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Subsidy Incidence in Agricultural Land Markets: An Experimental Investigation

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Subsidy Incidence in Agricultural Land Markets: An Experimental Investigation

Abstract

We use laboratory market experiments to control for market power and social norms in order to evaluate market outcomes associated with subsidy incidence. We estimate the incidence of a stylized agricultural subsidy in laboratory land rental negotiations and compare the market behavior of university students to agricultural professionals. In separate sessions with both subject groups, 21.5 percent of a per-unit subsidy paid to the buyer (tenant) was passed on to sellers (landlords). The consistent treatment effect between students and professionals is encouraging, particularly in the use of experimental laboratory methods for *ex ante* analyses of agricultural policy impacts.

Key Words:

agricultural subsidies, ex ante policy analysis, laboratory market experiments, land market, professional versus student subject pools, subsidy incidence

JEL Classifications:

Q1, Q18, C92

Subsidy Incidence in Agricultural Land Markets: An Experimental Investigation

Since the Agricultural Act of 1933, a succession of U.S. farm bills have sought to enhance farmer income. The U.S. government paid out over 200 billion dollars to producers from 1999 through 2009 (Environmental Working Group 2010). These subsidies largely define American agricultural markets (Sumner 2007). The way in which these payments pass through and are capitalized in factor markets, such as land rental markets, raises important questions about intended beneficiaries, transfer efficiency, and the potential for market distortions associated with different agricultural policies.

Several policy issues stem from potential impacts of subsidies in agricultural land markets. If a tenant producer is able to supplement their income with government payments tied to a piece of farmland, it is assumed they may be willing to pay a higher price for the opportunity to farm rented land. In such circumstances, government payments intended for the farmer are "passed through" to landowners via higher rental rates. If this is the case, income transfers to tenant producers are not an efficient means to boost producer income. Additionally, payments paid or passed to landowners may be capitalized into land or other input values resulting in inflated asset prices. This may inhibit new farmers' entry into the industry and decrease the mobility of assets, obscuring efficient market signals and resource use. Future support reform becomes challenging as policy expectations impact asset values (Tweeten and Zulauf 2008) and programs become embedded in all aspects of the industry (Sumner 2007). We focus on the incidence of a subsidy in this analysis of policy impacts in agricultural land markets.

The agricultural land market is emphasized in the literature with regard to the incidence and impacts of income transfers from taxpayers to producers via production subsidies. Bhaskar

and Beghin (2009) review empirical studies which indicate distortions occur via land markets as payments are passed on to landowners through higher rents and capitalized into land values. Theory predicts that payments will be capitalized into the factor with the most inelastic supply—land (Floyd 1965). Net present value models often assume 100 percent incidence, that is, the entire subsidy payment is assumed to be capitalized into the value of land (Kirwan and Roberts 2010). Contrary to this, Kirwan (2009) finds only 20 to 25 percent of subsidies are captured by landlords in commodity markets. To explain this deviation from predictions of full incidence in neoclassical models, Kirwan cites imperfect competition in agricultural land rental markets as well as social norms, trust, and fairness embedded in tenant-landlord relationships. In a more refined field-level analysis, Kirwan and Roberts (2010) address farm-level aggregation issues, allowing better control for land quality and a more direct link between subsidies and cash rent. Incidence estimates in this study indicate previous results may have been upwardly-biased, with new estimates of 14 to 24 percent pass-through to landlords. Again, Kirwan and Roberts highlight the need for further investigation into this notable disparity between observed and theorized incidence.

In this research, we control for market power and social norms using economic experiments to measure the incidence of subsidy payments in a simulated land market. We use both a convenience sample of university students and compare their data to field data collected from agricultural professionals. Our incidence estimates are comparable to those cited above. We find similar incidence rates, but differing negotiation patterns, among the two subject groups.

