The Long-Run Supply of Real Estate: An empirical study into the UK hotel market 2003 - 2013

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Despite their unique characteristics, real estate markets around the world still follow fundamental economic principles, although until recently there has historically been limited literature focusing on this topic. The following article reviews previous research on real estate economics and tests how it applies to the United Kingdom (UK) hotel supply between 2003 and 2013. Using data from industry sources, it empirically examines the application of the law of supply to the UK hotel market, as well as the impact of the global financial crisis and the 2012 London Olympics on the supply pattern. It also attempts to determine the price elasticity of supply of this market. The results demonstrate the usefulness of applying economic theory to real estate and highlight the need for further research into this area.

Keywords: hotels, real estate development, economics, law of supply, investment

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Introduction

Real estate markets are unique in many respects and differ significantly from the markets for most goods and services. However, as Sivitanides (2011) pointed out, they still follow fundamental economic principles including, but not limited to, the law of supply and demand. Having been somewhat overlooked by real estate academics and professionals historically (Featherstone, 1986), these principles have started to be recognised as key frameworks for the critical analysis of a variety of real estate markets around the world.

As a real estate asset class, hotels are distinctive in their hybrid investment risk profile and their remarkable correlation with wider macroeconomic factors (Property Council of Australia, 2003; Hess et al., 2001). Unlike the office, retail and industrial property sectors which have attracted a great amount of literature, theoretical and empirical research into the hotel real estate market, especially on the supply side, has been very limited and predominantly based around the United States (Newell and Seabrook, 2006).

This article aims to contribute to the contemporary real estate economics literature with a comprehensive examination of the relationship between the law of supply and the hotel industry, which is arguably the most distinctive real estate asset. The United Kingdom (UK) was specifically chosen for its transparency and the availability of hotel industry data in terms of supply and price. The article also focuses on long-run supply over a period of ten years rather than short-run supply, as hotel development takes years of planning and construction and is unlikely to react immediately to price changes in the short term. The author also pays special attention to supply movements and elasticity (or sensitivity to price changes) during the global financial crisis and the 2012 London Olympics, the two most significant events in the chosen timespan with far-reaching impact on the hotel market.

The first part of this article contains a comprehensive literature review of previous research related to real estate supply, from which a list of four hypotheses can be developed. Using data available from industry sources, the second part then tests each hypothesis by exploring the relationship between price and supply movements within the UK hotel market between 2003 and 2013. It also examines in detail the impact of the late 2000s global financial crisis and the 2012 London Olympics on this supply pattern.
Literature Review

The Law of Supply

In economics, supply is defined as the total amount of goods and services that producers are willing and able to sell at a given price in a given time period (Cleaver, 2011). According to the law of supply, supply of a product tends to increase as the price of that product increases, assuming that all other factors remain constant (Perloff, 2012). This positive relationship is usually illustrated as an upward-sloping supply curve, similar to the one in Figure 1 below.

![Supply Curve](image)

**Figure 1:** The Supply Curve

The supply curve consists of only two variables, quantity and price, and assumes that all other factors remain constant. Other factors that can shift the supply curve include the costs of production (including land, labour and capital), technology, price of related product and market expectations (Pindyck, 2013).

A fundamental concept that is directly related to the law of supply and the supply curve is the price elasticity of supply, which is defined as the responsiveness of the quantity of goods supplied to price changes (Cleaver, 2011). It is calculated by dividing the percentage change in quantity demanded by the percentage change in price.

Long-Run Real Estate Supply

Research by Fraser (1986) concluded that the short-term supply of real estate is virtually fixed and totally price inelastic in economic terms, illustrated by a vertical line instead of an upward-sloping curve. This is because of the ‘construction lag’, or the time required for development, which typically ranges from 12 months for residential and industrial, to 24
months for office and retail (Sivitanides, 2011). For instance, if there is a sudden 10% increase in the Average Daily Rate (ADR) of London hotels tomorrow, total room inventory will remain the same for a while before supply responds to this strong price increase. In the long run, however, developers have ample time to react to price changes and the consensus is that there will be a positive relationship between quantity supplied and price per unit.

According to Sivitanides (2011), the three factors that have a major impact on long-run real estate supply are the project costs, expectations about future real estate demand and prices and perceived risk. First, higher costs for capital, labour, land and building materials lead to a higher overall project cost, smaller returns and therefore less motivation for developers to build new properties. Empirical research conducted by Chow et al. (2002) into Singapore’s supply of industrial spaces in particular highlighted a strongly negative correlation between new supply and the cost of capital, or financing costs. With regards to the second factor, most investors’ and developers’ expectations about demand and prices have been empirically proven to be ‘myopic’ by DiPasquale and Wheaton (1996). In other words, without reliable forecasts that suggest otherwise, current trends in real estate demand and price are myopically expected to continue into the future. Regarding perceived risk, Dixit and Pindyck (1994) have explained that more uncertainty, which is closely linked to the ‘construction lag’ discussed above, leads to a higher price threshold at which point investors are willing to develop new properties – a substantial investment that is extremely difficult to reverse. The impact of such perceived risk on new real estate supply has been proven statistically to be significant, although not as strong as the first two factors, according to an empirical study by Sivitanidou and Sivitanides (2000) into the US office-commercial market.

