



*Econ Journal Watch,
Volume 1, Number 3,
December 2004, pp 437-454.*

Fashion Cycles in Economics

PHILIP R. P. COELHO, DANIEL B. KLEIN,
AND JAMES E. MCCLURE*

A COMMENT ON: WOLFGANG PESENDORFER. 1995. DESIGN INNOVATIONS AND FASHION CYCLES. *AMERICAN ECONOMIC REVIEW* 85(4): 771-792.

[Abstract](#), [Keywords](#), [JEL Codes](#)

THE *RAISON D'ÊTRE* FOR SCIENCE, AND ECONOMIC ANALYSIS IN particular, is to understand and explain observable phenomena. Yet, in an article in the *American Economic Review*, Wolfgang Pesendorfer (1995) develops a model of the design cycle of fashion goods that shows little regard for data, observational experience, history, intuition, or semantic integrity. These cornerstones of scholarship are superceded by the quest for a mathematical argument sustaining certain preconceptions.

Throughout the paper there is an unmistakable animus against fashion; in the abstract, Pesendorfer notes: "The paper gives conditions under which all consumers would be better off by banning the use of fashion" (Pesendorfer 1995, 771). A quote from Georg Simmel reinforces this negative view of fashion: "Judging from the ugly and repugnant things that are sometimes in vogue, it would seem as though fashion were desirous of exhibiting its power by getting us to adopt the most atrocious things for its sake alone" (Simmel [1904], 544; quoted in Pesendorfer 1995, 771). This sets the stage for constructing a model where fashion serves no purpose other than social differentiation.

Relying on Simmel, Pesendorfer introduces fashion as a way in which people distinguish themselves from others.

* Coelho and McClure: Department of Economics, Ball State University.
Klein: Department of Economics, Santa Clara University.

The purpose of fashion is to facilitate differentiation of “types” in the process of social interaction. The demand for new designs is derived from the desire of agents to interact with the “right” people. (Pesendorfer 1995, 772)

Here the similarity with Simmel ceases. Confusion results from Pesendorfer’s going back-and-forth between “fashion,” “garment,” and “design.” The only aspect of a fashion garment that is important in the model is its “look” or design. Unlike real-world garments, Pesendorfer’s “design” does not comfort, protect, warm, or beautify; neither does it generate prestige nor ostentation. It is best to think of a “design” as something like a ticket that lets the buyer enter into interaction with other ticket holders. Pesendorfer uses the terms “fashion,” “garment,” and “design” interchangeably because, in the model, they all mean simply the ticket to mix with other ticket holders.

The design is the basis for a never-ending compulsory matching process that establishes two-person groups. There are numerous problems with the model: (1) There is neither a definition, nor an elaboration of, the phenomena modeled; (2) alternative explanations of fashion cycles are ignored and even deliberately elided;¹ (3) the model of fashion as a signal is so abstract that it has no observational counterpart in reality; and (4) real time does not exist, and neither memory nor history exist.

¹ Pesendorfer draws heavily upon Simmel, but misquotes Simmel in a way that makes it appear that Simmel’s ideas are as one dimensional as Pesendorfer’s. On page 771, Pesendorfer shows a block quotation from Simmel. But looking up the quote, we found that he had edited out, without inserting ellipse to indicate omissions, “the desire for change” as an impetus for fashion. Below is the exact quote from Simmel ([1904], 543) with the text omitted without indication by Pesendorfer shown in bold italics:

[Fashion] satisfies ***in no less degree*** the need of differentiation, ***the tendency towards dissimilarity, the desire for change and contrast, on the one hand by a constant change of contents, which gives to the fashion of today an individual stamp as opposed to that of yesterday and to-morrow, on the other hand*** because fashions differ for different classes—the fashions of the upper stratum of society are never identical with those of the lower; in fact, they are abandoned by the former as soon as the latter prepares to appropriate them.

A DISCUSSION OF PESENDORFER'S MODEL OF FASHION DESIGN CYCLES

Pesendorfer's theory has two parts: 1) a static matching model that is constrained to two types of consumers; and 2) a dynamic game where a designer sets the prices of new designs and decides when to innovate in response to a dynamic version of the static matching model.