Methods

As our review indicates, payment incidence in agricultural land markets does not reflect the standard economic theoretical prediction—land does not fully absorb subsidy values. Further, fundamental econometric issues remain in estimating the level of incidence. Rental rates are highly connected with subsidy payments, which are calculated using yield in a base period. Privately-negotiated rental contracts are often unobservable and non-laboratory survey data used to estimate negotiated rental rates are subject to nonresponse error. Also, for the purpose of the standard present value model commonly used in empirical evaluations of capitalization of benefits, expected returns to land from market versus subsidy income are unobservable (Goodwin, Mishra, and Ortalo-Magne 2003).

Schotter (2006) contends that while economic theory is a useful tool, based on carefully prescribed assumptions and "capable of making strong point predictions" (p. 501), it should not be interpreted as descriptive of human behavior. In fact, he argues, specific predictions from theory are useful as a jumping off point precisely because they are likely wrong and it is important to consider empirical and experimental tools to discern how economic theory might relate to actual behavior in markets.

Complementing empirical work, the experimental laboratory provides control of extraneous factors in order to systematically examine particular aspects of market behavior. We use laboratory market experiments to control for market power and social norms in order to evaluate market outcomes associated with subsidy incidence. Our experimental design defines aspects of the trading environment which may influence actual land rental contracts in order to focus on bargaining behavior in response to a specific, simplified subsidy.

Experimental results offer an interesting opportunity to study how subsidies are shared via market negotiations. Our objective is to gain a better understanding of bargaining behavior in subsidized markets as well as provide a measure of payment incidence in this controlled experimental setting.

Experimental Design

Our experimental design provides a market context to address the policy research question: How much of a subsidy given to the buyer (tenant producer) is passed on to the seller (landowner) via market negotiations when controlling for such factors as market power and social norms in land rental contracts? We developed a simplified private negotiation, forward laboratory market to assess the effect of subsidies on prices and trading decisions in a factor market. Experimental procedures follow standard practices (Davis and Holt 1993, Friedman and Sunder 1994) and relate to previous research (Menkhaus, et al. 2003, Menkhaus, et al. 2007). Design considerations to minimize subject bias, such as induced-value performance, anonymity, and standardized recruitment and laboratory practices, were carefully considered when defining methods and procedures.

Laboratory Market Design and Procedures

A market consists of a trading institution and method of delivery. The trading institution defines the rules by which buyers and sellers interact and arrive at trades. *Private negotiation* is the relevant trading institution in agricultural land rental markets. In private negotiation two agents, a buyer and a seller, make offers and counteroffers until there is agreement on price and other contractual arrangements. Two methods may be used in delivery of goods traded: advance production or forward delivery. In advance production sellers enter a market with inventory in

stock, incurring sunk costs before sales. In a forward market transaction, price and quantity are agreed upon before production. In the land market, sunk costs associated with advance production (and their resulting risks and incentives) are not relevant. A *forward delivery* market was therefore used in this research.

Trades were negotiated between buyer-seller pairs by typing in bids and offers over a computer network. Experimental sessions using student participants were conducted in a campus experimental economics laboratory. Sessions with agricultural professionals were conducted using a mobile laboratory of linked laptop computers at recruitment area locations.

Each experimental session followed a standard procedure. At the beginning of each session, eight participants were randomly designated as four buyers and four sellers. The session began with a presentation of instructions followed by one or more practice sessions. (Practice sessions used different costs and values than the primary experiment.) Actual trading did not begin until all participants were comfortable with the mechanics of trading. Following instructions and practice sessions, 20 or more trading periods were conducted during each experimental session. Participants did not know when the session would end in order to avoid strategic behavior in the final round.

Each trading period was organized as follows: Before trading began, each buyer was shown a private table of unit redemption values for eight units and each seller was shown a table of unit costs for eight units. Redemption values started at 130 tokens for the first unit and decreased by ten to 60 tokens for the eighth unit; costs began at 30 tokens increasing by ten to 100 tokens. Individual and aggregate unit cost and unit redemption value schedules are step functions following Davis and Holt (1993, 9-14). Summing the aggregate supply (cost) and

demand (redemption value) relationships results in induced supply and demand from which equilibrium market outcomes are predicted. For these unit values and unit costs, with four buyers and four sellers, the expected equilibrium price and number of trades are, respectively, 80 tokens and a quantity tunnel of 20 to 24 units (figure 1).

