Drew University

College of Liberal Arts

"It's Not a Bag. It's a Birkin!"

Can the Demand for Hermès Birkin Bags be Explained Through a Neoclassical Framework?

A Thesis in Economics

by

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Abstract

Women are spending exorbitant amount of money on Birkins; purses made by French fashion house *Hermès* with a starting price of 12,000 USD that goes into the hundreds of thousands at auction. The thesis explores what motivates people to purchase such expensive handbags using two modeling strategies: a single period expected utility model and a dynamic continuous time utility model. The main modeling innovation is the disaggregation of utility into three components: consumption, snob, and gambling. The models provide some intuition with regards to the demand for Birkin bags amongst "average" women as opposed to socialites. The rise of social media provides an explanation on why those from lower income brackets are buying the Birkin: acquiring snob value has become independent of the bag's consumption.

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I. Introduction

On June 12th, 2018, a 2008 Hermès Birkin Bag was sold at British auction house *Christie's* for £162,500[1], breaking the European record for most expensive handbag ever sold at auction. (Busby) The *Himalaya Niloticus* bag was made of Nile crocodile skin, featured a diamond-encrusted 18k white gold lock, and reported to be in "grade-two condition"[2] (i.e. with almost no discernable flaws). This sale did not break the 2017 world record of £253,000[3] for a bag sold at auction, when an almost identical Himalayan Birkin was sold at a *Christie's* event in Hong Kong. (Ibid.) According to *Christie's*, Hermès Birkin Bags—along with the Kelly bag[4]—account for about 90% of global auction sales for handbags, described by the auction house as "the 'undisputed most valuable bag in the world.'" (Ibid.) Following the release of the Birkin by French fashion house Hermès in 1984, the bag has grown to become a status symbol, adorning the arms of famed celebrities such as Victoria Beckham and Kim Kardashian, each of whom have reportedly acquired a collection worth millions of dollars. And according to the *Telegraph UK,* Hermès is the most sought after brand by handbag collectors. Such an observation begs the question: *why is anyone buying such an expensive handbag?*

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[1] Approximately 210,446 USD
[2] For a full list and description of *Christie's* Condition Report Grades, see Table I in Appendix B
[3] Approximately 327,648 USD
[4] The Kelly Bag is a leather handbag designed by Hermès named after American actress Grace Kelly, who popularized the bag.

This paper provides an economic explanation of consumer demand for the Hermès Birkin. The paper proposes a neoclassical economic model that conceptualizes three components of the utility from the Birkin bag: consumption, snob, and gambling.

Section II describes the history of the Hermès Birkin and its primary and secondary markets. Section III summarizes the current state of the literature and the major works used in the thesis. Section IV specifies the two modelling strategies taken: a single period expected utility model and a dynamic continuous time utility model[5]. The single period expected utility model focuses on the gambling component of utility. The dynamic continuous time utility model focuses on the components of utility and their tradeoffs over time. Section V presents the results and interpretation for the optimization of the lifetime dynamic utility model. Section VI concludes with implications for future empirical testing of the model. The conclusion focuses on the rise of social media and its effects on the snob value associated with the Birkin and its implications on demand. The model provides some intuition with regards to the demand for Birkin bags amongst average women as opposed to socialites. Through rethinking consumption value associated with the Birkin, the model suggests implications for those working in the luxury fashion industry in terms of pricing and quantity, as well as for those working in and/or studying corollary markets (e.g. luxury cars, clothing, vacations, etc. …).

[5] The two models are separate due to the difficulty of combining uncertainty and dynamics

II. Market Definition and Overview:

(A) History:

In 1984, English actress and model Jane Birkin was upgraded on an Air France flight from Paris to London when she met then-Hermès CEO, Jean-Louis Dumas. Birkin's belongings proceeded to spill out of her humble straw bag, sparking a conversation with Dumas about her ideal accessory (Leitch). As she recounted to the *Telegraph UK* in 2012, the actress and model drew her design specifications on an airplane sick bag, which she described as "a handbag that is bigger than the Kelly but smaller than Serge [Gainsbourg]'s suitcase." Quickly, Monsieur Dumas designed Birkin's ideal "deep and supple" hold all, with pockets, proposing that he give Birkin the bag for free in exchange for her lending her surname to the design: and thus the Birkin was born. (Ibid.) Figure I in Appendix A displays the Birkin in its four available sizes.

The Birkin arguably played a major role in making Hermès the fashion house it is today. According to Jérôme Lalande, an antique dealer specializing in 20th century leather goods, "it opened Hermès up to new markets and customers, but it also changed the typical Hermès client." (Foreman) According to Lalande, the Birkin was not immediately successful. It only became popular in the late 90s, more than a decade after its initial release, at the dawn of the "It-bag" era[6]. (Ibid.) The Birkin reached its position as the ultimate status symbol when it was featured in a 2001 episode of *Sex and the City*, when

[6] The period between the late 90s to early 2000s is referred to by *Vogue* as the "it-bag" era as several high-priced luxury handbags "became one of the ultimate markers of status and high fashion tastes." (Fraser) Examples of "it-bags" include the Lady Dior (popularized by Princess Diana), the Fendi Baguette, the Chloé Paddington, and, the Hermès Birkin.

Samantha used one of her celebrity client's names to skip the five year waiting list for the handbag[7]. After the episode aired, the Birkin's actual waitlist reportedly tripled in length. (Idacavage)

(B) Primary and Secondary Markets:

Today, the Birkin market is composed of primary and secondary markets. The primary market comprises Birkin bags that are purchased directly from the 304 brick-and-mortar Hermès stores: 122 in Asia, 113 in Europe, 38 in North America, 13 in Latin America, 11 in the Middle East, and 7 in Oceania. The secondary market, on the other hand, includes Birkins purchased through authenticated luxury consignment stores and websites (e.g. *Bag Hunter*, *TheRealReal*, *Rebag*, *Tradesy*, *Vestaire Collective*, etc. …) as well as auction houses (e.g. *Christie's*). The thesis focuses on the secondary market, taking the supply of Birkins on the primary market by Hermès as given.

Birkins differ from other luxury handbags in that new bags cannot be purchased directly off-the-shelf or online[8]. In order to obtain a Birkin, one must have a purchase history with the brand[9] and develop a "relationship" with one of their store associates[10]

[7] The process for purchasing a Birkin is described in Section II (B): Primary and Secondary Markets
[8] Hermès is not the only luxury fashion house to not offer an online shopping option: Chanel, Céline, and Dior similarly do not sell their ready-to-wear clothes and handbags online
[9] Hermès produces 10 product types: leather goods (gloves, belts, wallets, and bags-including the Birkin), scarves and silk accessories, ties, men's and women's wear, fragrance, watches, stationery, shoes, home products (tableware, furniture, wallpaper, etc.), and equestrian gear and apparel
[10] Although this purchase process sounds ripe for bribery, I found no such evidence through my research

(Sherman; Pollak). The store associates would subsequently offer the buyer a spot on a month-to-years long waitlist[11] if they deem them "worthy." (Ibid.)

Each bag is handmade by a single highly-trained artisan, and requires 18 to 25 hours to create. (Ibid.) The bag also comes with lifetime "spa treatment" services, where Hermès sends the bag to Paris for reconditioning. The number of Birkins Hermès produces is limited, although an official number has never been revealed by the fashion house. (Ibid.)

The starting price for a Birkin, as of 2015, in the primary market is around 12,000 USD. The price can go into the hundred thousands, depending on color, leather/skin type, and hardware material. (Kane) In the secondary market, rare colors, exotic skins, and gold hardware garnished with diamonds all tend to add to the resale value. (Ibid.) As for the secondary market, a 2017 study by online luxury handbag marketplace *Bag Hunter* claimed that in just one year, the average Birkin rose 16% in value, with more "exotic" bags fetching up to 20%. The same study also asserted that Birkins have outperformed both the S&P500 and gold in the last 35 years, with an average annual rate of return of 14.2% compared to 11.66% and 1.9%, respectively (see Figures II and III in Appendix A). While auction house *Christie's* handbag specialist, Mathew Rubinger, stated that "a 'carefully used' [Birkin] typically fetches between 80% and 120% of what the previous owner paid for it. In contrast, a lesser brand handbag in the same condition can be resold for only about 10% of what the original owner spent." (Jacobs)

[11] The length of the Birkin waitlist has never been released by Hermès.

(C) Black Market:

Due to the high level of craftmanship required in the production of the Birkin, the bag is difficult to replicate or reproduce, thus making counterfeits easy to recognize. (De Bautista) Hermès has also instilled a policy to destroy any counterfeit bags that they encounter to prevent such bags from circulating the secondary market. Some authenticated luxury consignment stores, such as *TheRealReal* and *Rebag*, have similar policies.

One exception that I found involving counterfeit Birkins occurred in June 2012. Following a year-long investigation resulting from an "Hermès complaint based on clues and abnormal behavior identified through the house's internal monitoring systems," French police dismantled an international crime ring, run by Hermès staff, which produced fake Hermès bags, including the Birkin. (Milligen) The ring made bags in France and had parallel distribution outlets in Europe, the United States, and Asia. The Paris public prosecutor estimated that the criminal enterprise generated 18 million EUR in sales through one branch alone. (Ibid.)