The Static Matching Model

1. *High is better than low*

The model assumes two types of consumers (high and low types), both preferring to be matched with those who are high types, but the high types cannot be identified by either observation or reputation. The "purpose of a consumer" in Pesendorfer's model is "to 'date' another consumer" (Pesendorfer 1995, 775). Mathematically the high types are in the range $[0, \alpha]$, and low types $[\alpha, 1]$.² "Type" is left undefined; it can be almost anything imaginable. "Depending on the interpretation, the type of an individual [consumer] may refer to her education, entertainment skills, or human capital" (775). The meaning of neither "date" nor "type" is specified. In each period all individuals are assigned partners, forming dyadic matches. It is unspecified who, or what, establishes and maintains the matches. Once matched, an individual is stuck with that partner for that period. Specific partners can neither be chosen nor rejected; partners are assigned dictatorially in a system of forced association.³

Both high and low-types prefer to be matched with a high-type. The utility premium associated with a match with a high type is greater for high types than it is for low types. In other words, what a high-type gains by avoiding a low type is greater than what a low-type loses by not being

² The functions that are used to depict consumer behavior are continuous. This means that there are an infinite number of consumers and/or the consumer is infinitely divisible into smaller units.

³ When Pesendorfer presents the matching rule, he says that individuals paired according to the rule "meet" (Pesendorfer 1995, 776) each other. In the abstract he refers to his theory as a "dating game" (771). In fact pairs of people not only meet each other but are assigned to be together for the duration. His usage is like suggesting that two prison inmates who are assigned to share a prison cell for the duration of their sentence merely meet each other. Pesendorfer's word choice obscures the assumption of forced association.

matched to a high-type.

The money price paid for a design is subtracted from the buyer's contemporaneous utility. A differential in utility between high and low types when matched to a high-type is necessary for the existence of equilibria where high-types pay for stratification and low-types do not pay.

Although Pesendorfer states that the matching model is applicable to the market for high-fashion garments (Pesendorfer 1995, 772), one of its fundamental assumptions turns reality on its head. Under Pesendorfer's assumptions, a high-type is willing to pay more to for a design the more that other high-types are wearing the identical design. Yet in reality, if a fashion-minded person goes to a social affair and finds others bedecked identically to herself, she is like to be disconcerted, rather than glad, about matching outfits.

2. *Buying designs and matching rules*

It is assumed that there is only one design that individuals may buy, and a single institution that issues it and sells it. Consumers desire the design because people who buy it are (randomly) matched with others who have bought it; people who do not buy the design are (randomly) matched with others who do not have it.⁴ If only high-type people have the design, then buying it ensures a high-type partner with certainty. If 80 percent of people with the design are high-type, then, irrespective of whether you are high or low, buying it provides a 0.8 probability of a match with a high-type partner.

If everyone but one buys the design, then the exception is matched to a low-type person. Pesendorfer does not address the implications of this assumption; there are several possibilities: perhaps there is cloning on demand for a low-type, or perhaps there is a freezer from which low-types are drawn and thawed as needed, or, more realistically, there could be a dungeon where low-type people are kept waiting for such exigencies. There are more difficulties. Who oversees the cloning/freezer/dungeon—and

⁴ In presenting the matching rule, Pesendorfer misstates the meaning of his notation, making the model difficult to understand. He uses $\mu_i(n)$ to mean the amount (i.e., measure) of type i consumers (i being high or low) using design n as a fraction of the set of *all* consumers (a set which has measure equaling 1). For example, if high types constitute a third of all consumers (that is, α equals $1/3$) and they all buy design n , then $\mu_h(n)$ equals $1/3$. Yet here is how Pesendorfer explains $\mu_i(n)$: "Let $\mu_i(n)$, $i = 1, h$ denote the fraction of consumers of type i using design n " (p. 776). What he says would imply for the example that $\mu_h(n)$ equals 1, rather than $1/3$.

why? The assumption of a slack low-type means that low-types always attach a positive price to the design. The design would have no value to a lone person without it if she were matched randomly with the set of all others; this would drive the price to zero. To prevent this, Pesendorfer has to assume that a *low-type* match will be forced (with certainty) upon the isolated design-less consumer, a match that (in equilibrium) will always make him worse off (in expected value) relative to parting with money and acquiring the design (giving him a chance of being matched with a high type). The model that Pesendorfer constructs is one where fashion is “useless” except in a “social context” (Pesendorfer 1995, 775). The assumption of forced association in Pesendorfer’s model drives the consumer demand for design. Producing more than one design and competition are “wasteful” (783).

