Making Business Sense

The economic costs of gridlock

An assessment of the direct and indirect economic costs of idling during heavy road traffic congestion to households in the UK, France and Germany

Report for INRIX

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Authorship and acknowledgements

This report has been produced by Cebr, an independent economics and business research consultancy established in 1993, providing forecasts and advice to City institutions, government departments, local authorities and numerous blue chip companies throughout Europe. The study was led by Cebr Senior Economist Shehan Mohamed.

This study was commissioned by INRIX, a leading international provider of traffic information, traffic analytics and driver services.

The report has utilised data available in the public domain from a variety of national statistical offices including the Office for National Statistics, Eurostat, Destatis and INSEE. In addition, traffic congestion data for large urban zones (LUZs) in the UK, France and Germany were provided by INRIX.

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Executive summary

This report summarises the findings of an independent study into the direct and indirect economic costs placed upon households due to workers and businesses experiencing heavy road traffic congestion during peak periods. The study analyses the amount of time spent idling in traffic jams by commuters, business travellers and freight vehicles in the UK, France and Germany. We evaluate the direct impacts to the 29 million commuters that travel to work by car, both in terms of their increased fuel costs from time spent idling and the value of lost work hours. Furthermore, the study quantifies the indirect costs to households stemming from higher costs to businesses as a result of congestion.

Summary of findings

In order to model the costs of time spent idling in traffic, the annual number of 'wasted hours' experienced by drivers in large urban zones (LUZs)[1] around the UK, France and Germany were calculated by INRIX - a leading provider of big data traffic information. The Centre for Economics and Business Research (Cebr) took these estimates of annual 'wasted hours' and modelled the direct and indirect effects of vehicle idling on households.

Aggregate costs to households

The table below illustrates the total annual aggregate costs to all households resulting from time spent idling during peak periods[2].

Table A Aggregate annual costs of idling in traffic to households, millions of euros, 2011

	Country, €m			Cities, €m		
	UK	**France**	**Germany**	**London**	**Paris**	**Stuttgart**
Direct costs (higher fuel and value of time costs)	€3,620	€3,883	€5,647	€1,358	€1,817	€701
Indirect costs (higher costs of goods & services)	€1,320	€1,674	€2,183	€539	€858	€261
Total	**€4,940**	**€5,557**	**€7,830**	**€1,896**	**€2,675**	**€962**

Source: INRIX, Cebr analysis

Our findings show the costs of idling to car-commuting households in the UK, France and Germany were **€4.9bn, €5.6bn** and **€7.8bn** respectively in 2011[3]. This equates to **€18.3bn** in total idling costs across the **96 million** households forming the EU's three largest economies. **Direct costs** to households include fuel consumed during idling in traffic[4], and the value of lost working hours and/or leisure time from having to work longer hours. These direct costs totalled **€13.2bn** across the UK, France and Germany. In 2011, a total of **39.2**, **40.8** and **39.2** hours per vehicle were wasted idling in the UK, France and Germany respectively.

Indirect costs to households refer to **higher consumer prices charged to all households** (including those who do not commute by car) as a result of the cost of doing business increasing. This happens

[1] 'Annual wasted hours' data has been provided by INRIX for 18, 13 and 22 large urban areas (LUZs) in the UK, France and Germany respectively.

[2] Peak periods are defined as the 'AM peak', typically between 7am and 9am, and the 'PM peak' between 4pm and 7pm.

[3] The average £/€ exchange rate in 2011 of 1.15 was used as a currency conversion rate.

[4] An average fuel consumption rate when idling of 0.5 litres per hour was used.

when congestion during the rush hour period causes delays to business travellers which lowers productivity and raises the costs of production. Furthermore, time spent idling by both light goods vehicles (LGVs) and heavy goods vehicles (HGVs) imposes higher freight costs on businesses, which are in turn passed on to the consumer. Total indirect costs to households were **€5.2bn** in the UK, France and Germany in 2011 – representing around 28% of the total costs of idling in traffic.

At the city-level, Parisian households incurred the largest annual aggregate idling costs in 2011 of **€2.7bn.** The cities of London and Stuttgart incurred aggregate idling costs of **€1.9bn** and **€0.9bn** respectively over the same period.

Costs to individual households that commute by car

The table below illustrates the total annual costs to individual households commuting by car resulting from time spent idling during peak periods.

