NAME-YOUR-OWN-PRICE MODELS FOR SEAT UPGRADES:

A case study on American Airlines

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Abstract: In this paper I research the Name-Your-Own-Price mechanism for the purpose of auctioning off business and first class seats. We use the realize case of American Airlines to test our hypotheses with regard to effects on prices, passenger quantity and revenues. We find that the NYOP mechanism negatively affects business fares, but positively affects passenger quantities and revenues, which is in accordance with our expectations.

Keywords: NYOP, Name-Your-Own-Price, Auction, American Airlines, Upgrades

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INTRODUCTION

American Airlines, the world's largest airline, started testing a Name-Your-Own-Price (NYOP) mechanism in November 2013. We mostly know such mechanisms from auction sites, where services and products can be bought by bidding, a lot of the time successful bids are lower than official posted prices. In the 1990's Priceline, an online retail channel, was the first to introduce such a bidding system. Now, this specific pricing mechanism has already been implemented by several airlines all over the world. Unoccupied business seats are being auctioned off to improve profitability. So far only newspapers and other media had their say on the auctioning of business seats. As for the New York Times and Wall Street Journal, airlines are in the phase of changing their business to increase the amount of seats payed for: *"The shift from free first-class seats to paid ones has been happening gradually over the last few years. It has everything to do with airlines' efforts to wring more money from travelers however they can, in this case by monetizing the chance for roomier seats and pampered service that constitute first class."* And *"Airlines might be more concerned about alienating loyal frequent fliers if they thought travelers had more alternatives..."* (Julie Weed, 2016 article in the New York Times) And *"Delta Air Lines, for example, says that as a result of offering discounted first-class fares and paid upgrades for fees, 57% of its first-class seats have customers who paid their way in rather than free upgrades, up from 11% a few years ago. And Delta wants to push that to 70% over the next two years, Delta executives told investors in December."* (Scott McCartney, 2016 article in the Wall Street Journal).

Some articles noted that loyal elite frequent flyers might be harmed by the auction programs: *"Many elites are angered by airlines adding these bid for upgrade programs, as they feel their complimentary upgrade space is being auctioned off. That's compounded by airlines offering flat-fee upgrades at the check-in counter and boarding gate, providing even more obstacles to top-tier elite who are high on the upgrade list, but never clear. It's a tough act, as airlines have to balance maximizing revenue streams with keeping their most loyal flyers satisfied."* (Richard Kerr, 2015 article on thepointsguy.com)

Large parts of business class are being occupied by freely upgraded passengers due to their perks. However, with this change other consumers can be reached as underlined by Julie Weed in the Wall Street Journal: *"Customers in the lower tiers of elite status often see themselves at the bottom of very* *long upgrade lists. SeatBoost, which launched an upgrade auction app that Virgin America began using in September, thinks those frequent fliers may be prime candidates for auctions."* (Scott McCartney, 2016 article in the Wall Street Journal)

The addition of the NYOP mechanism to the existing channels with posted prices by American Airlines offered a good opportunity to research this business model. In the specifics of our research we wanted to assess the effects of the implementation of the NYOP mechanism. Therefore, we focused on the effects on prices, quantity and revenues. In doing so we contribute to current literature with some new aspects with regard to the use of NYOP in combination with service providers and their upgrades. The difference between an upgrade to a higher class and a direct purchase of a certain class causes differences in consumer behaviour. From previous literature we've learned that the effect of a NYOP mechanism essentially depends on the design of the mechanism, the bidding strategy of the consumers, and the expectations or predictions by sellers and consumers regarding each others' strategy. We see different possibilities for the design such as single bidding versus rebidding, selection or generation of bids, the degree of transparency with regard to the product and prices. In optimally setting threshold prices, these elements as well as the bidding strategy of the consumer have to be considered. It poses a game theory scenario were both agents consumer and seller act strategically considering each other's actions. Thus it is important for sellers to assess the expectation of the bidder correctly to optimally increase their surplus. Most prior studies focus on the differences between the NYOP and posted price channels and the optimal design of the NYOP mechanism. More recent studies took a first step in researching the NYOP mechanism in addition to the posted prices channel.

In accordance with our expectations, we find that the implementation of the NYOP mechanism positively affects revenues and the quantity of passengers. We also find that average prices in business class go decrease due to the NYOP mechanism, while overall prices increase. Furthermore, the NYOP mechanism had positive effects on the number of total passengers and business class passengers indicating a higher monetisation of the available seats. Lastly, as a combination of prices and quantity, revenues also increased due to the NYOP mechanism.

In the following section we set out concepts, forming our theoretical framework and hypotheses. Subsequently, we elaborate on the used method, dataset and variables. The results are then interpreted and analysed. Finally, we discuss and conclude on these results.

THEORETICAL FRAMEWORK

This research will mainly contribute by assessing the impact of a NYOP mechanism specifically used to sell premium services in addition to the existing sales channels. We consider a scenario where a service provider sells two product classes through posted prices, than a NYOP mechanism is added to improve premium service sales by offering current consumers[1] an opportunity to bid for an upgrade.

We assess the impact of the NYOP mechanism by answering three main questions:

1. What is the impact on prices?
2. What is the impact on the number of consumers served?
3. What is the impact on revenues?

Additionally, we assess the effects on a deeper level between premium and 'normal' services. As the NYOP mechanism is implemented to increase sales in premium classes, this dimension is also the primary focus. However, due to the intertwined nature of the premium and 'normal' classes a NYOP mechanism on a premium level probably affects consumer actions with regard to the 'normal' class as well. We combine different concepts in literature, which we use to form expectations. In the following section we start discussing previous literature on NYOP and service providers.

PREVIOUS LITERATURE

We select recent papers for the use of explaining important aspects of NYOP auctions and service upgrades from top journals. We summarise these papers and their main findings in a table, which is added to the appendices (Appendix A).

Foremost example used in literature to research the NYOP mechanism is the Priceline model. However, when we scrutinize the Priceline model and compare it to the classification model by Kim et al. (2008), we conclude that this model is a combination of two classifications. We added a summary of these classifications to the appendix (Appendix B). It is slightly more complex than just a simplified

[1] We identify current consumers as consumers who have bought an economy seat ticket, which flight has not yet departed. These consumers can be eligible for a seat upgrade to a higher class.

NYOP pricing mechanism, because the site also uses reversed auction to connect bids to suitable offers by sellers. In essence a NYOP mechanism allows a buyer to name a price for a certain good, where a seller in turn can accept or decline depending on its threshold, which depends on its reservation price. In the Priceline model a successful bid not only depends on the reservation price of one seller, but multiple potential sellers. In this form the product the buyer tries to purchase is indifferent for each seller. Therefore, Priceline is able to offer these goods without giving full details (e.g. the brand). This is called an opaque feature of selling, allowing Priceline to connect multiple unknown sellers to buyers. However, this feature is also known to destroy value since details of a good add value from consumers' perspective (Shapiro and Zilante, 2009). The Priceline business model offered companies a new method of price segmenting consumers without damaging their brand image.

The Priceline model opened up a whole new field of research on pricing mechanisms. Most basic underlying question 'Is the NYOP model good for companies and/or consumers?' has been effectively researched through all sorts of perspectives. The answer to this question depends on the combination of the design of the NYOP implemented and consumer behaviour. When we review literature we identify that the correct prediction of bidding behaviour as the most important factor in the success of a NYOP mechanism. From a seller's perspective the choice for a certain pricing mechanism lies in its profitability. In order to maximize seller's surplus, a seller wants consumers to bid at their maximum willingness-to-pay. One of the first research papers on NYOP is written by Chernev (2003), where he links the height of willingness-to-pay of a consumer to the design. He finds evidence that price generation compared to price selection on the part of the consumer leads to a better profitability, provided that consumers have certain reference to correctly form their willingness-to-pay. In contrast to earlier visions of the internet as a market place without friction, it becomes evident that friction is apparent in online bidding mechanisms, although still lower than the frictional costs one would incur while shopping 'offline' (Hann and Terwiesch, 2003)[2]. These frictional costs can partly be influenced through the interface of

[2] Frictional costs: search costs on the part of the consumer including the disutility of investing time and effort to interact. In the internet environment it includes the search and disutility of investing time and effort to interact with a website and various interfaces (Hann and Terwiesch, 2003).

the site. For example, by giving reference prices or creating an easy-to-use interface. However, a seller should not completely eliminate frictional costs as it means that bidders can optimally maximize their consumer surplus (spread between bid and seller threshold), by strategically starting with low bids, incrementally increase their bids to retrieve the sellers' threshold. Importantly, Spann et al. (2004) recognizes the fact that it is not the willingness-to-pay of a bidder that directly leads to a bid but the trade-off between the probability of acceptance of a bid and her consumer surplus. As a bidder bids higher his surplus decreases but probability of acceptance increases.

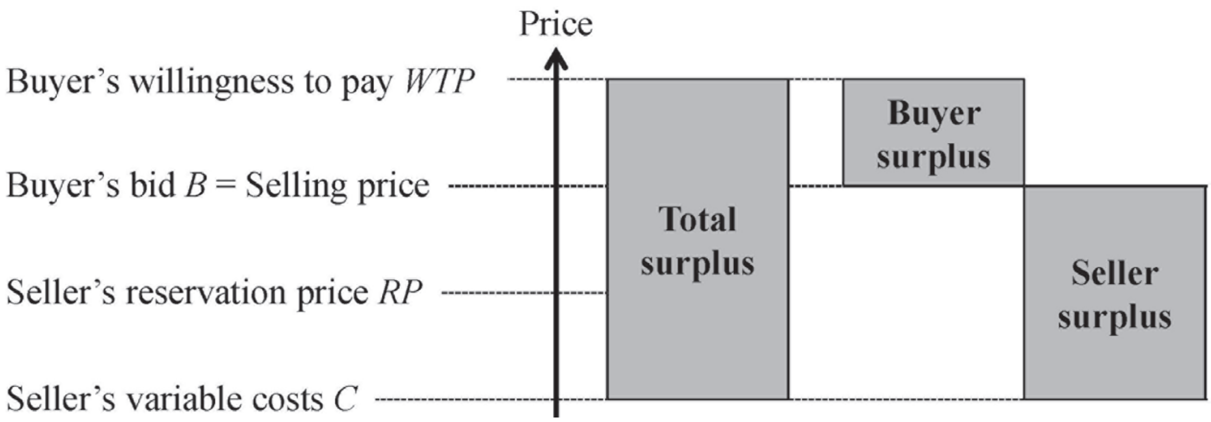


Figure 1. Bargaining zone if B ≥ RP (Voigt and Hinz, 2014)

They provide evidence that a seller can derive the consumers' willingness-to-pay by studying their individual bids. Thus the NYOP structure can be used to segment bidders and subsequently an optimal threshold can be estimated. This allows sellers to extract more consumers' surplus. Fay (2004) further examines the choice between a single restricted bidding design or a multiple bidding design. Their analysis shows that due to the sophistication of bidders[3], single bid models are generally not feasible. Some bidders are able to circumvent the restrictions posed in single bid systems by 'partial repeat bidding'[4] and profit from having more knowledge as the seller threshold is optimally set based on single bids. Essentially, it is more profitable for a seller to allow multiple bidding and consider the consumers

[3] Sophisticated users are able to circumvent policies such as single bidding restrictions by camouflaging one's identity or otherwise manipulating the bidding procedure (Fay, 2004).

[4] Partial repeat bidding is the situation in which a portion of the population is restricted to single bid while others can rebid.

updated knowledge in establishing a threshold price, because the costs of enforcing single bid restrictions are too high.

Ding et al. (2005) tries to provide more insight in the factors which influence the bidding strategy of a consumer. Importantly, he shows that emotions affect bids in such a way that bids do not correspond with the assumption of economic rationality normally causing a (classic) profit maximizing strategy. Spann and Tellis (2006) further address the fitness of economic theory for NYOP mechanisms. They provide evidence against strict rationality even in the environment of the internet, which is considered to enhance rational decisions due to the easy access to information sources. This implicates that sellers can profit from this irrational behaviour, provided that they adjust their strategy accordingly. Therefore, NYOP can be more effective than assumed by earlier research based on rationality.

Although strict rationality is not presumable, strategic behaviour is apparent and does affect bidding strategy. Experience and knowledge positively affects consumer surplus extracted by consumers. Essentially a NYOP mechanism poses a economic problem for seller and buyer in the same manner that game theory predicts agents to act strategically (anticipating counter-agents' actions). All studied models share a common feature in the design of a NYOP mechanism by a secret or unknown threshold from a consumer's perspective. This unknown threshold is also constant in most models. This encourages consumers to learn about the threshold. Apparently, in some countries it is not legal due to trade laws to alter threshold prices[5]. Another common reason to refrain from dynamic thresholds[6] is avoiding negative publicity and thus losing consumers. Though, theoretically it is superior from a profit maximizing perspective, because it allows for better price discrimination. A seller threshold adapting to individual consumer behaviour is technology-wise very feasible. However, different companies have expressed their concern with regard to negative effects on consumer perception. Hinz et al. (2011) tries to provide some insight into dynamic pricing and their results show that expected profit and welfare

5 In the study by Terwiesch et al. (2005) a German company refrained from using dynamic thresholds due to German trade laws and fear for negative public opinions.

6 Dynamic thresholds: the use of different thresholds per individual based on their behaviour and preferences.

increase. More interesting is the fact that they find that customer satisfaction increases, in contrary to the presumed negative effects. The key to this lies in transparency to the consumer.

As technological innovation offered sellers to implement and improve pricing mechanisms, communication between individuals and size of networks also increased. Hinz and Spann (2008) fill the gap that these technological innovations have made with regard to information sharing through social networks. A decrease in information asymmetry can have negative effects on sellers' profit depending on the design of NYOP. Sellers can influence the information a bidder has, through the degree of transparency employed. Wilson and Zhang (2008) study a situation where consumers are provided with almost full knowledge of the model (knowledge with regard to their winning probabilities). By anticipating on possible strategic behaviour and incorporating it into their optimal threshold, they eliminate 'uncontrollable' strategic behaviour. It is essential for sellers to assess their consumers' expectations to undertake actions to increase seller surplus. Dependent on the accuracy of the buyer's prediction and frictional costs a seller might choose to decrease the information asymmetry.

In some studies, posted prices have shown to outperform NYOP mechanisms (Fay, 2004; Terwiesch et al., 2005). Though, the right design and the correct prediction of consumer bidding strategy is very important. Another factor influencing seller profitability is the presence of competitors. Fay (2009), addresses this particular subject by researching for a NYOP mechanism in combination with competition. They provide evidence that a NYOP mechanism can soften price competition between competitors as they can target other customers due to the difference in threshold prices and posted price. However, this depends on the level of heterogeneity in frictional costs and allowing rebidding or not. From the NYOP seller perspective is it preferable to use rebidding in the case of high heterogeneity in frictional costs. Rebidding attracts a larger customer base, because lower prices can be obtained. In addition, the seller using posted prices will have less incentive to aggressively reduce prices, because they can target the upper part of the market due to a clear segmentation. On the other hand, in case of low heterogeneity a NYOP seller should prefer a single bidding system, as this will increase threshold prices and lower the customer base. In this case the market is not as clearly segmented, therefore, the NYOP seller should not differentiate too much from the posted price that it evokes aggressive pricing by the posted price seller.

Shapiro and Zilante (2009) contribute some very interesting results to literature with regard to our research. They research the profitability of a NYOP mechanism under own brand name in addition to an existing posted price channel. They provide evidence that a NYOP mechanism coupled with a posted priced mechanism is significantly beneficial for sellers and consumers. The NYOP mechanism positively affects profit / revenues by offering lower prices through the NYOP and reaching a different price segment. This increases market share / demand, which in turn compensates for the lower prices, which also makes the NYOP channel profitable on its own. Remarkably, it does not cannibalise posted price sales as consumers with high reservation prices still purchase through posted price channel. These consumers are for example not interested in the hassle involved with bidding. The outcome depends on the height of the established seller threshold price, which should be set optimally. A threshold price too close to marginal cost will result in a profit decrease. Furthermore, the choice for an opaque setting does not necessarily negatively affects profitability. However, in their results NYOP mechanisms without perform better. Shapiro (2011) finds similar results, backing the idea of using both NYOP and posted prices to improve profitability. Though, in a scenario with risk-neutral buyers[7], posted price will outperform NYOP. Recent study by Voigt and Hinz (2014) showed that buyers have the general tendency to be risk-averse, because unaccepted bids were followed by significantly higher increased bids than successful bids. They find that a NYOP mechanism is sustainable, also in the long run, despite increasing customer knowledge and experience over time. He points out that demand for homogenous products is more price sensitive, thus it makes sense to use alternative pricing mechanisms such as NYOP to reach different price segments. Most adjacent to our research is the study by Wang et al. (2009). They investigate the NYOP mechanism when used by a service provider using the airline industry as an example. In their research they define two different scenarios based on whether a service provider should employ a NYOP retailer or should vertically integrate the independent NYOP retailer. They find that a

7 Risk-neutral buyers are indifferent for the risk involved and is only interested in the potential gains of each investment and ignores potential downside of risky investments or actions.

vertically integrated NYOP retailer is more profitable than an independent NYOP retailer, mainly because the seller can retain the independent NYOP retailers fee and the threshold can be better adjusted to compliment posted prices.

