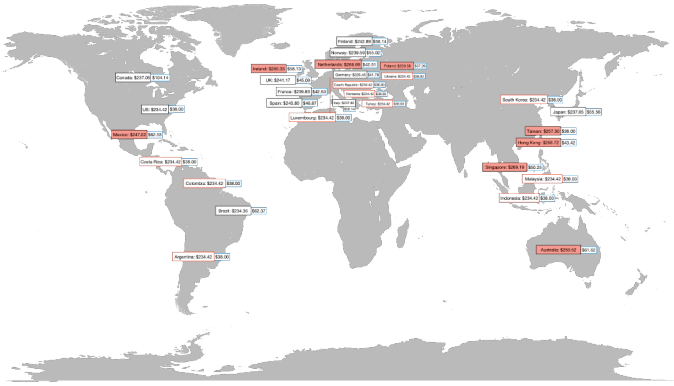
Rose M, Rahman M. Who's Paying More to Tour These United States? Price Differences in International Travel Bookings. *Technology Science*. 2015081105. August 11, 2015. http://techscience.org/a/2015081105

Who's Paying More to Tour These United States? Price Differences in International Travel Bookings

Michael Rose and Mohammed Rahman

Highlights

- We tested whether customers from around the world see the same price online when searching for U.S. hotel rooms and rental cars
- We simulated connecting online from 30 countries around the world to travel site Kayak.com
- Simulated customers in five locations, including Hong Kong and Australia, were quoted hotel prices significantly above the global average. Prices shown to domestic customers in the U.S. were slightly below the average



Los Angeles hotel and rental car price quotes averaged worldwide

Abstract

Are there notable differences in quoted prices for U.S. hotels and car rentals based on a consumer's international location? We used virtual private network (VPN) generators, such as CyberGhost and TunnelBear, to simulate a change in our geographical location before searching travel sites. An IP address is the unique numerical assignment given to any device operating on the Internet. These numbers are encoded to indicate geographical location.

When we visit a website through a VPN, it relays communication between our computer and the website, so the website does not see our actual IP address but instead sees the one assigned by the VPN. This technique allowed us to glimpse different views of the same website from locations around the world. For example, by using an IP address assigned to Italy, we could systematically compare the price American hotels offer a prospective tourist in Italy with the price a tourist located in the U.S. is quoted on a private network in Boston.

Results summary: After running several VPN generators, we collected the price points of 24 hotels and 6 rental car companies in Los Angeles and Chicago from 32 IP addresses around the world. We observed significant price discrepancies. Travelers booking in certain countries pay quite a premium. Considering the number of tourists who travel the United States annually, our findings suggest that customers should be aware of this price imbalance in the market and use VPN generators or possibly access websites like Kayak.com via another country's top-level domain, directing their queries to Kayak.co,uk, Kayak.sg, etc., for example. (Of course, a VPN provides the user the experience of a customer in the location of the VPN, whereas simply accessing an overseas version of the website's domain may not have the same effect.)

Introduction

When purchasing online, a consumer might falsely believe his price inquiry is viewed by a website as generic, especially if he removes cookies and has no browser history. What could a website possibly know about him to differentiate price? Consumers often expect to pay different prices under different circumstances. For example, an airline ticket purchased weeks prior to travel is likely to be priced differently than one purchased just days before travel. Prices also vary depending on what website is used to purchase tickets.

What about purchasing the same hotel room from the same vendor at the same time? What about buying a stapler from the same online store at the same time? Most consumers expect the same price for these purchases in the absence of cookies and online tracking. An article in the *Wall Street Journal* in 2012 was among the first to show how prices could vary based on the consumer's perceived geo-location [2]. The website of the popular stationery store chain Staples reportedly displayed different prices to people based on the perceived distance of the consumer to a rival's brick-and-mortar store. The closer the consumer was to a rival, the more the price was discounted. Other studies found price differences based on whether the consumer used a Mac or a PC [3]. For example, Orbitz reportedly routed Mac visitors to pricier hotels than it did PC users [4]. What about American hotel rooms or car rentals sought by tourists visiting the United States?

Background

The tourism industry in the United States is a substantial segment of the U.S. economy. According to the International Trade Administration, more than 74 million foreigners visited

the United States in 2014, spending more than $200 billion. “As a whole, travel and tourism-related industries supported 7.7 million jobs in 2012.” [1] The U.S. is a popular travel destination, and hotel companies, rental car providers, and intermediary travel agents make an effort to adjust lodging and auto prices so that they can maximize their profit. Most customers would assume that prices for the same hotel room or rental car are similar, if not the same, no matter where the original booking location. Our study sought to determine whether tourists traveling to U.S. destinations are being charged different amounts for accommodation and vehicle rentals based on their location of purchase.

Methods

In order to obtain price quotes for U.S. travel as if we were foreigners ourselves, we looked at online travel booking via the travel search engine Kayak, which aggregates hotel and rental car rates from many sources/vendors for site visitors to compare and purchase. We needed Kayak to think we were accessing their website from locations other than Cambridge, Massachusetts, be it another city in the U.S. or another country entirely. We used a series of virtual private networks (VPNs) to maneuver around Kayak’s initial screening. In essence, VPN servers allow a private network to be joined by computers on the larger public Internet. When we originated requests to Kayak.com from VPNs around the world, our IP address encoded the location of that server, not our actual location in Cambridge, MA. VPNs are often used for privacy and online anonymity, especially in countries that erect firewalls to block access to certain websites. Individuals use VPNs to bypass these firewalls. In our case, VPNs were a useful tool to trick Kayak’s systems into providing us prices intended for customers in an entirely different geographic location, such as Japan or Mexico.