In observing the history of the Birkin and the current state of its primary and secondary markets, one can conclude that the Birkin market is a unique market in the level of snob value it has been able to achieve relative to other luxury brands, and the fashion house's ability to control the black market[12]. The exclusivity attached to the Birkin, along with its admired craftsmanship, and the fact that Hermès tends to increase the starting price for the bag every year, all contribute to the Birkin's standing as a covetable status symbol.

[12] A 2018 article by Fox Business reports that amongst fashion brands, Michael Kors, Nike, Louis Vuitton, and Chanel, are the most counterfeited, with 567, 539, 475, and 419 cases of counterfeiting, respectively.

III. Literature Review:

The current state of the literature spans four areas: literature focusing on consumer behavior within the luxury market, literature modelling luxury consumption in comparable markets, such as the wine and art markets; literature related to gambling and addiction; and non-academic literature from forums and social media posts. The following literature review describes and summarizes the major works used in the thesis, their respective conclusions, and the ways in which they contribute to the analysis.

(A) Literature Examining Consumer Behavior Within the Luxury Market:

Veblen 1899 is widely regarded as the seminal work on modelling luxury consumption. The book, which is entirely theoretical, provides insight into the consumption preferences of the wealthy by describing the emergence and evolution of the leisure class and qualitatively identifying that factors that affect their demand for luxury goods and services. Veblen postulates that conspicuous consumption by the wealthy is mainly motivated by two factors. First, the wealthy flaunt their own prosperity due to their desire to distinguish themselves from the lower class, and invite the "invidious comparison of others" or "pecuniary emulation," where consumers try to emulate the behavior of the classes above them to benefit from status signaling. Second, Veblen theorizes that the leisure class equates the price of goods with their corresponding quality, thus gaining more utility when consuming conspicuous goods and services. Veblen's work gave rise to the two concepts of "Veblen Goods," which are a type of luxury good for which the quantity demanded increases as the price increases, and the "Veblen Effect," which denotes consumers buying higher-priced goods driven by either their belief that the price reflects higher quality or status-seeking desire. Veblen's theories contributed in specifying the utility model in the thesis, wherein one of the variables included is the Veblen Effect.

My research did not uncover much empirical testing of Veblen's theoretical work. One is *Balabanis and Kastanakis 2014*, which experimentally tests Veblen's theories on leisure class behavior and conspicuous consumption through a large-scale survey and statistical exercise that describe the range of different luxury consumption motivations. The paper is split into a qualitative pre-study and a quantitative study. In the qualitative pre-study, Balabanis and Kastanakis conduct interviews with six managers of luxury-good brands to better understand why consumers purchase luxury goods. From these interviews, Balabanis and Kastanakis identify five luxury consumption motivations: hedonism, quality-seeking, snob factor, the Veblenian effect, and bandwagon consumption[13]. In the quantitative study, Balabanis and Kastanakis survey 431 luxury consumers from six randomly-chosen postcode areas in London[14] with 113 measures in the form of seven-point Likert scales indicating the likelihood of purchasing a luxury good. These 113 questions contain items/key words that measure the five luxury consumption motivations.

[13] The authors define the terms as follows:

- Hedonism: defined by the authors as the trait of pleasure seeking from the consumption of a luxury brand
- Quality-seeking: also referred to as "consumer perfectionism," refers to seeking luxury goods based on the perception of their higher quality
- Snob factor: defined by the authors to be when the preference for a good increases as its rarity increases
- Bandwagon consumption: when consumer preference for a good increases as the number of people buying it increases

[14] Since the Balabanis and Kastanakis study was done in London, we cannot generalize their findings to broader segments of the global market, especially when considering substantial demand for Birkins from East Asia.

In addition, questions include items measuring consumers' personality traits, such as self-concept, status-seeking, conformity, vanity, need-for-uniqueness, consumer-perfectionism, fashion-consciousness, and narcissism. For example: "I would buy a product just because it has status" and "When buying products, I generally purchase those brands that I think others will approve of" measure status-seeking and conformity, respectively. Balabanis and Kastanakis use structural equation modelling analysis with maximum likelihood estimation to find the relationship between the consumption behaviors and personality traits. They conclude that conspicuous consumption patterns are heterogenous, with all five identified motivations significantly influencing consumer behavior. Balabanis and Kastanakis' work provides a psychological overview of the leisure class and luxury consumption. Their surveys provide anecdotal evidence for the qualitative analysis within the thesis as well as background for the variables in the utility model.

(B) Literature Modelling Conspicuous Consumption:

Pollak 1977 models the Veblen Effect by incorporating price-dependent preferences into the utility function. The model distinguishes between market prices, P^M, which are the prices that enter the budget constraint, and "normal prices," P^N, a term Pollak uses to mean the prices that affect preferences. The assumption is that prices can affect preference in two ways: higher prices enhance the snob appeal of goods, and higher prices simply signal higher quality product. Unfortunately, Pollak demonstrates that the theory of including price dependent preference in the utility function cannot translate into a testable hypothesis. Pollak's conclusion is helpful in explaining why there is little empirical testing of Veblen's theory of conspicuous consumption.

Mandel 2009 formalizes Veblen's theory of utility/satisfaction derived from conspicuous consumption. He specifies a general equilibrium model for the art market. His utility function proposes the idea of a "utility dividend" as a special feature of demand for luxury goods. His model also explores the dual nature of art as a consumption and investment good by including expected capital gains in the wealth constraint and the utility dividend in the utility maximization function. Mandel's model differs from Pollak's in that price solely acts as a function of investment, not for status signaling. In the Mandel model, an individual's utility maximization is defined to be the utility from an individual's choice of consumption levels today, c_t, and art in the future, a_{t+1}, where $a_t p_t^a$ is the value of the individual's art collection, given current price realizations.

$$\max_{c_t, b_{t+1}, s_{t+1}, a_{t+1}} E_0 \left[\sum_{t=0}^{\infty} \beta^t u(c_t, a_{t+1}, a_t p_t^a) \right]$$

Mandel concludes that the price of art is affected by the utility derived from the two dynamics of consumption and investment. Although Mandel's paper specifies a general equilibrium model and not a partial demand model, his paper served as a basis for how I thought of the dual nature of the Birkin as a consumption good and investment vehicle.

(C) <u>Literature Related to Gambling:</u>

In the expected utility model of my thesis, I propose that the utility from owning a Birkin is derived from the value of investing in the bag, which is much akin to the utility from gambling[15]. *Von Neuman and Morgenstern 1944*, the seminal work on expected

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[15] In his paper, Conlisk defines gambling as accepting a risky prospect, "whether it be a gamble (such as a casino game), or something else (such as an investment opportunity)." (250)

utility theory, remark that their theory[16] cannot incorporate the utility of gambling without contradiction, mainly due to the lack of what they described to be a "refined system of psychology." The contradiction they allude to is in reference to the assumption of convex preferences, where risk aversion and gambling are incompatible. Nonetheless, many have tried to mathematically formalize a model for the utility of gambling.

Conlisk 1993 mathematically formalizes a model for the utility of gambling by maintaining the expected utility theory's underlying assumptions and restrictions while incorporating a small utility from gambling:

$$E(G,p,K) = pU[K+G] + (1-p)U[K-Gp(1-p)^{-1}] + \varepsilon V(G,p)$$

Where p is the probability of gain G, and K denotes the individual's initial wealth. Thus, the Conlisk model states that the expected utility, $E(G,p,K)$, of an individual given a risky prospect, (G,p), equals his ordinary expected utility plus his utility of gambling, $V(G,p)$. The utility of gambling is assumed to satisfy the Law of Diminishing Marginal Utility as it is increasing at a negative rate, i.e. $V_1(G,p) > 0$, $V_{11}(G,p) < 0$ [17]. The individual is assumed to accept the risky prospect if and only if the expected utility from the gains is higher than that from his wealth only: $E(G,p,K) > E(0,0,K) = U(K)$. The expected utility model presented in the thesis is based on the Conlisk paper.

The American Psychiatric Association diagnostic manual, DSM-5, classifies gambling as an addictive activity. *Becker and Murphy 1988* develop a theory of rational

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16 The Vonn Neumann-Morgenstern utility theorem states that expected utility is the weighted average of the utilities of the different possible outcomes. In other words: we make decisions based on expected utility, not on the nominal expected value of a gamble.

17 $V_1(G,p)$ denotes the first derivative, an $V_{11}(G,p)$ denotes the second derivative

addiction, where rationality denotes a "consistent plan to maximize utility over time." They construct a dynamic lifetime utility function for an individual whose utility is dependent on two goods, one of which is assumed addictive. Their key modelling contribution is that the current utility from the addictive good depends on a measure of past consumption of the good. The authors make the implication that in order to maximize utility over time, consumption levels of an addictive good must also increase over time. In other words, addictive goods have a diminishing marginal rate of utility and thus meet the standard concavity assumptions stated in the Law of Diminishing Marginal Utility; this is consistent with the Conlisk model on the utility from gambling. Becker and Murphy conclude that permanent changes in the prices of addictive goods "may have a modest short-run effect on the consumption of addictive goods."