Literature is almost non-existent with regard to different product classes in combination with pricing mechanisms. Some studies do differentiate consumer classes. For example, the distinction between leisure and business class travellers based on their willingness-to-pay and the moment they purchase the service (Wang et al., 2009; Gal-Or, 2011). However, they consider a single product class and not different classes as is mostly the case with service providers (e.g. hotels, airlines, rentals). Though, a lot has been written on product upgrades. Fudenberg and Tirole already concluded in 1988 that existing consumers pay lower prices for upgrades than new consumers. Their willingness to pay is lower because they already own a product version. To maximize their profits, companies utilize the difference between existing and new consumers by price discrimination. Most known for this phenomena are software companies. These companies improve their basic or original product with new features, more services and higher quality, but charge lower prices for these upgrades to existing users.

More literature is written on the allocation of fixed capacity to different classes, in which the airline industry occupies a prominent place as subject. Preliminary literature regarding revenue management already dates back to the 80's and 90's and mostly deals with optimal allocation. Over time researchers and the market improved revenue management and thus more tools were introduced to make the optimal solution more adaptable to market conditions and preferences of companies. One of such important developments was the use of overbooking (Suzuki, 2002; Suzuki, 2006). Overbooking implies that service providers try to sell more than their capacity allows. In case sales exceed capacity, overflow can be re-allocated directly to cancelations or consumers are compensated. Biyalorgosky et al. (2005) discuss the possibility of introducing upgradable tickets to solve the dilemma between demand uncertainty versus opportunity costs of business class and economy class. This dilemma represents two alternative strategies: one of high risk with possible unsold premium class services or more guaranteed advance selling with reduced price for premium class services with potential profit loss. Their results show that incorporating a potential upgrading feature, conditional on free capacity is a good solution.

Key insight is that the dilemma is caused by uncertain demand in premium services. Wang et al. (2009) states more specified to the airline industry: '*Interestingly, this is the one industry in which there is a lucrative market segment (with high willingness to pay) that enters late in the game and whose size is uncertain*.'. Moreover, they indicate that a NYOP mechanism is especially useful to improve profitability under such circumstances, because it increases flexibility for sellers in reacting to demand.

NYOP USED FOR SERVICE UPGRADES

Previous literature has researched the application of the NYOP in different ways. It started with the optimal design concerning the consumers' beliefs and actions in a broad sense and seller's response. Meanwhile, the choice between posted prices and a NYOP was also discussed, followed by the possibility of using a NYOP in addition to posted prices. thereby are also differences between vertically integrating such a NYOP channel or using an independent retailer. We research a new business model, where the NYOP mechanism is employed with the sole purpose of selling upgrades. A form of vertically integrating a NYOP mechanism, only focused on a specific product class. We depict this model in figure 2, with the arrows as consumer flow. With regard to our main objective we need to combine different fields of study regarding service upgrades and the NYOP mechanism. In forming expectations on the implementation of the NYOP to sell premium services, we first address all the influencing factors.

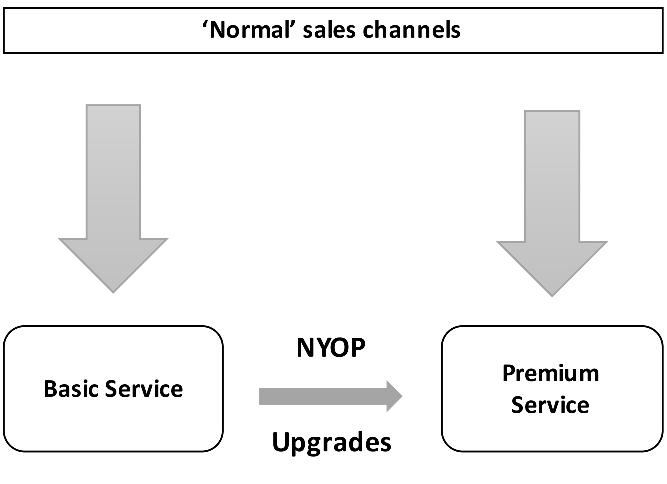
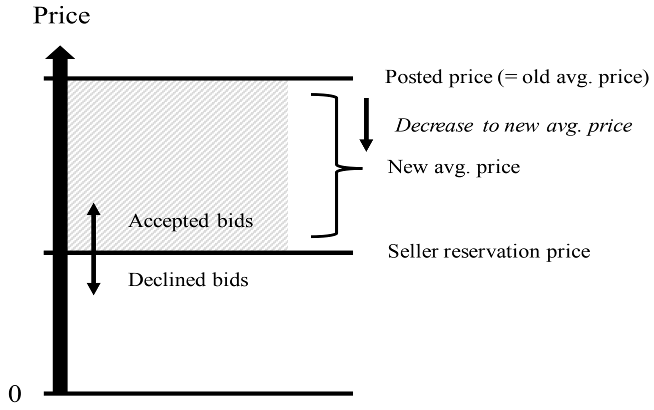


Figure 2. Consumer flow

A restrictive consequence of using a NYOP to sell upgrades is that the only eligible consumers are those who already have purchased the basic service. With regard to this model we derive some assumptions from the design. First of all, the opaque feature is not feasible in this setting. Unlike the setting in the Priceline model, the product details are known as the first purchase reveals this. The site is transparent on posted prices per specific flight and current consumers already purchased a ticket, thus they are already certain of most details. Though, specifics of the premium product can be hidden in the bidding procedure, but these can be obtained easily by browsing the posted prices channel. Transparency with respect to the details of the service positively affects the perceived value, increasing their reservation price. Secondly, we assume that service providers will generally opt for a single bidding system. The nature of this business model allows for a single bidding system that can be perfectly and easily enforced, because bids can be linked to the purchase of the basic service, making partial repeat bidding impossible. The paper by Fay (2004) states that the expected profit from both multiple bidding and single bidding is the same without the interference of partial repeat bidding. The fact that a single bidding system is easier to implement and poses lower frictional costs to the consumer shall be decisive for the choice between a single or multiple bidding system. Based on these assumptions we derive three propositions with regard to our research questions.

Proposition 1: Service providers adding a NYOP mechanism to the existing posted prices channel selling service upgrades will see a decrease in average premium service prices.

As Anderson and Wilson (2011) strikingly formulate: *'NYOP and opaque selling naturally segment price sensitive (brand agnostic) consumers from brand loyal (price inelastic) consumers providing an efficient mechanism for sellers to simultaneously sell at multiple prices to segment consumers'.* By offering consumers the opportunity to name their price, sellers can effectively target consumers with lower willingness-to-pay. Research by Shapiro and Zilante (2009) show that the NYOP does not cannibalise posted prices sales. This means that the 'original' posted price channel remains sustainable in a situation where both channels are used. Therefore, if a NYOP mechanism is added to sell premium services, the average price in the premium class will decrease to a level between a buyer's accepted bid and the posted price (see figure 3).



Old situation PP: *premium service posted price = average price premium*
New situation PP & NYOP: *premium service posted price > average price premium > accepted bid buyer, where accepted bid buyer ≥ seller reservation price*

Figure 3. Average price change due to the addition of the NYOP mechanism

Proposition 2: Service providers adding a NYOP mechanism to the existing posted prices channel selling service upgrades will see an increase in premium service consumers.

To increase profitability, the optimal seller threshold is set at a certain level that it attracts another segment than the segment targeted with the posted prices channel. The posted price is set high to target consumers with high reservation costs, possibly with high frictional costs who are not interested in the hassle of bidding. On the other hand, a lower reservation price is set to attract more price sensitive consumers. The fact that the NYOP mechanism is only offered to 'existing users' of the basic service, with certain lower willingness-to-pay further reduces possible cannibalisation problems. Thus after implementation of the NYOP mechanism the consumers using premium service increases with the number of accepted bids, as the number of posted prices consumers retains current demand (figure 4). Naturally, the number of (accepted) bids is dependable on available capacity and number of eligible consumers.

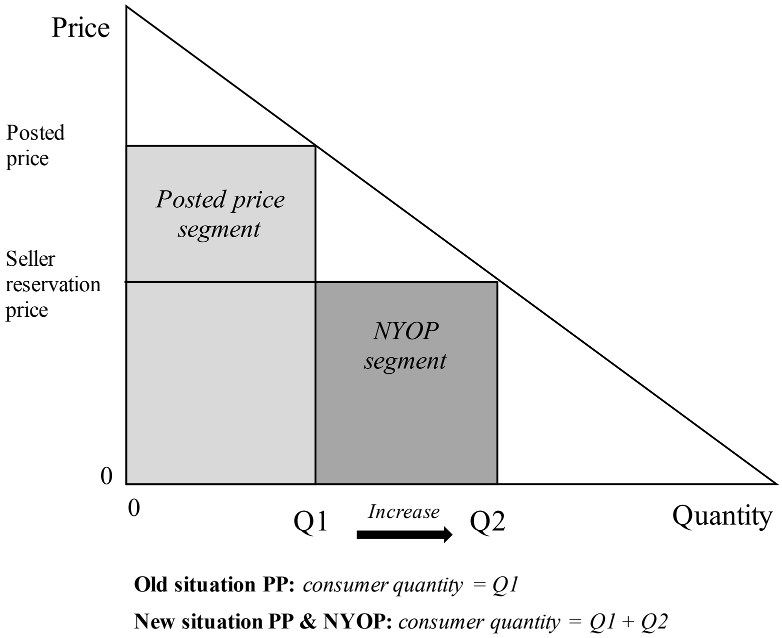


Figure 4. Increase in quantity due to NYOP mechanism

Proposition 3: Service providers adding a NYOP mechanism to the existing posted prices channel selling service upgrades will see an increase their revenues.

Following proposition 1 and 2, we expect that the NYOP mechanism increases revenues. As posted price channels are not cannibalised by the NYOP sales, every accepted bid should increase revenue (Shapiro and Zilante, 2011). The lower price in NYOP channel should attract enough consumers to make up for the lower price, thus still be significant. By increasing the number of monetised premium services instead of free upgrading due to overbooking or loyalty program perks, the total extracted value rises. Thus we expect that this increase in revenues is mostly generated by an increase in paying consumers in premium class. Assuming reservation price is set above marginal costs, the NYOP probably also positively affects profitability. However, we do not have insight in the costs factors of NYOP mechanisms thus our scope will focus on revenues.

METHOD

A lot of previous research uses experimental or laboratorial tests to test their hypotheses. In the table added to the appendix (Appendix 1), we also state the design of the research. 6 of the 22 papers discussed in the 'related research' chapter are empirical researches that use field data from for its research questions. The paper by Shapiro & Zilante (2009) and Wang et al. (2009) closely related to our paper research a situation where a NYOP mechanism is combined with a posted price channel. They use a laboratory experiment and an economic model to understand the effects. However, in this research we will make use of a case study. An laboratory experiment removes participants from their 'normal' environment. This has impacts on results as participants are almost 'perfectly' researched on a specific subject. It is easier to research a subject in their 'natural' environment through a case study as it is a real event or action. The decision by American Airlines to implement a NYOP mechanism in 2013 to sell unoccupied business seats fits our research very well. It allows us to essentially research American Airlines as treatment group and competitors as control group. To answer our research questions correctly, we alter the propositions made in the previous section into testable hypotheses specified to this American Airline case. We give some extra background information on this case with regard to the NYOP mechanism and Airline Industry. Subsequently we elaborate on the difference in differences method used to provide the results.

AMERICAN AIRLINES CASE

The airline industry is a very competitive market. Innovations such as loyalty programs have introduced some differentiation between airlines, but air travel is still relatively a homogenous product and demand is responsive to price. Especially to those consumers attracted to NYOP bidding sites in the first place. The traditional division of customers based on business and economy class is somewhat outdated (Mason, 2005). A lot more is going on within the borders of such classes with regard to price differentiation. Airlines do not have the possibility to alter their services such as hotels or service providers to increase differentiation. Thus airlines mostly differentiate customers based on travel purpose (business or leisure) or price sensitivity. New pricing mechanisms or applications thereof are always interesting to airlines. Our research subject, NYOP applied to service upgrades is one of those. This specific business model has not gotten any attention in literature so far, but has already been implemented by several airlines over the world. Primary partner-company for airlines providing such a service is Plusgrade[8]. They introduced a new way to increase occupancy and/or profit by auctioning off unoccupied business seats or other similar upgrades such as first class and premium seats. Some news articles stated that this is due to airlines trying to monetise more seats (Weed, 2016). American Airlines was one of such airlines enabling economy passengers to bid on unoccupied business seats. They stressed that loyalty programs would not be affected, but these previously unoccupied seats were given freely to frequent flyers. Thus, this new implementation must somehow affect frequent flyers.

The specifics of the NYOP in the American Airlines case are as follows. The bids are assessed at a certain moment before flights depart, on a first in first out base. This moment is mostly around 24 hours before departure if we follow reports on flyertalk.com and other informative sites[9], but the general terms and agreements (Appendix C) state that American Airlines can assess the bid until departure. In the interval between start of bidding and assessment moment, priority is still given to frequent flyers and customers of posted price fares. The acceptation of a bid is primarily dependant on the occupation. Therefore, it is possible that after a bid has been received and qualifies as sufficient bid with respect to the reservation bid, it can still be declined. As a result, profits can be maximized and negative effects on loyalty members can be kept to a minimum.

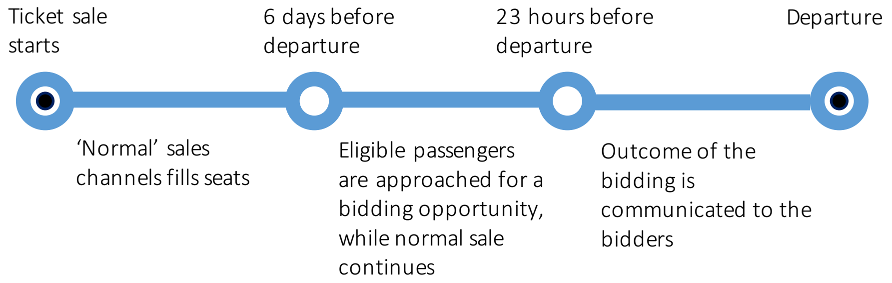


Figure 5. Bidding process

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8 Plusgrade is an American based company. It is the market leading provider of upgrade solutions. This is a segment of ancillary revenue and merchandising sector in the airline industry.

9 Flyertalk.com is a popular worldwide community, discussing all kinds of topics regarding the travel industry.

HYPOTHESES

1. *The implementation of the NYOP channel has a negative effect on average business fares at American Airlines compared to other carriers only using regular sales channels.*
2. *The implementation of the NYOP channel has a positive effect on average fares at American Airlines compared to other carriers only using regular sales channel.*

The NYOP mechanism naturally targets a consumer segment with lower reservation prices, otherwise they would have bought a posted price ticket. The seller reservation price is significantly lower than posted price but above marginal cost to successfully profit from price discriminating consumers. Thus accepted bids are higher than the seller reservation price and lower than posted price (figure 3). An economy flier which is upgraded through the NYOP channel pays a lower price than 'normal' business class travellers as discussed above. But the bid does raise the total value of the flight (figure 2). In the pre-NYOP situation, this upgrade could not have been monetised and the average fare of the whole flight would have been lower.