Hypothesis

We tested the proposition that international travel prices depend on the person’s IP address. Because of the differences in currency and an expected rate premium for foreign tourists, we consider a meaningful difference in prices to be one that varies at least 5% from the U.S. average price. We predicted that we would find variations meeting this criterion.

Data Collection

We chose Kayak as our mechanism for data retrieval because the website is a meta-search engine that accumulates price points from various booking websites. Rather than access these sites individually, Kayak allows us to search multiple sites at once. However, this also means that we may not be seeing the same booking sites or online travel agencies (OTAs) from country to country.

To simulate inquiries to the Kayak website from IP addresses around the world, we used several different virtual private network (VPN) providers. Our VPNs included:

- TunnelBear [5]

- CyberGhost VPN [6]
- SurfEasy [7]
- VPN Gate [8]
- VyprVPN [9]

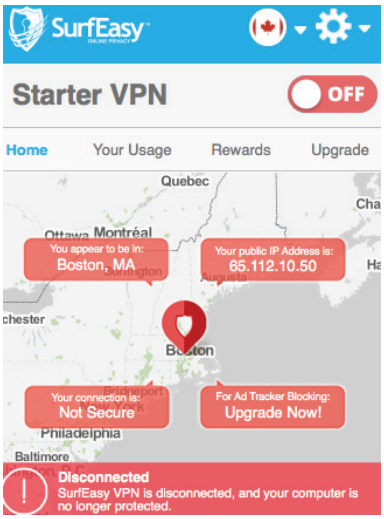


Figure 1. SurfEasy VPN interface

Four of the above VPN providers supply a downloadable application that gives the user access to their service. Figure 1 is the SurfEasy interface. Each VPN generator offered different free VPN servers around the world, so that using all of them together gave us a wide range of locations. For example, VPN Gate has access to many servers in Asia and South America, continents necessary to make our study truly global. As an additional means of ensuring that the prices we found were valid for that country alone, we cleared our browser's cookies and caches each time we changed our IP address.

Once we had access to the Kayak site from a disguised IP address, we aggregated hotel and rental car data for two major travel hubs in the United States, Chicago and Los Angeles. To get a wide variety of data, we picked 12 hotels in each city, 3 each from the four major hotel chains Hilton, Marriott, InterContinental, and Sheraton. The hotels selected were mid-range to lower-priced luxury options, as shown in the table below. All hotels had a TripAdvisor hotel class rating between 3 and 4 stars out of 5. We researched a one-night, one-person stay at the lowest-priced room for each hotel from June 1 to June 2, 2015.

Hotel	**Brand**	**Hotel Class**	**Price per Night (booked in U.S.)**
Hilton Chicago O'Hare Airport	Hilton	4	$169.00

Hilton Chicago	Hilton	4	$679.00
Hilton Chicago/Oak Lawn	Hilton	4	$144.00
Chicago Marriott O'Hare	Marriott	3.5	$259.00
Renaissance Chicago O'Hare Suites Hotel	Marriott	3.5	$259.00
Courtyard by Marriott Chicago O'Hare	Marriott	3	$214.00
Crowne Plaza	InterContinental	3.5	$189.00
Holiday Inn Hotel & Suites Chicago-O'Hare (Rosemont)	InterContinental	3	$198.00
Holiday Inn Chicago O'Hare Area	InterContinental	3	$170.00
Sheraton Chicago O'Hare Airport Hotel	Sheraton	3.5	$239.00
Four Points by Sheraton	Sheraton	3	$139.00
Westin O'Hare	Sheraton	4	$202.00

Table 1. Chicago hotels

Hotel	**Brand**	**Hotel Class**	**Price per Night (booked in U.S.)**
The Beverly Hilton	Hilton	4	$309.00
Hilton LA/Universal City	Hilton	3.5	$184.00
Hilton Checkers Los Angeles	Hilton	4	$259.00
JW Marriott Hotel Los Angeles at LA Live	Marriott	4	$359.00
Los Angeles Airport Marriott	Marriott	3.5	$199.00
Courtyard by Marriott Los Angeles L.A. Live	Marriott	3.5	$309.00
Crowne Plaza Commerce Casino	InterContinental	3.5	$171.00
Holiday Inn Los Angeles-Intl Airport	InterContinental	3	$127.00
InterContinental Los Angeles Century City	InterContinental	4	$309.00
The Westin Bonaventure	Sheraton	4	$199.00
Sheraton Los Angeles Downtown Hotel	Sheraton	3.5	$219.00
Sheraton Gateway Los Angeles Hotel	Sheraton	3.5	$169.00

Table 2. Los Angeles hotels

We recorded the cost of a 24-hour compact car rental in the same cities starting at noon June 1, 2015 from the following agencies: Avis, Enterprise, and Hertz. We searched for no extra options and did not include Kayak's optional insurance in the cost.

We searched using the IP addresses of 29 nations outside the U.S. We also simulated searches originating in three different U.S. cities, Boston, New York, and Washington, DC, to see if there is price variance based on customer location with the U.S.