In the parallel case, in which only one person buys the design (as opposed to all but one), then he is matched by the same rule that applies when no one has bought a design. Consequently, there is no need to hold a high-type person in reserve. Pesendorfer does not comment on the asymmetry of assumptions about what happens in the alternate cases where one person decides differently from all the rest.⁵

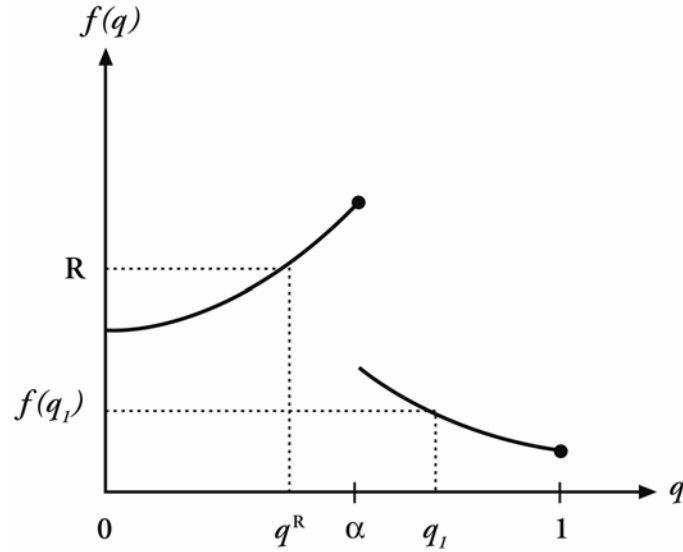
Before leaving the matching rule, there remains the issue of semantic integrity. Pesendorfer repeatedly calls the matching rule “the matching technology” (Pesendorfer 1995, 776-777). But normally “technology” means applied science or know-how. The matching rule in Pesendorfer’s model has nothing to do with know-how deployed to accomplish a goal; it is not technology, simply an assumption about the way things are. Calling the matching rule “the matching technology,” suggests that the fashion industry somehow uses technology to coordinate the matching of people, and obfuscates the artificial assumption of forced association.

3. *The last-to-buy function*

Pesendorfer’s Figure 1 (Pesendorfer 1995, 777), redrawn with embellishments here as Figure 1, elucidates the model; the horizontal axis measures consumers (denoted by q). Again, the high types and the low types are divided by α ; those on $[0, \alpha]$ are high, those on $(\alpha, 1]$ are low.

⁵ The symmetric assumption would be that when just one person buys a design, that person is (with certainty) matched with a high type, who is otherwise held in the dungeon.

Figure 1: The If-I-Were-Last-To-Buy Function



The vertical plot is $f(q)$: the expected benefit (willingness to pay) that consumer q would get from a design if she is the last one to buy a design (that is, if the design is bought by everyone on $[0, q]$ and no one on $(q, 1]$). For example, consumer q_1 would be willing to pay up to $f(q_1)$. In this model, *everyone's benefit* depends on the choice at the margin. Whether consumer q_1 (or some nonzero measure of consumers in the neighborhood of q_1) chooses to buy the design will affect the benefit of all other consumers. More specifically, when q_1 is a low type, it will reduce the benefit of all the interior consumers. Unlike the marginal benefit curve for apples, $f(q_1)$ does not display the benefits of *inframarginal* units. It shows one's benefit only when one is the "last" to buy it. If consumer q_1 is the last to buy, the actual benefits for all the interior consumers are as follows: (1) for the low type consumers with the design (that is, those on $(\alpha, q_1]$) the benefit is a *flat* line at $f(q_1)$; and (2) for the high types (on $[0, \alpha]$) the benefit is a *flat* line that is higher than $f(q_1)$. It is higher because high types benefit more from being matched with high types.

Notice that $f(q)$ is initially upward sloping. Consider the condition of consumer q^* (such that $0 < q^* < \alpha$), and assume that she is in the position of being the last one to buy the design. A high-type consumer will achieve the higher utility associated with matching with another high-type

consumer. But the consumer's willingness to pay for a design varies because the utility associated with not buying the design depends upon how many others have bought the good. Over the interval $[0, \alpha]$, as q^* approaches α , the pool of people left without the design (every $q > q^*$) is increasingly comprised of low types. As q^* goes up, the last high-type is buying it because if she does not, then the likelihood of a match with a low type rises.