3. *The implementation of the NYOP channel has a positive effect on the amount of business class passengers at American Airlines compared to other carriers only using regular sales channels.*
4. *The implementation of the NYOP channel has a positive effect on the amount of passengers at American Airlines compared to other carriers only using regular sales channels.*

To successfully price discriminate consumers based on their willingness-to-pay, prices are set significantly lower than posted prices. The lower price enables consumers with lower willingness-to-pay to make use of the service. Thus the original consumer quantity purchasing through the posted price channel increases with the consumer quantity purchasing through the NYOP mechanism (figure 4). As argued these channels do not cannibalise each other's sales. The NYOP mechanism does not increase the total passengers directly, as only existing economy passengers are eligible to place a bid. However, the potential option of bidding might positively increase posted prices sales for economy class tickets. As for some consumers the value of an economy ticket increases with the probability of purchasing a business seat for a lower price than the posted price. Interestingly, we did not find support in prior literature on the intuitive expectation that economy class is easier to sell than business class regarding with respect to demand and prices in absolute terms, which would than lead to positive effects on economy class sales as well.

5. *The implementation of the NYOP channel has a positive effect on American Airlines' revenues generated by business class passengers compared to other carriers only using regular sales channels.*
6. *The implementation of the NYOP channel has a positive effect on the total of American Airlines' revenues generated compared to other carriers only using regular sales channels.*

The NYOP channel enables American Airlines to monetise more seats in business class, instead of upgrading economy passengers for free due to overbooking or frequent flyer perks. We assume that the seller reservation price is set optimally. The lower price in the NYOP mechanism allows American Airlines to successfully price discriminate consumers and increase demand, while not cannibalising posted price sales. Furthermore, we expect that economy sales will not be harmed by the NYOP mechanism. More passengers upgrading could mean a decrease in economy sales as frequent flyers might feel negatively impacted. However, American Airlines has assured not to harm such loyalty programs.

DIFFERENCES IN DIFFERENCES

We use multiple difference in difference regressions to capture the effects on different dependent variables to test our hypotheses. A difference in difference estimation compares the change in outcomes

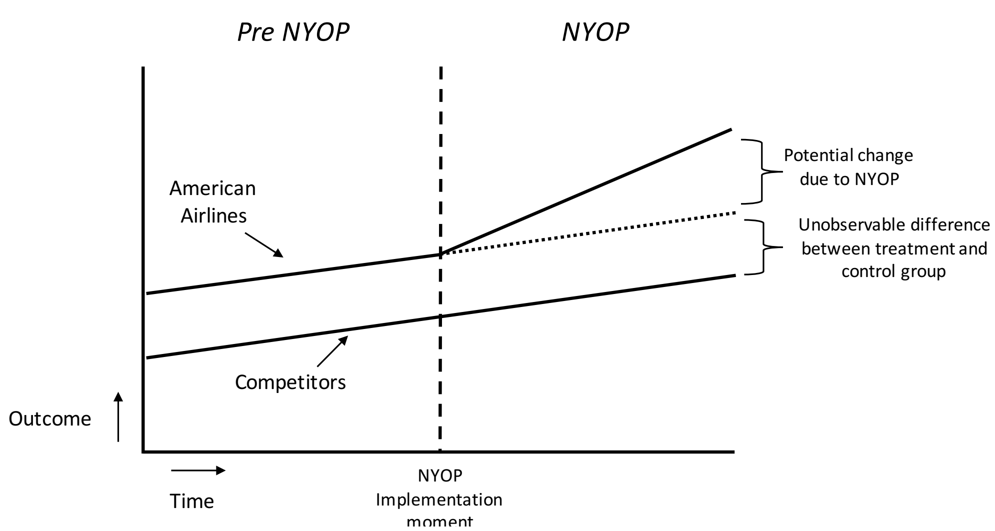

Figure 6. Difference in difference model with respect to American Airlines

for the treatment group to the change in outcomes for comparison group / control group. It allows for time-invariant unobservable differences between treatment and comparison group. Thus effects such as seasonal differences are accounted for, because both groups are affected.

In all regressions we account for differences between itineraries based on route specific characteristics and carriers by absorbing these through a origin-destination city pair fixed effect. To capture the effects on fares we use a triple difference in difference regression with the following equation:

$$Itinfare_{imt} = \alpha + \beta \cdot AA_i + \gamma \cdot After_t + \delta \cdot BusinessFirst_m + \psi \cdot AA_i * After_t + \phi \cdot After_t * BusinessFirst_m + \omega \cdot BusinessFirst_m * AA_i + \kappa \cdot AA_i * After_t * BusinessFirst_m + \sum \psi_{orig,dest} + u_{imt} \quad (1)$$

$Itinfare_{imt}$ is the itinerary fare per passenger for airline i in market segment m (business and first vs economy) in quarter t. The explanatory variables are three dummy variables representing American Airlines, after implementation of the NYOP, and business / first class. This regression is used to test hypotheses 1 and 2. The double interactions provide us with information whether the NYOP mechanism at American Airlines is actually beneficial compared to the business model without the NYOP mechanism. The triple interaction adds another dimension regarding business class, thus indicating whether prices in business / first class increase significantly compared to competitors due to the NYOP mechanism

We capture the effects on the dependent variables used for number of passengers, business passengers and economy passengers through double difference in difference analysis by estimating the following equations:

$$Sum\_bpass_{it} = \alpha + \beta \cdot AA_i + \gamma \cdot After_t + \delta \cdot AA_i * After_t + \sum \psi_{orig,dest} + u_{it} \quad (2)$$

$$Sum\_epass_{it} = \alpha + \beta \cdot AA_i + \gamma \cdot After_t + \delta \cdot AA_i * After_t + \sum \psi_{orig,dest} + u_{it} \quad (3)$$

$$Sum\_pass_{it} = \alpha + \beta \cdot AA_i + \gamma \cdot After_t + \delta \cdot AA_i * After_t + \sum \psi_{orig,dest} + u_{it} \quad (4)$$

Model 2 estimates the effects on the number of business / first class passengers where Sum_bpass_{it} is the sum of business / first class passengers for airline *i* in quarter *t.* Model 4 estimates the effects on the number of passengers where Sum_pass_{it} is the sum of passengers for airline i in quarter *t.* Lastly, model 3 estimates the effects on the number of economy class passengers Sum_epass_{it} is the sum of economy class passengers for airline i in quarter *t.*

The reason to use multiple double differences in differences models, instead of a triple difference in difference model lies in the nature of the dummy variable for business class. A triple difference in differences including such variable as an independent variable, would not explain the effect on the amount of business travellers. It would rather explain the effect of being in business class on the overall number of travellers.

The double interactions should provide us with insights on the effect of the NYOP structure at American Airlines on the number of business passengers, economy passengers and total passengers compared to other carriers not using NYOP mechanisms. Lastly, three double difference in differences are estimated to capture the effects for total revenues, business class revenues and economy class revenues through these equations:

$$Sum\_bitinrev_{it} = \alpha + \beta \cdot AA_i + \gamma \cdot After_t + \delta \cdot AA_i * After_t + \sum\psi_{orig,dest} + u_{it} \quad (5)$$

$$Sum\_eitinrev_{it} = \alpha + \beta \cdot AA_i + \gamma \cdot After_t + \delta \cdot AA_i * After_t + \sum\psi_{orig,dest} + u_{it} \quad (6)$$

$$Sum\_itinrev_{it} = \alpha + \beta \cdot AA_i + \gamma \cdot After_t + \delta \cdot AA_i * After_t + \sum\psi_{orig,dest} + u_{it} \quad (7)$$

Model 5 estimates the effects on the revenue of generated by business / first class passengers where $Sum\_bitinrev_{it}$ is the sum of revenue from by business / first class passengers for airline *i* in quarter *t.* Model 7 estimates the effects on the sum of revenue generated by all passengers where $Sum\_itinrev_{it}$ is the sum of revenue generated by all passengers for airline *i* in quarter *t.* Model 6 estimates the effects on the revenue generated by economy class passengers where $Sum\_eitinrev_{it}$ is the sum of revenue from economy passengers for airline i in quarter *t.* In similar fashion as the regressions regarding passengers the dummy regarding business class is not included, instead we made use of a dependent variable regarding business class revenues. As well as in the previous models, the interactions are the main explanatory variables with regard to the NYOP mechanism at American Airlines compared to other airlines without such price mechanism.

DESCRIPTIVE ANALYSIS

DATASET

The source of the data is the Office of Airline Information of the Bureau of Transportation Statistics, which holds all kinds of data regarding transportation in the United States. They also conduct surveys regarding airline transportation. The survey 'The Airline Origin and Destination Survey (DB1B)' is used in this research. It is a 10% sample of airline tickets from reporting carriers collected domestically in the US, on a quarterly basis starting from 1993 to present-day. Data includes origin, destination and other itinerary details of passengers transported in the American domestic market. This database is used to determine air traffic patterns, air carrier market shares and passenger flows. The survey is divided into three data tables with different topics: coupon-specific, directional market characteristics and summary characteristics. The table regarding coupon-specific information provides data regarding operating carrier, routes, number of passengers, fare classes and distance, whereas the Market table provides data such as reporting carrier and city market id. The table 'ticket' provides data such as itinerary fares and routes. The data provides these specifics for each unique domestic itinerary of the survey.

To create a usable data set, we collect all quarters from the years 2013 and 2014 from all three data tables. Firstly, we want a dataset in which we can compare the effects of the NYOP on American Airlines, but also in comparison to competitors not using the NYOP. Thus we filter the quarterly data to the routes on which American Airlines operated when the NYOP mechanism was in full use. Subsequently, we aggregate the quarterly data per table resulting in 3 datasets consisting of data from 2 years (2013 – 2014). These datasets are merged based on the itinerary id's. A lot of airlines use code sharing to increase their sales and brand value (Czerny, 2009). This also means that some tickets differ between operating and ticketing carrier. We are specifically interested in the purchased tickets where the selling carrier is identical to the operating carrier, because we consider a NYOP channel which is operated under own brand label. Consequently, itineraries without corresponding ticketing and operating carries are dropped from the dataset. Finally, we find some itinerary fares indicating a zero-dollar fare, which we find very questionable thus we drop these as well. These observations might be passengers who have gotten compensation or did not want to reveal their itinerary fares to the survey. After merging and dropping the necessary observations we obtain a dataset containing 8,130,589 observations based on unique itinerary ID's. In the final dataset we have 27 different airlines. The largest five airlines represent around 86% of all observations. American Airlines, logically, accounts for the largest share of 30%. This distribution is similar to the the actual ranking of airlines with regard to revenue, enplaned passengers and daily departures (BTS, 2015). There are 183 different airports in the United States represented in this dataset, which are either regional or international airports. Between these airports we identify 1,172 different routes with distances ranging from 39 to 4,243 miles (or 63 km to 6,828 km). There are over 17.7 million passengers included in this dataset, of those passengers about 7% were seated in business class or higher and 93% in economy class.

The regression for the effects on passengers and revenues needs for further restructuring of the dataset. In the data for fares, we research on the fare per passenger level. With regard to passengers and revenues, we need to sum the number of passengers per quarter for each carrier. Otherwise we cannot compare the changes per quarter. This means that we have to filter the dataset from the number of observations on a unique itinerary ID level to the number of observations with regard to unique routes per carrier per quarter. Thus in order to obtain one observation per quarter, operating carrier and route, we dropping duplicates. This command adjusts the number of observations in the dataset to 15,852 observations.

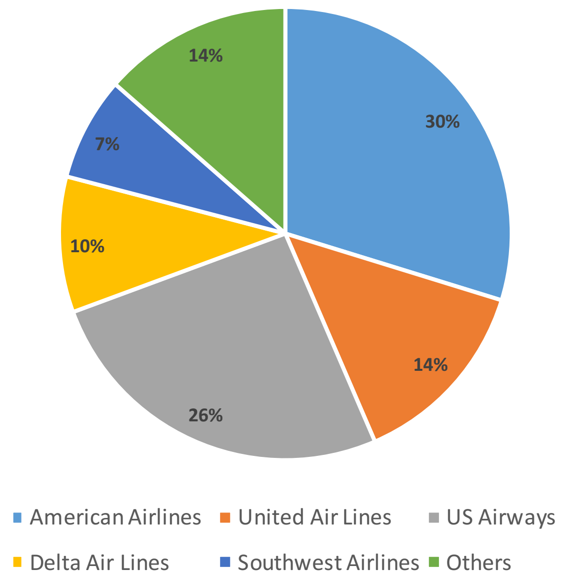

Figure 7. Distribution of observations per airline

VARIABLES

We are interested in the effects on fares. The fares are represented in the dataset by the variable *itinfare.* It is a continuous variable indicating the fare price per passenger in dollars for each unique itinerary. On average the fare price is 471 dollars, when we consider business / first class and economy class, we see that the average for those classes is 700 and 453 dollars respectively. Furthermore, we see that the mean for itinerary fares at American Airlines lies higher than average with 493 dollars. The means specified to American Airlines are also above overall average with 956 and 470 dollars. We plotted a graph of average fares through time divided for American Airlines and other carriers combined (figure 8). This gives us some rough information on possible effects of the implementation of the NYOP structure in November 2013. When we analyse the graph we do not see an evident change the development of average fares, however bear in mind that this graph does not account for any route and carrier specific characteristics. We can assume that average fares increase moderately for both American Airlines and other carriers. Furthermore, we see that fares for American Airlines are higher than the average for other airlines and average fares range from 440 to 500 dollars throughout the full time period. When we analyse the histogram with respect to the distribution of observations for *itinfare*, we conclude that the variable is not normally distributed. Therefore, we transform *itinfare* into a logarithmic, *ln_itinfare*. We've added the histograms for both normal and logarithmic form to the appendix (Appendix D).

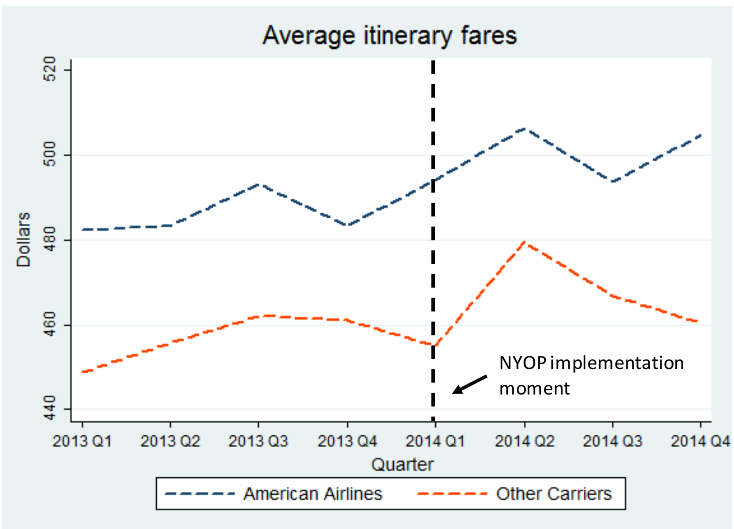

Figure 8. Average itinerary fares

We use three dependent variables with regard to our interest in the effects on passengers. These are *sum_pass, sum_epass* and *sum_bpass*. The variable *sum_pass* represents the sum of passengers in each quarter on a specific route for a specific carrier. The variables *sum_bpass* and *sum_epass* are similar, only these concentrate on business / first class passengers and economy class passengers. The mean for *sum_pass* is 1091 passengers per route per carrier per quarter. Specified for American Airlines, *sum_pass* has a higher mean of 1451 dollars. We also plotted a graph on the average passengers per quarter for American Airlines and the other carriers combined (figure 9). We see a dip in both lines from the last quarter in 2013 to the first quarter of 2014, then continuing an upward trend again, which might indicate a positive effect by the NYOP model. However, as both lines show this upward trend it might just be a cyclical trend affecting all carriers. The means for *sum_bpass* and *sum_epass* are respectively 92 and 997 passengers per route per carrier per quarter. Remarkably, the mean for *sum_bpass* specified for American Airlines is significantly lower with 52 dollars, but for *sum_epass* significantly higher with 1,399 dollars. We conclude from the histograms that these variables are not distributed normally, thus we also transform these to logarithmic variables. After the transformation the logarithmic variables show more normal distributions (Appendix D).

