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The Impacts of the Deregulation Act (2015) on Taxi-Related Incidents and Crimes in Leeds

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EXECUTIVE SUMMARY

- New ride hailing apps, such as Uber and Lift, are disrupting the traditional means by which consumers interact with private hire services. The 2015 Deregulation Act has helped to fuel these changes by effectively allowing drivers to operate in licensing authorities other than those that they have been licensed in.
- This report investigates the changes in ‘taxi-related’ incidents and crime events, using data collected by West Yorkshire Police for the Leeds district between 1 April 2013 and 31 March 2017. It seeks to highlight any changes to recorded crime levels that might be attributed to the Licensing Act and/or the activities of new ride hailing services.
- The main findings include:
 - After approximately December 2015, not long after the introduction of the Deregulation Act, the volumes of calls for service for *taxi-related* crimes began to decrease, whereas *all* calls (i.e. non-taxi-related) began to increase.
 - Examining taxi-related *Nuisance* and *Civil Dispute* incidents in particular, these diverged considerably from all other (non-taxi) incidents around the time of the introduction of the Act. This could be a due to fewer cash-based payments (these are a common cause of incidents).
 - As with incidents, the volume of taxi-related crime events also began to diverge (and decrease) from all other comparable crimes around the time of the introduction of the Act.
 - There appears to have been a large (38%) increase in new private hire driver license applications in Leeds after the introduction of the Deregulation Act. Much of this increase can be attributed to Uber applications (up by 1316% across the study period), but some other firms such as Amber Cars saw increases as well.
- The report recommends that licensing authorities (continue to) offer de-escalation training to reduce the number of Civil Disputes, and that they should collect more information about the drivers who are working in their area.
- The report provides compelling evidence that taxi-related crime has declined since the introduction of the Licensing Act, but is not yet in a position to state, categorically, that these changes are as a result of the Act.”

1 BACKGROUND

The growth and popularity of ride hailing ‘apps’ in recent years continues to change the ways in which consumers are able to interact with private hire services in England and Wales. These ‘disruptive’ effects on the traditional taxi and private hire services industry have created a more fluid private hire service economy, giving drivers the means to work flexibly alongside other paid work and, on some platforms, work at higher rates when demand is high via ‘surge pricing’. However, these trends have also created new challenges for regulators and local enforcement by giving drivers the means to regularly collect fares in licensing authorities beyond that which they are currently licenced. This is problematic as there are currently no national common standards nor a shared common database of licenced drivers in England and Wales (see Sections 1.3, 1.4 of the Law Commission Report 2014).

The foundation for these trends in the taxi and private hire services industry in England and Wales date back to the introduction of the Deregulation Act 2015 in October 2015 which aimed to reduce burdens on businesses and other bodies by improving or removing regulation in particular industries during the 2010 to 2015 Parliament. Specifically, the Deregulation Act 2015 established a new standard duration for taxi and private hire licences, and inserted two new sections in the Local Government (Miscellaneous Provisions) Act 1976 which covers the sub-contracting of bookings from one operator licenced in one licensing authority to the same operator located in a different licensing authority (see Sections 10, 11 of the Deregulation Act 2015 (Chapter 20) Explanatory Notes). In short, the Act allowed private hire drivers to operate across the whole of England and Wales, in areas in which they are not currently licenced, provided that the operator, driver and vehicle are licenced in the same area and the booking is also accepted in that area (see Executive Summary contained in Transport for London: Cross Border Hiring- Proposals for Legislative Change.).

At the time of writing, there have been few attempts to explore and examine the potential impacts of the Deregulation Act 2015 and growth in popularity in ride hailing ‘apps’ in the taxi and private hire services industry in England and Wales, and even fewer attempts to explore the potential impact on recorded crime. The latest figures from the Department of Transport show that the total number of licenced vehicles and drivers in England reached record levels in March 2017, driven by a 23.6% increase in licenced private hire vehicles (see Taxi and Private Hire Vehicle Statistics: England 2017.). At the same time, the Crime Survey of England and Wales has shown that levels of crime have continued to fall since the 1990s, and levels of lower-harm offences that might be expected to occur inside licenced taxi and private hire vehicles in England and Wales have remained stable or declined in 2016-17 compared to the previous year (see Trends in Crime in Crime in England and Wales: year ending September 2017.). This could point to a notable distinction between rising numbers of licenced vehicles and drivers at the same time as falling levels of taxi-related crime, although it is too early to say this with confidence.

2 DATA SOURCES AND DATA PREPARATION

The core data contained in this report were obtained from West Yorkshire Police and Leeds City Council and include:

- Calls for service and crime data for the Leeds district. These were recorded by West Yorkshire Police from 01 April 2013 - 31 March 2017.
- Private hire driver application data and active licence data recorded by Leeds City Council from 01 April 2013 - 31 March 2017.

Other data contained in this report were collated from a range of online sources including figures published by the Safer Leeds Community Partnership, and statistics published by the Department for Transport and the Crime Survey of England and Wales.

This project investigates the level of ‘taxi-related’ incidents and crimes in Leeds. Here a ‘taxi-related’ occurrence was defined as:

An incident or crime that involved an active driver who was working at the time and also interacting with a paying fare or another person in or near to the vehicle

The first data preparation task is therefore to isolate ‘taxi-related’ incidents and crimes from all other recorded occurrences. Some occurrence types, such as burglary, are extremely unlikely, or even impossible, to be associated with a journey in a minicab or private hire vehicle. Hence the analysis only included the following relevant categories: *Theft Offences, Violence Against the Person, Arson and Criminal Damage, Public Order Offences, Sexual Offences, Robbery, Miscellaneous Crimes Against Society, Possession of Weapons, Drugs Offences, Road Offences, and Non-Crimes (Civil Disputes, Nuisance, OPL)*.

The extraction of ‘taxi-related’ events was accomplished through the use of free text searches to identify calls for service (*incidents*) and crime records (*crimes*) that were recorded by West Yorkshire Police and were related to taxi journeys in Leeds during the study period. This process involved searching the *log text* and *crime notes* fields for words or phrases that identified ‘taxi-related’ records. The words searched for included: ‘taxi’, ‘taxi driver’, ‘private hire’, ‘private hire driver’, and ‘minicab’. After this process, the matching records were inspected manually by the academic team. Ultimately the data preparation process produced four datasets: a large dataset of ‘all incidents and all crime’, and a subset of this data that included ‘taxi-related’ incidents, and ‘taxi-related’ crime.

The final data preparation task was to isolate criminal offences (*crimes*) from other occurrences (*incidents*). This was accomplished by identifying the incident records that had been ‘crimed’ – crime records that have an original incident number attached to them – and separating these from the remaining crime and incident data. This was done in order to explore trends in civil occurrences (such as Civil

Disputes, Nuisance, OPL) which are not contained in crime data, and to contrast trends in incidents with the trends in criminal offences over time.

The data preparation process was problematic for a number of reasons. It was time consuming, even with the assistance of numerous team members; and was inherently subjective, relying on intuition to determine whether an incident or crime was related to taxi journeys. There were also many records that lacked a detailed description in the log text or crime notes, and many more lacked a location 'qualifier' (only 18% of 'taxi-related' records contained the qualifier 'taxi') or the location qualifier was merely described as 'road' or 'car', which made identifying records that were related to taxi journeys in Leeds even more difficult. The initial aim for data extraction was to employ supervised machine learning techniques to help better identify and extract 'taxi-related' records, however, this was harder to achieve than anticipated and needs to be explored further in future work. One recommendation of this report is to improve the recording of 'taxi-related' incidents and crimes, making them more easily identifiable so that more detailed analysis can be conducted in future on a larger scale in less time and with greater accuracy.