With 32 distinct locations, 12 hotels and 3 rental agencies, we ended up with a total of approximately 480 data points per city, for a total of approximately 960 observations. We say approximately because for rental cars, the availability of certain rental agencies for foreign nations was somewhat irregular. Hertz, Enterprise, and Avis were available to any customer in the U.S., but when we queried from a foreign IP address, in some nations only one or two of these agencies were listed. Therefore these nations had fewer data points taken into account while calculating their overall average of rental car prices.

Statistical Analysis

As prices for lodging and rental cars are highly variable, we chose a single date, June 1, 2015, on which to test all of our observations. This date was picked to be far enough in the future that it would be less likely to be affected by current conditions. We also performed all of our data collection on the same day—April 27, 2015—so prices would not fluctuate between observations. Before collecting the data used in this study, we observed that hotel and rental car prices fluctuate on Kayak.com from day to day, though not in the course of a single day. This allowed us to collect reliable data in one 24-hour period.

In order to compare the pricing available at each customer location, we expressed the difference between each quoted price and the U.S. price as a percentage. These percentages were then averaged together to get an average difference in hotel and rental car pricing for each location. This method lets us look at the overall difference in pricing more accurately. The average percentage difference is a measure that is less biased by differences in the range in hotels and rental agencies collected in each market, and less affected by the fact that a rental car agency might not be accessible to all countries. We then constructed bar graphs showing these average differences across the globe for comparison and a heat map for hotels, comparing them by region. Finally, we created histograms for each city showing the distribution of these average differences.

Kayak does not appear to customize information and rates for some countries (see Results below). Simulated inquiries from these countries were redirected to the U.S. website and generated the same information and prices shown to U.S. users. Elsewhere, prices collected from Kayak were quoted in the host country's currency.

Prices were collected without any associated taxes or booking fees, and all prices were converted to USD applying rates in effect as of 12:00 PM EDT, April 27 2015. Observed price

differences should not exist due to currency conversion, as we used constant exchange rates for all conversions. We observed differences even among nations using the same currency, notably Eurozone countries.

Results

The results of our experiment are shown on the following graphs and maps. On the maps, large price labels represent the average quoted hotel price in U.S. dollars for that country, while smaller blue labels represent the average car-rental cost for that country. There was no observed price difference among users based in Boston, New York, and Washington, DC. All price differences observed in this study were based solely on having an international IP address.

Nations with labels outlined in red have the same prices as the United States; these countries have no localized version of Kayak.com, and Kayak displayed the standard U.S. site and associated prices in USD. Labels shaded in red indicate nations with hotel prices with a greater than 5% difference from the U.S. average price.

