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„Counterfeit goods in durable good markets“

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Abstract

This theoretical paper investigates durable good markets. More specifically it aims to uncover how the introduction of risk, in the shape of counterfeit goods into the market, impact producer profits. The paper designs and compares theoretical models which include and exclude risk to find that the introduction of counterfeit producers may have a positive effect on genuine producer profits. The positive relationship is however contingent on a sufficient difference in marginal costs of production between genuine and counterfeit goods as well as consumers' perceived lifetime value between genuine and counterfeit products. If the difference is relatively small the aforementioned relationship is negative.

The relationship between risk and genuine producer profits is driven by competition between the second-hand and retail market. Additional counterfeit producers may both increase competition through increased supply to compete with genuine goods or lower the competitiveness of said market with additional risk of purchasing a counterfeit good. Given a set of parameters, the models designed in this paper can determine the direction of the relationship between risk and genuine producer profits as well as provide dynamics of price, supply and profit.

A translation of the abstract into German is available in the appendix (Section 6.9)

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1. Introduction Section

1.1 Introduction

The wide consensus in studies on the counterfeiting industry is that it has been growing rapidly since the 1970s. (Harvey and Ronkainen, 1985; Grossman and Shapiro, 1988; Blatt, 1993; Carty, 1994; Chaudhry and Walsh, 1996; Bian and Moutinho, 2011; Kapferer and Michaut, 2014). The literature almost exclusively focuses on the negative externalities the counterfeiting industry have on consumers, producers and society as a whole. Pau et al. (2001, p. 45) suggests that "Worldwide, counterfeiting activities cost companies 10-20 percent of sales". Furthermore the International Chamber of Commerce (2018) recently conducted a study in which it estimates that "the negative impacts of counterfeiting and piracy are projected to drain US$4.2 trillion from the global economy and put 5.4 million legitimate jobs at risk by 2022." Counterfeiting is therefore a major issue worth investigating. This paper however presents another perspective to the literature by exploring positive effects which counterfeiting may, in theory, have on genuine producers.

This theoretical paper investigates durable good markets. More specifically it aims to uncover how the introduction of risk, in the shape of counterfeit goods[1] into the market, impact producer profits. The scope of the paper is limited to focus on durable goods, because of their close affiliation with high quality luxury goods made to last for generations. Producers of luxury goods were in 2004 estimated to lose more than $12 billion every year due to counterfeit competitors. (Bian et al., 2016) This makes durable goods an ideal focus for this paper.

The correlation between the introduction of counterfeit goods and genuine producer profits may not be limited to durable goods. The scope of this paper is however limited to explore durable goods because similar research with non-durable goods would require a different theoretical model[2].

[1] Counterfeit products are those bearing a trademark that is identical to, or indistinguishable from, a trademark registered to another party and infringe the rights of the holder of the trademark (Chaudhry and Walsh, 1996) Such goods are copied to deceive consumers to believe that it is the genuine article (Pau et Al. 2001)

[2] A different theoretical model is required due to the different properties of non-durable goods.

Durable goods do share several unique properties, which are common in goods targeted for counterfeiting. The technology, perception and materials used in durable goods do not deteriorate over time. As a result they do not become obsolete. Theoretically this induces unit demand from consumers who require only one durable product of a specific type in their lifetime. A second consequence of the durability is that durable goods are costly to develop, produce and market. These costs are reflected in the high retail pricing which further enhances the benefits gained through counterfeiting the product.
A third property is a consistent consumer value of durable products with time and with usage. In the real world, the second-hand price of a luxury good is however "considerably less than you would pay at a boutique or authorized retailer were you to buy something new". (Forester J., 2012) There may be several explanations for this price gap among new and used luxury goods. One explanation is that no truly durable goods exist. This paper highlights another explanation for the price gap – which is that it stems from the risk introduced by the presence of counterfeit goods on the secondary market. The value a consumer has for the ultra durable good does therefore not change with its age. The lower second-hand market price is reflecting the concerns associated with accidently buying a counterfeit product.

It is important to note that the model presented in this paper applies to goods which are counterfeited. As several durable goods are not counterfeited, such as land or real estate, the model is not universal to all durable products.

Luxury wrist watches serve as a particularly pertinent example of durable goods in this paper as many counterfeit luxury watches are in circulation. This industry is therefore used to draw comparisons between theory and the real world. The theoretical models are, however, not exclusive to the luxury wrist watch market, but applicable to any durable goods market in which counterfeit goods are present. Other examples may include design furniture, luxury jewellery, handbags and other accessories.

An industry leading journalist and collector Ben Clymer (2014) states that: "My mechanical watches will last for generations" when comparing the digital Apple watch to mechanical luxury watches. Furthermore Dennis Green (20015) highlights that watches have "intricate movements and insanely strong pedigree [which] helps them maintain their value.

And the best part is: the technology changes very slowly”. Clymer and Green both highlight that luxury watches are highly durable and unlikely to become obsolete.

Durable good markets were initially modelled by Ronald Coase in 1972. His theoretical work led to the Coase Conjecture which concluded that one or more producers are be unable to obtain abnormal profits. Nancy Stokey would in her 1981 paper *Rational Expectations and Durable Goods Pricing* expand on the work of Coase. She developed a model in which abnormal profits were plausible. As a result this paper builds on Stokey’s work because the effect of risk on producer profits is explored.

In both Coase and Stokey’s theoretical work, abnormal profits were either absent or limited due to limited demand stemming from unit demand consumers. This paper contributes to the theoretical literature through the introduction of risk onto the second-hand market and exploring the effects on demand on the retail market. The hypothesis is that counterfeit goods on the second-hand market may compromise consumer confidence in the second-hand market. As a consequence the ability for the second-hand market to compete directly with the retail market is diminished. Less competition consequentially allows for higher genuine producer profits.

We live in a throw-away society: a world in which disposable goods are increasingly common. A large majority of goods are being made “deliberate obsolescen[t] in all its forms – technologically, psychological or planned” (Slade G., 2006, p. 3) by producers to ensure a steady demand from consumers. Large durable good industries do however still exist in which products are made to last and be serviced for generations. In the past, the presence of counterfeit goods has been detested in such industries. The findings of this paper does however highlight that counterfeit goods may have positive effects on genuine producer profits. The direction of the effect which additional counterfeit products have on genuine producer profits is driven by trade of between the competitiveness of the second-hand market.

1.2 Literature Review

This literature review provides an overview of previous developments in the theoretical literature on durable good models. The paper hopes to continue the evolution on this literature by adding risk into the model; an element which has not yet been introduced. The model summaries in this section create a good framework for understanding the models setup in section 2 of this paper.

1.2.1 The Coase conjecture (1972)

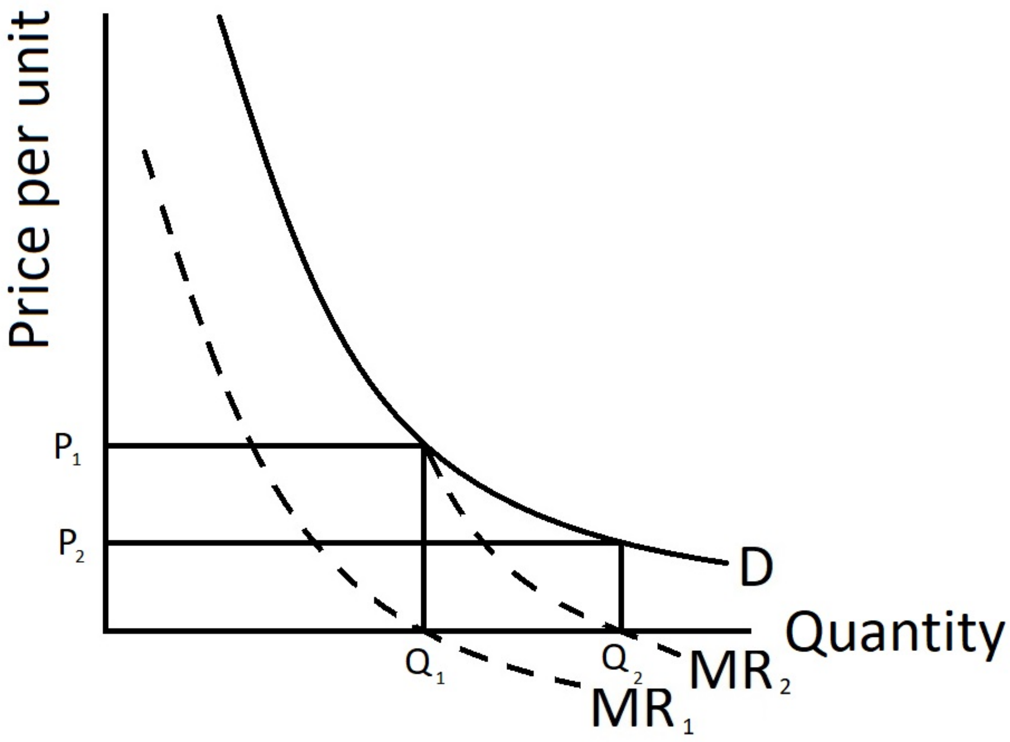
In 1972 Ronald Coase argued that in a market "with complete durability, the price becomes independent of the number of suppliers and is thus always equal to the competitive price[3]." (Coase, p. 144) This means that a monopolist would be unable to sell goods at the monopoly price. In a market with non-durable goods, the monopoly price would be profit maximizing.

The rationale behind the Coase conjecture stems from a simple monopoly maximization problem but with completely durable goods supplied. This is explained using Figure 1[4]. For the following example, assume that there is no cost of production, meaning marginal cost is always 0. Unit demand is also assumed (this is somewhat realistic when it comes to luxury products). Furthermore the supplier does not derive utility from unsold goods, but only benefits from goods which are indeed sold. The supplier does not produce more than the total demand as the good is completely durable and once everyone has been supplied with the good, no demand remain. Any surplus goods produced are worthless and would be a waste to produce. The monopolist initially supplies Q_1 to the market at the price P_1 as this maximizes profits (producing where MR_1=MC). TD-Q_1 units of demand then remain after the initial supply of Q_1.[5] As stated the supplier does not gain utility from the durable goods not sold and therefore attempts to sell of the remaining supply TD-Q_1. The

[3] The competitive price is equal to the marginal cost
[4] Figure 1 is not to scale
[5] TD is total demand

monopolist again attempts to maximize profits and thus sell Q_2-Q_1 at P_2. This pattern continues until all goods are sold. Coase (1972, p.143) assumes that “there were no costs of disposing of [the good, so] the whole process would take place in the twinkling of an eye”. It is assumed here that time is a resource and if there is no cost of selling, the sale should happen instantaneous. Rational consumers are able to predict that the price level would fall to the marginal cost of production “in the twinkling of an eye”. They would therefore be unwilling to pay more than the competitive price. As a result the monopolist is unable to make abnormal profits because it faces an infinitely elastic demand schedule at the competitive price, despite being the sole supplier. It is obvious that the result is not exclusive to markets with a monopolist supplier, but also holds for markets with more suppliers. Furthermore the quantity of goods sold in each “round” has no effect on the underlying fact that the entire stock is sold instantly, because of the non-existing cost of disposing of the good.

Figure 1



In his paper Coase outlines measures a monopolist producing completely durable goods may take to retain its monopoly power and abnormal profits. Such measures include limiting future supply, offering buy back schemes at a price below P_1 in the future, renting out the product for a finite period, making the product less durable, donating machinery and plans used for production to someone who will not use it for production or destroying said machinery and plans.

Some of these measures cannot be applied to the luxury industry. For example, renting or leasing a luxury product may be undesirable to consumers as ownership is an important part of the status projection which has been found to be important to consumers (Phau et Al. 2001, p. 51)

Diminishing the durability of a good to generate future demand is also not a realistic solution in the luxury industry due to competition. In luxury industries, in which goods are made to last, a manufacturer which makes their goods less durable would likely see a rapid decline in the demand for their product. Consumers are found to value durability of luxury goods and would instead seek to buy from a competitor. (Phau et Al. 2001, p. 51)

This paper considers risk on the second-hand market as a measure which can help a producer retain abnormal profits; a measure not considered by Coase.

Coase was among the first to model durable goods and highlight that producers may encounter difficulties in the pursuit of abnormal profit. This paper considers durable goods in a similar way to Coase. The models in this paper are based on models which Stokey developed from the Coase Conjecture.

1.2.2 Stokey's introduction of the discrete time model (1981)

In her 1981 paper *Rational Expectations and Durable Goods Pricing* Nancy L. Stokey relaxes the assumption "no costs in disposing of goods" used in the Coase conjecture. As a consequence, Stokey developed a discrete time model in which the process of selling the entire stock of goods would not happen in the "twinkle of an eye" as it did in Coase's original model.

In Stokey's discrete time model both the buyers profits as well as of the utility a consumer receives from consuming the durable good are time discounted. Furthermore the demand will depend "not only on the current price but also on buyers' expectations about future prices." (Stokey, p. 112)

In simple terms, Stokey highlights how impatient consumers are willing to pay more for a good despite knowing that future prices fall, which in turn means that they can sell the durable good for less or could have bought it cheaper at a future time. Consumers with a low discount factor (meaning that they are impatient) are willing to pay the higher price for the privilege of ownership of the durable good in that period. As the producer supply more of the durable good in each discrete time period the price falls. The amount the price decrease in each period can be perceived as a rent for owning that good in the period. This allows a monopolist durable goods producer to make abnormal profits if the discrete periods are sufficiently long and if the monopolist is relatively more patient compared to the consumers.

The model developed by Stokey constitutes a good basis for a durable goods model which includes profits. The focus on profits in this paper therefore use a discrete time model similar to the one developed by Stokey. The model in this paper does however add risk and assess the correlation between the level of risk on the second-hand market and profits for a monopolist.

1.2.3 Conlisk J. et al.: Cyclic Pricing by a Durable Goods Monopolist(1984)

Population growth was not incorporated into the models developed by Coase and Stokey outlined in section 2.2.1 and 2.2.2. Population growth may however increase the possibilities for a monopolist in a durable goods market to generate abnormal profits. This is illustrated well in the model developed by John Conlisk, Eitan Gerstner and Joel Sobel in 1984. In their model, the durable goods are sold periodically just as in the Stokey's model. However, new consumers enter the market in each period, representing population growth.

Conlisk et al. find that the monopolist seller implements a price discrimination strategy (by changing the prices in cycles) to maximize profits, thus selling to both consumers with high and low willingness to pay. In most periods the price would remain high, but as the group of consumers with a lower willingness to pay accumulate over several periods, the monopolist would lower the price to sell to them. In their model the price set by the monopolist seller varies across periods depending on the preferences of the consumers entering the market.

It is important to note that the model presented by Conlisk et al. does not allow for consumers to sell the durable goods once they have been bought. This means that in contrast to the model developed in this paper, there is no incorporation of a second hand market.

For simplicity the paper assumes that there is no population growth just as in the models developed by Coase and Stokey. This means that Conlisk's findings are not relevant in this paper. Instead it purely aims to show that adverse risks on the secondary market may have positive effects on the durable goods producer's profits. Conlisk's contribution is however an important one and should therefore be recognized. In a more realistic version of the models, population growth should be taken into account. The introduction of population growth should not have any adverse affects on the findings of the model developed in this paper.

1.2.4 George Akerlof: Market for Lemons (1970)

In the 1970 paper *The Market for Lemons: Quality Uncertainty and the Market Mechanism* George Akerlof presents a model which aimed to explain how adverse selection on the second-hand market can affect the quality of the goods available. The paper specifically shows how the quality of goods on the second-hand market can degrade in the presence of information asymmetry between sellers and buyers leading to a situation in which only bad quality goods remain. This would occur because the average value of the goods on the market, to the buyers, could be lower than the price a seller of a high quality is willing to sell at. The seller would not wish to sell the good at the second-hand market price. As high quality good sellers remove their goods from the market, prices decrease. This incentivises more high quality good sellers to leave the market and could trigger a market collapse in which no high quality goods remain. It is worth noting that George Akerlof assumes that all buyers are unable to perceive differences between high and low quality goods. This assumption is unrealistic for real world applications. In the model presented in this paper, consumers have a probability to identify a high quality good from a low quality good. This probability is dependent on the expertise level assigned to the consumer.

In his paper, George Akerlof coined the phrase “lemon” for bad quality goods and “peach” for good quality goods.

This paper introduces risk using two types of goods just as in George Akerlof’s model. The good quality goods are represented by genuine products and bad quality goods are represented by counterfeit goods. The paper however does not investigate adverse selection. Instead it presents two markets so that both goods may co-exist. The genuine goods available on the second-hand market are supplied by a fixed proportion of the population who bought these genuine goods in previous periods. Rather than this proportion being fixed, it would be realistic to assume that this proportion would depend on the second-hand market price. The inclusion of adverse selection on the second-hand market could therefore be an interesting addition to the model developed in this paper.

2. Models

In this section, two models are constructed. In both models, a retail and second-hand market compete. The only difference between the models is that one includes risk in the shape of counterfeit goods on the second-hand market. Simulations of both models should reveal how producer profit is affected by risk.

A list containing the variables used in the theoretical models below can be found in the appendix section 6.5.

2.1 Assumptions

This paper takes a theoretical approach. Assumptions are therefore made which may distort the realism of the models. This section lists the simplifying and essential assumptions associated with the models in the paper and highlight why they are made.

2.1.1 Essential assumptions

If one of the assumptions made in this section are not met, then the models in the paper could lead to a conclusion different from the one made in this paper. This makes the following assumptions essential.

1. The model including risk breaks down if consumers value counterfeit goods greater than genuine goods. If this was the case no demand would exist for the retail market. φ must therefore be such that[6]:

$$0 < \varphi_i < 1 \ \forall i$$

2. Costs of production for the genuine producer are higher than that of the counterfeit producers such that$1 \geq MC_{real} > MC_{fake} \geq 0$[7]. This assumption makes sense as the genuine producer has to develop, design and market a product where as counterfeit producers can copy R&D, already conducted

[6] The perceived lifetime value of counterfeit goods is some proportion (φ) of the value of the genuine good. Section 2.2.2 presents the variable φ in more detail.
[7] Demand is normalised to at most 1 in the models used in this paper.

research and free-ride on the marketing and design of the genuine producer. The quality of the counterfeit product is worse than the genuine product, which also explains the lower marginal production costs of counterfeiters.

3. Consumers are unable to pay agents with a higher expertise level (ψ_i) to purchase a good on the secondary market on their behalf[8]. Elimination of private curation services is essential as it would otherwise be possible for consumers to pay the agent with the highest level of expertise to remove the risk associated with the secondary market. Allowing curation services render the expertise level (ψ_i) in the model insignificant.
4. Just as Coase and Stokey did, this paper assumes no population growth, meaning that Conlisk's approach with a stable equilibrium supply is not considered.
5. Counterfeiting is exclusively deceptive[9] in the models, with only one type of genuine good and one type of counterfeit good available.

2.1.2 Simplifying assumptions

The assumptions made in this section are not essential and can be relaxed without changing the conclusion of the paper. If any of the following assumptions are relaxed it would however lead to more complex models.

1. The focus of this paper is durable goods. As such an important assumption is that a good can indeed be perfectly durable, as was also the case in the work of Coase and Stokey. In reality no good is perfectly durable; however some get close to the properties outlined in the introduction. The consequence of the assumption is that economic agents derive the same unit-demand[10] valuation from a new genuine good and a second-hand genuine good. This is because genuine durable goods in this paper are assumed to not deteriorate over time or with use.

[8] Expertise level determines how easily an agent can spot a counterfeit product. Section 2.2.1 presents the variable ψ_i in more detail.

[9] Deceptive counterfeiting occurs "when the consumer does not know that he is buying a fake" (Maman 2009, p. 1)

[10] A unit demand agent does not increase their utility from the purchase of more than one good of a specific type.

2. One monopolist produces genuine goods and many producers produce counterfeit goods. This simplifying assumption makes sense for a specific brand as the monopolist controls the authorised dealers. In luxury industries, authorised dealers are only able to supply genuine products. An example is the wristwatch industry where headquarters in "Switzerland controls all operations and budgets [of the] luxury watch sales industry" (Adams A., 2018). With no barriers to entry on the second-hand market, counterfeit producers engage in perfect competition (Bertrand Competition).
3. The genuine producer is a present-oriented agent and it therefore discounts future profits heavily. In this model the genuine producer has a discount factor of 0.[11]

   In luxury goods industries it is increasingly the case that high short-terms profits are preferred to lower but more stable long term profits. In the past, brands were family owned for generations. These brands were "not interested in volume [and short term profits] but rather value growth and are limiting annual sales". (Stern T., 2014). In the past 50 years family owned brands have been bought by large co-operations such as the Swatch group, Richemont, Kering, Fossil, Movado and LVMH. These large co-operations answer to stockholders who prefer short-term profits. Luxury goods producers "could [therefore] easily fall risk to potentially experiencing short-term growth while keeping the door open for mid-term failure because they never focused on understanding the real issues their brand is facing." (Adams A., 2017)

   Counterfeit producers' profit discounting is not important to consider as these producers cannot obtain abnormal profits.[12]

   Consumer utility discounting is discussed in section 3.2.3.
4. The models exhibit constant economies of scale. As a consequence marginal costs stay constant with time and output.
5. Counterfeit goods totally depreciate after one period[13] due to their lower quality. Private individuals are therefore unable to sell counterfeit goods on the second-

[11] A discount factor of 0 signifies that an agent only considers present profits and optimizes his/her utility or profits in each period.
[12] It is not possible to obtain abnormal profits under perfect competition. (see assumption 2, section 2.1.2)

hand market. If they could do so it would eliminate the adverse effects of obtaining a counterfeit product when buying from the second-hand market.

6. A certain proportion of the private individuals who own a genuine good choose to sell it on the second-hand market in each period. The decision to sell a durable product could be motivated by a sudden need of monetary funds. In the subsequent period the consumer is no longer in the situation of financial trouble and their previous value and thus demand for the product returns. It is assumed that individuals, selling their genuine good on the second-hand market, are willing to sell at any price point.
7. There is no correlation between consumers' expertise level (ψ_i) and how they value the genuine and counterfeit products ($v_{real,i}$ and $v_{fake,i}$).
8. There is no risk of a false positive[14], for a potential buyer when evaluating a product.
9. Markets clear, such that supply is equal to demand in the equilibrium.

2.2 Model with risk on the second-hand market

2.2.1 Risk

This model includes two markets: the retail market in which there is no risk of purchasing a counterfeit good[15] and the secondary market in which risk is present. On the second-hand market, products are supplied by private individuals as well as by counterfeit producers. As a result "peaches" (genuine goods) and "lemons" (counterfeit goods) are present on the second-hand market.

