Market Convergence and Equilibrium in a Kenyan Informal Settlement*

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Abstract

The economies of developing countries are often characterized by market failures, but the causes of these inefficiencies remain incompletely understood. Here we use an experimental approach to study market interactions in a developing country from first principles. In particular, we ask whether basic predictions of neoclassical price theory hold in a simple market with participants from an informal settlement in Nairobi, Kenya. In developed countries, neoclassical price theory has been shown to accurately predict convergence and equilibrium in such markets. We use a classic double auction design, in which sellers set a price and buyers make a purchasing decision. All sellers have the same reservation price, and all buyers have the same, higher reservation price, creating a surplus. Since sellers have unlimited supply and buyers freely choose from which seller to buy, the predicted equilibrium transaction price is the sellers' marginal cost. We find that both offer and transaction prices converge rapidly to the theoretically predicted equilibrium. We find evidence for learning-by-doing, in that sellers learn to optimally set prices in the first few rounds of the game. In addition, we find evidence for learning-by-observing: when buyers switch into the role of sellers, they set prices optimally from the very first round. Optimal behavior, and thus profits, are strongly correlated with cognitive skills, especially mathematical ability. Together, these results suggest that neoclassical price theory accurately predicts basic market interactions in developing countries.

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Keywords: double auction, experimental market

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1 Introduction

Developing countries are frequently characterized by market failures; examples are capital market failures or a lack of insurance markets (Stiglitz, 1989). The market dynamics that give rise to these inefficiencies remain incompletely understood. The present study asks to what extent failures at the level of the most basic market mechanisms, such as price-setting and convergence to equilibrium in competitive markets, could be a contributing factor.

A rich tradition of research, originating in Smith (1962), has shown that economic markets can fruitfully be modeled in experimental settings. In Smith's classic double auction design, buyers and sellers interact as follows: sellers have an imaginary product that they produce at a marginal cost c. Buyers value the product at u. If $u \geq c$, this relationship creates a surplus and thus an incentive to trade; sellers will sell the product at a price p, where $c \leq p \leq u$, and the resulting surplus is $p - c \geq 0$ for sellers and $u - p \geq 0$ for buyers. Depending on the particular supply and demand schedule imposed on buyers and sellers, neoclassical price theory makes exact predictions about the equilibrium for transaction prices in such settings. Smith, and many after him (cf. Section 2), showed that the behavior of Western subjects in experimental markets of this type closely matched these predictions. This result extends to other market structures, such as offer auctions and posted-offer markets. Thus, experimental markets have proven themselves to be useful tools in testing the predictions of neoclassical theory.

However, these results were obtained with experimental subjects in Western labs, often undergraduate students, who have been described with the acronym "WEIRD" (Western, Educated, Industrialized, Rich, and Democratic). It remains unknown whether market interactions in developing countries follow the predictions of neoclassical theory equally well. That this is not a foregone conclusion is illustrated by a host of recent studies showing substantial heterogeneity of economic behavior across cultures and continents (Henrich et al., 2001, 2005, 2010). Thus, the possibility remains that basic market mechnisms may function differently in developing countries, and any such differences may contribute to creating the inefficiences that often characterize markets in developing countries. Indeed, initial evidence suggests that convergence to equilibrium in experimental markets in Sierra Leone may not be complete (Bulte et al., 2012).

This study examines the predictions of neoclassical price theory in an experimental market with participants from an informal settlement in Nairobi, Kenya. We assigned participants to either a buyer or a seller role. Sellers could sell an imaginary product which they produced at a marginal cost of KES 10; buyers could buy this product with a reservation price of KES 20. For a transaction price p with $10 < p < 20$, the surplus to sellers was $p - 10$,

and that to buyers was $20 - p$. Each interaction began with each seller making a price offer that was visible to all buyers (as well as all other sellers). Buyers then chose whether and from which seller to buy, following which the surplus implied by the transaction accrued to each party, and the next round began. Since sellers had unlimited supply and buyers chose freely from which seller to buy, neoclassical price theory predicts an equilibrium offer and transaction price of KES 11. To see this, note that when a seller offers a price $p > 11$, any other seller can undercut her and steal her entire surplus in the next round.

We find that the behavior of our Kenyan participants matched this prediction very closely. Buyers make optimal decisions from the beginning of the experiment, in that they buy form the seller offering the lowest price. Sellers begin by setting prices too high on average, but converge rapidly to the theoretically predicted equilibrium price of KES 11. A role change after 15 rounds, where buyers take the role of sellers and vice-versa, shows that this learning effect occurred not only for the sellers, but also for the buyers: when buyers turn into sellers, they set prices optimally from the very first round. We thus find evidence for learning-by-doing in the sellers, and for learning-by-observing in the buyers. Finally, we also find that cognitive skills, especially mathematical ability, are a strong predictor of optimal behavior, and thus profits. Together, these results suggest that basic market interactions among residents of an information settlement in Kenya are well-described by neoclassical price theory, and suggest that the root causes of market failures in developing countries may not lie in basic market mechanisms such as price-setting and convergence to equilibrium.

2 Literature review

2.1 Laboratory market experiments to test predictions of neoclassical competitive market theory

Neoclassical competitive market theory tells us that the quantity supplied by sellers is positively related to the price of the good, the quantity demanded by buyers is negatively related to the price. The predicted price level is called the competitive equilibrium price and occurs where the quantity supplied equals the quantity demanded. That quantity is called the competitive equilibrium quantity.

Smith (e.g. Smith 1962) and many researchers after him showed that the predicted outcomes of neoclassical price theory hold in experimental laboratory settings and that we can get to understand market mechanisms by conducting experiements in laboratories.

Laboratory experiments are important because of two reasons: First, laboratory experiments can serve as empirical pretests of economic theory before using data obtained in the

field. Second, the insights received from laboratory experiments can be relevant when interpreting field data.(Smith 1976) Laboratory settings are a good way to test theories because we can control for external factors.

Many market experiments study how market structure affects market performance. Important elements of market structure are the trading institution and market supply and demand functions. The trading institution defines the rules of the trading process. Market supply and demand functions result from valuation and cost functions which are induced on the participants of an experiment.(Cason and Williams 1990)

2.1.1 Double auction experiments

Chamberlin (1948) conducted the first experiments to test neoclassical competitive market theory in the laboratory. The experiment was designed as a decentralized bargaining market. His aim was to investigate cases which also occur in real life where contract prices differ from theoretic equilibrium but cannnot be changed to get closer to equilibrium. The main findings show that the volume was typically higher and prices typically lower than predicted by competitive equilibrium models and there did not seem to occur convergence toward equilibrium.

Smith (1962) ran double oral auction experiments. Many centralized markets for financial assets are organized as double auctions. (Cason and Williams 1990) His experiments differed from Chamberlin's in some important points: bids and offers were centrally outcried (not decentralized negogiated) and there were several trade rounds (not just one round) so that the individuals had the possibility to learn. The main findings showed that quantity and price levels were very near competitive levels and market experience reinforced the equilibrating process. (Smith 1962) The double-auction mechanism has been repeated in many experiments with variations since Smith and the tendency to reach equilibrium has been confirmed again and again. That shwos that neither complete information nor large numbers of participants are necessary conditions for prices and quantities to reach competitive equilibrium. (Davis and Holt 1993)

2.1.2 Offer and bid auction experiments

Smith (1962) reports one experiment in which sellers made offers competitively and buyers could only passively accept or reject them. This is called an offer auction. Most retail markets are organized in this way. The offers were made orally and sequentially, what means that offers could be only altered after a new one has been made. (1964) Because sellers want to sell at the highest price possible, offered prices are expected to be high and

remain above the predicted equilibrium. The results show that this was only the case in the first trading period. Because of the competition between sellers, and because the first buyers became aware that they accepted too high prices, prices decreased and actually stayed below equilibrium for the rest of the experiment. Additionally, the coefficient of convergence (defined as standard deviation of exchange prices / predicted equilibrium price) increased. Because this experiment shows the lowest tendency to converge toward equilibrium from a series of experiments Smith (1962) reports, he concludes that market organization has a big influence on the equilibrating process. (Especially, markets in which only sellers make offers tend to benefit the buyers and to harm sellers. There are two forms of asymmetry which may work to the advantage of the buyers: First, the competitive pressure is on the offers made by sellers. Second, sellers reveal more information about prices at which they are willing to transact than buyers do.) (Smith 1962)

(Smith (1964) reports further experiments in which either sellers or buyers made offers or bids respectively (offer and bid auction) and in which both sellers and buyers could make offers and bids (double oral market). He found that transaction prices and expected transaction prices are lowest in offer auctions and highest in bid auctions. The organisation variables had an important effect on the equilibrium states towards which the markets were converging and on the speed of the convergence: Prices were significantly lower in offer auctions and significantly higher in bid auctions than in double-auction markets. Speed of convergence to equilibrium was lower in offer and bid auctions than in double oral markets.