Although we are calling $f(q)$ the last-to-buy function, Pesendorfer repeatedly calls it "the demand function" (Pesendorfer 1995, 776-777). The definition of a demand function is a function which, given a price, specifies the quantity demanded. In Figure 1 consider price R for the design; if $f(q)$ were a demand curve, that would mean that, at price R , consumers would demand q^R of the design. But, in fact, at a price of R , there are *three* equilibria: 1) an equilibrium in which no one bought the design (no one wants to be the only person to shell out for a design because in that case it does nothing to advance the quality of the forced match);^{6,7} 2) an equilibrium where every high-type (and no low-type) bought the design (in that case high-types would get benefit at the apex of the $f(q)$ curve and pay R for it); and 3) a knife-edge unstable equilibrium with exactly q^R consumers buying the design. When q^R consumers buy the design, the benefit exactly equals R , so in fact each high type is indifferent between buying and not buying.⁸

Pesendorfer does not explain the three equilibria. In calling $f(q)$ the demand function he suggests that at a price such as R it is the knife-edge unstable equilibrium that prevails. But Pesendorfer does not, in fact, treat $f(q)$ as a demand function. In all of his equilibria, if one high-type buys, they all do. Pesendorfer simply misuses the term "demand function," generating much confusion for the reader.⁹

⁶ Incidentally, it seems to us that, contrary to Pesendorfer's expression (4) on page 776, $f(q)$ equals zero when q is 0.

⁷ This equilibrium is unstable in the sense that if any non-zero measure of consumers "trembled" and purchased the design, dynamic forces would not push the system back to the original equilibrium. However, it is stable in the sense that it is not a knife-edge equilibrium. Every non-zero measure of consumers wishes to stick to the equilibrium not merely out of indifference, but of strictly superior utility. Thus, one might say that it is an unstable equilibrium, but not a knife-edge unstable equilibrium.

⁸ For the prices corresponding to the lower segment of the function, the "demand function" interpretation works—given a price, the function tells you quantity demanded, in a unique and stable equilibrium.

⁹ Pesendorfer makes another error when he writes: "This [the upward sloping portion of the so-called demand function] can be interpreted as a 'bandwagon effect' (Leibenstein, 1950)." Pesendorfer's attribution is flawed because Leibenstein explicitly modeled the bandwagon

Dynamic Equilibria and Design Cycles

To generate periodic design cycles, Pesendorfer embeds a modified version of the static matching model into a dynamic game in which a designer innovates and sets prices.¹⁰ Regarding the dynamics of consumers acquiring and processing information, in the appendix are the following remarks:

I assume that all agents can observe other's actions. However, strategies will be required to be anonymous (i.e., the deviations of a measure-zero set of agents do not affect equilibrium outcomes). Note that the interaction between consumers is entirely determined by the matching technology which determines matches using the currently displayed designs of consumers. Therefore, information about individual consumer histories is irrelevant for all agents, and one can interpret the game as one in which only the designer's action and total sales can be observed. (Pesendorfer 1995, 787)

The parallel discussion in the text is:

Implicit in the definition of the game is that histories of individuals are unobservable and hence the matching technology cannot condition on past designs used by a consumer. (Pesendorfer 1995, 778)

On one hand, there are zero costs of discovering what everyone else is currently consuming, but on the other hand there is neither memory about what was consumed in prior periods, nor strategic adaptation as new information is acquired. In this world "dating"/"matching"/"meeting" is

effect so as to exclude the existence of upward-sloping demand functions.

¹⁰ The mathematics of this game are so involved that even the paper's three page appendix is inadequate; readers who are interested in a complete explanation must acquire one of Pesendorfer's working papers. The working paper adds nuances that only lead to a greater number of possible equilibria. Because the nuances make the model even less operational, we do not examine it further. Incidentally, in condition (i) on page 779, we believe it should say $p \leq P(q)$, not $p \geq P(q)$.

behind a veil of never-ending ignorance, where it is impossible to learn from the past, hence the “technology” of human interaction is immutable. Here there is only one thing that can be observed about other people, the “look of,” or design of, a thing that everyone, without exception, will look upon as either “in,” or “out,” of fashion.

Discussing what happens in each period, Pesendorfer states that, “then [in each and every period] each consumer decides which designs to buy and which (of the designs she already owns) to sell” (Pesendorfer 1995, 777).

In footnote 10 Pesendorfer states: “All results are unchanged if consumers are not allowed to sell their designs.” Ordinarily we would expect a change in consumer behavior if the rights to resale are abrogated. But in Pesendorfer’s model: “If the new design is sold to both high and low types, then the old design *must* have a zero price” (Pesendorfer 1995, 778, emphasis added). The following paragraph explains why it must have a zero price.