The application and licence data sets did not require any significant manipulation relative to incident and crime data.

3 CALLS FOR SERVICE TRENDS

This section reviews the trends in the volume of taxi-related calls for service compared to all other comparable calls.

3.1 TAXI-RELATED INCIDENTS

The most common calls for service recorded in Leeds during the study period overall were *Nuisance* and *Violence Against the Person* incidents which accounted for 28% and 17% of all calls for service. The most common taxi-related calls for service were *Civil Disputes* and *Violence Against the Person* incidents which accounted for 47% and 14% of taxi-related calls for service respectively.

Table 1. Calls for service by count and proportion

Calls for service Incident type	Taxi-related calls for service		All calls for service
	Count	Proportion	Proportion
Civil Dispute	546	47%	5%
Violence Against Person	161	14%	17%
Nuisance	99	9%	28%
Road Related Offence	95	8%	7%
Theft - Make Off Without Payment	46	4%	1%
Public Order	39	3%	3%
Criminal Damage	38	3%	10%
Theft - Other/ Handling	37	3%	9%
Suspicious Circumstances in a M/V	32	3%	10%
Other Notifiable Crime	21	2%	4%
Robbery	15	1%	1%
Hate Incident- Crime	7	1%	0%
Section 4/5 Public Order Act	6	1%	0%
Sexual Offence	5	0%	2%
Over Proscribed Limit	4	0%	2%
Total	1151	-	-

Interestingly, *Civil Disputes* decreased year on year across both sets of data, with a 47% decline in recorded taxi-related *Civil Disputes*, and a 50% in all *Civil Disputes* recorded during the study period. As both sets of data declined to a similar extent, this could point to a change in recording practice or reflect modern operational constraints due to reduced budget and resources rather than a 'real' terms decline, however it was beyond the scope of the research to fully examine this in greater detail.

Notably, taxi-related *Violence Against the Person* incidents increased by 79% during the full study period, however all violence against the person incidents increased by 111% during that time. This is interesting as it may point to a separation between particular types of taxi-related incidents relative to all incidents during this study period. This is discussed in more detail in Section 5.

This was not dissimilar to *Road Related Offences*: whereby taxi-related incidents increased by 163% but all incidents increased by 56% during the study period. This raises a number of questions that go beyond the scope of this research, such as: is this reflective of more road offences by taxi and private hire drivers in Leeds or a more road-safety conscious public who might be more willing to report taxi-related road offences due to being a notifiable occupation? Were these drivers licenced? Were they taxi or private hire drivers? Were they working at the time of the offence and from which licencing authority were they licenced in? Etc.

Since the growth in popularity of ride hailing ‘apps’ and the introduction of the Deregulation Act, concerns have been raised by local government and the local taxi and private hire service trade in Leeds about a rise in ‘out of town’ drivers and the potential risks to public safety if these drivers and vehicles conform to lower standards of training and safety checks relative to local drivers and vehicles. There could be an interesting link between *Road Related Offences*, ride hailing ‘apps’ and the introduction of the Deregulation Act, and a rise in ‘out of town’ drivers and vehicles in Leeds, however this is a large topic and one worth exploring in greater detail in future research.

Figure 1 displays a yearly rolling average of calls for service, comparing *taxi-related* and *all*. In both graphs the data have been indexed to a starting value of 1 in order to allow comparisons across datasets with different absolute volumes.

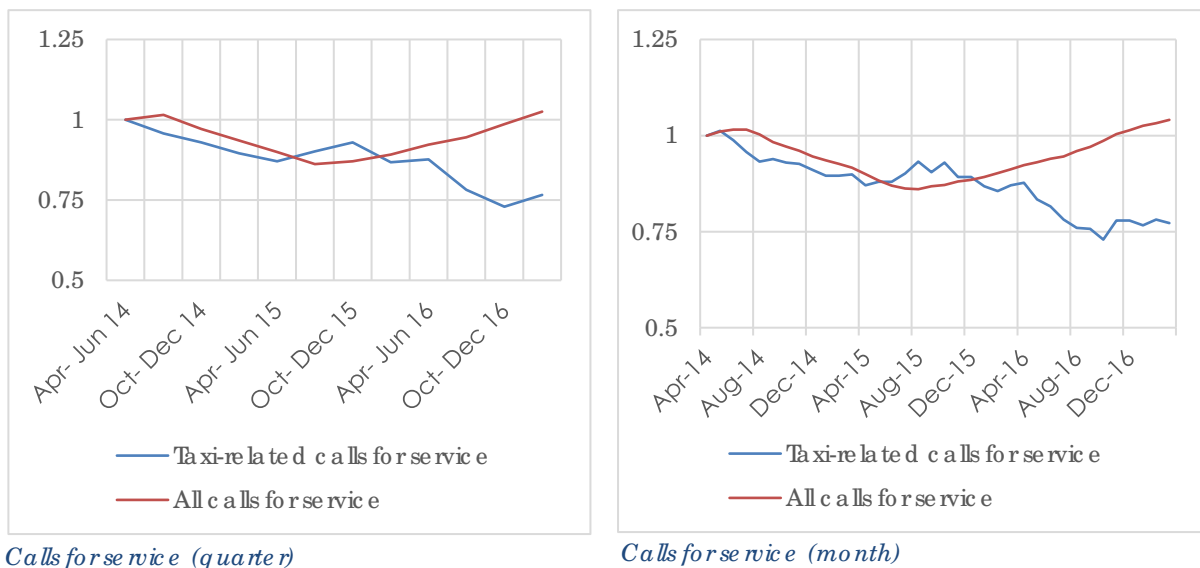
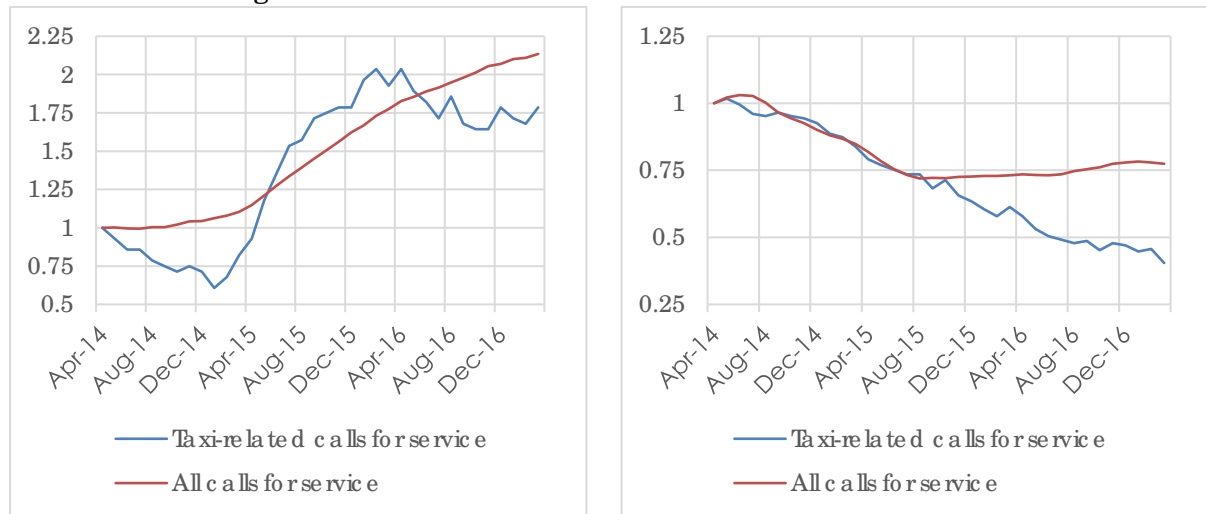


Figure 1. Trends in calls for service, comparing taxi-related incidents to all incidents.