Table B Annual costs of idling in traffic to car-commuting household, euros per household, 2011

	Country, €			Cities. €		
	UK	**France**	**Germany**	**London**	**Paris**	**Stuttgart**
Direct costs (higher fuel and value of time costs)	€442	€499	€427	€994	€762	€715
Indirect costs (higher costs of goods & services)	€124	€147	€105	€163	€172	€217
Total	**€566**	**€645**	**€533**	**€1,157**	**€934**	**€932**
% workers commuting by car	69%	77%	66%	33%	43%	65%
Total commuting by car	8,190,000	7,780,000	13,210,000	1,370,000	2,390,000	980,000

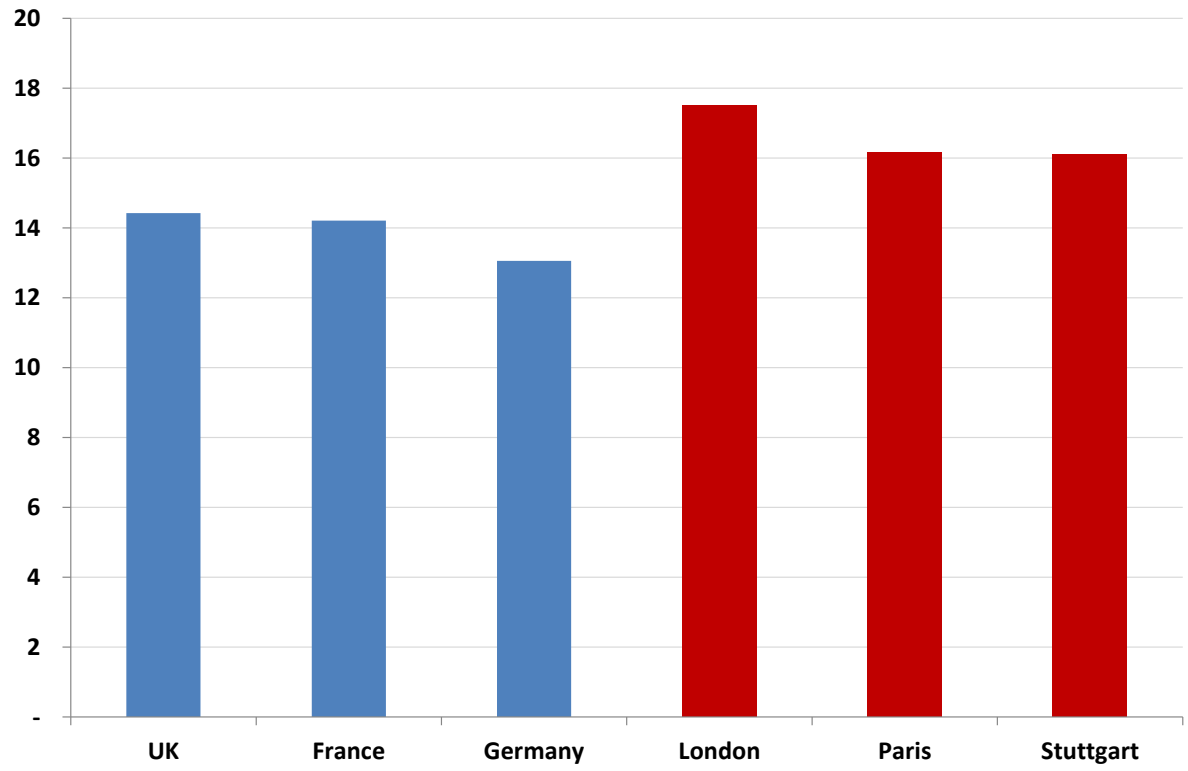
Source: INRIX, Cebr analysis

Our findings show that the total annual idling costs per car-commuting household in the UK, France and Germany were **€566, €645** and **€533** respectively in 2011. At the city-level, idling costs were highest in London at **€1,157** per car-commuting household – this was largely driven by a higher than average number of hours spent idling in traffic (**66.1 hours** per vehicle per year). Paris and Stuttgart had similar annual costs per car-commuting household at **€934** and **€932** respectively. The average annual hours spent idling in traffic were **57.8** and **57.9 hours** per vehicle for Paris and Stuttgart respectively. To put this into context, the total number of hours spent working per year by the average full-time worker in 2011 was **1,946, 1,808** and **1,887 hours** in the UK, France and Germany respectively. This means that the average Londoner travelling to work by car spends nearly two working weeks stuck in traffic every year.

The impact of indirect costs to household (through higher prices of goods and services), is highest in Stuttgart where indirect costs make up 24% of total costs compared to 19% and 14% in Paris and London respectively. This is because car-travel is more prominent in Stuttgart (**65%** of workers travel by car) compared to Paris (**43%**) and London (**33%**).

Figure C illustrates the total direct and indirect cost to car-commuting households for every hour spent idle in traffic.