If a consumer is the only person to purchase a design, then she will be matched with a random consumer from the pool of individuals who use no design. The design does not improve the quality of the consumer’s match in this case and therefore has no value. Thus, a design is only valuable to consumers if a coordination problem is solved. I assume that the designer can coordinate demand for his latest design. Part of the innovation cost c should be interpreted as expenses for marketing and advertising to achieve the coordination of consumers to the largest demand. I also assume that whenever the designer creates a new design he cannot simultaneously advertise the old designs, and hence the coordination of the demand for the old designs breaks down. Consequently, I restrict attention to equilibria in which designs other than the latest innovation are sold at a zero price. (Pesendorfer 1995, 778)

Here Pesendorfer means that: 1) People have no discretion over whom they are to associate with, instead they are randomly matched (noted previously); 2) A “coordination” problem has to be overcome, otherwise designs (which are assumed to contribute nothing to consumer utility directly), would be valueless to consumers; 3) The designer, via “advertising and marketing,” is able to “coordinate” consumers so that an otherwise

valueless design takes on value because the designer is given the power to force consumers to make the choices that give value to the design; 4) Although the designer's ability to coordinate is unlimited for the latest design (even in cases where the "latest" design lasts multiple periods), it is assumed that no one is able to coordinate the consumers of old designs to any degree (this forces the prices of old designs, in "equilibria," to zero).

Coordination costs are assumed to be: 1) a component of fixed cost incurred at the time of innovation; 2) invariant with respect to the size of the market and the proportions of consumer types. Although a number of coordinations may be required in multiple periods (in the cases where the "latest design" lasts more than one period), the costs of coordinating in all periods for a particular innovation occur at just the moment of innovation. This assumes that the designer has perfect foresight and that he prefers not to defer deferrable costs. The fixed cost "c" in Pesendorfer's model is a catch-all "black box" holding both the costs of design "innovation" and the costs of coordinating consumers. This is where the wastefulness comes in: something that is valueless to consumers ends up being innovated, and in some of Pesendorfer's cases, innovated an infinite number of times. Pesendorfer claims that "the current model predicts 'overinvestment' in product quality" (Pesendorfer 1995, 775), but really the result drops out directly from the bizarre assumptions about "matching" and the sterility of "designs." The result is not "predicted," it is deliberately constructed.

"STYLIZED FACTS"

Some of Pesendorfer's "stylized facts" (Pesendorfer 1995, 785) warrant special scrutiny; one is the crucial characteristic that drives the markets for durable fashion goods.

Appearance is an important component of most durable consumption goods. Large amounts of resources are devoted to the development of designs for clothing, cars, furniture, and electronic equipment. These resources are not primarily used to make those goods more functional; rather their goal is to let the product appear *fashionable*. (Pesendorfer 1995, 771, italics in the original)

Another “stylized fact” is that monopoly power exists in fashion designs.

[I]t is observed that even if potential competitors are free to enter the design market, *one* possible outcome is that one designer is chosen to be a fashion czar and behaves as a monopolist. If all consumers believe that only the fashion czar is capable of creating “fashion,” then this will be the equilibrium outcome. (Pesendorfer 1995, 773)

History and other types of evidence contradict both the reasonableness of focusing solely upon designs and the assumption of design monopolies. The model assumes that an innovation in fashion (design) has a temporal monopoly. Pesendorfer suggests that over time the monopoly breaks down as the design is copied and becomes less fashionable because it is more widespread. He specifies that the temporal monopoly is about a year long for clothing design (Pesendorfer 1995, 785).¹¹ These “stylized facts” are incompatible with the facts. If a new design appears in Milan or Paris, that design may be transmitted across the globe in minutes. Sketches, photos, specifications are all in the hands of competitors less than one day after an initial showing. Indeed, the technology of hand-held computers, cameras, and camcorders allows photos of designs to be transmitted worldwide within seconds.¹²

Nor did the stylized facts apply to the fashion world before the advent of real-time telecommunications: the resources invested in

¹¹ Pesendorfer (1995, 771) states: “A model of fashion cycles is developed in which designs are used as a signaling device in a ‘dating game.’ A monopolist periodically creates a new design. Over time the price of the design falls as it spreads across the population. Once sufficiently many customers own the design it is profitable to create a new design and thereby render the old design obsolete.”

