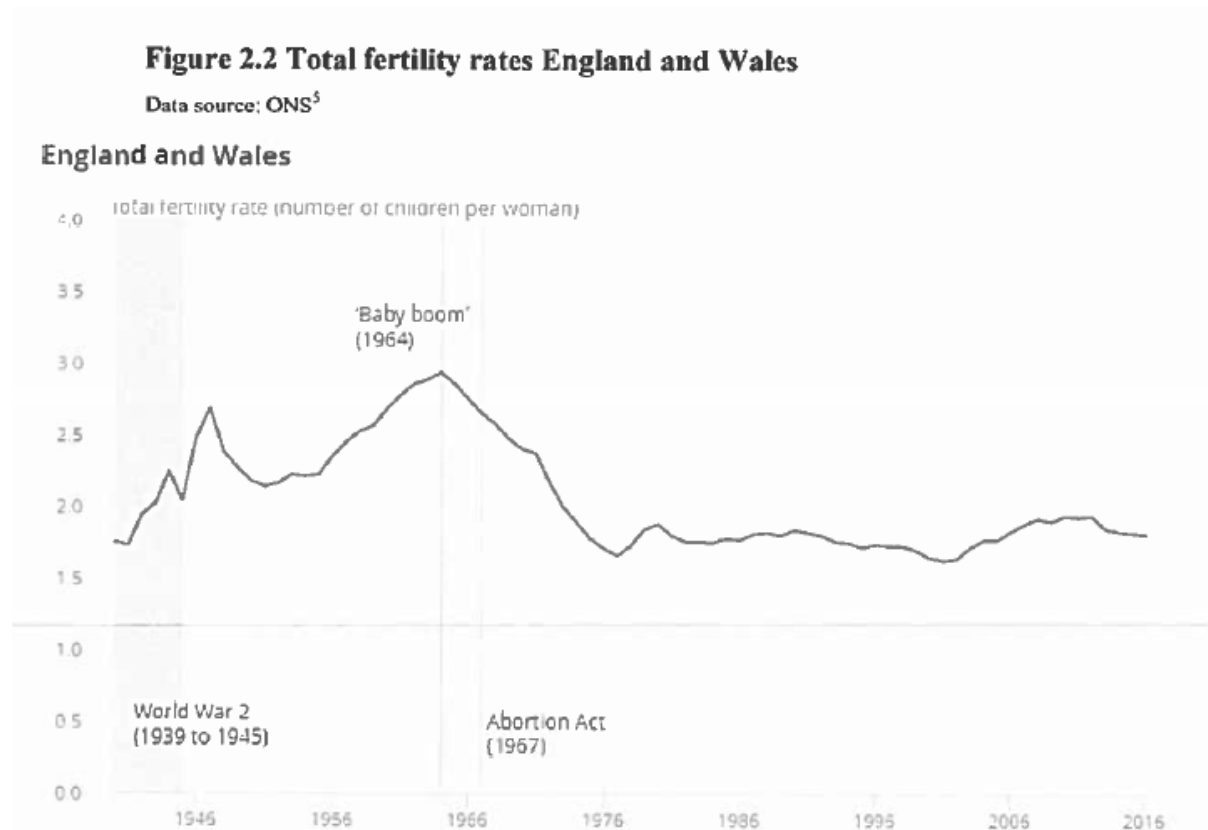
¹¹ Office of National Statistics (2013) *The Economic position of households* (online) Available at: http://webarchive.nationalarchives.gov.uk/20160110091940/http://www.ons.gov.uk/ons/dcp171766_295084.pdf (Accessed 5 Jan 2018)

involves watching over new technology.¹² This is where the argument to job loss can take a more optimistic stance; technology frees up employment for workers to contribute to the economy elsewhere. However, this ideology may be slightly naive, amongst other factors, it assumes those whose jobs which are replaced by technology, are able to work elsewhere. This relies on skills and occupational mobility of labour, the ease of movement of resources between jobs, which may not be the case as technology is predicted to replace the majority of lower skilled jobs which are less likely to find employment as easily.