Figure C Average direct and indirect cost to car-commuting household per hour idle in traffic, euros



Source: ONS, Destatis, INSEE, Eurostat, Cebr analysis

Our findings show that the hourly costs of idling are highest in the UK **(€14.4 per hour**) compared to France **(€14.2 per hour**) and Germany **(€13.1 per hour**). This reflects a higher value of commuting time in the UK (the average full-time hourly wage is higher than France and Germany), and higher UK fuel prices in 2011.At the city-level, London has the highest costs per car-commuting household **(€17.6 per hour**) compared to Paris (€**16.2 per hour**) and Stuttgart **(€16.1 per hour**). This reflects a higher commuting value of time for London compared to Paris and Stuttgart. A higher commuting value of time means that wasted hours in traffic are more valuable as workers' earnings are higher.

1 Introduction

The Centre for Economics and Business Research (Cebr) was commissioned by INRIX to evaluate the direct and indirect costs to British, French and German households from heavy road traffic congestion experienced by both workers and businesses. In this study, we use road congestion data from AM and PM peaks in large urban zones (LUZs), and Cebr's proprietary transport, city & macroeconomic models, in order to estimate costs of idling to the EU's three largest economies. We draw comparisons between road congestion characteristics and total aggregate household costs for each country. Furthermore, we study the impacts on households living in three European cities which are estimated to have the some of the highest costs associated with heavy traffic congestion. In the next section, we outline our methodology for quantifying both the direct and indirect impacts of congestion on households in the UK, France and Germany.

This report is structured as follows:

- Section 2 outlines the methodology
- Section 3 considers the direct and indirect household impacts of idling in heavy road traffic congestion for the UK, France and Germany respectively.
- Section 4 provides an inter-country and inter-city comparison of the household impacts of idling in heavy road traffic congestion.

