

# How many cents on the dollar? Women and men in product markets

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Gender inequality in contemporary U.S. society is a well-documented, widespread phenomenon. However, little is known about gender disparities in product markets. This study is the first to use actual market data to study the behavior of women and men as sellers and buyers and differences in market outcomes. We analyze a unique and large data set containing all eBay auction transactions of most popular products by private sellers between the years 2009 and 2012. Women sellers received a smaller number of bids and lower final prices than did equally qualified men sellers of the exact same product. On average, women sellers received about 80 cents for every dollar a man received when selling the identical new product and 97 cents when selling the same used product. These findings held even after controlling for the sentiments that appear in the text of the sellers' listings. Nonetheless, it is worth noting that this gap varied by the type of the product being sold. As a policy, eBay does not reveal the gender of users. We attribute the price differences to the ability of buyers to discern the gender of the seller. We present results from an experiment that shows that people accurately identify the gender of sellers on the basis of typical information provided in postings. We supplement the analysis with an additional off-eBay experiment showing that, in a controlled setting, people are willing to pay less for money-value gift cards when they are sold by women rather than men.

## INTRODUCTION

This study tests for gender disparities in online product markets. It analyzes new and unique data on all transactions of the 420 most popular products conducted on eBay between 2009 and 2012, to discern differences in the behavior of women and men as sellers and buyers and differences in market outcomes. The study explores whether women behave differently as sellers and buyers than men do and, when they behave similarly, whether women are paid less for the same product being sold. The crux of the findings is that women receive a smaller number of bids and lower final prices than do equally qualified men sellers of the same products. On average, women sellers received about 80 cents for every dollar a man received when selling the identical new product and 97 cents when selling the same used product. We complement the analysis with two experiments: one demonstrating that the gender of sellers on eBay can be accurately assessed on the basis of typical information provided in postings, and the other demonstrating that buyers report a lower willingness to pay for a specific product (a gift card) when sold by a woman compared to a man.

Gender inequality persists in U.S. society to this day. In the labor market, progress toward equality in employment, occupation, and earnings has been at a standstill since the 1990s (1–4). In 2014, 74% of women and 88% of men aged 25 to 54 were participating in the paid labor force (5). When participating in the labor force, a considerable number of women and men still work in substantially sex-segregated occupations and jobs (6). Women in the United States are less likely than men to hold lucrative positions and positions with authority and decision-making power (7–9). In 2014, women's median wages for full-time, year-round work were only 82% of their male counterparts' median wages (5). At home, women, regardless of

their employment status, tend to do more household work compared to men (10).

Little is known about gender inequality and discrimination in product markets. The limited evidence is based on the findings of field experiments, which suggests discrimination against women buyers in product markets (11, 12). It has been hypothesized that women are discriminated against in the rental and insurance markets because they are believed to have a lesser ability to meet payments (12) or because gender is used as a proxy for reservation price (12).

The focus on product markets and, in particular, on identical new products that are sold in auctions by women and men sellers enables us to rule out explanations for the gender price gap that are related to the quality of the products being sold. Thus, we improve on the existing literature on the gender wage gap in the labor force. Gender disparities and wage penalties in the labor market have been extensively documented by economists and sociologists. Nonetheless, in such studies, it is hard to control for the actual (and the perceived) productivity of women and men and the quality of their work. Thus, in the context of the labor force, it is hard to refute that what drives the gender wage gap is also differences in productivity and quality of work between women and men. Here, by focusing on identical new products—a new blue iPod shuffle, second generation, for instance—the quality of the products sold is controlled for, so that quality-related explanations for the gender price gap become irrelevant and only beliefs about sellers, their status, and the quality of the transaction matter.

By analyzing auctions (where sellers do not interact with buyers), differences in the negotiation skills of women and men sellers also become irrelevant. Finally, by controlling for the actual reputation of sellers and the texts that they use in their ads, as well as for all the characteristics of the listings that buyers can observe, we are also able to rule out all other explanations related to the actual quality of the seller and the nature of the transaction. Thus, what drives the gender price gap that we observe are beliefs about gender and the effects that they have on consumers' willingness to pay for desired products.