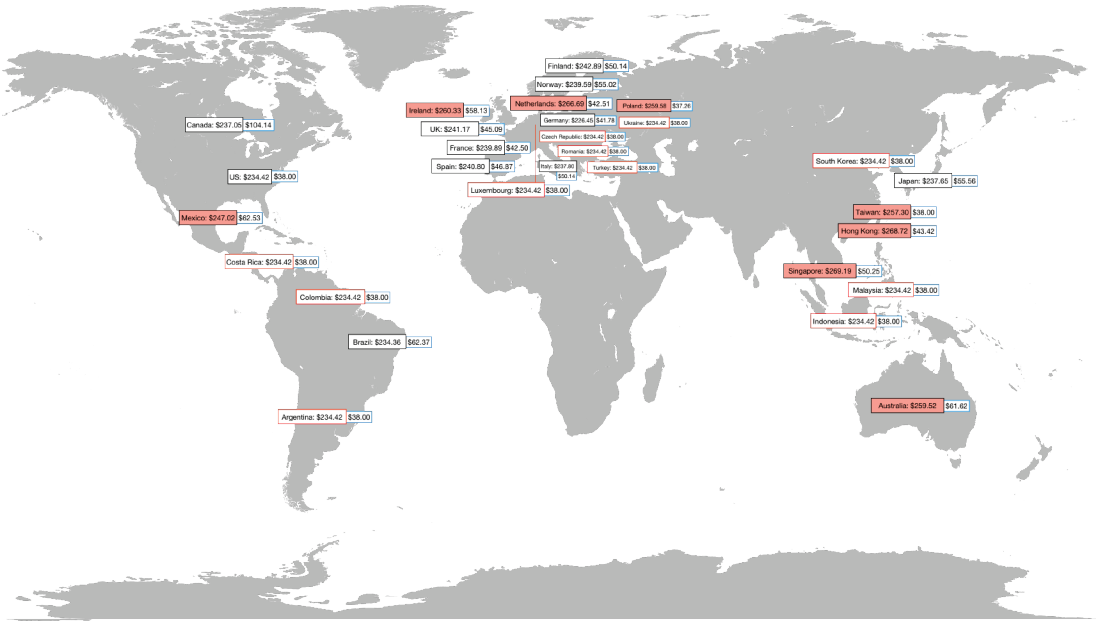


Figure 2. Los Angeles hotel and rental car price quotes averaged worldwide

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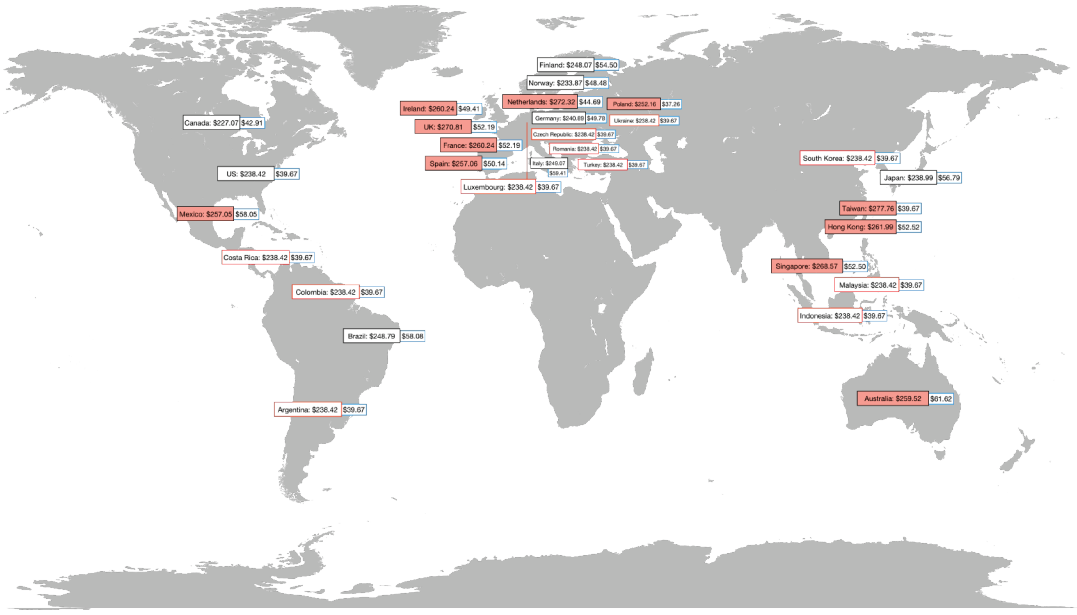

Figure 3. Chicago hotel and rental car price quotes averaged worldwide

To better visualize the price differences by country, we prepared graphs that show each country's average value from the map as a percent difference from the U.S. Note that these graphs do not include the nations whose prices are outlined on the map in red (those that have a 0% difference.):

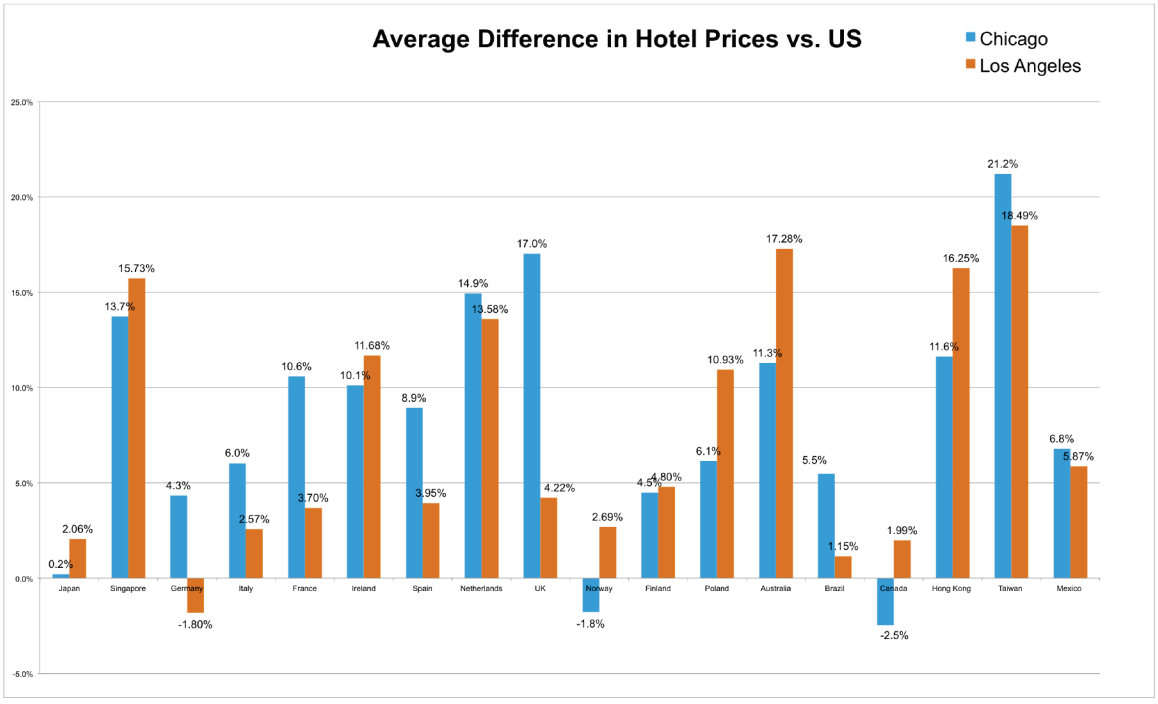

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Figure 4. Average difference in hotel price quotes generated by simulated queries from selected countries vs. the U.S. baseline