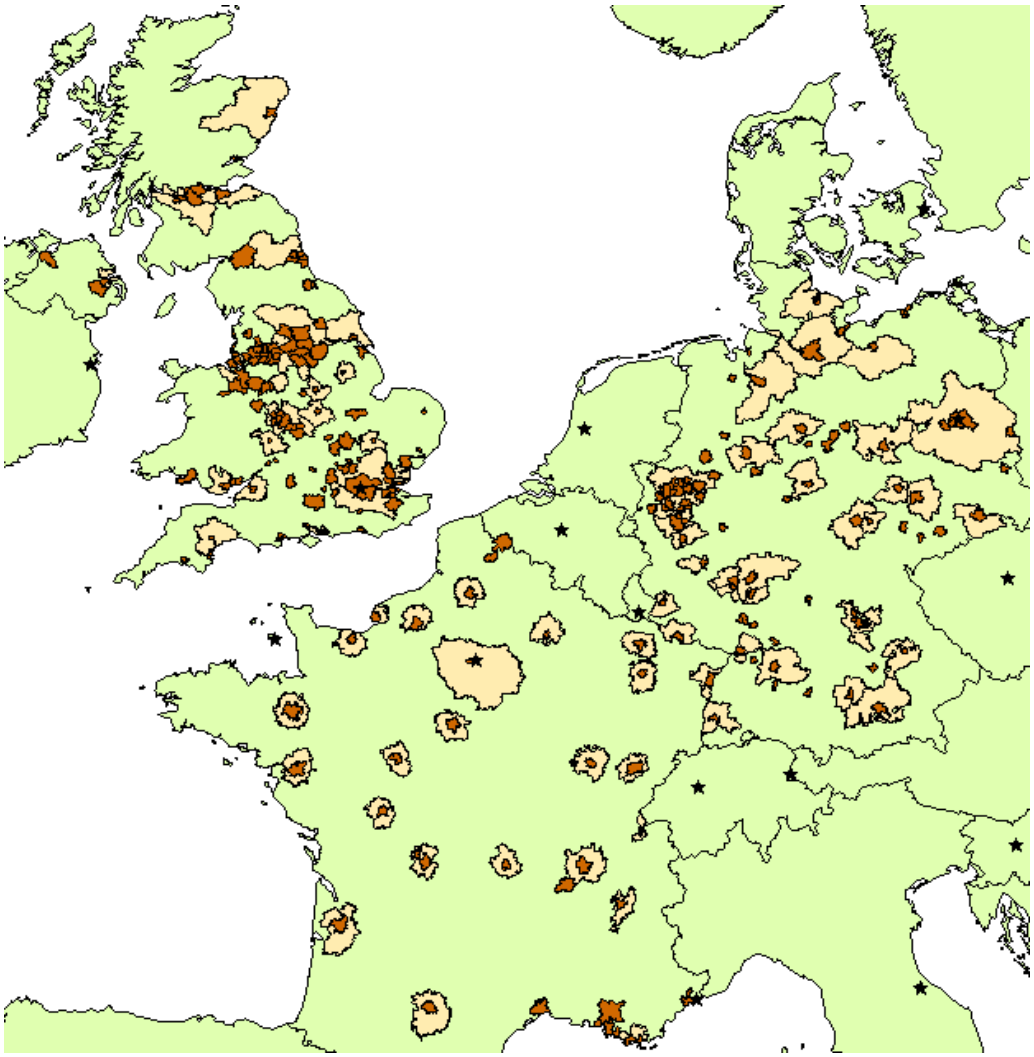
2 Methodology

In order to estimate the costs of time spent idling in peak periods by commuters, business travellers and road freight, Cebr developed a three-stage approach. This was to:-

2.1 'Wasted hours'

1. *Calculate the average number of annual 'wasted hours' per vehicle which are spent idling during peak periods:* this required traffic congestion data to be provided by INRIX for 18, 13 and 22 large urban zones (see figure below) in the UK, France and Germany respectively. Cebr took these estimates and calculated a national figure for annual hours spent idling for each country.

Figure 1 Traffic congestion data recorded for Large Urban Zones (LUZs) in UK, France and Germany



Source: Eurostat, Urban Audit, Cebr analysis

2.2 Direct costs

2. *Quantify the direct costs to car-commuting households from time spent idling in traffic:* using Cebr's transport, city and macroeconomic models, we calculated the direct costs to car-commuting households as a result of higher fuel consumption and the lost value of workers' time spent in traffic.

   In order to calculate **direct fuel costs**, we used 2011 national fuel price averages for Euro-super 95 (regular unleaded petrol)[5]. Average fuel consumed per vehicle when idle **is assumed to be 0.5 litres per hour** for the average medium-sized car[6]. A number of sources place the average fuel consumed to range from 0.5-0.7 litres per hour.

   Road congestion during AM and PM peaks also causes commuters to experience delays in their journey to and from work. This means that fewer hours are spent working or enjoying leisure time, and more hours are spent stuck in traffic. The value of this 'wasted time' is related to the full-time hourly wage that a worker is paid. We have assumed the value of wasted time to the commuter to be worth **50% of the hourly national and city wage** because a proportion of lost productivity in traffic is assumed to be recovered during the working week. Furthermore, even though all wasted time could be made up over the working week, this could come at the expense of longer hours worked and therefore less leisure time enjoyed. This means commuters will either have to i) leave early to get to work on time and/or ii) work later hours in the evening or take their work home. In either case, **leisure time is lost to the worker – this is also captured in the commuting value of time**.

The effects of congestion during peak periods are not only felt directly by commuters and households. Employees of businesses are travelling to and from business meetings and freight firms are delivering goods to businesses. This means that congestion during peak periods can increase the cost of doing business which ultimately impacts households.

2.3 Indirect costs

3. *Quantify the indirect costs to all households from business travellers and road freight idling in traffic:* we calculated the costs of heavy traffic congestion to businesses as a result of delays caused during business trips and higher costs of freighting goods[7].

   Business travellers who make trips during AM and PM peaks experience delays to their journey to and from business meetings. Higher levels of congestion mean that employees spend more

[5] UK petrol prices are sourced from the monthly fuel price reports published by the Automobile Association (AA) based on the Unleaded 95 Octane measure. France and Germany petrol prices are sourced from the weekly European Commission Oil Bulletin based on the equivalent Euro-super 95 measure.

