



### Forecasting demand for the Credit Hire Industry in the UK

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# Forecasting demand for the Credit Hire Industry in the UK

## Abstract

This study aims to test on the predictability of Credit Hire services for the Automobile & Insurance Industry; a relatively sophisticated time-series forecasting procedure, which conducts a competition among exponential smoothing models, is utilised as to forecast demand for a leading UK Credit Hire Operator (CHO) and the generated forecasts are compared with the Naïve method, resulting that demand for CHO services is indeed extremely hard to forecast as the underlying variable is the number of road accidents – a true stochastic variable.

## I. INTRODUCTION

During the last decades organisations are gradually realising the potential benefits of predicting the outcome of future events and strive to reduce uncertainty by implementing high-quality forecasting methods. Forecasting is particularly important in business sectors where accurate prediction of demand is fundamental to success. One such sector consists of the Credit Hire Operators (CHOs), a hybrid business model, which combines features of the traditional car rental companies and the modern credit institutions. The principal operation of CHOs involves facilitating the innocent party of an accident, by providing like for like replacement vehicle services on credit, and alleviating the usual high levels of dispute and litigation in the claim process.

According to the British Department for Transport (2006) around 200,000 vehicle accidents occur in the UK every year. Since the year 2004, and after a long period of

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3 legal actions between CHOs and insurers (for an example see *Dimond v Lovell -*  
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6 *2000*), Credit Hire has been regulated by the Office of Fair Trade, the UK's consumer  
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8 and competition authority. It has also been supported (McLaren, 2000) that, CHOs  
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10 are an important part of the automobile and insurance industry, while the sector  
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12 turnover is constantly increasing. However, there is, until today, a complete lack of  
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14 research on the CHOs' economic prospects and sustainability.  
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18 Success in this industry is very much related to having a good estimation of the  
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20 demand for vehicles. Furthermore, since CHOs can have quite a broad supply chain  
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22 (manufacturers, insurers, solicitors, repairers etc.), it is not only in their own interest  
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24 to estimate demand accurately, but also to the other organisations whose business  
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26 they are linked to.  
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35 The purpose of this study is to test whether a relatively sophisticated forecasting  
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37 procedure has the ability to soundly forecast the demand for CHO services. In order  
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39 to do this, data from a leading UK CHO (referred to as Company X) has been used.  
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## 47 **II. LITERATURE REVIEW AND THEORETICAL BACKGROUND**

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50 Forecasting is by no means an exact science; there are seldom two independent cases  
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52 where the same method can be applied (Jenkins, 1982). Each individual forecasting  
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54 scenario warrants careful analysis and will usually involve the use of a structured  
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56 approach, such as the one proposed in Makridakis *et al* (1998).  
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Business forecasting is present, in some form or another, in all areas of business as it plays an integral part in planning and strategic decision making. Makridakis (1996) explains that forecasting can play a significant role in business improvement through its direct implications on planning and strategy so long as the forecasting function is well integrated into the organisation. A large variety of qualitative and quantitative methods of all levels of sophistication have been adopted by business forecasters in order to predict real life time series (Allen and Salim, 2005; Petropoulos *et al.*, 2005; Kargbo, 2007). Several studies comparing the accuracy and quality of these different methods reach the consensus that the simple methods do not perform any worse (in some cases they actually perform better) than the more sophisticated ones (Makridakis *et al.*, 1982; Armstrong, 1984). This emphasises the importance of carefully outlining a set of suitable methods in any given forecasting situation, testing them, and proceeding with the best performer.

### III. DATA & EXPERIMENTAL SETUP

To provide an applicable solution for the CHOs, forecasting estimates need to be generated for three different variables: *referrals*, *hires* and *hire days*. *Referrals* are request invoices describing the specifications of the unroadworthy vehicles needing replacement, *hires* represent the number of vehicles which are actually on hire at any given moment and *hire days* are the number of days that vehicles are on hire at any given moment. A representative sample was drawn from Company X's database for analysis. This database consisted of daily referral entries in chronological order, specifying the make and model, the on and off hire date and the category of the damaged vehicle (prestige, sub-prestige or domestic).