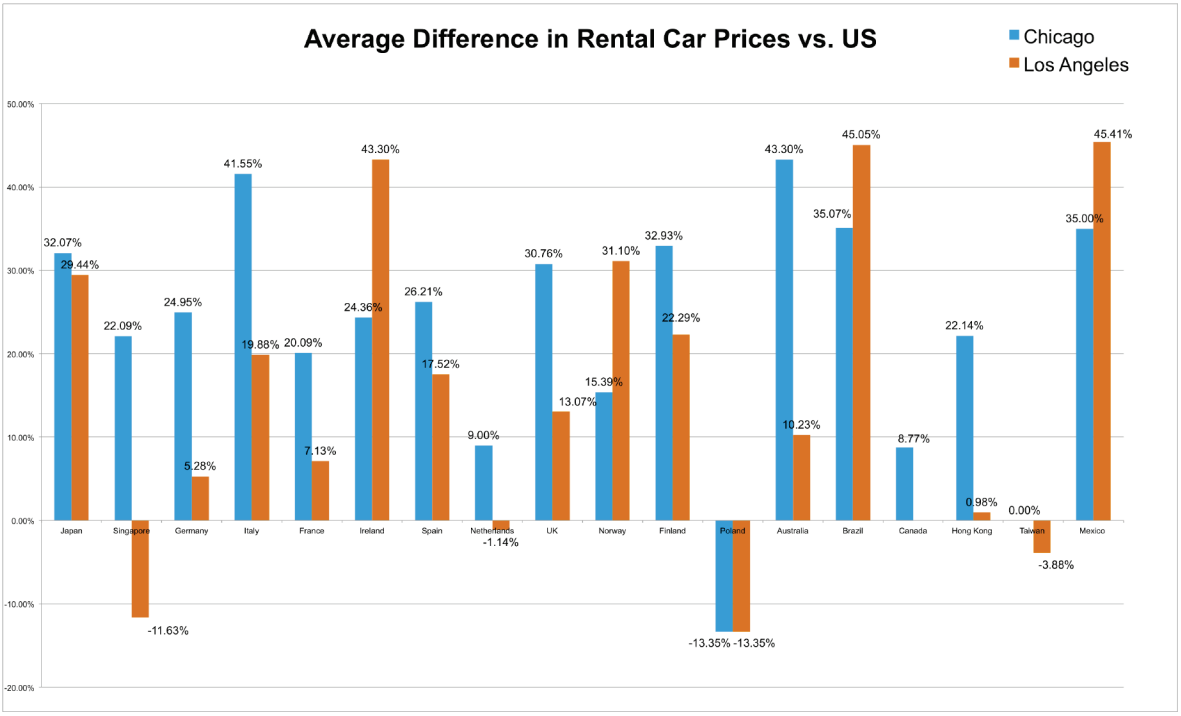
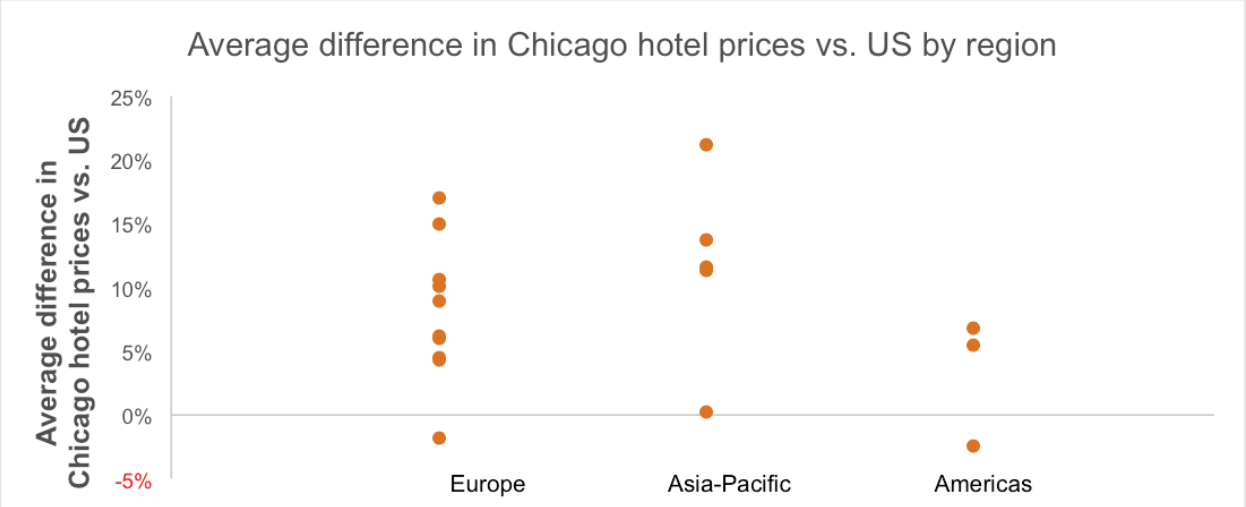


Figure 5. Average difference in rental car price quotes generated by simulated queries from selected countries vs. the U.S. baseline (See Rental Cars section below for note on Canada)