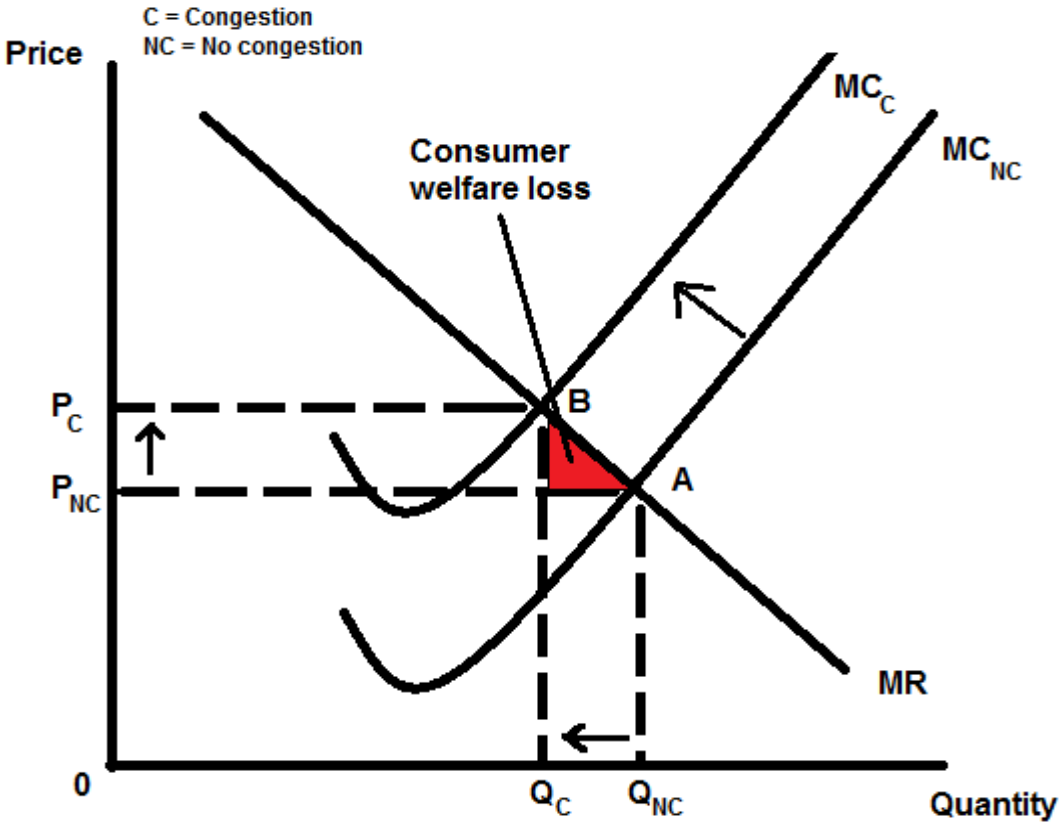
[6] Various sources state the average fuel consumed per hour idle to range from 0.5-0.7 litres per hour. See Appendix A for a list of references.

[7] We assume the mix of road traffic during AM and PM peaks to be roughly 82% commuting, 12% on business and 6% freight. This is based on business and commuter time profile data from the 2011 National Travel Survey (NTS) published by the Department for Transport (DfT) and freight statistics from the 2009 Travel in London report published by Transport for London (TfL).

time stuck in traffic and less productive time in the workplace. The value of this 'wasted time' to the employee's business is related to the hourly GDP per worker. We have assumed the value of wasted time to businesses to be worth **50% of the hourly national and city GDP per worker** because a proportion of lost productivity in traffic is assumed to be recovered during the working week.

Loss of productivity to businesses raises the unit costs of production i.e. the cost of producing a unit of economic output. As illustrated in Figure 1, this results in higher prices of goods and services for the consumer.

Figure 1 Effect of higher levels of congestion on marginal cost (MC) of production



Source: Cebr analysis

Higher levels of congestion increase the prices at which businesses supply goods and services to consumers. Higher prices reduce the quantities of goods and services purchased by households (moving purchases from Q_{NC} to Q_C) which results in a loss of consumer welfare.

In addition to these business productivity losses, unit costs are pushed up by extra fuel expenses to businesses as a result of time spent idling in traffic by employees on business trips. Higher fuel and labour costs to freight companies also indirectly serve to further push up the marginal costs for businesses. We have assumed that 80%-90% of these costs incurred by businesses are passed on to consumers in the form of higher prices for goods and services that are produced[8].

[8] This is based on analysis of the combined use matrix in the national supply and use tables of the UK, France and Germany. An analysis of total resources used to produce outputs for domestic use compared to those which are produced for export was conducted.

3 National and city-level direct and indirect household impacts

In this section, we summarise the direct and indirect household impacts resulting from time spent idling during heavy road traffic congestion for select countries and cities.

3.1 The United Kingdom

In the UK, there are 26.3m households, and total employment of 29.2m in 2011. In the 18 large urban zones (LUZs) studied, the average percentage of workers commuting by car was estimated to be 69%[9]. This implies that there are a total of 8.2m workers commuting by car on the average working day. Table 2 illustrates the total annual wasted hours spent idling in traffic for all large urban zones (LUZs) along with total employment.

Table 2 Annual wasted hours per vehicle and total employment

Large Urban Zone (LUZ)	Annual wasted hours per vehicle	Employment
London	66.1	4,107,500
Manchester	45.1	1,162,300
Liverpool	38.8	519,200
Birmingham	34.0	972,300
Belfast	33.8	107,000
Newcastle upon Tyne	32.9	510,600
Nottingham	32.1	216,100
Bradford-Leeds	30.3	999,500
Edinburgh	29.3	448,700
Sheffield	28.9	557,000
Portsmouth	28.3	115,500
Glasgow	27.3	796,500
Bristol	25.6	564,500
Cardiff	25.2	204,500
Coventry	25.2	168,700
Stoke-on-Trent	25.0	97,700
Leicester	24.2	191,900
Kingston-upon-Hull	23.0	151,000
United Kingdom (LUZs only)	**39.2**	**11,890,500**

Source: ONS, INRIX, Cebr analysis

London has the highest level of road congestion, with a total of 66.1 hours spent idling in traffic every year per vehicle during peak periods. The two UK LUZs with the highest levels of employment – London and Manchester –also have the worst levels of heavy traffic congestion.