Walker and Williams (1988) reexamined Smiths (1964) results. The experiments differed in some features from Smith's: The experiment was not conducted orally but with computers. Not all subjects could actually take part in a transaction. The computerized auctions utilized a trading rule that required bids to become progressively higher and offers to become progressively lower. They find little support for the robustness of Smiths results. They find large differences in behaviour that was not related to the organization of the experiment (if the experiment was organized as a double or bid or offer makret).

2.1.3 Posted-offer and posted-bid auction experiments

Williams (1973) extended Smith's (1964) experiments to cases in which more than one good can be traded and to posted-offer auctions and posted-bid auctions. In a posted-offer auction sellers make offers simultaneously and cannot change them afterwards. This is similar to real markets where some time passes between price changes. (Williams 1973) Most retail markets are organized as posted-offer markets and assumed to be consistent with the predictions of competitive price theory. (Cason and Williams 1990) One after the other, each buyer can decide which price he wants to accept and which quantity he wants to buy. The order at

which the buyers enter the market is randomly selected.(Cason and Williams 1990) (Davis and Holt 1993) Williams results are exactly opposite to Smith's findings about offer markets: If sellers could make offers, transaction prices and expected prices were signifcantly above theoretical equilibrium prices. If buyers could make bids, they were significatntly below. Williams markets converged towards equilibrium less rapidly. This shows the importance of institutions: the form of making offers or bids can influence market outcomes. If there could only be made one offer (or bid), there was much less pressure on the prices to decrease (or to increase). (Williams 1973)

Ketcham, Smith and Williams (1984) investigate computerized posted-offer market experiments. In previous experiments, posted-offer markets showed a slower convergence and lesser efficiency than double auctions.(Plott and Smith 1978; Williams 1973) Ketcham, Smith and Williams (1984) considered if sellers had complete information about all offered prices and if indiviuals were experienced. "Experienced" means that the individual had participated in at least one experiment with the same trading rules . They found that in posted-offer markets, prices tend to be higher and efficieny lower than in double-auction markets. Experience tends to increase both efficeny and the speed of convergence to the equilibrium price.

Smith (1965) observes a strong tendency to converge to theoretical equilibrium even in markets with an extreme asymmety in buyer and seller rent. That is quite surprising because one might expect that extreme earnings inequality delay or even prevent market convergence to the competitive equilibrium.(Smith and Williams 2000) Davis and Williams (1986) extend the study of Smith and Williams (1982) , which showed that rent surplus had an effect on the path of price convergence toward equilibrium. They investigate if asymmetry in consumer and producer surplus affects convergence to competitive equilibrium in posted-offer markets. Second, they investigate if convergence differs between posted offer and double-auction markets while controlling for the effects of surplus asymmetries. (Davis and Williams 1986) Their results make clear that institutional differences should be kept in mind and carefully considered when interpreting results of market experiments. There seems to be an institutional bias which dominates the effect of unequal rents: The convergence path of posted-offer markets approached the equilibrium from above the convergence path of double-auction markets. Asymmetries in seller and buyer surplus had no effect. So they contradict the results of Smith (1965) and Smtih and Williams (1982) Like in previous studies, results showed that efficency in posted-auction markets was below efficiency in double-auction market. They support the conclusion of Kecham, Smith and Williams (1984).

Davis and Holt (1993) compare the results of Smith and Williams (1982) to the ones of Davis and WIlliams (1986). They show that price convergence from above is characteristic of posted-offer markets. Prices tend to be higher in posted-offer markets than in double-auction

markets. In a posted-offer auction, buyers are passive and tend to buy all goods, as long as a profit results out of that. Therefore, sellers will offer high prices and initial prices are above equilibrium. Prices go down only because of competition among sellers. Posted-offer markets extract less surplus than double-auction markets. Experiments where sellers cannot change their offers during the experiment tend to have lower efficiency levels, because too high offers cannot be corrected. After some periods, posted-offer markets extract a big part of possible profit from trade and efficiency rates increase, though they are somewhat lower than in double auctions. Markets do converge to theoretical equilibrium, though somewhat slower than in double-auction experiments and not as completely. (Davis and Holt 1993)

2.2 Comparability of people in the developing and in the developed world

Explanations of poverty and development depend on the assumptions that are made about individual preferences. There is evidence that people living in developing countries do not behave in accordance with the existing theories. Cardenas and Carpenter (2008) state the importance of testing the assumptions made about decision-making. Because poverty influences the way the poor make decisions, their behavior may not be comparable to the one of people living in the developed world. (Cardenas and Carpenter 2004)

Henrich et al. emphasize the heterogeneity of behaviour between different cultures. (Henrich et al. 2006; Henrich et al. 2010; Henrich et al. 2010a; Henrich et al. 2010b; Henrich et al. 2012). Referring to experimental findings from several disciplines they state that "WEIRD" (Western, Educated, Industrialized, Rich, and Democratic) people, who are the participants in most experiments, are particularly different from other populations. They are among the least representative people and their behavior is therefore among the least adequate to make generalizations about. (Henrich et al. 2010b) For example, there are findings that show that WEIRD subjects rely on analytical reasoning strategies much more than people from non-western countries. However, many theories, including neo-classical price theory rely on the central assumption of analytical reasoning. There are findings from evolutionary biology, neuroscience and related fields that the heterogeneity of people from different populations stems from the adaptation to diverse cultural contexts. (Henrich et al. 2010a) Henrich et al. (2010) show that market integration influences behavior. Market context determines market mechanisms and thus accounts for differences of market mechanisms between countries. Actually, there is the possibility that basic market mechanisms do not function properly in the developing world and might therefore account for market failures in such countries.

2.3 An experiment to test neoclassical market theory in the developing world

There is some evidence from a field experiment by Bulte et al. (2012) that basic market mechanisms indeed do not function properly in developing countries. List (2002, 2004) showed that not only laboratory experiments but also field experiments can test neoclassical price theory reliably. He examined decentralized bargianing markets in the spirit of Chamberlin by moving the investigation to naturally occuring marketplaces, namely the sport card and the collector pin markets. This field experimental design allowed him to gather data in a natural environment but he was still able to keep the necessary control to compare treatments. His findings show that neoclassical price theory predicted outcomes quite well in that there was a strong tendency of transaction prices to converge toward equilibrium and competitive equilibrium was reached in many market rounds. Centralization and publicity of bids and offers were not necessary for markets to reach equilibrium. Market composition and market experience did influence market outcomes. (List 2002; List 2004)

Bulte et al. (2012) moved the investigation of neoclassical market theory to the developing countries by running field experiments in a market in rural Sierra Leone. They investigate a setting that differs in some important points from earlier experiemnts to test neoclasical theory: Sierra Leone is characterized by self-subsistence and low levels of integration into markets. They want to fundamentally test neoclassical theory, which has been criticized as not being univserally applicable because it builds on Western ethical and behavioral foundations. (Bulte et al. 2012; Cardenas and Carpenter 2004; Cardenas and Carpenter 2008; Henrich et al. 2006; Henrich et al. 2010; Henrich et al. 2010a; Henrich et al. 2010b; Henrich et al. 2012). The design of the experiment was such that neoclassical price theory was given the best chance to succeed. They used oral double auction markets with multiple rounds. Transaction prices were made public to all participants. (Bulte et al. 2012)Earlier experimental findings (List 2002; List 2004; Smith 1962) did not automatically extend to Sierra Leone: The outcomes did not converge towards equilibrium, there was no effect of market experience and efficiency levels were lower than in previous studies. They found an effect of local hierarchies and social role on behavior. If status considerations were eliminated by placing participants in a context where trade is more or less anonymous, overall efficiency increases approximately to efficiency in earlier studies. Overall, their results show that market inefficiences can arise regardless of the market institution. Thus, not only marekt institution, but also the social context and culutral factors have an influence on market outcomes. (Bulte et al. 2012)Although Bulte et al. claim that there was no convergence toward market equilibrium in their market, this conclusion should be considered with some

care. There might be at least two alternative explanations for this. First, it is not clear that subjects did fully understand their task. Second, there is the possibility that learning may be really slow and that the amount of periods conducted in their experiments, namely 10, may not be enough to observe convergence.