At the beginning of each period buyers and sellers were randomly paired to negotiate prices and trade up to eight units over three bargaining rounds. (Random pairing controls for the confounding effects reputation can have on outcomes.) Units were traded sequentially, starting with the first unit. As trades were made, buyers earned the difference between the redemption value for the unit traded and the agreed price; sellers earned the agreed price minus their unit cost. Following this experimental design, market power is controlled via uniform cost and redemption schedules and symmetrical numbers of buyers and sellers. All individuals are an equal footing as they enter the market.

Following common practice (Davis and Holt 1993, 41), an improvement rule was implemented in which buyers were bound to make progressively higher bids and sellers to make progressively lower offers. In addition to a schedule of unit redemption values or costs, during trading each player was provided with private trading information including their current bid or offer, their trading partner's current bid or offer, and a calculation of profits earned as each unit was traded. At the end of each trading period a summary each participant's period and total earnings was also privately displayed.

Payment Procedures

Students were paid a $7 show-up fee in addition to their market earnings. Unlike student participants, who had lower opportunity costs and attended sessions easily accessible to them on

campus, professional recruits often had to travel significant distances and take time away from their jobs or farm operations. To compensate them for their time and travel costs, each professional participant received a $50 show-up fee in addition to their market earnings.

Participants in both subject pools were paid based on their earnings in the experimental market. Earnings were denoted in a monetarily-convertible currency referred to as tokens (1 token equaled 1 cent). Market earnings accumulated during the sequence of trading periods and token earnings were cashed in at the end of the experiment. Average market earnings, paid to participants in addition to their $7 or $50 show-up fee, were $32.45 for sessions that lasted about an hour and a half.

Treatments

Two agricultural support policy treatments are investigated. The first is a market in which no support is paid out. This "no subsidy" treatment allows for comparison of how the market might be impacted under a subsidy policy. Results also include a "per-unit subsidy" treatment in which buyers were paid an additional 20 tokens[1] on each unit they purchased. Buyers and sellers were aware of the subsidy treatment.

University students and professionals working in agriculture may enter market negotiations with different expectations or "social norms," along with different experiences in markets in general, particularly in bilateral bargaining. Our experimental design allows the opportunity to compare the results of market experiments across student and professional subjects. The market behavior of 48 university students to was compared to 52 agricultural professionals. University students were recruited on campus, mainly from business and economics classes; professionals working in agriculture were recruited via telephone and email

using lists provided by county Cooperative Extension offices. We hypothesize that student participants share common experimental market behavior and will not differ in behavior from agricultural professionals when trading in a market shocked by a subsidy and when market design inhibits non-essential preferences.

Analysis

Data were analyzed both graphically and using a convergence model. The following general convergence model, based on those developed by Ashenfelter and Genesove (1992) and Noussair, Plott, and Riezmen (1995), was estimated to describe the data and allow for statistical comparisons:

$$(1) \qquad P_{it} = B_0\left[(t-1)/t\right] + B_1(1/t) + \sum_{j=1}^{i-1}\alpha_j D_j\left[(t-1)/t\right] + \sum_{j=1}^{i-1}\beta_j D_j(1/t) + u_{it},$$

where P_{it} is the average period sale price or number of units traded across replications and all trades for each of t periods (1, ... , 20) in cross section (treatment) i; B_0 is the predicted asymptote and B_1 is the starting level of the dependent variable for the base treatment; α and β are, respectively, adjustments to the asymptote and starting level for each treatment's relation to the base; D_j is a dummy variable separating j treatments; and u_{it} is an error term. The Parks method (1967) was used to estimate the model as it accounts for unique statistical properties resulting from the panel data sets. Analyses were conducted in SAS using the PANEL Procedure (SAS 1999).