(D) <u>Non-Academic Sources:</u>

In addition to academic literature, I used anecdotes from purse discussion forums and YouTube videos. There exists a large online community dedicated to discussing the various luxury handbags on the market, including the Birkin. The Purse Forum was launched in late 2005 as an addition to the popular fashion review site, *Purse Blog*. The addition of the Purse Forum enabled "members to expand upon the conversations that were started on Purse Blog, as well as start their own." There are currently over 135,000 members of the Purse Forum. As of March 2019, Hermès, the maker of the Birkin, has 36.1 thousand threads with 2.87 million posts on the site. Through scouring through these forums and videos, I was able to find anecdotal evidence for the theory I present in the thesis, particularly with regards to the variables specified in the utility function.

IV. Economic Models

The paper employs two different modelling strategies: a single period expected utility model based on Conlisk, and a dynamic continuous time utility model. The two modelling strategies are used for different purposes. The single period expected utility model provides intuition into the expected utility from gambling aspect of Birkins. The continuous time utility model provides dynamic analysis of the different components of utility that arise from purchasing a Birkin. The two models are separate due to the difficulty of combining uncertainty and dynamics. Both models use the same notation, which is discussed in Section V (A) prior to describing the models. A comprehensive list of all the variables and their definitions is summarized in Table II in Appendix B.

(A) Model Background:

The paper theorizes that the utility from owning a stock of Birkins, $U(\mathbb{B})$, contains three components: the consumption value of the Birkin, B^C, the wealth signaling/snob value from owning the Birkin, B^S, and the gambling thrill value from prospective returns on the Birkin, B^G. $\mathbb{B}$ is the stock value of Birkins that measures both the quantity of bags and their quality. The units of B^C, B^S, and B^G are time units denoting time spent on attaining each component of utility from the stock value.

The consumption value of the Birkin, B^C, denotes the functional use of the Birkin similarly to any other handbag. For example, carrying personal items in a Birkin or using it as a fashion accessory gives Birkin owners consumption value.

The term B^S denotes the utility from the wealth signaling/snob value of owning a Birkin. Birkin owners enjoy snob value when carrying a Birkin to important social events.

This term comes from Veblen, who claims that “refined tastes are a voucher of a life of leisure” since they require time, application, and expense. (29) Veblen’s account of “refined tastes” exemplifies the Birkin, which similarly requires time and application to attain, and is expensive to purchase. The snob/signaling effect, B^S, specified in the model can also be seen in Veblen when he states “in order to stand well in the eyes of the community, it is necessary to come up to a certain, somewhat indefinite, conventional standard of wealth … if these articles of consumption are costly, they are felt to be noble and honorific.” (25;50) The same sentiment that Veblen expressed back in 1899 can be seen today when scouring through the *Purse Forum*. Users point to their Birkin as an “ultimate status symbol”; one user recalls how people “randomly come up [to me] to touch my baby and try to grab at her.” (Hermasaholic; angelicskater16) Another user states that when carrying her Birkin she feels as though she is “wearing couture.” (birkel)

Many users receive this snob value from the Birkin through social media rather than pure consumption. The rise of social media has enabled Birkin owners to flaunt their bags online and getting snob value, without running the risk of damaging the Birkin and devaluing it. The *Purse Forum* contains tens of forum pages dedicated to users revealing their Birkins and unboxing their purchases for compliments. Similarly, YouTube videos of Birkin unboxings are particularly popular, with many boasting hundreds of thousands of views. Further, notable Birkin collectors, such as Jamie Chua, Victoria Beckham, and Kris Jenner have massive displays of their Birkins that adorn their popular Instagram pages and YouTube “closet tours.”

Other users also point to the thrill value that comes with the potential returns they could make on the secondary market, which is denoted as the gambling value, B^G. The gambling value from owning an Hermès bag can be seen in the many commentators who justify their exorbitant purchase as a "great investment" and an "excellent investment, so it won't hurt if you buy more than one." (Kyokei; Sparkel) Other users note that "[the Birkin]" and that "[Birkin] hold their value far better." (GLX; Tonimichelle)

Thus, in order to model demand from the utility of owning a stock of Birkins, $\mathbb{B}$, I specify the three aforementioned components to utility: the consumption value of the Birkin, B^c, the snob value of owning the Birkin, B^S, and the thrill value from "gambling' on the prospective returns on the Birkin, B^G

(B) Expected Utility Model:

The first modelling approach is a single period expected utility model based on Conlisk, the purpose of this model is to focus on the gambling component of utility. Recall the Conlisk model, where p is the probability of gain G, and K denotes the individual's initial wealth:

$$E(G,p,K) = pU[K+G] + (1-p)U[K - Gp(1-p)^{-1}] + \varepsilon V(G,p)$$

The corollary in my model is the expected utility from owning a Birkin, which is the probability of investment gains $(\mathbb{B}B_2^M - \mathbb{B}B_1^M)$ and losses $(\mathbb{B}B_1^M - \mathbb{B}B_2^M)$ from selling the bag on the secondary market, where $\mathbb{B}B_2^M > \mathbb{B}B_1^M$. B^M is the market price of the Birkin and Z is the consumption value of a composite good of price normalized to 1 USD the consumption value of the Birkin. B^C is the consumption value of the Birkin, B^S is the wealth signaling/snob value of owning the Birkin, and B^G is the gambling value on prospective returns on the Birkin:

$$E[U] = pU[Z + (\mathbb{B}B_2^M - \mathbb{B}B_1^M)] + (1-p)U[Z + (\mathbb{B}B_2^M - \mathbb{B}B_1^M)] + U(B^C, B^S, B^G);\ \mathbb{B}B_2^M > \mathbb{B}B_1^M \quad (1)$$

Where the gambling prospect (the Birkin) satisfies the zero expected value condition. i.e. is fair:

$$p(\mathbb{B}B_2^M - \mathbb{B}B_1^M) + (1-p)(\mathbb{B}B_1^M - \mathbb{B}B_2^M) = 0 \quad (2)$$

$$p(\mathbb{B}B_2^M - \mathbb{B}B_1^M) = -(1-p)(\mathbb{B}B_1^M - \mathbb{B}B_2^M) \quad (3)$$

$$-p(1-p)^{-1}(\mathbb{B}B_2^M - \mathbb{B}B_1^M) = (\mathbb{B}B_1^M - \mathbb{B}B_2^M) \tag{4}$$

Therefore, the expected utility model can be written as such:

$$\begin{aligned} E[U] &= pU[Z + (\mathbb{B}B_2^M - \mathbb{B}B_1^M)] \\ &+ (1-p)U[Z - p(1-p)^{-1}(\mathbb{B}B_2^M - \mathbb{B}B_1^M)] + U(B^C, B^S, B^G) \end{aligned} \tag{5}$$

To follow Conlisk's notation, where G denotes investment gains $(\mathbb{B}B_2^M - \mathbb{B}B_1^M)$:

$$\begin{aligned} E[U] &= E[G, p, Z] \\ &= pU[Z + G] + (1-p)U[Z - Gp(1-p)^{-1})] + U(B^C, B^S, B^G) \end{aligned} \tag{6}$$

Define the expected benefit function as the expected utility from the gamble minus the expected utility of consuming the composite good $b[G, Z] \equiv E[G, p, Z] - U(Z)$:

$$\begin{aligned} b[G, Z] &= pU[Z + G] + (1-p)U[Z - Gp(1-p)^{-1})] \\ &+ U(B^C, B^S, B^G) - U(Z) \end{aligned} \tag{7}$$

Taking the first derivative of the benefit function with respect to gains G:

$$b_1{}'[G, Z] = pU'[Z + G] - pU'[Z - Gp(1-p)^{-1})] + U'(B^C, B^S, B^G) \tag{8}$$

In order to maximize the benefit function, we set the first derivative to zero. The first order condition would be:

$$pU'[Z + G] - pU'[Z - Gp(1-p)^{-1})] + U'(B^C, B^S, B^G) = 0 \tag{9}$$

Thus, the equilibrium condition is:

$$pU'[Z + G] + U'(B^C, B^S, B^G) = pU'[Z - Gp(1-p)^{-1})] \tag{10}$$

The above equality represents an opportunity cost equilibrium that indicates when an individual might make the decision to sell or keep their Birkin. If the probability of investment losses (the right hand side of the equality) is higher than that of investment gains (the first term in the left hand side of the equality), it must be offset by a higher utility from owning a Birkin and its subsequent components of consumption, snob, and gambling. Otherwise, the individual would sell the Birkin to increase their wealth and gain utility from composite good consumption, Z. Therefore, people will hold/buy Birkins with very small probabilities of gain due to utility values received from the components of utility B^C, B^S, and B^G (the second term in the left hand side of the equality), a feature unlike other more typical financial assets.

(C) Dynamic Lifetime Utility:

The second modelling approach is a dynamic continuous time utility model. The purpose of this model is to provide dynamic analysis of the different components of utility that arise from purchasing a Birkin and their tradeoffs over time.