3 Research Question

The previous literature review shows that there has been a lot of research on the predictions of neoclassical price theory conducted in laboratory experiments in Western countries. However, the extent to which these results hold in the developing world remains underresearched. The selection of participants in an experiment should account for the fact that economic agents in a certain market may think and behave differently from economic students, who normally are the participants in experiments. (Cardenas and Carpenter 2004; Cardenas and Carpenter 2008; Davis and Holt 1993; Henrich et al. 2006; Henrich et al. 2010; Henrich et al. 2010a; Henrich et al. 2010b; Henrich et al. 2012)Thus, if we want neoclassical price theory to help us solve problems in developing countries, we first have to test if its predictions do actually hold in this environment. There are concerns that the theory might be biased toward Western values and expectations about behavior which do not necessarily hold in other parts of the world. (Bulte et al. 2012; Cardenas and Carpenter 2004; Cardenas and Carpenter 2008; Henrich et al. 2006; Henrich et al. 2010; Henrich et al. 2010a; Henrich et al. 2010b; Henrich et al. 2012)There indeed might be evidence from a field experiment that people in developing countries do not automatically behave in accordance with neoclassical theory and that there is no learning effect (Bulte et al. 2012). However, these conclusions should be considered with care, because it might be that subjects did not understand their task or that convergence was very slow. Before using data obtained in the field, laboratory experiments can serve as empirical pretests of economic theory. The insights received from laboratory experiments can be relevant when interpreting field data. (Smith 1976) Thus, it is important that the predictions of neo-classical price theory are investigated in a laboratory experiment with people living in poverty, where trade can be kept anonymous, before making any conclusions about the predictions of neoclassical price theory holding in the developing world or not.

The aim of this paper is to investigate the predictions of neoclassical price theory in the Nairobi informal settlement of Kibera in Kenya. We want to examine if and how prices converge toward the equilibrium price. For this purpose, we move the investigation back to the laboratory and examine an experiment similar to posted-offer market experiments [1].

[1]Literature about posted-offer market experiments: (Davis and Holt 1993; Davis and Williams 1986;

This enables us to test the predictions of neoclassical price theory in a simple setting where we can control for cultural and social factors by keeping trade anonymous. Neoclassical price theory is given the best chance to succeed. Additionally, we can have a closer look at market experience. We investigate convergence to the market equilibrium and we try to answer the questions if there is a learning effect as the experiment proceeds and if there is an effect after the participants switch roles. Finally, we try to answer the question if cognitive ability has an effect on the prices offered and on the actual transaction prices.

4 Experiment

4.1 Setting

The 220 participants were inhabitants of the informal settlement of Kibera in Nairobi, Kenia. The subject pool consists of 5000 potential participants in the Nairobi informal settlements. Most of them live in Kibera. Compared to Nairobi and Kenyan population, women are slightly overrepresented. The age composition is almost exactly the same as Nairobi's: The age ranges from 17 to 93 years, with a mean age of 31.33. A majority of Nairobi informal settlement inhabitants belong to the Luo tribe, so members of this tribe are overrepresented in the subject pool comparing to the Kenyan population. People registered in Busara's subject pool are a bit more likely to have some level of education and to have had secondary education in comparison with Nairobi and Kenyan population. They are relatively less likely to have university education. Compared to Kenyan population, single men with no children are slightly over-represented. (Haushofer et al. 2012)

The data contains information about answers to nonverbal, mathematical and cognitive reflection task questions, offer and transaction prices, the amount of goods actually bought, the profits made and the reaction time that passes until an offer is made and accepted.

To take part in the experiment, participants did not have to have reading or writing skills, access to a computer or a bank account. They only had to have access to a cell phone and the MPesa mobile money system which more than 90% of Nairobi informal settlement inhabitants have. (Haushofer et al. 2012) So, our experiment included the poorest part of Kenyan population. The participants were recruited through text messages or phone calls. Experiments were conducted with the help of touchscreen computers and participants were carefully instructed to make sure that people understood the task even if they were not used to computers or could not read or write.

Ketcham et al. 1984; Plott and Smith 1978; Smith and Williams 2000; Williams 1973)

4.2 Experimental Design

The experiment analysed here was a laboratory auction experiment conducted in November 2012 at Busara Center for Behavioral Economics in the informal settlements of Kibera and Viwandani (?) in Nairobi, Kenia. The experiment was constructed to make the task as easy as possible for the participants to understand and to give neoclassical theory the best chance to succeed.

The experiment consisted of 13 sessions. People were divided into two groups, one played as buyers, the other as sellers. After 15 rounds, the participants switched their roles: People previously playing as sellers now played as buyers and vice versa for 15 periods. The market structure investigated in this experiment is similar to posted-offer market experiments conducted in earlier studies. Our experiment differed to similar market experiments in that the buyers chose among the offers simultaneously, not sequentially. [2]The market in the experiment consisted of sellers wanting to sell an imaginary homogenous good to the buyers. The sellers had a cost of 10 KES providing this good. The value of the product to the buyers was 20 KES. Costs and product valuations remained the same for the whole experiment and were strictly private. Each seller had to make an offer at which price he was ready to sell his product. All buyers and sellers could see all the offers on their screens. The buyers could choose among the offers or neglect to accept any of them. Each buyer could only buy one good from one seller but more than one buyer could buy from one seller. So, one seller could sell more than one good. In this, our setting differs from similar experiments conducted in earlier studies. The profit of the sellers was the transaction price minus the cost of Ksh 10. The profit of the buyers was the value of Ksh 20 minus the transaction price. To protect people from making losses, they could not offer prices below 11 nor accept offers above 19. Thus, if a buyer accepted an offer, she or he and the involved seller were sure to make a profit of at least one. The transacted amount, the transaction prices and the profits were not public information. Each individual just received information about how much profit she or he made.

Before the actual experiment started, participants had to solve some test tasks, including mathematical questions, cognitive reflelection test (CRT) questions and nonverbal questions where people had to choose from an array of elements to complete geometrical images. Before the first 15 and the last 15 periods, sellers and buyers were asked some role-specific questions and there was a test run to make sure people understood their task. The profit of the test run did not count toward the payoff the participants got at the end of the experiment. People were paid Ksh 200 for participation and transport, Ksh 50 if they arrived on time, Ksh 5

[2]Literature about posted-offer market experiments: (Davis and Holt 1993; Davis and Williams 1986; Ketcham et al. 1984; Plott and Smith 1978; Smith and Williams 2000; Williams 1973)

for each question they answered correctly in the first task and the profit they made in the actual experiment. The money was transferred through MPesa to their phone number.

The information conditions are common in market experiments: Each seller and buyer only knew about their own cost and valuation of the good respectively. Each participant was isolated at his own computer and no communication was allowed. These information restrictions reduce the parameters over which experimental conditions can vary. (Cason and Williams 1990)

Because buyers can choose from all offers, we expect them to choose the lowest price. More than one buyer can buy from one seller. Therefore, we expect the highest-offering sellers in each period not to sell any product. Sellers can compare their own offer to the all the other offers made and they get information if they sold any good or not. Theorefore, we expect them to learn and to offer lower prices, if they could not sell a product at a price that was apparently too high for the buyers to accept.

5 Methods

5.1 Convergence to equilibrium

We winsorized all price data at 99%.[3] To investigate how and if prices converge toward equilibrium, we first look at some summary statistics. Then, we use tobit regressions to test if prices are significantly different from the equilibrium price of 11. We subtract 11 from the offered price and the transaction price and then test with tobit regressions if the resulting offered prices and transaction prices are significantly different from 0. We then test if the offered prices are significantly different from the transaction prices.

5.2 Learning effect

To test if there is a learning effect on offered prices and actual transaction prices, we conducted a repeated measures ANOVA. The full model includes terms for the variable afterswitch indicating before or after the role change, the subject variable subject_progressiven nested within afterswitch, t as variable indicating the period, t interacted with afterswitch and t interacted with subject_progressiven nested within afterswitch. The highest order is dropped and becomes the residual error. Period is the within subjects factor (excluding indiviual differences) and afterswitch is the between subjects factor (individual differences). The error term for afterswitch is subject_progressiven nested within afterswitch. The error term

[3] Analyses with log specifications and linear, un-winsorized specifications are reported in the Appendix.

for t and t interacted with afterswitch is t interacted subject_progressiven nested within afterswitch. This is not included in the model and is therefore the residual error. Thus, our model looks as follows:

$$y_i = \beta_0 + \beta_1 \text{afterswitch} + \beta_2 \text{subject\_progressiven}|\text{afterswitch} + \sum_{t=1}^{T} \gamma_t 1(t) + \sum_{t=1}^{T} \delta_t \text{afterswitch} * 1(t) + \varepsilon_i$$

y_i is the offered or the transaction price. t is a variable indicating the period. subject_progressiven|afters indicates the term subject_progressiven nested withing afterswitch.

This enables us to test if prices go down as the experiment proceeds and the participants gain experience. We do this regression for the whole experiment for both the buyers and the sellers.

5.3 Effect of the role change

To test if prices are lower after the role change, we conducted OLS regressions of the following form:

$$y_i = \beta_0 + \beta_1 \text{afterswitch} + T_i + \varepsilon_i$$

afterswitch is a dummy variable that takes the value 0 in periods 1 to 15 and 1 in periods 17 to 31, so it changes from 0 to 1 when participants change their roles. T_i includes dummy variables for each period.