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3 To generate forecasts for the above variables, we are introducing the XFP, a six-step  
4 forecasting procedure, which conducts a competition between a selection of  
5 exponential smoothing (ES) methods and consequentially outputs the best forecasts  
6 for the required horizon. The procedure involves choosing the desired aggregation  
7 level (make, model, horizon), producing holdout forecasts with the use of forecasting  
8 software, inputting holdout forecasts into a spreadsheet template, generating  
9 forecasts for the required horizon for four ES models<sup>1</sup>, and finally, adjusting the  
10 forecasts based on the judgement and expertise of the forecaster. The competition of  
11 the XFP is limited to ES models because of their simplicity and robustness. ES  
12 models do not require any information about the forecasting environment and treat  
13 the system as a 'black box' (Makridakis *et al.*, 1998). Additionally, the used ES are  
14 preferred for their combined ability to handle a broad range of data types.

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36 The method acting as a benchmark over the performance of the XFP is the Naïve,  
37 also known as the random walk, which simply uses the most recent observation as a  
38 forecast. According to Makridakis *et al* (1998), many economic and business series  
39 behave as random walks, making them very difficult to forecast. In many of these  
40 cases, the Naïve method is the best forecasting alternative. The two accuracy  
41 measures used in this assessment are the Mean Absolute Percentage Error (MAPE)  
42 and the symmetric Mean Absolute Percentage Error (sMAPE)

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54 The hypothesis test will reveal whether there is enough statistical evidence in the  
55 sample to reject the claim that the Naïve performs better than (or equally to) the XFP.

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<sup>1</sup> The four models are : Simple Exponential Smoothing (SES), Holt Exponential Smoothing (HES),  
Holt- Winters Exponential Smoothing (HWES) and Double Exponential Smoothing (DES)

$$H_0 : \varepsilon_1 \geq \varepsilon_2 \text{ versus } H_1 : \varepsilon_1 < \varepsilon_2$$

where  $\varepsilon_1$  is the mean APE and sAPE of the forecasts produced with the XFP and  $\varepsilon_2$  is the mean APE and sAPE of the forecasts produced with the Naïve method.

#### IV. RESULTS & DISCUSSION

The XFP and the Naïve method were both applied to certain time series of the most popular vehicle specifications that Company X deals with (Audi, BMW, Mercedes Benz). Both methods (*XFP* and *Naïve*) were used to forecast the three variables (*referrals*, *hires* and *hire dates*) for three different horizons (*short* - 1 month ahead, *medium* - 3 months ahead and *long term* - 12 months ahead). Thus, forecasts were prepared for 144 individual months.

The results are presented in Table 1, where mean and medians for the error measures are reported. The mean MAPE of the XFP forecasts was found to be 23.4%, while the Naïve method generated a smaller value of 22.3%. Similarly, the XFP resulted in greater mean and median sMAPE, than the Naïve. To test whether the differences of these values are statistically significant we ran the appropriate<sup>2</sup> paired observation test. For both the error measures the null hypothesis can be rejected, thus all differences in are not statistically significant and the XFP does not perform any better than the Naïve – not to say than on average and on-median it is actually worse.

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<sup>2</sup> When the differences in the paired observations were deemed to be normally distributed, a *paired T-Test* was used and otherwise, the *Wilcoxon Signed Rank Test* was used.

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**[Insert Table 1 about here]**

Thus, based on the sample taken, there is not enough evidence to suggest that the XFP is better than the Naïve for the ‘popular’ vehicle aggregation. However, because the forecast errors are rather low (approximately 20%), they could be used by CHOs for decision making support on organisational issues like future staff, cash flow and depot requirements. Moreover, academically they provide a rather useful foundation and benchmark for future research.