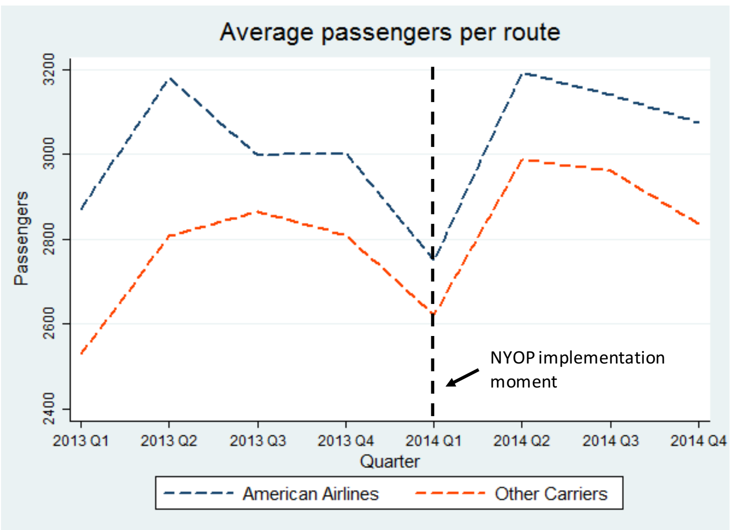

Figure 9. Average passengers per route

Lastly, we are interested in the actual gains with regard to the revenues. We use three dependent variables to explain revenues from economy passengers, business/first class passengers and total revenues earned. *Sum_itinrev* represents the sum of revenue in each quarter on a specific route for a specific carrier. This allows us to research the difference between different time periods and between carriers. The mean for *sum_itinrev* is 409,342 dollars per quarter per route per carrier. When we specify the mean to American Airlines, we notice that it lies higher than overall average with 605,407 dollars. This follows the distribution of market share. Again, we plotted a graph for the average revenues per route. Similar to the graph regarding average passengers per route, there is a dip around 2013 Q3 and 2014 Q1, followed by an upward trend. However, in this graph we notice a heavier downward trend in Q4 2014. We do not notice any big differences in this graph between American Airlines and other carriers combined.

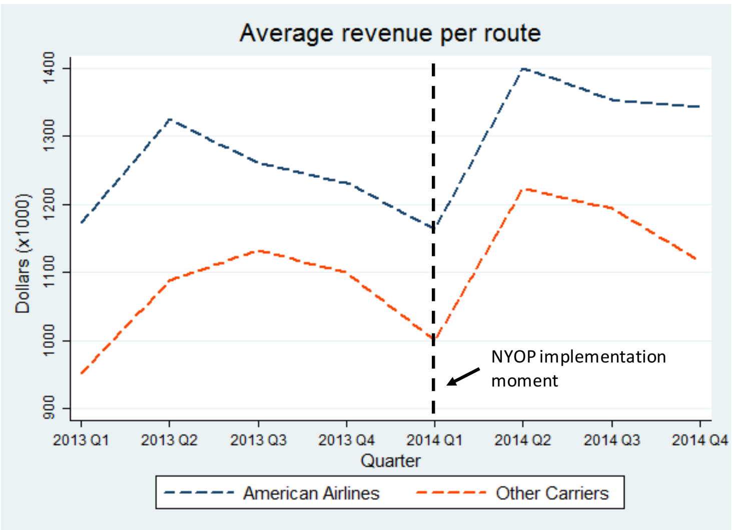

Figure 10. Average revenue per route

The variables *sum_bitinrev* and *sum_eitinrev* are similarly interpreted as *sum_itinrev*, however these are specific to business class revenue and economy class revenue respectively. The mean for *sum_eitinrev* (362,922 dollars) is higher than the mean for *sum_bitinrev* (44,510 dollars), probably due to the difference in demand. The mean for *sum_bitinrev* specified to American Airlines is close to the to the overall mean (44,377 dollars) and for *sum_eitinrev* the mean lies significantly higher (561,012 dollars). We notice these variables are all skewed left and not normally distributed, thus we transform the variable to logarithmic forms: *ln_sum_itinrev, ln_sum_bitinerv* and *ln_sum_eitinrev* (Appendix D).

We use the dummies *AA, businessfirst* and *after* and interactions thereof as independent variables to explain the effects. The variable *AA* signifies a division between American Airlines and other carriers. *Businessfirst* signifies the division between the class types economy and business/first. To differentiate the period before the implementation of the NYOP and during the NYOP we use the variable *after.* The NYOP mechanism was officially operational in November 2013. However, we consider the half of Q3 2013, in which the NYOP mechanism was operational, negligible as it was a start-up phase. First full quarter in which the NYOP was operational was Q1 in 2014. Thus, the four quarters in 2013 are identified as 'before' and the four quarters in 2014 as 'after'. The interaction terms are most interesting for us. These provide us information whether the NYOP structure at American Airlines is actually beneficial compared to the business model without NYOP and other companies before and after implementation. The interaction *AA*after* represents the effect on fares after implementation of the NYOP structure at AA compared to other carriers without NYOP. Lastly, we use a triple interaction *businessfirst*AA*after*, which is related to the effects on business fares at American Airlines after implementation of the NYOP structure compared to other carriers not using NYOP mechanisms. We added a summary of the variables and specifications regarding business class and American Airlines to the Appendix (Appendix E and F).

EMPIRICAL ANALYSIS

RESULTS

In this section we analyse the results obtained from the regressions we ran based upon the equations for the different difference in difference models. All of the effects stated are and estimated while all else is kept fixed, in other words ceteris paribus. Furthermore, all of the dependent variables used are logarithmic transformations, thus the coefficients are interpreted in terms of percentages ($\%\Delta y = 100 \cdot \beta 1 \cdot \Delta x$). In the following table (next page) we show the models regarding itinerary fares and number of passengers per route per carrier. These are used to test hypotheses 1 to 4. We start by analysing model 1 with *ln_itinfare* as dependent variable.

The standard dummies in model 1, *AA, businessfirst and after* are all insignificant. Thus we can't derive anything from these variables about the market position of American Airlines, the prices in 2014 or affirm that business class fares are higher priced than economy class. However, all of the interactions show significant effects. The interaction term *after∗businessfirst* is significant with a positive sign on itinerary fares. Business class fares in 2014 are 5% higher than fares in 2013. Business fares have increased significantly compared to the developments in economy fares and business fares in 2013. *Businessfirst∗AA* shows a significant positive coefficient of 1.03, meaning that fares for business class at American airlines is 103% higher relative to other carriers and economy class. Implying that American Airlines charges higher prices than average in the market for 2013 and 2014 combined. Our main interaction with regard to hypotheses 2 is *AA∗after*. It shows a positive significant sign of 0.04. This means that fares for American Airlines in 2014, thus after implementation of the NYOP mechanism, are 4% higher compared to fares in 2013 for American Airlines relative to other carriers. This is in accordance with the expected positive effect of the NYOP mechanism stated in hypothesis 2. Our main variable, with regard to hypothesis 1, is the triple interaction term *businessfirst∗AA∗after.* The coefficient is negative and significant with an effect of -90% on itinerary fares after implementation of the NYOP mechanism relative to other carriers and economy class fares. This follows our theory on the negative effects of the NYOP with regard to the average price. In essence it supports our view regarding the strategy for implementing both posted prices and a NYOP mechanism. The NYOP mechanism targets a different segment of consumers which have lower reservation prices. Therefore, the average price in business class decreases. This negative effect only supports that the prices do indeed decrease when the NYOP mechanism is in use, it does not say anything about the additional revenue. We will see assess this in the next models. Both *AA∗after and businessfirst∗AA∗after* are significant and provide support for hypothesis 1 and 2. That the results also affirm hypothesis 2 reinforces our evidence for lower prices due to the NYOP mechanism. Overall prices at American Airlines increase and Business fares at American Airlines decrease after the implementation of the NYOP mechanism relative to other carriers and economy class. This can have two different explanations. Firstly, economy prices have risen and compensated the decrease of business fares or secondly, which we find more presumable, economy prices did not change but more seats were monetised thus increasing total value extracted. However, we

Itinerary fares and passengers VARIABLES	(1) ln_itinfare	(2) ln_sum_bpass	(3) ln_sum_epass	(4) ln_sum_pass
AA	-0.04	-0.32	1.80***	1.88***
	[0.04]	[0.20]	[0.24]	[0.24]
after	0.01	0.06*	-0.02	-0.02
	[0.00]	[0.03]	[0.03]	[0.03]
businessfirst	0.04			
	[0.05]			
AAxafter	0.04***	0.52***	0.01	0.07
	[0.01]	[0.05]	[0.07]	[0.07]
afterxbusinessfirst	0.05***			
	[0.01]			
businessfirstxAA	1.03***			
	[0.07]			
businessfirstxAAxafter	-0.90***			
	[0.04]			
Constant	5.85***	3.37***	4.99***	4.95***
	[0.02]	[0.11]	[0.11]	[0.11]
Observations	8,130,589	9,396	14,871	15,852
R-squared	0.062	0.497	0.424	0.381
Origin Destination Pair FE	YES	YES	YES	YES

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table 1. Results for itinerary fares and passengers

notice that the R-squared in model 1 is very low. It might be that the predictions of the effects are not very precise, but the relationships can still be trusted.

Model 2 regarding *ln_sum_bpass* shows the effects estimated with regard to hypothesis 3. The significant variable *after* shows that number of business passengers per route and quarter in the market is increasing with 6% in 2014 compared to 2013. This is in accordance with the 'rough' graph we plotted with respect to the average number of passengers per route. We can't say anything about the position of American Airlines compared to other carriers over the whole time period as the variable *AA* is insignificant. More importantly the model does show a positive significant sign for the interaction *AA*after.* According to this interaction variable American Airlines has served 52% more business / first class passengers per route and quarter in 2014 than in 2013 compared to other carriers. Thus this supports hypothesis 3, that the NYOP mechanism increases the occupation in business class. Model 3 and 4 only report significant effects for the variable *AA.* Both effects are positive. The number of passengers travelling with American Airlines per quarter is 188% higher compared to other carriers. Specified to economy passengers we see that the number of economy passengers travelling with American Airlines per quarter is 180% higher than other carriers. This supports the view of American Airlines as a leading company in the American airline industry. Unfortunately, the interaction terms are insignificant, thus we can't verify hypothesis 4 regarding overall passengers

Finally, we analyse the results for the dependent variables explaining revenues in models 5, 6 and 7 in table 2. Model 5 shows the effects with respect to the business class revenues per quarter. All of the variables in this model are significant. The dummy variable *AA* indicates that business class revenues per quarter are 39% higher for American Airlines compared to other carriers. Again, this affirms the view on American Airlines as a market leading airline. Additionally, this variable also reports significant positive effects in model 6 and 7, regarding economy class and overall revenues per quarter with difference between American Airlines of 199% and 191%, respectively. We see that business class revenues per quarter increase for all carriers with 14% in 2014 compared to 2013. The interaction term *AA*after* shows a positive significant effect of 0.12. This means that the business class revenues per quarter in 2014 are 12% higher for American Airlines than in 2013, relative to other carriers. This provides evidence for hypothesis 5 regarding a positive effect on business class revenues due to the implementation of the NYOP mechanism. As the main interactions in the models 1 and 2 for fares and business passengers are also in accordance with our hypotheses, we can conclude that the NYOP has had it expected effects with regard to business class fares, business class passengers and business class revenues. With regard to the overall revenues generated, we find that revenues for American Airlines in 2014 are 14% higher compared to 2013 relative to other carriers. This is in accordance with hypothesis 6 regarding revenues a positive effect of the NYOP mechanism on the revenues generated by American Airlines compared to other carriers.

Revenue			
	(5)	(6)	(7)
VARIABLES	ln_sum_bitinrev	ln_sum_eitinrev	ln_sum_itinrev
AA	0.39*	1.91***	1.99***
	[0.22]	[0.25]	[0.26]
after	0.14***	-0.02	-0.02
	[0.04]	[0.03]	[0.03]
AAxafter	0.12**	0.1	0.14**
	[0.05]	[0.06]	[0.07]
Constant	9.55***	10.80***	10.78***
	[0.11]	[0.11]	[0.12]
Observations	9,396	14,871	15,852
R-squared	0.475	0.404	0.366
Origin Destination Pair FE	YES	YES	YES

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table 2. Results for revenues

ROBUSTNESS CHECKS

In this section we reaffirm our results by robustness checks. We adjust the dataset to a new definition of competitors. We filter the competitors to only those that fly economy and business class. We repeat all of the analyses and results, starting with the descriptive part.

DATASET

We start by filtering the initial 'final' dataset to the carriers that operate both business and economy class. 12 carriers did not fly both classes, thus these are dropped from the dataset. This amounts to a decrease the total of observations of unique itinerary ID's with 181,942 observations to 7,948,647 observations. We retain 15 carriers. We can conclude that the carriers dropped accounted for a small part of the dataset and might have been carriers with a very low market share and not very well comparable with American Airlines. If we analyse the remaining carriers, we notice that the distribution of the largest carriers is similar as before the robustness alteration (Appendix G). Due to the robustness adjustment there are 8 unique airports and 22 unique flight routes less. There are still 175 unique airports in the United States and 1,150 unique routes remaining in the dataset. There are around 16.6 million passengers included in this dataset, where about 8% is seated in business class and 92% in economy class. Again for the regressions with regard to the number of passengers and revenues we have to restructure the dataset to make it usable on a route level for each carrier and per quarter. In doing so we obtain a dataset of 14,560 observations.

VARIABLES

The dataset for the robustness checks does not differ significantly from the initial dataset. *Itinfare* for example has a mean of 476 dollars, that only deviates a meagre 5 dollars from the prior mean of 471 dollars. Specified to business class and American Airlines, similar to the analysis in the previous descriptive part, the means do not show any substantial differences. When we replot the graph, the fares show a similar development for both American Airlines and other carriers (Appendix J). We transform the variable *itinfare* into a logarithmic from as the variable is not normally distributed. We have added the histograms and summary of the variables to the appendix (Appendix H and I).

The dependent variables *sum_pass*, *sum_bpass* and *sum_epass* show similar means as before. In this dataset *sum_pass* has a 50 more passengers on average. All of the means specified to American Airlines logically remain the same. All of the dependent variables with regard to passengers are also transformed to their logarithmic forms (Appendix H and J for histograms and replotted graphs). Naturally, there are relatively heavier changes in revenues as it is a multiplication of prices and quantity. However, also for the dependent variables in connection to revenues we do not see substantial or suspicious differences. The means for these variables logically increase, as some smaller airlines are dropped from the dataset. For example, the mean for *sum_itinrev* changed from 409,342 dollars to 436,818 dollars per route per carrier. This is an increase of 6% and this is the biggest change. These variables are also transformed to their logarithmic forms due to their non-normal distribution. The independent variables show identical means after the robustness adjustment.

RESULTS

In the similar fashion as the prior results we report the effects on the different dependable variables in different models. In the following table we show the effects for the model 1 to 4 regarding itinerary fares and amount of passengers.

Model 1 explains the effects on itinerary fares. In this dataset, the dummies for American Airlines versus other carriers and before and after implementation of the NYOP mechanism are significant in contrast with the prior results in model 1 where all of the dummies were insignificant. The variable *AA* shows a significant negative effect of 13%, meaning that fares for American Airlines are 13% lower than other carriers. However, this is measure over the whole time period, including the period of the NYOP. The dummy after shows a significant positive effect on itinerary fares. Thus prices for all carriers increase in 2014. The variable *businessfirst* is insignificant similar to the initial results. The double and triple interactions show almost identical effects. Thus also in this model Hypothesis 1 and 2 are supported. The triple interaction *businessfirst∗AA∗after* is significant and has a negative sign as hypothesised. The effect shows that business class fares for American Airlines are significantly lower after the NYOP was implemented with 91% relative to the development in fares of other carriers and economy class. This is only a 1% difference with de effect stated for this interaction in the initial results.

The double interaction *AA∗after*, actually shows an identical effect of 4% on itinerary fares for American Airlines after implementation of the NYOP mechanism relative to the development of fares for other carriers.