5.4 Effect of the cognitive ability

To test if there is an effect of the cognitive ability on prices, we used following OLS regressions:

$$y_i = \beta_0 + \beta_1 P_i + T_i + \varepsilon_i$$

P_i is a variable including overall performance in cognitive tests conducted before the actual experiment started. These regressions were also run by splitting up P in the three different parts: Nonverbal, mathematical and CRT. Addtitionally, instead of testing the effect of performance in the tasks, the reaction time was included in the regression. Reaction time measures the time that passed until the sellers made an offer and the buyers accepted one.

6 Results

6.1 Convergence towards equilibrium

6.1.1 Summary statistics

Figure 1 and 2 show the mean offered prices and the mean transaction prices, together with their standard errors, for each period. The mean offered prices start quite far above the transaction prices and the predicted equilibrium price. They converge to a range between 12 and 13 within 5 periods and stay there for the rest of the experiment. After the role change, the mean offered prices start much lower than in the first round, namely at around 13 and stayed again between 12 and 13 for the following periods. The standard errors are largest in the first four periods. The mean transaction prices are much lower than the mean offered price: They start below 12 and remain there until the end of the experiment. Buyers make few and small mistakes: standard errors are much smaller than the ones of the offered prices.

So, we can conclude that mean offered prices start quite high above equilibrium but fall relatively fast towards equilibrium, though they do not reach it. The small standard errors show that sellers make fewer and smaller mistakes as the experimnet proceeded. Because prices fall in the first periods and because they stayed low in later ones, there might be a learning effct. Additionally, the role change seems to have an effect on the price-setting behavior of the sellers: Prices start from a lower level than in the first round of the experiment. The effect of experience is investigated below. Buyers make few and small mistakes: Prices are near equilibrium and standard errors are much smaller than the ones of the offered prices.

6.1.2 Percentage of sellers and buyers at a certain price

Figures 4 and 5 show the percentage of sellers who offered a certain price and of buyers who accepted a certain price. The numbers of sellers who offered a price of 11 rises from 20% continuously to about 70%. After the switch, 45% of the sellers offer a price of 11, going up to about 75%. The number of sellers who offer a price of 12 goes down from about 25% to 10% before the role change and from 20% to 5% afterwards. In the first period about 60% of sellers offer a price of 13 or higher, going down to below 20%. After the switch, about 35% make an offer of 13 or higher, going down to 20%. Thus many sellers behave in accordance with theory and offer a price of 11. Again, there seems to be a learning effect as the experiment proceeds and an effect of the role change.

Buyers behave even more in accordance with theory. The amount of buyers who accepte a price of 11 rises from 65% to 90% before, and from 85% to 90%, sometimes 95% after the switch. Initially, 20% of buyers accept a price of 12, going down to about 5%. After the

role change, not even 10% of buyers accept a price of 12, going down to less than 5%. The amount of buyers who accept a price of 13 or higher starts from above 10% going down to about 8% before the switch and is between 5% and 10% after the switch.

Figures 6 and 7 show the cumulative percentage of sellers and buyers at a certain price both before and after the role change. Cumulative percentages of sellers after the role change are consistently above the ones before the role change: Sellers seem to behave more in accordance with neoclassical price theory after the role change. The percentage of sellers who offer a price of 20 KHS or higher falls from about 1% to about 0.5%. Also buyers seem to behave more correctly after the role change: Cumulative percentages are above the ones before the role change.

Together, these figures raise the question if there was a learning effect: People seem to behave more in accordance with neoclassical price theory as the experiment proceeds and after the role chance. Results of an ANOVA and of OLS regressions are reported below.

6.1.3 Tobit regressions

Table 1 shows tobit regressions to test if prices are significantly different from the predicted equilibrium price of 11 and if offered prices differed from transaction prices. The coefficients are negative at the 1% to 5 % level. That means that people behave optimally: They want to offer and to accept low prices. That prices are above 11 and do not completely reach 11 lies in the fact that people can only make mistakes into one direction because they cannot offer prices below 11.

6.2 Learning effect

The results of the ANOVA which are presented in Table 2 show that there is a significant effect of t on offered prices: The p-values of all three adjustments are equal or lower than 0.01. Thus, prices change significantly over time. The R^2 however is very small. Table 3 shows the predictive margins: The mean offered prices fall continuously from 15.214 KES to 13.632 KES within three periods. The prices reach the lowest level of 12.300 KES in the 13th period. After that, they rise again to 12.573 KES. The confidence intervalls for all but the second period are lower than the confidence intervall for the first period. Though, some of the confidence intervalls overlap.

There is a significant effect of t on transaction prices as well which is showed in Table 4: the p-values of all three adjustments are below 0.01. The R^2 is even smaller than for offered prices, it is only 0.00777. The mean transaction prices decrease from 11.534 KES to 11.271 KES within three periods. The lowest price of 11.145 KES is reached in the 14th period.

Some confidence intervalls overlap considerably. Again, the confidence intervalls for all but the second period are lower than the confidence intervall for the first period.

So, there seems to be a learning effect on offered prices: There is a significant time effect, offered prices go down from 15.214 KES to 12.300 KES and all prices are significantly lower than the first one (with the exception of the price in the second period). But prices do not drop continuously. There is a significant learning effect on transaction prices as well, though again prices do not drop continuously and the effect is smaller than on offered prices: Transaction prices go down from 11.534 KES to 11.145 KES.

6.3 Effect of role change

Table 3 shows the results of the OLS regression to test if there is an effect of the role change on the offered and the transaction prices. There is a significant effect of the role change on offered prices at the 1% level: Everything else being held constant, the role change lowers the offered prices by 4.436 KHS. There is no effect on the transaction prices.

Because offered prices are lower after the role change, we can conlcude that market experience indeed plays an important role: Sellers behave more in accordance with neoclassical market theory if they gained market experience as buyers before. Buyers do not change behavior after the role change.

6.4 Effect of cognitive ability

Table 4 shows the effects of cognitive ability on offered and transaction prices. Cognitive ability is measured as performance in test questions that were asked before the experiment and in reaction time of buyers and sellers to make an offer or accept one. Everything else being held constant, there is a significant negative effect of overall performance in the pre-experiment questions on both offered and transaction prices on the 1% level. By looking at the performance in the individual tasks, we only find a significant negative effect of mathematical performace on offered prices. There is a significant effect of nonverbal and mathematical performance on transaction prices.

Thus, if people are more intelligent, they behave more in accordance with neoclassical price theory: They offer and accept lower prices. There is a significant positive effect of reaction time on offered and transaction prices: If more time passed until an offer was made or accepted, prices were higher. That supports our finding that people who are more intelligent behave more correctly.

7 Conclusion

The aim of this paper was to investigate the predictions of neoclassical price theory in the Nairobi informal settlement of Kibera in Kenya. For this purpose, the investigation was moved back to the laboratory and an experiment similar to posted-offer market experiments [4]was conducted.

Smith (e.g. Smith 1962) and many researchers after him show that we can understand market mechanisms by conducting experiements in laboratories. Predicted outcomes of neoclassical price theory hold in experimental laboratory settings, also in posted-offer markets settings. The experiment presented in this paper was conducted in Kenya and examines a market structure similar to a posted-offer market. From earlier findings, we might expect the predictions of neoclassical price theory to hold in our experimental setting. However, there are doubts if people from different countries and cultural backgrounds are comparable to WEIRD (Western, Educated, Industrialized, Rich, and Democratic) people, who are the most common participants in lab experiments. In particular, there is evidence from one field experiment in Sierra Leona that equilibrium is not reached. So, it might be the case that neoclassical price theory does not hold for the experiment conducted in Kenya.

We investigated convergence to market equilibrium and the presence of a learning effect as the experiment proceeds, both for buyers and sellers. In addition, we tested if cognitive ability has an effect on the prices offered and on the actual transaction prices.

Our salient finding shows that participants of the experiment behave near-optimally: sellers offer, and buyers buy at, prices near the theoretically predicted equilibrium. That prices are above 11 and do not completely reach 11 lies in the fact that people can only make mistakes into one direction because they cannot offer prices below 11. There is a significant effect of the periods on offered and transaction prices. Though, mean prices do not drop continuously. The effect on transaction prices is smaller than on offered prices. Market experience does play an important role on sellers: Offered prices are lower after the role change. So, sellers behave correctly but they learn as the experiment proceeds and offer significantly lower prices after having gained market experience as buyers. Buyers seem to behave even more in accordance with market theory: They only accept prices near equilibrium from the beginning. The strength of the learning effect is small and transaction prices are not significantly lower after the role change. If people are more intelligent, they behave more in accordance with neoclassical price theory: They offer and accept lower prices.