The first point to note is that the volume in *taxi-related* calls for service appeared to separate from all calls for service around December 2015, not long after the introduction of the Deregulation Act in October 2015. It then began to decline whereas *all* calls began to increase. It is notable that there was a positive correlation between the two sets of data before the introduction of the Deregulation Act, but then a strong negative correlation in the remaining study period, with Pearson’s coefficient correlation values of 0.78 and then -0.83 respectively.

Figure 2 shows a yearly rolling average of *Violence Against the Person* offences and *Nuisance* and *Civil Disputes* recorded during the study period, comparing taxi-related calls for service against all calls for service.



Violence Against the Person (0.93, -0.56)

Nuisance and Civil Disputes (0.97, -0.81)

Figure 2. Trends in Violence Against the Person and Nuisance and Civil Disputes, comparing taxi-related and all calls for service recorded during the study period. The numbers in brackets display a Pearson's coefficient correlation value before and after the Deregulation Act in October 2015.

The first point to note is that the trends in taxi-related calls for service appear to separate from the trends in all calls for service, albeit at different points in time. It is notable that there was a near-perfect positive correlation in both *Violence Against the Person* as well as *Nuisance* and *Civil Disputes* in the study period before the introduction of the Deregulation Act in October 2015, but a negative / strong negative correlation between the two sets of data in the study period from November 2015 onwards.

The second point to note is that taxi-related *Nuisance* and *Civil Disputes* declined over time, but *Violence Against the Person* offences ended higher, relative to its original start point. It is also notable that there was a more prominent separation in trend in *Nuisance* and *Civil Disputes* relative to *Violence Against the Person* offences, reflected by the strong negative Pearson's coefficient correlation value of -0.81 relative to -0.56. The timing of this separation is also interesting as it would appear to coincide with the introduction of the Deregulation Act in October 2015, which also coincides with the popularisation of ride hailing 'apps' in England and Wales as a means to request and pay for a private hire booking. As many of the taxi-related *Nuisance* and *Civil Disputes* recorded during the study period appeared to be related to non-payment based on recorded text details, you might anticipate that this transition to 'app'-based payments without the need for cash may have reduced the opportunity for taxi-related *Nuisance* and *Civil Disputes* during the study period. The potential link between 'app'-based payments and the decline in some recorded incidents/ crimes in Leeds warrants more detailed analysis, ideally on a national or regional level.

4 CRIME TRENDS

The report will now discuss the trends in crime events, rather than incidents, comparing *taxi-related* events to *all*.

4.1 TAXI-RELATED CRIME

The most common types of taxi-related crime and all crime recorded in Leeds (from April 2013 to March 2017) were *Theft Offences* and *Violence Against the Person* offences. *Violence Against the Person* offences accounted for a similar proportion of taxi-related crime and all crime; namely 26% and 25% respectively.

As before, some forms of crime such as *Burglary* and *Shoplifting* were naturally absent. Other crime types (see taxi-related *Arson and Criminal Damage* in Table 2.) were slightly lower than anticipated as the data naturally ignores crime committed away from a vehicle or crime related to non-passengers.

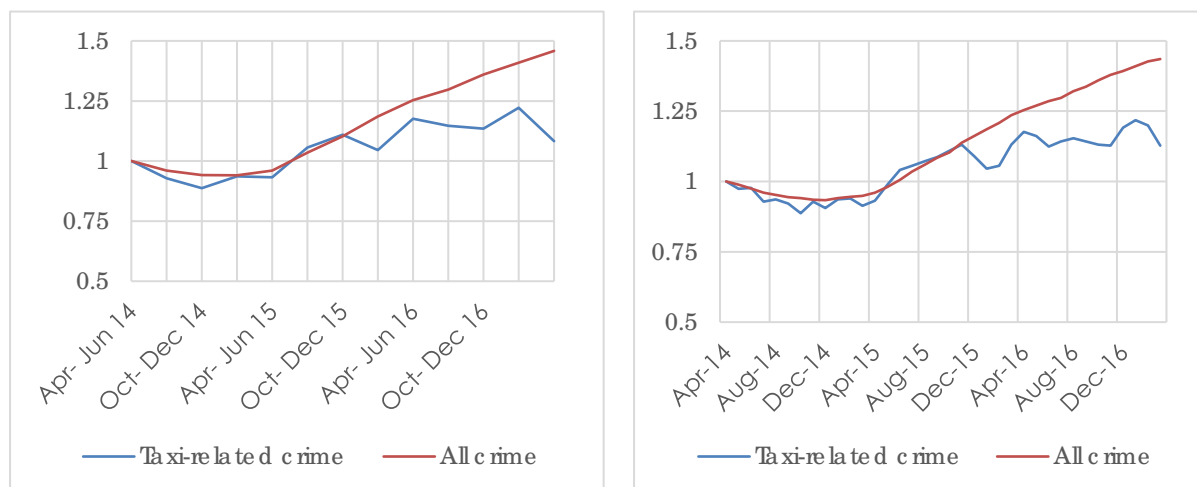
Table 2. *Taxi-related crime by count and proportion.*

Crime Category	Taxi-related crime		All crime
Theft Offences	530	48%	40%
Violence Against the Person	289	26%	25%
Arson and Criminal Damage	111	10%	19%
Public Order Offences	71	6%	7%
Sexual Offences	42	4%	2%
Robbery	37	3%	2%
Miscellaneous Crimes Against Society	25	2%	1%
Possession of Weapons	4	0%	1%
(Blank)	3	0%	-
Drugs Offences	3	0%	4%
Total	1115		-

The next section will further examine the relationship between taxi-related crime and all crime during the study period, with specific focus on certain forms of crime such as *Theft Offences* and *Violence Against the Person* offences in particular. These are the most common and therefore sufficiently common to allow a reliable comparison.

4.2 COMPARING TAXI-RELATED CRIME TO ALL CRIME OVER TIME

Figure 3 shows a rolling average of taxi-related crime and all crime recorded in Leeds during the study period (April 2013- March 2017).



Taxi-related crime and all crime (quarter)

Taxi-related crime and all crime (month)

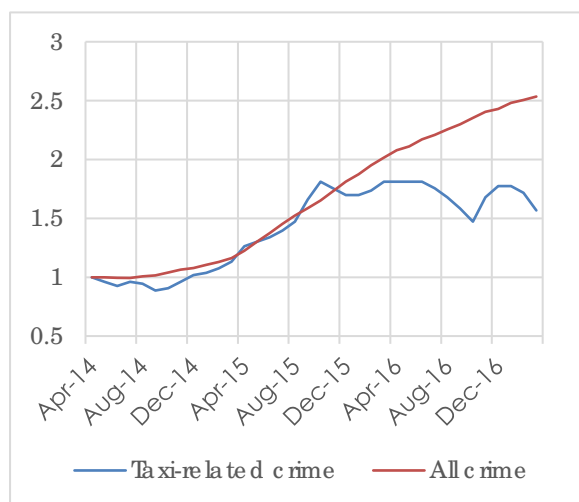
Figure 3. Taxi-related crime and all crime overtime, shown by a rolling average in order to smooth out high peaks and low troughs in taxi-related crime due to relative volumes.