In order to conduct statistical tests for differences between converged price and trade levels, data were checked for normal distribution of residuals using a Shapiro-Wilk test for normality. T-tests from the convergence model are reported for outcomes meeting this

assumption; non-parametric Wilcoxon tests using average market outcomes over the last five trading periods for each replication are reported for data which did not meet this requirement.

Market Results

Three replications were conducted for each of the two policy treatments with student participants. Four replications were conducted for each policy treatment with professional subjects. An additional replication was added as a precaution after initial problems with attendance and technical issues related to the remote lab facilities. Data from one of these sessions were eliminated from analysis due to a system crash early in trading. Additionally, two professional sessions were conducted with six, rather than eight, participants.[2] The data represent averages for each trading period across the three or four replications by policy and subject treatments.

A summary of experimental results includes estimated convergence levels as well as a graphic illustration of average price and number of trades per period by treatment. Table 1 includes parameter estimates and statistical tests from the convergence analysis. Figures 2 and 3 illustrate these outcomes by policy treatment, comparing student and professional participant groups.

Price

In student results, negotiated prices in the base market with no subsidy paid out converged to an estimated value of 81.6 tokens, near the predicted equilibrium of 80 tokens. When buyers in the market were paid a 20-token subsidy on each unit they purchased, prices rose, converging to an estimated 85.9 tokens in the student sessions (table 1, figure 2).

Professional subjects negotiated lower prices than their student counterparts across both policy treatments. With no subsidy paid out, estimated average prices in markets with professional subjects converged at 76.1 tokens. However, in keeping with the policy treatment effect seen in student results, professional participants negotiated higher prices when buyers in the market were given the per-unit subsidy (table 1, figure 2).

Within each subject group, estimated average prices increased 4.3 tokens when a 20-token payment was made to the buyer on each unit traded, resulting in pass-through rate to sellers of 21.5 percent for students and professionals.[3] Non-parametric tests indicate no significant pair-wise differences between replications in average prices in the last 5 periods of trading.

Trades

The number of trades per period in student markets converged at an estimated level of 16.6 in the no-subsidy treatment. A subsidy paid to the buyer on each unit traded resulted in a significant increase of less than one trade or a converged level of 17.4 trades per period (table 1, figure 3).

The number of trades was higher overall in markets with professional subjects, converging at an estimated level of 18.9 in the no-subsidy treatment. While the incentive to trade increased (to an estimated 19.2 units) when professional buyers were paid a subsidy, the increase in actual trading was not statistically significant (table 1, figure 3).

The number of trades negotiated by professional participants was closer to the predicted market equilibrium of 20 to 24 units than student outcomes. Overall, trading results are consistent with previous work that reports trading levels significantly below the predicted

equilibrium tunnel of 20 to 24 trades per period can be expected in the private negotiation trading institution compared to open market auctions (Menkhaus, Phillips, and Bastian 2003).

Summary and Conclusions

Laboratory results indicate the estimated pass-through rate, measuring the incidence of a per-unit buyer subsidy, was identical for students and agricultural professionals with identical market structures and institutions. In markets with both subject groups, 21.5 percent of a per-unit subsidy paid to buyers was passed on to sellers in the market via higher prices. This treatment-effect estimate is comparable to the 14 to 25 percent incidence reported in recent empirical studies (Kirwan 2009, Kirwan and Roberts 2010). The external validity of these results from the literature is important. At times when data are limited our results support the use of market experiments to provide measures subsidy incidence in factor markets.

While the treatment effect measuring subsidy incidence was the same between the two subject pools, there is a behavioral difference in the number of trades made by students and professionals. The number of trades conducted per period by professional participants was significantly higher than for students. This higher number of trades by professionals contributes to an explanation of lower price levels negotiated by this subject pool.

An explanation for the difference in the trading levels between students and professionals goes beyond the experiment design used in this study. What can be said about the differences between these two subject pools? Professionals likely were more experienced traders than students, particularly in private negotiation. This could contribute to more efficient negotiations for trade price and increase the number of trades completed during a trading period in our laboratory market. Further, as stated, the opportunity cost for professionals is greater than that

for students. This could prompt professionals to bargain for more of the total surplus, as is observed in the experiment results.