In saying that, a productivity effect could occur whereby new technology creates new jobs as existing jobs are replaced, beyond the development and supervision of such technologies which we will only discover when we realise they are needed once new technologies are implemented across the economy. In the short run the displacement effect discussed above may dominate. However, in the longer run, when markets adapt to automation and AI, a productivity effect can dominate and lead to a positive impact on employment. This of course, is where policy making is important, as Governments should use the opportunities that arise with the evolution of technology. For example, robots will create more, high-paying jobs which require high-skilled workers which means with sufficient education, especially in science and technology, could bring more valuable employment and increase economic growth for the economy through more GDP. For example, increased demand for technology increases the need for suppliers of new machines such as engineers and data scientists. It is possible that robots and humans may work together on jobs; some take the view that robotics will simply make our jobs easier as they will most likely substitute labour activities but not completely replace jobs. Thus, automation could allow a focus on higher skilled, quality and paid tasks with new opportunities that we must ensure workers are able to embrace.

AH Economics – Analysis and Evaluation - Candidate 3 (p5-6)

PROJECT TITLE: What are the Economic effects of the United Kingdom's ageing population and what can the government do to remedy it?



2. Total Fertility Rate – This is the average number of children born per woman. In the UK, this rate stands at 1.81 as of 2016 which is lower than the replacement rate of just over 2 children per woman needed to keep the population afloat. The UK had a steady total fertility rate approximately between 1.75 and 1.85 for around three decades since 1976, although the fertility rate has been rising towards the replacement rate. This rise is mainly due to an increase in immigration during those times and immigrants then settling to raise a family here. Nevertheless, the low UK total fertility rate can be attributed to a few factors such as:

- Increased availability of birth control and the legalisation of abortion; this allows women to have more choice on whether they want to follow through with pregnancy after conception.
- Also, the changing roles of women have also played a part in the falling total fertility rate as more women are in employment more than ever in the UK whereas half a century ago they would be more likely to stay at home and be a housewife. This means that employment is more of a focus than growing a family nowadays, leading to less children being born.
- Another reason is that the costs of raising a child have also gone up as the average cost of raising a child until the age of 21 in the UK is over £230,000.⁶ This has put off

many people from having children as they'd be sacrificing money that could be spent on buying a house for example.

AH Economics – Conclusion - Candidate 1 (p16-17)

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Conclusion

In this dissertation I discussed the impact banning new diesel petrol cars and vans from 2040 would have on the UK economy as alternatives are developed and what this shift will mean for UK industries, consumers, the electricity grid and the role government will have.

The UK relies heavily on the use of cars and vans, and miles travelled in vehicles now go into several hundreds of billions. Vehicles are a leading source of pollution, especially in cities. The negative externalities of this pollution is at a cost to both our health and economy. A change needs to be made.

By the future banning of the sale of new diesel and petrol cars the UK are making a step towards reducing the amount of pollutants in the air and therefore slowing down the effects of global warming and damaging effects on our health. The diesel scandal has helped to prompt this government action.

The leading replacement for the ICE vehicle is electric vehicles. This is a global development with China at the forefront of the move.

It's a massive change to produce this new form of vehicle. A notable investment will be essential. The technology is still under development and the production of electric cars requires a whole different kind of technology and skills. There are already new companies competing with the traditional car firms. If the UK car industry emerges as a winner it will benefit the UK economy, but if they don't get it right then it will be

³⁵ Department for transport (2018) Reported road casualties in Great Britain: quarterly provisional estimates year ending September 2017, page 1 [ONLINE] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/691593/quarterly-estimates-1-1-19-september-2017.pdf [Accessed 30 Jan 2018]

detrimental to the car industry and the economy in the UK. In the short run it will be tough for the UK car industry if sales continue to fall of conventional cars.

Overall the initial cost of purchasing an electric car is high but it saves costs over the vehicle's lifetime. Currently electric cars are not as practical as ICE cars because of their limited running time and initial costs. The short time between recharges is especially limiting for commercial vehicles. However, as breakthroughs are made in battery technology and electric car production increases, the initial costs will start to fall and they will become more widespread. Significant investment will be needed in charging infrastructure. There is a question over how home charging will be managed for a large part of the population. These factors create inequalities in those who will be able to take advantage of electric vehicles. There needs to be a good solution for everyone, and the government, who have stipulated the ban, need to address this issue.

The move to electric cars will only succeed in reducing the negative externalities of pollution if the extra electricity needed is generated by renewable sources and the timing of demand for the electricity can be controlled. A change in engine type is essential to help create a better environment for our generation and ones to follow. However I think a lot more future planning is needed to be done by the government, on electricity generation and charging points.

Mobility is of huge importance to the economy, this is about to undergo its first major change for a long time and it looks like it could be the start of even bigger changes not just a new way of powering a vehicle but a new way of driving vehicles with autonomous vehicles looking evermore like a reality. I think the government are heading in the right direction and I expect a positive outcome where companies will adapt to these changes.