The first thing to note is that taxi-related crime and all recorded crime increased over the study period, by 13% and 44% respectively. It is also notable that this tendency to increase over time is also reflected by a Pearson's coefficient correlation of 0.91 across the full study period.

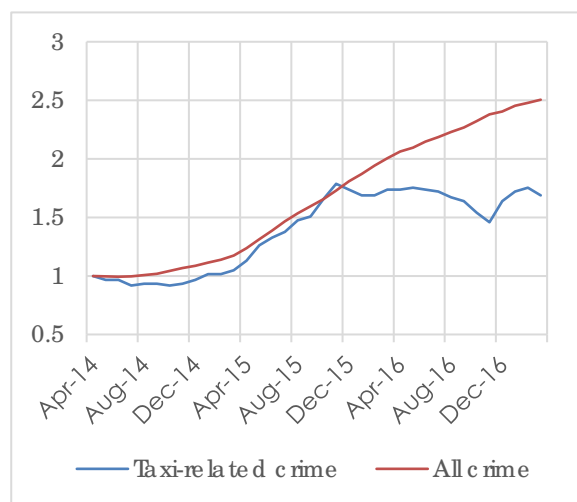
The second thing to note is that taxi-related crime appeared to separate from the trend in all crime in December 2015, shortly after the Deregulation Act came into effect in October 2015, with a near-perfect positive correlation of 0.97 in the study period before that time (April 2013–October 2015) and a weaker correlation of 0.63 from November 2015 onwards. The timing of this separation again appears to be significant, coinciding with the trend in calls for service data (see Section 3), and is further explored in the following section.

4.3 COMPARING TAXI-RELATED CRIME TO ALL CRIME OVER TIME (SUBCATEGORIES)

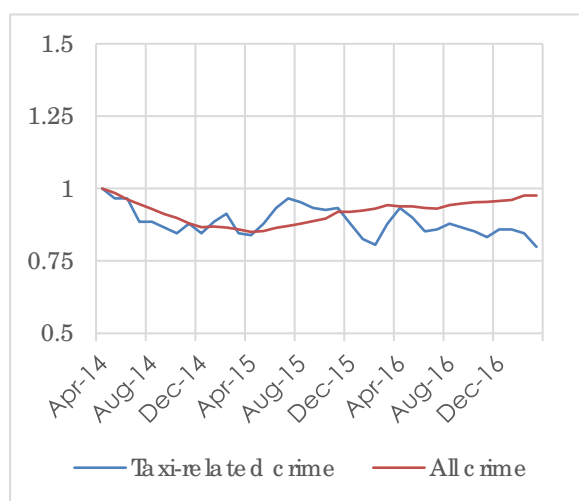
Figure 4 displays a series of crime types (subcategories) recorded in Leeds during the study period, shown by a yearly rolling average and compares taxi-related crime and all crime over time.



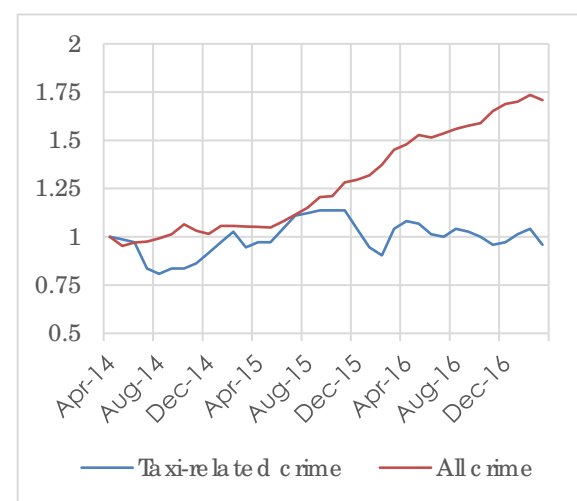
Violence Against the Person (0.98, -0.34)



Violence Against the Person and Sexual Offences (0.98, -0.43)



Theft (0.56, -0.40)



Theft - Make off without Payment (0.74, -0.21)

Figure 4. Trends in subcategories of recorded crime, comparing taxi-related crime and all crime recorded in Leeds during the study period (April 2013- March 2017). The numbers in brackets display a Pearson's coefficient correlation value before and after the De regulation Act in October 2015.

The first point to note is that there was a sustained increase in all *Violence Against the Person* offences recorded in Leeds during the study period, up by 153% overall, and those related to taxis up by 57%. Similar increases have been highlighted in other work such as the Safer Leeds Joint Strategic Assessment 2016, having identified significant annual increases in violent crime, largely due to a rise in *Assault with Injury* and *Assault without Injury*, prompted by a change in recording practices to comply with national guidance.

The second point to note is that taxi-related *Violence Against the Person* offences appeared to plateau in December 2015 whilst all *Violence Against the Person* offences continued to rise. This is interesting as it mirrors the trend in calls for service data (see Section 3) and again points to a change in trend not long after the Deregulation Act was introduced across England and Wales (see Pearson's coefficient correlation values before and after October 2015 in Figure 4).

The third point to note is that all *Theft Offences* remained stable over time relative to other crime types, down by -2% overall. This mirrors findings contained in the Crime Survey for England and Wales 2016 which points to a long term gradual decline in *Theft Offences* over a number of years at the national level, as well as the Safer Leeds Joint Strategic Assessment 2016 which pointed to a stable trend in *Theft Offences* recorded in Leeds over recent years.

It is also worth noting that there was a greater decline in taxi-related *Theft Offences* relative to all *Theft Offences*; -20% compared to -2% respectively. This decrease appears to be largely due to a -39% decline in recorded *Other Theft*, offences that were typically described in recorded text as the theft of personal property, usually smartphones, left in the vehicle or taken as 'collateral' for payment after a journey in a taxi. It is not known to what extent this trend is influenced by the Deregulation Act and the popularisation of 'app'-based technology to pre-book and pay for private hire journeys or whether the use of other 'apps' such as 'find-my-phone', may have decreased the opportunity for crime and raised the chances of identifying a suspect or location of property despite being recorded stolen.

Interestingly, taxi-related *Make off without Payment* offences remained largely stable over time, but also appeared separate from the trend in all crime not long after the Deregulation Act (see Pearson's coefficient correlation values before and after October 2015 in Figure 4). There could be a variety of reasons for this change, however the recent trend in using 'apps' to book and pay for private hire journeys might again decrease the opportunity to commit/ recorded volume of taxi-related *Other Theft*.

4.4 LOCATION OF TAXI-RELATED CRIME

Table 3 displays *taxi-related* crime and *all* crime by partnership working area. These are geographical management areas used by West Yorkshire Police, Leeds City Council and other partners, and are formed by joining three or more wards together (with the exception of the ‘City’ area). This classification was a more appropriate method of showing low volume crime in Leeds. Ward level and lower/ medium super output areas were not large enough to clearly show relative difference.

Table 3 Taxi-related crime and all crime shown by Leeds Partnership Working Area. Missing grid coordinates meant that a location could not be identified in 8% of cases.

Partnership Working Area (PWA)	Taxi-related crime		All crime
City	219	21%	17%
Inner East	188	18%	15%
Inner North West	118	12%	7%
Inner West	98	10%	8%
Outer East	74	7%	6%
Inner North East	72	7%	7%
Inner South	67	7%	13%
Outer South	61	6%	7%
Outer West	60	6%	7%
Outer North West	38	4%	5%
Outer North East	31	3%	4%
Total	1026		-

The most common PWA in Leeds for recorded crime and disorder during the study period was the *City*. It is notable that 21% of taxi-related crime was attributed to this area, which was higher than anticipated based on the proportion of all crime recorded in this area (see Table 3.).