Finally, the consistent treatment effect between students and professionals is encouraging, particularly in the use of experimental laboratory methods for *ex ante* analyses of agricultural policies. This is the first study to compare laboratory market results from students and agricultural professionals. These results suggest that even when controlling for such factors as market power and social norms in negotiating land rental contracts, a payment incidence rate similar to that estimated in recent econometric studies is observed. Thus, experiments may offer an opportunity to isolate and study potential behaviors contributing to payment incidence and evaluate the potential impacts of policies designed to either control for payment incidence or address other goals such as decoupling.

[1] The subsidy of 20 tokens is comparable, on a per-unit basis, with that used by Bastian et al. (2008) and Phillips et al. (2010).

[2] Trade data for these sessions were corrected to account for fewer players and a statistical comparison was conducted using convergence model estimates, which indicate no difference between professional sessions with eight or six players (no difference in converged price, t-value = 0.34, p-value = 0.74; no difference in converged trades, t-value = -1.29, p-value = 0.21).

[3] The estimated incidence or pass-through rate is calculated as the difference between the converged average price for subsidized and unsubsidized treatments divided by the subsidy per unit: the student subject pass-through rate = (85.9 - 81.6) / 20 = 0.215 or 21.5 percent; the professional subject pass-through rate = (80.4 - 76.1) / 20 = 0.215 or 21.5 percent.

References

Ashenfelter, O., and D. Genesove. 1992. "Testing for Price Anomalies in Real Estate Auctions." *The American Economic Review* 8(2):501-505.

Bastian, C.T., D.J. Menkhaus, A.M. Nagler, and N.S. Ballenger. 2008. "Ex Ante Evaluation of Alternative Agricultural Policies in Laboratory Posted Bid Markets." *American Journal of Agricultural Economics* 90(5:1208-1215.

Bhaskar, A., and J.C. Beghin. 2009. "How Coupled Are Decoupled Farm Payments? A Review of the Evidence." *Journal of Agricultural and Resource Economics* 34(1):130-153.

Binmore, K. 1999. "Why Experiment in Economics?" *The Economics Journal* 109(453):F16-F24.

Davis, D.D., and C.A. Holt. 1993. *Experimental Economics.* Princeton, N.J.: Princeton University Press.

Environmental Working Group. 2010. *Farm Subsidy Database.* http://farm.ewg.org/regionsummary.php (accessed November 1, 2010).

Floyd, J.E. 1965. "The Effects of Farm Price Supports on the Returns to Land and Labor in Agriculture." *The Journal of the Political Economy* 73(2):148-158.

Friedman, D., and S. Sunder. 1994. *Experimental Methods: A Primer for Economists.* Cambridge: Cambridge University Press.

Goodwin, B.K., A.K. Mishra, and F.N. Ortalo-Magne. 2003. "What's Wrong with Our Models of Agricultural Land Values?" *American Journal of Agricultural Economics* 85(3):744-752.

Kirwan, B., and M.J. Roberts.2010. "Who Really Benefits from Agricultural Subsidies? Evidence from Field-Level Data." *Selected Paper Agricultural & Applied Economics Association AAEA, CAES, & WAEA Joint Annual Meeting, July 25-27,* Denver, Colorado.

Kirwan, B.E. 2009. "The Incidence of U.S. Agricultural Subsidies on Farmland Rental Rates." *Journal of Political Economy* 117(1):138-164.

Menkhaus, D.J., O.R. Phillips, A.F.M Johnston, and A.V. Yakunina. 2003. "Price Discovery in Private Negotiation Trading with Forward and Spot Deliveries." *Review of Agricultural Economics* 25(1):89-107.

Menkhaus, D.J., O.R. Phillips, and C.T. Bastian. 2003. "Impacts of Alternative Trading Institutions and Methods of Delivery on Laboratory Market Outcomes." *American Journal of Agricultural Economics* 85(5):1323-1329.