[13] The period of deterioration for counterfeit goods may be altered to fit a specific model. Such an alteration would require a mechanism which determines how the demand of a consumer who obtains a counterfeit good would be altered in subsequent period.
[14] A false positive in this case means that a buyer believes a genuine product to be counterfeited.
[15] This is due to assumption 2 in section 2.1.2.

In luxury markets similar situation to the one mentioned above is observable. Jack Forester (2012) summarizes the advantage of buying from an authorized luxury retailer well:

"The upside of buying [from an authorized retailer] is pretty straightforward - although you may pay through the nose, you do have a place to which you can return if you should discover you've got a lemon, and ask for satisfaction under such protection as your warranty affords."

The probability of buying a "lemon" (the risk) is determined by 3 variables. Firstly it is dependent on the proportion of counterfeit goods on the second-hand market (μ):

$$\mu = \frac{S_{fake}}{PS_{real} + S_{fake}}$$

The second variable (PS_{real}) is the entire supply from private individuals and is embedded into variable μ. PS_{real} is equal to a fraction (λ)[16] of all genuine goods supplied in all previous periods such that:

$$PS_{real} = \lambda \sum_{t=0}^{T-1} S_{real,t} \text{ where } \lambda \in [0,1]$$

The final variable, the probability of buying a "lemon", is dependent on the expertise level of an individual buyer (ψ_i). The variable ψ_i is the probability for individual i of spotting a counterfeit product[17]. In this model, the expertise level is uniformly distributed between 0 and 1 over all consumers.

$$\psi_i \sim unif(0, 1)$$

The expertise distribution may be adjusted to fit a particular circumstance. However it should not affect the orientation of results in this paper.

[16] See assumption 6 in section 2.1.2
[17] No chance of a false positive evaluation (see assumption 8, section 2.1.2)

By combining the variables ψ_i and μ, one can find the probability[18] of buying a counterfeit product for individual i:

$$\mathrm{Pr_{buying\ fake}}^{\mathrm{i}} = \mu - \mu\psi_i$$

The above formula, exhibits a negative correlation between expertise level (ψ_i) and the risk of buying a counterfeit product and a positive correlation between the proportion of counterfeit goods on the second-hand market (μ) and the risk of buying a counterfeit product.

2.2.2 Valuation

The expected utility a consumer receives from a purchase on the secondary market is not only determined by the risk associated with the secondary market. The expected utility is also affected by the difference in perceived value between a genuine and a counterfeit product. In this model the perceived lifetime value of the genuine good is uniformly distributed between 0 and 1 across consumers. The distribution can be changed to fit a particular population.

The perceived lifetime value of counterfeit goods is some proportion (φ) of the value of the genuine good, such that:

$$v_{fake,i} = \varphi * v_{real,i} \;\; where\ \varphi \in [0,1]$$

The value of φ can be seen to be that of a single representative consumer and therefore be considered uniform across all consumers. Quality and status projection should be taken into account when determining the value of φ for a specific durable good.

In this model the value relationship between genuine and counterfeit products is such that:

$$\varphi = \frac{MC_{fake}}{MC_{real}}$$

[18] No chance of a false positive evaluation (see assumption 8, section 2.1.2)

The idea is based on "the product-based approach, [which] argues that quality and direct cost are positively related. The implicit assumption here is that quality differences reflect variations in performance, features, durability or other product attributes that require more expensive components or materials, additional labor hours in construction or other commitments of tangible resources" (Garvin 1984, p. 35)

Factors, other than product costs, have an effect on the relative valuation of a counterfeit good compared to a genuine good. Any value between zero and one can be chosen for φ such that it fits a specific market.

It holds that $\varphi < 1$, such that the value of a genuine good is greater than the value of a counterfeit good[19]. There should be a significant gap between both the value and the marginal cost of genuine and counterfeit goods.[20] As a result φ should be relatively small.

Utility of buying retail for individual i:

$$u_{RT,i} = v_{real,i} - P_{RT} \; where \; P_{RT} \; is \; the \; retail \; market \; price$$

Expected utility of buying second-hand for individual i:

$$u_{SH,i} = (v_{real,i} - P_{SH})\big(1 - (\mu - \mu\psi_i)\big) + \big(\varphi v_{real,i} - P_{SH}\big)(\mu - \mu\psi_i)$$

$$where \; P_{SH} \; is \; the \; second - hand \; market \; price$$

When $u_{RT,i} > u_{SH,i} \geq 0$, then consumer i demands from the retail market.

When $0 \leq u_{RT,i} < u_{SH,i}$ then consumer i demands from the second-hand market.

When $0 \leq u_{RT,i} = u_{SH,i}$ then consumer i is indifferent between purchasing on the retail market or the second-hand market.

Potential consumers make the decision to either purchase on the retail market, second-hand market or to not purchase at all. The consumers can only make this decision once per time period. That means that a consumer who purchase, and is allocated a counterfeit good, on the second-hand market is unable to purchase a second time on the

[19] See assumption 1, section 2.1.1
[20] This significant gap comes as a result of assumption 5, section 2.1.2

second-hand market or on the retail market. Due to unit demand, consumers who own a genuine good will decide to not purchase at all.

2.2.3 Competition between retail and second-hand market

This section outlines types of competition which occur between market suppliers. This model includes three groups of sellers. The genuine (monopolist) and counterfeit producers produce the goods. Private individuals are selling a genuine good, purchased in a previous period. Different dimensions of competition occur both within these groups and between different groups.

Regarding competition that occurs within the groups themselves, the genuine producer is a monopolist so no competition exists within this "group". The monopolist can choose the retail price and supply level which maximizes its profit.

In the case of counterfeit producers, Bertrand competition occurs[21]. This induces perfect competition and thus counterfeit producers sell products at the marginal cost.

The model contains a "large" number of private sellers. These individual can maximally sell one good.[22] Therefore no competition exists in either quantity supplied or price within the group of private sellers because each individual seller is naturally capacity constraint to one product.

The type of competition between the three different groups is determined by which market a group has access to. In the model retail and a second-hand market exist. The genuine producer is the only actor with access to the retail market and does therefore not face competition from other actors on that market.

The counterfeit producers and the private sellers are limited to sell goods on the second-hand market. As mentioned previously the counterfeit producers sell their products at a price equal to the marginal cost. The private sellers do not undercut the counterfeit

[21] See assumption 2, section 2.1.2
[22] Individual private sellers have unit demand for durable goods. See assumption 1, section 2.1.2

producers' price[23], nor do they increase their asking price as that would mean not selling the product. A price increase from a private seller can be mimicked by counterfeit producers. The private seller is therefore unable to differentiate her as a seller or the product through pricing. A buyer on the second-hand market would therefore be unable to distinguish whether the good is genuine or counterfeit based on the price. Private sellers are therefore unable to sell their good at a price higher than the one set by the counterfeit producers.

2.2.4 Retail market demand

This section derives the retail market demand. First a brief summary of information presented in section 2.2.1-2.2.3:

$$Consumers\ have\ unit\ demand.$$

$$u_{RT,i} = v_{real,i} - P_{RT}$$

$$u_{SH,i} = (v_{real,i} - P_{SH}) * \left(1 - (\mu - \mu\psi_i)\right) + \left(\varphi * v_{real,i} - P_{SH}\right) * (\mu - \mu\psi_i)$$

$$\mu = \frac{S_{fake}}{PS_{real} + S_{fake}}$$

$$\psi_i \sim unif(0,1)$$

$$v_{real,i} \sim unif(0,1)$$

$$population\ size\ is\ normalized\ to\ 1$$

Consumers demand goods from the retail market if utility of buying on the retail market is greater than the expected utility of buying on the second-hand market:

$$u_{RT,i} \geq u_{SH,i}$$

[23] Private sellers are capacity constraint to one good as a consequence of their unit demand. See assumption 1, section 2.1.2.

And if the utility of buying on the retail market is positive[24]:

$$u_{RT,i} \geq 0$$

So,

$$v_{real,i} - P_{RT} \geq (v_{real,i} - P_{SH})\big(1 - (\mu - \mu\psi_i)\big) + \big(\varphi * v_{real,i} - P_{SH}\big)(\mu - \mu\psi_i)$$

And,

$$v_{real,i} - P_{RT} \geq 0$$

Simplify:

$$\psi_i \leq \frac{P_{SH} - P_{RT}}{v_{real,i} * \mu(1-\varphi)} + 1 \ or \ v_{real,i} \geq \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)(1-\psi_i)}$$

and

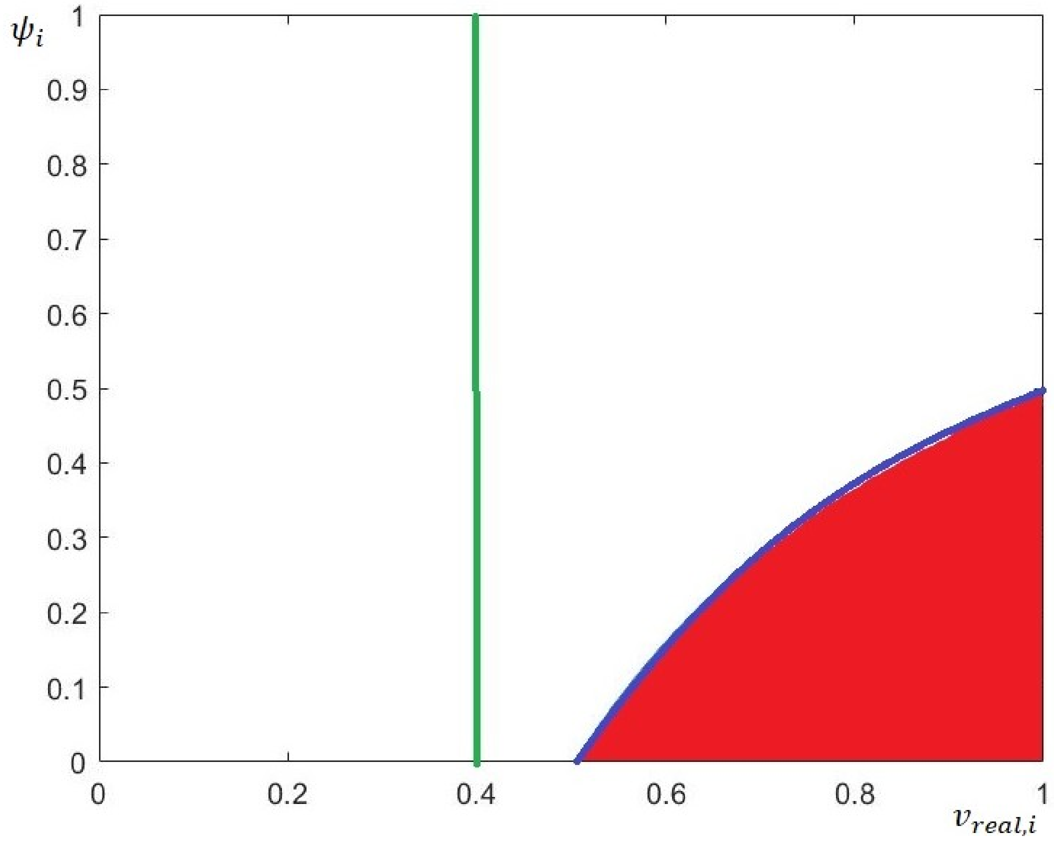
$$v_{real,i} \geq P_{RT}$$

Total possible demand can be presented as the area inside a one by one square with one axis representing expertise level and the other representing value for a real good. Inside the area of the square the population is evenly distributed.

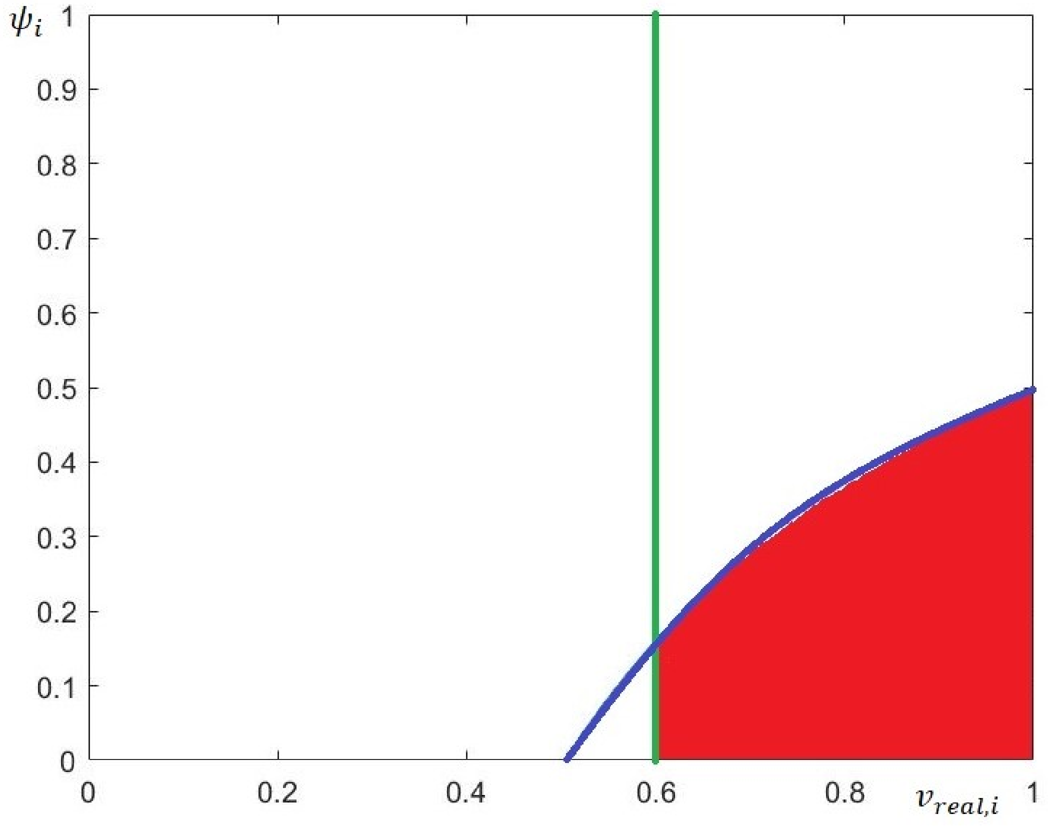
Two possible ways of dividing this “square of demand” are illustrated in graphs 2.2.4.1 and 2.2.4.2 below. In these graphs the demand area has been divided by the conditions above. The divisions of the square determine the proportion of the population demanding goods on the retail market. The red area represents the retail market demand.

[24] A consumer obtains a utility level equal to 0 if she does not purchase from the retail or second-hand market.

Graph 2.2.4.1



Graph 2.2.4.2



In the graphs above the green line represents the condition:

$$v_{real,i} \geq P_{RT}$$

The blue line comes from the condition:

$$\psi_i \leq \frac{P_{SH} - P_{RT}}{v_{real,i} * \mu(1-\varphi)} + 1$$

The graphs above are generated with the variables set to arbitrary values to demonstrate how demand functions are derived. The graphs show two possible scenarios leading to two equations for the area denoting demand for the retail market. In the first graph the green line is not limiting the demand (red) area whereas on the second graph the demand area is limited by the condition. So the demand for the retail market (the red areas in the two graphs above) is the area under the blue curve with the definite integral running between max $(P_{RT}, -\frac{P_{SH}-P_{RT}}{\mu(1-\varphi)}$[25]$)$ and 1 .

So the demand on retail market is:

$$Q_{RT} = \int_{\max\left(P_{RT}, -\frac{P_{SH}-P_{RT}}{\mu(1-\varphi)}\right)}^{1} \frac{P_{SH} - P_{RT}}{v_{real,i} * \mu(1-\varphi)} + 1 \, dv_{real,i}$$

$$=$$

$$\left[v_{real,i} + \frac{P_{SH} - P_{RT}}{\mu(1-\varphi)} * \ln\left(v_{real,i}\right)\right]_{\max\left(P_{RT}, -\frac{P_{SH}-P_{RT}}{\mu(1-\varphi)}\right)}^{1}$$

When $P_{RT} > -\frac{P_{SH}-P_{RT}}{\mu(1-\varphi)}$

$$Q_{RT} = 1 + \frac{P_{SH} - P_{RT}}{\mu(1-\varphi)} * \ln(1) - P_{RT} + \frac{P_{SH} - P_{RT}}{\mu(1-\varphi)} * \ln(P_{RT})$$

$$Q_{RT} = 1 - P_{RT} + \frac{P_{SH} - P_{RT}}{\mu(1-\varphi)} * \ln(P_{RT})$$

[25] This limit is found by setting the condition represented by the blue line equal to zero and solve for $v_{real,i}$

When $P_{RT} < -\frac{P_{SH}-P_{RT}}{\mu(1-\varphi)}$

$$Q_{RT} = 1 + \frac{P_{SH} - P_{RT}}{\mu(1-\varphi)} * \ln(1) + \frac{P_{SH} - P_{RT}}{\mu(1-\varphi)} + \frac{P_{SH} - P_{RT}}{\mu(1-\varphi)} * \ln\left(\frac{P_{RT} + P_{SH}}{\mu(1-\varphi)}\right)$$

$$Q_{RT} = 1 + 2 * \frac{P_{SH} - P_{RT}}{\mu(1-\varphi)} * \ln\left(\frac{P_{RT} + P_{SH}}{\mu(1-\varphi)}\right)$$

The demand diminishes over time as consumers who have bought a genuine good no longer demand it. The proportion of demand for the retail market should therefore be multiplied by the proportion of the population whom have not yet purchased a genuine good.

Under condition 1: $P_{RT} > \frac{P_{RT}-P_{SH}}{\mu(1-\varphi)}$:

$$Q_{RT,t} = \left(1 - P_{RT,t} + \frac{P_{SH} - P_{RT,t}}{\mu(1-\varphi)} * \ln\left(P_{RT,t}\right)\right) * (1 - \sum_{i=0}^{t-1} S_{real,t})$$

Under condition 2: $P_{RT} < \frac{P_{RT}-P_{SH}}{\mu(1-\varphi)}$:

$$Q_{RT,t} = \left(1 + 2 * \frac{P_{SH} - P_{RT,t}}{\mu(1-\varphi)} * \ln\left(-\frac{P_{SH} - P_{RT,t}}{\mu(1-\varphi)}\right)\right) * (1 - \sum_{i=0}^{t-1} S_{real,t})$$

It is not necessary to subtract the supply of genuine goods supplied from the private sellers as these sellers demand the genuine good again in the next period.[26]

[26] It is also unnecessary to subtract the supply of the counterfeit goods as they are assumed to totally depreciate after one period. (assumption 5, section 2.1.2)

2.2.5 Second-hand market demand

This section derives the demand functions for the second-hand market. It takes the same approach as in section 2.2.4:

$$\textit{Consumers have unit demand.}$$

$$u_{RT,i} = v_{real,i} - P_{RT}$$

$$u_{SH,i} = (v_{real,i} - P_{SH})\big(1 - (\mu - \mu\psi_i)\big) + \big(\varphi v_{real,i} - P_{SH}\big)(\mu - \mu\psi_i)$$

$$\mu = \frac{S_{fake}}{PS_{real} + S_{fake}}$$

$$\psi_i \sim unif(0,1)$$

$$v_{real,i} \sim unif(0,1)$$

$$\textit{population size is normalized to } 1$$

Consumers demand goods from the second-hand market if the expected utility of buying on the second-hand market is greater than the utility of buying on the retail market:
$u_{RT,i} \leq u_{SH,i}$

And if the expected utility of buying on the second-hand market is positive[27]: $u_{SH,i} \geq 0$

So,

$$v_{real,i} - P_{RT} \leq (v_{real,i} - P_{SH})\big(1 - (\mu - \mu\psi_i)\big) + \big(\varphi v_{real,i} - P_{SH}\big)(\mu - \mu\psi_i)$$

And,

$$(v_{real,i} - P_{SH})\big(1 - (\mu - \mu\psi_i)\big) + \big(\varphi v_{real,i} - P_{SH}\big)(\mu - \mu\psi_i) \geq 0$$

Solve for ψ_i and $v_{real,i}$:

$$\psi_i \geq \frac{P_{SH} - P_{RT}}{v_{real,i} * \mu(1-\varphi)} + 1 \ or \ v_{real,i} \leq \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)(1-\psi_i)}$$

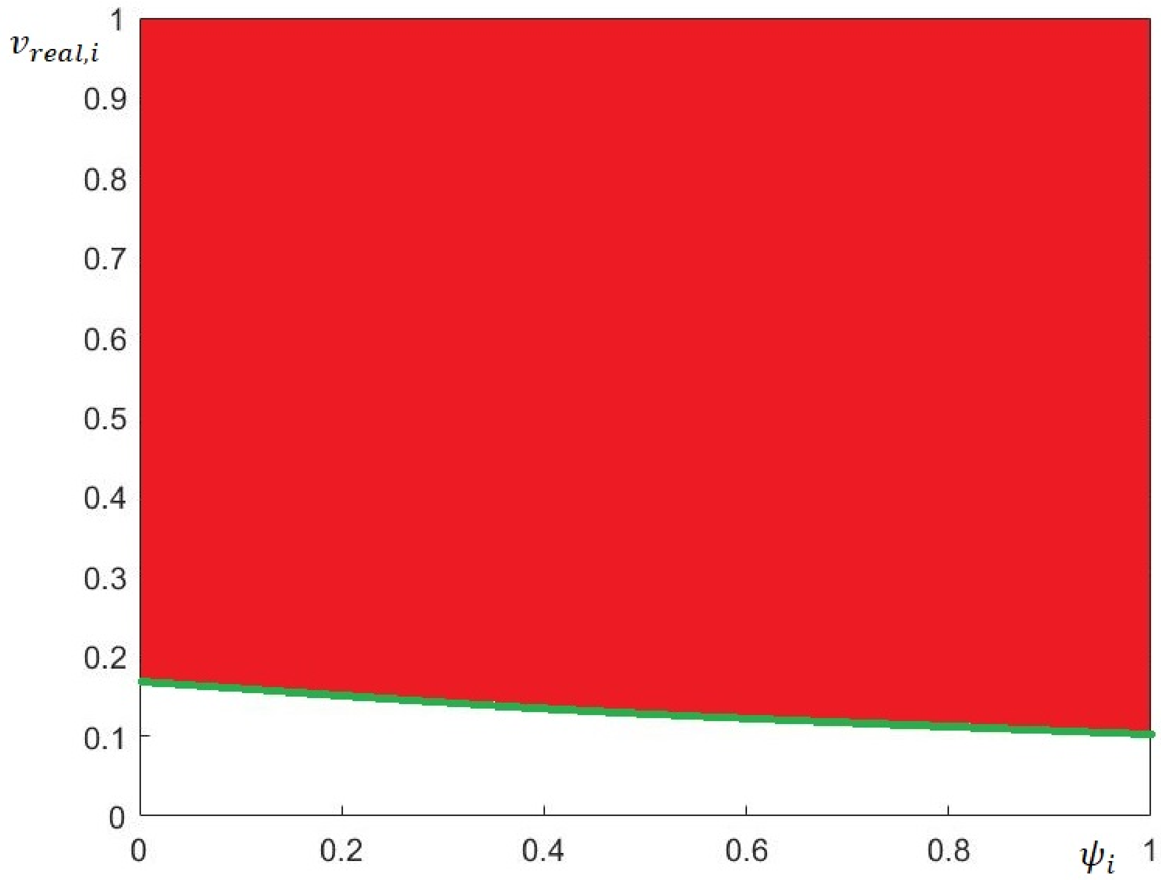
[27] A consumer obtains a utility level equal to 0 if she does not purchase from the retail or second-hand market.