¹²The Fax machine was widely available in the 1970s insuring the virtual instantaneous transmission of new designs. Given the importance of current design or fashion in the garment industry, substantial resources are committed to discovering what the new design's are before they are shown. Consequently some of the competitors have knowledge of new fashions even *before* they are officially shown for the first time. Some employers restrict their employees from bringing hand-held computer devices to work because of the ease with which designs can be transmitted.

discovering fashion trends ensured that this information was quickly and widely disseminated as far back as reliable information about a fashion industry exists. E.L. Jones, writing on the fashion markets of the eighteenth century, states:

In important respects Europe had become a unified market area, for the factors of production, capital and labor, and increasingly for goods. Obviously it was easiest for commodities of low bulk and high value to surmount the physical and political obstacles to trade, as we may see from the world of fashion. Unification in this field was aided by the Grand Tour and the practice of sending annually round each major city as far afield as St. Petersburg, and that western outpost of Europe, Boston, Massachusetts, a jointed wooden doll dressed in the season's Paris mode. Dressmakers everywhere copied the style. Generals permitted the 'wooden mademoiselle' to pass through the lines. Fashionable society was animated by periodic crazes for foreign styles, in the continent for things English, in England for things French. Scarcely a corner was remote enough to be exempt: even the National Museum of Iceland contains furniture which represents Danish taste, itself swayed by French, English, German and Dutch influences. (Jones 1981, 113-114; citations omitted)

If dressmakers in eighteenth century Boston were using that year's Parisian styles, how can a temporal monopoly in fashion design exist in the present-day?

The answer is that no quasi-monopoly in fashion design exists. What principally allows garment producers to price their products at a premium to "ordinary" garments is their reputation for producing superior garments, superior in a number of production characteristics. Some are qualities associated with: (1) the fabric, such as type (wool, cotton, linen, silk, blend, synthetics, etc.), weave, thread count, weight, color, backing, and so forth; (2) construction (double or single thread) and piping; and (3) ancillary objects (buttons, zippers, ornamentation). Whole sub-industries are devoted to, for examples, buttons and zippers, and an incorrect decision

on one of these margins can force the garment maker into closure.¹³ A major reason why fashion goods sell for premium prices is that they are relatively expensive to produce because the materials and specialized production capabilities that produce fashion goods can only be supplied at positive and usually increasing marginal costs. In contrast Pesendorfer's model requires that the marginal cost of an additional garment is zero.¹⁴

People in the fashion trade realize that the marginal cost of a particular design is trivial. Consequently consumers do not pay for design *per se*. Because Pesendorfer's model is about how consumers pay for fashion design, it is either devoid of empirical content, or easily refuted by looking at a recent issue of a fashion industry trade journal. Pesendorfer seems to acknowledge this in his concluding remarks. On the basis of the comments of an anonymous referee (Pesendorfer 1995, 786, n30), he states that the costs of "materials" applied to the designs are essential considerations to fashion theories that could be observationally tested (786-787). He leaves these considerations "for future research" (787).

To support his "stylized facts" and the explanatory power of his model, Pesendorfer refers to sumptuary laws of the past (Pesendorfer 1995, 786, n29). Pesendorfer argues that "sumptuary legislation will be efficient in the sense that the maximal gains from social interaction will be realized without waste of resources on design innovations" (786); thus the sumptuary laws are something he believes his model explains and justifies. There are some problems here. First, sumptuary laws did limit imitation of the "upper" class by the "lower" class, but sumptuary laws limited the lower classes' access to *products* (silk, gold thread, certain foods and colors, etc.). Designs, *per se*, were unimportant.¹⁵ Also, Pesendorfer says we would expect to find sumptuary laws "in societies with a well-defined class structure" (786), yet his assumption about individuals knowing nothing about each other except the design of their clothing especially lacks plausibility if class structure is well-defined.

¹³ One of the co-authors (Coelho) has had real world experience in this area. His firm sold fashion blue jeans, and he contracted to have cheap, yet purportedly high-quality zippers placed in the garments that were being manufactured to specifications. The zippers were cheap, but turned out to be low-quality; they had a tendency to split apart when worn. The subsequent purchase-returns and loss of goodwill led to the firm's closure.

¹⁴ "Once a design *n* has been created, the designer can produce indivisible unit of it at zero marginal cost" (Pesendorfer 1995, 775).

¹⁵ In his own discussion of sumptuary laws, Pesendorfer (1995, 786), citing J. M. Vincent (1934), alludes to the case of lower classes during the Middle Ages being restricted from wearing "velvets and silks", but nowhere does he provide an example of sumptuary laws on designs *per se*.