So, like in earlier findings from posted-offer market experiments, prices converge towards

[4]Literature about posted-offer market experiments: (Davis and Holt 1993; Davis and Williams 1986; Ketcham et al. 1984; Plott and Smith 1978; Smith and Williams 2000; Williams 1973)

equilibrium and market experience has a significant negative effect on prices. Earlier findings however showed that convergence in posted-offer market experiments is not complete. In the experiment reported in this paper, this inefficiency can be explained through the fact that people can only make mistakes into one direction. People actually behave optimally: They both want to offer and to accept low prices.

Our findings contradict Bulte et al. (2012): the experiment reported in this paper shows that a market consisting of informal settlement inhabitants does work: Participants behave optimally and prices converge toward equilibrium. There is evidence that basic market mechanisms do work in developing countries. Thus, the failure of basic market mechanisms is unlikely to be the cause for market failures in developing countries. If this result is robust in other settings remains to be investigated.

Markets have been investigated in laboratory experiments in the western world a lot of times and helped to understand basic market mechanisms. This paper delivers evidence that we can investigate market mechanisms in developing countries in the laboratory as well, which provides the opportunity to investigate different market structures and getting to understand markets in developing countries.

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Figure 1: Mean offered prices and mean transaction prices

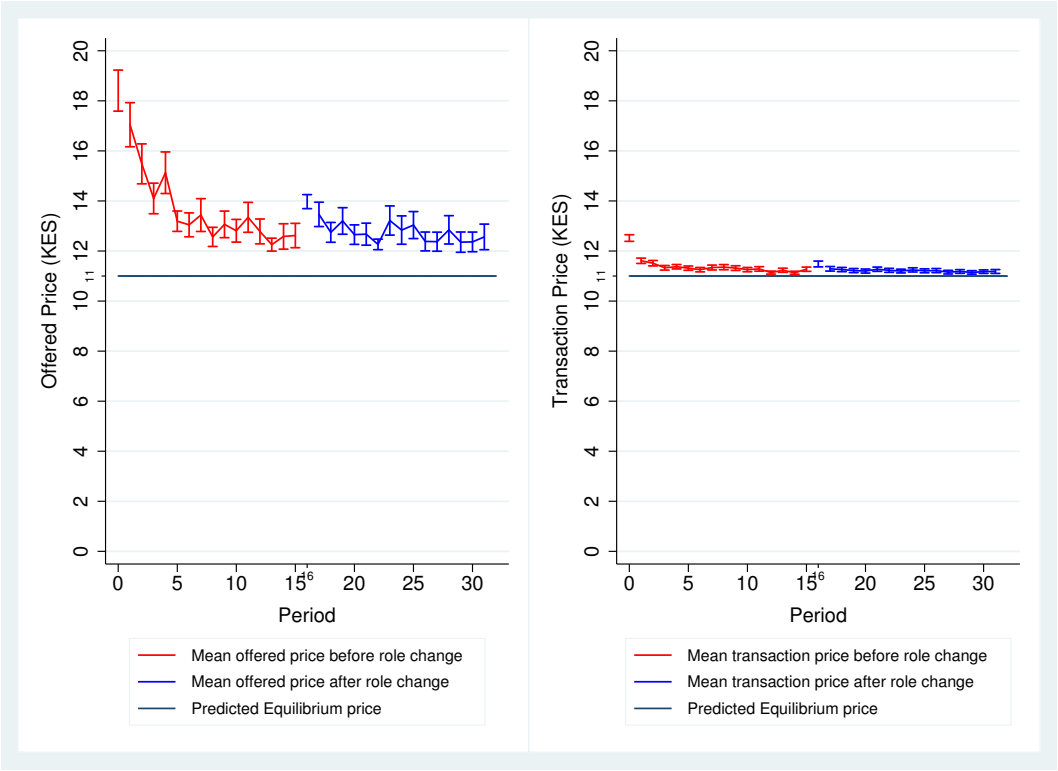


Table 1: Tobit regression

	(1) Offer price	(2) Transaction price	(3) Difference
All periods			
Difference from 11	−4.423***	−5.723***	−1.776*
	(1.610)	(1.379)	(0.983)
Observations	3300	3278	13178
Before switch			
Difference from 11	−5.614**	−7.947***	−2.505
	(2.224)	(1.795)	(1.744)
Observations	1650	1644	6594
After switch			
Difference from 11	−3.180**	−4.393***	−0.896
	(1.296)	(1.222)	(1.170)
Observations	1650	1634	6584

Figure 2: Percentage of sellers and of buyers at a certain price

Figure 3: Cumulative percentage of sellers and of buyers at a certain price

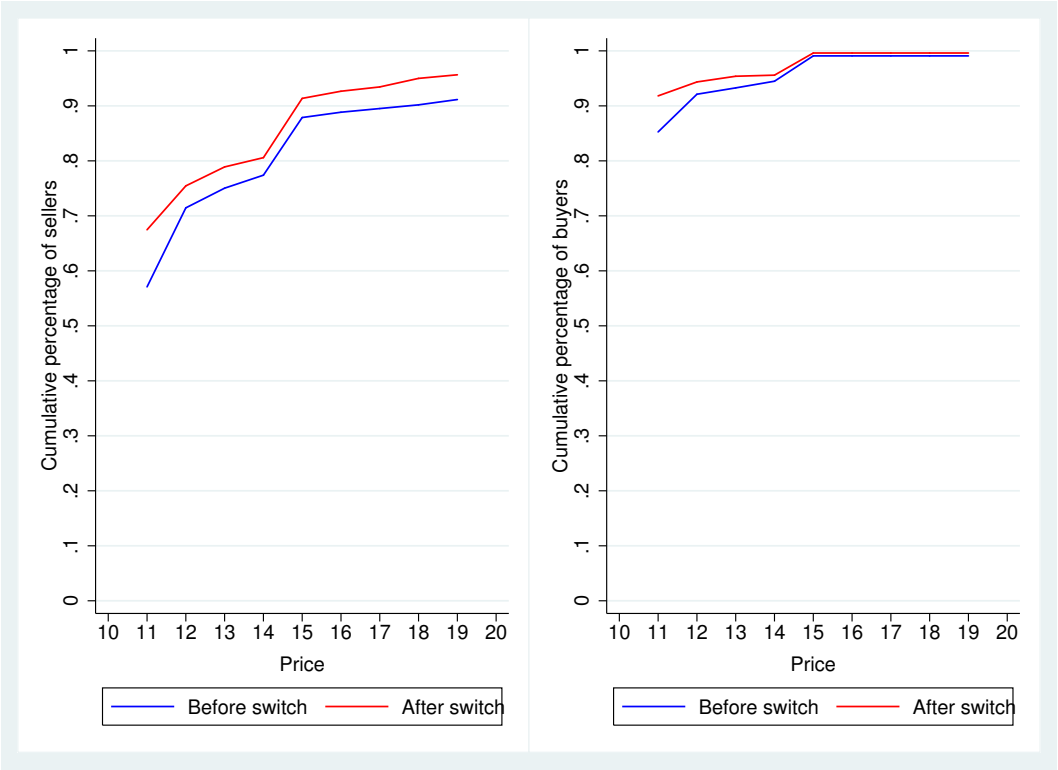


Table 2: Repeated-measures ANOVA for offered prices, winsorized at 99%

	df	F	Prob>F
afterswitch	1	3.75	0.0542
t	14	6.44	0.0000
afterswitch#t	14	3.50	0.0000

Table 3: Predictive margins, offered prices

	Margin	Delta-method Std. Err.	z-score	95% CI		N
t1	15.214***	0.306	49.644	14.613	15.814	3300
t2	14.082***	0.306	45.951	13.481	14.682	3300
t3	13.632***	0.306	44.482	13.031	14.232	3300
t4	13.855***	0.306	45.209	13.254	14.455	3300
t5	12.923***	0.306	42.169	12.322	13.523	3300
t6	12.650***	0.306	41.279	12.049	13.251	3300
t7	13.295***	0.306	43.385	12.695	13.896	3300
t8	12.682***	0.306	41.382	12.081	13.282	3300
t9	13.032***	0.306	42.525	12.431	13.632	3300
t10	12.586***	0.306	41.071	11.986	13.187	3300
t11	12.841***	0.306	41.902	12.240	13.442	3300
t12	12.791***	0.306	41.738	12.190	13.392	3300
t13	12.300***	0.306	40.137	11.699	12.901	3300
t14	12.464***	0.306	40.671	11.863	13.064	3300
t15	12.573***	0.306	41.027	11.972	13.173	3300

Table 4: Repeated-measures ANOVA for transaction prices, winsorized at 99%

	df	F	Prob>F
afterswitch	1	1.17	0.2810
t	14	4.57	0.0000
afterswitch#t	14	1.54	0.0880