and

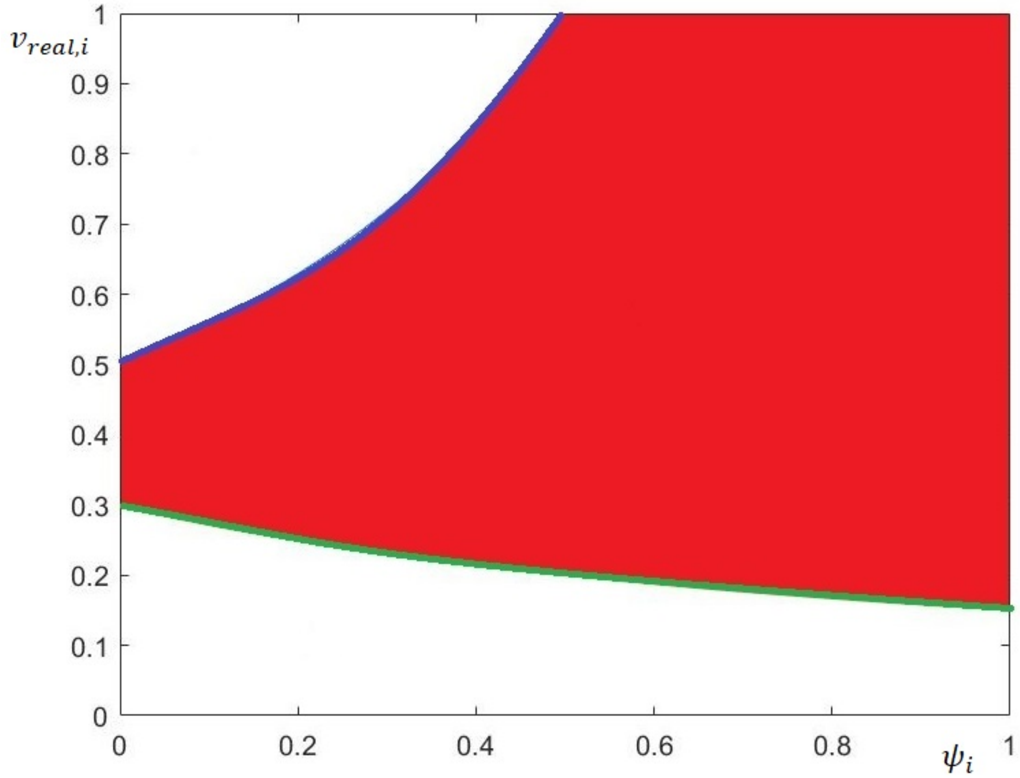
$$v_{real,i} \geq \frac{P_{SH}}{\mu(\psi_i + \varphi - 1 - \psi_i * \varphi) + 1} \; or \; \psi_i \geq \frac{P_{SH} + \mu * v_{real,i} - v_{real,i} - \mu * v_{real,i} * \varphi}{v_{real,i} * \mu(1 - \varphi)}$$

Just as in section 2.2.4, the demand for goods on the second-hand market can be depicted graphically. The red area in the graphs below represents the second-hand demand.

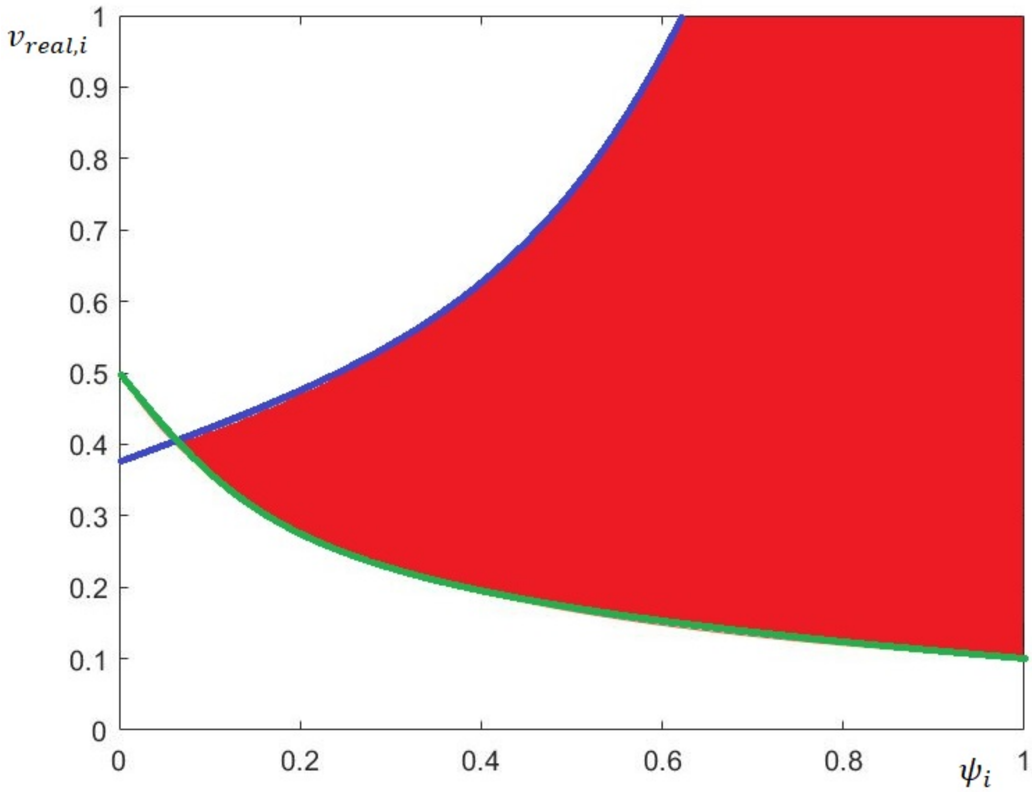
<u>Graph 2.2.5.1</u>



Graph 2.2.5.2



Graph 2.2.5.3



In graph 2.2.5.1, 2.2.5.2 and 2.2.5.3 above the green line represent the condition:

$$v_{real,i} \geq \frac{P_{SH}}{\mu(\psi_i + \varphi - 1 - \psi_i * \varphi) + 1}$$

The blue line represents the condition:

$$v_{real,i} \leq \frac{P_{RT} - P_{SH}}{\mu(1 - \varphi)(1 - \psi_i)}$$

Just as in section 2.2.5, the graphs are generated with the variables set to arbitrary values to demonstrate how demand functions are derived in three possible scenarios.

There are two limits which should be used for the integrals the first limit occurs when $v_{real,i} = 1$ in the condition:

$$v_{real,i} \leq \frac{P_{RT} - P_{SH}}{\mu(1 - \varphi)(1 - \psi_i)} \ (\textit{blue line in graphs})$$

First limit:

$$1 = \frac{P_{RT} - P_{SH}}{\mu(1 - \varphi)(1 - \psi_i)}$$

Solve for ψ_i:

$$\psi_i = 1 - \frac{P_{RT} - P_{SH}}{\mu(1 - \varphi)}$$

The second limit occurs where the two conditions are equal to each other. In other words where the blue and green line cross each other in graph 2.2.5.3:

$$\frac{P_{RT} - P_{SH}}{\mu(1 - \varphi)(1 - \psi_i)} = \frac{P_{SH}}{\mu(\psi_i + \varphi - 1 - \psi_i * \varphi) + 1}$$

Solve for ψ_i:

$$\psi_i = \frac{P_{SH} + P_{RT}(\mu - 1 - \mu\varphi)}{\mu * P_{RT} * (1 - \varphi)}$$

The area of demand is within the 1 by 1 square which the graphs make up. Negative limits are therefore substituted by 0.

The proportion of the population demanding goods from the second-hand market is:

$$Q_{SH} = 1 - max\left(0, 1 - \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)} - \int_0^{\max\left(0,\ 1-\frac{P_{RT}-P_{SH}}{\mu(1-\varphi)}\right)} \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)(1-\psi_i)} d\psi_i\right)$$
$$- \left(\int_0^{\max\left(0,\ \frac{P_{SH}+P_{RT}(\mu-1-\mu\ )}{\mu P_{RT}(1-\varphi)}\right)} \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)(1-\psi_i)} d\psi_i\right)$$
$$- (\int_{\max\left(0,\ \frac{P_{SH}+P_{RT}(\mu-1-\mu\varphi)}{\mu P_{RT}(1-\varphi)}\right)}^{1} \frac{P_{SH}}{\mu(\psi_i + \varphi - 1 - \psi_i * \varphi) + 1} d\psi_i)$$

It always holds that:

$$\frac{P_{SH} + P_{RT}(\mu - 1 - \mu\varphi)}{\mu * P_{RT} * (1-\varphi)} < 1 - \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)}$$

By transitivity, it must also hold that if:

$$\frac{P_{SH} + P_{RT}(\mu - 1 - \mu\varphi)}{\mu * P_{RT} * (1-\varphi)} > 0 \implies 1 - \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)} > 0$$

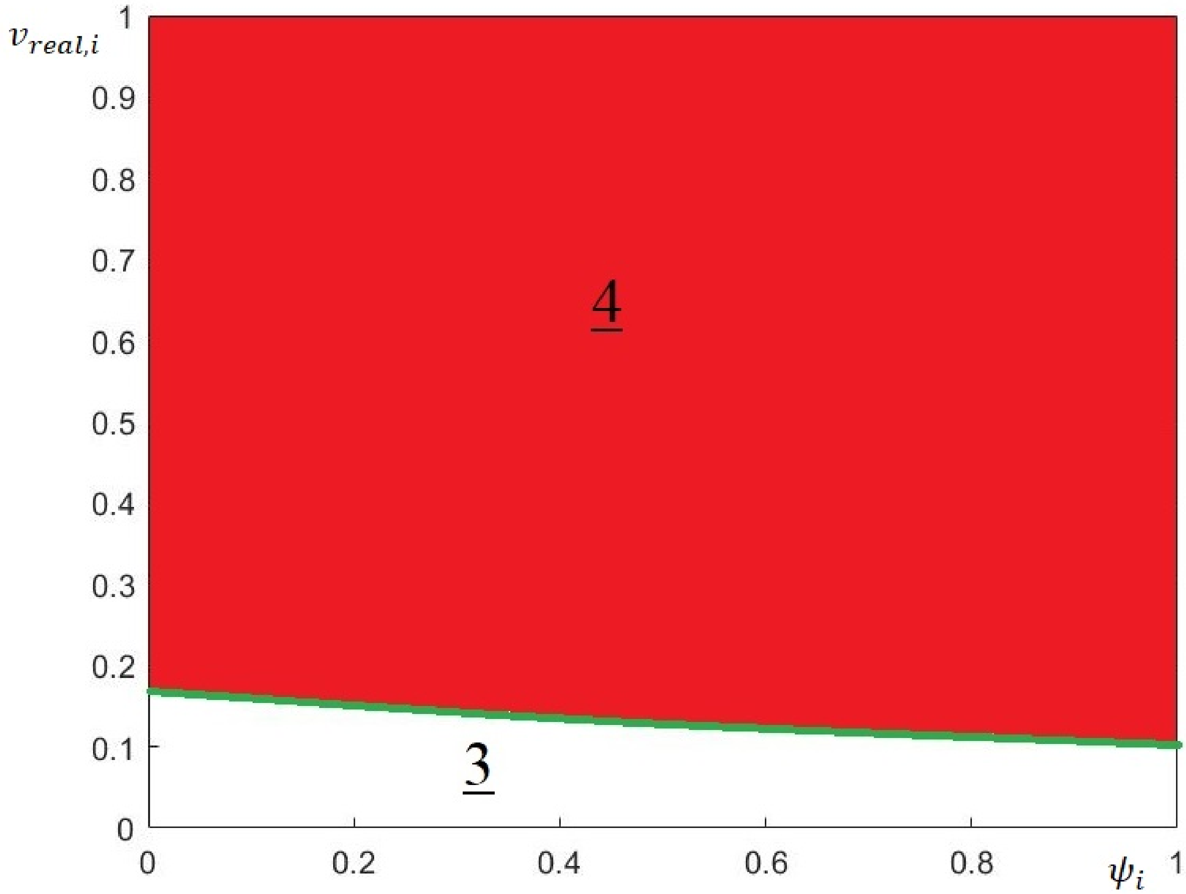
As a consequence three different demand functions exist under three different conditions.

The first condition is best represented by graph 2.2.5.1 and occurs when:

$$\frac{P_{SH} + P_{RT}(\mu - 1 - \mu\varphi)}{\mu * P_{RT} * (1-\varphi)} < 1 - \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)} < 0$$

In this scenario there is no demand for any retail goods. It would possible to find the demand for the second-hand market by subtracting the area which represents the proportion of the population who do not demand any goods (at that price level) from the total possible demand. In the graph below area 4 is equal to one minus area 3[28].

[28] The total possible demand is one represented by a one by one square as shown in the graph.



The only actor able to affect the conditions (blue and green lines) is the genuine producer. The genuine producer pursues maximum profits and does therefore not set a price which results in zero demand for the retail market. The scenario in graph above does therefore not occur.

The demand functions under the two other conditions[29] in which there is positive demand for the retail market have been derived in the appendix section 6.1.

The second condition is best represented by graph 2.2.5.2 and occurs when:

$$\frac{P_{SH} + P_{RT}(\mu - 1 - \mu\varphi)}{\mu * P_{RT} * (1 - \varphi)} < 0 < 1 - \frac{P_{RT} - P_{SH}}{\mu(1 - \varphi)}$$

[29] The conditions under which positive demand for the retail market exists are represented by graph 2.2.5.2 and 2.2.5.3

In that case the demand function is:

$$Q_{SH,t,C2} = \left(\frac{P_{RT}-P_{SH}}{\mu(1-\varphi)}\left(\ln\left(\frac{P_{RT}-P_{SH}}{\mu(1-\varphi)}\right)-1\right)+\left(\frac{P_{SH}}{\mu(1-\varphi)}*\ln(\mu\varphi-\mu+1)\right)\right)*(1-\sum_{i=0}^{t-1}S_{real,t})$$

The third condition is best represented by graph 2.2.5.3 and occurs when:

$$0<\frac{P_{SH}+P_{RT}(\mu-1-\mu\varphi)}{\mu*P_{RT}*(1-\varphi)}<1-\frac{P_{RT}-P_{SH}}{\mu(1-\varphi)}$$

Under this condition the demand function is:

$$Q_{SH,t,C3} = \left(\frac{P_{RT}-P_{SH}}{\mu(1-\varphi)}\left(\ln\left(\frac{P_{RT}-P_{SH}}{\mu(1-\varphi)}\right)+\ln\left(1-\frac{P_{SH}+P_{RT}(\mu-1-\mu\varphi)}{\mu P_{RT}(1-\varphi)}\right)+1\right)+\frac{P_{SH}}{\mu(1-\varphi)}*\ln\left(\frac{P_{SH}}{P_{RT}}\right)\right)*(1-\sum_{i=0}^{t-1}S_{real,t})$$

2.2.6 Model setup

At t=0 there are no goods on any market nor among the population. The genuine producer is therefore a true monopolist and at t=1, it acts accordingly. No counterfeit goods are produced at t=1 as it is impossible to counterfeit a product that does not exist.

In t=1:

$S_{Real,1} = 0.5 - 0.5MC_{real}$ $\qquad$ $S_{fake,1} = 0$ $\qquad$ $PS_{real,1} = \lambda S_{Real,0} = 0$

The variables at t=1 are required to generate variables for future periods.

The demand remaining on the second-hand market for the counterfeit producer is:

$$Q_{fake} = Q_{SH} - PS_{real}$$

In equilibrium it holds that the quantity demanded is equal to the quantity supplied[30]:

$$Q_{fake} = S_{fake}$$

Furthermore, all counterfeit goods producers increase supply until[31]:

$$P_{SH} = MC_{fake}$$

The genuine producer therefore single-handedly determines Q_{fake} and Q_{RT} through its choice of P_{RT}.

When substituting $MC_{fake}\ for\ P_{SH}$ and $\mu\ for\ \frac{S_{fake}}{PS_{real}+S_{fake}}$ inside Q_{SH} in the equation $Q_{fake} = Q_{SH} - PS_{real}$, and also and $S_{fake}\ for\ Q_{fake}$ in the same equation, the resulting function cannot be solved analytically for S_{fake}[32]. A numerical approach is therefore employed through Matlab programming. More specifically Matlab is used to generate a vector of possible retail prices and counterfeit supply quantities for which $Q_{fake} = Q_{SH} - PS_{real}$ holds true. These can be substituted into the appropriate demand function for the retail market[33], given which condition holds. The retail demand (Q_{RT}) figure is then added to the vector of possible retail prices and counterfeit supply quantities. The vector now specifies one quantity of counterfeit supply and one value of quantity supplied for each retail market price (P_{RT}). A genuine producer profit level can be determined for each retail market (P_{RT}). The genuine producer profit is:

$$\pi_{real,t} = \left(P_{RT,t} - MC_{real}\right) * \ Q_{RT,t}$$

In each time period the genuine producer optimizes their profits w.r.t. $P_{RT,t}$. The largest profit given all possible prices is therefore the one chosen by the producer. The profit maximization problem is also solved using Matlab.

[30] See assumption 9, section 2.1.2

[31] See assumption 2, section 2.1.2. Furthermore private sellers are price takers selling at the price set by the counterfeit producers. So they also sell their goods at the price equal to MC_{fake}.

[32] The function cannot be solved for S_{fake} analytically because the term is embedded inside natural logs. Please note that S_{fake} is included in the variable μ

[33] The two possible demand function $Q_{RT,t,C1}$ and $Q_{RT,t,C2}$ were derived in section 2.2.4

Please note that the above process is carried out the appropriate second-hand demand function($Q_{SH,C2}$ or $Q_{SH,C3}$) in Matlab. The iteration yielding the highest genuine producer profit is the one which determine the final output levels. The process is being run for T periods.

The Matlab simulation code is available upon request to madssk92@gmail.com

The graphic representations of simulated profit, supply and price levels over time can be found in Section 3. In section 3 these variables are also compared to simulation outputs from the model outlined in section 2.3.

2.3 Model without risk on the second-hand market

This section builds a model which excludes the risk seen in the model in section 2.2. This model outputs supply and price level of both the retail and second-hand market over time. The profit of the genuine producer can also be found using the model. The profit found is compared to the model outlined in section 2.2. The comparison facilitates a response to the question of whether or not the presence of counterfeit goods on the second-hand market has a positive or negative effect on the monopolists profit levels. To keep the two models comparable all variables and assumptions are kept constant. Only the counterfeit producer is omitted in this model, thus removing the risk factor.

In this model there exist no counterfeit goods and consumers (buyers) are therefore indifferent between buying on the retail and second-hand market[34] if the price on the two markets is identical. Just as in the model w/ risk, private sellers follow the price set by the market leader (in this case that is the genuine producer)[35]. As a consequence the price is indeed identical on the retail and second-hand market:

$$P_{RT} = P_{SH}$$

[34] Consumers are indifferent between a new durable good and an identical second-hand durable good. See assumption 1, section 2.1.2

[35] This is a result of unit demand and a large number of consumers. See assumption 1, section 2.1.2

And,

$$Q^{norisk}{}_{RT} = Q^{norisk}{}_{SH} = \frac{1 - P_{RT} - \sum_{i=0}^{t-1} S_{real,t}}{2}$$

The demand functions above are derived the appendix (section 6.2).

As highlighted in section 6.2, the above demand function is relevant in the case in which there are no constraints on the supply quantity of the monopolist and the private sellers. In this model, just as in section 2.2, the private sellers are able to maximally supply:

$$PS_{real} = \lambda \sum_{t=0}^{T-1} S_{real,t} \ \ where\ \lambda \in [0,1]$$

The private sellers follow the price set by the monopolist producer who sets the price to maximize their profit in any given period. The price set by the monopolist does not affect the supply from the private sellers. The capacity constraint on the supply of the private sellers implies that two possible quantities can be supplied by the private sellers such that:

If $PS_{real} < Q^{norisk}{}_{SH}$ the private sellers supply:

$$PS_{real}$$

If $PS_{real} > Q^{norisk}{}_{SH}$ the private sellers supply:

$$\frac{1 - P_{RT} - \sum_{i=0}^{t-1} S_{real,t}}{2}$$

These levels of supply affect the supply and profit levels of the monopolist producer.

The profit of the monopolist is:

$$\pi_{monopolist,t} = \left(P_{RT,t} - MC_{real}\right) * \ S_{RT,t}$$

The two second-hand supply functions result in two different profits levels:

$$\pi_{monopolist,t} = \begin{cases} \left(P_{RT,t} - MC_{real}\right) * \left(1 - P_{RT} - PS_{real} - \sum_{i=0}^{t-1} S_{real,t}\right) \\ \quad when\ PS_{real} < \frac{1 - P_{RT} - \sum_{i=0}^{t-1} S_{real,t}}{2} \\ \left(P_{RT,t} - MC_{real}\right) * \left(\frac{1 - P_{RT} - \sum_{i=0}^{t-1} S_{real,t}}{2}\right) \\ \quad when\ PS_{real} > \frac{1 - P_{RT} - \sum_{i=0}^{t-1} S_{real,t}}{2} \end{cases}$$

The price level, and thus also the supply, is chosen by the monopolist to maximize profits just as in the model in section 2.2. The optimization is done in Matlab.