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eBay is a well-known online commerce company where people and businesses buy and sell a broad range of products and services worldwide. As noted, previous studies on gender discrimination in product markets have been mostly experimental in nature, yielding only a relatively small number of observations and focusing mostly on women as buyers. The sheer size of the data set used for the present study (1,106,741 transactions) and the ability to access all data available to the parties at the time they made their transactions allowed for a much broader research and analysis than were possible in previous investigations. Using this data set, we were able to assess the behavior of women and men as sellers and buyers, as well as the divergences in outcomes in the entire market being studied. We were also able to analyze the effects of such factors as reputation, use of reserve prices, and use of sentiment in listing texts.

Data were extracted in 2014 at the eBay Research Lab. The 420 most popular products from each of the meta-categories in the eBay catalog were selected for analysis. (The meta-categories are as follows: antiques; art; baby; books; business and industrial; cameras and photo; cell phones and accessories; clothing, shoes, and accessories; coins and paper money; collectibles, computers/tablets, and networking; consumer electronics, crafts, DVDs, and movies; dolls and bears; gift cards and coupons; health and beauty; home and garden; jewelry and watches; music, musical instruments, and gear; pet supplies; sporting goods; sports memorabilia, cards, and fan shop; tickets and experiences; toys and hobbies; and travel, video games, and consoles. For the list of all product categories on eBay, see [www.ebay.com/sch/allcategories/allcategories](http://www.ebay.com/sch/allcategories/allcategories).) For each product, we analyzed all completed transactions in which private sellers from the United States were involved. Private sellers were defined as sellers who are not categorized as stores by eBay and who have a feedback score of less than 1000. The feedback score is the number of positive feedbacks minus the number of negative feedbacks received. Given that most feedbacks are positive, the feedback score approximates the number of the members' transactions on eBay. The gender of sellers and buyers was identified on the basis of the gender reported by users at the time of registration. Because data were extracted with the cooperation and support of eBay, we had all the information that was known to the parties at the time of the transaction, together with additional data such as the final outcome and the ex post evaluation of the seller's performance by the buyer. Data related to the transactions (product details, including type, condition, and price; dates of the item listing and the completion of the transaction; text contents and the number and type of pictures in the item listing; whether a reserve price had been set; feedback given to the seller; and so on), the sellers (gender, reputation, experience, and state of residence), and the buyers (gender and state of residence) were used to analyze gender disparities in behavior and transaction outcomes.

## RESULTS

### Women and men as sellers and buyers

We found that there were fewer women sellers than men. Women tended to have less experience as sellers but better reputations than the men did. As sellers, women tended to set a higher start price in auctions and were slightly more willing to pay for setting a hidden reserve price than their male counterparts were (there is a fee on eBay for setting a reserve price).

Women represented only 23.07% of the private sellers in the data set. Of the four main sale platforms available on eBay, women were

most represented as sellers in completed transactions listed as "Buy It Now," in which sellers set a price for an immediate purchase of an item (24.08% of sellers on this platform were women). Women were least represented as sellers in completed transactions listed as "Buy It Now or Best Offer," which, in addition to purchase at a set price, allow for direct negotiations between the buyer and seller (16.52% of sellers on this platform were women). Women made up 23.44% of completed transactions listed as "Auction" and 22.77% of completed transactions listed as "Auction or Buy It Now" (see table S1). In a multinomial logistic regression model predicting the platform of sale, in which "Auction" was the baseline comparison platform, being female was negatively associated with the choices of the "Buy It Now or Best Offer" and "Auction or Buy It Now" platforms, and positively associated with choosing the "Buy It Now" platform ( $P < 0.001$ ,  $n = 1,106,741$ ; see table S2).

Auctions are ideal for testing for gender differences in outcomes because, after an item has been listed, the final price is not affected by the seller's behavior, only by the bidding of potential buyers. For example, in auction-style listings, potential buyers do not negotiate with the seller, and thus, the seller's bargaining skills do not affect the final price. We therefore proceeded with the analysis of "Auction" transactions only. Table 1 presents the summary statistics of best-selling products posted as "Auction."