Itenerary fares and passengers VARIABLES	(1) ln_itinfare	(2) ln_sum_bpass	(3) ln_sum_epass	(4) ln_sum_pass
AA	-0.13***	-0.32	1.94***	1.77***
	[0.02]	[0.20]	[0.27]	[0.27]
after	0.01**	0.06*	-0.04	-0.05
	[0.00]	[0.03]	[0.03]	[0.03]
businessfirst	0.02			
	[0.05]			
AAxafter	0.04***	0.52***	0.03	0.09
	[0.01]	[0.05]	[0.07]	[0.07]
afterxbusinessfirst	0.05***			
	[0.01]			
businessfirstxAA	1.06***			
	[0.07]			
businessfirstxAAxafter	-0.91***			
	[0.04]			
Constant	5.89***	3.37***	4.91***	5.05***
	[0.01]	[0.11]	[0.12]	[0.12]
Observations	7,948,647	9,396	13,968	14,560
R-squared	0.062	0.497	0.437	0.422
Origin Destination Pair FE	YES	YES	YES	YES

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table 3. Results for itinerary fares and passenger - robustness check

Model 2 with *ln_sum_bpass* as dependent variable shows the effects on business class passengers per quarter. We see that *after* is significant and positive with 0.06. This means that in 2014 the amount of business class passengers increased with 6% compared to 2013. The main interaction, *AA∗after,* reports a significant 52% increase of business class passengers per quarter for American Airlines after implementation of the NYOP, relative to the developments of other carriers from 2013 to 2014. This model is identical to the initial results. Unfortunately, all of the variables for model 3 and 4 are insignificant, except for *AA*. This was also the case in our previous initial results. However, the variable *AA* does not explain the effects with regard to our hypotheses. It reports a 177% higher total amount of passengers and 194% higher amount of economy passengers for American Airlines than other carriers in the whole research period. These are somewhat similar to the previous results. The r-squared for the model 3 and 4 increased and those for 1 and 2 remained the same. The very low r-squared for model 1 remained very low, thus we still have to be cautiously with the magnitude of these effects.

Revenue	(5)	(6)	(7)
VARIABLES	ln_sum_bitinrev	ln_sum_eitinrev	ln_sum_itinrev
AA	0.39*	1.95***	1.81***
	[0.22]	[0.28]	[0.29]
after	0.14***	-0.02	-0.03
	[0.04]	[0.03]	[0.03]
AAxafter	0.12**	0.1	0.15**
	[0.05]	[0.07]	[0.06]
Constant	9.55***	10.77***	10.91***
	[0.11]	[0.13]	[0.12]
Observations	9,396	13,968	14,560
R-squared	0.475	0.415	0.399
Origin Destination Pair FE	YES	YES	YES

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table 4. Results for revenues – robustness check

Firstly, we notice that the effects estimated in model 5 regarding revenues generated by business class per quarter is identical to the initial results for this model. Thus again, we have support for hypothesis 5, in which we expected a positive effect of the NYOP mechanism on revenues generated by business class for American Airlines compared to other carriers. Models 6 and 7 show slight differences with their corresponding models in the initial results, but the tendency is the same. Where model 6 and 7 in the initial models show that American Airlines 191% higher economy class revenues and has 199% higher total revenues, respectively, than other carriers when the whole research period is considered. In this 'new' dataset the same variables show that American Airlines 195% higher economy class revenues and has 181% higher total revenues than other carriers. The main interaction *AA∗after* is significant and positive in model 7, reinforcing the evidence for hypothesis 6. Its magnitude increased with 1% percentage points from a 14% increase to a 15% increase in this robustness check model. Meaning that the revenues increased with 15% for American Airlines after the NYOP mechanism was implemented compared the revenues before the NYOP mechanism was implemented, relative to the developments of other carriers without NYOP mechanism from 2013 to 2014.

The results in the robustness check differ only marginally from the initial results. Therefore, our conclusions do not change or become less strong. We have added a table to the appendix which clearly set out the effects for the different hypotheses of both initial results and results in the robustness check (Appendix K).

DISCUSSION

The results in the different models affirm our expected effects, except for the effect on the amount of total passengers for American Airlines. Though, the result explaining this effect was insignificant, thus it does not confirm nor rule out the corresponding hypothesis. In the following part we will further discuss the meaning of the results.

We argued that the NYOP mechanism enables companies, in our case an airline, to segment and price discriminate consumers based on their reservation prices and frictional costs. Consumers with high reservation prices and/or high frictional costs, would buy their fares through posted price channels. The more price sensitive consumers are attracted to the NYOP mechanism it as allows consumers to place a bid according to their bidding strategy based on frictional cost, reservation prices and their expectations of the seller's threshold. These consumers can successfully purchase the same service for a lower price. Due to the structure at American Airlines, cannibalisation is not to be expected and previous literature has shown that this is no issue in general due to differences in the frictional costs. We found significant results that confirm hypothesis 1 and 2 regarding the expected effects of the NYOP on fares. Hypothesis 1 confirmed that average fares in business class decreased significantly when the NYOP mechanism was operational compared to companies without the NYOP mechanism. While hypothesis 2 confirmed that fares in general increased significantly when the NYOP was operation compared to companies without the NYOP mechanism. When we combine these, we have evidence that that more business seats were monetised, for a lower price than the posted price, but still increasing the total value extracted when the NYOP mechanism was in use.

With regard to the demand, the NYOP mechanism allows companies to segment their consumers based on their reservation price and frictional cost. When the seller threshold is set accordingly (optimal), based on the relations with posted price and bidding strategy of the consumers a different consumer group can be attracted. Mostly a lower price also attracts a larger group of price sensitive consumers. As discussed the NYOP mechanism does not cannibalise posted priced sales thus the quantity of sales in this case passengers should increase after the NYOP mechanism is implemented.

As the NYOP mechanism is implemented to sell upgrades, we expected to see an increase in business class passengers after implementation compared to other carriers with NYOP mechanism. We also argued that due to potential bidding when purchasing an economy ticket that we would also see a (small) increase in economy class passengers as some buyers value the chance of a successful bid an thus possible bargain. Therefore, we expected an increase in total passengers. The results did not conclude on the effects on number of economy class passengers or total passengers as the effects were insignificant with regard to hypothesis 4. Although this was not our main interest it could have given more insight in the effects of the consumer flow between the two classes and posted price channel for economy fares. Due to the insignificant effects of *AA∗after* in models 3 and 4 we can't conclude on the side effects of the NYOP mechanism on economy class quantity. However, results in model 3 did confirm our expected effect stated in hypothesis 3. Thus we can conclude that the NYOP mechanism does indeed reach another different business class consumer group increasing the amount of business class travellers. When we combine Hypothesis 1, 2 and 3, we argue that at least for business class, revenues should increase due to the NYOP mechanism because more value is extracted from in business class and the number of business class passengers also increases.

To confirm our expectations on revenues with regard to business class and the airline in general we use the models 5, 6 and 7. The expected effects we hypothesised in hypothesis 5 and 6 combine the prior concepts for fares and passengers. With regard to the hypotheses specified to business class we argued that more seats were monetised, although for a lower price than posted price. This still increases total value as we deal with fixed capacity. The seats sold by NYOP, would otherwise be a 'free' upgrades or unoccupied seats. Additionally, the NYOP mechanism reaches a different consumer group, therefore the quantity of passengers increases. We expect that while quantity increases and extracted value from the available seats considering demand uncertainty also increases, revenues should increase as well. When business class revenues increase, total revenues should increase as well, while keeping economy class revenues fixed. The results in connection to revenues support these views and expected effects. The coefficients for the interactions terms confirm that business class revenues and total revenues increased significantly at American Airlines after implementation of the NYOP mechanism, relative to economy class and other carriers. Thus NYOP mechanism is a good addition to a posted prices channel with respect to upgrades from economy to business / first class.

where significantly higher after the implementation of the NYOP compared to the development of the revenues at other companies without the NYOP. Thus this is proof that a NYOP mechanism can be a good addition to the posted prices channel.

Conclusion and Implications

In this research we investigated the business model of using both a NYOP mechanism and posted prices channel for upgrades. We broke the research down to prices, quantity and revenues to analyses the effects of the implementation of the NYOP mechanism.

1. What is the impact on prices?
2. What is the impact on the number of consumers served?
3. What is the impact on revenues?

The case of American Airlines allowed us to test the hypotheses we formed from previous literature. By using a real case we contribute to the existing theory on NYOP coupled with posted prices that was mostly based on experimental tests in non-natural environments or economic models. This case once more shows that the choice for a NYOP model does not have to imply a choice between posted prices channel and a NYOP channel, or the use of a NYOP mechanism through a retail, but shows that it can be successfully implemented to a specific product group as a solution to problems. In this case service providers with fixed capacity causing demand uncertainty in premium classes. In particular, airlines can profit from adding a NYOP mechanism as it also increases flexibility to their business model.

Our results provide evidence for our expectations with respect to our research questions. We find that the NYOP mechanism did offer consumers lower prices for upgrades than the official posted prices. Our hypotheses regarding prices show that average prices in business class decrease after the NYOP mechanism is implemented, while overall average prices increase after the NYOP mechanism is implemented. This can indicate two things: business class fares decrease and economy fares increase more or more presumable while economy fares do not change, extra business class seats are sold for lower prices but still higher fares than economy fares thus increasing total average fares. Indeed, we find that the amount of business class passengers at American Airlines increases significantly after the NYOP mechanism is implemented, relative to the developments of other airlines and economy class passengers. This thus reinforces our presumed expectation of extra business seat being monetised after the NYOP mechanism is implemented. We can’t conclude on the effects on the total amount of passengers and economy passengers as the results are insignificant. Therefore, we can't conclude on any possible side effects with regard to this passenger group.

Our last research question regards the impact of the NYOP mechanism on revenues. As a combination of the latter two questions on prices and quantity, our expectations are logically based on the concepts formed for these questions. Our results on the revenues generated by business class, economy class and the airline as a whole confirmed these expectations. We find that revenues generated by business class and total revenues increase due to the implementation of the NYOP mechanism, relative to the developments of other airlines without a NYOP mechanism. Thus with regard to revenues we conclude that adding a NYOP mechanism has a positive effect. Of course this depends per environment and structure, but in markets where consumers can be effectively segmented on price the NYOP has positive effects with respect to price and quantity and consequently revenues. Our specific case using the airline industry is a good example of a market with a relatively homogenous good in which consumers behave more price sensitive.

IMPLICATIONS

This case of an implementation of a NYOP mechanism at American Airlines used a single bidding system. Due to the focus of this research on a business model with both NYOP and posted prices versus business models only using a posted prices channel, the difference between a single bidding and rebidding system cannot be estimated. Though, our research provides proof that a single bidding system has positive effect on revenues. We presume that cannibalising effects did not occur based on previous literature which provided evidence that a NYOP with sufficiently differentiating threshold prices reached a different consumer group. Furthermore, we argue that seller surplus should increase as the NYOP mechanism implemented only offered 'existing' consumers in our case economy passengers a chance to bid. Therefore, it naturally targets consumers with lower reservation prices. However, we do not rule out cannibalising effects of the NYOP mechanism with our results, but did find that it indeed reaches a different consumer group as business class passengers did increase. Thus we find that the basis for our concepts, which we extracted from previous literature, is correct. This research reaffirms these concepts and in turn contributes with more specific knowledge with regard to the NYOP mechanism in combination with posted prices under own brand.

Previous literature addressed the point that service providers with fixed capacity have issues with demand uncertainty for consumers that have high reservation prices, but arrive late in the game. Introducing a NYOP mechanism can add a factor of flexibility to deal with this demand certainty. It allows companies to maintain relatively high posted prices, while reducing the risk of unoccupied seats, because these can still be monetised through the NYOP mechanism. Adding a NYO mechanism can also be introduced to increase quantity by reaching different consumer groups than the posted prices channel does. However, one must keep in mind that it is important to consider the characteristics of the market with regard to cannibalisation and competition.

LIMITATIONS AND FUTURE RESEARCH

This research has some limitations to the data, results, specifics of the case. We find that the results on itinerary fares showed a very low r-squared, causing the effects to be very imprecise. Thus this study cannot be used to effectively conclude on the magnitudes of the effect due to the implementation of the NYOP mechanism. Furthermore, the case revolves around the implementation of a test of the NYOP mechanism. This is the most important limitation as we do not have a lot of information on the specifics of this 'test'. The problem which arises is that the results may not be caused by the NYOP mechanism, but by another unknown factor, because we do not know the scope of the test. In case the NYOP mechanism was implemented on a full scale with regard to the domestic market, we still do not know the ending date of the test. Fact is that the NYOP mechanism was terminated due to the integration of IT systems between American Airlines and US Airways due to the merger that had legally been finalised on 9 December 2013. This further decreases the trustworthiness of the results. A whole different limitation of the research is the fact that it does not consider the costs, in other words actual profit. The dataset did not include any cost or profit explaining observations. Therefore, we can't conclude on the seller surplus and possible increase of costs due to the implementation of the NYOP mechanism. This case uses a relatively specific case and model, which decreases the generality of the concluded effects of the NYOP mechanism.

In the light of this research future research could address the issues we stated above. This research does not confirm positive effects of the use of NYOP mechanism for service providers on profitability. Thus this gap still needs to be filled with some more information on the cost factors. More importantly due to the unknown details of the implementation at American Airlines with regard to the scale of implementation and duration future research should re-investigate our research questions.

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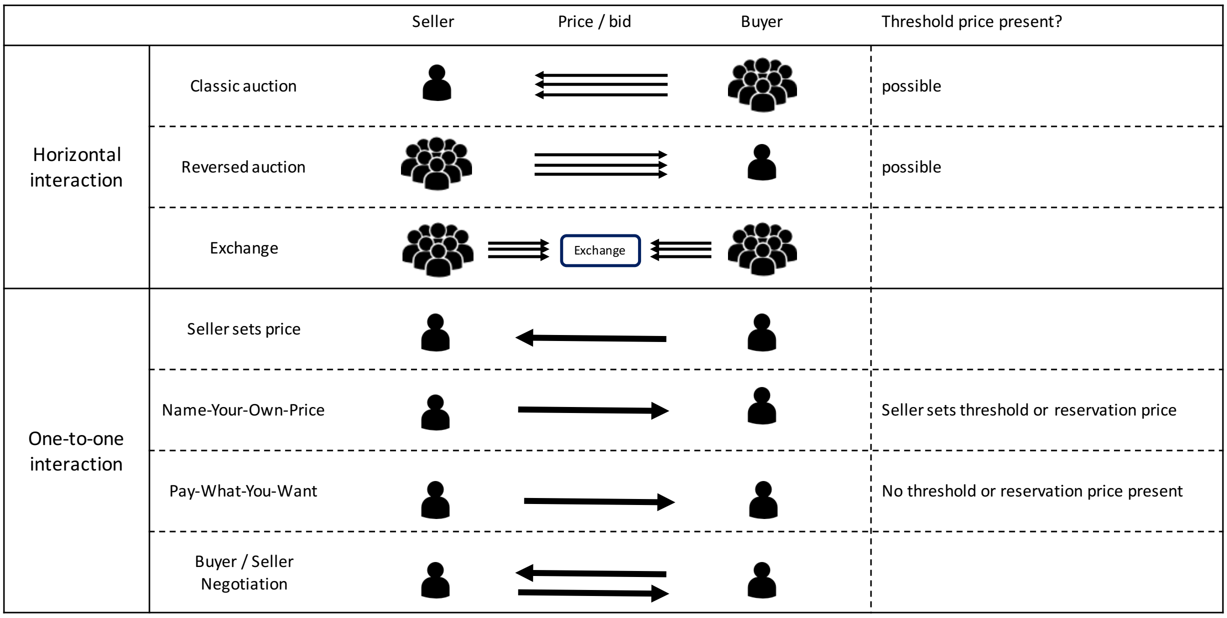
APPENDICES