[9] The 2011 UK modal share of car as a usual method of travel to work is based on the Office for National Statistics (ONS) Labour Force Survey (May 2012)

In order to evaluate the direct and indirect household impacts of the annual wasted hours generated by road traffic congestion, Cebr developed appropriate commuter and business values of time (VoT). Table 3 illustrates the commuting and business values of time for the UK and London.

Table 3 Commuting and business values of times (VoT) per hour, UK and London

	United Kingdom	London
Commuting VoT	€9.7	€13.5
Business VoT	€18.5	€28.6

Source: OECD, ONS, Cebr analysis

The average commuting value of time in the UK is €9.70 per hour compared to €13.50 per hour in London[10]. These estimates are based on 50% of the hourly full-time wage in these areas. This is because a proportion of lost time spent stuck in traffic is made up by workers during the working week. The average business value of time in the UK is €18.50 per hour compared to €28.6 per hour in London. These estimates are based on 50% of the hourly GDP generated per worker in these areas. This reflects a proportion of the lost productivity in traffic being recovered during the working week. Table 4 reveals the direct and indirect household impacts of time spent idling during traffic.

Table 4 Direct and indirect household impacts of idling in traffic, euros per year

	Aggregate, €m		Individual (per car-commuting household), €	
	UK	London	UK	London
Direct costs (higher fuel and value of time costs)	€3,620	€1,358	€442	€994
Indirect costs (higher costs of goods & services)	€1,320	€539	€124	€163
Total	**€4,940**	**€1,896**	**€566**	**€1,157**

Source: INRIX, Cebr analysis

Our analysis shows that the annual total costs of idling to UK households is €4.9bn, of which €1.9bn is incurred by households in London. The individual cost to a car-commuting household is €566 in the UK compared to €1,157 in London. The average annual number of litres consumed during idling in traffic is 20 litres per vehicle in the UK compared to 33 litres in London. This means that total annual costs accruing from fuel wasted during idling is €60 per vehicle in the UK and €102 in London[11]. The remainder of direct costs is explained by the value of commuting time which reflects potential losses in earnings and leisure time. Indirect costs from higher prices for goods and services make up 14% of total costs to households.

3.2 France

In France, there are 28.7m households and employment totalled 25.5m in 2011. The population of France in 2011 is estimated to be 63.1m – roughly the same size as the UK population in the same period. In the 13 LUZs studied, the average percentage of workers commuting by car was estimated

[10] The average £/€ exchange rate in 2011 of 1.15 was used as a currency conversion rate.

[11] An average 2011 UK fuel price of €1.54 per litre was sourced from the Automobile Association (AA) based on the Unleaded 95 Octane measure.

to be 77%- significantly higher than the UK (69%) and Germany (66%)[12]. This implies that there a total of 7.8m workers commuting by car on the average working day.

Table 5 illustrates the total annual wasted hours spent idling in traffic for all LUZs along with total employment.

Table 5 Annual wasted hours per vehicle and total employment

Large Urban Zone (LUZ)	Annual wasted hours per vehicle	Employment
Paris	57.8	5,548,895
Lyon	45.0	868,996
Bordeaux	43.7	545,587
Toulouse	39.7	618,576
Grenoble	38.8	352,931
Toulon	38.6	237,924
Strasbourg	36.7	298,161
Nantes	35.2	462,027
Rennes	30.7	346,179
Caen	29.7	198,612
Nancy	26.8	223,067
Tours	24.2	219,010
Clermont-Ferrand	21.8	224,132
France (LUZs only)	**45.4**	**10,144,099**

Source: INSEE, INRIX, Cebr analysis

Paris has the highest level of road congestion, with a total of 57.8 hours spent idling in traffic every year per vehicle. This is similar to levels of congestion in Stuttgart (57.9 hours) but significantly less than congestion in London (66.1 hours). The two French LUZs with the highest levels of employment – Paris and Lyon– also have the worst levels of heavy traffic congestion. Table 6 illustrates the commuting and business values of time for France and Paris.