Women sellers in the data set had less experience than did men sellers. On average, the women in the data set had been members of eBay for 9.02 years, as opposed to an average of 9.81 years for the men ( $P < 0.001$ ). In an ordinary least squares (OLS) regression model controlling for the year of auction, women's experience was 9.6 months shorter than men's ( $P < 0.001$ ,  $n = 631,516$ ; see table S3).

However, women sellers had better reputations as sellers than the men sellers did. On eBay, the reputation ("feedback score") of each seller appears in parentheses next to the seller's username and at the top of the feedback profile. Next to the reputation, a star that changes its color when the reputation increases may also be present. The reputation is calculated on the basis of the number of past transactions for which a seller received positive feedback minus the number of transactions for which negative feedback was received. Women sellers had an average reputation of 275, as opposed to an average of 260 for the men ( $P < 0.001$ ). Likewise, women had a slightly higher percentage of transactions for which positive feedback had been given in the year preceding the current transaction (99.60% for women and 99.58% for men,  $P < 0.05$ ). In OLS regression models predicting the reputation of sellers, women sellers had higher reputation score than men sellers. On average, the reputation score of women sellers was 25.23 higher than that of men sellers, controlling for year and sellers' experience ( $P < 0.001$ ,  $n = 631,516$ ; see table S3).

On average, women sellers in the data set had set lower auction start prices than did the men ( $P < 0.001$ ). At the same time, women tended to be involved as sellers in auctions for cheaper products than were the men, in which start prices tend to be lower in general. In auctions for the sale of the same products, women set higher start prices than men did. An OLS regression model controlling for the type of product being sold, its condition, year, and seller's reputation and experience found that women sellers set a start price that was \$6.47 higher than that set by men ( $P < 0.001$ ,  $n = 615,735$ ; see table S3).

Sellers in auctions on eBay can pay to set a hidden minimum price ("reserve price"), so that if the listing ends without any bid meeting this price, they are not obligated to sell the item. The fee for setting a reserve price is \$2 if the reserve price is below \$200 and 1% of the reserve price if

**Table 1. Summary statistics of auctions of best-selling products on eBay 2009 to 2012, by gender.**

	Women		Men		Test for difference in means/proportions
	Mean	SD	Mean	SD	
Price	101.26	154.46	136.15	181.46	$P < 0.001$
Number of bids	11.68	9.51	14.02	10.51	$P < 0.001$
Percent positive feedback	99.60	2.35	99.58	2.41	$P < 0.05$
Reputation	274.77	253.32	260.29	248.16	$P < 0.001$
Start price	40.24	102.20	46.57	116.93	$P < 0.001$
Reserve price (dummy)	0.03		0.03		—
New	0.17		0.11		$P < 0.001$
Rating: average	4.84	0.45	4.84	0.44	—
Rating: description	4.86	0.54	4.85	0.56	$P < 0.001$
Rating: shipping time	4.82	0.60	4.84	0.56	$P < 0.001$
Rating: shipping charges	4.83	0.54	4.83	0.54	—
Rating: communication	4.84	0.58	4.84	0.56	—
Bold title	0.02		0.04		$P < 0.001$
Number of pictures	1.36	1.63	1.78	1.92	$P < 0.001$
Stock photo	0.29		0.21		$P < 0.001$
Same state	0.05		0.06		$P < 0.001$
Duration (days)	4.81	2.32	4.66	2.40	$P < 0.001$
Year	2010.41	0.99	2010.45	0.98	$P < 0.001$
Years in eBay	9.02	3.35	9.81	3.37	$P < 0.001$
Sentiments	0.032	0.21	0.030	0.22	$P < 0.001$
<i>n</i>	148,017		483,499		

it is higher than \$200. The maximum fee is \$50. On average, women and men were equally likely to set a reserve price, but in auctions for the sale of the same products, women showed a slightly higher willingness to pay for setting a reserve price than men sellers did. In a logistic regression model predicting the choice to pay for a reserve price and controlling for the type of product being sold, the marginal effect of a woman seller on the probability of using the option of a reserve price was 0.007, suggesting that the change in the probability of a woman setting a reserve price as opposed to a man is less than 1% ( $P < 0.001$ ,  $n = 586,400$ ; see table S3).