A. Summary of recent papers and their main findings on the subject of NYOP mechanisms and service upgrades

Summary of previous literature				
Authors	**Year**	**Title**	**Method**	**Main finding**
Anderson, C.K. & Wilson, J.G.	2011	Name-Your-Own Price Aution Mechanisms - Modeling and Future Implications	Theoretical	NYOP naturally segments consumers, This research is essentially a large summary of prior research on consumer reserve prices, beliefs and strategy and retailer policy, in particular the economic models used.
Biyalogorksy, E. Gerstner, E., Weiss, D. & Xie, J.	2005	The Economics of Service Upgrades	Theoretical	This research considers the possibility of introducing upgradable tickets in a scenario with fixed capacity and multiple service classes. They find that it is more profitable to use such upgradable tickets, unless the probability of advance selling first class is sufficiently high.
Chernev, A.	2003	Reverse Pricing and Online Price Elicitation Strategies in Consumer Choice	Empirical (Laboratory experiment)	They find that consumers often prefer a price-elicitation task that offers less flexibility and is more restrictive in allowing consumers to express their willingness to pay. Consumer price-generation are moderated by a reference price which can be either provided externally or generated internally . NYOP mechanisms can be profitable when consumers can form correct reference prices.
Ding, M., Eliashberg, J. Huber, J. & Saini, R.	2005	Emotional Bidders: An Analytical and Experimental Examination of Consumers' Behavior in a Priceline-like Reverse Auction	Empirical (Laboratory experiment)	Classic economic model did not apply to the behavior of bidders. Emotions are an integral component of a bidder's decision statee and bidding strategy.
Fay, S.	2004	Partial-Repeat-bidding in the Name-Your-Own-Price Channel	Theoretical	Single bidding restrictions are less profitable due to partial repeat bidding by consumers. However, in a perfect situation single bidding is beneficial and might be preferable over rebidding structures.
Fay, S.	2009	Competitive Reasons for the Name-Your-Own-Price Channel	Theoretical	A firm can employ an NYOP mechanism rather than posted prices, as the NYOP format provides a mechanism for reducing price competition.
Fudenberg, D. & Tirole, J.	1988	Upgrades, Trade-Ins and BuyBacks	Theoretical	If a new good is a sufficiently large improvement the semi-anonymity constraint binds, in that a monopolist would prefer to charge a higher price for upgrades than for sales to new consumers. If the new good is a smaller improvement, then upgrade discounts are optimal.
Gal-Or, E.	2011	Pricing Practices of Resellers in the Airline Industry: Posted Price vs. Name-Your-Own-Price Models	Theoretical	Business-class demand is stochastic and has a higher willingness to pay. Airlines find it optimal to reserve capacity for sale after a portion is offered as advance purchase tickets. Airlines prefer resellers to use NYOP depending on which allows for better extraction of the surplus of the reseller.
Hann, I.-H. & Terwiesch, C.	2003	Measuring the Frictional Costs of Online Transactions: The Case of a Name-Your-Own-Price Channel	Empirical (Field experiment)	Frictional costs are substantial and sufficient to avoid complete dissolvement of the information rent information rent (the spread between the submitted offer and the thresh- old price), even when consumers are allowed to rebid. Consumer experience with the NYOP mechanism is the main driver of frictional cost, as it lowers due to learning from previous placed bids. However Sociodemo-graphic variables do not have significant impacts on the frictional cost. A rebidding mechanism decreases the information rent incurred by sellers and does not significantly increase the number of succesfull bids.
Hinz, O. & Spann, M.	2008	The Impact of Information Diffusion on Bidding Behavior in Secret Reserve Price Auctions	Empirical (Laboratory experiment)	Social media allows consumers to share information. The value of information is influenced by two dimensions: the amount of information and the dispersion of information. More connections allows more information to be collected, intermediairy connections between different parts of the network allows more information to be dispersed. The effects indicate that online sellers have to account for the social interaction among their consumers to sustain their business models.
Hinz, O., Hann, I.-H. & Spann, M.	2011	Price Discrimination in E-commerce? An Examination of Dynamic Pricing in Name-Your-Own-Price Markets	Empirical (Laboratory & Field experiment)	In the context of NYOP mechanisms, dynamic pricing is viable and preferable over a fixed threshold price. Not only does profit and welfare increase if sellers apply an adaptive threshold price, but customer satisfaction increases as well.
Kim, J.-Y., Natter, M. & Spann, M.	2008	Pay-What-You-Want - A New Participative Pricing Mechanism	Empirical (Field experiment)	In testing PWYP (Pay-what-you-want), they also find that consumers do not behave as rational as traditional economc theory suggests. It can imrove sellers' credibility. Price paid in this mechanism depends on the consumers internal reference price and the proportion that the consumer is willing to share of his deal profit with the seller.
Shapiro, D.	2011	Profitability of the Name-Your-Own-Price Channel in the Case of Risk-Averse Buyers	Theoretical	Under a posted-price scenario there are unserved customers, then adding NYOP will inrease the seller's profit. Effectively, the NYOP will enable the seller to reach those low-valuation customers and profit from that. The choice between a combination of NYOP and Posted prices or only a NYOP depends on the substitutability of the posted price and alternative options. When the two options are almost perfect substitutes, then adding the posted price to NYOP will benefit the seller.
Shapiro, D. & Zillante, A.	2009	Naming Your Own Price Mechanisms: Revenu Gain or Drain?	Empirical (Laboratory experiment)	We show that without the opaque feature, the NYOP mechanism coupled with the posted price provides significant benefits to both consumers and producers. When the NYOP agency is opaque, then the NYOP + posted price combination does not perform better than the posted-price benchmarks. seller's profit significantly decreases only if the threshold is set too close to the marginal cost.
Spann, M. & Tellis, G.J.	2006	Does the Internet Promote Better Consumer Decisions? The Case of Name-Your-Own-Price Auctions	Empirical (Field experiment)	A majority of bidding sequences are not consistent with the predictions of an economic model of a rational, price-minimizing consumer. This finding indicates that the Internet does not eliminate or lower consumers' irrational decisions. Consumers are more likely to bid rationally for larger distances, which can be explained by higher involvement for or savings from such flights. Consumers who have more experience have lower bids on average, probably because of the knowledge they have gained.
Spann, M., Bernd, S. & Schäfers, B.	2004	Measuring Individual Frictional Costs and Willingness-To-Pay via Name-Your-Own-Price Mechanisms	Empirical (Field experiment)	Their results indicate a considerable variation of individual WTP and frictional costs of consumers. willingness-to-pay (WTP) and individual frictional costs can be derived from individual bids in the context of a name-yourown-price mechanism. willingness-to-pay (WTP) and individual frictional costs can be derived from individual bids in the context of a name-your-own-price mechanism.
Suzuki, Y.	2002	An Empirical Analysis of the Optimal Overbooking Policies for US Major Airlines	Empirical (Field experiment)	although there is a significant negative overbooking effect, the positive side of overbooking is so strong that it more than offsets its negative side. if an airline increases overbooking, it may trigger an ''overbooking war'' (all carriers increase overbooking levels), the end result of which is a decreased revenue for every airline.
Suzuki, Y.	2006	The Net Benefit of Airline Overbooking	Empirical (Laboratory experiment)	Gross overbooking benefit of overbooking may be positive under all conditions, the net benefit can be negative if the share of ''new'' customers within the ''additional'' passengers (new-customer proportion) is too small.
Terwiesch, C., Savin, S. & Hann, I.-H.	2005	Online Haggling at a Name-Your-Own-Price Retailer: Theory and Application	Empirical (Field experiment)	Investing effort in haggling is wasteful from a welfare perspective, but allows both retailer and wholesaler to engage in a finer market segmen tation. The wholesaler uses an NYOP retailer as an additional channel to serve parts of the consumer population who are not willing to purchase the prod uct at the posted price. Similarly, the NYOP retailer is able to engage in price discrimination within the set of consumers who visit his website
Voigt, S. & Hinz, O.	2014	Assessing Strategic behavior in Name-Your-Own-Price Markets	Empirical (Laboratory experiment)	Buyers tend to be risk averse, they sacrificed some of their surplus to increase their chances of obtaining the product. Furthermore sellers can use their information advantage to collectively steer buyers' bidding behavior.
Wang, T., Gal-Or, E. & Chatterjee, R.	2009	The Name-Your-Own-Price channel in the Trvel Industry: An Analytical Exploration	Theoretical	it is the uncertainty in business travel demand that provides the economic rationale for contracting with an NYOP retailer, not the expectation of excess capacity. Indeed, all else equal, the larger the capacity, the less likely it is that contracting with an NYOP retailer is the right decision on the part of the service provider
Wilson, J. G. & Zhang, G.	2008	Optimal Design of a Name-Your-Own-Price Channel	Theoretical	The retailer can use market research data to obtain information about customers' reserve prices. Knowing this distribution, optimal strategies can be explicitly derived. In their design with single bidding and available inventory is large relative to the cusotmer base, the customers cannot 'game' the system and there is full transparency which will remove any feelings that the system is unfair.

B. Summary of classifications of participative pricing mechanisms.



C. General terms and conditions for bidding for an upgrade through Plusgrade

1. The following terms and conditions ("Terms and Conditions") shall apply to an offer ("Offer") made by you ("you"," Passenger") to American Airlines ("American", "AA", "we", "us") for an opportunity to upgrade from the class of service that was originally purchased for travel with American Airlines to a higher class of service ("Upgrade").

2. You must be at least 18 years of age and able to enter into binding contracts. You shall be deemed to have the authority to act on behalf of and to bind the person or persons named or included on the Offer to these Terms and Conditions.

3. Passengers may only submit one Offer per flight which corresponds to your purchased ticket, and offers must always be made and paid by using a credit card.

4. An Offer, when submitted by you in association with a booking made with AA, whether made directly via the Plusgrade website or indirectly through other means, shall entitle the person or persons named on the Offer, subject to these Terms and Conditions, to be considered for an Upgrade.

5. American Airlines reserves the right, in its sole discretion, to decide whether or not to accept your Offer, and it makes no representation that any passenger will be upgraded regardless of whether or not seats are available in the class of service for which an Offer is being made.

6. You may revise or cancel your Offer through the hyperlink on the offer email within the time frame indicated in your confirmation email, provided that your Offer has not already been accepted by American Airlines and provided your credit card has not been charged. However, if your Offer is accepted before you cancel or amend your Offer, you are legally bound to complete payment for the price stated in your original Offer.

7. An Offer that complies with these Terms and Conditions will be valid (“Valid Offer”) from the time of its submission to American Airlines, with the validity of the offer expiring at the scheduled departure date and time, or, in the event that the flight has been delayed, the time at which the airplane doors have been closed for departure. Furthermore, should you cancel your Offer, using the cancel link provided in the offer confirmation email and within the allocated window, the offer shall no longer be a Valid Offer.

8. In the event American Airlines re-accommodates you on to another flight for whatever reason other than your default, any Offer you made in relation to the original booking may be transferred to the new flight(s), subject to availability of the upgraded class.

9. American Airlines may accept your Offer any time during the period it remains a Valid Offer. In the event AA accepts your Offer, your credit card shall be charged the full amount immediately upon acceptance, and AA will issue a new ticket reflecting your Upgrade to each Passenger included in your original flight booking. The total amount charged will include all applicable pre-payable taxes and fees (if any) for the Upgrade. The total amount that you must pay will be disclosed to you prior to you submitting your Offer. An Upgrade that has been issued by American Airlines can be changed or transferred only in accordance with applicable Fare Rules and/ or AAs Condition of Carriage or International General Rules Tariff.

10. The charge on your credit card may appear in the name of “AA UPGRADE 9177407291”, or similar, who are collecting the charges for your Upgrade on behalf of American Airlines. You agree that you cannot challenge or dispute a charge for reason of the name appearing on the credit card statement is as aforementioned.

11. There will be no refunds, credits, or exchanges once your Offer has been accepted by American Airlines and your credit card has been charged, except under the following conditions: a. The flight for which your Offer was accepted and you were upgraded was cancelled, and American Airlines re-accommodated you on another flight but in the class of service of your original booking, in which case the amount paid for the Upgrade will be refunded to the payment card that was used to pay for the Upgrade and American Airlines shall have not further liability to you. b. Your Offer was accepted and you were given an Upgrade, but you were not able to be seated in the upgraded class of service for reasons attributable to American Airlines, including, but not limited to, a change in equipment, a delay in the connecting flight that resulted in your missing the connection on which you were upgraded, but excluding reasons attributable to your actions, including, but not limited to, you on your own volition opting to change flights, you missing a flight. c. You are entitled to refunds, credits, or exchanges under applicable Fare Rules and/or and/ or AAs Condition of Carriage or International General Rules Tariff.

12. Should refunds be approved, they will be processed in the currency in which the Upgrade amount was charged. Such refunds would be limited to amount charged for the upgrade and no bank related charges, including but not limited to foreign exchange conversion and fees, will be refunded

13. The fare conditions for the original ticket you purchased shall remain in effect and will be applicable even if your Offer has been accepted and you have been upgraded, including, but not limited to, cancellation policies, change fees and rules relating to the accrual of frequent flyer miles.

14. If the Passenger changes his/ her ticket, American Airlines has no obligation to seat him/ her in the upgraded class of service, unless the Passenger pays for the Upgrade as per the airlines’ standard change policies and the policies and

conditions associated with the fare class of original ticket.

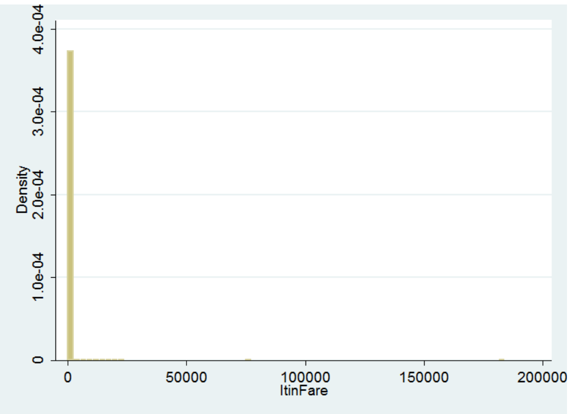
15. American Airlines does not guarantee specific seat assignments to Passengers whose Offers are accepted and who are upgraded. American Airlines does not guarantee that you will be offered a meal for the class of service to which you have been upgraded, nor other amenities generally associated with the class of service to which you have been upgraded.

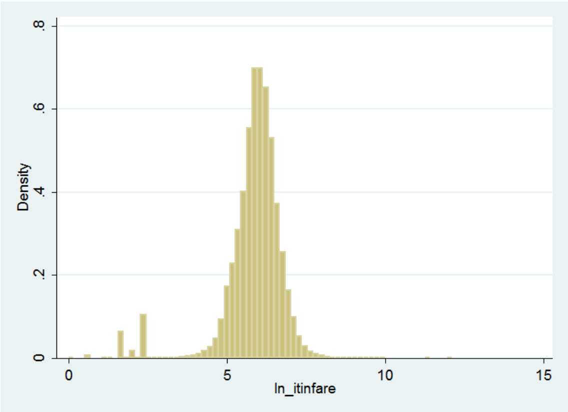
16. In the event your Offer was accepted and your credit card was charged the Offer amount but the Upgrade was not provided, you may apply for a refund at www.refunds.aa.com. Your request must include the original boarding pass for the flight in question. If you are not able to provide the original boarding pass for the flight in dispute, American Airlines is under no obligation to refund you for the amount you paid for the Upgrade.

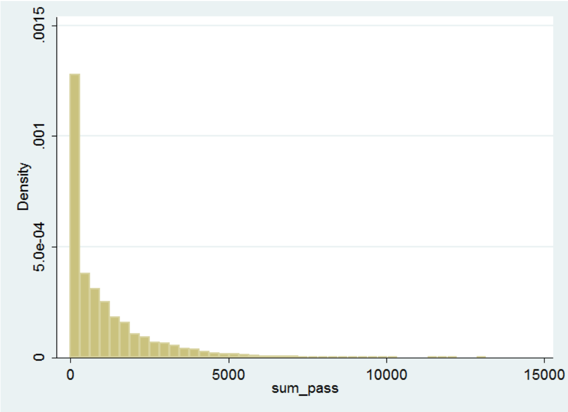
17. American Airlines reserves the right to modify and otherwise change these Terms and Conditions. Except as provided for in the preceding sentence, no amendment, modification or waiver to these Terms and Conditions shall be binding on American Airlines unless made in writing and signed by an authorized officer of the airline.

18. These terms and conditions should be read in conjunction with American Airlines' Condition of Carriage or International General Rules Tariff, Privacy Policy, and AA.com Site Usage Policy which you can read on www.aa.com. The failure of American to exercise any of its rights shall not be construed as a waiver or relinquishment of the future performance of any of its rights, and your obligations with respect to such future performance shall continue in full force and effect.