Recall the Mandel model, where an individual maximizes utility from current consumption, c_t, and art in the future, a_{t+1}, where $a_t p_t^a$ is the value of the individual's art collection, given current price realizations:

$$\max_{c_t, b_{t+1}, s_{t+1}, a_{t+1}} E_0 \left[\sum_{t=0}^{\infty} \beta^t u(c_t, a_{t+1}, a_t p_t^a) \right]$$

Following the Mandel model[18], an individual's lifetime utility, U, is defined to be the utility from the consumption value of a composite good of price normalized to 1 USD, Z_t, and the utility from owning a Birkin, $\mathbb{B}$ over all $t \in [0, T]$, where time T is the exogenous terminal time/the end of the individual's planning horizon. This utility at each moment t is a known increasing concave function (diminishing marginal utility of consumption) where $U' > 0$ and $U" < 0$. Future utility is discounted at a constant exogenous rate r:

$$\max_{\{Z, \mathbb{B}\}} U = \int_0^T e^{-rt} U(Z(t), \mathbb{B}(t), \mathbb{B}'(t)) \ dt \tag{11}$$

The stock of Birkins, $\mathbb{B}$, measures the change in the number of bags, their quality, or both. The utility of owning a Birkin is composed of the consumption value of the Birkin,

[18] In this paper, I use a continuous time model while Mandel's model uses discrete time. Despite the different mathematical approaches in modelling utility over time, they do not cause meaningful differences in the implications of the model

B^c, the snob value of owning the Birkin, B^S, and the thrill value from “gambling’ on the prospective returns on the Birkin, B^G[19].

$$U(\mathbb{B}) = U(B^c, B^S, B^G) \quad (12)$$

The variable $\mathbb{B}'$ is the change in the stock value of Birkins over time. It is affected not only by the number of Birkins, but the change in its utility components as well. Since $\mathbb{B}'$ is the time derivative of $\mathbb{B}$, it would also contain the time derivatives of its three components: $B^{c\prime}, B^{S\prime}, B^{G\prime}$. Since $\mathbb{B}'$ is the time derivative of $\mathbb{B}$, it would also contain the time derivatives of its three components: $B^{c\prime}, B^{S\prime}, B^{G\prime}$. For example, consuming a Birkin would in turn effect its condition and lower its resale value, thus making $\mathbb{B}'$ negative. If a Birkin owner takes the bag out of its original packaging and uses it to go out for dinner, then the rise in the contemporaneous consumption value would result in a negative change in the stock value $\mathbb{B}'$. The Birkin, now out of original packaging and used, loses resale value, which might make $\mathbb{B}'$ negative as B^c goes up and $B^{S\prime}$ and $B^{G\prime}$ go down. On the other hand, since Birkins have historically appreciated in value over time, keeping a Birkin in pristine condition (unused and in original packaging) would make $\mathbb{B}'$ positive as its snob and gambling value components increase. A $\mathbb{B}'$ equal to zero would indicate a combination of both scenarios with the net stock value unchanged. Thus, $U(\mathbb{B}')$ would denote the utility the Birkin owner would get from the change in its value over time.

[19] Refer to section V (A) for further clarification on the components of $\mathbb{B}$.

(i) Wealth Constraint:

The dynamic lifetime utility function is subject to a wealth constraint. The individual derives current wealth from exogenously determined income $Y(t)$, from interest iK on their holdings of capital assets $K(t)$, the market price of the Birkin they buy/sell $B^M(t)$, and their consumption of a composite good of price normalized to 1 USD, $Z(t)$.

$$\dot{W} = \frac{\partial W}{\partial t} = Y(t) + iK(t) - \mathbb{B}B^M(t) - Z(t) \tag{13}$$

Selling a Birkin would make $\mathbb{B}$, the stock of Birkins, decrease, thereby adding its market price to the individual's wealth. Similarly, using a Birkin reduces the stock value and subsequently the individual's wealth, as would the depreciation of any other depreciable asset. The return on the Birkin is treated differently from the return on any other asset, $iK(t)$, because if the capital gains on the Birkin were to be subsumed into $iK(t)$, the market price of the Birkin, B^M, would not be distinguished, which is central to the research question.

(ii) End point Conditions:

The dynamic lifetime utility function is subject to two end point conditions:

$$U(0) = U(T) = 0 \tag{14}$$

$$W(0) \geq 0\,, W(T) \geq 0 \tag{15}$$

The above end point conditions assume that the individual does not have any utility or debt in the beginning or end of their planning horizon. For the current modelling project, these are technical conditions included here for completeness but not used in the optimization process.

V. Dynamic Optimization Using Calculus of Variations:

(A) <u>First Order Condition—The Euler Equation:</u>

Recall the dynamic lifetime utility model and its wealth constraint:

$$\max_{\{Z,\mathbb{B}\}} U = \int_0^T e^{-rt} U(Z(t), \mathbb{B}(t), \mathbb{B}'(t))\ dt$$

$$\dot{W} = \frac{\partial W}{\partial t} = Y(t) + iK(t) - \mathbb{B}B^M(t) - Z(t)$$

s.t:

$$U(0) = U(T) = 0$$

$$W(0) \geq 0\ , W(T) \geq 0$$

Putting the wealth constrain above in terms of the consumption value, Z, we can then substitute the resulting equality into the dynamic lifetime utility function. This substitution is done in order to make the dynamic lifetime utility function only in terms of variables $\mathbb{B}$ and $\mathbb{B}'$, which is the research focus of this paper:

$$Z = Y + iK - \mathbb{B}B^M - \dot{W} \tag{16}$$

$$\max_{\{Z,\mathbb{B}\}} U = \int_0^T e^{-rt} U(Y + iK - \mathbb{B}B^M - \dot{W}, \mathbb{B}, \mathbb{B}')\ dt \tag{17}$$

Now we can compute the Euler Equation, which is the generalization of the first-order necessary conditions to maximize a function, i.e. when the first derivative of the function is equal to zero. The Euler Equation is the "fundamental necessary condition for the optimality of the [utility] function." (Kamien and Shwartz 16) To attain the maximum of the function U, the first derivatives of its variables $\mathbb{B}$ and $\mathbb{B}'$ must both be zero in equilibrium, and thus are equal:

$$\frac{\partial U}{\partial \mathbb{B}} = e^{-rt}\,[-U_{B^M}, U_{\mathbb{B}}] = 0 \tag{18}$$

$$\frac{\partial U}{\partial \mathbb{B}'} = e^{-rt} U_{\mathbb{B}'} = 0 \tag{19}$$

Therefore:

$$\frac{\partial U}{\partial \mathbb{B}} = \frac{\partial U}{\partial \mathbb{B}'} \tag{20}$$

$$e^{-rt}\,[-U_{B^M}, U_{\mathbb{B}}] = e^{-rt} U_{\mathbb{B}'} \tag{21}$$

Since both sides of the equation contain the term e^{-rt}, we can divide it out:

$$[-U_{B^M,} U_{\mathbb{B}}] = U_{\mathbb{B}'} \tag{22}$$

Keeping in mind that the derivatives of $\mathbb{B}$ and $\mathbb{B}'$ contain the corresponding derivatives of their three component variables B^C, B^S, and B^G. Two form of notation are presented for the purpose of clarity, however they are equivalent:

$$U_{\mathbb{B}} = \left(\frac{\partial U}{\partial B^c}, \frac{\partial U}{\partial B^S}, \frac{\partial U}{\partial B^G}\right) = \left(U_{B^C}, U_{B^S}, U_{B^G}\right) \tag{23}$$

$$U_{\mathbb{B}'} = \left(\frac{\partial^2 U}{\partial B^c \partial t}, \frac{\partial^2 U}{\partial B^S \partial t}, \frac{\partial^2 U}{\partial B^G \partial t}\right) = \left(U_{B^C t}, U_{B^S t}, U_{B^G t}\right) \tag{24}$$

Therefore:

$$\left[-U_{B^{M}}{}_{,}\left(U_{B^{C}}, U_{B^{S}}, U_{B^{G}}\right)\right] = \left(U_{B^{C}t}, U_{B^{S}t}, U_{B^{G}t}\right) \qquad (25)$$

The Euler Equation above indicates that contemporaneous utility is equal to the change in future utility. Contemporaneous utility includes both the opportunity cost of money spent on the Birkin, $-U_{B^{M}}{}_{,}$ as well as the marginal utility of the components of $\mathbb{B}$: $U_{B^{C}}, U_{B^{S}}, U_{B^{G}}$. The resulting Euler Equation implies that current behavior affects tomorrow's outcomes. For example, if an individual chooses to consume more of the Birkin today, it will affect—decrease—snob and gambling values in the future.

Without resorting to a specific functional form for utility, not much more can be said about the first order condition. The second order conditions may provide additional insight into the model, especially regarding variable relations of the components of $\mathbb{B}$.