The Matlab simulation code is available upon request to madssk92@gmail.com

The graphic representations of simulated profit, supply and price levels over time is presented in section 3. There they are compared to the simulation outputs from model in section 2.2.

3. Findings

This section analyse the Matlab simulations of both the model including and excluding risk which were outlined in section 2. As numerical analysis is used in the simulations several variables have been kept constant such that:

- Marginal cost of genuine goods (MC_{real}) = 0.4
- Marginal cost of counterfeit goods (MC_{fake}) = 0.1
- Fraction of genuine goods supplied in previous periods, being supplied on the second-hand market (λ) = 0.1
- 25 periods are simulated

The variables above may be modified to fit a particular market. The effects of such alterations are explored in section 3.2.

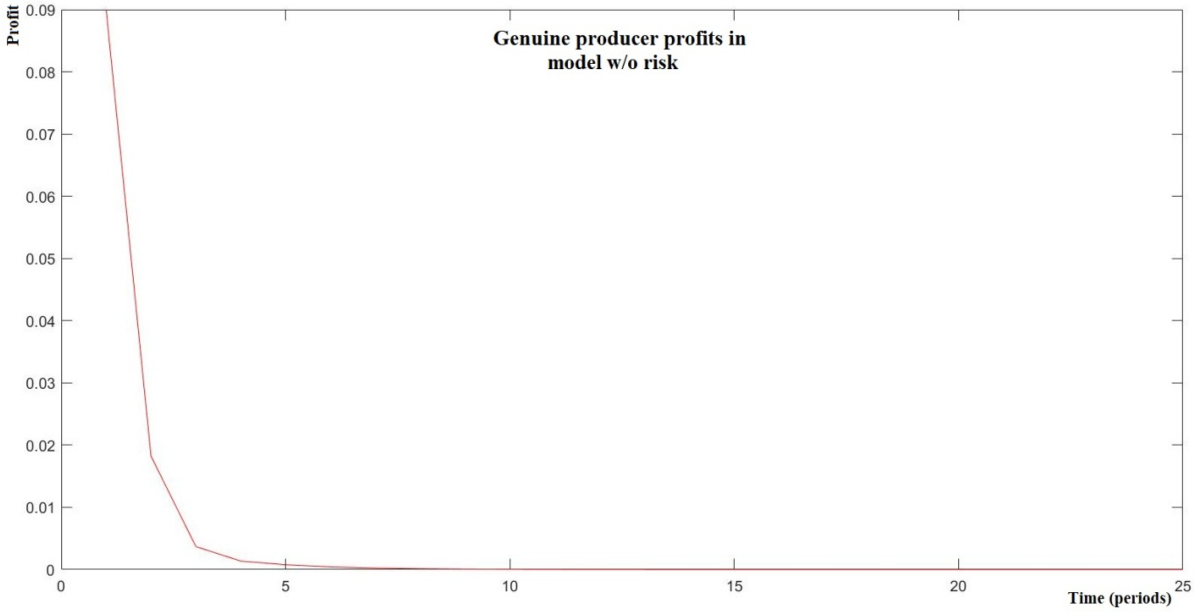
To develop a more realistic model, consumer utility discounting is incorporated into the model, in section 3.2.2. The section also demonstrates that the addition of discounting does however not affect previous results.

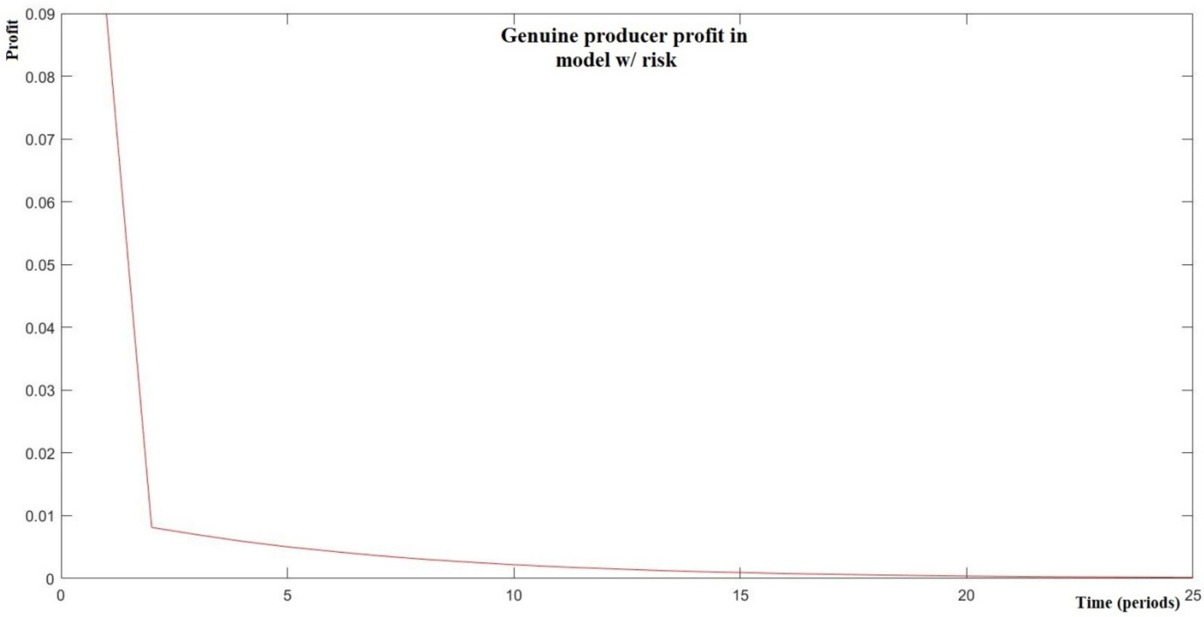
As mentioned in the introduction (section 1.1) the relationship between risk and profits may be analogous in models with none durable goods, meaning that the result is not unique to durable goods. The magnitude of the relationship may however differ substantially in the case of none durable goods models.

In interpreting results please note that the simulations begin in period one. In period zero there is no economic activity.

3.1 Genuine producer profit and risk relationship comparison

The genuine producer profit vectors culminating from Matlab simulations are explained in this section. A graphic representation of the vectors can be found in the two graphs below:





The total profit from 25 periods w/ risk is 0.142688. The total profit from 25 periods w/o risk is 0.115021. The difference in total profits, between the two models, is about 24.1 percent. This difference is driven by both lower retail prices and lower level of retail supply/demand in the model which does not include risk. So the genuine producer competing against a second-hand market in which risk is present is able to sell more goods at a higher price. As the marginal cost of production is identical in both models, the profits available to the genuine producer are greater in the model which includes risk. Retail price and retail supply from the model simulations are presented individually in the appendix (section 6.6). Intuitively the higher genuine producer profits stem from the lower competitiveness associated with a risky second-hand market[36]. A genuine producer in an environment without counterfeit goods is therefore at a disadvantage to one in an environment in which counterfeit goods do present a risk to consumers.

This result supports my initial hypothesis and suggests that risk may diminish the competitiveness of the second-hand market which allows for higher genuine producer profits.

3.2 Variable effects

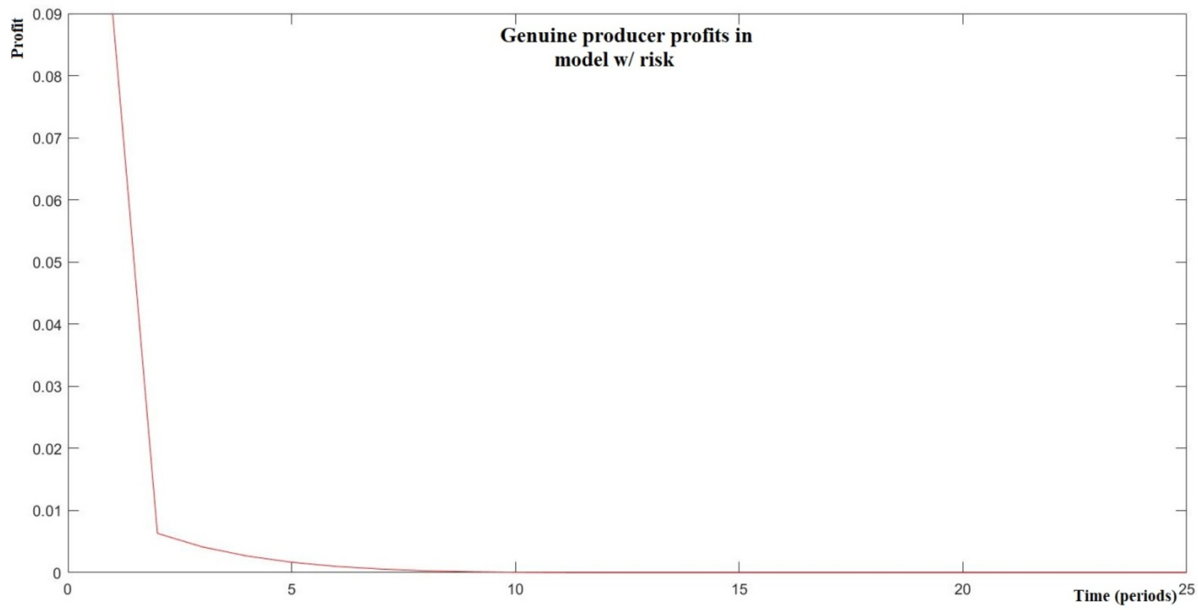
3.2.1 Valuation differences(φ)

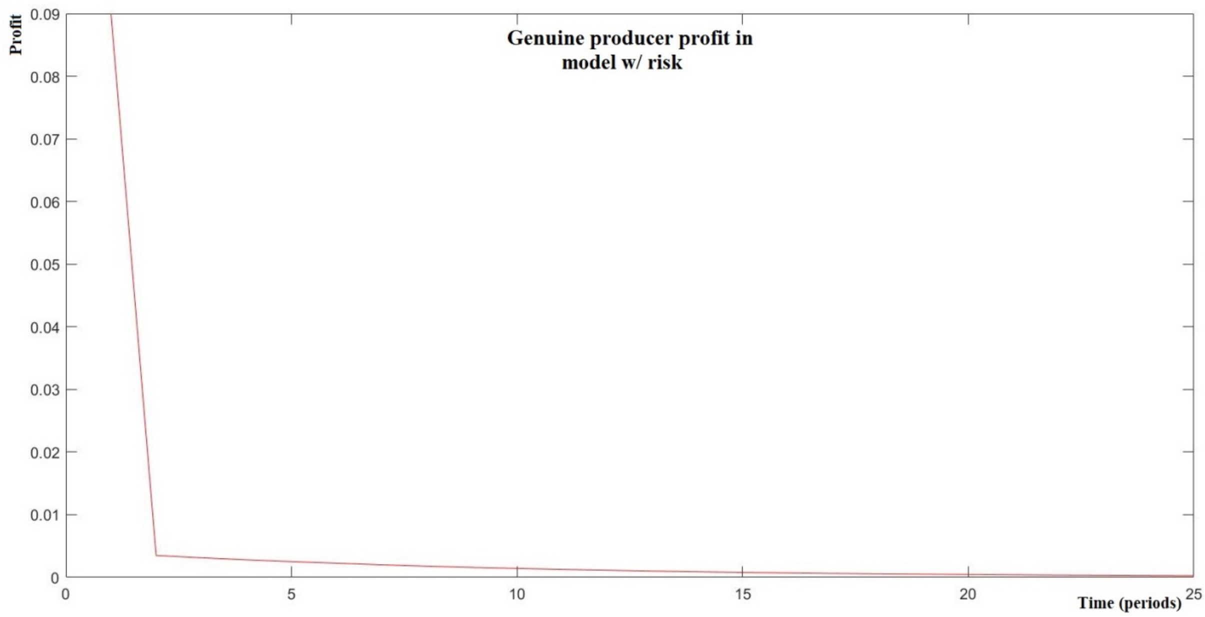
As explained in section 2.2.2, the indicator of the relationship between the consumer lifetime value of genuine and counterfeit goods (φ) is determined by the ratio of marginal cost of counterfeit goods to the marginal cost of genuine goods such that:

$$\varphi = \frac{MC_{fake}}{MC_{real}}$$

It was also highlighted that this was a simplifying assumption and that more factors than the marginal costs impact the relative evaluation of one good compared to another. This section explores the effects of increasing and decreasing φ while keeping the marginal costs the same. In the second graph below φ is 0.4. In layman's terms, the consumers value counterfeit good at 40% of the value given to genuine goods, compared to 25% in the models shown in section 3.1.

[36] Consumer demand is diverted from the second-hand market to the retail market as risk associated with buying on the second-hand market increase.





The graphs above graphically represent the genuine producer profits over time with $\varphi = 0.25$ and $\varphi = 0.4$ respectively. Together the graphs demonstrate that if consumers' value for counterfeit goods increase relative to the genuine goods (as shown in the second graph), then genuine producer profits decrease.

In the first graph the total profit from 25 periods w/ risk is 0.142688. In the second graph total profit is 0.120385 over 25 periods. So the genuine producer profit is 15.6 percent lower when consumers value counterfeit goods relatively lower. It is worth noting that if the difference in value given to counterfeit and genuine goods is not large enough, it may not be advantageous for the genuine producer to have risk on the second-hand market. That is because the relatively higher value given to the counterfeit good also deteriorates the perception of risk. If for example φ is increased to 0.6, the genuine producer receives 0.093263 in total profit from 25 periods in a model with risk. With φ=0.6, the genuine producer would be better off if there was no risk on the second-hand market[37]. Intuitively that is because there is less risk involved with getting a counterfeit product as the difference in perceived value between a counterfeit and genuine product shrink. As the perceived risk of receiving a counterfeit product is diminished, all that remains is the additional competition against the genuine producer. This additional competition would drive the negative correlation between risk on the second-hand market and genuine producer profits.

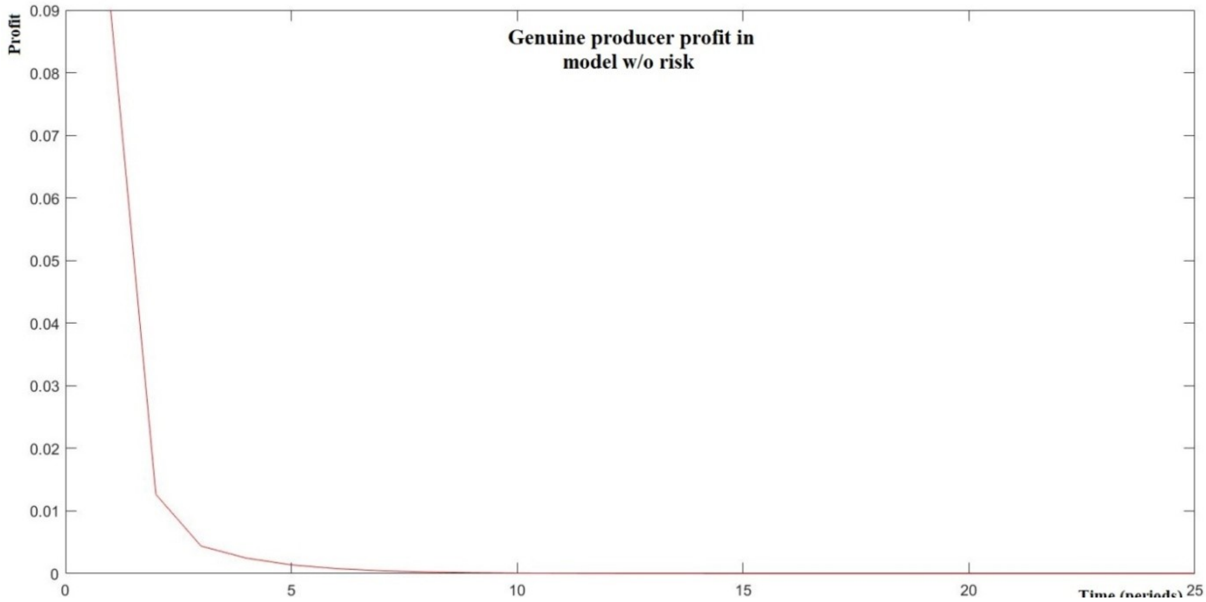
Similarly if the gap between marginal cost of genuine and counterfeit goods is small, the price set by the counterfeit producers on the second-hand market will be similar to the marginal cost of the genuine producer. The genuine producer will then have difficulties competing with the relatively low prices which counterfeit producers offer. This could also lead to a negative correlation between risk on the second-hand market and genuine producer profits.

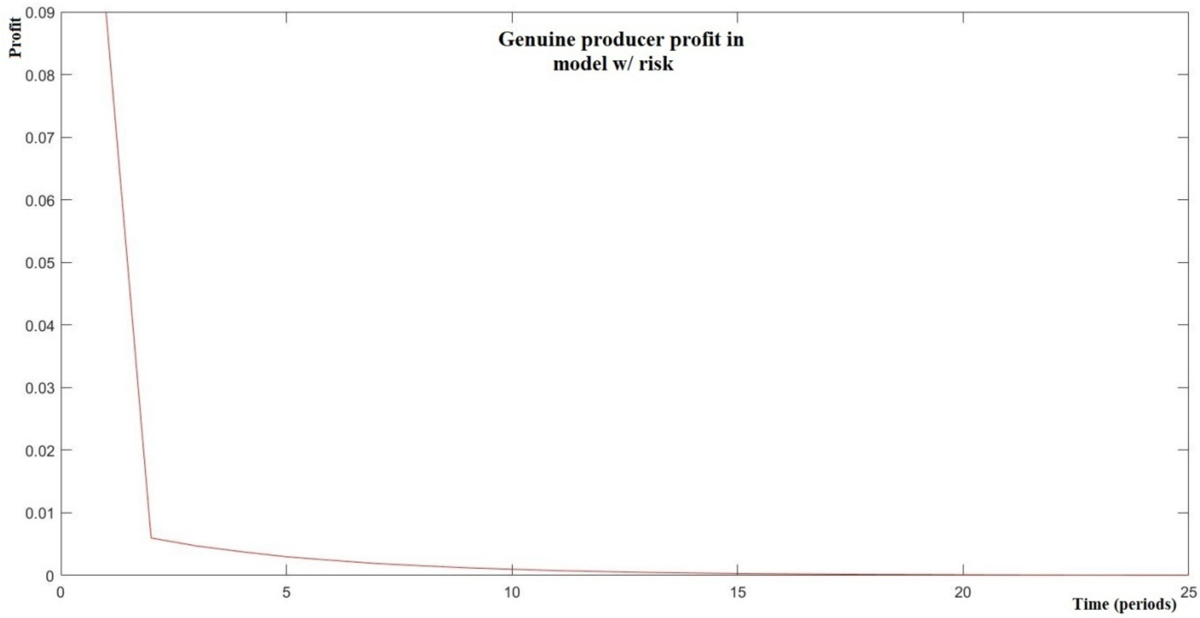
3.2.2 Proportion of private individuals selling(λ)

In section 3.1, 10 percent of the consumers who previously purchased genuine goods, resell them on the second-hand market in every period (λ = 0.1). This section looks at the impact a change in λ has on the genuine producer profit levels as well as how they may affect the possible positive effects which risk on the second-hand market have.

In the graphs below λ is 0.25. In other words, 25 percent of the consumers who previously purchased genuine goods resell them on the second-hand market in every period, compared to 10 percent in the models simulated in section 3.1.

[37] As shown in section 3.1 the genuine producer receives 0.115021 in total profits in the model excluding risk.





In the graphs above the total profit from the 25 periods w/ risk and w/o risk is 0.119281 and 0.112701 respectively. The difference in total profits is about 5.8 percent. In section 3.1 the difference was 24.1 percent. This means that there is a negative correlation between λ and the advantage which risk on the second-hand market affords the genuine producer. It is also clear that the total genuine producer profit fell in both models as λ increased. The rationale is similar to the one in section 3.2.1. The increased quantity of genuine goods supplied by private individuals to the second-hand market also decrease the risk of receiving a counterfeit product on the second-hand market[38]. As a consequence the level of competition from the second-hand market on the retail market is larger, leading to a decrease in genuine producer profits.