Recorded crime was also common in the InnerPWAs of Leeds during the study period, and was particularly common in the *Inner East* in both sets of data. Interestingly, taxi-related crime was consistently more common in inner areas of Leeds relative to all crime, with the exception of the *Inner South* (see Table 3.).

The least common PWAs for recorded crime and disorder were the OuterPWAs, and in particular the *Outer North East* which accounted for the smallest proportion of crime in both sets of data. Across the full study period, these outer-lying areas of Leeds accounted for 26% of taxi-related crime and 33% of all crime, respectively. On the one hand this appears to be an interesting separation between the two sets of data, however this could also be reflective of fewer opportunities for taxi-related crime due to fewer roads, lower traffic density and fewer trips to these areas due to time / distance travelled from the city centre.

4.5 COMPARING THE LOCATION OF TAXI-RELATED CRIME AND ALL CRIME OVER TIME

Figure 5 displays the location of recorded crime in Leeds during the study period, shown by merged PWA, comparing taxi-related crime and all crime over time. In the chart on the left, the City and all Inner PWAs are shown together. This was necessary as there were far fewer taxi-related crimes recorded in the *City* relative to all *Inner PWAs* combined, resulting in sharp peaks and low troughs, making the *City* unsuitable for comparison on its own.

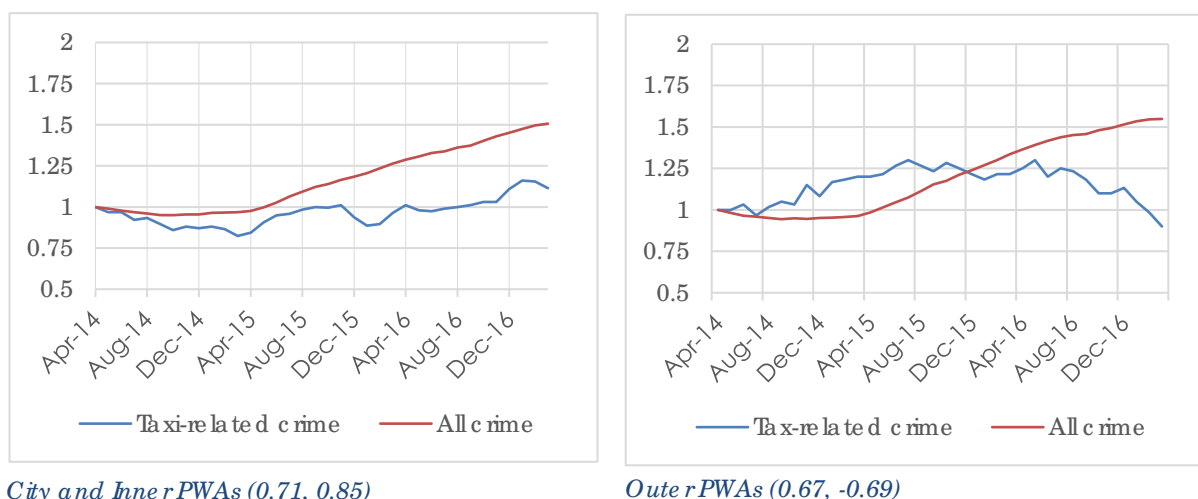


Figure 5 Trends in the location of recorded crime in Leeds by PWA, comparing taxi-related crime and all crime recorded in the City and Inner PWAs and the Outer PWAs of Leeds. Numbers in brackets display a Pearson's correlation coefficient values before and after the Deregulation Act which was introduced in October 2015.

The first point to note is that *taxi-related* and *all crime* increased in the *City* and *Inner PWAs*, ending 11% and 51% higher by the end of the study period, respectively. It is also notable that taxi-related crime and all crime had a greater tendency to increase over time in the study period after the Deregulation Act in October 2015 (see Pearson's correlation coefficient values in Figure 6.).

The second point to note is that taxi-related crime started to decline in the *Outer PWAs* in December 2015, but all crime continued to increase, ending -10% and 55% lower/higher, respectively. This is also reflected by the shift from a positive correlation value of 0.67 to a negative correlation value of -0.69. The timing of this separation is interesting as it appears to coincide with the introduction of the Deregulation Act, and also follows the trends in calls for service / recorded crime over time (see Section 5., and Section 6.). It would be interesting to examine whether this separation between taxi-related crime and all crime is also evidenced in other cities located in England and Wales in a separate paper. If undertaken, this work could help identify whether the trends in Leeds are anomalous or whether they form part of a larger trend since the Deregulation Act came in to effect in England and Wales.

Figure 6 displays the prevalence of recorded crime in Leeds during the study period, shown by 250m hexagon areas shaded according to count, and compares *taxi-related* and *all* crime before and after the Deregulation Act 2015. Figure 6 Prevalence of recorded crime in Leeds during study period, shaded from light to dark based on standard deviation². Results are shown according to a set scale. Prevalence mapping was the preferred method for geo-spatial analysis to enable comparison between the two sets of data which are of different relative size³.

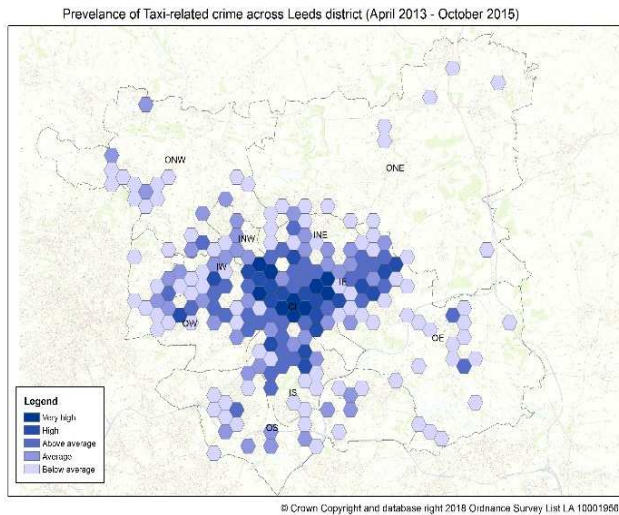


Chart A.

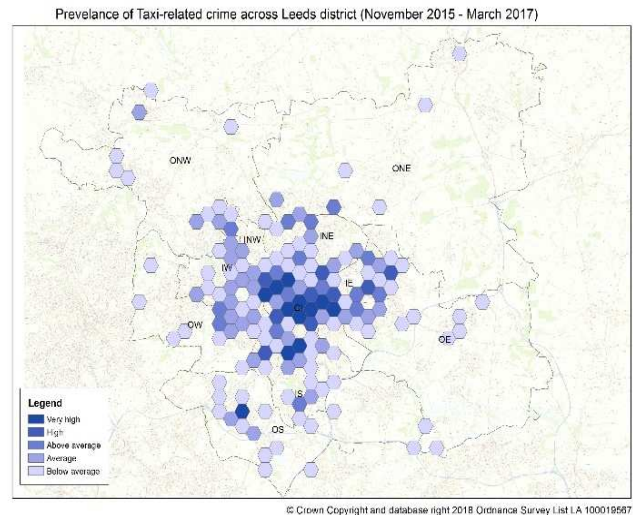


Chart B.