(B) Second Order Conditions:

While the Euler Equation is the necessary condition for dynamic optimization, a negative semidefinite Hessian matrix is a sufficient condition. The second order conditions aid in providing traction on the relative magnitudes of the derivatives of the choice variables/ components of the utility from owning a Birkin. Thus, to gain more insight into the relative magnitudes of the components of utility required for optimum equilibrium, a Hessian matrix of the second-order partial derivatives of the function $U(\mathbb{B})$ is constructed below.

$$\begin{bmatrix} U_{ZZ} & U_{ZB^C} & U_{ZB^S} & U_{ZB^G} \\ U_{B^CZ} & U_{B^CB^C} & U_{B^CB^S} & U_{B^CB^G} \\ U_{B^SZ} & U_{B^SB^C} & U_{B^SB^S} & U_{B^SB^G} \\ U_{B^GZ} & U_{B^GB^C} & U_{B^GB^S} & U_{B^GB^G} \end{bmatrix} \quad (26)$$

Since the utility function must be a concave function, the Hessian matrix must be negative semidefinite, meaning that its determinant is negative. Further, since the function U is continuous, then by Schwarz' theorem, the Hessian matrix is symmetrical. This means that the order of second order partial derivatives can be interchanged:

$$U_{ZB^C} = U_{B^CZ}$$

$$U_{ZB^S} = U_{B^SZ}$$

$$U_{ZB^G} = U_{B^GZ}$$

$$U_{B^CB^S} = U_{B^SB^C}$$

$$U_{B^CB^G} = U_{B^GB^C}$$

$$U_{B^SB^G} = U_{B^GB^S}$$

Therefore, the Hessian matrix can be written as such:

$$\begin{bmatrix} U_{ZZ} & U_{ZB^C} & U_{ZB^S} & U_{ZB^G} \\ U_{ZB^C} & U_{B^C B^C} & U_{B^C B^S} & U_{B^C B^G} \\ U_{ZB^S} & U_{B^C B^S} & U_{B^S B^S} & U_{B^S B^G} \\ U_{ZB^G} & U_{B^C B^G} & U_{B^S B^G} & U_{B^G B^G} \end{bmatrix} \tag{27}$$

i. <u>Sign Assumptions of Second Order Partial Derivatives:</u>

In order to calculate the determinant of the Hessian matrix, assumptions must be made concerning the signs of the second order partial derivatives. The first assumption is that the entertainment value of gambling on a Birkin, B^G, and its consumption, B^C, are inversely related. The assumption comes from the possibility that using bags runs the risk of being scratched, damaged, lost, and/or stolen, therefore losing value and diminishing potential investment prospects. Hence, the more consumption value the less gambling value, and the more gambling value the less consumption value. Therefore, the second order cross partial $U_{B^C B^G}$ would be negative:

$$U_{B^C B^G} < 0$$

Another assumption is that B^G is complementary to the snob value from owning a Birkin, B^S. The assumption is due to the conjecture that more expensive, luxurious, and often rare Birkins tend to yield higher investment returns than their more common, and relatively cheaper, counterparts. This can be seen through the 2017 *Bag Hunter* study, where mixed exotic skins and bi-color Birkins yielded a 20% average rate of return over just one year, whereas Black and Etoupe Birkins made of Togo, Epsom, or Clemence[20] leathers and gold hardware returned 14%. Therefore, the second order cross partial $U_{B^s B^G}$ would be positive:

$$U_{B^s B^G} > 0$$

[20] Togo bags are made from calves, whereas Clemence and Epsom bags are made of baby bulls. (Mull)

The case of B^S and its relation to B^C is more ambiguous. The rise of the internet and social media has enabled users to show off their belongings and attain snob value without ever having to "consume" their luxury items in the real world and run the risk of damaging them and reducing future snob and gambling appeal. One can argue that prior to the age of social media, the relationship between the consumption value B^C and the snob value B^S was strongly positive: the only way a Birkin owner could obtain snob value is through consuming the handbag. However, since then, the relationship between B^S and B^C has become weaker since owners can now boast their Birkins on platforms such as Facebook, YouTube, and Instagram. Nonetheless, it would be difficult to assess whether the relationship between B^S and B^C remains positive or has become negative without further quantitative analysis. Therefore, the sign of second order cross partial $U_{B^C B^S}$ is an empirical question. The restrictions associated with the Hessian matrix may offer some more insight into the relationship between the consumption value B^C and the snob value B^S.

Another assumption associated with this model is that the relationship between consumption of the composite commodity, Z, is inversely related to the consumption value of Birkins, B^C. This assumption comes from the notion that money spent on Birkins would otherwise be spent on the composite commodity. There are certain cases of consumption, such as visiting fancy restaurants and lavish social events/activities, where B^C would be complimentary to Z. However, I assume such cases to be a small portion of the composite commodity. Therefore, the second cross partial U_{ZB^C} would be negative:

$$U_{ZB^C} < 0$$

U_{ZB^S} and U_{ZB^G} are assumed to be zero since the utilities from the consumption of the composite commodity and the snob and gambling values are assumed independent.

Recall the law of diminishing marginal utility, which states that as consumption increases, the marginal utility derived from the consumption of each extra unit decreases (i.e. concavity of the utility function). Therefore, the second order cross partials U_{ZZ}, $U_{B^C B^C}$ and $U_{B^S B^S}$ would be negative:

$$U_{ZZ} < 0$$

$$U_{B^C B^C} < 0$$

$$U_{B^S B^S} < 0$$

Recall the Becker-Murphy Theory of Rational Addiction, which states that the addictive goods have a declining marginal utility. Therefore, the second order cross partial $U_{B^G B^G}$ would be negative:

$$U_{B^G B^G} < 0$$

ii. Determinant of the Hessian Matrix:

The Hessian matrix is subsequently constructed with the underlying sign assumptions incorporated:

$$\begin{bmatrix} \overbrace{U_{ZZ}}^{-} & \overbrace{U_{ZB^C}}^{-} & \overbrace{U_{ZB^S}}^{0} & \overbrace{U_{ZB^G}}^{0} \\ \overbrace{U_{ZB^C}}^{-} & \overbrace{U_{B^C B^C}}^{-} & \overbrace{U_{B^C B^S}}^{?} & \overbrace{U_{B^C B^G}}^{-} \\ \overbrace{U_{ZB^S}}^{0} & \overbrace{U_{B^C B^S}}^{?} & \overbrace{U_{B^S B^S}}^{-} & \overbrace{U_{B^S B^G}}^{+} \\ \overbrace{U_{ZB^G}}^{0} & \overbrace{U_{B^C B^G}}^{-} & \overbrace{U_{B^S B^G}}^{+} & \overbrace{U_{B^G B^G}}^{-} \end{bmatrix} \tag{28}$$

Calculating the determinant, recall that since the utility function must be a concave function, the Hessian matrix must be negative semidefinite, meaning that its determinant is negative:

$$\begin{aligned} \det = {} & U_{ZZ}\, det \begin{bmatrix} U_{B^C B^C} & U_{B^C B^S} & U_{B^C B^G} \\ U_{B^C B^S} & U_{B^S B^S} & U_{B^S B^G} \\ U_{B^C B^G} & U_{B^S B^G} & U_{B^G B^G} \end{bmatrix} \\ & - U_{ZB^C}\, det \begin{bmatrix} U_{ZB^C} & U_{B^C B^S} & U_{B^C B^G} \\ U_{ZB^S} & U_{B^S B^S} & U_{B^S B^G} \\ U_{ZB^G} & U_{B^S B^G} & U_{B^G B^G} \end{bmatrix} \\ & + U_{ZB^S}\, det \begin{bmatrix} U_{ZB^C} & U_{B^C B^C} & U_{B^C B^G} \\ U_{ZB^S} & U_{B^C B^S} & U_{B^S B^G} \\ U_{ZB^G} & U_{B^C B^G} & U_{B^G B^G} \end{bmatrix} \\ & - U_{ZB^G}\, det \begin{bmatrix} U_{ZB^C} & U_{B^C B^C} & U_{B^C B^S} \\ U_{ZB^S} & U_{B^C B^S} & U_{B^S B^S} \\ U_{ZB^G} & U_{B^C B^G} & U_{B^S B^G} \end{bmatrix} < 0 \end{aligned} \tag{29}$$

Since the cross partials U_{ZB^S} and U_{ZB^G} are zero, equation 29 simplifies to:

$$\det = U_{ZZ}\, det \begin{bmatrix} U_{B^C B^C} & U_{B^C B^S} & U_{B^C B^G} \\ U_{B^C B^S} & U_{B^S B^S} & U_{B^S B^G} \\ U_{B^C B^G} & U_{B^S B^G} & U_{B^G B^G} \end{bmatrix} - U_{ZB^C}\, det \begin{bmatrix} U_{ZB^C} & U_{B^C B^S} & U_{B^C B^G} \\ U_{ZB^S} & U_{B^S B^S} & U_{B^S B^G} \\ U_{ZB^G} & U_{B^S B^G} & U_{B^G B^G} \end{bmatrix} < 0 \tag{30}$$

Choosing the first row in both matrices as the reference rows, the determinant becomes:

$$\begin{aligned} \det = {} & U_{ZZ}\left(U_{B^C B^C}\, det \begin{bmatrix} U_{B^S B^S} & U_{B^S B^G} \\ U_{B^S B^G} & U_{B^G B^G} \end{bmatrix} \right. \\ & \left. - U_{B^C B^S}\, det \begin{bmatrix} U_{B^C B^S} & U_{B^S B^G} \\ U_{B^C B^G} & U_{B^G B^G} \end{bmatrix} + U_{B^C B^G}\, det \begin{bmatrix} U_{B^C B^S} & U_{B^S B^S} \\ U_{B^C B^G} & U_{B^S B^G} \end{bmatrix}\right) \\ & - U_{ZB^C}\left(U_{ZB^C} \det \begin{bmatrix} U_{B^S B^S} & U_{B^S B^G} \\ U_{B^S B^G} & U_{B^G B^G} \end{bmatrix} - U_{ZB^S} \det \begin{bmatrix} U_{B^C B^S} & U_{B^C B^G} \\ U_{B^S B^G} & U_{B^G B^G} \end{bmatrix} \right. \\ & \left. + U_{ZB^G} \det \begin{bmatrix} U_{B^C B^S} & U_{B^C B^G} \\ U_{B^S B^S} & U_{B^S B^G} \end{bmatrix}\right) < 0 \end{aligned} \tag{31}$$