Buyers on eBay can confidentially evaluate sellers on a scale of 1 to 5, in four categories: (i) accuracy of item description, (ii) shipping time, (iii) shipping charges, and (iv) communication. No significant differences were found in the average ratings received by men and women in all four categories. Women and men sellers received similar ratings for shipping charges and communication, and women scored slightly higher on item description ( $P < 0.001$ ) and slightly lower on shipping time ( $P < 0.001$ ). In an OLS regression model controlling for the type of product being sold, its condition, year, seller's reputation and experience, price, and other transaction characteristics, no statistically significant differences were found between women and men sellers in the average evaluations of transactions ( $n = 351,076$ ; see table S3).

Last, women buyers were found to prefer purchasing products from women sellers rather than from men sellers. In a logistic regression model predicting whether the buyer was a woman and controlling for the type of product being sold and all other characteristics, the marginal effect of a woman seller on the probability of a woman buyer was of 0.01 ( $P < 0.001$ ,  $n = 260,075$ ; see table S4).

### Market outcomes in auctions

Below, we describe the differences in auction outcomes between women and men, after controlling for all the characteristics discussed above. In all the models predicting market outcomes, we controlled for the type of product being sold using eBay's very precise and specified product classification (product fixed effect). This means that we compared the number of bids and final prices achieved when equally qualified women and men sold the exact same product. For example, we compared the number of bids and the final price received by women and men who have the same reputation, experience, number of pictures in the ad, etc., in an auction for a new "Bulova 18K Gold 95G07 Wrist Watch for Women."

Women sellers in our data set received a smaller number of bids for their products and obtained lower final prices than did equally

qualified men selling the same products. Table 2 shows the disparities in market outcomes for women and men in auctions.

In OLS regression models predicting the final number of bids obtained in an auction, women received 0.89 fewer bids than did men, controlling for type of product, its condition, seller's reputation and experience, auction start price, presence of a reserve price, upgrading of a listing (using a bold title), number and type of pictures used in a listing, and the day, month, and year of the sale transaction (model 1;  $P < 0.001$ ,  $n = 615,735$ ). Likewise, in auctions, women received final prices that were lower by \$4.88 than the prices received by men (model 2;  $P < 0.001$ ,  $n = 615,115$ , the type of the product and all other control variables added). To pull outlying data, the final price in model 3 was log-transformed. In this model, women sellers received final prices that were 5.3% lower than the prices received by men. Thus, on average, when selling a product, women received 94.7 cents for every dollar received by men.

In model 4, we tested whether price disparities are affected by the item's condition. Thus, the gender of the seller was interacted with the condition of the product sold. Overall, the effect of being a woman seller is greater for new products than for old ones. Whereas when selling used products, women received final prices that were 2.9% lower than the prices received by men, for new products, women received prices that were 19.7% lower ( $P < 0.001$ ,  $n = 615,115$ , the type of the product and all other control variables added). Thus, when selling a new product, women received 80 cents for every dollar received by men.

Most of the products sold on eBay by private sellers are used products. As a result, the average effect found in models 2 and 3 are closer to the effect of being a woman who sells used products. However, note that with new products, women and men sellers are selling the exact same products, whereas with used products, the specific condition of the product cannot be assessed. It is therefore possible that what reduces the price gap in the context of used products (as compared to new products) is that potential buyers trust women's account of the condition of used products more than they trust men's—even when they enjoy the same reputation on eBay. Nonetheless, for the main purpose of this paper, the price gap found for new products is the one of interest: with new identical products, the gender price gap cannot be attributed to the quality of the product but rather to beliefs about gender.