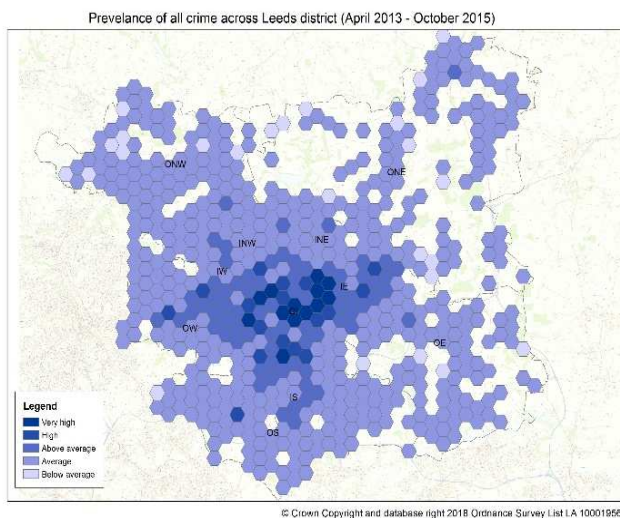


Chart C.

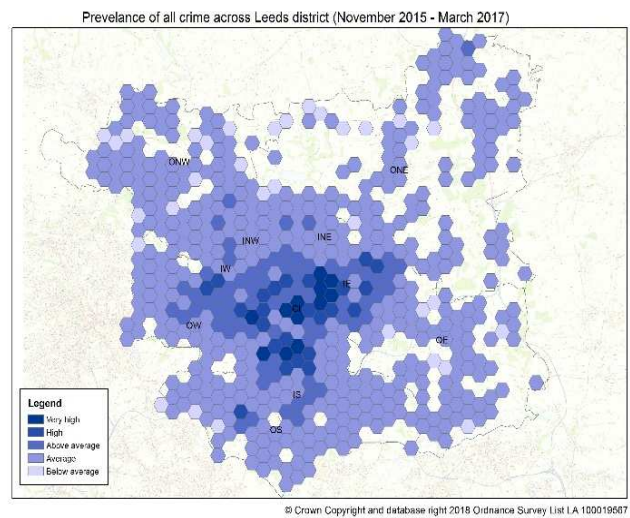


Chart D.

² Prevalence level was determined by standard deviation above or below the average (mean) whereby 'Below average' relates to -0.5 lower than the mean, 'Average' relates to one standard deviation ± 0.5 around the mean, 'Above average' relates to up to 1.0 standard deviation above the mean, 'High' falls between 1.0 and 2.0 standard deviations from the mean and 'Very high' relates to 2.0 or more standard deviations above the mean.

³ Prevalence by hex grid was more appropriate than kernel density across ONS output areas as each hexagon is a set geographical area with shared boundaries to another hexagon, and does not smooth point data to create artificial areas of prevalence or hot spots, but rather forces it within a centroid, and can be used to compare prevalence across areas that share common traits and across data sets of different relative size.

The first point to note is that there was a very high prevalence of recorded crime in the *City* and also a very high / high prevalence in the *Inner PWAs* across the study period. It is also notable that recorded crime was less prevalent in the *Outer PWAs* relative to the *City* and *Inner PWAs*.

The second point to note is that taxi-related crime was recorded in fewer areas in Leeds after the Deregulation Act (reflected by fewer shaded hex areas in Chart A compared to Chart B in Figure 6) whilst the location of all crime remained stable over time. It is also notable that the taxi-related crime became less prevalent in outer-lying areas of Leeds after the Deregulation Act in October 2015 (see increase in below average / average hex areas in Chart B compared with Chart A in Figure 6) which was counter to the trend in all crime.

Figure 7 displays the prevalence of recorded crime in Leeds during the study period, shown by prevalence level (shaded from light to dark, from lowest to highest) and shown before and after the Deregulation Act.



Chart A.

Chart B.

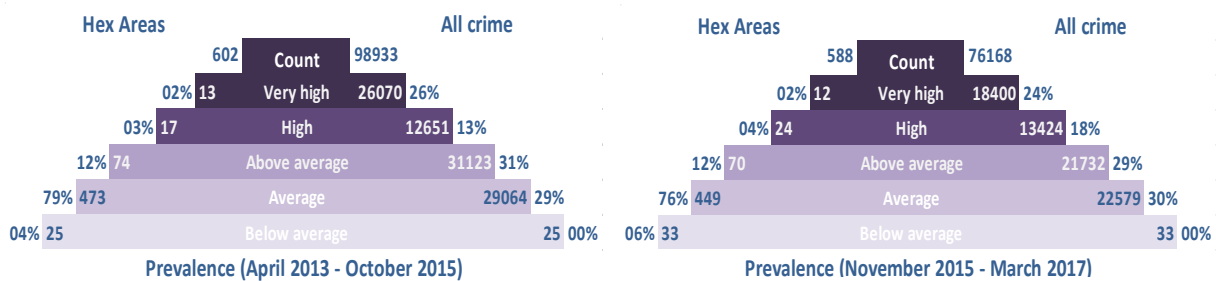


Chart C.

Chart D.

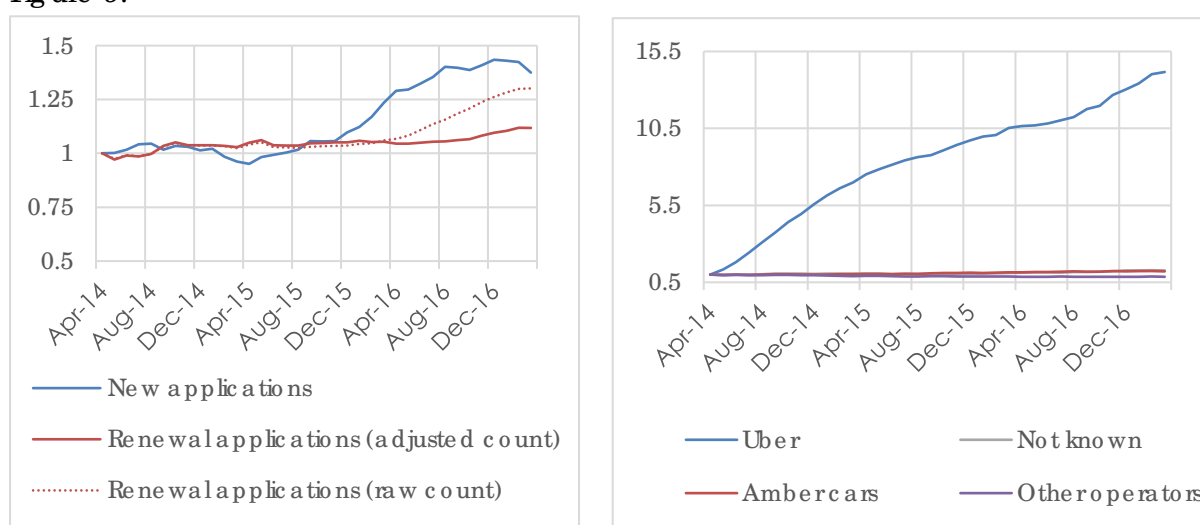
Figure 7 Prevalence of recorded crime in Leeds during the study period, comparing taxi-related crime and all crime before and after the Deregulation Act in October 2015. The numbers display the raw count whilst percentage displays proportion.