D. Histograms of the distribution of observations of variables in their original and transformed logarithmic form.



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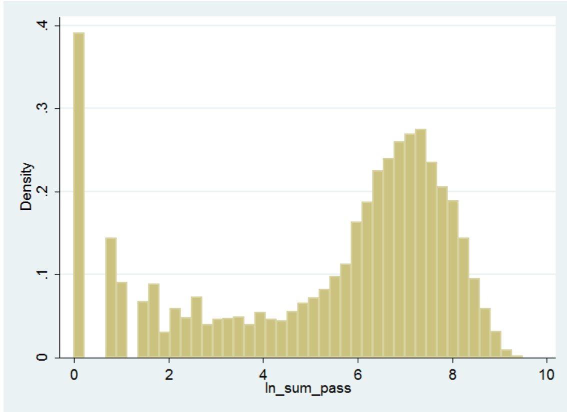
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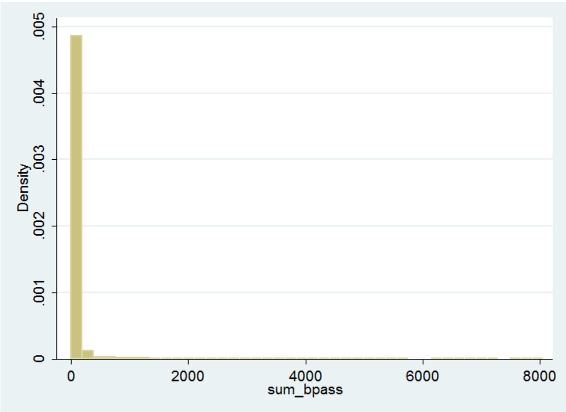
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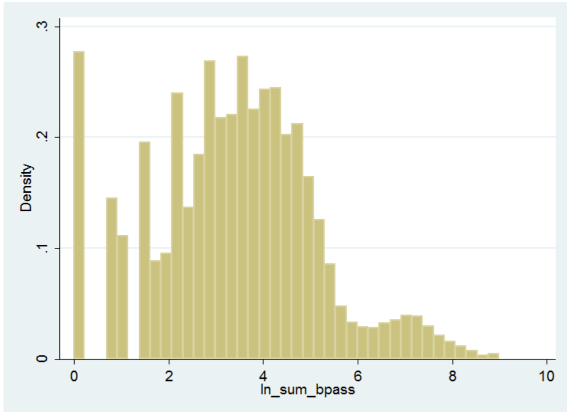
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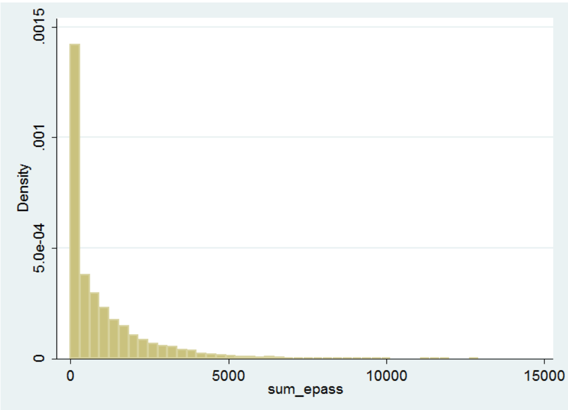
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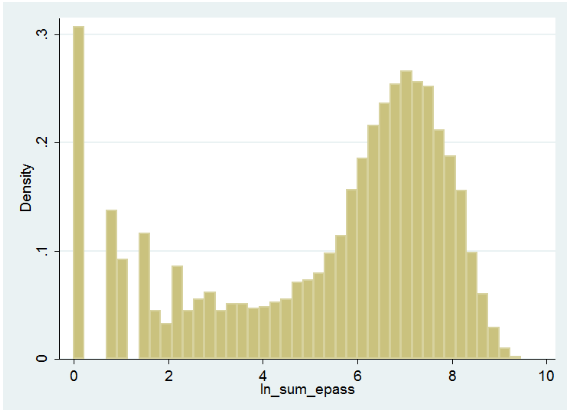
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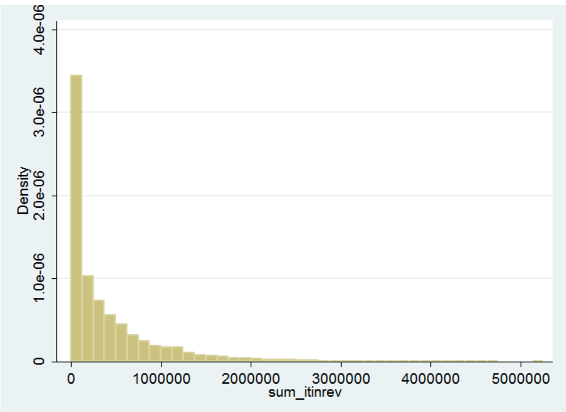
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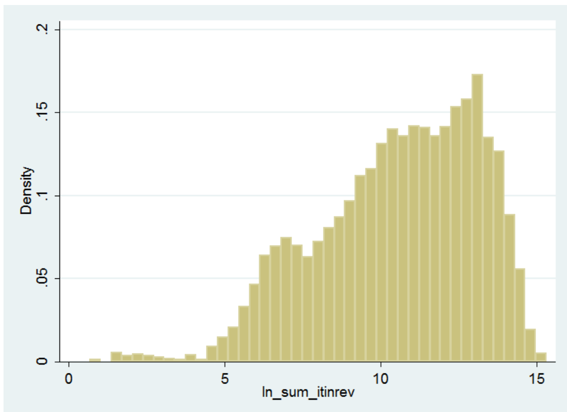
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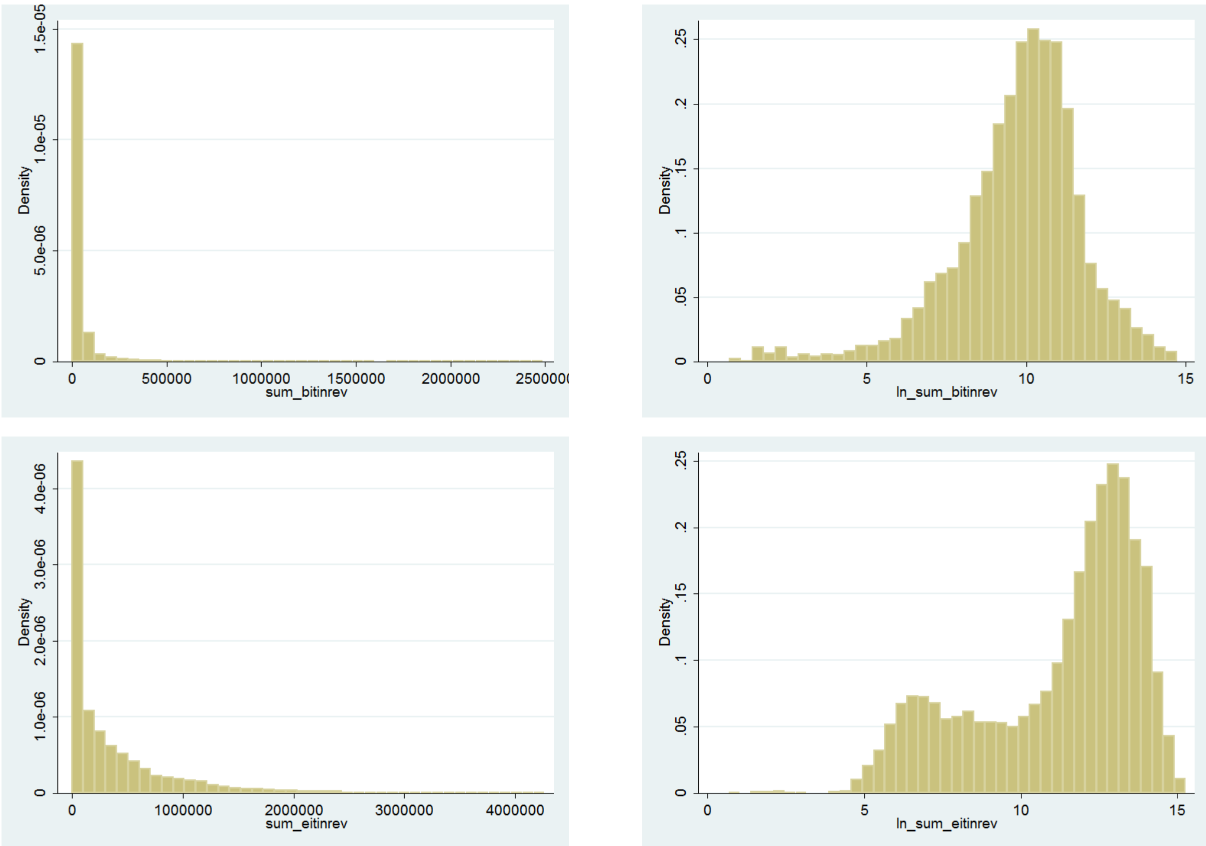
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5
10
15
ln_sum_eitinrev

E. Summary of variables

Initial dataset

Variable			Definition	Obs	Mean	Std. Dev.	Min	Max
Dependent	Continuous	itinfare	Price per passenger for a itinerary	8130589	470.919	380.303	1	184260
Independent	Dummy	businessfirst	Dummy, 1 = business class or first class and 0 = economy class	8130589	0.074	0.261	0	1
Independent	Dummy	AA	Dummy, 1 = American Airlines and 0 = Other carriers	8130589	0.298	0.457	0	1
Independent	Dummy	after	dummy, 1 = after implementation (2014) and 0 = pre implementation (2013)	8130589	0.524	0.499	0	1
Independent	Interaction	AAxafter	Interaction, 1 = after implementation at American Airlines and 0 = outcomes for other carriers before and after implemenation and american airlines before implementation	8130589	0.155	0.362	0	1
Independent	Interaction	afterxbusinessfirst	Interaction, 1 = after implementation for business class and 0 = outcomes for economy class befor and after implementation and before implementation for business class	8130589	0.042	0.201	0	1
Independent	Interaction	businessfirstxAA	Interaction, 1 = business class at American Airlines and 0 = business class at other carriers and economy class in general	8130589	0.014	0.117	0	1
Independent	Interaction	businessfirstxAAxafter	Interaction, 1 = in business class at American Airlines after implementation and 0 = not being in business class and/or American Airlines and/or after implementation and any variations of such	8130589	0.010	0.098	0	1

Initial dataset adjusted for passenger regression by: drop duplicates qtr opcarrier routeid, force

Variable			Definition	Obs	Mean	Std. Dev.	Min	Max
Dependent	Continuous	sum_pass	The sum of passengers per route per operating carrier per quarter	15852	1090.843	1449.400	1	13185
Dependent	Continuous	sum_bpass	The sum of business / first class passengers per route per operating carrier per quarter	15852	92.461	402.101	0	8072
Dependent	Continuous	sum_epass	The sum of economy class passengers per route per operating carrier per quarter	15852	996.623	1388.123	0	12925
Dependent	Continuous	sum_itinrev	The sum of revenue per route per operating carrier per quarter	15852	409342	584730.800	2.000	5258547
Dependent	Continuous	sum_bitinrev	The sum of revenue from business/first class per route per operating carrier per quarter	15852	44509.950	152570.500	0	2489297
Dependent	Continuous	sum_eitinrev	The sum of revenue from economy class per route per operating carrier per quarter	15852	362921.600	525767.000	0	4272393
Independent	Dummy	AA	Dummy, 1 = American Airlines and 0 = Other carriers	15852	0.193	0.394	0	1
Independent	Dummy	after	Dummy, 1 = after implementation (2014) and 0 = pre implementation (2013)	15852	0.515	0.500	0	1
Independent	Interaction	AAxafter	Interaction, 1 = after implementation at American Airlines and 0 = outcomes for other carriers before and after implemenation and american airlines before implementation	15852	0.096	0.295	0	1

F. Summary of dependent variables, specified for AA, 0 = Other Carriers and 1 = American Airlines

Summary of sum_itinrev			
AA	Mean	Std. Dev.	Freq.
0	362593.24	548925.48	12800.00
1	605406.59	681673.64	3052.00
Total	409342.32	584730.75	15852.00

Summary of sum_pass			
AA	Mean	Std. Dev.	Freq.
0	1004.93	1413.04	12800.00
1	1451.15	1541.83	3052.00
Total	1090.84	1449.40	15852.00

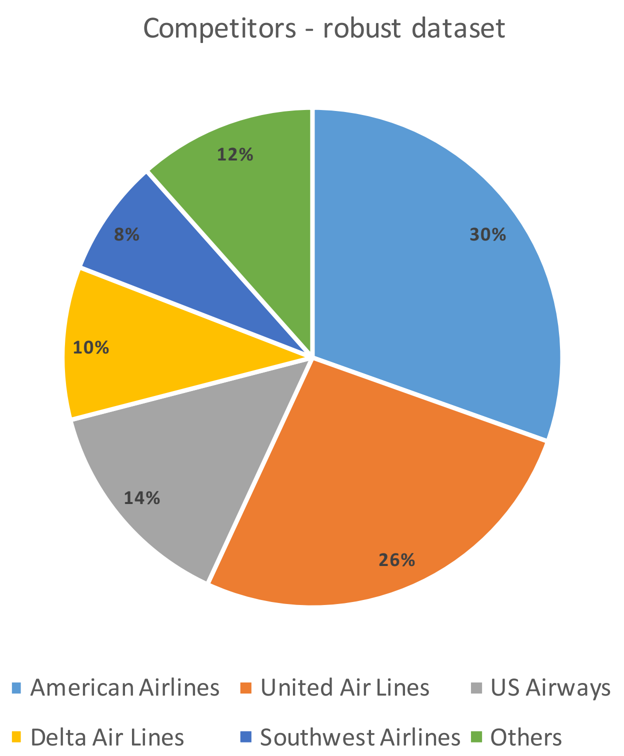
Summary of sum_bitinrev			
AA	Mean	Std. Dev.	Freq.
0	44541.73	156882.43	12800.00
1	44376.65	132995.67	3052.00
Total	44509.95	152570.54	15852.00

Summary of sum_bpass			
AA	Mean	Std. Dev.	Freq.
0	102.04	441.20	12800.00
1	52.29	146.34	3052.00
Total	92.46	402.10	15852.00

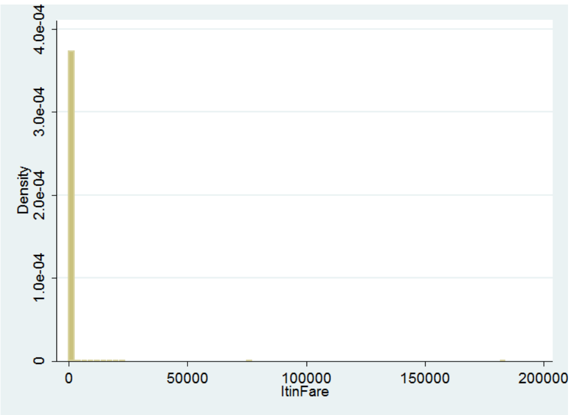
Summary of sum_eitinrev			
AA	Mean	Std. Dev.	Freq.
0	315689.30	491896.35	12800.00
1	561012.49	610333.76	3052.00
Total	362921.59	525767.05	15852.00

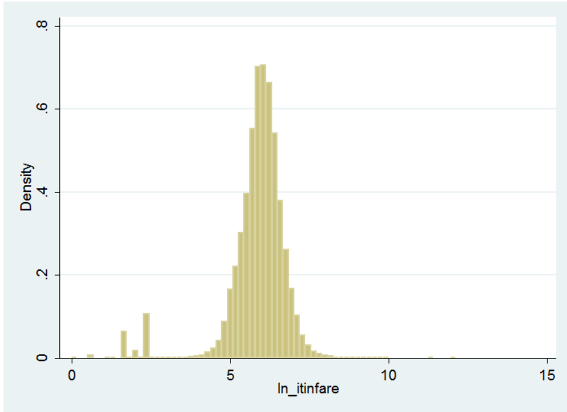
Summary of sum_epass			
AA	Mean	Std. Dev.	Freq.
0	900.72	1347.88	12800.00
1	1398.84	1479.51	3052.00
Total	996.62	1388.12	15852.00

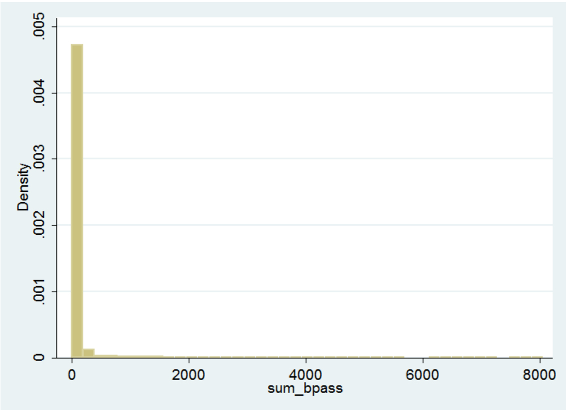
G. Distribution of observations to carriers – robustness check version