The control variables of reputation, bold listing title, more pictures, and longer experience on eBay all had a statistically significant positive effect on the number of bids and on the final price. A higher auction start price had a statistically significant negative effect on the number of bids but a statistically significant positive effect on the final price obtained.

Recall that women sellers tend to use the reserve price option slightly more than men sellers do (1% more likely). If buyers on eBay knew that women sellers tend to do so, they might avoid buying from women, which could explain a small part of the difference in the number of bids and final prices. However, because on average there are no differences between women and men in the tendency to set a reserve price (differences are found only when controls are added to the models), there is no reason to assume that buyers are aware of such a difference, especially given that the overall tendency to set a reserve price is itself very low (only 3% of sales).

To highlight the findings, we focus on the example of money-value gift cards. In an OLS model predicting the final price in auctions (log-transformed), women selling money-value gift cards obtained 6.8% less, on average, than men sellers did for the same gift cards (model 6,  $P <$

0.001,  $n = 10,979$ , all control variables added, including the venue at which the gift card can be used). This example is especially telling because, with gift cards, buyers can easily evaluate the worth of the product with no additional information because the condition of the product is irrelevant, and because the ownership and usage of gift cards are not associated with one gender.

Our findings also show that women buyers tend to pay more than men buyers for the same products. In OLS regression models predicting the final transaction price obtained in an auction, women buyers pay 3% more than men buyers (see model 5,  $P < 0.001$ ,  $n = 259,777$ , all control variables added). However, note that although women tended to buy more from women than from men, the effect of the interaction between being a woman seller and being a woman buyer was insignificant. Being a female buyer was not included in all the models that we describe because adding it to the models did not change the main effect of being a woman seller but significantly reduced the number of observations.

Women's willingness to pay more than men for identical products may be related to the cultural beliefs and stereotypes about women being less instrumental and agentic than men. Studies have shown that women learn to conform to such beliefs and stereotypes and to behave according to them (13, 14). It may also be that women buyers on eBay are less instrumental than men buyers on eBay because of the selection of women and men into auctions on eBay. It may be that the women who prefer to buy in auctions are less instrumental than the average woman buyer on eBay, because the more instrumental women prefer other platforms (or avoid buying on eBay). However, we do not have the data on buyers to support this possibility.

Finally, to better understand the mechanisms responsible for the price differences between women and men sellers, we further explored variations across product categories. In Fig. 1 and table S5, we present the effects of being a woman seller on the final price (log-transformed) for each product category in our sample. Whereas gaps seem to vary across categories and products, we found no systematic patterns: the size of the market and the "gender of the product" (whether the product is bought or sold more by women or by men than the average product) did not explain the variations found across products. Therefore, further research and additional external measures of the gender of the product are required to fully explore the variation across products.

### Texts and sentiments

To identify differences in the listing texts of women and men sellers and test for the possible effects of these differences on market outcomes, we conducted a sentiment analysis of the titles and subtitles of all auction listings using Semantria, a text analysis software. The software detected the contextual polarity of the listing—whether the description of the product was positive, negative, or neutral—and then gave each listing a score ranging from  $-2$  to  $2$ . The sentiment analysis showed that women and men sellers do, indeed, resort to different sentiments in their listing texts. The average sentiment score for texts posted by women was 0.032, and for texts posted by men was 0.030 ( $P < 0.01$ ,  $n = 629,357$ ). Because in Semantria texts are given a score between  $-2$  and  $2$ , the difference that we found is relatively small. In an OLS regression model predicting the sentiment score for the text of any given listing, being female was associated with a sentiment score that is lower than that associated with being male in auctions for the same products ( $P < 0.001$ ,  $n = 612,983$ , all control variables added; see table S6).

Last, although the sentiments expressed in listing texts positively affect the final transaction price, disparities in the final price between

**Table 2. OLS regression models predicting the number of bids and final price: eBay auctions 2009 to 2012.** All regressions include year, start month, end month, start day, end day, duration and product fixed effects.