3.2.3 Consumer utility discounting

The models presented in section 2.2 and 2.3 have not featured utility discounting. In reality, consumers are however impatient. They therefore discount[39] future consumption. This section demonstrates that discounting does not affect the underlying result shown above, but simply diminish future profits. This section exhibits results for which a consumption rate of discount is 3 percent[40] is implemented. The consumption rate of discount accounts for how much a consumer values the consumption of a good in one period compared to another. It does however not account for the time a consumer has ownership of the durable good. This must also be taken into account. In a model lasting T periods, a consumer values a genuine good in period t such that[41]:

$$dv_{real,i,t} = \left(\frac{v_{real,i}}{(1.03)^{t-1}}\right) * \frac{1+T-t}{T} = \left(\frac{v_{real,i} * (1+T-t)}{T * (1.03)^{t-1}}\right)$$

The effect of consumer impatience is partially mitigated by interest rates. The opportunity cost of buying a durable good is the lost yield which the consumer could have received from the interest rate on a bond or investment. For this model an interest rate of 3 percent is incorporated. This rate reflects real 10 year government bond interest rates[42]. All prices and costs in the model must be adjusted such that:

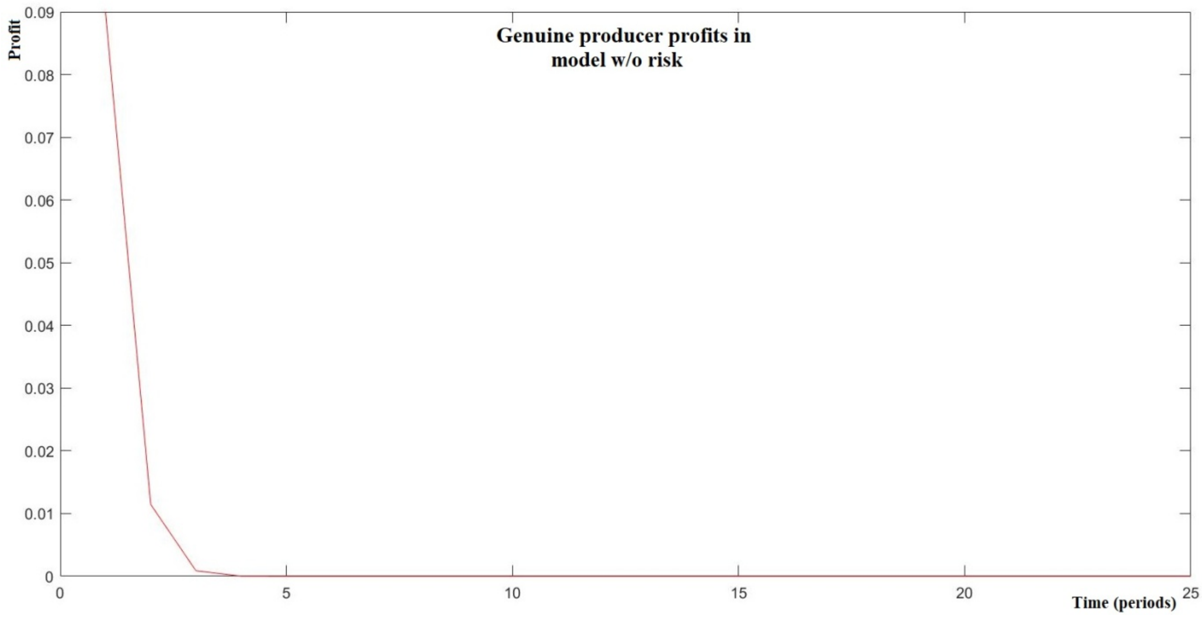
$$P_{adjusted} = (P_{unadjusted}) * (0.97)^{t-1}$$

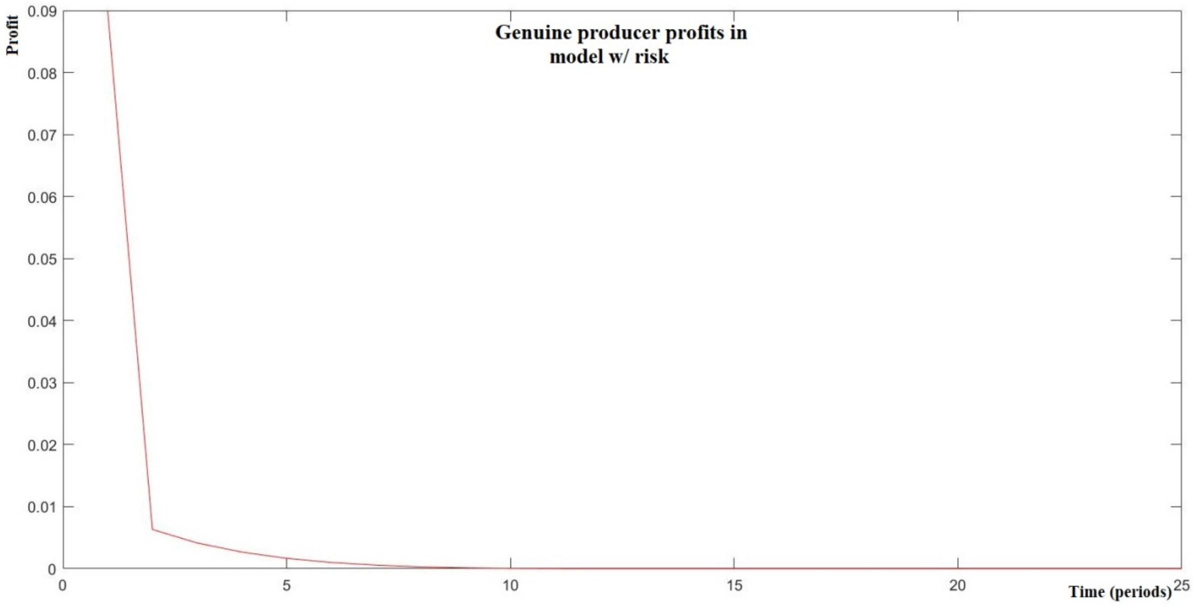
[38] This is because private individuals are only able to supply genuine goods. See assumption 5, section 2.1.2.
[39] Discounting is the process of reducing the value of future flows to give an agent the present valuation. (Sloman and Wride 2009, p. 262)
[40] The consumption rate of discount equal to 3 percent was estimated to be realistic by Arrow et al. (2013, p. 349).
[41] Please note that the model begins in period 1.
[42] 10 Yr bond interest rates: US - 3.1, UK – 1.4, Germany – 0.4, Italy – 3.5, Spain – 1.6, India – 7.8 and France – 0.75 (rates from tradingeconomics.com October 2018)

The discounting and interest rates variables above can be incorporated into the models presented in section 2 to generate different supply, price and profit functions. These are derived in the same way as in the models in section 2.2 and 2.3 but with the price and good value adjusted. The derivations of the functions which incorporate utility discounting can be found in the appendix (section 6.7 and 6.8).

The genuine producer profit vectors culminating from the models w/ and w/o risk in which consumer utility discounting and interest rates are incorporated are explained and represented graphically below. Just as in section 3.1 variables have been kept constant such that:

- Marginal cost of genuine goods (MC_{real}) = 0.4
- Marginal cost of counterfeit goods (MC_{fake}) = 0.1
- Fraction of genuine goods supplied in previous periods, being supplied on the second-hand market (λ) = 0.1
- 25 periods are simulated





The total profit from 25 periods w/ risk and discounting is 0.106853. The total profit from 25 periods w/discounting and w/o risk is 0.102350.

The addition of discounting does not change the results presented in section 3.1, 3.2.1 and 3.2.2. The incorporation of consumer utility discounting does however decrease profits levels compared to the results in section 3.1. It also condenses the effects presented in section 3.2.1 and 3.2.2. As more time periods are simulated the differences between results w/ and w/o consumer utility discounting fade. So the models w/ discounting are identical to the models w/o discounting in the limit as infinite time periods are simulated ($T \rightarrow \infty$). This paper focuses on ultra durable goods which can be handed down through generations[43]. Consequentially, the theory is best represented over an infinite amount of time. An extension of the results in section 3.1, 3.2.1 and 3.2.2 do represent such a scenario well.

3.2.4 Other remarks

Another variable that could be interesting to alter is the distribution of both the consumers' lifetime value of the genuine good as well as the distribution of their expertise level. It may also be interesting to vary the lower and upper bounds of value given to the genuine good and expertise levels within the population. Such alterations are not carried out in this paper, but could be investigated through future development of the models.

[43] Genuine durable goods in this paper do not deteriorate over time or with use. See assumption 1, section 2.1.2

4. Analysis and Weaknesses

This section evaluates weaknesses and potential improvements which could be made to the models. Several weaknesses emanate from the assumptions made in section 2.1.1. These assumptions are discussed in this section.

No good is truly ultra durable, so even the highest quality product made to last for generations may break or become obsolete. This would however only constitute an issue if the findings of this paper are applied to market profits spanning several generations.

Since the supplied quantity from producers varies in each period it may be unrealistic to assume that marginal cost remains constant. The addition of economies of scale into the model should however only change the magnitude of the results rather than the orientation.

The exclusion of private curators in the models is unrealistic. In the real world private curators and dealers do exist. These agents are able to profit of their expertise in the field.

This paper assumes deceptive-counterfeiting with all counterfeit goods sold at the same price. In reality non-deceptive counterfeiting[44] also occurs. Tom et Al. (1998, p. 417) found that approximately 38% of the consumers knowingly purchase one or more counterfeit products. This is a significant amount of the counterfeiting industry, which can only harm the genuine producers' profits.

In the models in section 2, genuine goods available on the secondary market are supplied by a fixed proportion of past consumers. The lack of correlation between the proportion of individuals who sell their good and on second-hand market price is unrealistic. Modifying the second-hand market in the model to follow the law of supply[45] would make it more realistic[46].

The lack of correlation between expertise and valuation of the genuine good over the population is not entirely realistic. The introduction of correlation in the models

[44] Non-deceptive counterfeiting occurs when consumers "know at the time of purchase that they are buying a fake" (Maman 2009, p.1)
[45] The law of supply is a fundamental principle of economic theory declaring that, ceteris paribus, a price increase induces an increase in the quantity supplied.
[46] Please note that this would also require the introduction of changing value which agents have for products. This would require either more theory or the introduction of a random number generator.

presented should however not affect the orientation of the findings. In reality it is challenging to determine the relationship between the value of real and counterfeit goods because genuine and counterfeit products are available at different levels of quality. Higgins R. S. and Rubin P. H. (1986) highlight that brand names serve two main purposes. “Traditionally, the purpose of brand names has been to assure quality [but] more recently, trademarks seem to have taken on an additional function. Many persons purchase branded goods for the purpose of demonstrating to others that they are consumers of the particular good.” (p. 211) In other words, some consumers are attracted to brand names because of their quality, whereas other’s put importance on the status a branded product projects. As a consequence, an individual with a high level of expertise may or may not value a good higher than an individual who has a low level of expertise but to whom status projection is important.

Real prices[47] of luxury products generally increase over time according to real world data. Graphs showing how retail prices have increased with time in the luxury goods markets have been included in the appendix section 6.3. These graphs included pricing data for the luxury watch and luxury handbag markets. Reasons however exist, why real prices of durable goods increase over time in reality, when they decrease over time according to the theory presented in this paper.

First of all population growth exist - both in the sense that the world population grows as well as the populations able to afford luxury goods grow. Consequentially the quantity of consumers and demand also grow with time. This explains one aspect of how real prices increase with time. As discussed in section 1.2.3, this paper does not take population growth into account. The result is that it is not theoretically possible for an ultra durable goods producer to increase prices over time.

Another aspect which may explain why real prices of luxury products generally increase over time is that price increases can boost brand perception and equity among consumers. Waheed Kareem Abdul (2017) found “that there is a significant negative impact of consumers’ price unfairness perceptions of past purchase on customer-based brand equity. Furthermore, the magnitude was found to strengthen [this] negative effect” (p. 634)

[47]Real prices are adjusted for general price level changes over time, i.e., inflation or deflation.

It should be noted that Waheed's study was conducted on electronic goods[48]. His findings may therefore not be directly transferable to luxury goods markets. The findings do however have merit as they are consistent with economic theory that consumers would be unhappy with a price decrease just after purchasing a product. This logic is also presented in the Coase Conjecture outlined in section 1.2.1[49]. The consistent and significant retail price increase strategy may artificially make consumers perceive the product as an investment opportunity. This in turn generates demand among consumers for whom a good investment is important. Furthermore consumers are less likely to feel that they bought a product at an unfair high price. So the strategy to increase real prices can generate demand as it "enhances the continuous [consumer] relationship with the brand, [due to how] the perceptions of past purchase influence brand loyalty and positive word of mouth behaviour." (Keller, 2013)

To sum up, the models presented in this paper assume zero population growth and do not take into account changing marginal costs over time, non-deceptive counterfeiting and the positive effects an increase in price has on demand. Furthermore competition from other luxury brands producing ultra durable goods is not included in the models. The repercussion of the weaknesses outlined above is that the models presented in this paper are not entirely realistic. The weaknesses do however not take away from the ability to study the effects of risk in the shape of counterfeit goods on the secondary market. The unrealistic nature of the model could also be rectified through the inclusion of elements mentioned above in future model iterations.

[48] Electronic products are considered to be none durable

[49] In the Coase conjecture, consumers were unwilling to purchase goods, knowing that prices would decrease in the future.

5. Conclusion

This paper has designed and compared models which include and exclude risk in the shape of counterfeit products. The comparison has found that a positive relationship between risk on the second-hand market and genuine producer profits is plausible. Intuitively, higher genuine producer profits can stem from lower competitiveness associated with a more risky second-hand market[50]. The positive correlation introduces a positive aspect of counterfeiting, to genuine producers, which the literature has not yet investigated. The models used isolate and only investigate the effects of counterfeiting on the relationship. In other words, the models omit several other variables[51] which should be taken into account in a more realistic analysis. Counterfeiting constitutes a significant issue; particularly in luxury industries which produce durable goods. As a consequence manufactures who operate in such industries should take into account both variables omitted from this paper as well as the positive correlation of counterfeit goods on a second-hand/grey market on their profits. The inclusion of other variables may indeed change the positive correlation found in this paper into a negative one. This does however not warrant the exclusion of this paper's findings from the aforementioned strategy development. The model framework in this paper can be extended to consider real world luxury markets.

The relationship between risk on the second-hand market and genuine producer profits is not uniformly positive. The relationship is only positive if the difference between consumers' perceived value of the genuine and counterfeit good is sufficiently large and if the difference between the marginal costs of genuine and counterfeit producers is sufficiently large. The relationship between risk and genuine producer profits is driven by competition between the second-hand and retail market. Additional counterfeit producers may both increase competition through increased supply to compete with genuine goods or lower the competitiveness of said market with additional risk of purchasing a counterfeit good. Given a set of parameters, the models designed in this paper can determine the direction of the relationship between risk and genuine producer profits as well as provide dynamics of price, supply and profit.

[50] Consumer demand is diverted from the second-hand market to the retail market as risk associated with buying on the second-hand market increase.
[51] Such variables include the effects on the total demand exerted by population growth, competition from other luxury goods manufactures and the change in status projection and perceived investment potential of the durable product generated by counterfeit products.

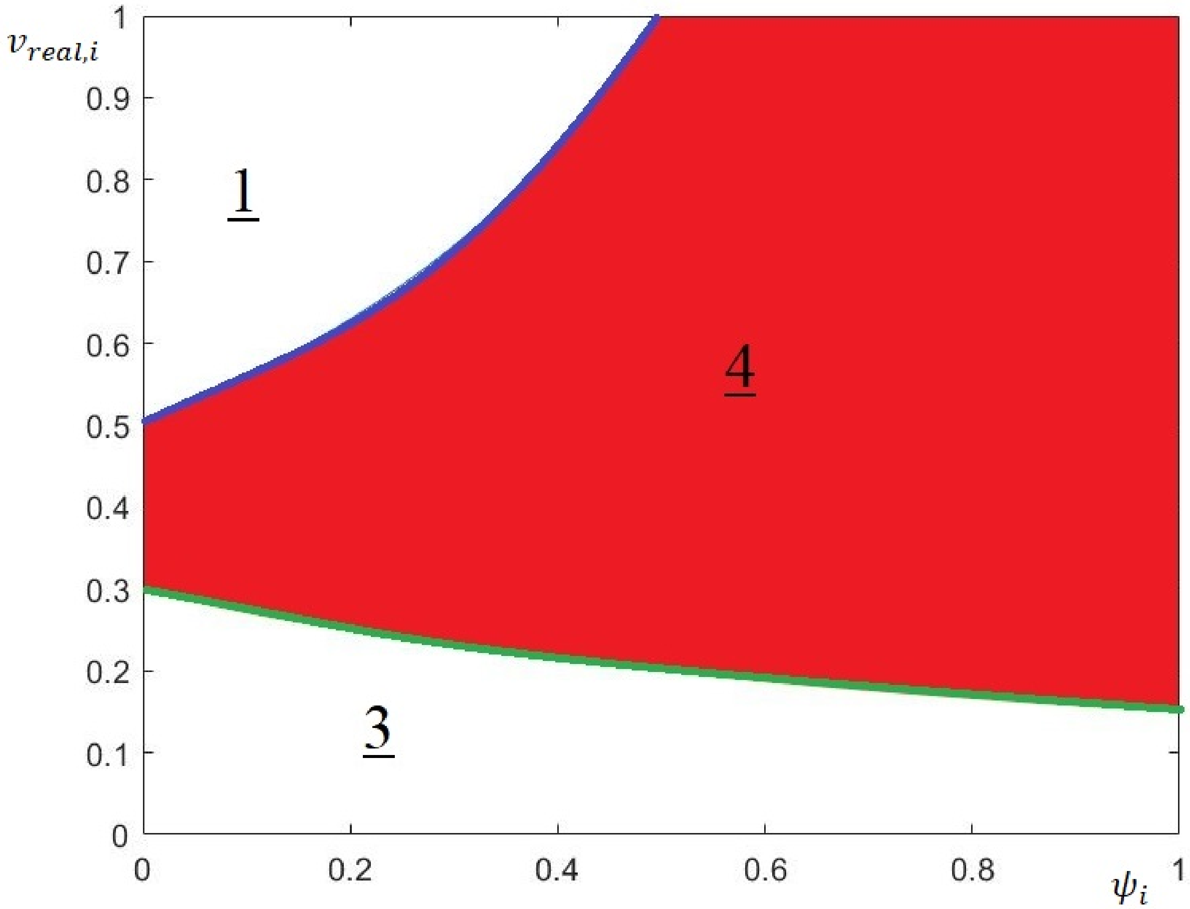
6. Appendix

6.1 Second-hand market demand derivation under condition 2 and 3 (with risk on the second-hand market)

The second condition is best represented by the graph below and occurs when:

$$\frac{P_{SH} + P_{RT}(\mu - 1 - \mu\varphi)}{\mu * P_{RT} * (1 - \varphi)} < 0 < 1 - \frac{P_{RT} - P_{SH}}{\mu(1 - \varphi)}$$

In this scenario there is some demand for retail goods represented by area 1 in the graph below. The demand for the second-hand market (area 4) is equal to one minus the area which represents the proportion of the population who do not demand goods (area 3) minus the area representing demand for retail goods (area 1).



Given this condition the demand function is:

$$Q_{SH,t,C2} = 1 - \left(1 - \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)} - \int_0^{1-\frac{P_{RT}-P_{SH}}{\mu(1-\varphi)}} \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)(1-\psi_i)} d\psi_i\right) - (\int_0^1 \frac{P_{SH}}{\mu(\psi_i + \varphi - 1 - \psi_i * \varphi) + 1} d\psi_i)$$

Solve the integrals to get:

$$Q_{SH,t,C2} = 1 - \left(1 - \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)} - \left[-\frac{P_{RT} - P_{SH}}{\mu(1-\varphi)} * \ln(|1-\psi_i|)\right]_0^{1-\frac{P_{RT}-P_{SH}}{\mu(1-\varphi)}}\right) - \left[\frac{P_{SH}}{\mu(1-\varphi)} * \ln\left(|\psi_i(\mu - \varphi\mu) + \mu(\varphi - 1) + 1|\right)\right]_0^1$$

Simplify:

$$Q_{SH,t,C2} = \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)} (\ln\left(\frac{P_{RT} - P_{SH}}{\mu(1-\varphi)}\right) - 1) + (\frac{P_{SH}}{\mu(1-\varphi)} * \ln(\mu\varphi - \mu + 1))$$

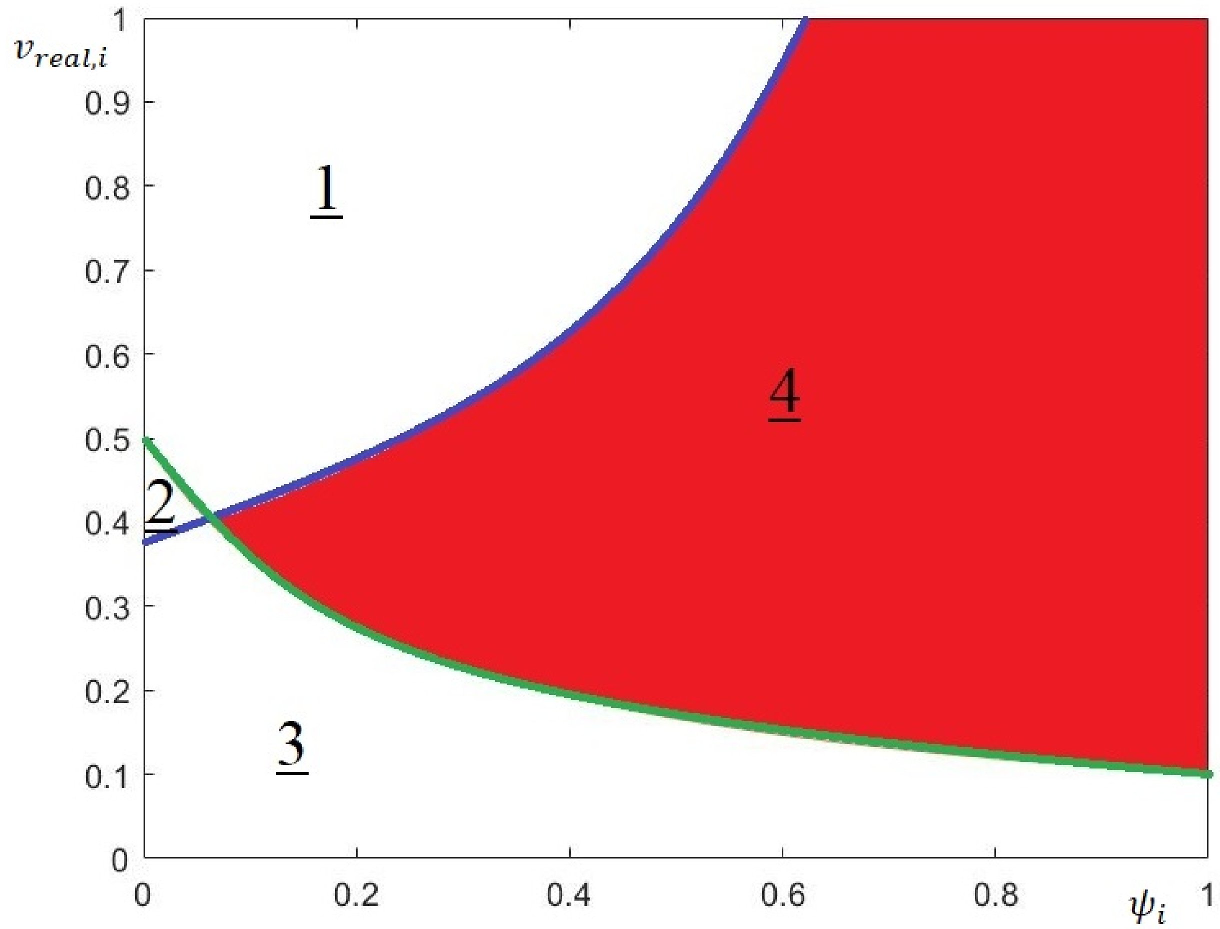
Just as in section 2.2.5 multiply the demand function by the proportion of remaining demand such that:

$$Q_{SH,t,C2} = \left(\frac{P_{RT} - P_{SH}}{\mu(1-\varphi)}\left(\ln\left(\frac{P_{RT} - P_{SH}}{\mu(1-\varphi)}\right) - 1\right) + \left(\frac{P_{SH}}{\mu(1-\varphi)} * \ln(\mu\varphi - \mu + 1)\right)\right) * \left(1 - \sum_{i=0}^{t-1} S_{real,t}\right)$$

The third condition is best represented by the graph below and occurs when:

$$0 < \frac{P_{SH} + P_{RT}(\mu - 1 - \mu\varphi)}{\mu * P_{RT} * (1-\varphi)} < 1 - \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)}$$

Under this condition the demand for the second-hand market is 1 minus area 1, 2 and 3 in the graph below.