Since the cross partials U_{ZB^S} and U_{ZB^G} are zero, equation 31 simplifies to:

$$\begin{aligned} \det = {} & U_{ZZ}\left(U_{B^C B^C}\, det \begin{bmatrix} U_{B^S B^S} & U_{B^S B^G} \\ U_{B^S B^G} & U_{B^G B^G} \end{bmatrix} \right. \\ & \left. - U_{B^C B^S}\, det \begin{bmatrix} U_{B^C B^S} & U_{B^S B^G} \\ U_{B^C B^G} & U_{B^G B^G} \end{bmatrix} + U_{B^C B^G}\, det \begin{bmatrix} U_{B^C B^S} & U_{B^S B^S} \\ U_{B^C B^G} & U_{B^S B^G} \end{bmatrix}\right) \\ & - U_{ZB^C}\left(U_{ZB^C} \det \begin{bmatrix} U_{B^S B^S} & U_{B^S B^G} \\ U_{B^S B^G} & U_{B^G B^G} \end{bmatrix}\right) < 0 \end{aligned} \tag{32}$$

Next, we compute the determinant of each 2x2 matrix in equation 32. Recall that a 2x2 matrix $\begin{bmatrix} a & c \\ b & d \end{bmatrix}$ has a determinant of $ad - bc$:

$$\begin{aligned} \det = U_{ZZ}[U_{B^C B^C}\big(U_{B^S B^S}U_{B^G B^G} - U_{B^S B^G}U_{B^S B^G}\big) \\ - U_{B^C B^S}\big(U_{B^C B^S}U_{B^G B^G} - U_{B^S B^G}U_{B^C B^G}\big) \\ + U_{B^C B^G}\big(U_{B^C B^S}U_{B^S B^G} - U_{B^S B^S}U_{B^C B^G}\big)] \\ - U_{ZB^C}[U_{ZB^C}\big(U_{B^S B^S}U_{B^G B^G} - U_{B^S B^G}U_{B^S B^G}\big)] < 0 \end{aligned} \tag{33}$$

Multiplying out the parentheses:

$$\begin{aligned} \det = U_{ZZ}\big(U_{B^C B^C}U_{B^S B^S}U_{B^G B^G} - U_{B^C B^C}U_{B^S B^G}U_{B^S B^G} \\ - U_{B^C B^S}U_{B^C B^S}U_{B^G B^G} + U_{B^C B^S}U_{B^S B^G}U_{B^C B^G} + U_{B^C B^G}U_{B^C B^S}U_{B^S B^G} \\ - U_{B^C B^G}U_{B^S B^S}U_{B^C B^G}\big) - U_{ZB^C}(U_{ZB^C}U_{B^S B^S}U_{B^G B^G} \\ - U_{ZB^C}U_{B^S B^G}U_{B^S B^G}) < 0 \end{aligned} \tag{34}$$

Multiplying out the square brackets:

$$\begin{aligned} \det = U_{ZZ}U_{B^C B^C}U_{B^S B^S}U_{B^G B^G} - U_{ZZ}U_{B^C B^C}U_{B^S B^G}U_{B^S B^G} - \\ U_{ZZ}U_{B^C B^S}U_{B^C B^S}U_{B^G B^G} + U_{ZZ}U_{B^C B^S}U_{B^S B^G}U_{B^C B^G} + \\ U_{ZZ}U_{B^C B^G}U_{B^C B^S}U_{B^S B^G} - U_{ZZ}U_{B^C B^G}U_{B^S B^S}U_{B^C B^G} - \\ U_{ZB^C}U_{ZB^C}U_{B^S B^S}U_{B^G B^G} + U_{ZB^C}U_{ZB^C}U_{B^S B^G}U_{B^S B^G} < 0 \end{aligned} \tag{35}$$

Combining like terms together:

$$\begin{aligned} \det = U_{ZZ}U_{B^C B^C}U_{B^S B^S}U_{B^G B^G} - U_{ZZ}U_{B^C B^C}\big(U_{B^S B^G}\big)^2 - \\ U_{ZZ}\big(U_{B^C B^S}\big)^2 U_{B^G B^G} + 2U_{ZZ}U_{B^C B^S}U_{B^S B^G}U_{B^C B^G} - \\ U_{ZZ}U_{B^S B^S}\big(U_{B^C B^G}\big)^2 - (U_{ZB^C})^2 U_{B^S B^S}U_{B^G B^G} + \big(U_{ZB^C}\big)^2 (U_{B^S B^G})^2 < 0 \end{aligned} \tag{36}$$

Recall the sign assumption of the second order partial derivatives made in Section V (B) i:

$$\det = \overbrace{U_{ZZ}U_{B^CB^C}U_{B^SB^S}U_{B^GB^G}}^{+} \overbrace{-U_{ZZ}U_{B^CB^C}(U_{B^SB^G})^2}^{-}$$
$$\overbrace{-U_{ZZ}(U_{B^CB^S})^2U_{B^GB^G}}^{-} + \overbrace{2(U_{ZZ}U_{B^CB^S}U_{B^SB^G}U_{B^CB^G})}^{?} \tag{37}$$
$$\overbrace{-U_{ZZ}U_{B^SB^S}(U_{B^CB^G})^2}^{-} \overbrace{-(U_{ZB^C})^2U_{B^SB^S}U_{B^GB^G}}^{-} + \overbrace{(U_{ZB^C})^2(U_{B^SB^G})^2}^{+} < 0$$

For a negative semidefinite Hessian, the negative terms must be greater in magnitude than the positive terms. Thus, putting all of the negative terms on the right-hand-side of the inequality:

$$U_{ZZ}U_{B^CB^C}U_{B^SB^S}U_{B^GB^G} + \left(U_{ZB^C}\right)^2(U_{B^SB^G})^2$$
$$< U_{ZZ}U_{B^CB^C}\left(U_{B^SB^G}\right)^2 + U_{ZZ}\left(U_{B^CB^S}\right)^2U_{B^GB^G} + U_{ZZ}U_{B^SB^S}(U_{B^CB^G})^2 \tag{38}$$
$$+ \left(U_{ZB^C}\right)^2U_{B^SB^S}U_{B^GB^G}$$

In analyzing the inequality, the market for Birkins will be split into two segments, socialites, i.e. rich women, and "average women," i.e. women with lower incomes who must save to purchase Birkins. The determinant in equation (38) helps to tell plausible stories concerning the demand from the two market segments, which will imply some testable empirical hypotheses.

When looking at the *Purse Forum*, "average women" dedicate entire forums to discuss the lengths they go through in order to buy their very own Birkin. Users recount how they "clip coupons for groceries," sell their possessions on *eBay*, "eat at home 99% of the time," and go to *Walmart* and *Dollar Tree Stores* for groceries in order to save up for a Birkin. (Haute Couturess; H_addict)

The socialite, whose consumption levels are higher than those of the average woman, has a lower second derivative with respect to U_{ZZ} and $U_{B^C B^C}$; this can be seen in Figure I within Appendix C. Thus, the above inequality is more likely to hold since the first term, $U_{ZZ}U_{B^C B^C}U_{B^S B^S}U_{B^G B^G}$, multiplies the two cross partials and thus is perceived to be very small.

However, in terms of the average woman, whose consumption levels are lower than those of the socialite, there needs to be another term(s) that offsets the higher magnitudes of U_{ZZ} and $U_{B^C B^C}$ for the inequality to hold. The hypothesis consistent with this second order restriction is that the rise of social media combined with the growing perception of the Birkin as an investment good has increased demand for Birkins among those with lower incomes because of the snob and gambling values. In other words, in order for the inequality to hold, the hypothesis is that lower composite good consumption and Birkin consumption needs to be offset with higher snob and gambling values. Looking at the utility graph in Appendix C Figure II, one can observe that, in this hypothesis, the average woman would have higher marginal snob and gambling and thus lower values of $U_{B^S B^S}$ and $U_{B^G B^G}$; in this scenario, the first term in the inequality, $U_{ZZ}U_{B^C B^C}U_{B^S B^S}U_{B^G B^G}$, is perceived to very small, and thus the inequality holds.

As for the $U_{B^C B^S}$ term, prior to social media, the variable would have been unambiguously positive. A positive $U_{B^C B^S}$ would have created issues in terms of the inequality as the term $2(U_{ZZ}U_{B^C B^S}U_{B^S B^G}U_{B^C B^G})$ would be placed on left hand side of the inequality, which must remain smaller than the right hand side. In other words, a positive

$U_{B}c_{B}s$ would have made the determinant larger in magnitude, which is an issue since the determinant must be negative in order for the Slutsky restrictions to hold. However, due to the rise in social media, the $U_{B}c_{B}s$ term has become less positive and possibly negative, and thus more likely to maintain the inequality.