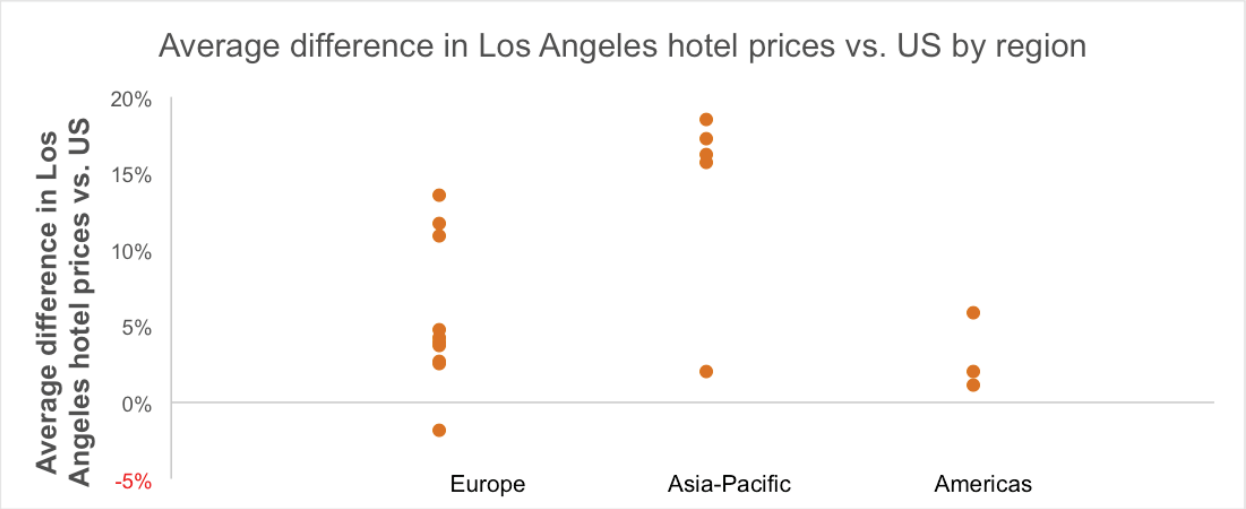


Figure 6. Average difference in hotel price quotes generated by simulated queries from selected countries by region

Hotels

Many of our observations were based on European IP addresses, as these were the most common and reliable servers easily accessible via the VPNs above. On the map, you can see that several such inquiries were redirected to standard U.S. prices. Prices otherwise were almost wholly more expensive than the U.S. baseline. For Los Angeles, all the European prices besides Germany were greater or equal to the U.S. baseline. The average increase by country ranged from 2.57% (Italy) to 13.58% (Netherlands). Chicago was similar, with only Norway having a price lower, by 1.8%, than the U.S. baseline. Chicago price increases ranged from 4.3% (Germany) to 17.0% (UK).

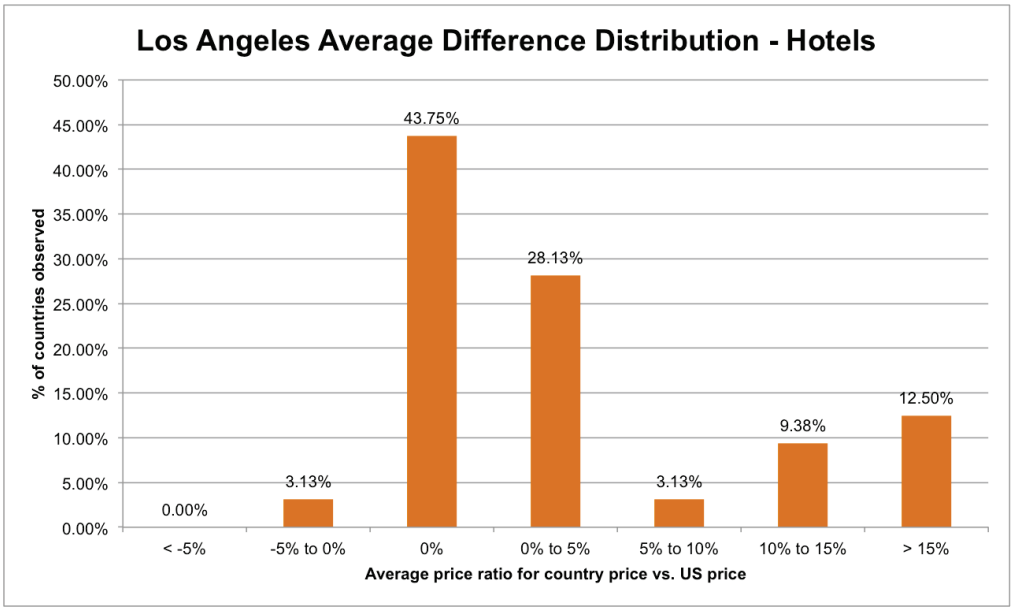
For queries from the Americas, Los Angeles prices were either the same as the U.S., but with Mexican prices almost 6% more expensive and Brazil having a small change of 1.1%. In Chicago, prices shown to simulated Mexican and Brazilian users were well above the U.S. baseline with increases of 6.8% and 5.5% respectively. Canada beat the U.S. with a 2.5% lower price average in Chicago, while having slightly higher LA prices by 2.69%. In Asia, we observed that for simulated users in some countries, such as in Indonesia, Malaysia, and South Korea, prices remained at the U.S. level, but in nearby nations costs rose significantly – for Chicago, increases included Singapore (13.7%), Taiwan (21.2%), and Hong Kong (11.6%). Los Angeles hotel prices were higher in these nations as well, with Singapore at 15.7%, Taiwan at 18.49% and Hong Kong at 16.25%.

Rental Cars

Rental car pricing was observed to be much more volatile than hotels. Rental car prices from Asia for both L.A. and Chicago were both much higher than the U.S. (Australia at 43%, or

Japan at 32%) or sometimes lower (LA rentals in Singapore, -11%). European prices for both cities were generally 20%-30% more expensive than the U.S. baseline with the notable exceptions including Italian prices for Chicago (41.55%) or Irish prices for Los Angeles (43.3%). In the Americas, prices that did not repeat the U.S. site pricing were some of the most expensive worldwide, with a 30%-40% premium in Mexico and Brazil. Canada was an odd outlier. For Chicago, rental prices were nearly the same as the United States, but in Los Angeles a rental car held an unusually high 148% increase. This outlier, while verified and noted here, is not included in Figure 5 to retain the clarity of the display of all the other data.