Under the third condition the demand function is:

$$Q_{SH,t,C3} = 1 - \left(1 - \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)} - \int_0^{1-\frac{P_{RT}-P_{SH}}{\mu(1-\varphi)}} \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)(1-\psi_i)} d\psi_i\right)$$
$$- \left(\int_0^{\frac{P_{SH}+P_{RT}(\mu-1-\mu\ )}{\mu P_{RT}(1-\varphi)}} \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)(1-\psi_i)} d\psi_i\right)$$
$$- (\int_{\frac{P_{SH}+P_{RT}(\mu-1-\mu\varphi)}{\mu P_{RT}(1-\varphi)}}^{1} \frac{P_{SH}}{\mu(\psi_i + \varphi - 1 - \psi_i * \varphi) + 1} d\psi_i)$$

Solve the integrals:

$$Q_{SH,t,C3} = 1 - \left(1 - \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)} - \left[-\frac{P_{RT} - P_{SH}}{\mu(1-\varphi)} * \ln(1-\psi_i)\right]_0^{1-\frac{P_{RT}-P_{SH}}{\mu(1-\varphi)}}\right)$$

$$- \left[-\frac{P_{RT} - P_{SH}}{\mu(1-\varphi)} * \ln(1-\psi_i)\right]_0^{\frac{P_{SH}+P_{RT}(\mu-1-\mu\varphi)}{\mu P_{RT}(1-\varphi)}}$$

$$- \left[\frac{P_{SH}}{\mu(1-\varphi)} * \ln\left(\psi_i(\mu - \varphi\mu) + \mu(\varphi - 1) + 1\right)\right]_{\frac{P_{SH}+P_{RT}(\mu-1-\mu\varphi)}{\mu P_{RT}(1-\varphi)}}^1$$

Simplify:

$$Q_{SH,t,C3} = \frac{P_{RT} - P_{SH}}{\mu(1-\varphi)} \left(\ln\left(\frac{P_{RT} - P_{SH}}{\mu(1-\varphi)}\right) + \ln\left(1 - \frac{P_{SH} + P_{RT}(\mu - 1 - \mu\varphi)}{\mu P_{RT}(1-\varphi)}\right) + 1\right) + \frac{P_{SH}}{\mu(1-\varphi)} * \ln\left(\frac{P_{SH}}{P_{RT}}\right)$$

Just as with the demand function under condition 2 multiply the demand proportion by the proportion of remaining demand such that:

$$Q_{SH,t,C3} = \left(\frac{P_{RT} - P_{SH}}{\mu(1-\varphi)}\left(\ln\left(\frac{P_{RT} - P_{SH}}{\mu(1-\varphi)}\right) + \ln\left(1 - \frac{P_{SH} + P_{RT}(\mu - 1 - \mu\varphi)}{\mu P_{RT}(1-\varphi)}\right) + 1\right) + \frac{P_{SH}}{\mu(1-\varphi)} * \ln\left(\frac{P_{SH}}{P_{RT}}\right)\right) * \left(1 - \sum_{i=0}^{t-1} S_{real,t}\right)$$

6.2 Retail and second-hand market demand derivation (without risk on the second-hand market)

This section outlines the derivation of the retail market and second-hand demand function given the following information:

$$Consumers\ have\ unit\ demand.$$

$$u_{RT,i} = v_{real,i} - P_{RT}$$

$$u_{SH,i} = (v_{real,i} - P_{SH})\big(1 - (\mu - \mu\psi_i)\big) + \big(\varphi v_{real,i} - P_{SH}\big)(\mu - \mu\psi_i)$$

$$As\ no\ risk\ is\ present\ on\ the\ second\ hand\ market, \qquad \mu = 0\ \ so:$$

$$u_{SH,i} = v_{real,i} - P_{SH}$$

$$v_{real,i} \sim unif(0,1)$$

$$population\ size\ is\ normalized\ to\ 1$$

Consumers demand from the retail market if:

$$u_{RT,i} > u_{SH,i}\ and\ u_{RT,i} > 0$$

So if:

$$v_{real,i} - P_{RT} > v_{real,i} - P_{SH}$$

$$P_{RT} < P_{SH}$$

And,

$$v_{real,i} - P_{RT} > 0$$

$$v_{real,i} > P_{RT}$$

If the prices on the retail and second-hand market are equal the demand is split evenly between the two markets.

Since $v_{real,i} \sim unif(0,1)$, the demand function of the retail market is:

$$Q^{norisk}{}_{RT} = \begin{cases} 1 - P_{RT} - \sum_{i=0}^{t-1} S_{real,t} \ if \ P_{RT} < P_{SH} \\ 0 \ if \ \ P_{RT} > P_{SH} \\ \dfrac{1 - P_{RT} - \sum_{i=0}^{t-1} S_{real,t}}{2} \ if \ P_{RT} = P_{SH} \end{cases}$$

Similarly the demand function of the second-hand market is:

$$Q^{norisk}{}_{SH} = \begin{cases} 1 - P_{SH} - \sum_{i=0}^{t-1} S_{real,t} \ \ if \ P_{RT} > P_{SH} \\ 0 \ if \ \ P_{RT} < P_{SH} \\ \dfrac{1 - P_{SH} - \sum_{i=0}^{t-1} S_{real,t}}{2} \ if \ P_{RT} = P_{SH} \end{cases}$$

Just as in the model in section 2.2, there are many agents selling the good on the second-hand market. The private sellers are therefore price takers and follow the price set by the monopolist producer. As a consequence $P_{RT} = P_{SH}$.

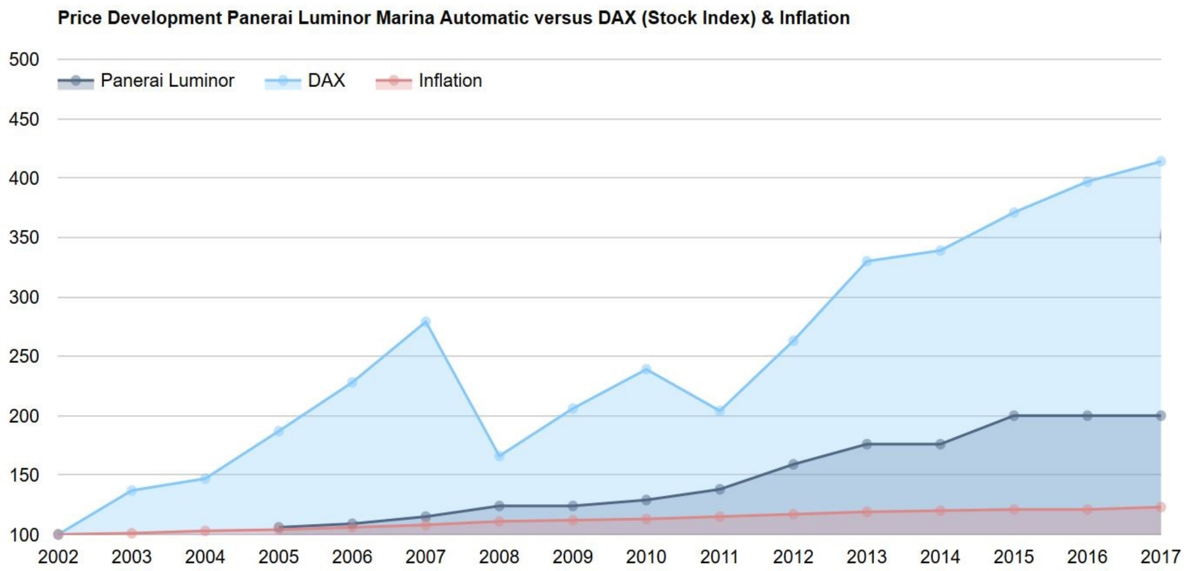
This means that demand for brand new and second-hand goods is the same:

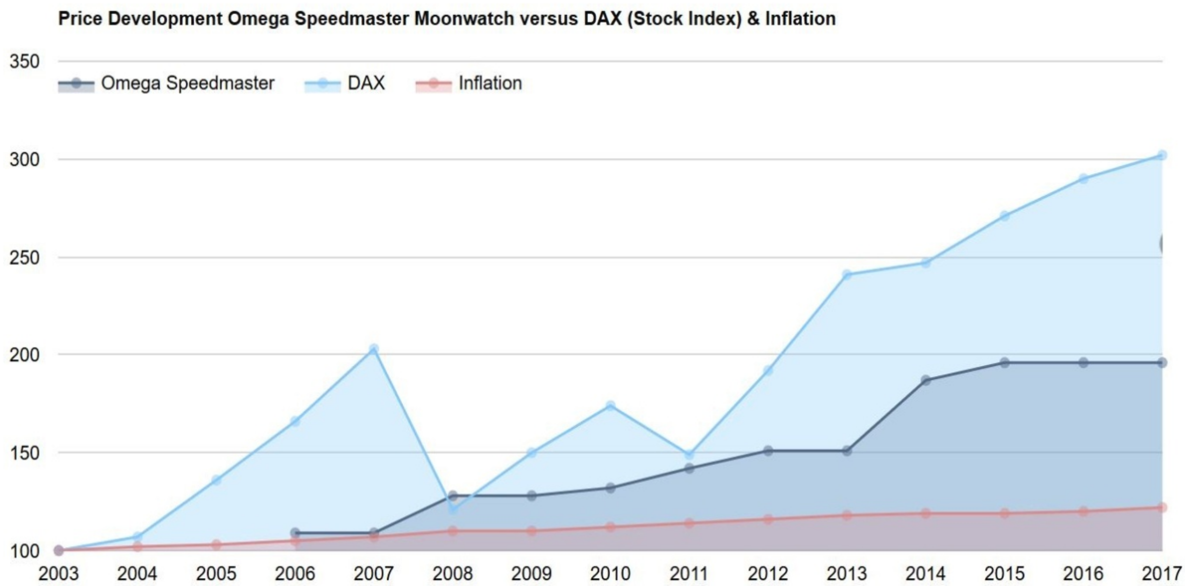
$$Q^{norisk}{}_{RT} = Q^{norisk}{}_{SH} = \frac{1 - P_{RT} - \sum_{i=0}^{t-1} S_{real,t}}{2}$$

The above demand function is only relevant if there are no constraints on the quantity each party can supply.

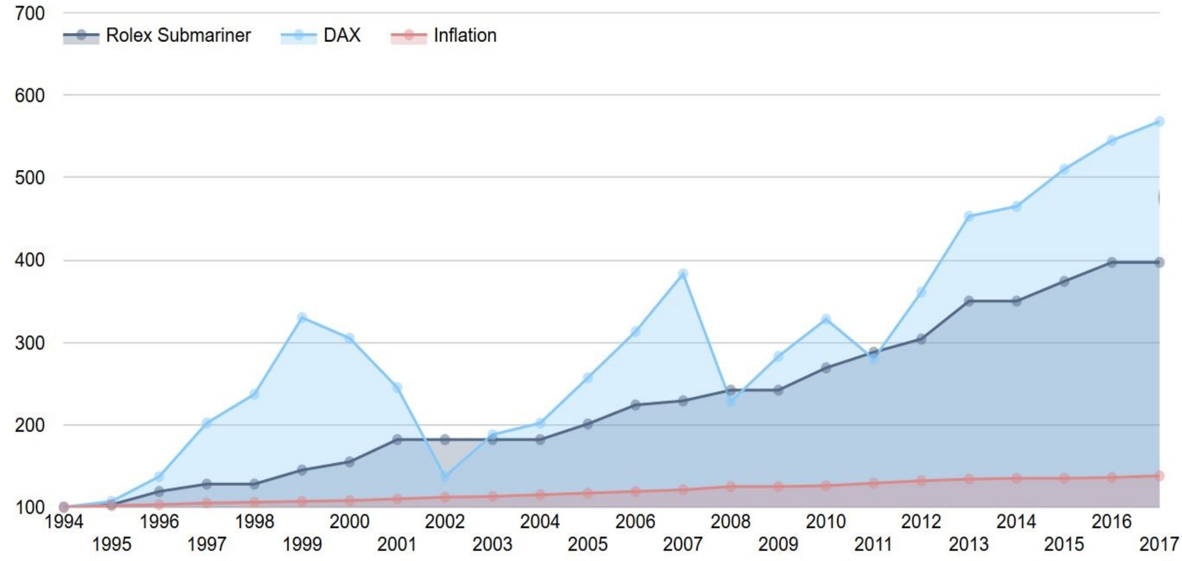
6.3 Examples of retail price changes over time for luxury goods

6.3.1 Luxury watches

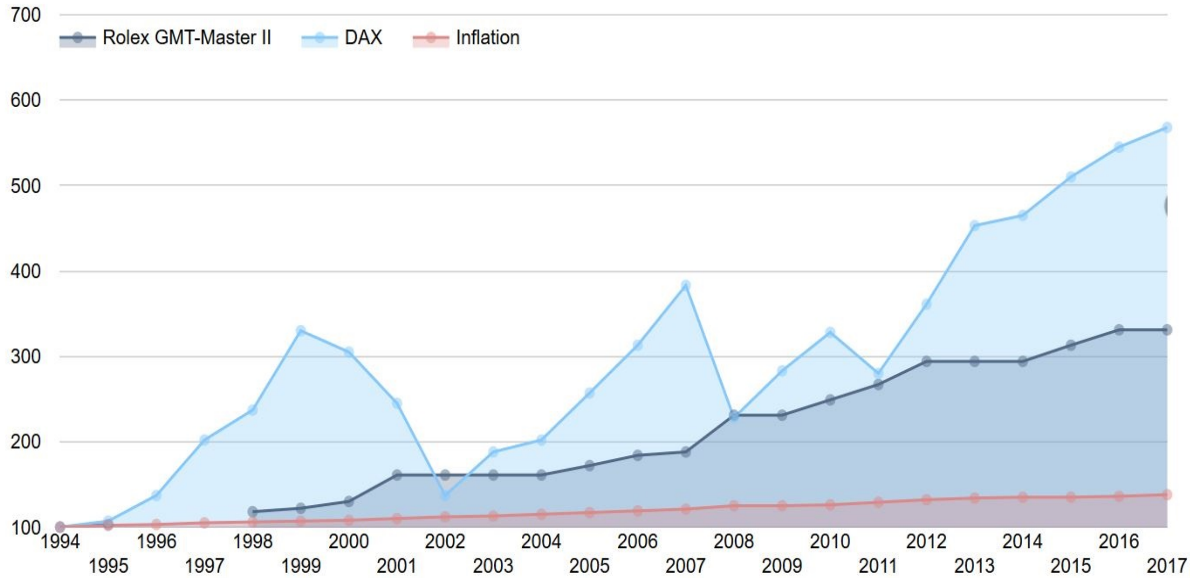




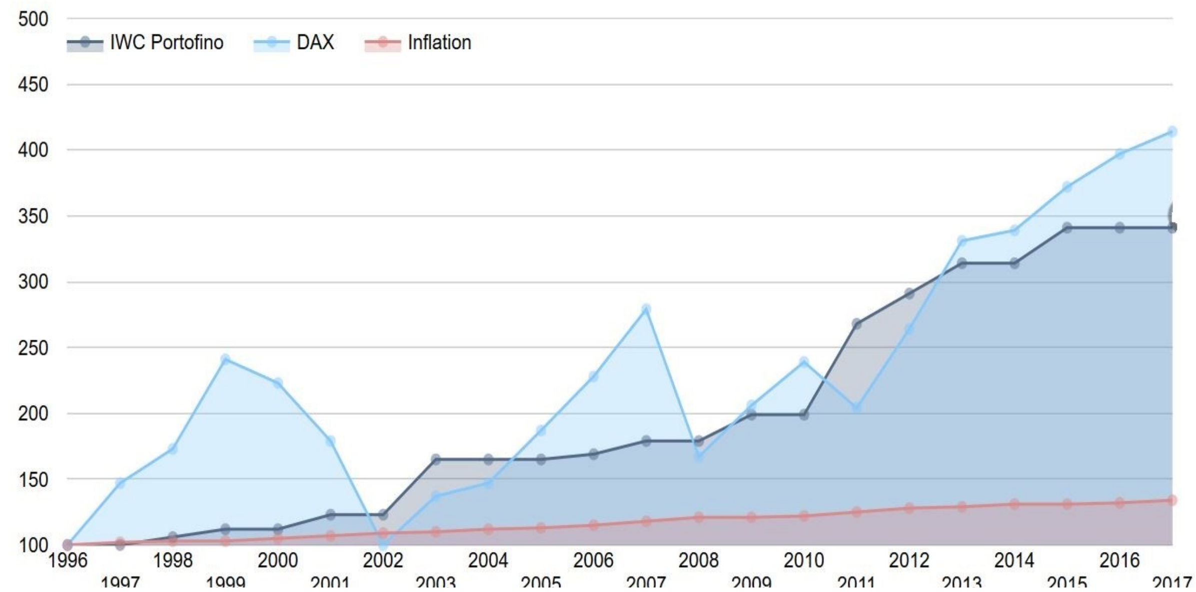
Price Development Rolex Submariner versus DAX (Stock Index) & Inflation



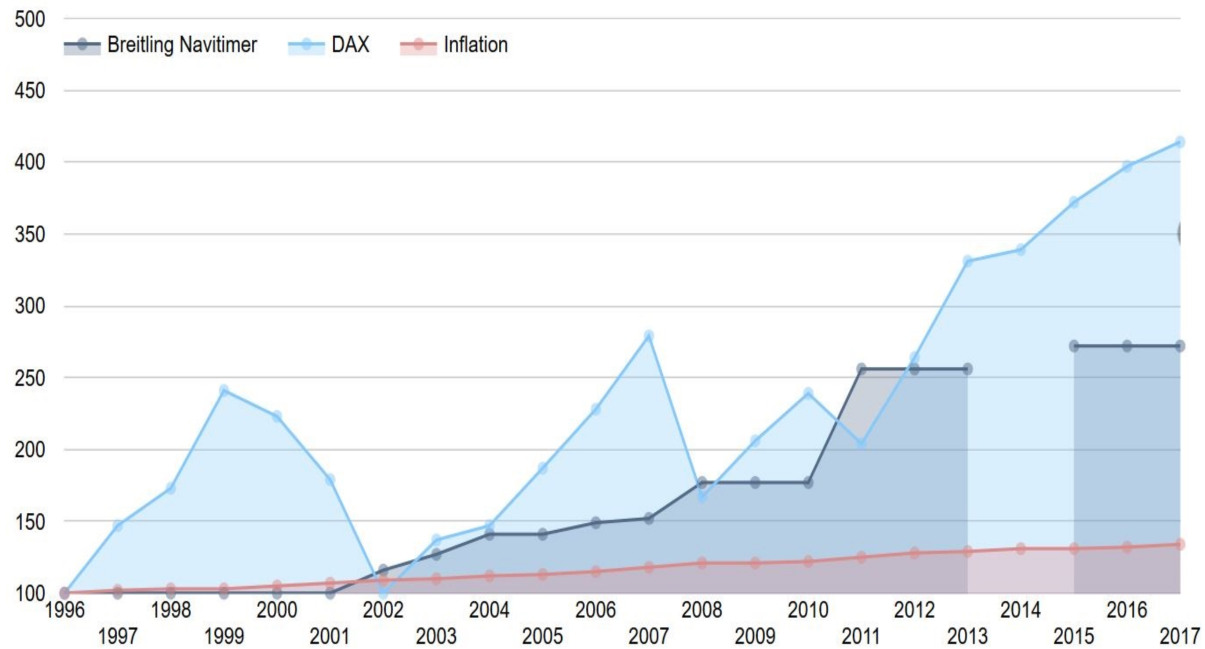
Price Development Rolex GMT-Master II versus DAX (Stock Index) & Inflation

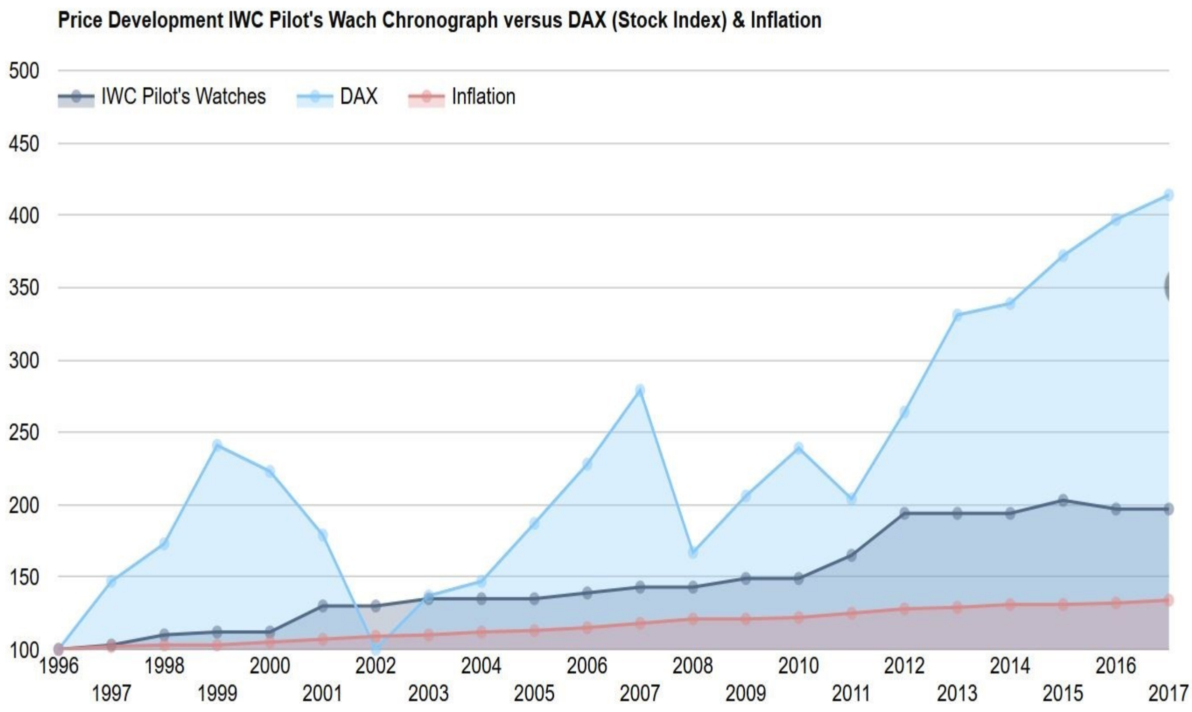


Price Development IWC Portofino Automatic versus DAX (Stock Index) & Inflation



Price Development Breitling Navitimer versus DAX (Stock Index) & Inflation



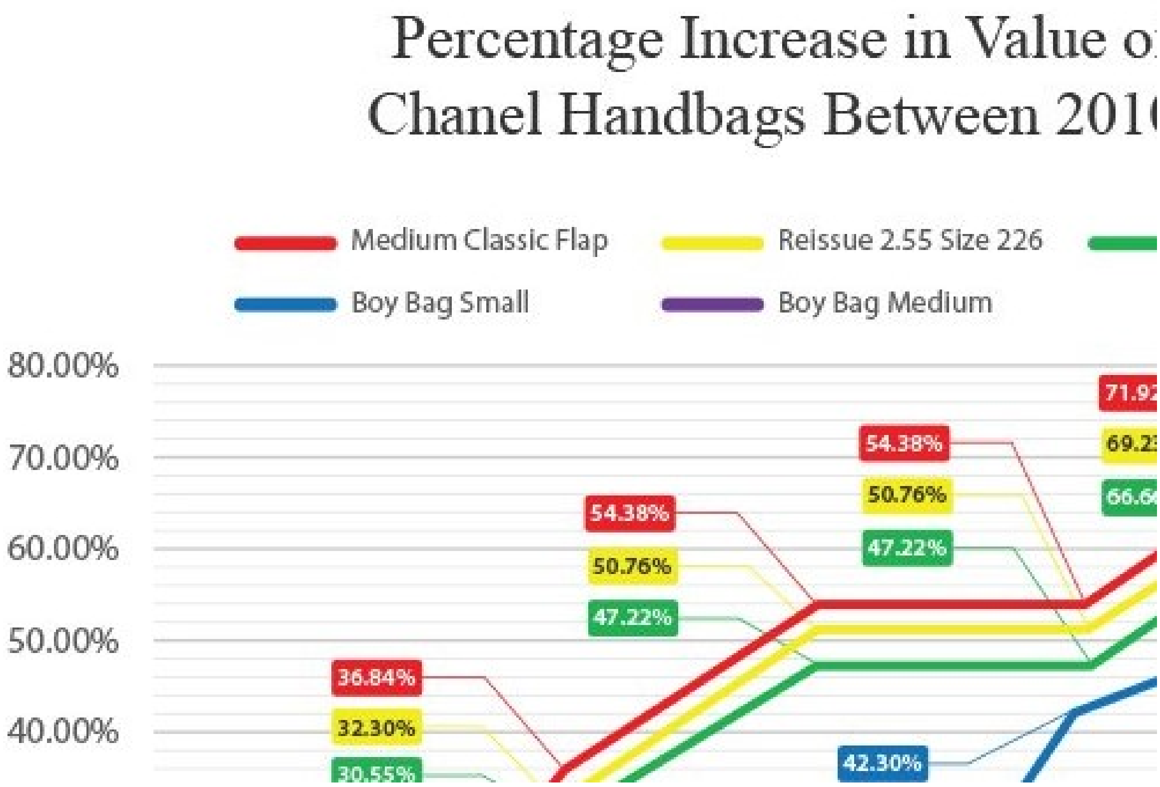


A common feature of luxury watches is that their retail price grows at rate higher than inflation. However the rate of retail price increase is generally lower than that of blue chip stocks although there are periods of exceptions. In the all of the cases above[52], the retail prices have increased consistently even through periods of financial crisis such as in 2007-2008 contrary to stock prices which have fallen.