Menkhaus, D.J., O.R. Phillips, C.T. Bastian, and L.B. Gittings. 2007. "The Matching Problem (and Inventories) in Private Negotiation." *American Journal of Agricultural Economics* 89(4):1073-1084.

Noussair, C.N., C.R. Plott, and R.G. Riezman. 1995. "An Experimental Investigation of the Patterns of International Trade." *American Economic Review* 85(3):462-491.

Parks, R.W. 1967. "Efficient Estimation of a System of Regression Equations When Disturbances Are Both Serially and Contemporaneously Correlated." *Journal of the American Statistical Association* 62(318):500-509.

Phillips, O.R., A.M. Nagler, D.J. Menkhaus, and C.T. Bastian. 2010. "Experimental Work on Subsidies, Moral Hazard, and Market Power in Agricultural Markets." *Contemporary Economic Policy* 28(4):488-501.

SAS. 1999. *SAS/ETS User's Guide, Version 8.* Cary, N.C.: SAS Institute, Inc.

Schotter, A. 2006. "Strong and Wrong: The Use of Rational Choice Theory in Experimental Economics." *Journal of Theoretical Politics* 18(4):498-511.

Sumner, D.A. 2007. "Farm Subsidy Tradition and Modern Agricultural Realities." *Paper prepared for AEI Project on Agricultural Policy for the 2007 Farm Bill and Beyond.*

Thompson, W., A.K. Mishra, and J. Dewbre. 2009. "Farm Household income and Transfer Efficiency: An Evaluation of United States Farm Program Payments." *American Journal of Agricultural Economics* 91(5):1296-1301.

Tweeten, L., and C. Zulauf. 2008. "Farm Price and Income Policy: Lessons From History." *Agribusiness* 24(2):145-160.

Table 1. Estimated convergence levels for market outcomes

Subject Group Treatment	Market Outcome Price* (Tokens)	 Number of Trades
Student Participants		
No Subsidy	81.6[a]	16.6[a]
Per-unit Subsidy	85.9[a]	17.4[b]
Professional Participants		
No Subsidy	76.1[a]	18.9[c]
Per-unit Subsidy	80.4[a]	19.2[c]

[a—c] Estimates with the same superscript letter indicate no significant difference, different superscripts indicate statistical difference at 95 percent confidence level.

* Non-parametric (Wilcoxon) significance tests are reported for price estimates due to non-normal distribution of residuals (Shapiro-Wilk test statistic = 0.956, p-value 0.008).