Table 5: Predictive margins, transaction prices

				95% CI		
	Margin	Delta-method Std. Err.	z-score			N
t1	11.460***	0.038	302.971	11.386	11.534	3278
t2	11.390***	0.038	301.138	11.315	11.464	3278
t3	11.271***	0.038	299.463	11.197	11.345	3278
t4	11.284***	0.038	300.545	11.211	11.358	3278
t5	11.294***	0.038	299.340	11.220	11.368	3278
t6	11.239***	0.038	299.340	11.166	11.313	3278
t7	11.267***	0.038	299.349	11.193	11.340	3278
t8	11.298***	0.038	300.911	11.225	11.372	3278
t9	11.261***	0.038	297.744	11.187	11.335	3278
t10	11.234***	0.038	298.502	11.160	11.308	3278
t11	11.216***	0.038	298.019	11.142	11.290	3278
t12	11.156***	0.038	296.438	11.083	11.230	3278
t13	11.206***	0.038	297.012	11.132	11.280	3278
t14	11.145***	0.038	293.976	11.071	11.220	3278
t15	11.225***	0.038	298.974	11.152	11.299	3278

Table 6: Effect of role change

	(1) Offerprice	(2) Boughtprice
After switch	−4.436***	−0.319
	(1.377)	(0.223)
Observations	3300	3278

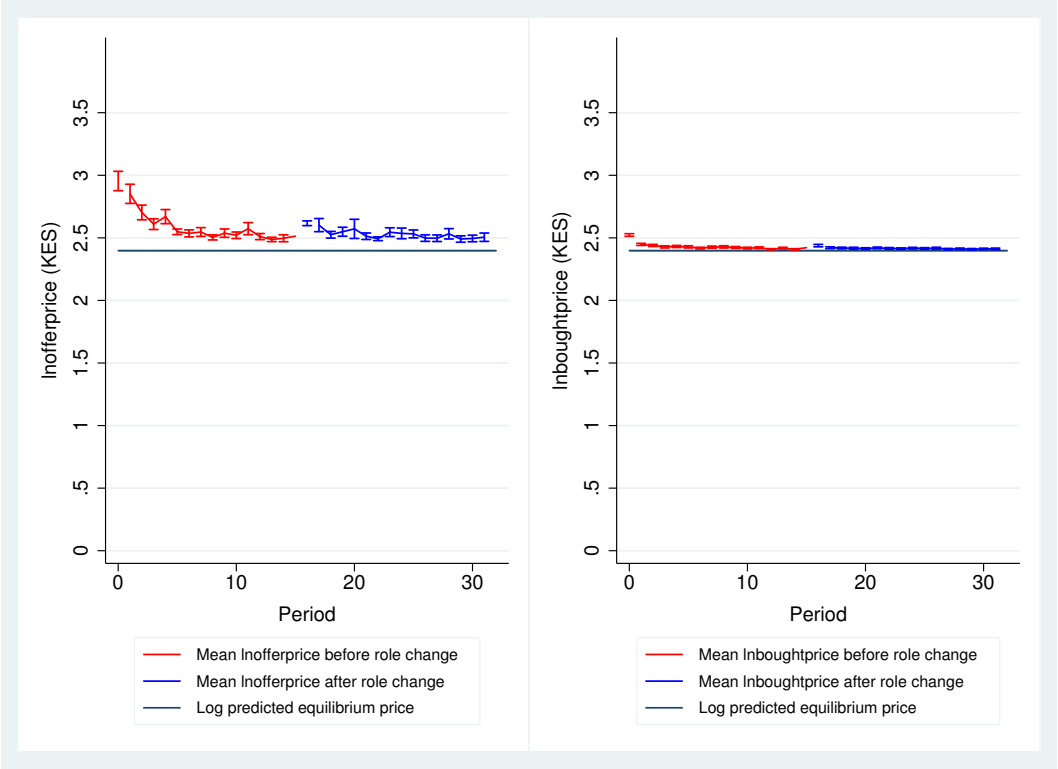
Notes: Notes go here. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table 7: Effect of cognitive ability

	(1) Offerprice	(2) Offerprice	(3) Offerprice	(4) Boughtprice	(5) Boughtprice	(6) Boughtprice
Overall performance	−0.632***			−0.142***		
	(0.102)			(0.0396)		
Nonverbal performance		−0.312			−0.0813*	
		(0.214)			(0.0425)	
Mathematical performance		−1.393***			−0.320***	
		(0.402)			(0.101)	
CRT performance		−0.149			−0.0148	
		(0.129)			(0.0231)	
Reaction time			0.0572*			0.0149***
			(0.0275)			(0.00378)
Observations	3300	3300	3300	3278	3278	3278

Notes: Notes go here. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Figure 4: Log mean offered and transaction prices, not winsorized



9 Appendix

Figure 5: Mean offered and transaction prices, linear, not winsorized

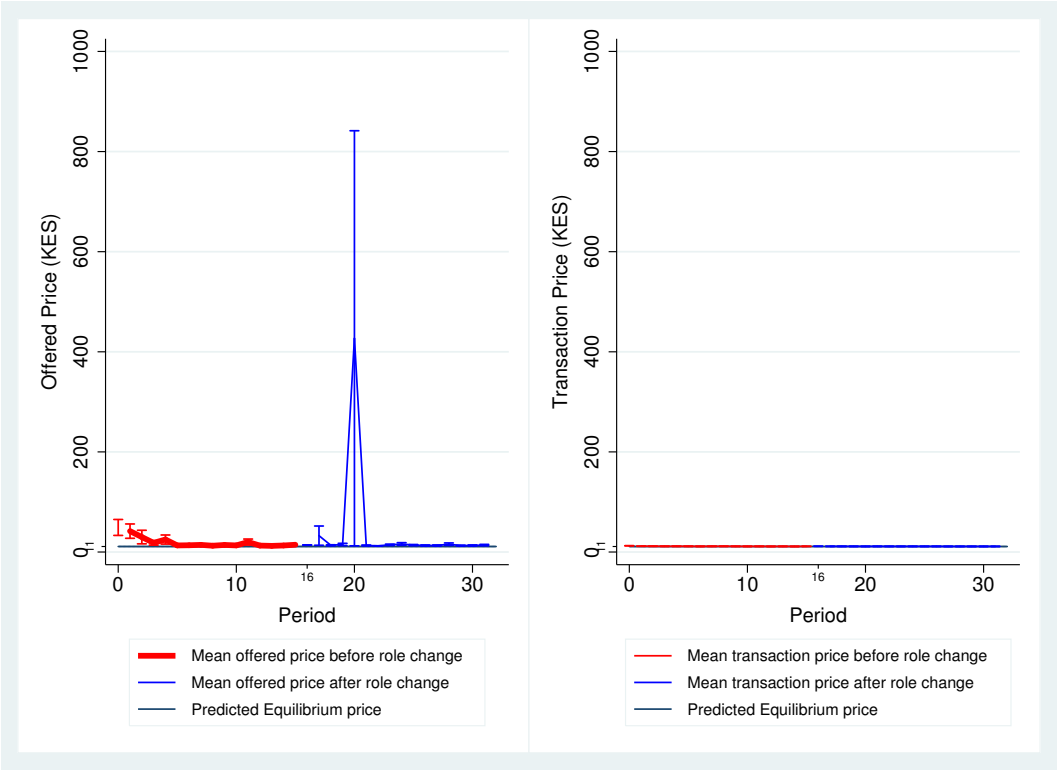


Figure 6: Percentage of sellers and of buyers at a certain price, linear, not winsorized

Figure 7: Cumulative percentage of sellers and of buyers at a certain price, linear, not winsorized

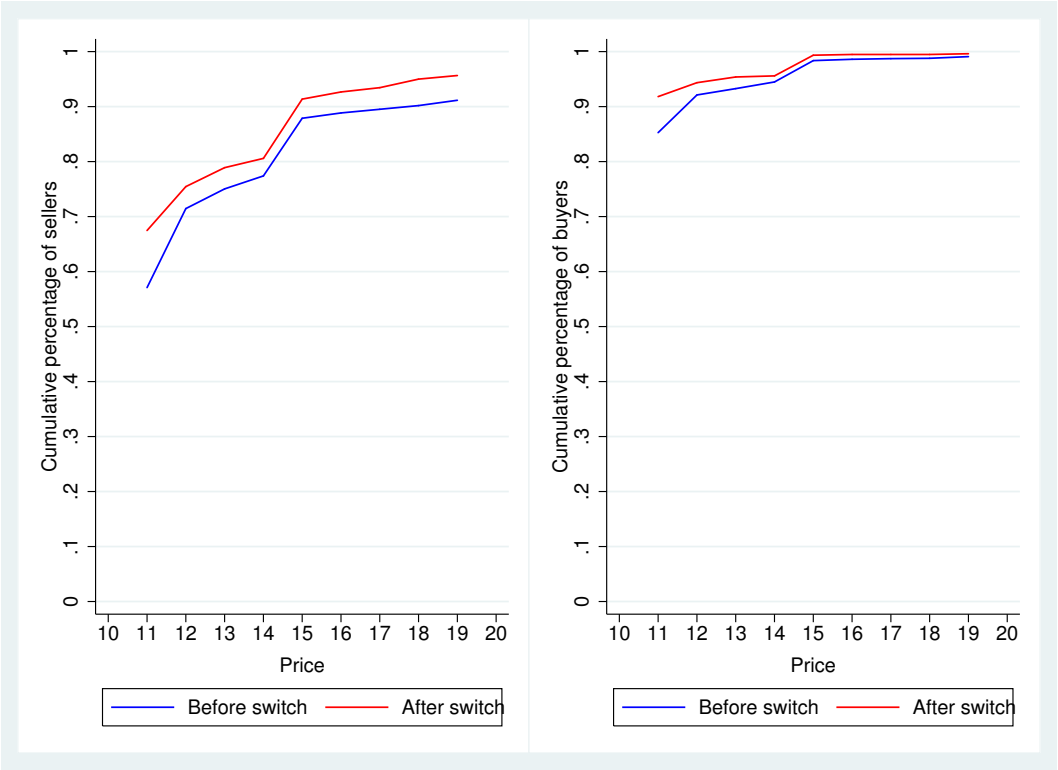


Table 8: Tobit regressions for each period before the role change, winsorized at 99%