The graphs above are sourced from Timerating.com (2018). Retail price data was available for more watches, but is omitted due to the short time period for which price data had been collected.

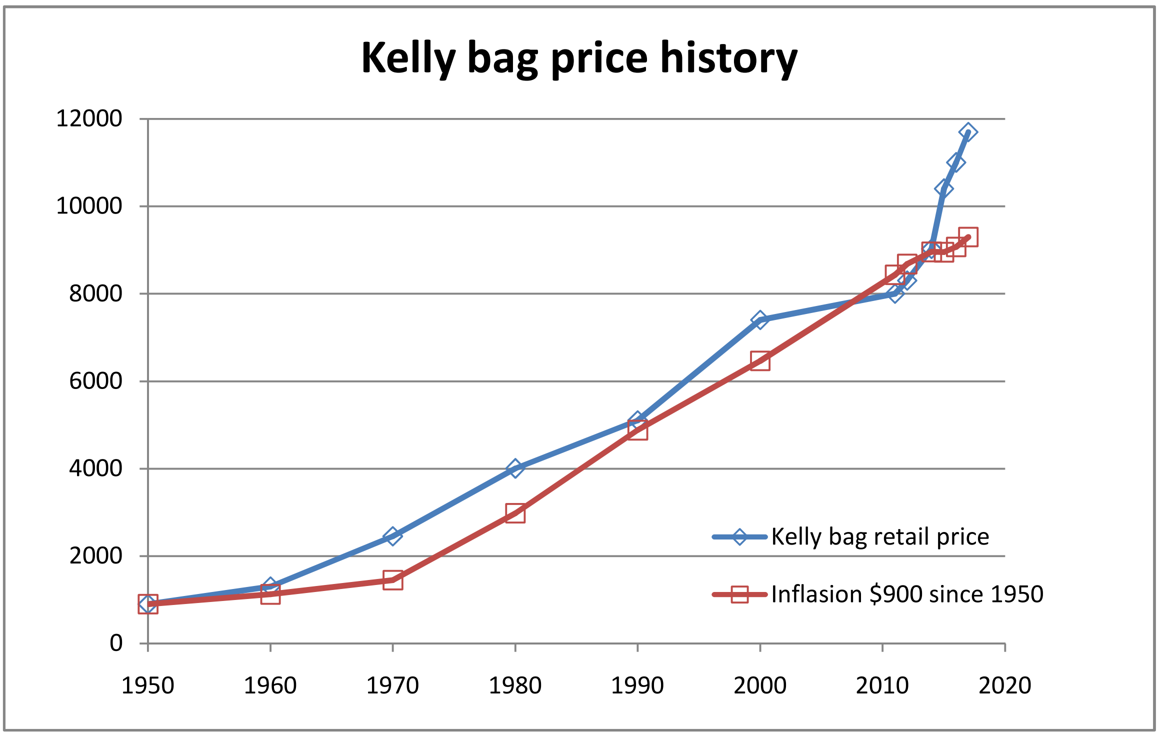
[52] The IWCs' retail prices do not grow but remains steady in times of crisis.

6.3.2 Luxury handbags



The retail history presented in the graph above should be perceived codicillary on it only showing price increases over a relatively short timeframe. More specifically, it is a time period which lack major economic crisis. The 2016 study from baghunter.com which produced the graph does however also include other graphs and data which show the retail pricing only ever increasing since the Chanel Medium Classic Flap Bag was released in 1955. The price increase is also substantially larger than the inflation, meaning that the real retail price has been increasing.

The real retail price increase over time is not exclusive to Chanel bags. Baghunter.com also conducted a study into the price of Hermes bags. They found that the real retail price for the Hermes' Kelly bag has also been continually increasing since 1950. The graph below show the history of retail pricing for the Hermes Kelly bag:



The data represented in the graph above is from Hermesbagprice.com (2018) as well as from Baghunter.com (2014). The inflation has been calculated using the inflation calculator available at data.bls.gov/cgi-bin/cpicalc.pl.

Zoe Brennan (2016) remarked about Hermes bag:

"*Costing an eye-watering £6,000-plus each, these bags are so covetable, they are said to be a better investment than stocks and shares - for unlike a new car or piece of jewellery, they appreciate in value the moment you buy them*"

These luxury handbags fall into a similar category of goods as luxury watches.

6.4 List of abbreviations

MC – Marginal cost

MR – Marginal revenue

p – Price

Q – Quantity

TD – Total demand

v – Value

w/ – With

w/o – Without

w.r.t – With respect to

6.5 Variables

MC_{real}: $The\ marginal\ cost\ facing\ genuine\ producers.$

MC_{fake}: $The\ marginal\ cost\ facing\ counterfeit\ producers.$

p^{i}_{fake}: $The\ probability\ of\ conumser\ i\ to\ buy\ a\ counterfeit\ good.$

P_{SH}: $The\ price\ of\ a\ good\ on\ the\ second-hand\ market.$

P_{RT}: $The\ price\ of\ a\ good\ on\ the\ retail\ market.$

PS_{real}: $Supply\ of\ genuine\ goods\ to\ the\ second\ hand\ market\ by\ private\ individuals.$

Q_{real}: $Demand\ for\ goods\ from\ the\ retail\ market.$

Q_{fake}: $Demand\ for\ goods\ from\ the\ second-hand\ market.$

S_{real}: $Supply\ of\ genuine\ goods\ to\ the\ retail\ market\ by\ genuine\ producers.$

S_{fake}: $Supply\ of\ counterfeit\ goods\ by\ counterfeit\ producers\ on\ the\ second\ hand\ market.$

S_{total}: $Total\ supply\ of\ the\ good\ to\ the\ market.\ (S_{real} + S_{fake} + PS_{real}).$

$v_{fake,i}$: $The\ lifetime\ value\ of\ a\ counterfeit\ good\ to\ individual\ i.$

$v_{real,i}$: $The\ lifetime\ value\ of\ a\ genuine\ good\ to\ individual\ i.$

$dv_{real,i,t}$: $The\ lifetime\ value\ of\ a\ genuine\ good\ to\ individual\ i\ adjusted\ for\ consumption\ discount\ rate\ at\ period\ t.$

ψ_i: $Expertise\ level\ of\ individual\ i\ (probability\ to\ spot\ a\ fake\ good\ if\ presented\ with\ one).$

λ: $The\ fraction\ of\ real\ goods\ supplied\ in\ all\ previous\ periods, which\ will\ be\ supplied\ on\ the\ second-hand\ market\ in\ the\ current\ period.$

μ: $The\ proportion\ of\ counterfeit\ goods\ to\ genuine\ goods\ on\ the\ second-hand\ market.$

φ: $The\ proportion\ of a\ genuine\ good's\ value\ in\ terms\ of\ the\ value\ of\ a\ counterfeit\ good.$

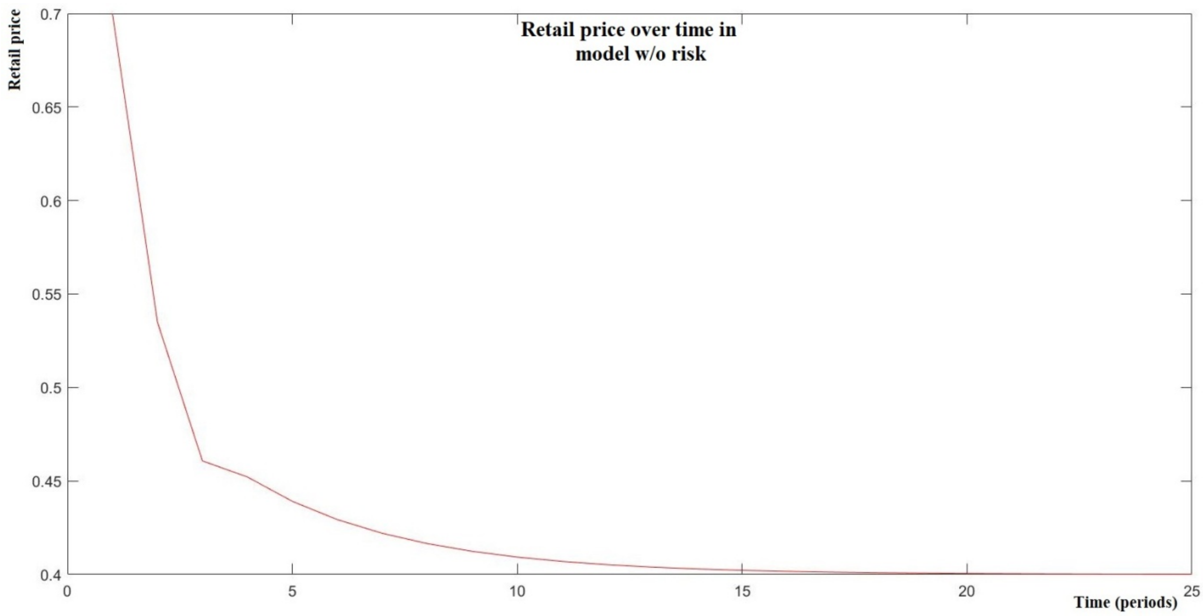
π_{real}: $The\ profit\ to\ the\ genuine\ producer.$

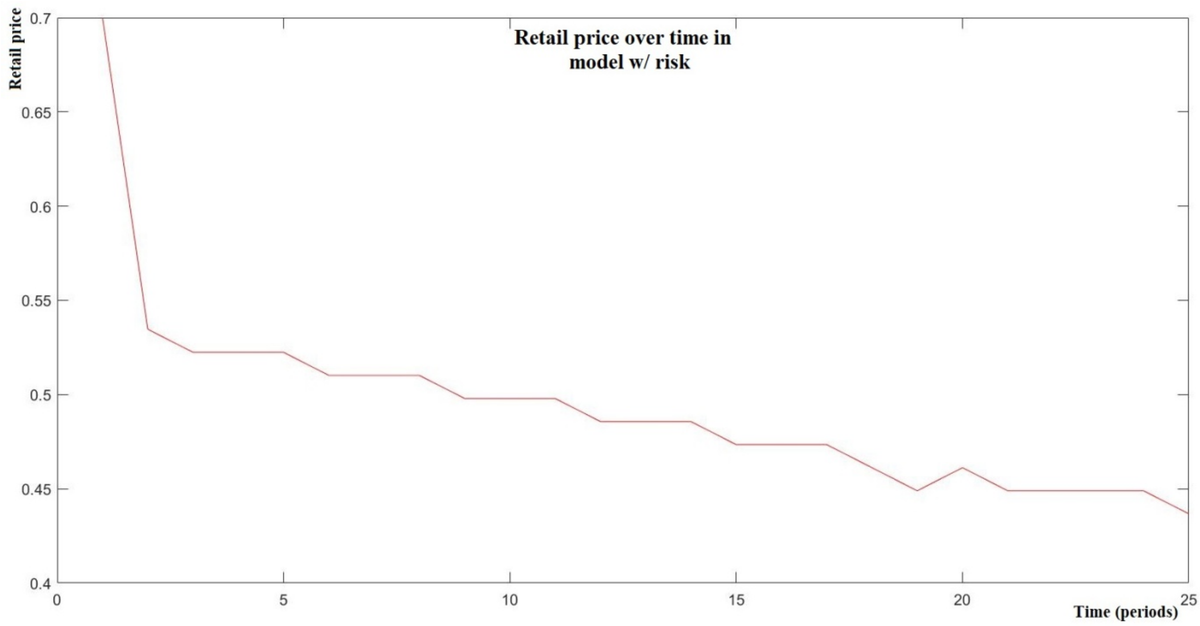
t: $The\ time\ peiod\ index.$

T: $The\ amount\ of\ time\ peiods\ of\ the\ model.$

6.6 Retail price and supply dynamics from Matlab simulations

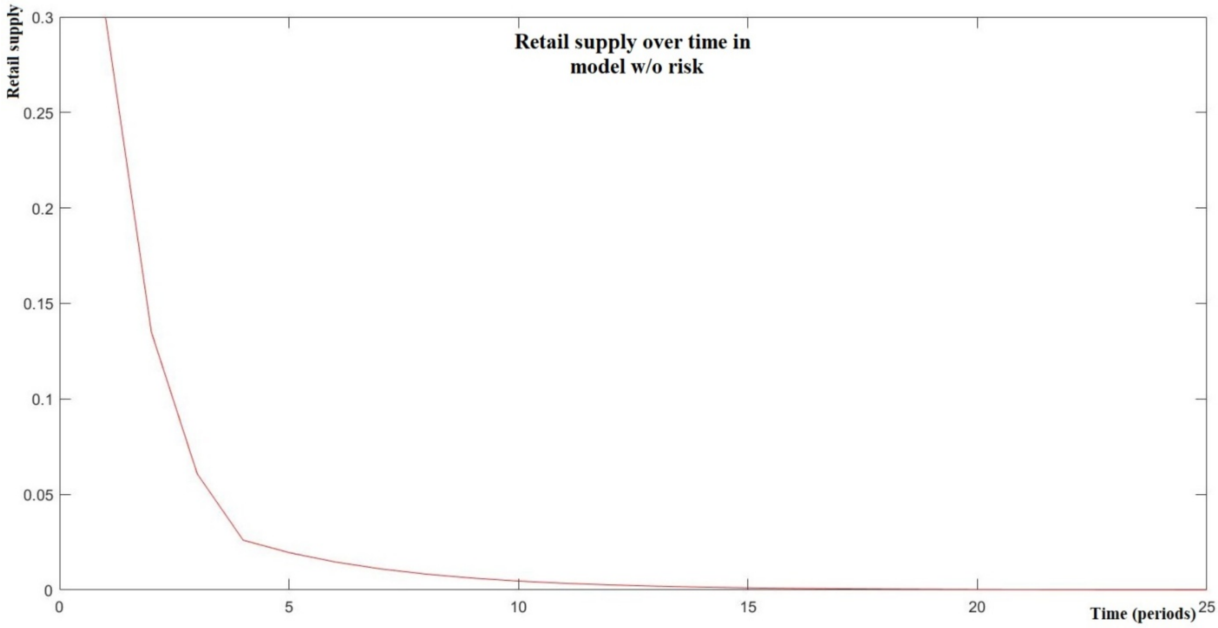
The retail price vectors culminating from Matlab simulations of 25 periods are presented graphically and explained below:

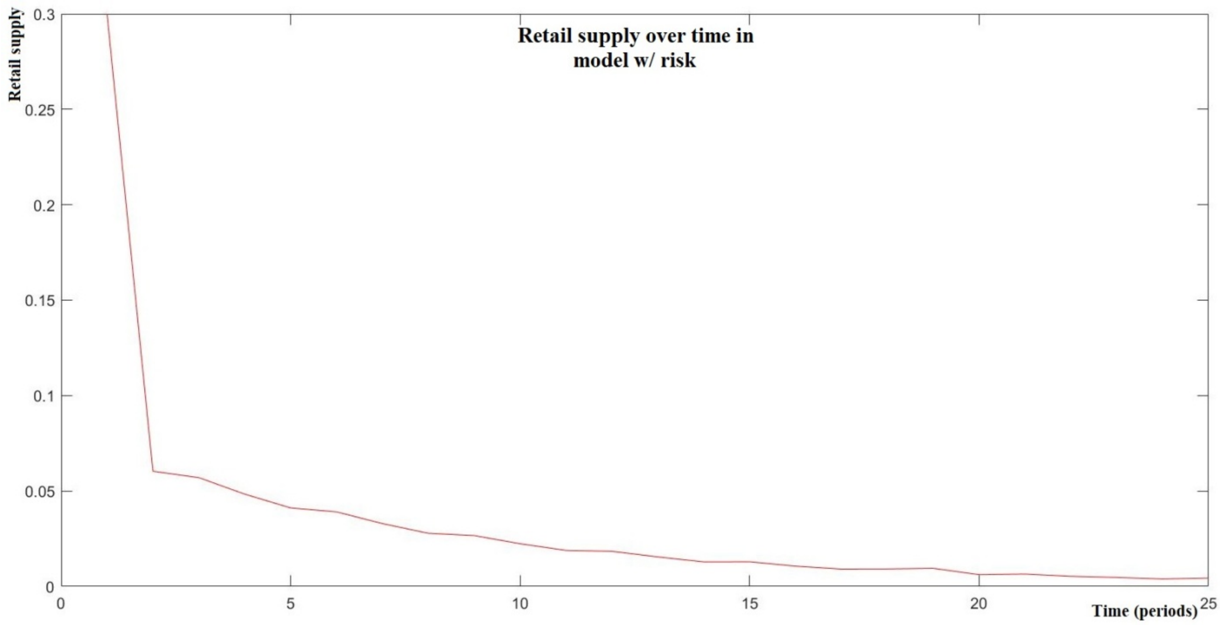




The graphs above demonstrate that the retail price in the model including risk is declining at a slower rate compared to the retail price in the model which excludes risk on the second-hand market. The difference in the rate of decline is a consequence of the second-hand market's lower competitiveness in the model with risk included. So in the model w/ risk, demand is more price inelastic than in the model w/o risk.

The retail supply vectors culminating from Matlab simulations of 25 periods are presented graphically and explained below:





The graphs above show that the genuine producer in a model including risk on the second-hand market is able to supply a larger quantity than a genuine producer in a model excluding risk on the second-hand market. In the model including risk 0.803539 is supplied in the 25 periods compared to 0.599807 supplied in the model excluding risk. The difference in supply is therefore 40.0 percent. The lower supply is a direct consequence of lower demand on the second-hand market. That is because the presence of risk causes the second-hand market to be less attractive and competitive. The simulations above show that a genuine producer has an advantage when there is risk in the second-hand market. Both the retail market price and supply provide insight into the underlying mechanisms behind the correlation between profits and risk shown in section 3.1.

6.7 Model w/ risk adjusted for utility discounting and interest rates

This section outlines the derivation of the retail market and second-hand demand and profit functions given the following information:

$$Consumers\ have\ unit\ demand.$$

$$u_{RT,i} = dv_{real,i} - P_{RT} * (0.97)^{t-1}$$

$$u_{SH,i} = (dv_{real,i} - P_{SH} * (0.97)^{t-1}) * \big(1 - (\mu - \mu\psi_i)\big) + \big(\varphi * dv_{real,i} - P_{SH} * (0.97)^{t-1}\big) * (\mu - \mu\psi_i)$$

$$\mu = \frac{S_{fake}}{PS_{real} + S_{fake}}$$

$$\psi_i \sim unif(0, 1)$$

$$dv_{real,i} \sim unif(0, \left(\frac{1 + T - t}{T * (1.03)^{t-1}}\right))$$

$$population\ size\ is\ normalized\ to\ 1$$

Consumers demand goods from the retail market if they obtain a higher expected level of utility from buying on the retail market compared to buying on the second-hand market:

$$u_{RT,i} \geq u_{SH,i}$$

And if consumers receive a positive level of utility from buying on the retail market[53]:

$$u_{RT,i} \geq 0$$

So if,

$$\begin{aligned} dv_{real,i} - P_{RT} * (0.97)^{t-1} \\ &\geq (dv_{real,i} - P_{SH} * (0.97)^{t-1})\big(1 - (\mu - \mu\psi_i)\big) \\ &+ \big(\varphi * dv_{real,i} - P_{SH} * (0.97)^{t-1}\big)(\mu - \mu\psi_i) \end{aligned}$$

And,

$$dv_{real,i} - P_{RT} * (0.97)^{t-1} \geq 0$$

Simplify:

$$\psi_i \leq \frac{(P_{SH} - P_{RT}) * (0.97)^{t-1}}{dv_{real,i} * \mu(1-\varphi)} + 1 \; or \; dv_{real,i} \geq \frac{(P_{RT} - P_{SH}) * (0.97)^{t-1}}{\mu(1-\varphi)(1-\psi_i)}$$

And,

$$dv_{real,i} \geq P_{RT} * (0.97)^{t-1}$$

As in section 2.2, demand is found through division of the total demand. The method is the same as the one used in section 2.2. It produces the retail demand functions:

Under condition 1: $P_{RT} * (0.97)^{t-1} > \frac{(P_{RT}-P_{SH})*(0.97)^{t-1}}{\mu(1-\varphi)}$:

$$\begin{aligned} Q_{RT,t,C1} = \Bigg(&\frac{1+T-t}{T*(1.03)^{t-1}} + \frac{(P_{SH}-P_{RT})*(0.97)^{t-1}}{\mu(1-\varphi)} * \ln\left(\frac{1+T-t}{T*(1.03)^{t-1}}\right) - P_{RT} \\ &* (0.97)^{t-1} + \frac{(P_{SH}-P_{RT})*(0.97)^{t-1}}{\mu(1-\varphi)} * \ln(P_{RT} * (0.97)^{t-1})\Bigg) * (1 \\ &- \sum_{i=0}^{t-1} S_{real,t}) \end{aligned}$$

[53] A consumer obtains a utility level equal to 0 if she does not purchase from the retail or second-hand market.