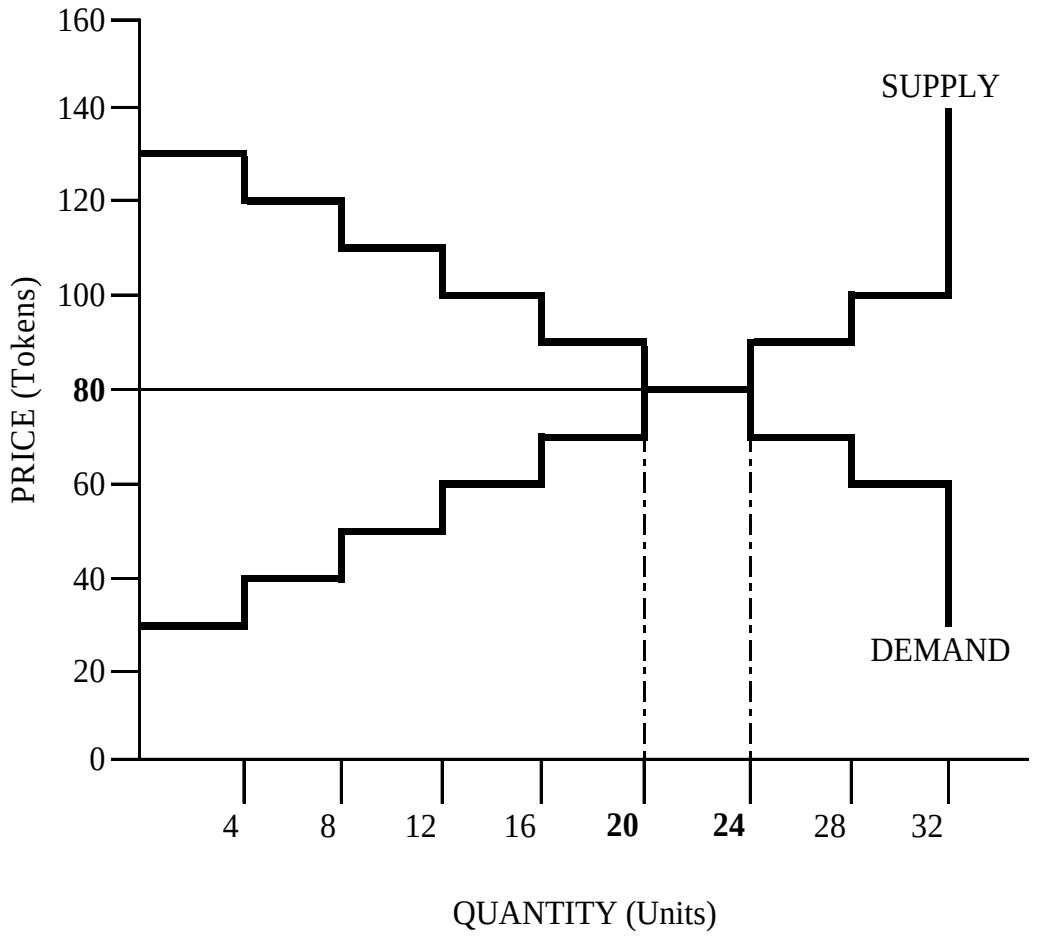

Figure 1. Induced aggregate market demand and supply for four buyers and four sellers