The third point to note is that the prevalence of taxi-related crime in Leeds changed over time counter to the trend in all crime, with more *Very High* hex areas that accounted for a larger proportion of taxi-related crime, whilst *High* / *Average* hex areas were fewer in number and lower in proportion, and *Below Average* hex areas declined in number but accounted for a greater share of taxi-related crime (see change in proportion between Chart A and Chart B relative to C and D in Figure 7). It is also worth noting that the distribution of taxi-related crime changed over time counter to the trend in all crime, with a kurtosis of 45 (up from 38) and a skewness of 7 (up from 5) in the study period after the Deregulation Act in October 2015, indicating that taxi-related crime data was more heavy-tailed and more skewed, whilst all crime data was lighter-tailed and less skewed with a kurtosis of 169 (down from 191) and skewness of 11 (down from 12) during that time.

5 TAXI AND PRIVATE HIRE LICENSING DATA OVER TIME

Thus far the report has examined changes in the number of incidents and number of crimes. This section will assess, as far as possible, the changes in number of possible taxi drivers who are licensed during the study period.

Figure 8 shows *New* and *Renewal* private hire driver applications processed by Leeds City Council over the study period, and also shows named operator (if known) at the time of application. *New* and *Renewal* taxi driver application data were unfortunately not obtained for this piece of work. The drawback with not having these data shall be mitigated by ‘active’ taxi and private hire licence date over time, as shown later in Figure 9.



New and Renewal applications

Operator on application (if known)

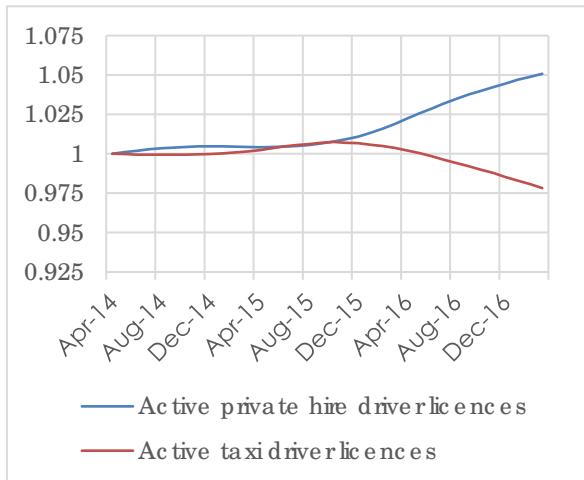
Figure 8. Trends in private hire driver applications processed by Leeds City Council during the study period. ‘Not known’ refers to the number of applications without a named operator or refers to applicants who were recorded as not working on the date the application was processed. ‘Adjusted count’ shows the anticipated number of renewal applications if a standard private hire licence had been granted.

It is important to note that there were a greater number of *Renewal* private hire applications processed by Leeds city Council from April 2016 onwards than was expected. On closer inspection, more *Temporary* private hire driver licences (valid for three months) appear to have been issued at this time relative to the period before April 2016. This meant that *Renewal* applications were 18% higher relative to what would be expected if a standard one-year private hire licence had been issued (see differences in raw count and adjusted count in renewal applications in Figure 8). There are many reasons why there may have been an increase in temporary licences, including operational constraints, or as a result of more enforcement / compliance action, however it was beyond the scope of this piece of work to explore this in any greater detail.

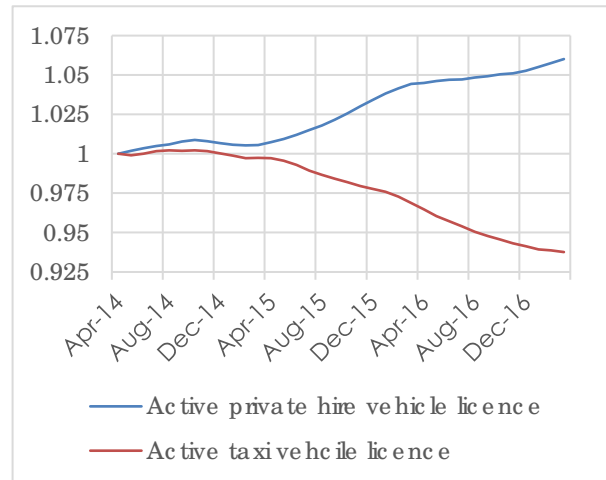
The first point to observe is that *New* and *Renewal* private hire driver applications started to rise in December 2015 and were up by 38% and 12% by the end of the study period (see trends in private hire driver applications shown in Figure 8). It is also worth noting that there was a 30% increase in the mean number of *New* applications in the study period after the Deregulation Act in October 2015, rising to 748 (up from 580). It is interesting that this separation in trend also coincides with the introduction of the Deregulation Act in October 2015 as this piece of legislation was largely aimed at private hire vehicles and private hire operators, making it possible for an operator to subcontract a booking to an operator in a different area and not be in breach if that driver or vehicle is licenced in a different licensing authority (see Section 66. of the Deregulation Act 2015 Explanatory Notes). This might have encouraged more drivers into the industry by offering them the opportunity for more bookings in a different licensing authority to the one in which they are licenced.

The third point to note is that there was a large sustained increase in the number of *New* and *Renewal* private hire driver applications linked to *Uber* across the whole study period, up by 1316%, and a twofold increase in the mean number of applications in the study period after the Deregulation Act in October 2015, rising to 769 (up from 375). Interestingly, there was also a rise in the number of applications linked to *Ambercars* which were up by 21%, and also a 15% rise in the mean value 1028 (up from 895), but a slight reduction in *New* and *Renewal* applications linked to *Other Operators* which were down by -14% during that time. This would appear to indicate that there has been growth as well as consolidation in the private hire operator industry located and licenced to operate in Leeds during this time, which could have an impact on our understanding of trends in recorded crime.

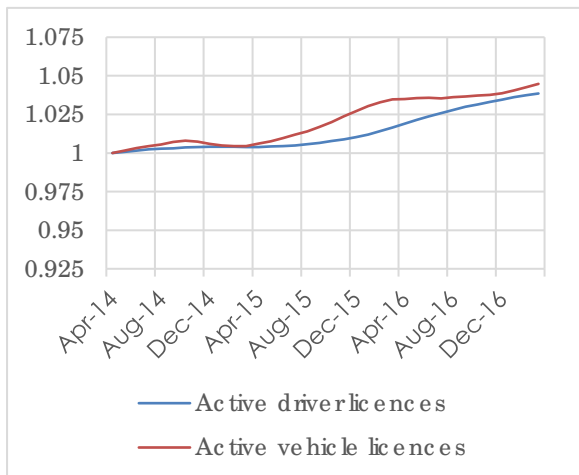
Figure 9 shows active driver/ vehicle licences ‘issued’ by Leeds City Council during the study period, and compares active private hire licences and active taxi licences over time.



Active driver licences (0.67, -0.98)



Active vehicle licences (-0.89, -0.94)



Active driver / vehicle licences (0.92, 0.92)

Figure 9. Trends in taxi and private hire licensing data in Leeds during the study period, comparing active private hire licences and active taxi licences over time. An ‘active licence’ refers to those which were valid and currently ‘issued’ (not suspended or revoked) at the end date of each month. Numbers display a Pearson’s coefficient correlation values before and after the Deregulation Act in October 2015.

Active private hire driver licences appeared to separate from active taxi driver licences in December 2015, which coincides with the increase in New private hire driver applications over time (see Figure 9 Figure 8) and was also around the time the Deregulation Act came into force in October 2015. This separation is also reflected in the shift from a positive correlation of 0.67 to a strong negative correlation of -0.98 (see Pearson’s coefficient values in Figure 9). Interestingly, active private hire vehicle licences also separated from active taxi vehicle licences, but much earlier than anticipated, with a strong negative correlation throughout the study period.