	(1) Offer price	(2) Transaction price	(3) Difference
Difference from 11 in periods 1 to 15			
1	4.749***	−1.114	6.442***
	(1.269)	(1.043)	(2.330)
2	0.351	-2.019	1.458
	(2.049)	(1.448)	(2.402)
3	−1.435	−3.816*	0.982
	(1.833)	(2.162)	(2.409)
4	-0.931	-2.398*	1.177
	(1.727)	(1.277)	(2.270)
5	−0.481	−2.956*	0.744
	(0.819)	(1.707)	(0.967)
6	-2.811*	-7.305***	0.396
	(1.541)	(2.159)	(1.939)
7	−4.972**	−5.352***	−2.509
	(2.120)	(1.455)	(1.962)
8	-3.583**	-7.181***	-2.444
	(1.807)	(2.368)	(1.717)
9	−4.762***	−5.472***	−2.717
	(1.589)	(1.216)	(2.146)
10	-3.374**	-6.219***	-0.920
	(1.324)	(1.566)	(1.500)
11	−5.018**	−6.701***	−1.773
	(2.278)	(2.164)	(2.622)
12	-4.296***	-6.932**	0.333
	(1.649)	(2.726)	(2.853)
13	−4.007**	−7.518***	−3.026*
	(1.565)	(2.426)	(1.580)
14	−9.542***	−8.014**	−4.886**
	(3.335)	(3.242)	(2.321)
15	−6.723***	−5.768***	−5.122**
	(2.450)	(1.350)	(2.491)

Table 9: Tobit regressions for each period after the switch, winsorized at 99%

	(1) Offer price	(2) Transaction price	(3) Difference
Difference from 11 in periods 17 to 31			
17	−0.377	−5.223*	2.590
	(1.390)	(2.696)	(1.663)
18	-2.985	-5.439***	-1.205
	(2.139)	(1.930)	(1.975)
19	−5.266***	−8.805***	−1.073
	(1.914)	(3.092)	(2.761)
20	-3.181	-9.917***	0.302
	(2.157)	(2.702)	(1.543)
21	−3.993*	−5.768***	−2.149
	(2.169)	(1.595)	(1.614)
22	-2.186	-7.604***	-1.213
	(1.498)	(2.688)	(1.335)
23	−5.553***	−6.902***	−1.395
	(1.972)	(2.002)	(3.347)
24	-7.415**	-7.001***	-4.501**
	(3.215)	(1.806)	(2.131)
25	−7.389**	−8.438***	−3.502
	(3.242)	(2.663)	(2.693)
26	-7.480**	-8.805***	-5.573*
	(3.569)	(2.161)	(3.096)
27	−7.099*	−12.542***	−3.231
	(4.218)	(4.174)	(3.378)
28	−9.878**	−9.087***	−5.497*
	(4.403)	(2.907)	(3.142)
29	−9.137***	−11.822***	−5.155*
	(3.026)	(3.147)	(2.749)
30	−6.908*	−8.517***	−4.086
	(3.556)	(2.362)	(2.814)
31	−11.406**	−11.225***	−7.286*
	(4.886)	(2.735)	(3.929)

Table 10: Tobit regressions, log, not winsorized

	(1) Offer price	(2) Transaction price	(3) Difference
All periods			
Log difference from 11	−0.340**	−0.475***	0.375***
	(0.138)	(0.120)	(0.079)
Observations	3300	3278	6579
Before switch			
Log difference from 11	−0.473**	−0.643***	0.310**
	(0.215)	(0.146)	(0.137)
Observations	1650	1644	3294
After switch			
Log difference from 11	−0.227**	−0.371***	0.443***
	(0.108)	(0.112)	(0.116)
Observations	1650	1634	3285

Table 11: Tobit regressions for each period before the role change, log, not winsorized

	(1) Offer price	(2) Transaction price	(3) Difference
Log difference from 11 in periods 1 to 15			
1	0.341***	−0.088	1.255***
	(0.103)	(0.084)	(0.359)
2	-0.004	-0.158	0.734***
	(0.165)	(0.115)	(0.261)
3	−0.109	−0.355	0.582***
	(0.169)	(0.216)	(0.207)
4	-0.077	-0.222*	0.704***
	(0.148)	(0.124)	(0.215)
5	0.005	−0.300*	0.375***
	(0.046)	(0.183)	(0.084)
6	-0.151	-0.572***	0.433**
	(0.097)	(0.169)	(0.178)
7	−0.254**	−0.445***	0.328*
	(0.121)	(0.126)	(0.169)
8	-0.179**	-0.618***	0.194
	(0.086)	(0.205)	(0.126)
9	−0.300***	−0.434***	0.281
	(0.106)	(0.098)	(0.186)
10	-0.180**	-0.491***	0.331**
	(0.083)	(0.124)	(0.142)
11	−0.430**	−0.530***	0.466
	(0.217)	(0.172)	(0.294)
12	-0.197**	-0.556**	0.400*
	(0.086)	(0.222)	(0.206)
13	−0.268**	−0.639***	0.123
	(0.106)	(0.205)	(0.133)
14	−0.530**	−0.641**	0.184
	(0.219)	(0.249)	(0.176)
15	−0.486**	−0.519***	0.098
	(0.213)	(0.145)	(0.164)

Table 12: Tobit regressionseach period after the role change, log, not winsorized

	(1) Offer price	(2) Transaction price	(3) Difference
Log difference from 11 in periods 17 to 31			
17	−0.112	−0.411*	0.773***
	(0.143)	(0.211)	(0.268)
18	-0.198	-0.430***	0.309**
	(0.155)	(0.150)	(0.137)
19	−0.362**	−0.795**	0.449*
	(0.150)	(0.323)	(0.232)
20	-0.765	-0.806***	0.780*
	(0.497)	(0.205)	(0.451)
21	−0.227	−0.457***	0.253***
	(0.146)	(0.125)	(0.092)
22	-0.156	-0.602***	0.216***
	(0.110)	(0.209)	(0.083)
23	−0.331**	−0.546***	0.428
	(0.131)	(0.154)	(0.295)
24	-0.572**	-0.552***	0.239
	(0.255)	(0.141)	(0.180)
25	−0.435**	−0.692***	0.303
	(0.208)	(0.217)	(0.189)
26	-0.531**	-0.795***	0.056
	(0.255)	(0.241)	(0.212)
27	−0.499*	−0.977***	0.237
	(0.299)	(0.324)	(0.209)
28	−0.738**	−0.715***	0.230
	(0.338)	(0.223)	(0.174)
29	−0.586***	−0.928***	0.139
	(0.200)	(0.245)	(0.226)
30	−0.473*	−0.677***	0.157
	(0.259)	(0.183)	(0.190)
31	−0.762**	−0.878***	0.081
	(0.342)	(0.212)	(0.220)