Table 6 Commuting and business value of times (VoT) per hour, France and Paris

	France	Paris
Commuting VoT	€9.5	€11.7
Business VoT	€26.6	€36.2

Source: OECD, INSEE, Cebr analysis

The average commuting value of time in France is €9.5 per hour compared to €11.7 per hour in Paris. This is lower than the UK and London respectively. The average business value of time in France is €26.6 per hour and €36.2 per hour in Paris. This is higher than in the UK and London respectively, reflecting higher productivity per hour in France and Paris compared to the UK and London.

[12] France modal share of car for commuting is based on 2009 data from the Urban Audit project published by Eurostat (April 2012). Paris modal share is an estimate from Syndicat des transports d'Ile-de- France – Enquete Global Transport (2010).

Table 7 reveals the direct and indirect household impacts of time spent idling during traffic.

Table 7 Direct and indirect household impacts of idling in traffic, euros per year

	Aggregate, €m		Individual (per car-commuting household), €	
	France	**Paris**	**France**	**Paris**
Direct costs (higher fuel and value of time costs)	€3,883	€1,817	€499	€762
Indirect costs (higher costs of goods & services)	€1,674	€858	€147	€172
Total	**€5,557**	**€2,675**	**€645**	**€934**

Source: INRIX, Cebr analysis

Our analysis shows that the annual total costs of idling to French households is €5.6bn, of which €2.7bn is incurred by households in Paris. The individual cost to a car-commuting household is €623 in France compared to €905 in Paris. The average annual number of litres consumed during idling in traffic is 23 litres per vehicle in France compared to 29 litres in Paris. This means that total annual costs accruing from fuel wasted during idling is €68 per vehicle in France and €87 in Paris[13]. The remainder of direct costs is explained by the value of commuting time which reflects potential losses in earnings and leisure time. Indirect costs from higher prices for goods and services make up 30% of total costs to households.

3.3 Germany

In Germany, there are 82.1m households and employment totalled 39.5m in 2011-significantly higher than the UK and France. In the 22 LUZs studied, the average percentage of workers commuting by car was estimated to be 66% - roughly the same as the UK (69%)[14]. This implies that there are a total of 13.2m workers commuting by car on the average working day. Table 8 illustrates the total annual wasted hours spent idling in traffic for all large urban zones (LUZs) along with total employment.

Table 8 Annual wasted hours per vehicle and total employment

Large Urban Zone (LUZ)	Annual wasted hours per vehicle	Employment
Stuttgart	57.9	1,510,624
Köln	57.5	1,074,265
Hamburg	54.5	1,742,233
Dusseldorf	50.5	945,238
Ruhrgebiet	46.9	2,493,362
Karlsruhe	44.2	423,033
Saarbrucken	42.6	443,590
Bonn	41.7	462,805
Munchen	39.4	1,683,970

[13] An average 2011 France fuel price of €1.50 per litre was sourced from the weekly European Commission Oil Bulletin based on the Euro-super 95 measure.

[14] German modal share of car for commuting is based on 2009 data from the Urban Audit project published by Eurostat (April 2012)

Freiburg im Breisgau	39.2	328,096
Bielefeld	35.4	666,935
Frankfurt am Main	34.2	1,502,153
Hannover	33.4	701,335
Nuremburg	28.6	769,413
Kiel	27.4	317,765
Darmstadt	27.2	229,130
Dresden	25.8	531,193
Berlin	25.3	2,390,367
Leipzig	25.1	494,313
Bremen	23.8	638,630
Magdeburg	21.7	253,510
Augsburg	19.2	323,963
Germany (LUZ only)	**40.8**	**19,925,924**

Source: Destatis, INRIX, Cebr analysis

Stuttgart has the highest level of road congestion, with a total of 57.9 hours spent idling in traffic every year per vehicle. The two German LUZs with the highest levels of employment are Ruhrgebeit and Berlin – but these areas rank only 5th and 18th in terms of levels of congestion. Table 9 illustrates the commuting and business values of time for Germany and Stuttgart[15].

Table 9 Commuting and business value of times (VoT) per hour, Germany and Stuttgart

	Germany	**Stuttgart**
Commuting VoT	€8.9	€10.8
Business VoT	€23.2	€25.9

Source: OECD, Destatis, Stuttgart Region Economic Development Corporation, Cebr analysis

The average commuting value of time in Germany is €8.9 per hour compared to €10.8 in Stuttgart. This is lower than the UK and France. The average business value of time in Germany is €23.2 per hour compared to €25.9 in Stuttgart. Table 10 reveals the direct and indirect household impacts of time spent idling during traffic.