Under condition 2: $P_{RT} * (0.97)^{t-1} < \frac{(P_{RT}-P_{SH})*(0.97)^{t-1}}{\mu(1-\varphi)}$:

$$Q_{RT,t,C2} = \left(\frac{1+T-t}{T*(1.03)^{t-1}} + \frac{(P_{SH}-P_{RT})*(0.97)^{t-1}}{\mu(1-\varphi)} * \ln\left(\frac{1+T-t}{T*(1.03)^{t-1}}\right) + \frac{(P_{SH}-P_{RT})*(0.97)^{t-1}}{\mu(1-\varphi)} + \frac{(P_{SH}-P_{RT})*(0.97)^{t-1}}{\mu(1-\varphi)} * \ln\left(-\frac{(P_{SH}-P_{RT})*(0.97)^{t-1}}{\mu(1-\varphi)}\right)\right) * (1 - \sum_{i=0}^{t-1} S_{real,t})$$

Consumers demand goods from the second-hand market if they obtain a higher expected level of utility from buying on the second-hand market compared to buying on the retail market:

$$u_{RT,i} \leq u_{SH,i}$$

And if they receive a positive expected level of utility from buying on the second-hand market[54]:

$$u_{SH,i} \geq 0$$

So,

$$dv_{real,i} - P_{RT} * (0.97)^{t-1} \leq (dv_{real,i} - P_{SH} * (0.97)^{t-1})\big(1 - (\mu - \mu\psi_i)\big) + \big(\varphi * dv_{real,i} - P_{SH} * (0.97)^{t-1}\big)(\mu - \mu\psi_i)$$

And,

$$(dv_{real,i} - P_{SH} * (0.97)^{t-1})\big(1 - (\mu - \mu\psi_i)\big) + \big(\varphi * dv_{real,i} - P_{SH} * (0.97)^{t-1}\big)(\mu - \mu\psi_i) \geq 0$$

[54] A consumer obtains a utility level equal to 0 if she does not purchase from the retail or second-hand market.

Solve for ψ_i and $v_{real,i}$:

$$\psi_i \geq \frac{(P_{SH} - P_{RT}) * (0.97)^{t-1}}{dv_{real,i} * \mu(1-\varphi)} + 1 \; or \; dv_{real,i} \leq \frac{(P_{RT} - P_{SH}) * (0.97)^{t-1}}{\mu(1-\varphi)(1-\psi_i)}$$

And,

$$dv_{real,i} \geq \frac{P_{SH} * (0.97)^{t-1}}{\mu(\psi_i + \varphi - 1 - \psi_i * \varphi) + 1} \; or$$

$$\psi_i \geq \frac{P_{SH} * (0.97)^{t-1} + \mu * dv_{real,i} - dv_{real,i} - \mu * dv_{real,i} * \varphi}{dv_{real,i} * \mu(1-\varphi)}$$

Yet again, demand is found through division of the total demand such that:

$$\begin{aligned} Q_{SH} = {} & \frac{1+T-t}{T*(1.03)^{t-1}} \\ & - max\left(0, \left(1 - \frac{(0.9991)^{t-1} * T * (P_{RT} - P_{SH})}{\mu(1+T-t)(1-\varphi)}\right) * \frac{1+T-t}{T*(1.03)^{t-1}}\right. \\ & \left. - \int_0^{\max\left(0,\; 1 - \frac{(0.9991)^{t-1} * T * (P_{RT} - P_{SH})}{\mu(1+T-t)(1-\varphi)}\right)} \frac{(P_{RT} - P_{SH}) * (0.97)^{t-1}}{\mu(1-\varphi)(1-\psi_i)} d\psi_i \right) \\ & - \left(\int_0^{\max\left(0,\; \frac{P_{SH} + P_{RT}(\mu - 1 - \mu\varphi)}{\mu P_{RT}(1-\varphi)}\right)} \frac{(P_{RT} - P_{SH}) * (0.97)^{t-1}}{\mu(1-\varphi)(1-\psi_i)} d\psi_i \right) \\ & - \left(\int_{\max\left(0,\; \frac{P_{SH} + P_{RT}(\mu - 1 - \mu\varphi)}{\mu P_{RT}(1-\varphi)}\right)}^{1} \frac{P_{SH} * (0.97)^{t-1}}{\mu(\psi_i + \varphi - 1 - \psi_i * \varphi) + 1} d\psi_i \right) \end{aligned}$$

The above function is found using the same steps as in section 2.2. They produce second-hand demand functions:

$$Q_{SH,t,C2} = \left(\frac{1+T-t}{T*(1.03)^{t-1}} - \left(1 - \frac{(0.9991)^{t-1}*T*(P_{RT}-P_{SH})}{\mu(1+T-t)(1-\varphi)}\right)*\frac{1+T-t}{T*(1.03)^{t-1}} - \frac{(P_{RT}-P_{SH})*(0.97)^{t-1}}{\mu(1-\varphi)}*\ln\left(\left|-\frac{(0.9991)^{t-1}*T*(P_{RT}-P_{SH})}{\mu(1+T-t)(1-\varphi)}\right|\right) + \frac{P_{SH}*(0.97)^{t-1}}{\mu(1-\varphi)}*\ln\left(|\mu(\varphi-1)+1|\right)\right)*(1-\sum_{i=0}^{t-1}S_{real,t})$$

When

$$\frac{P_{SH}+P_{RT}(\mu-1-\mu\varphi)}{\mu*P_{RT}*(1-\varphi)} < 0 < 1 - \frac{(0.9991)^{t-1}*T*(P_{RT}-P_{SH})}{\mu(1+T-t)(1-\varphi)}$$

And,

$$Q_{SH,t,C3} = \left(\frac{1+T-t}{T*(1.03)^{t-1}} - \left(1 - \frac{(0.9991)^{t-1}*T*(P_{RT}-P_{SH})}{\mu(1+T-t)(1-\varphi)}\right)*\frac{1+T-t}{T*(1.03)^{t-1}} - \frac{(P_{RT}-P_{SH})*(0.97)^{t-1}}{\mu(1-\varphi)}*\ln\left(\left|-\frac{(0.9991)^{t-1}*T*(P_{RT}-P_{SH})}{\mu(1+T-t)(1-\varphi)}\right|\right) + \frac{(P_{RT}-P_{SH})*(0.97)^{t-1}}{\mu(1-\varphi)}*\ln\left(\left|1-\frac{P_{SH}+P_{RT}(\mu-1-\mu\varphi)}{\mu P_{RT}(1-\varphi)}\right|\right) + \frac{P_{SH}*(0.97)^{t-1}}{\mu(1-\varphi)}*\ln\left(\left|\frac{P_{SH}+P_{RT}(\mu-1-\mu\varphi)}{P_{RT}}+\mu(\varphi-1)+1\right|\right)\right)*(1-\sum_{i=0}^{t-1}S_{real,t})$$

When

$$0 < \frac{P_{SH}+P_{RT}(\mu-1-\mu\varphi)}{\mu*P_{RT}*(1-\varphi)} < 1 - \frac{(0.9991)^{t-1}*T*(P_{RT}-P_{SH})}{\mu(1+T-t)(1-\varphi)}$$

6.8 Model w/o risk adjusted for utility discounting and interest rates

This section outlines the derivation of the retail market and second-hand demand and profit functions given the following information:

$$Consumers\ have\ unit\ demand.$$

$$u_{RT,i} = dv_{real,i} - P_{RT} * (0.97)^{t-1}$$

$$u_{SH,i} = (dv_{real,i} - P_{SH} * (0.97)^{t-1}) * \big(1 - (\mu - \mu\psi_i)\big) + \big(\varphi * dv_{real,i} - P_{SH} * (0.97)^{t-1}\big) * (\mu - \mu\psi_i)$$

$$As\ no\ risk\ is\ present\ on\ the\ second\ hand\ market, \qquad \mu = 0\ \ so:$$

$$u_{SH,i} = dv_{real,i} - P_{SH} * (0.97)^{t-1}$$

$$v_{real,i} \sim unif(0, \frac{1 + T - t}{T * (1.03)^{t-1}})$$

$$population\ size\ is\ normalized\ to\ 1$$

Consumers demand from the retail market if:

$$u_{RT,i} > u_{SH,i}\ and\ u_{RT,i} > 0$$ [55]

So if:

$$dv_{real,i} - P_{RT} * (0.97)^{t-1} > dv_{real,i} - P_{SH} * (0.97)^{t-1}$$

$$P_{RT} * (0.97)^{t-1} < P_{SH} * (0.97)^{t-1}$$

And,

$$dv_{real,i} - P_{RT} * (0.97)^{t-1} > 0$$

$$dv_{real,i} > P_{RT} * (0.97)^{t-1}$$

[55] And if they receive a positive expected level of utility from buying on the second-hand market

If the prices on the retail and second-hand market are equal the demand is split evenly between the two markets.

Since $v_{real,i} \sim unif(0, \frac{1+T-t}{T*(1.03)^{t-1}})$, the demand function of the retail market is:

$$Q^{norisk}{}_{RT} = \begin{cases} \dfrac{1+T-t}{T*(1.03)^{t-1}} - P_{RT}*(0.97)^{t-1} - \displaystyle\sum_{i=0}^{t-1} S_{real,t} \ \ if\ P_{RT} < P_{SH} \\ 0\ if\ \ P_{RT} > P_{SH} \\ \dfrac{\frac{1+T-t}{T*(1.03)^{t-1}} - P_{RT}*(0.97)^{t-1} - \sum_{i=0}^{t-1} S_{real,t}}{2}\ \ if\ P_{RT} = P_{SH} \end{cases}$$

Similarly the demand function of the second-hand market is:

$$Q^{norisk}{}_{SH} = \begin{cases} \dfrac{1+T-t}{T*(1.03)^{t-1}} - P_{SH}*(0.97)^{t-1} - \displaystyle\sum_{i=0}^{t-1} S_{real,t} \ \ if\ P_{RT} > P_{SH} \\ 0\ if\ \ P_{RT} < P_{SH} \\ \dfrac{\frac{1+T-t}{T*(1.03)^{t-1}} - P_{SH}*(0.97)^{t-1} - \sum_{i=0}^{t-1} S_{real,t}}{2}\ \ if\ P_{RT} = P_{SH} \end{cases}$$

Just as in the model in section 2.2, there are many agents selling the good on the second-hand market. The private sellers are therefore price takers and follow the price set by the monopolist producer. As a consequence it holds that $P_{RT} = P_{SH}$.

This means that demand for brand new and second-hand goods is the same:

$$Q^{norisk}{}_{RT} = Q^{norisk}{}_{SH} = \frac{\frac{1+T-t}{T*(1.03)^{t-1}} - P_{RT}*(0.97)^{t-1} - \sum_{i=0}^{t-1} S_{real,t}}{2}$$

It is important to note that this demand is only relevant if there are no constraints on the amount each party can supply. Just as in section 2.3 capacity constraints should be taken into account. The application of the same steps taken in section 2.3 produces two profit functions:

$$\pi_{monopolist,t} = \begin{cases} \left(P_{RT,t} - MC_{real}\right) * (0.97)^{t-1} * \left(\dfrac{1+T-t}{T*(1.03)^{t-1}} - P_{RT}(0.97)^{t-1} - PS_{real} - \sum_{i=0}^{t-1} S_{real,t}\right) \\ \quad when\ PS_{real} < \dfrac{(\frac{1+T-t}{T*(1.03)^{t-1}} - P_{RT}(0.97)^{t-1} - \sum_{i=0}^{t-1} S_{real,t})}{2} \\ \left(P_{RT,t} - MC_{real}\right) * (0.97)^{t-1} * \left(\dfrac{\frac{1+T-t}{T*(1.03)^{t-1}} - P_{RT}(0.97)^{t-1} - \sum_{i=0}^{t-1} S_{real,t}}{2}\right) \\ \quad when\ PS_{real} > \dfrac{\frac{1+T-t}{T*(1.03)^{t-1}} - P_{RT}(0.97)^{t-1} - \sum_{i=0}^{t-1} S_{real,t}}{2} \end{cases}$$

The price level, and thus also the supply, is chosen by the monopolist to maximize profits just as in the model in section 2.3. The profit optimization is solved using Matlab.

The Matlab simulation code is available upon request to madssk92@gmail.com

The graphic representations of simulated profit, supply and price levels over time for both the models (including discounting) with and without risk is presented and compared in section 3.2.3.

6.9 Abstract translated into German

Dieses theoretische Paper untersucht den Markt dauerhafter Güter. Genauer genommen befasst es sich mit der Thematik wie die Einführung von Risiko, in Form von Produktfälschungen, die Profite der Produzenten beeinflusst. Dieses Paper erarbeitet und vergleicht theoretische Modelle mit und ohne Risiko um zu analysieren, dass die Einführung von Produktfälschungen einen positiven Effekt auf die Profite der Produzenten hat. Die positive Beziehung ist aber abhängig von einem ausreichenden Unterschied in den Grenzkosten der Produktion zwischen den herkömmlichen Gütern und den Fälschungen, als auch dem Wert den Konsumenten aus der wahrgenommenen Lebenszeit der jeweiligen Produkte schöpfen. Wenn diese Differenz relativ gering ist, dann ist die vorher genannte Beziehung negativ.

Die Beziehung zwischen Risiko und dem Profit der Produzenten der echten Güter ist abhängig vom Wettkampf zwischen dem Gebrauchtwarenmarkt und dem Einzelhandel. Zusätzliche Produzenten von Fälschungen, können auf der einen Seite den Wettkampf intensivieren, durch ein zusätzliches Angebot, dass mit den echten Gütern konkurriert oder den Wettbewerb auch verringern, durch das zusätzliche Risiko ein Fälschungsgut zu kaufen. Gegeben einem Set an Parametern, kann das in dieser Arbeit erstellte Modell die Richtung der Beziehung zwischen Risiko und dem Profit der Produzenten der echten Güter zeigen, als auch die Dynamiken des Preises, des Angebots und des Profits.

7. Bibliography

Arrow K. Cooper M., Gollier C., Groom B., Heal G., Newell R., Nordhaus W., Pindyck R., Pizer W., Portney P., Sterner T., Tol R. S. J., Weitzman M. (2013), *Determining Benefits and Costs for Future Generations*, Science, Vol. 341, No. 6144, pp. 349---350

Adams A. (2017), *Despite Consumer Demand, The Luxury Watch Industry Will Have To Shrink Before It Recovers*, Forbes.com, accessed June 2018 from https://www.forbes.com/sites/arieladams/2017/06/23/despite-consumer-demand-the-luxury-watch-industry-will-have-to-shrink-before-it-recovers/#4a840ba72c75

Adams A. (2018), *How The Swiss Luxury Watch Industry Is Dismantling Business Operations In America*, Forbes.com, accessed June 2018 from https://www.forbes.com/sites/arieladams/2018/03/02/the-swiss-luxury-watch-industry-is-dismantling-business-ops-in-america-its-most-important-market/#b739e7669f30

Akerlof G. (1970), *The Market for "Lemons": Quality Uncertainty and the Market Mechanism*, The Quarterly Journal of Economics, Vol. 84, No. 3, pp. 488-500

Baghunter.com (2016), *Chanel Bag Values Research Study: Chanel Handbag Price History and Investment Potential*, published June 2016, accessed September 2018 fromhttps://baghunter.com/pages/chanel-bag-values-research-study

Baghunter.com (2014), *The Investment Value of Hermès*, published September 2014, accessed September 2018 fromhttps://baghunter.com/pages/chanel-bag-values-research-study

Bian X. and Moutinho L. (2011), *The role of brand image, product involvement, and knowledge in explaining consumer purchase behaviour of counterfeits: Direct and indirect effects*, European Journal of Marketing, Vol. 45, No. 2, pp.191-216

Bian X., Wang K. W., Smith A. and Yannopoulou N. (2016), *New insights into unethical counterfeit consumption*, Journal of Business Research, Vol. 69, No. 10, pp. 4249-4258

Blatt, J. (1993), *Battling counterfeit products on the US side of the Pacific Rim*, The International Computer lawyer, Vol. 1, No. 13, pp. 32-33

Brennan Z. (2016), *The bag you are not allowed to buy*, Daily Mail, accessed September 2018 fromhttps://www.dailymail.co.uk/femail/article-3556882/The-bag-not-allowed-buy-covetable-snooty-stores-sell-list-happened-sent-ordinary-women-ask-Hermes-handbag.html

Bulow J. I. (1982), *Durable-Goods Monopolists*, Journal of Political Economy, Vol. 90, No. 2, pp. 314-332

Carty, P. (1994), *Fake's progress*, Accountancy, Vol. 114, No. 1216, pp. 44-46.

Chaudhry P.E. and Walsh M.G. (1996), *An assessment of the impact of counterfeiting in international markets: the piracy paradox persists*, Columbia Journal of World Business, Vol. 31, No. 3, pp. 34-49

Clymer B. (2014), *A Watch Guy's Thoughts On The Apple Watch After Seeing It In The Metal*, Hodinkee, accessed April 2018 fromhttps://www.hodinkee.com/articles/hodinkee-apple-watch-review

Coase R.H. (1972), *Durability and Monopoly*, Journal of Law and Economics, Vol. 15, No. 1, pp. 143-149

Conlisk J., Gerstner E. and Sobel J. (1984), *Cyclic Pricing by a Durable Goods Monopolist*, The Quarterly Journal of Economics, Vol. 99, No. 3, pp. 489-505

Forster J. (2012), *Wanna Buy A Watch? Vintage Vs. New: A Guide For The Perplexed*, Forbes, accessed April 2018 fromhttps://www.forbes.com/sites/jackforster/2012/09/02/wanna-buy-a-watch-vintage-vs-new-a-guide-for-the-perplexed/#410cf3903cfd

Garvin D. A. (1984), *What Does" Product Quality" Really Mean?*, Sloan Management Review, Cambridge, Mass. Vol. 26, No. 1, pp. 25-43

Green D. (2015), *9 beautiful watches that will last a lot longer than the Apple Watch*, Businessinsider.com, accessed July 2018 fromhttps://www.businessinsider.com/9-beautiful-watches-that-will-last-a-lot-longer-than-the-apple-watch-2015-6?r=US&IR=T&IR=T

Grossman G. and Shapiro C. (1988), *Foreign counterfeiting of status goods*, Journal of Economics, Vol. 103, No. 1, pp. 79-100

Harvey M.G. and Ronkainen I.A. (1985), *International counterfeiters: marketing success without the cost and the risk*, Columbia Journal of World Business, Vol. 20, No. 3, Fall, pp. 37-45.

Hermesbagprice.com (2018), accessed September 2018 fromhttp://www.hermesbagprice.com/

Higgins R. S. and Rubin P. H. (1986), *Counterfeit Goods*, Journal of Law and Economics, Vol. 29, No. 2, pp. 211-230

Inflation calculator, accessed September 2018 from https://data.bls.gov/cgi-bin/cpicalc.pl

International Chamber of Commerce (2018), *Counterfeiting & Piracy (BASCAP)*, accessed October 2018 from https://iccwbo.org/global-issues-trends/bascap-counterfeiting-piracy

Kapferer J. N. and Michaut A. (2014), *Luxury counterfeit purchasing: The collateral effect of luxury brands' trading down policy*, Journal of Brand Strategy, Vol. 3, No. 1, pp. 59-70

Keller, K.L. (2013), *Strategic Brand Management*, 4th ed., Pearson, New York, New York

Maman A. F (2009), *Non-deceptive Counterfeiting of Luxury Goods: A Postmodern Approach to a Postmodern (Mis)behaviour*, 4th International Marketing Trends Conference, accessed October 2018 from https://www.scribd.com/document/320649076/Non-Deceptive-Counterfeiting-of-Luxury-Goods-A-Postmodern-Approach-to-a-Postmodern-Mis-Behaviour

Phau I., Prendergast G. and Chuen L.H. (2001), *Profiling brand-piracy-prone consumers: an exploratory study in Hong Kong's clothing industry*, Journal of Fashion Marketing and Management, Vol. 5, No. 1, pp. 45-55

Timerating.com (2018), accessed September 2018 fromhttps://www.timerating.com/en/top-watches/

Tom G., Garibaldi B., Zeng Y. and Pilcher, J. (1998), *Consumer demand for counterfeit goods*, Psychology & Marketing, Vol. 15, No. 5, pp. 405-21

Slade G. (2006), *Made to Break: Technology and obsolescence in America*, Harvard University Press, Cambrigde, Massachusetts

Sloman J. and Wride A. (2009), *Economics*, Seventh Edition, Pearson Education Limited, Essex, England

Stern T. (2014), *How a family can guard a luxury brand*, by Kenyon-Rouvinez D. and Schwass J., IMD.org, accessed June 2018 from https://www.imd.org/research-knowledge/articles/how-a-family-can-guard-a-luxury-brand/

Stokey N. L. (1981), *Rational Expectations and Durable Goods Pricing*, The Bell Journal of Economics, Vol. 12, No. 1, pp. 112-128

Waheed K. Abdul (2017), *Price reduction strategy: Effect of consumers' price unfairness perceptions of past purchase on brand equity*, Asia Pacific Journal of Marketing and Logistics, Vol. 29, No. 3, pp.634-652