FINAL REMARKS

Pesendorfer's fashion model involves a long chain of complex mathematical relationships with vague linkages. Mathematical modeling can be useful in elucidating complex reasoning where verbal or descriptive reasoning is not sufficiently precise, but modeling complexity in economics comes at substantial cost. An underlying assumption of mathematical reasoning is that the relationships are stable throughout the analysis. The longer the chain of mathematical reasoning required by a theory, the longer the chain of required stable relationships between the variables. The difficulty with this stability assumption is that economic analysis deals with phenomena that occur in the real world in real time. Operationalism, the ability to assess models against real-world observations, is crucial in economic model building.

In 1955 Donald F. Gordon identified the problem with employing long, complex mathematical relationships in economic models. Each mathematical step is temporally stable only by virtue of the *ceteris paribus* assumption. The longer and more complex the mathematical model, the more likely the assumption of *ceteris paribus* will be incorrect. As long as the workings of the model do not occur instantaneously the passage of time materially affects outcomes in ways unspecified by the mathematics. Gordon noted a paradox: mathematics is most useful in elucidating long, complex chains of reasoning, yet the longer the chain of reasoning the more likely that *ceteris paribus* assumptions will be violated. Paradoxically, the more useful mathematics is in framing explanations, the more likely is it that observational reality will confound the explanations.¹⁶

Fashions are notoriously ephemeral. What can be said of the length of the mathematical chain in the paper? It has 10 numbered equations (excluding those in the appendix), one mathematically stated theorem, three mathematically stated propositions, and a mathematical appendix

¹⁶ Paul A. Samuelson (1952, 57) noted that Alfred Marshall and John Stuart Mill were given to "speaking of the dangers involved in long chains of logical reasoning." He explained Marshall's perspective: "Marshall treated such chains as if their truth content was subject to radioactive decay and leakage – at the end of n propositions only half the truth was left, at the end of a chain of $2n$ propositions, only half of half the truth remained, and so forth in a geometric multiplier series converging to zero truth." Gordon (1955, 58) also cited Marshall as having disdain for "long chains of reasoning." Also alert to the problem of employing tenuous derivations in economics, Wassily Leontief (1971, 1-2) remarked that: "Uncritical enthusiasm for mathematical formulation tends often to conceal the ephemeral substantive content of the argument behind the formidable front of algebraic signs."

(Pesendorfer 1995, 787-791) that proves the propositions, but only begins to prove Theorem 1. In the appendix Pesendorfer indicates that only the “outline” of the proof of Theorem 1 will be provided; on the same page, in footnote 32, he directs readers who are interested in the “details” of this proof to a 1993 working paper of his (Pesendorfer 1995, 788). The working paper is thirty-six pages in length including references and figures.

The costs of mathematical complexity in economics can be partially or entirely offset by the additional insights that the mathematics provide.¹⁷ But the complex assumptions embedded in Pesendorfer’s mathematics are so poorly specified and, when interpretable, so bizarre that any operational challenge could be deflected by stating a divergence between the empirical challenge and the model’s assumptions. In a word, the model is non-operational. The exercise is barren. The paper is a great example of what does not count as science.

Unlike Pesendorfer’s model, in the real world: 1) populations are diverse (people are more than just “high” and “low” types); 2) people have freedom of association; they are not locked into a never-ending, randomized game that forces didactic associations based upon the distributions of garment designs in the population; 3) there are no clones, prisoners, nor cryogenic slaves available to satisfy a “matching technology”; 4) when it is important to them, people notice and remember the garments that others have worn; 5) “high” class women do not prefer to have other women (regardless of class) show up at social events identically attired; 6) consumers do not costlessly observe the contemporaneous purchase decisions of all other consumers; 7) consumers are constrained not only by the prices of fashion goods, but also by their incomes and the physical necessity of purchasing things other than fashion goods; 8) there is no single designer of fashion goods; 9) there are no temporal monopolies in designs; 10) advertising is not infinitely costly for old designs; 11) fashion designers do not have perfect foresight over future advertising expenditures nor their impact upon consumers; 12) advertising costs are not fixed in advance of their occurrence, and advertisers prefer to pay these costs later rather than sooner (*ceteris paribus*); 13) fashion designers are not limited to supplying only one design at a time; and finally 14) replicating fashion garments entails positive marginal costs.