Table 10 Direct and indirect household impacts of idling in traffic, euros per year

	Aggregate, €m		**Individual (per car-commuting household), €**	
	Germany	**Stuttgart**	**Germany**	**Stuttgart**
Direct costs (higher fuel and value of time costs)	€5,647	€701	€427	€715
Indirect costs (higher costs of goods & services)	€2,183	€261	€105	€217
Total	**€7,830**	**€962**	**€533**	**€932**

Source: INRIX, Cebr analysis

[15] Stuttgart business value of time (VoT) is based on GDP estimates from the Stuttgart Region Economic Development Corporation.

Our analysis shows that the annual total costs of idling to German households is €7.8bn, of which €1.0bn is incurred by households in Stuttgart. The individual cost to a car-commuting household is €533 in Germany compared to €932 in Stuttgart. The average annual number of litres consumed during idling in traffic is 20 litres per vehicle in Germany compared to 29 litres in Stuttgart. This means that total annual costs accruing from fuel wasted during idling is €62 per vehicle in Germany and €89 in Stuttgart[16]. The remainder of direct costs is explained by the value of commuting time which reflects potential losses in earnings and leisure time. Indirect costs from higher prices for goods and services make up 24% of total costs to households.

In the next section, we compare our findings for household impacts between countries and cities.

4 Inter-country and inter-city comparison of household impacts

In this section, we compare the household costs of idling in traffic between countries and cities respectively.

4.1 Inter-country comparison

A summary of the main differences in costs incurred by households in UK, France and Germany is provided below, along with the main reasons driving differences between countries' incurred costs.

- Total time spent idling per vehicle is highest in France (45.8 hours) compared to UK (39.2 hours) and Germany (40.8 hours).

- As such, **individual annual costs per car-commuting household** are highest in France (€645) compared to the UK (€566) and Germany (€533) The UK has the second highest cost per car-commuting household because the commuting value of time (€9.7 per hour) is higher than in Germany (€8.9 per hour).

- In spite of Germany having the lowest individual costs, total **aggregate annual household costs** are actually highest in Germany (€7.8bn) compared to France (€5.6bn) and UK. (€4.9bn).

- Total aggregate household costs are highest in Germany because it has the most large urban areas (LUZs) in which workers are commuting by car. Germany has 22 LUZs compared to 18 and 13 LUZs in the UK and France respectively. It is estimated that there are 13.2m workers commuting by car in Germany compared to 8.2m and 7.8m in UK and France respectively.

- On an hourly basis, the costs of idling are highest in the UK at €14.4 per hour, compared to €14.2 and €13.1 per hour in France and Germany respectively.

[16] An average 2011 Germany fuel price of €1.53 per litre was sourced from the weekly European Commission Oil Bulletin based on the Euro-super 95 measure.

4.2 Inter-city comparison

A summary of the main differences in costs incurred by households in London, Paris and Stuttgart is provided below, along with the main reasons driving differences between the cities' incurred costs.

- In 2011, total time spent idling per vehicle was highest in London (66.1 hours) compared to Paris (57.8 hours) and Stuttgart (57.9 hours). To put this into context, the average full-time worker works 1,946, 1,808 and 1,887 hours per year in UK, France and Germany respectively.

- As such, **individual annual costs per car-commuting household** are highest in London (€1,157) compared to Paris (€934) and Stuttgart (€932). The average costs of congestion per household are higher in the studied cities compared to countries as a whole because more hours are wasted in traffic and the value of commuting/business time is more valuable.

- The impact of indirect costs to household (through higher prices of goods and services), is highest in Stuttgart where indirect costs make up 24% of total costs compared to 19% and 14% in Paris and London respectively. This is because car travel is more prominent in Stuttgart (65% of workers commute by car) compared to Paris (43%) and London (33%).

- Even though Stuttgart has the highest individual costs, total **aggregate annual household costs** are actually highest in Paris (€2.7bn) compared to Stuttgart (€1.0bn) and London (€1.9bn).

- Total aggregate household costs are highest in Paris because it has the most workers travelling to work by car in terms of physical numbers. There are 2.4m workers commuting by car in Paris compared to 1.4m in London and 1.0m in Stuttgart. The modal shares of car in these cities are 43%, 33% and 65% for Paris, London and Stuttgart respectively. Another reason why Paris has the highest costs is because the business value of time is €36.2 per hour compared to €25.9 and €28.6 in Stuttgart and London respectively.

- Paris has the largest congestion cost impact relative to the national picture – around 48% of national congestion costs are borne by Parisian households. This compares to 38% and 12% of total national costs borne by households in London and Stuttgart respectively.

- On an hourly basis, the costs of idling are highest in London at €17.5 per hour, compared to €16.2 and €16.1 per hour in Paris and Stuttgart respectively.