The global average prices for Los Angeles and Chicago hotels were $243.07 and $247.51, respectively. The global average prices for L.A. and Chicago rental cars were $45.79 and $47.97, respectively. The closeness of these averages probably reflects the facts that L.A. and Chicago are both major travel hubs and we tested a similar spread of midrange and low priced luxury hotels from the same chains. Queries from 11 of the 32 VPN locations redirected to the American Kayak site, including Ukraine, Argentina, Colombia, Costa Rica, Luxembourg, Czech Republic, Romania, Ukraine, Turkey, Indonesia, Malaysia and South Korea. Germany (high $230s), the United States (mid $230s, $38), and the 11 countries that redirected to the U.S. site, were consistently lower than the global mean. On the other hand, there were some countries that were consistently higher than the mean, notably Australia ($270, $61), Taiwan (high $270s), and Netherlands ($270).



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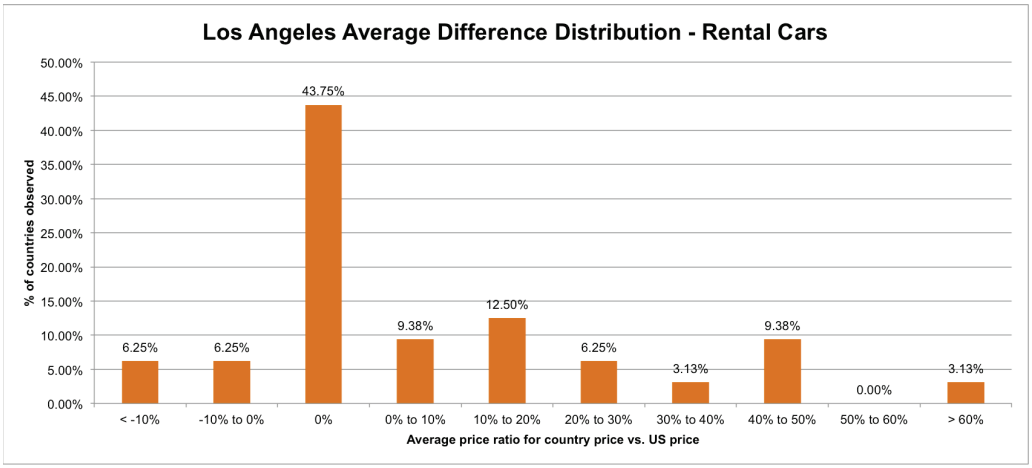
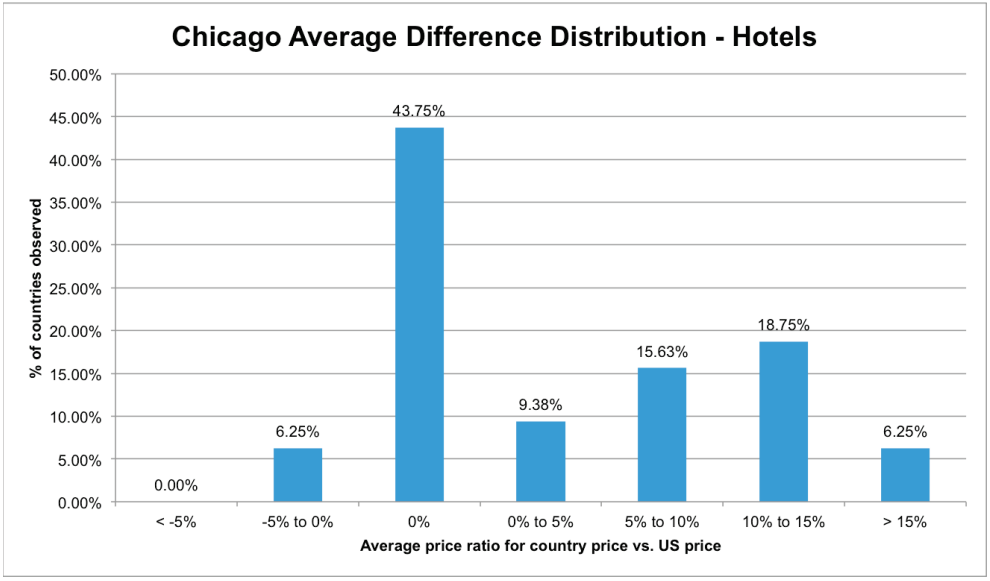


Figure 7. Distribution of differences (in percent) for Los Angeles hotels and rental cars