	(1) Bids	(2) Price	(3) Log price	(4) Log price	(5) Log price	(6) Log price (gift cards)
Woman	-0.885*** (0.027)	-4.880*** (0.306)	-0.054*** (0.002)	-0.029*** (0.002)	-0.056*** (0.003)	-0.068*** (0.016)
Woman × new				-0.190*** (0.006)		
Woman buyer					0.030*** (0.003)	
Card title price						0.006*** (0.000)
New	1.198*** (0.041)	29.447*** (0.470)	0.212*** (0.003)	0.265*** (0.004)	0.210*** (0.005)	-0.236 (0.189)
Percent positive feedback	0.013** (0.004)	0.081 (0.051)	0.001 (0.000)	0.001 (0.000)	0.000 (0.001)	-0.005 (0.003)
Reputation	0.003*** (0.000)	0.023*** (0.002)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000 (0.000)
Reputation × reputation	-0.000*** (0.000)	-0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000 (0.000)
Years in eBay	0.013*** (0.003)	0.248*** (0.039)	0.014*** (0.000)	0.014*** (0.000)	0.013*** (0.000)	0.013*** (0.002)
Start price	-0.036*** (0.000)	0.487*** (0.001)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)
Reserve (dummy)	0.446*** (0.061)	43.648*** (0.702)	0.265*** (0.005)	0.265*** (0.005)	0.279*** (0.008)	0.361*** (0.078)
Bold title	1.851*** (0.060)	36.857*** (0.687)	0.155*** (0.005)	0.155*** (0.005)	0.162*** (0.007)	0.020 (0.085)
Number of pictures	0.367*** (0.007)	3.988*** (0.084)	0.037*** (0.001)	0.037*** (0.001)	0.039*** (0.001)	-0.000 (0.026)
Stock photo	-0.072* (0.033)	1.474*** (0.380)	0.016*** (0.003)	0.016*** (0.003)	0.015*** (0.004)	0.029 (0.029)
Same state	-0.110* (0.046)	-2.079*** (0.534)	-0.009* (0.004)	-0.008* (0.004)	-0.002 (0.006)	-0.033 (0.030)
Constant	19.520*** (0.532)	186.958*** (6.124)	4.819*** (0.041)	4.808*** (0.041)	3.752*** (0.057)	2.545*** (0.351)
R <sup>2</sup>	0.354	0.703	0.742	0.743	0.737	0.637
n	615,735.000	615,115.000	615,115.000	615,115.000	259,777.000	10,979.000

\*Significance at the 95% level. \*\*Significance at the 99% level. \*\*\*Significance at the 99.9% level.

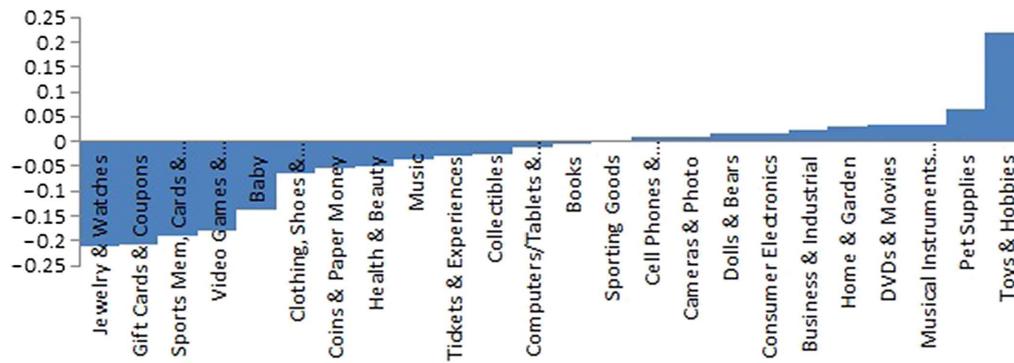


Fig. 1. Price gaps by product category.