**Hotels as a Real Estate Asset Class**

As Newell and Seabrook (2006) have noted, hotels have been somewhat overlooked by real estate academics in favour of more traditional property sectors like office, retail and industrial properties. Most of the research on hotels as a real estate asset class has been mostly theoretical and focused on the difference between hotels and these traditional asset classes.

According to Hess et al. (2001), amongst all real estate asset classes, hotels are most likely to be affected by external events and adverse changes in wider economic conditions. Compared to other property sectors, the hotel market is more volatile and risky by nature, with less stable cash-flows as a result of seasonality, a lack of long-term leases and high customer turnover (Quan et al., 2002; Jeffrey et al., 2002). Any rooms remaining unsold on any given night cannot be ‘stored’ for future consumption and the revenue for that particular
night is forever lost. Individual hotels across different locations and star ratings are also extremely heterogeneous in their performance (Vietzer, 2000). As Chen and Kachani (2007) pointed out, the flexibility and dynamism in pricing is one of the hotel industry’s major advantages over other property sectors, as room rates can be adjusted daily or even constantly according to supply and demand.

The Property Council of Australia (2003) concluded that hotels should be considered as a hybrid asset class as each hotel shares the characteristics of both an operating business and a property. It is therefore problematic to assume that all theoretical and empirical evidence that applies to the wider real estate industry would also apply to hotels (Corgel, 2005).

Research Hypotheses

Drawing on the literature review above, the author proposes that the following hypotheses be tested empirically in the second part of this article:

Hypothesis A: Under normal market conditions with year-on-year price increases, UK hotel supply between 2003 and 2013 also increases.

Hypothesis B: The financial crisis contributed to a fall in price, which in turns caused a fall in supply within the UK hotel market.

Hypothesis C: There was an acceleration of supply coming into the market in the years coming up to the 2012 London Olympics.

Hypothesis D: Within the UK hotel market over the past decade, supply was generally price elastic

The justifications for the hypotheses above to be tested are as follows: According to the law of supply, supply increases when price increases. Therefore, to illustrate that the law of supply applies to the UK hotel market, Hypothesis A needs to be proven. The law of supply also suggests that supply decreases when price decreases. One known period of such declining price levels is the late 2000s Global Recession. Hypothesis B was developed with this in mind.

Hypothesis C relates to Sivitanides (2011) and DiPasquale and Wheaton’s (1996) literature on the relationship between investors’ myopic price expectations and real estate supply. The author has observed an apparent lack of real estate economic literature that incorporates
price elasticity of supply, despite its direct relevance to the law of supply itself. Hypothesis D is intended to fill this gap.

Methodology

Using data obtained from industry sources, this article critically examines the relationship between the movements over the past decade of two key variables within the UK hotel market: price and quantity supplied.

Price has been calculated by adopting Smith Travel Research (STR) figures of the Average Daily Rates (ADR) of all its benchmarked hotels in the UK. Founded in 1985, STR is the market-leading hotel research company that tracks key performance indicator data from over 50,000 participating hotels around the world (STR, 2014). ADR is a crucial statistical unit used in the hotel industry and is defined as the average rental income per paid occupied room night over a specified period of time (Morey and Dittman, 1995). In short, ADR is the average price per occupied room night, or the price per unit.

Quantity has been calculated adopting data provided by AM:PM Hotels. AM:PM Hotels, a leading market intelligence firm for the UK and Ireland hotel industry, maintains a comprehensive database of the UK hotel supply and its historical movements (AM:PM Hotels, 2014). The total quantity supplied in the market for each year has been calculated by multiplying the total number of rooms of all UK hotels by 365 days. The result is the total number of hotel room nights available for sale across the UK in that particular year.

The results are then analysed statistically and graphically to test the four hypotheses listed above. A detailed discussion follows, explaining possible reasons for these results.