From the dynamic optimization of the lifetime utility model and the interpretation of the results of the first order and second order conditions, the Euler Equation and the determinant of the Hessian matrix, respectively, a discussion surrounding the implications of the model on future empirical research emerges.

VI: Conclusion and Implications for Future Research

The results of the Euler Equation and the determinant of the Hessian matrix offer opportunities for further exploration and research. The dynamic optimization of the lifetime utility model provides traction on key empirical questions concerning changes in the demand for Birkins, as well as research on comparable luxury brands/markets and their ability to replicate the Hermès Birkin model. The rise of social media has significantly impacted the market for Birkins due to the addition of snob and gambling values as central components of the utility function of Birkins. Thus, we can discern two hypotheses vis-à-vis the market demand for Birkins. First, the market demand for Birkins has grown since the advent of social media and consequently increased the equilibrium price and quantity for the Birkin. Second, the market demand for Birkins has become more elastic with the broadening of the market to comprise "average women" in addition to socialites.

(A) The Rise of Social Media and the Demand for Birkins

The research suggests that the rise of social media has enabled individuals to receive snob value from owning Birkins without the need to consume them. The predicted higher levels of snob associated with the Birkin combined with the bag's repute as an investment vehicle can therefore not only increase the demand for Birkins, but widen the target market as well to include "average women" as well. Anecdotal evidence from online purse forums suggests that "average women" have started to seek Birkins for higher levels of snob and gambling values. Thus, it can be hypothesized that the market demand curve for Birkins has shifted to the right. This is illustrated in Figure III within Appendix C where

D_1 is the demand curve for Birkins pre social media and D_2 is the demand curve post social media.

The model could also be used to predict the quantity of Birkins that Hermès produces every year, since that figure has never has never been publicly revealed, as well as the equilibrium quantity. Looking at the graph in Figure III in Appendix C, taking supply of Birkins by Hermès as given, the equilibrium quantity has increased in the post social media era.

Similarly, the model could also be used to predict the equilibrium price of Birkins. Predicting the equilibrium price of Birkins could be helpful to both Hermès and second hand authenticated luxury consignment stores, especially when factoring in the snob and gambling values within their pricing algorithms. The hypothesis of a higher price due to the addition of snob and gambling values is consistent with the aforementioned hypothesis of increased demand in the social media era. This is illustrated in Figure III in Appendix C, where, taking supply of Birkins by Hermès as given, the equilibrium price of Birkins has increased in the post social media era.

The model could likewise be used to predict changes in the slope of the demand curve. Recall that the slope of the demand curve comes from the own-price elasticity of a good, which is comprised of the good's price compensated elasticity[21], its price as a share

[21] Price compensated elasticity measures the responsiveness of demand for a certain good due to a change in its price, holding income constant

of income, and its income elasticity[22]. Where P is the price of the good, Q is the quantity of the good, and M is the individual's income:

$$\frac{\partial Q_i}{\partial p_i}\frac{P}{Q} = \frac{\partial Q_i^U}{\partial p_i}\frac{P}{Q} - \frac{PQ_i}{M}\frac{\partial Q_i}{\partial M}\frac{M}{Q}$$

For the socialite, a Birkin would represent a smaller share of income, $\left(\frac{PQ_i}{M}\right)$, compared to that of the average woman. This means that, for the socialite, the Birkin has a smaller income effect. Assuming the same substitution effect for both women, the own price elasticity of Birkins would be larger for the socialite than for the average woman. In other words, the model suggests that the demand for Birkins is relatively more inelastic for socialites than for average women and relatively more elastic for average women compared to socialites. Recall the earlier hypothesis that higher levels of snob associated with the Birkin combined with the bag's repute as an investment vehicle can widen the target market to include "average women." Assuming this is true, then the rising hypothesis is that the demand for Birkins has become more elastic since the rise of social media and the broadening of the market to include "average women."

(B) <u>Research on the Luxury Fashion Market</u>

One key question that arises from this research is why other comparable luxury brands, such as Louis Vuitton or Chanel, have not replicated Hermès' Birkin model. Have such brands tried and failed? Or is it a strategic choice on their part? This paper's research on the primary and secondary market of the Birkin can provide some insight on the question

[22] Income elasticity measures the responsiveness of demand for a certain good due to a change in income

of why comparable luxury brands—fashion or otherwise—have not emulated the Birkin model.

Since Hermès is marketed as a family-run brand[23] that is not part of a larger fashion conglomerate, the hypothesis that they behave differently to other luxury brands arises. For conglomerates such *LVMH*—which owns Louis Vuitton, Dior, Fendi, and Celine amongst others—and *Kering*—which owns Balenciaga, Saint Laurent, and Gucci amongst others—a product is part of a global brand portfolio of luxury goods, and can boost other goods within the portfolio via the spillover effect. This is different for Hermès, which has a much narrower product portfolio. Thus, for other luxury fashion brands, the Birkin model may not be as financial beneficial as it is for Hermès. Other factors may also have contributed to why brands have not replicated the Birkin model, such as first-mover-advantage gained by Hermès. Since the Birkin was the first-of-its-kind in terms of its artificial scarcity and exclusivity (and subsequent snob and gambling values attached), Hermès could have been able to gain significant competitive advantage, thus impeding other brands from following suit.

An April 2019 article by the *New York Times* estimates that there are over 1 million Birkins in the secondary market, most of which is attributed to the rise of the internet, social media, and online authenticated luxury consignment retailers. Thus, the future of the Birkin bag is called into question; "what does it really mean for an accessory whose image and

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[23] The Dumas-Hermès family owns 65.1% of the share capital of Hermès International S.A. For reference, Louis Vuitton is owned by LVMH Moët Hennessy Louis Vuitton SE (also known as LVMH), a public French multinational luxury goods conglomerate that controls around 60 subsidiaries in several markets, including wine and spirits, selective retail, fashion and leather goods, watches and jewelry, and perfumes and cosmetics. On the other hand, Chanel remains a private family-owned business.

allure is grounded largely in exclusivity and carefully measured supply, in an industry where perception plays an outsize role, not to mention for the people seduced by such rarity? Does it risk dilution and, even worse, devaluation of both value and allure?" (Zerbo) While, in theory, the rise of resale could potentially hurt Hermès, as of now, "demand for Birkins actually seems to be rising with supply." (Ibid.) Nonetheless, the question remains: will the Birkin continue to rise despite the continuing growth of the secondary market, a la the *Rolex Daytona*, or will it eventually lose its status at the apex of luxury and snob? Only time will tell.

Appendix A:

Figure I:

Figure II:

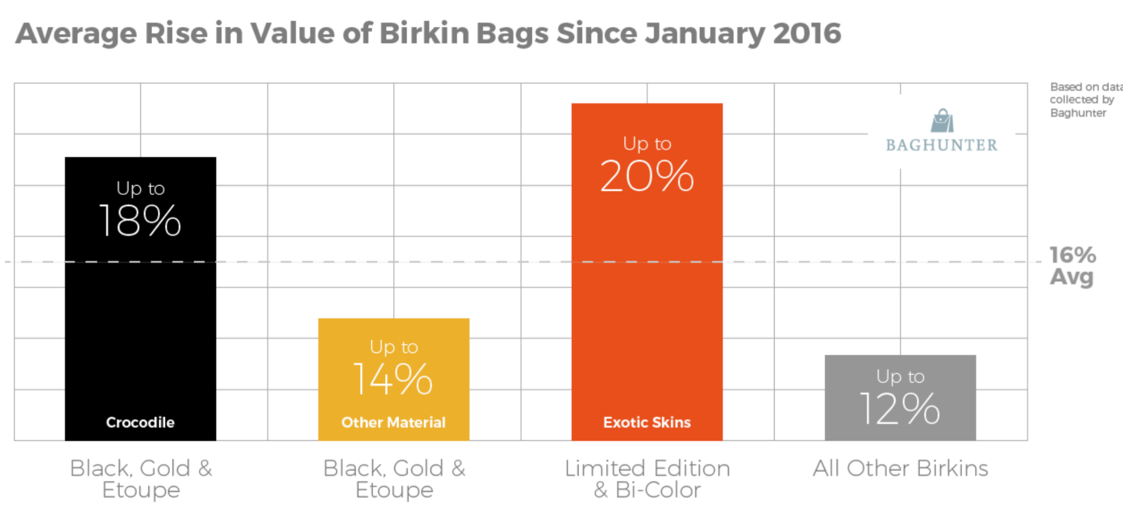
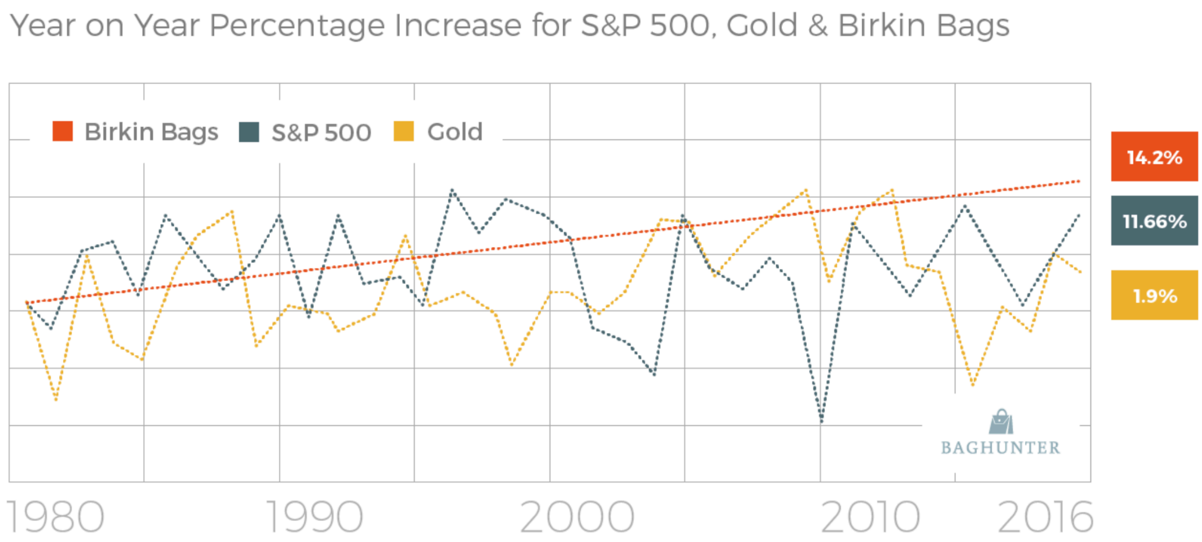