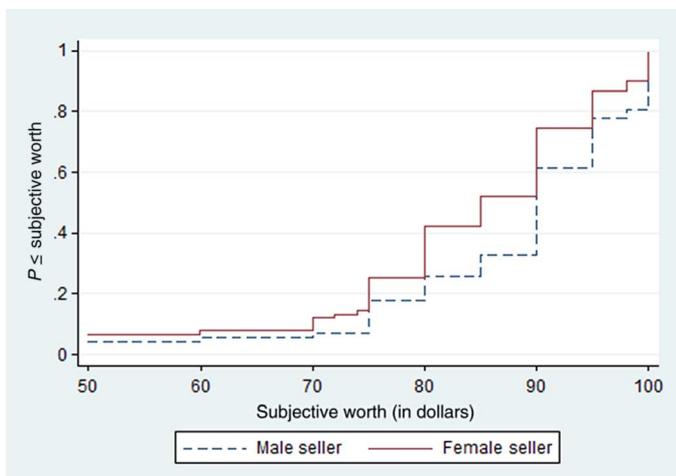


Fig. 2. Cumulative distributions of gift cards' subjective worth by seller's gender. Gaps are calculated as the percent price difference for women sellers compared to men sellers.

women and men are hardly affected when controlling for the effects of the sentiments used in the texts. When controlling for sentiments, women sellers still receive 3% less for the same used products and 19% less for the same new products ( $P < 0.001$ ,  $n = 612,983$ , all controls added; see table S7).

### Gender categorization on eBay

Potential buyers do not receive direct information from eBay about the sellers' gender. Yet, the gender of a private seller can be gleaned from the range of items a merchant is offering for sale (for example, selling female clothing suggests that the seller is likely a woman) and, at times, from the seller's username. To verify that people do accurately categorize sellers on eBay as either male or female, we conducted an experiment on Amazon Mechanical Turk, in which participants were asked to report whether they could identify the gender of five actual eBay sellers. One hundred sellers were randomly selected from among all the sellers in our main data set who were selling more than one product on eBay at the time.

Four hundred people participated in the experiment, each evaluating five user profiles. Of the 2000 evaluations, the gender was correctly identified in 1127 cases and mistakenly identified in 170. In 701 cases, participants reported that they could not discern whether the sellers were male or female ( $Z < 0.001$ ; see table S8). We also found that the prob-

ability of correctly identifying the gender of the seller increased by 5% with every additional item for sale on display on the seller's profile (see table S9).

The relative success in identifying seller gender is not surprising. Together with race and age, gender is a primary category of difference in the United States (15). This means that people automatically and intuitively gender-categorize every person that they encounter and later rely on these categories in their perceptions and evaluations of others (16). Indeed, we rarely leave encounters, however short they are, without determining whether the person we have met is a woman or a man. In real-world human interactions, gender categorization is based on salient physical features that are easily and quickly recognized. However, in the online world, these are less evident. The fact that people have little difficulty in finding clues for the gender of individuals with whom they interact with online is indicative of how important gender categories are for the way in which people make sense of their interactions.

### Woman, man, and the value assigned to products

One mechanism that could generate disparities between women and men in product markets is the attribution of a lower value to a product sold by a woman than to a product sold by a man. Findings in the "Goldberg paradigm" experiment support this hypothesis. In this experiment, an article was assessed slightly less highly when participants thought it had been written by a woman rather than a man (17). Likewise, there is some evidence that people's attributed status reflects on the status of the objects they have (18) and that, in the labor force, women's roles tend to be culturally devalued and associated with lower pay (19–22) than roles held by men. This may suggest that a lower status (and therefore a lower price) is assigned to the products that women have and sell.

To test whether people evaluate products that women sell as less valuable than the same products when sold by men, we conducted another experiment on Amazon Mechanical Turk, asking participants to report the monetary value they assign to an Amazon \$100 money-value gift card ("How much are you willing to pay?") when sold by either Alison or Brad.

As shown in Fig. 2, the results of the experiment support the hypothesis that a lower value is assigned to products when sold by women than by men. One hundred sixteen people participated in the experiment; 59 were asked to report their evaluation of a \$100 gift card sold by Alison, and 57 were asked to report their evaluation of a \$100 gift card sold by Brad. The average value assigned to the gift card sold by a woman was \$83.34, whereas the average value assigned to the same card sold by a man was \$87.42 ( $P < 0.05$ ; see table S10). Recall that similar differences in price between women and

men sellers were found when we analyzed transactions of gift cards on eBay (Table 2). (The gender of the participants in the experiments did not affect the final price, nor did it affect the differences between the prices of gift cards sold by a woman and the prices of gift cards sold by a man.)