Table 13: Tobit regressions, linear not winsorized

Table 14: Tobit regressions before the role change, linear, not winsorized

	(1) Offer price	(2) Transaction price	(3) Difference
Difference from 11 in periods 1 to 15			
1	6.849	−1.114	27.440
	(12.136)	(1.043)	(31.909)
2	-56.681	-2.019	-37.730
	(38.061)	(1.448)	(30.649)
3	−26.750	−4.704	−9.971
	(19.463)	(2.910)	(14.020)
4	-44.018	-2.950*	-22.720
	(28.334)	(1.677)	(20.258)
5	−0.671	−4.122	0.498
	(0.915)	(2.546)	(1.007)
6	-6.380*	-7.305***	-0.428
	(3.471)	(2.159)	(2.909)
7	−9.773**	−5.730***	−4.987*
	(4.214)	(1.630)	(2.997)
8	-4.017*	-8.158***	-2.825
	(2.082)	(2.753)	(1.852)
9	−12.625***	−5.472***	−7.004
	(4.153)	(1.216)	(4.321)
10	-6.703**	-6.219***	-2.236
	(3.151)	(1.566)	(2.381)
11	−63.689*	−6.701***	−29.247
	(34.574)	(2.164)	(21.904)
12	-5.203***	-6.932**	0.212
	(1.921)	(2.726)	(3.227)
13	−4.007**	−8.214***	−3.141*
	(1.565)	(2.671)	(1.627)
14	−16.976*	−8.014**	−8.679
	(8.901)	(3.242)	(5.586)
15	−32.558*	−6.870***	−22.878*
	(17.218)	(2.090)	(12.981)

Table 15: Tobit regressions after the role change, linear, not winsorized

	(1) Offer price	(2) Transaction price	(3) Difference
Difference from 11 in periods 17 to 31			
17	−97.708**	−5.223*	8.237
	(48.498)	(2.696)	(46.629)
18	-9.791	-5.439***	-4.560
	(6.204)	(1.930)	(4.434)
19	−26.248**	−10.641**	−9.054
	(12.323)	(4.557)	(9.308)
20	-4580.201*	-10.406***	-1025.794
	(2644.529)	(2.623)	(1060.291)
21	−8.695	−5.768***	−4.627
	(5.697)	(1.595)	(3.524)
22	-2.186	-7.604***	-1.213
	(1.498)	(2.688)	(1.335)
23	−14.383***	−6.902***	−4.570
	(4.518)	(2.002)	(6.557)
24	-36.912**	-7.001***	-21.036**
	(17.555)	(1.806)	(9.932)
25	−16.512**	−8.857***	−7.980
	(8.284)	(2.796)	(4.996)
26	-20.639*	-10.641***	-14.129*
	(11.809)	(3.474)	(8.376)
27	−19.609	−12.542***	−8.766
	(12.781)	(4.174)	(8.028)
28	−44.417*	−9.087***	−23.854*
	(22.979)	(2.907)	(13.649)
29	−18.845**	−11.822***	−10.182**
	(7.727)	(3.147)	(4.428)
30	−19.033	−8.517***	−10.746
	(11.592)	(2.362)	(7.334)
31	−30.683**	−11.225***	−18.288*
	(14.683)	(2.735)	(10.677)

Table 16: Learning effect, predictive margins, log offered prices, not winsorized

				95% CI		
	Margin	Delta-method Std. Err.	z-score			N
t1	2.727***	0.023	117.892	2.681	2.772	3300
t2	2.614***	0.023	113.009	2.568	2.659	3300
t3	2.579***	0.023	111.512	2.534	2.625	3300
t4	2.621***	0.023	113.308	2.575	2.666	3300
t5	2.531***	0.023	109.420	2.485	2.576	3300
t6	2.514***	0.023	108.700	2.469	2.559	3300
t7	2.546***	0.023	110.081	2.501	2.591	3300
t8	2.520***	0.023	108.938	2.474	2.565	3300
t9	2.535***	0.023	109.580	2.489	2.580	3300
t10	2.509***	0.023	108.491	2.464	2.555	3300
t11	2.535***	0.023	109.607	2.490	2.580	3300
t12	2.521***	0.023	109.008	2.476	2.567	3300
t13	2.489***	0.023	107.609	2.444	2.534	3300
t14	2.496***	0.023	107.913	2.451	2.541	3300
t15	2.509***	0.023	108.484	2.464	2.555	3300

Table 17: Learning effect, predictive margins, log transaction prices, not winsorized

				95% CI		
	Margin	Delta-method Std. Err.	z-score			N
t1	2.435***	0.003	732.553	2.429	2.442	3278
t2	2.429***	0.003	730.867	2.423	2.436	3278
t3	2.422***	0.003	732.327	2.416	2.429	3278
t4	2.422***	0.003	734.144	2.416	2.429	3278
t5	2.424***	0.003	730.984	2.417	2.430	3278
t6	2.417***	0.003	732.440	2.410	2.423	3278
t7	2.420***	0.003	731.539	2.413	2.426	3278
t8	2.423***	0.003	734.160	2.416	2.429	3278
t9	2.419***	0.003	727.795	2.413	2.426	3278
t10	2.418***	0.003	730.927	2.411	2.424	3278
t11	2.415***	0.003	730.147	2.408	2.421	3278
t12	2.410***	0.003	728.767	2.404	2.417	3278
t13	2.415***	0.003	728.293	2.408	2.421	3278
t14	2.410***	0.003	723.183	2.403	2.416	3278
t15	2.417***	0.003	732.444	2.410	2.423	3278

Table 18: Learning effect, predictive margins, offered prices, not winsorized

				95% CI		
	Margin	Delta-method Std. Err.	z-score			N
t1	37.250	53.385	0.698	−67.384	141.884	3300
t2	21.673	53.385	0.406	−82.961	126.306	3300
t3	16.686	53.385	0.313	−87.947	121.320	3300
t4	225.977***	53.385	4.233	121.344	330.611	3300
t5	13.191	53.385	0.247	−91.443	117.825	3300
t6	12.900	53.385	0.242	−91.734	117.534	3300
t7	14.350	53.385	0.269	−90.284	118.984	3300
t8	14.332	53.385	0.268	−90.302	118.965	3300
t9	14.000	53.385	0.262	−90.634	118.634	3300
t10	13.145	53.385	0.246	−91.488	117.779	3300
t11	16.500	53.385	0.309	−88.134	121.134	3300
t12	14.309	53.385	0.268	−90.325	118.943	3300
t13	12.550	53.385	0.235	−92.084	117.184	3300
t14	13.077	53.385	0.245	−91.556	117.711	3300
t15	14.200	53.385	0.266	−90.434	118.834	3300

Table 19: Learning effect, predictive margins, transaction prices, not winsorized

				95% CI		
	Margin	Delta-method Std. Err.	z-score			N
t1	11.460***	0.044	259.702	11.374	11.547	3278
t2	11.391***	0.044	258.151	11.304	11.477	3278
t3	11.316***	0.044	257.727	11.230	11.402	3278
t4	11.311***	0.044	258.238	11.226	11.397	3278
t5	11.331***	0.044	257.420	11.244	11.417	3278
t6	11.239***	0.044	256.584	11.153	11.325	3278
t7	11.276***	0.044	256.797	11.190	11.362	3278
t8	11.316***	0.044	258.344	11.230	11.402	3278
t9	11.266***	0.044	255.344	11.180	11.353	3278
t10	11.252***	0.044	256.278	11.166	11.338	3278
t11	11.216***	0.044	255.448	11.130	11.302	3278
t12	11.156***	0.044	254.093	11.070	11.242	3278
t13	11.216***	0.044	254.826	11.130	11.303	3278
t14	11.145***	0.044	251.978	11.058	11.231	3278
t15	11.243***	0.044	256.684	11.158	11.329	3278

Table 20: Effect of role change, log, not winsorized

	(1) Log Offerprice	(2) Log Boughtprice
After switch	-0.347^{**}	-0.0267
	(0.116)	(0.0178)
Observations	3300	3278

Table 21: Effect of role change, linear, not winsorized

	(1) Offerprice	(2) Boughtprice
After switch	-27.90^{*}	-0.319
	(15.59)	(0.223)
Observations	3300	3278

Table 22: Effect of cognitive ability, log, not winsorized

	(1) Log Offerprice	(2) Log Offerprice	(3) Log Offerprice	(4) Log Boughtprice	(5) Log Boughtprice	(6) Log Boughtprice
Overall performance	−0.0422***			−0.0114***		
	(0.00933)			(0.00310)		
Nonverbal performance		−0.0122			−0.00663*	
		(0.0158)			(0.00339)	
Mathematical performance		−0.100**			−0.0254***	
		(0.0375)			(0.00782)	
CRT performance		−0.0114			−0.00137	
		(0.0101)			(0.00189)	
Reaction time			0.00398*			0.00132***
			(0.00194)			(0.000365)
Observations	3300	3300	3300	3278	3278	3278

Table 23: Tobit regressions, linear, not winsorized

	(1) Offerprice	(2) Offerprice	(3) Offerprice	(4) Boughtprice	(5) Boughtprice	(6) Boughtprice
Overall performance	−13.98			−0.145***		
	(14.23)			(0.0396)		
Nonverbal performance		7.300			−0.0847*	
		(6.533)			(0.0428)	
Mathematical performance		−49.61			−0.323***	
		(49.92)			(0.101)	
CRT performance		1.643			−0.0168	
		(3.146)			(0.0247)	
Reaction time			0.532			0.0170***
			(0.531)			(0.00493)
Observations	3300	3300	3300	3278	3278	3278