Figure III:


Year on Year Percentage Increase for S&P 500, Gold & Birkin Bags
Birkin Bags
S&P 500
Gold
14.2%
11.66%
1.9%
BAGHUNTER
1980
1990
2000
2010
2016

Appendix B:

Table I: Condition Report Grades

Grade	Description
1	As new. Appears never to have been used. It exhibits no signs of wear
2	In excellent to pristine condition. To the untrained eye, it may appear brand new. There may be a slight condition note, but overall the condition of the bag is nearly perfect
3	In excellent condition. This is a piece that has seldom been used and shows little to no wear. There may be small condition issues to note overall the piece is in excellent condition
4	In very good condition. This piece may show signs of light wear. It is in very good condition but the corners may show signs of light scuffing, the base may show light scratches, and the hardware may exhibit light marks.
5	In good condition. This is a piece that shows wear. There are condition issues that will be noted in the condition report
6	In fair condition. This piece shows significant wear and/ or damage. It may require repair or refurbishment in order to be used. Condition issues will be noted in the condition report

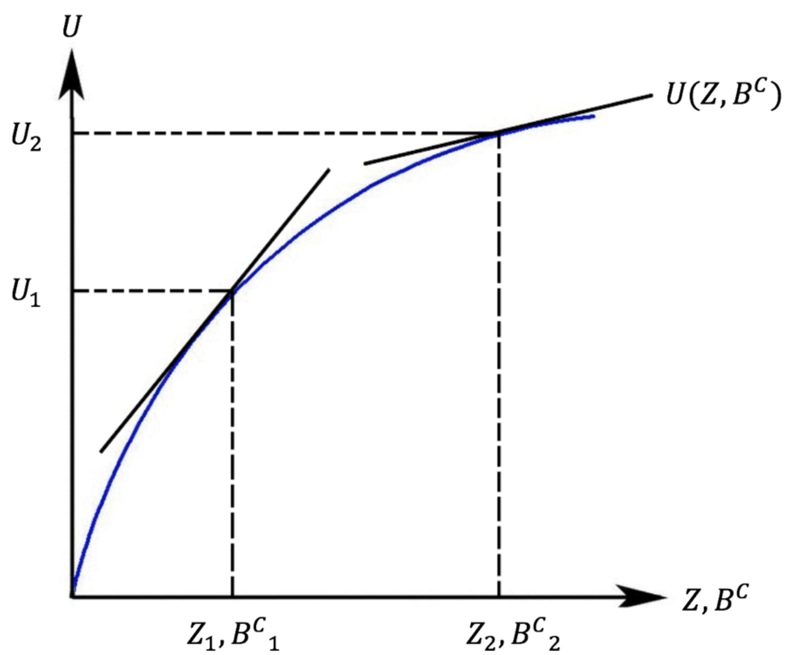
Table II: Variable Definitions

Z	Composite commodity with normalized price of $1
$\mathbb{B}$	Number of Hermès Birkin Bags
B^c	Consumption value from owning Hermès Birkin Bag, in time
B^S	Wealth signaling/snob value of owning Hermès Birkin Bag, in time
B^G	Thrill/entertainment value of "gambling" on Hermès Birkin Bag, in time
Y	Income (assumed exogenous)
r	Discount rate
K	Asset (e.g. stocks, bonds, etc.)
i	Interest earnings/capital gains
B^M	Market price of the Hermès Birkin Bag
T	Exogenous terminal time
p	Probability of price of Birkin increasing, $B_2^M > B_1^M$

Appendix C:

Figure I:

The following graph displays the utility function from the consumption of the composite commodity Z and the consumption of the Birkin B^C. Z_1, ${B^C}_1$ represent the consumption values for the "average women," while Z_2, ${B^C}_2$ represent the consumption values of the socialite. Correspondingly, U_1 is the utility value for the "average women" and U_2 is the utility value for the socialite. As you can see, the marginal utility (represented by the tangent lines on the utility function) from the consumption of the commodity good and the Birkin is lower for the socialite than it is for the "average women."



<u>Figure II:</u>

The following graph displays the utility function from the snob value from owning Birkins B^S and gambling value from owning Birkins B^G. ${B^S}_1, {B^G}_1$ represent the snob and gambling values for the socialite, while ${B^S}_2$, ${B^G}_2$ represent the snob and gambling values for the "average women." Correspondingly, U_1 is the utility value for the socialite and U_2 is the utility value for the "average woman." As you can see, the marginal utility (represented by the tangent lines on the utility function) from the snob and gambling values from owning the Birkin is lower for the "average women" than it is for the socialite.

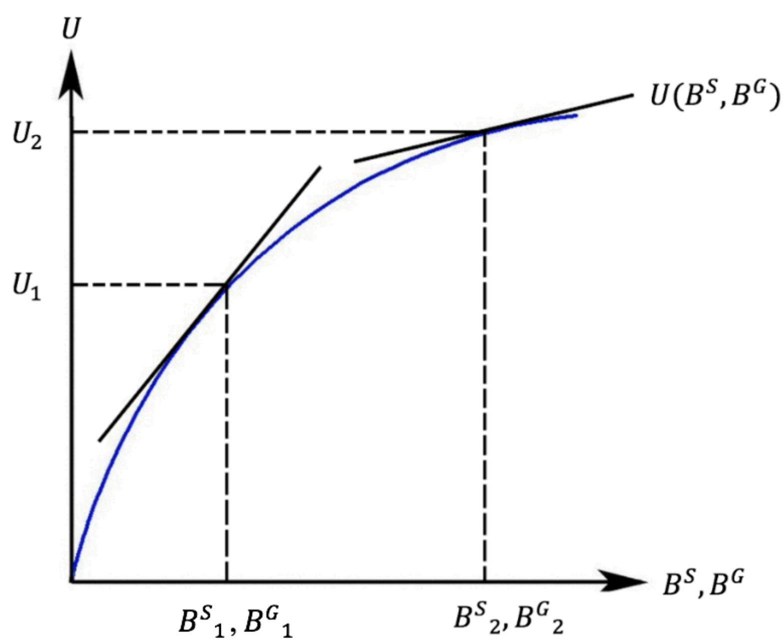
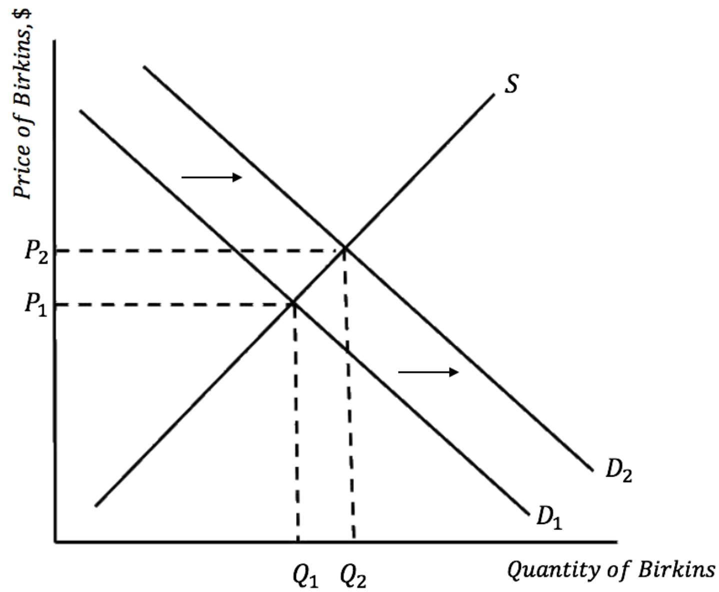


Figure III:



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