## DISCUSSION

Our study demonstrates the gender differences in the behavior of men and women sellers and buyers on eBay and can be considered as representative of the U.S. product markets in general. The data from our study show that women sellers on eBay have fewer years of experience and are more risk-averse than men sellers but have more positive reputations. The data also show that women obtain a smaller number of bids and lower final prices in auctions of both used and new products. One explanation for this disparity is that people tend to assign a lower value to products when sold by women rather than by men. This rationale was supported by the results of an experiment that we conducted. Furthermore, we found that women buyers tend to pay more for products they purchase than men do.

The results of our study are particularly noteworthy when we consider the market that we studied. As a policy, eBay does not explicitly state the gender of its users. Nevertheless, men and women are easily gender-categorized by other users. We suspect that even greater divergences are present in other product markets where gender is always known.

## MATERIALS AND METHODS

### Main eBay data analysis

Data were extracted in 2014 at the eBay Research Lab. The 420 most popular products from each of the meta-categories in the eBay catalog were selected for analysis. The gender of sellers and buyers was identified on the basis of the gender reported by users at the time of registration. Data related to the transactions (product details, including type, condition, and price; dates of the item listing and the completion of the transaction; text contents and the number and type of pictures in the item listing; whether a reserve price had been set; feedback given to the seller; and so on), the sellers (gender, reputation, experience, and state of residence), and the buyers (gender, state of residence) were used to analyze gender disparities in behavior and transaction outcomes. We used OLS and logistic regression models (product fixed effects) to predict the number of bids, the final prices, and other interesting sales characteristics.

### Sex categorization on eBay

The experiment was conducted on Amazon Mechanical Turk. One hundred sellers were randomly selected from among all the sellers in our main data set who were selling more than one product on eBay at the time. Four hundred research participants were asked to report whether they could identify the gender of five of these actual eBay sellers by their profiles. Each participant was asked to evaluate five user profiles. Probability tests ( $z$  scores) were used to evaluate the results.

### Woman, man, and the value assigned to products

To test whether people evaluate products that women sell as less valuable than the same products when sold by men, we conducted an experiment on Amazon Mechanical Turk, asking participants to report the monetary value they assign to an Amazon \$100 money-value gift card ("How much are you willing to pay?") when sold by either Alison or Brad.  $T$  tests were used to evaluate the results.

## SUPPLEMENTARY MATERIALS

Supplementary material for this article is available at <http://advances.sciencemag.org/cgi/content/full/2/2/e1500599/DC1>

According to our agreement with eBay, we cannot use, reproduce, or access the data. The Stata do-file used for conducting the analysis is available online. We also provide the data and do-files for the two experiments conducted.

Table S1. Distribution of women and men sellers across sale platforms.

Table S2. Multinomial regression models predicting the sale platform, eBay 2009 to 2012.

Table S3. Models predicting the likelihood of various seller characteristics, choices, and rating.

Table S4. Logistic regression models predicting the likelihood of having a woman buyer.

Table S5. Regression coefficients from OLS models predicting the final price: eBay auctions 2009 to 2012, by product category.

Table S6. OLS regression models predicting the usage of sentiments in the listing, eBay auctions 2009 to 2012.

Table S7. OLS regression models predicting the final price, controlling for the sentiments used: eBay auctions 2009 to 2012.

Table S8. Gender identification of eBay users, experimental results.

Table S9. Logistic regression model predicting the likelihood of correctly identifying the gender of eBay users.

Table S10. The value assigned to products by the gender of seller, experimental results.

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to replicate the work would be afforded access to the data under the same conditions as the authors. Contact eBay at Yan.Chelly@ebay.com.

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## How many cents on the dollar? Women and men in product markets

Tamar Kricheli-Katz and Tali Regev

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