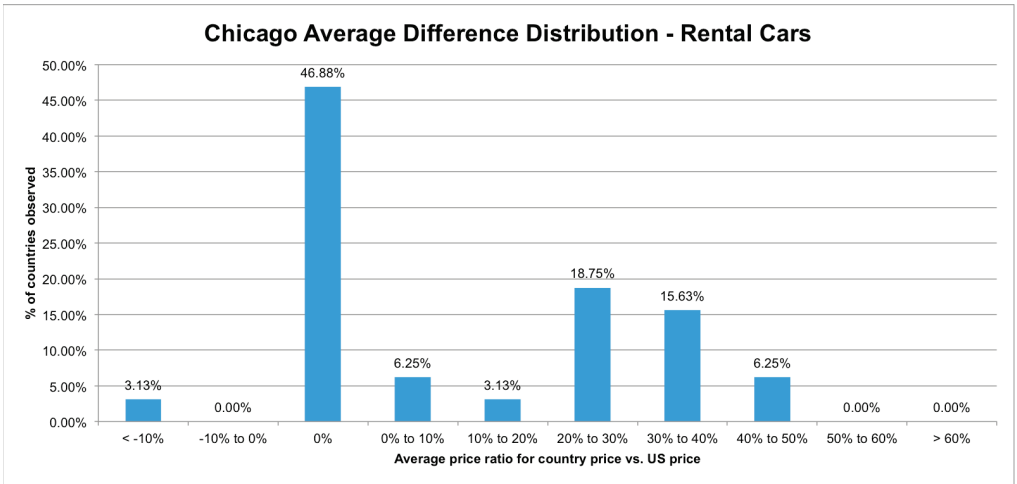


Figure 8. Distribution of differences (in percent) for Chicago hotels and rental cars

From the distributions, we can more clearly see that around half of the countries surveyed had a price difference of 0% in both cities for both rental cars and hotels. These are the countries that displayed the U.S. site regardless of IP address. Relatively few other countries had an average difference of less than 0%, the largest group being 12.5% of countries having an average difference under 0% for LA rental cars. The distributions further underscore the variation present in rental car pricing worldwide. The variation in hotel pricing was much more contained, almost entirely an increase of under 15% from U.S. prices.

Discussion

To an extent, our hypothesis was correct. We were right to believe that there would be price discrimination, but we actually underestimated the degree of price variation present in the market. We hypothesized there would be at least a visible 5% difference, and saw this reached or passed in both cities – 8 countries had a > 5% increase for Los Angeles hotels, and 15 had a > 5% increase for LA rental cars. For Chicago, 11 countries passed the 5% increase hypothesis for hotels, while 16 passed the mark for rental cars.

In regards to hotel prices, the U.S. had relatively cheap pricing for domestic Kayak users. Some locations, like Australia and Hong Kong, were quoted an average price significantly higher than the mean, about $30 more. One thing to note that we didn't check is that since Kayak is a meta-search engine, it may be showing a selection of results from different booking sites and online travel agencies in each country, and it is this selection that limits the opportunities for customers to take advantage of price differences across countries. For example, Australia's higher average prices may be driven by local taxes or fees on hotel bookings. We also did not check to see whether an Australian customer can use the U.S. Kayak.com site and try to purchase a hotel online from a U.S. booking site recommended by Kayak with an Australian credit card tied to an Australian billing address. As such, we recommend that any tourist coming from other countries should check themselves to see if they can successfully book their desired hotel that may display a cheaper rate when viewed from a U.S. IP address via VPN. Something interesting was that the countries farthest away from the U.S. often had hotel prices that were expensive compared to the global mean, but the countries closest to the U.S., like Canada and Mexico, had car rental prices that were comparatively more expensive.

Rental car pricing was a bit more difficult to pinpoint. Generally, aside from the countries whose website automatically redirected to the U.S. Kayak site, foreigners have to pay more to rent a car in the U.S., especially because many rental agencies are not advertised to foreigners.

Taken as a whole, the results of this experiment were significant and, most importantly, relevant to the average traveler and consumer. We found evidence of price discrimination

based on international IP address, and we believe we have enough evidence to justify the claim that when using Kayak, most people located outside the United States would find it advantageous to VPN into the U.S. to book a U.S. hotel or rental car if possible. The exception would be tourists coming from countries that use the U.S. site or quote prices close to that of the United States. There were some issues that did not affect our results but are worth noting for future studies in this area, which are addressed in the Next Steps section. Nevertheless we think this project was the proper catalyst for a larger, more comprehensive study on price differences based on location, also outlined in the following section.

Next Steps

Some of the issues that arose in our project were:

- Time and labor-intensive manual data collection.
- We had limited VPN access to worldwide servers because we used free VPN generators that often required waiting in queues and relegated us to oft-dropped connections.
- Some VPNs were rather slow, because the free VPN generators we used do not find the optimal IP address per country.

We outline the following next steps to extend our project on a greater scale to find more conclusive results:

- Use a still-wider range of countries via paid VPN networks – these are more reliable and would allow us to access nearly any country we wanted.
- Automate the process. We configured the VPNs personally and manually collected the price data from the Kayak website, a tedious process. In the future we would want to automate the process via a web crawler that gets the data automatically.
- Widen our online search – we would want to extend our pricing search to other online companies and websites, to see if they too show signs of price discrimination.
- Confirm that customers from different countries can book hotels and rental cars online from websites that are not based in their country.
- Analyze the effect of different currencies on Kayak bookings to ensure the results we found were not a byproduct of differing currencies and conversions. We would also look at booking fees and taxes for each nation in question to observe how this would affect the final price to consumers, as this study only dealt with raw booking costs.
- Consider the effect of actuarial pricing on rental car quotes which may affect the overall cost (and confirm a car booked via VPN would not have its rate rescinded upon pickup with a foreign driver's license.)

We hope to eventually create a program that screens through all the free VPNs available and finds that IP address that has the cheapest quote.

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Data

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