It should be emphasized that our criticisms assume that

¹⁷ See Edward Chambers and Don Gordon (1966) for an exceptional example of how general equilibrium analysis can be used to gain real world insights; they investigated the impact of the wheat boom on the Canadian economy from 1901 to 1911.

Pesendorfer's model is for the purpose of providing operational propositions about specific phenomena. If it had alternative, albeit unstated, purposes our criticisms may be misplaced.¹⁸ Speculating on the "true" motivation behind an enterprise rather than its stated rationale is a sterile enterprise. We conclude that Pesendorfer's paper is inconsistent with observable reality. Milton Friedman (1953) famously maintained that in scientific inquiry it is legitimate to assert arbitrary assumptions about things that are not observable. Pesendorfer's error was to apply Friedman's dictum to things that are observable.

REFERENCES

- Baumol, William J.** 1990. Sir John Versus the Hicksians, or Theorist Malgré Lui?. *Journal of Economic Literature* 28(4): 1708-1715.
- Chambers, Edward J., and Donald F. Gordon** (1966). Primary Products and Economic Growth. *Journal of Political Economy* 74(4): 315-332.
- Davis, William L.** 2004. Preference Falsification in the Economics Profession. *Econ Journal Watch* 1(2): 359-368.
- Debreu, Gerard.** 1992. Random Walk and Life Philosophy. In *Eminent Economists: Their Life Philosophies*, ed. M Szenberg. New York: Cambridge University Press, 107-114.
- Friedman, Milton** 1953. The Methodology of Positive Economics. In his *Essays in Positive Economics*. Chicago: University of Chicago Press, 3-43.
- Gordon, Donald F.** 1955. Operational Propositions in Economics. *Journal of Political Economy* 63(2): 150-161.

¹⁸ Alternative justifications of economic modeling are characterized by skepticism and sarcasm: Axel Leijonhufvud (1973, 334) spoofs "There has been a great deal of debate in recent years over whether certain Econ modls and the associated belief-systems are best to be regarded as religious, folklore and mythology, philosophical and 'scientific,' or as sport and games." William Baumol (1990) suggests that the real purpose of some model building is model building, with economic phenomena serving as "hat racks" upon which to hang the models. Finally, Davis (2004) provides survey results indicating widespread skepticism about the official practices in the economics profession.

- Jones, E.L.** 1981. *The European Miracle*. Cambridge: Cambridge University Press.
- Leibenstein, Harvey.** 1968. Bandwagon, Snob, and Veblen Effects in the Theory of Consumers' Demand. Reprinted in *Readings in Microeconomics*, ed. William Breit and Harold Hochman. Hinsdale, IL: Dryden Press, 123-139.
- Leijonhufvud, Axel.** 1973. Life Among the Econ. *Western Economic Journal* 11 (September): 327-337.
- Leontief, Wassily** 1971. Theoretical Assumptions and Nonobservable Facts. *American Economic Review* 61(1): 1-7.
- Pesendorfer, Wolfgang.** 1995. Design Innovations and Fashion Cycles. *American Economic Review* 85(4): 771-792.
- Samuelson, Paul A.** 1952. Economic Theory and Mathematics-An Appraisal. *American Economic Review. Papers and Proceedings of the Sixty-fourth Annual Meeting of The American Economic Association* 42(2): 56-66.
- Simmel, Georg.** 1957 [1904]. Fashion. *American Journal of Sociology*. 62(6): 541-558.

ABOUT THE AUTHORS



Philip R. P. Coelho is of professor of economics at Ball State University. He has published in *The American Economic Review*, *The Journal of Economic History*, *The Southern Economic Journal*, *Economic Inquiry* and other journals. Current research interests are the economic effects of morbid diseases, the biological basis of economic behavior, and ethics and behavior in business. His email address is: 00prcoelho@bsu.edu.



Daniel B. Klein is associate professor of economics at Santa Clara University, associate fellow at the Ratio Institute (Stockholm), and editor of *Econ Journal Watch*. He is the editor of [What Do Economists Contribute?](#) (NYU Press/Palgrave). His email address is: dklein@scu.edu.



James E. McClure (Ph.D., Purdue University, 1983) is Professor of Economics in the Miller College of Business at Ball State University (email address: jmclure@bsu.edu). His publications appear in such journals such as: *Economic Inquiry*, *The Journal of Economic Behavior and Organization*, and *Southern Economic Journal*. His email address is: jmclure@bsu.edu.

[GO TO RESPONSE BY WOLFGANG PESENDORFER](#)