Data

Based on the data sources and calculation methods detailed above, Table 1 lists the available room nights and average daily rate of the UK hotel market year by year between 2003 and 2013:
<table>
<thead>
<tr>
<th>Year</th>
<th>Available Room Nights (Quantity Supplied)</th>
<th>ADR (Price)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>186,639,465</td>
<td>£68.55</td>
</tr>
<tr>
<td>2004</td>
<td>189,274,035</td>
<td>£71.66</td>
</tr>
<tr>
<td>2005</td>
<td>191,019,100</td>
<td>£73.81</td>
</tr>
<tr>
<td>2006</td>
<td>193,010,905</td>
<td>£77.37</td>
</tr>
<tr>
<td>2007</td>
<td>195,365,520</td>
<td>£82.01</td>
</tr>
<tr>
<td>2008</td>
<td>199,983,135</td>
<td>£78.97</td>
</tr>
<tr>
<td>2009</td>
<td>203,333,470</td>
<td>£74.35</td>
</tr>
<tr>
<td>2010</td>
<td>205,984,465</td>
<td>£75.82</td>
</tr>
<tr>
<td>2011</td>
<td>211,888,705</td>
<td>£77.85</td>
</tr>
<tr>
<td>2012</td>
<td>216,753,790</td>
<td>£80.21</td>
</tr>
<tr>
<td>2013</td>
<td>217,539,635</td>
<td>£80.24</td>
</tr>
</tbody>
</table>

**Table 1:** Supply and price of the UK hotel market (2003 – 2013)  
Source: Adapted from STR Global (2014) and AM:PM Hotels (2014)

Table 1 is illustrated in a graphical form in Figure 2 below:

**Figure 2:** The supply curve of the UK hotel market (2003-2013)  
Source: Adapted from STR Global (2014) and AM:PM Hotels (2014)
Analysis and Discussion

Based on Table 1 and Figure 2, the following analysis can be made with regards to each of the research hypotheses.

**The Law of Supply (Hypothesis A)**

As can be seen in Figure 2, over the ten years under consideration, there were two periods where the UK hotel market appeared consistent with the law of supply: 2003-2007 and 2010-2012.

During these two periods, the supply curve followed an upward-sloping pattern, which means that supply increased as price increased. Using a formula cited by Rodgers and Nicewander (1988), a correlation coefficient \( r \) is calculated below between supply \( Q \) and price \( P \) over the 2003-2007 period, using figures from Table 1:

\[
r = \frac{n(\Sigma QP) - (\Sigma Q)(\Sigma P)}{\sqrt{n \Sigma Q^2 - (\Sigma Q)^2}[n \Sigma P^2 - (\Sigma P)^2]} \approx 0.9917986
\]

**Figure 3:** Correlation between supply and price from 2003 to 2007

Similarly, between 2010 and 2012, which was after the peak of the global recession, there was another upward supply curve. The correlation coefficient between supply and price over this second period is:

\[
r = \frac{n(\Sigma QP) - (\Sigma Q)(\Sigma P)}{\sqrt{n \Sigma Q^2 - (\Sigma Q)^2}[n \Sigma P^2 - (\Sigma P)^2]} \approx 0.996079
\]

**Figure 4:** Correlation between supply and price from 2010 to 2012

The correlation coefficients between supply and price for 2003-2007 and 2010-2012 are both very close to 1. This suggests that there was a positive relationship between supply and
price within the UK hotel market over these two periods, which is consistent with the law of supply.

It can also be argued that the two periods under consideration, in fact, represent stable, normal market conditions (pre- and post-crisis). These findings support Hypothesis A, that under normal market conditions, the UK hotel market follows the economic law of supply.

**The Global Financial Crisis (Hypothesis B)**

As can be seen in Figure 2, between 2007 and 2009, the peak of the global recession, UK hotel supply continued to rise while prices dropped dramatically by more than 10.3%. This negative relationship is in sharp contrast to the law of supply: the supply curve was actually downward-sloping between 2007 and 2009.

The standard assumption of the law of supply is that except for supply and price, all other factors remain constant (Perloff, 2012). It is clear that the global financial crisis of the late 2000s, the most severe since the Great Depression, was an extraordinary economic event, which caused dramatic and adverse changes to market conditions. Such changes violated this key assumption of the law of supply and led to contradictory movements in the supply pattern. Furthermore, the ‘construction lag’ and relatively irreversible nature of real estate development helped escalate the problem, as it was not possible for hotel owners to reduce the number of rooms in supply to react to a sudden price drop. Investors, having committed huge sums of capital, could not simply cease the developments. This explains why new supply continued to be added to the UK hotel market, amidst the financial crisis. Additional supply coming in under difficult market conditions with falling demand increased the level of competition, driving price further downwards.