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## V. CONCLUSIONS AND FURTHER RESEARCH

The results suggest that the time series under consideration are very difficult to forecast. In other words, the failure to beat the benchmark for the series under consideration advocates that the demand follows an almost chaotic behaviour, comparable to the random walk; this might well be explained by the fact that the true underlying variable under these series are the road accidents.

Two possible routes for further research could be suggested

- The first route is to include more sophisticated time series extrapolation models - however the use of ES models was necessitated by the lack of sufficient historic data. Given the time and cost requirements, it could also be interesting to delve into the forecasting environment and attempt to fit explanatory models as well.
- Secondly, it could be the case that the referral demand for CHOs is simply unpredictable, behaving like white noise around a mean. In such a case, it would perhaps be recommended that CHOs concentrate their efforts on learning how to adapt their operations to this unpredictable demand. Research could focus on the possibility of insuring or securitising this uncertainty, while strategic alliances with vehicle manufacturers and fleet management businesses could also prove to be insightful case studies.

## TABLES &amp; FIGURES

TABLE 1: FORECASTING ERROR MEASURES: MOST POPULAR VEHICLES

		<b>XFP METHOD</b>	<b>NAÏVE METHOD</b>	<i>DIFFERENCE</i>	<i>T-TEST</i>
<b>MAPE</b>	<b>Mean</b>	23.4%	22.3%	<i>1.130</i>	<i>1.46</i>
	<b>Median</b>	21.5%	19.3%	<i>2.144</i>	<i>2661</i> <i>(Wilcoxon)</i>
<b>sMAPE</b>	<b>Mean</b>	22.3%	21.8%	<i>0.454</i>	<i>0.69</i>
	<b>Median</b>	20.0%	19.2%	<i>0.786</i>	<i>2641</i> <i>(Wilcoxon)</i>

*All Differences are NOT statistically Significant at 95% Level of Confidence*

**REFERENCES**

- Allen, D. E. and H. M. Salim (2005). "Forecasting profitability and earnings: a study of the UK market (1982-2000)." *Applied Economics* **37**(17): 2009 - 2018.
- Armstrong, J. S. (1984). "Forecasting by Extrapolation - Conclusions from 25 Years of Research." *Interfaces* **14**(6): 52-61.
- Department for Transport, Scottish Executive and Wales National Assembly (2006). Transport statistics Great Britain 2006. Norwich, TSO
- Dimond v Lovell - [2000]. 2 All ER 897.
- Jenkins, G. M. (1982). "Some Practical Aspects of Forecasting in Organizations." *Journal of Forecasting* **1**(1): 3-21.
- Kargbo, J. M. (2007). "Forecasting agricultural exports and imports in South Africa." *Applied Economics* **39**(16): 2069 - 2084.
- Makridakis, S. (1996). "Forecasting: Its role and value for planning and strategy - Reply." *International Journal of Forecasting* **12**(4): 555-557.
- Makridakis, S., A. Andersen, R. Carbone, R. Fildes, M. Hibon, R. Lewandowski, J. Newton, E. Parzen and R. Winkler (1982). "The Accuracy of Extrapolation (Time-Series) Methods - Results of a Forecasting Competition." *Journal of Forecasting* **1**(2): 111-153.
- Makridakis, S., S. C. Wheelwright and R. J. Hyndman (1998). Forecasting : methods and applications. New York ; Chichester, Wiley.

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2  
3 McLaren, I. (2000). "Consumer credit and credit hire." *New Law Journal* **150**(6938):  
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5 837-838.  
6  
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9 Petropoulos, C., K. Nikolopoulos, A. Patelis and V. Assimakopoulos (2005). "A  
10  
11 technical analysis approach to tourism demand forecasting." *Applied*  
12  
13 *Economics Letters* **12**(6): 327 - 333.  
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