Also, it appears that when combined there was still a net rise in the number of active driver and vehicle licences issued by Leeds City Council by the end of the study period, up by of 4% and 5% respectively (see combined rolling average *private hire* and *taxi* driver/ vehicle licences in Figure 9). This suggests that, overall, there were a higher number of drivers licenced to operate in Leeds and more licenced vehicles on the roads in Leeds by the end of the study period. However without data on the number of estimated / counted trips undertaken in a licenced vehicle in Leeds it is hard to be sure of this.

6 ESTIMATING THE NUMBER OF MINICAB JOURNEYS

A drawback throughout the preceding analysis is that the number of minicab journeys has not been taken into account. Whilst comparisons of 'taxi-related' and 'all crime' incidents still hold, it would be useful to know whether the number of journeys (and hence the denominator for crime rates) has changed as well. The data that were closest to a count or estimation of the number of minicab journeys in Leeds were road level annual average daily flows (AADFs) of cars and taxis estimated or counted in Leeds from 2013 - 2016, and the average number of trips taken by mode (minicab) per person per year in England during that time. Both of these are recorded and made available for download by the Department for Transport.

The first data set – the AADFs of estimated or counted cars and taxis in Leeds – shows that the overall number of cars and taxis in Leeds was 15% in 2016 higher compared to 2013, whilst the second data set showed that the number of trips broadly remained stable overtime at 10 trips per person per year, although this rose to 11 trips per person per year in 2016.

This is interesting because a combination of different data sources all point towards overall growth in the taxi and private hire industry in Leeds, and significant growth in the private hire segment, which has implications for our understanding of trends in recorded crime. A stable trend in taxi-related crime, in the context of more licenced drivers / vehicles on the roads and more trips by passengers using these services in Leeds, means that taxi-related crime has moved even lower relative to the trend in all crime.

7 CAVEATS

Another drawback in the preceding analysis is that risk has not been taken into account. Alongside the analysis of incidents and crimes, it would have also been useful to know whether the risk of travelling in a taxi or private hire vehicle in Leeds has changed over the study period. Whilst the current findings appear to point towards fewer incidents and less crime since the Deregulation Act, which might suggest a lower-risk, this topic needs to be examined in greater detail, and ideally on a national scale in the context of no common standards on policies like convictions criteria and vehicle safety as well as no national database of licensed drivers and vehicles.

It also would have been useful to examine the *severity* of the recorded crimes as aggregating different crimes into one total is problematic, ignoring the fact that some crimes can be more harmful than others. Whilst current findings suggest there has been a separation between taxi-related crimes and all crimes during the study period, the severity or impact of these offences on the victim and society have not yet been explored. For example, the work did not attempt to estimate whether the most serious taxi-related crimes have changed in line with the least serious (and most common). Future work could look to explore this topic further through the use of a crime harm index based on sentencing guidelines, the likely impact on victims and likely cost to society.

In a similar vein, we do not yet fully understand the role and impact of external factors on trends in recorded incidents and crimes over time. Whilst it might be expected that changes in recording practice – whether in response to recommendations given by Her Majesty’s Inspectorate of Constabulary and Fire & Rescue Services (HMICFRS) or from the impact of austerity on operations such as proactive policing – would affect both taxi-related and all incident and crime data in equal measure, the use of ride-hailing ‘apps’ could have had an impact on reporting behaviour in a way that is not yet clear. For example, taxi-related complaints, incidents and crimes might be reported to the operator but not feature in police recording. It also would have been useful to examine the ways in which reporting behaviour may have had an impact on the recorded location of taxi-related incidents and crimes. For example, the reporting person may have a greater certainty of their location in central and inner areas of Leeds, and the reporting practices of drivers who are still claiming time might also have had an impact on the recorded location (e.g. a driver might be less likely to take time out to report an offence during peak hours).

8 SUMMARY AND CONCLUSIONS

8.1 SUMMARY

The findings of this research appears to indicate that since the introduction of the Deregulation Act (2015) taxi-related incidents and crimes separated from the trend in all incidents and all crimes recorded in Leeds during the study period. Results also indicate this separation was more pronounced in particular types of incidents and crimes such as *Nuisance* and *Civil Disputes, Road-related Offences, Violence Against Person*, and *Make off without Payment*, and was less pronounced in recorded *Theft Offences*. Spatial analysis also appears to indicate that since the introduction of the Deregulation Act (2015) taxi-related crime moved counter to all crime, becoming more common, less scattered, and more prevalent in central and inner areas, and was in contrast less common and less prevalent in outer areas of Leeds. Findings also point towards a rise in the number of new private hire driver applications and number of active private hire driver and vehicle licences after the introduction the Act, and a cumulative increase in active licences (issued by Leeds City Council) and consolidation in the private hire services industry in Leeds across the whole study period. Whilst it is not clear precisely how many minibab journeys were undertaken by the public in Leeds during the study period, we estimate that the number of journeys is likely to have increased slightly based on local annual average daily flows of cars and taxis (AADFs) and self-reported journey data. Overall, these findings suggest that since the Deregulation Act (2015) there are more active licenced taxi and private hire drivers and vehicles in Leeds, more cars and taxis on the road; and within this context, even *lower* levels of taxi-related incidents and crime which had already moved counter to the trends in all incidents and all crime from November 2015 onwards.

8.2 POLICY RECOMMENDATIONS

The results of this project are not yet conclusive as there are number of important caveats (discussed in Section 7). However, these early results still point to some policy recommendations. Firstly, Civil Disputes represent the largest proportion of taxi-related crime (47%, see Table 1). Therefore the first recommendation is that **licensing authorities (continue to) offer de-escalation training to drivers**. This training should help to prevent disagreements from escalating into crimes or incidents.

Secondly, it was difficult to find data to support the anecdotal evidence that drivers who were licensed in districts outside Leeds were working within the city. Some license data were collected by Leeds City Council Taxi Licensing through the use of mobile video vans, but these were not used in the analysis because they were not collected in a sufficiently rigorous manner. The project recommends that **the CCTV license data continue to be collected, but using a more rigorous methodology**. For example, the data could be collected at consistent times every week and at consistent locations.

8.3 FUTURE WORK

The most immediate tasks for future work are:

- **To conduct a more rigorous statistical analysis of the change in taxi-related crime.** Although the correlation statistics used throughout the report are illuminating, the changes might not be statistically significant. Time series analysis might offer more concrete evidence for a change in the number of crimes over time at the point of the introduction of the 2015 Licensing Act.
- **To inspect the *individual crimes and incidents in more detail.*** Although this report found a relative decrease in taxi-related crime, it did not attempt to estimate harm. It is therefore possible that the Act has simultaneously reduced the total number of incidents by encouraging operators that provide cashless payments (such as Uber) to operate, but at the same time caused an increase in the most serious offences by making it easier for drivers to obtain licenses from less strict licensing authorities and then operate elsewhere.
- **To broaden the analysis to other cities/regions.** This work focused entirely on Leeds. It would be very useful to conduct a similar analysis in another city to determine whether the results here are likely to generalise.
- **Develop reliable machine-learning methods that can identify ‘taxi-related’ crime automatically.** The task of separating ‘taxi-related’ crime from all others was extremely time consuming, and prevents this work from easily being repeated in other areas. It is possible that a supervised machine learning algorithm could be used to identify taxi-related crime with limited human intervention.
- The *General Data Protection Regulation (GDPR)* will come in to force in May 2018. This will undoubtedly have an impact on the ways that licensing authorities and minicab / private hire companies handle personal data. For example, firms might find it more difficult to ‘blacklist’ passengers. Future work could **begin to explore the potential impacts of the GDPR on taxi-related crime.**