These findings support the first half of Hypothesis B, which assumes that the recession caused a fall in price. However, the second assumption of the hypothesis, a fall in supply, appears inaccurate. The UK hotel market did not exactly follow the law of supply during the financial crisis, as the result of inflexible supply, irreversible supply addition and ‘construction lag’, all of which characterise the real estate industry.
The 2012 London Olympics and Price Elasticity of Supply (Hypothesis C and D)

As mentioned above, between 2010 and 2012, the UK hotel market closely followed the law of supply, with a strong positive correlation between quantity and price. Not only did this period come after the peak of the financial crisis, it was also the period that directly preceded the Olympics. To see whether there was an acceleration of supply addition to the UK hotel market in this period, a comparison needs to be made between this pre-Olympics period and the pre-crisis period of 2003-2007 regarding the compound annual growth rate (CAGR) of supply and price:

<table>
<thead>
<tr>
<th>Year</th>
<th>Supply Change % from previous year</th>
<th>Price Change % from previous year</th>
<th>Price Elasticity of Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2004</td>
<td>1.41%</td>
<td>4.54%</td>
<td>0.31</td>
</tr>
<tr>
<td>2005</td>
<td>0.92%</td>
<td>3.00%</td>
<td>0.31</td>
</tr>
<tr>
<td>2006</td>
<td>1.04%</td>
<td>4.82%</td>
<td>0.22</td>
</tr>
<tr>
<td>2007</td>
<td>1.22%</td>
<td>6.00%</td>
<td>0.20</td>
</tr>
<tr>
<td><strong>CAGR (2003 - 2007)</strong></td>
<td><strong>1.15%</strong></td>
<td><strong>4.58%</strong></td>
<td><strong>0.25</strong></td>
</tr>
<tr>
<td>2008</td>
<td>2.36%</td>
<td>-3.71%</td>
<td>-0.64</td>
</tr>
<tr>
<td>2009</td>
<td>1.68%</td>
<td>-5.84%</td>
<td>-0.29</td>
</tr>
<tr>
<td>2010</td>
<td>1.30%</td>
<td>1.97%</td>
<td>0.66</td>
</tr>
<tr>
<td>2011</td>
<td>2.87%</td>
<td>2.67%</td>
<td>1.07</td>
</tr>
<tr>
<td>2012</td>
<td>2.30%</td>
<td>3.03%</td>
<td>0.76</td>
</tr>
<tr>
<td><strong>CAGR (2010 - 2012)</strong></td>
<td><strong>2.16%</strong></td>
<td><strong>2.56%</strong></td>
<td><strong>0.84</strong></td>
</tr>
<tr>
<td>2013</td>
<td>0.36%</td>
<td>0.04%</td>
<td>9.00</td>
</tr>
</tbody>
</table>

Table 2: Changes in supply, price and elasticity of the UK hotel market (2003 – 2013)
Source: Adapted from STR Global (2014) and AM:PM Hotels (2014)

It is apparent from Table 2 that between 2010 and 2012, supply grew at a much faster rate year-on-year (at 2.16%) than during the 2003-2007 period (1.15%). In contrast, price
increases averaged only 2.56% per year, which was much lower than the 4.58% annual growth achieved between 2003 and 2007. These findings support Hypothesis C, in that there was indeed an acceleration of supply coming into the UK hotel market over the few years leading up to the Olympics. Furthermore, in 2013, the year after the Olympics, there was very minimal growth in both price and supply, which is understandable as hotel developments slowed after two years of rapid acceleration.

Table 2 also includes the price elasticity of supply (PES), calculated by dividing the percentage change in quantity supplied by change in price. With the exception of 2011 and 2013, PES remained lower than 1 over the studied period. Therefore, it can be argued that UK hotel supply has been generally price inelastic and even moved in the opposite direction from price during the crisis. With this in mind, Hypothesis D, which states that UK hotel supply is price elastic, can be rejected with a reasonable amount of certainty.

**Conclusion and Future Research**

This article seeks to broaden the current real estate economics literature by investigating how the law of supply and its related economic concepts apply to the UK hotel market between 2003 and 2013. By analysing data from industry sources to test a set of four hypotheses, it has demonstrated empirically that the UK hotel market did indeed follow the law of supply under normal market conditions, although during the financial crisis the relationship between quantity supplied and price was reversed. It also highlighted an acceleration of hotel supply coming in over the two-year period prior to the Olympics, which led to a slow-down in 2013. Lastly, UK hotel supply has been proven to be predominantly price inelastic over the period under consideration. The results of this research suggest that the law of supply and its related economic concepts indeed apply very well, although not perfectly, to the hotel market despite the complexity and distinctiveness of hotels as a real estate asset class.

Considering the limited amount of current research that relates hotels to real estate and economic principles, the author hopes this article will provide valuable insights for professionals and academics alike in both the hospitality and real estate fields. Hotel investors and developers in particular can refer to the article to make more informed decisions about whether and when they should bring a new hotel to market. However, the data analysed in this article is limited to the hotel market in the UK, a well-established and highly transparent market, and its findings should not be assumed to translate to other hotel markets around the world. Future research should expand on this initial research topic by
going beyond price and supply, and by applying further economic principles related to
demand, equilibrium, elasticity, substitutes and complements, to hotel real estate markets in
different countries and locales around the world.

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