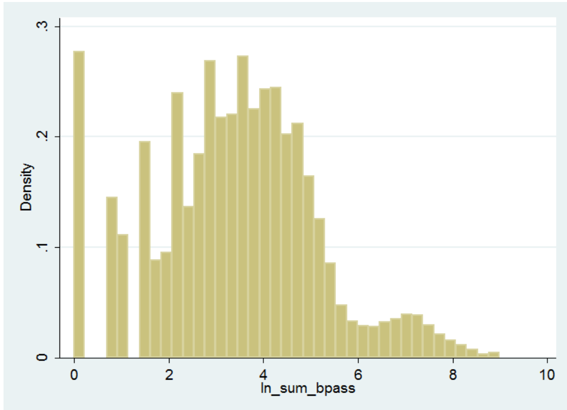


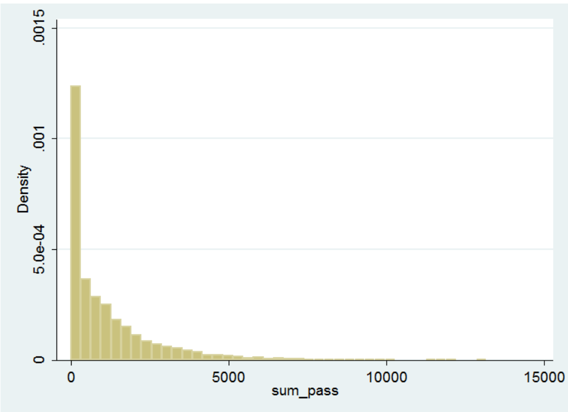
H. Histograms of the distribution of observations of variables in their original and transformed logarithmic form in the robustness check

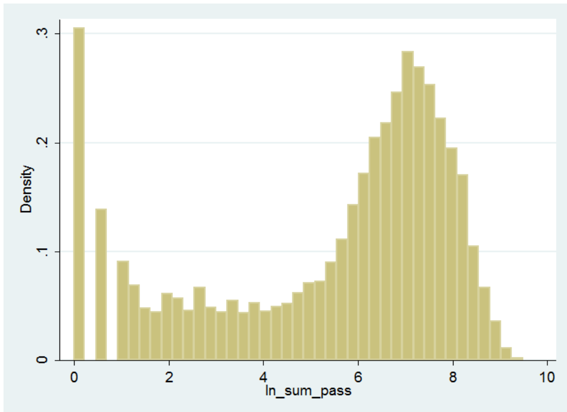


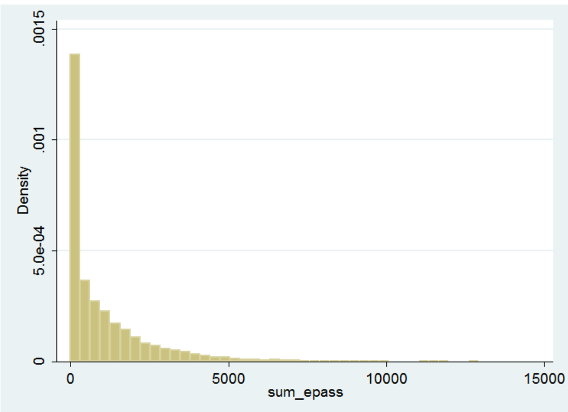


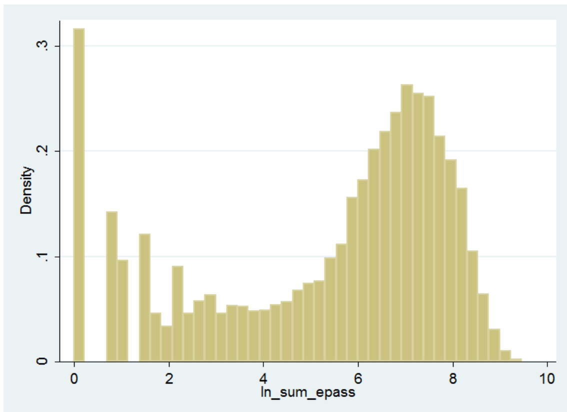


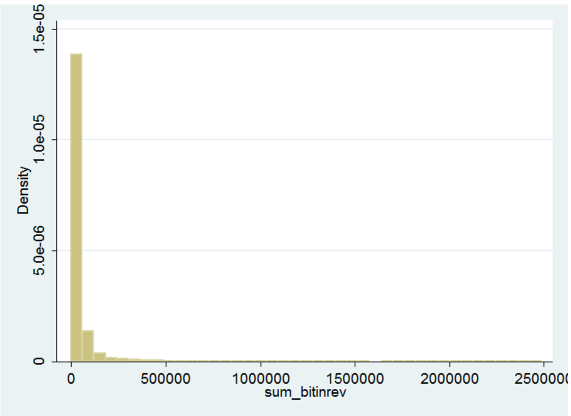








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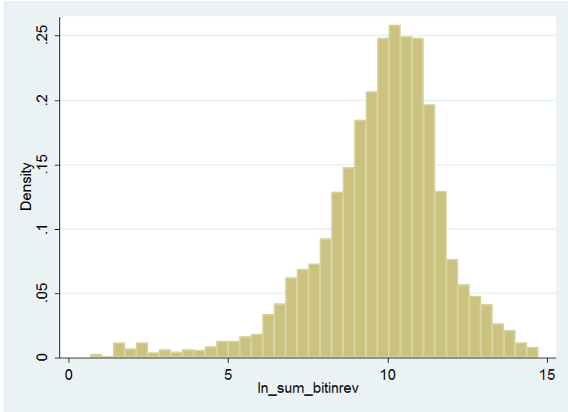
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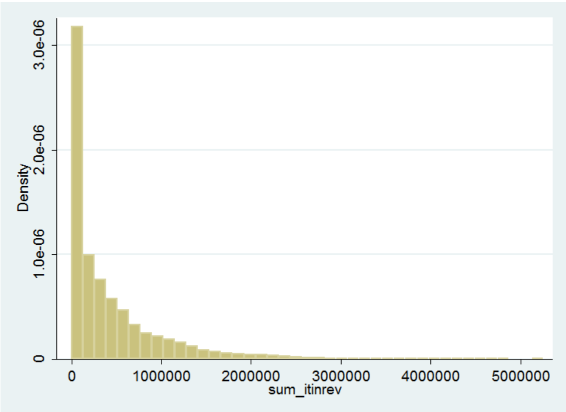
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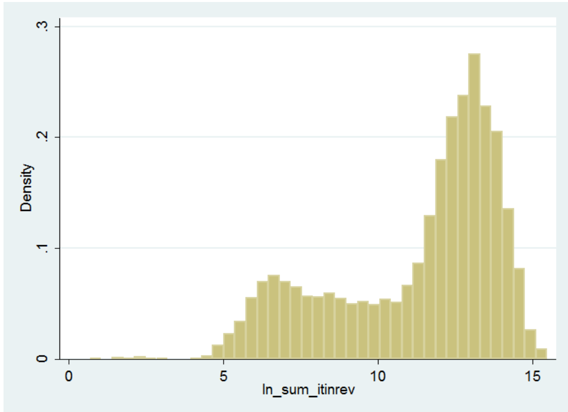
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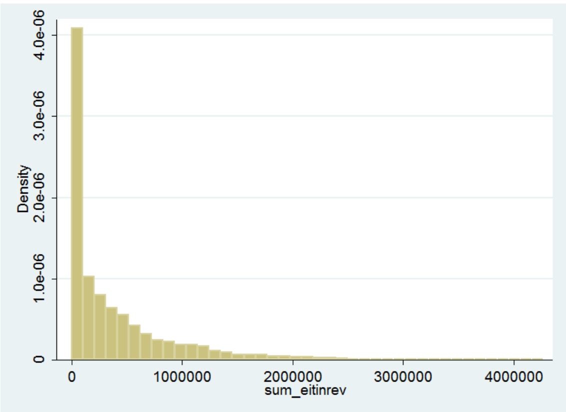
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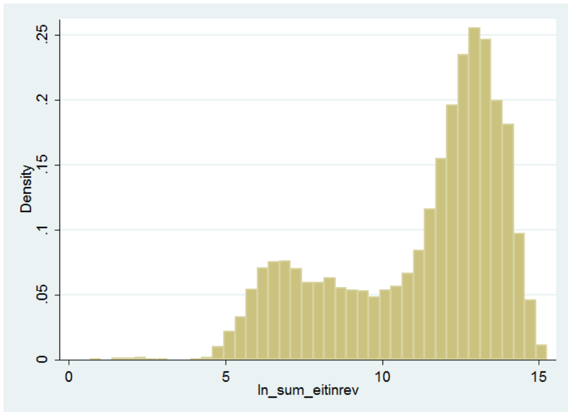
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15
ln_sum_eitinrev

I. Summary of variables – robustness check dataset

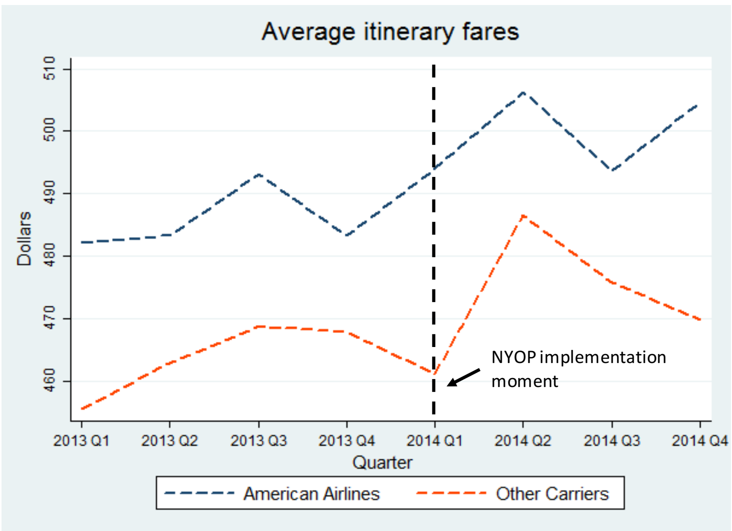
Initial dataset

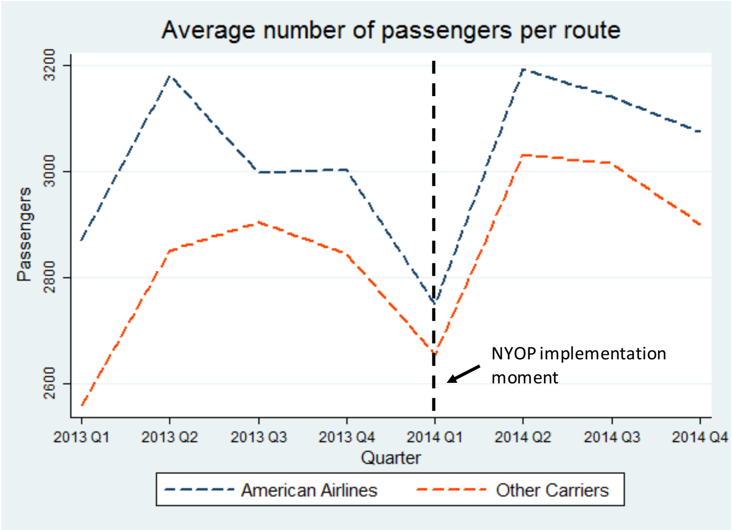
Variable			Definition	Obs	Mean	Std. Dev.	Min	Max
Dependent	Continuous	itinfare	Price per passenger for a itinerary	7948647	476.327	381.994	1	184260
Independent	Dummy	businessfirst	dummy, 1 = business class or first class and 0 = economy class	7948647	0.075	0.264	0	1
Independent	Dummy	AA	dummy, 1 = American Airlines and 0 = Other carriers	7948647	0.304	0.460	0	1
Independent	Dummy	after	dummy, 1 = after implementation (2014) and 0 = pre implementation (2013)	7948647	0.524	0.499	0	1
Independent	Interaction	AAxafter	Interaction, 1 = after implementation at American Airlines and 0 = outcomes for other carriers before and after implemenation and american airlines before implementation	7948647	0.158	0.365	0	1
Independent	Interaction	afterxbusinessfirst	Interaction, 1 = after implementation for business class and 0 = outcomes for economy class befor and after implementation and before implementation for business class	7948647	0.043	0.204	0	1
Independent	Interaction	businessfirstxAA	Interaction, 1 = business class at American Airlines and 0 = business class at other carriers and economy class in general	7948647	0.014	0.119	0	1
Independent	Interaction	businessfirstxAAxafter	Interaction, 1 = in business class at American Airlines after implementation and 0 = not being in business class and/or American Airlines and/or after implementation and any variations of such	7948647	0.010	0.100	0	1

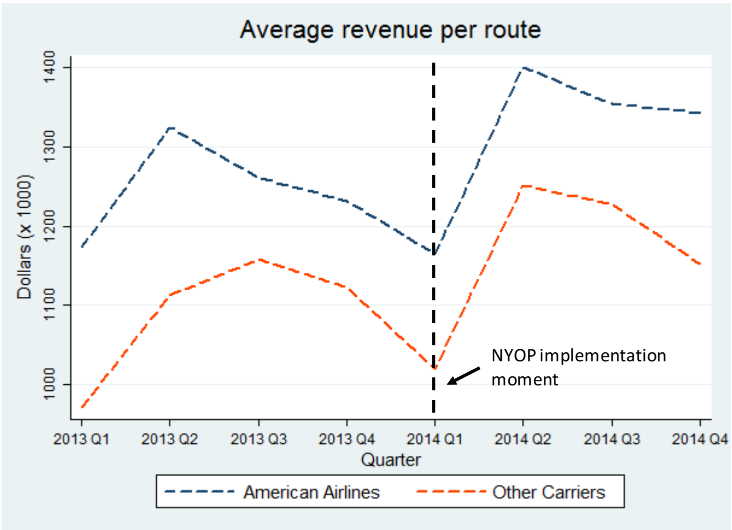
Initial dataset adjusted for passenger regression by: drop duplicates qtr opcarrier routeid, force

Variable			Definition	Obs	Mean	Std. Dev.	Min	Max
Dependent	Continuous	sum_pass	The sum of passengers per route per operating carrier per quarter	14560	1137.656	1489.181	1	13185
Dependent	Continuous	sum_bpass	The sum of business / first class passengers per route per operating carrier per quarter	14560	100.666	418.578	0	8072
Dependent	Continuous	sum_epass	The sum of economy class passengers per route per operating carrier per quarter	14560	1035.109	1427.246	0	12925
Dependent	Continuous	sum_itinrev	The sum of revenue per route per operating carrier per quarter	14560	436818.000	600867.700	2	5258547
Dependent	Continuous	sum_bitinrev	The sum of revenue from business/first class per route per operating carrier per quarter	14560	48459.590	158594.100	0	2489297
Dependent	Continuous	sum_eitinrev	The sum of revenue from economy class per route per operating carrier per quarter	14560	386308.100	540646.200	0	4272393
Independent	Dummy	AA	dummy, 1 = American Airlines and 0 = Other carriers	14560	0.210	0.407	0	1
Independent	Dummy	after	dummy, 1 = after implementation (2014) and 0 = pre implementation (2013)	14560	0.513	0.500	0	1
Independent	Interaction	AA*after	Interaction, 1 = after implementation at American Airlines and 0 = outcomes for other carriers before and after implementation and american airlines before implementation	14560	0.105	0.307	0	1

J. Graphs from robustness check dataset







K. Summary of effects in the initial models and robustness check models for the different hypotheses

No.	Hypothesis	Expected effect	Variable of interest	Model	Dependent variable	Initial effect	robust effect	Conclusion
1	The implementation of the NYOP channel has a negative effect on average business fares at American Airlines compared to other carriers only using regular sales channels.	negative	*businessfirst*AA*after*	1	ln_itinfare	-0.90***	-0.91***	Accepted
2	The implementation of the NYOP channel has a positive effect on average fares at American Airlines compared to other carriers only using regular sales channel.	positive	*AA*after*	1	ln_itinfare	0.04***	0.04***	Accepted
3	The implementation of the NYOP channel has a positive effect on the amount of business class passengers at American Airlines compared to other carriers only using regular sales	positive	*AA*after*	2	ln_sum_bpass	0.52***	0.52***	Accepted
4	The implementation of the NYOP channel has a positive effect on the amount of passengers at American Airlines compared to other carriers only using regular sales channels.	positive	*AA*after*	4	ln_sum_pass	insign.	insign.	Not conclusive
5	The implementation of the NYOP channel has a positive effect on American Airlines' revenues generated by business class passengers compared to other carriers only using regular sales	positive	*AA*after*	5	ln_sum_bitinrev	0.12**	0.12**	Accepted
6	The implementation of the NYOP channel has a positive effect on the total of American Airlines' revenues generated compared to other carriers only using regular sales channels.	positive	*AA*after*	7	ln_sum_itinrev	0.14**	0.15**	Accepted