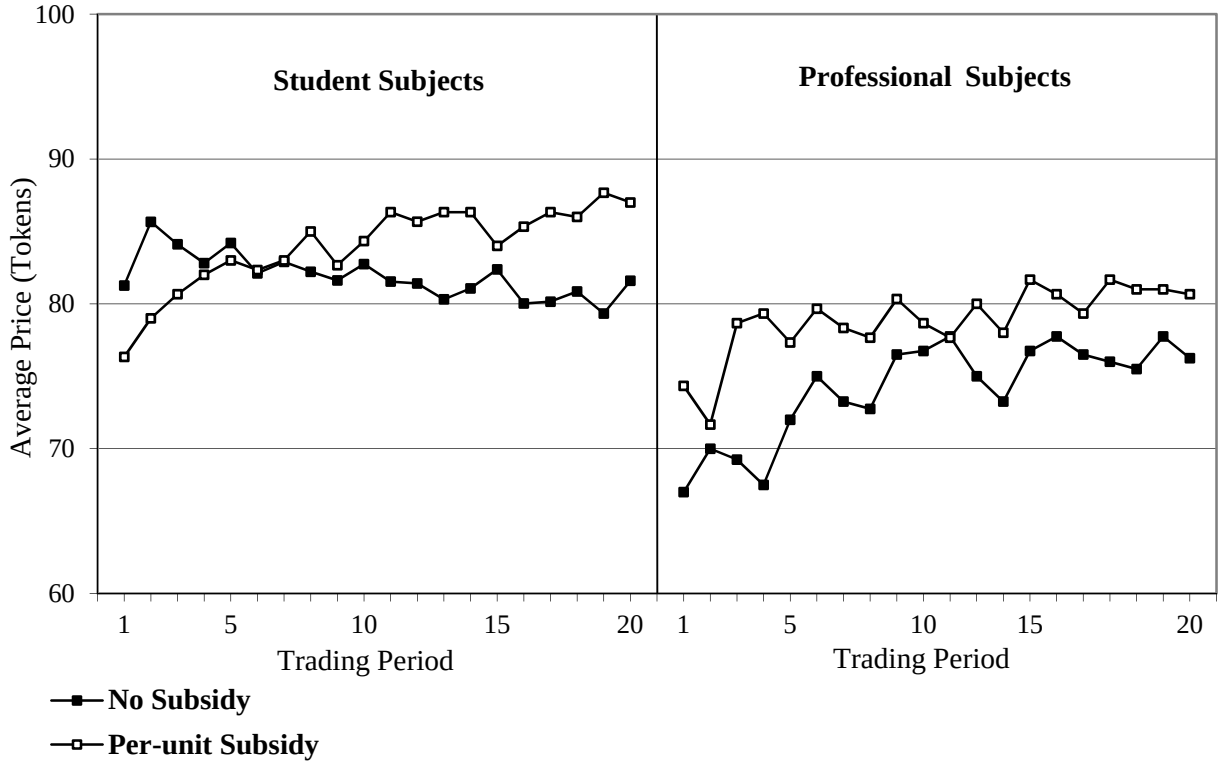

Figure 2. Average market prices per trading period by policy treatment for student and professional subjects

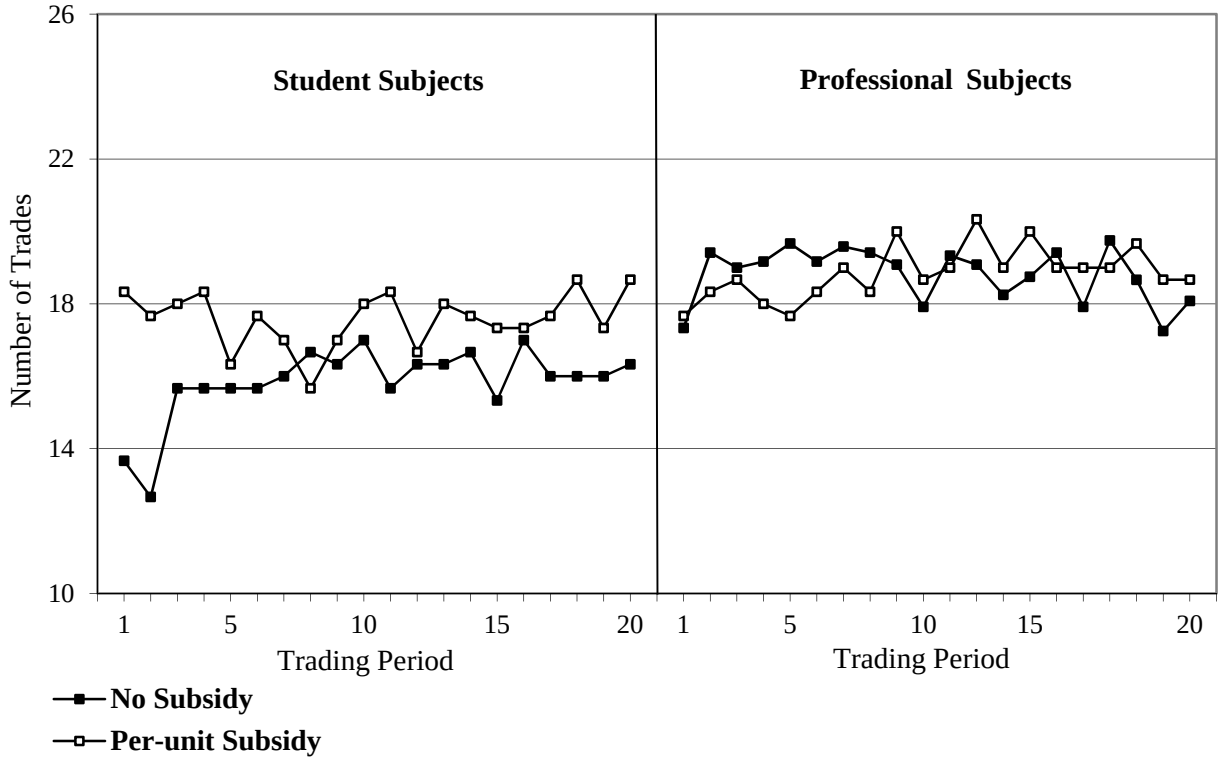

Figure 3. Number of trades per period by policy treatment for student and professional subjects