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The Role of Money Illusion in Nominal Price Adjustment

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Ernst Fehr and Jean-Robert Tyran (2001) (hereafter FT) investigate the role of a specific form of money illusion – taking nominal payoffs as a proxy for real payoffs – in nominal price adjustment within a price-setting game where firms' prices are strategic complements. In a laboratory setting, FT vary the payoff framing (real vs. nominal framing) and opponent types (a rational computer vs. human opponents) to study both the direct and indirect effects of money illusion. Their main finding is that a small amount of individual-level money illusion may generate significant nominal inertia following a negative monetary shock. The response to a positive monetary shock is asymmetric in that price convergence to equilibrium is considerably faster. Their results have been widely cited as evidence of money illusion, e.g. Janet Yellen and George Akerlof (2006), Edmund Cannon and Giam Cipriani (2006), Markus Brunnermeier and Christian Julliard, (2008), Suleyman Basak and Hongjun Yan (2010). While their experiments are innovative, we argue that certain features of FT's experimental design hinder a clear interpretation of their results. These features are:

1. In the treatment they used to measure individual-level money illusion rational agents and agents with money illusion have the same optimal strategy. Consequently, money illusion cannot be measured in their experiments.
2. The treatment design does not separate the cognitive task of finding the Nash Equilibrium (NE) from the task of coordinating with one's opponents. A nominal payoff frame may slow price adjustment because it increases agents' cognitive load, not (only) because it induces money illusion.
3. A visible focal point in the participants' real payoff space is obscured in their nominal payoff space. This may have slowed coordination to the new equilibrium apart from money illusion.

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4. The adjustment rates of prices following a monetary shock are well explained by agents setting their prices in period *t* so as to best respond to their opponents' prices in period *t*-1. In the payoff space of FT's positive shock environment this strategy would cause prices to adjust two to three times faster than in the payoff space of their negative shock environment, regardless of the presence of money illusion.

This paper reassesses the role of money illusion in FT's laboratory experiments. We modify the participants' payoff space to allow for (1) identification of money illusion at the individual level, (2) balance in focal points across payoff frames in treatments meant to assess the indirect effects of money illusion, and (3) symmetry in best reply functions following negative and positive monetary shocks. We also introduce a new treatment to assess the impact of cognitive load on price adjustment. We employ FT's methodology to reevaluate whether money illusion matters.

In the analysis that follows, it is important to distinguish between two categories of money illusion. The first category, which we will call "first order money illusion" includes any bounded rationality that leads agents to follow strategies that maximize their nominal payoffs. The second category, which we will call "second order money illusion," is less severe. An agent exhibits second order money illusion if his process of selecting a strategy primarily relies on the underlying real payoffs, but takes some account of nominal payoffs as well.

FT's proposed form of money illusion is that agents take nominal payoffs as a proxy for real payoffs. This is a form of first order money illusion because, although agents wish to maximize their real payoffs, they attempt to accomplish these ends by maximizing their nominal payoffs. In our experiments we find no evidence of first order money illusion, but we do find evidence of second order money illusion. Participants primarily chose from the set of prices that could result in their maximum real payoff, but within this set some participants favored prices which could also result in higher nominal payoffs. Beyond this rather small second order effect, all of the differences in price inertia across our treatments can be explained by differences in the cognitive load of finding the NE.

I. Experimental Design

In this section we briefly describe the experimental design employed by FT. We then explain how features of this design confound first order money illusion with other influences that might affect the evolution of prices after a monetary shock, and how we revise the original design to overcome these confounds in our own experiments. For the remainder of the paper we will use the terms "money illusion" and "first order money illusion" interchangeably. Second order money illusion will always be indicated by its full title.

A. *The Original Design*

FT studied money illusion in the context of a pricing experiment: participants took the role of firms choosing prices simultaneously with their opponents. No communication was allowed. Payoffs each period were determined by a profit function, the reduced form of which is:

$$\pi_i = \pi_i(P_i/\bar{P}_{-i}, M/\bar{P}_{-i}) \text{ , } i = 1, \dots, n \qquad (1)$$

where π_i is the real profit of firm i, M is the stock of money, and P_i and $\bar{P}_{-i}$ are the price set by i and the average price set by the other firms respectively. Profit function (1) implies that money is theoretically neutral, collusive pricing is a dominated strategy, and firms' prices are strategic complements (i.e., a firm's most profitable P_i is positively correlated with $\bar{P}_{-i}$).

Participants were organized into groups of four, and the membership of each group remained the same throughout the experiment. In each group, two participants took the roles of "type *x*" firms while the other two took the roles of "type *y*" firms. The firm types only differed in the functional form specified for them using profit function (1).[3] The profit functions were presented to participants as "income tables," which displayed a matrix of payoffs. The left column contained the set of P_i that a firm could choose and the top row contained all possible $\bar{P}_{-i}$ that could result from the prices chosen by its three counterparts. The income tables made it easy to look up the payoff associated with any $(P_i, \bar{P}_{-i})$ combination. All participants received the income tables for both firm types, so that the profit functions were common knowledge.

[3] Using unique payoff functions for each firm would have been the most realistic design, but would have made finding the equilibrium very challenging for participants. FT chose two firm types with separate payoff functions to balance realism with tractability.

In each period, every firm in a group selected a price $P_i \in \{1,2,\ldots,30\}$. Once all firms had set their prices, $\bar{P}_{-i}$ was calculated for each firm along with the corresponding real payoff, π_i. Participants were not told the individual prices chosen by each of their opponents, but they were shown $\bar{P}_{-i}$ and π_i as informational feedback at the end of each period. All negative shock experiments consisted of 2T periods. For the first T periods of the experiment the money supply was given by $M_0 = 42$, and the equilibrium prices of firms of type *x* and type *y* were 9 and 27, for an average equilibrium price, $\bar{P}_0^*$, of 18. In equilibrium, all firms earned the maximum payoff of 40. These initial T periods composed the "pre-shock" phase of the experiment

After the pre-shock phase had concluded, a monetary shock was implemented by distributing new income tables to all participants. The shock was fully anticipated in that the experimenters publicly announced that there would be a change in income tables in period T+1, as well as the fact that the experiment would continue for an additional T periods, which composed the "post-shock" phase. In this phase, the money supply was cut by two thirds to $M_1 = 14$. Consequently, in the new equilibrium type *x* firms would set a price of 3 and type *y* firms would set a price of 9, so that $\bar{P}_1^* = 6$, 12 increments below the pre-shock equilibrium. The equilibrium payoff for all firms remained 40, as in the pre-shock phase.

There were two treatment variables, the first of which was the representation of payoffs. In the Real (R) treatments, participants' income tables were populated by their real payoffs, π_i. In the Nominal (N) treatments the participants' income tables contained nominal payoffs, $\bar{P}_{-i}\pi_i$, which required a firm to manually deflate by the average price of its opponents to obtain real payoffs.

The second treatment variable allowed FT to separate the direct individual-level effect of first order money illusion (irrational agents setting inefficiently high prices) from its indirect strategic effects (rational agents best responding to irrational ones by also setting inefficiently high prices). In the Computerized (C) treatments, each participant was grouped with three computerized opponents who set their prices so as to maximize their real payoffs given the price that the participant had chosen in the current period. In addition to the income tables, participants in the C treatments were shown the $\bar{P}_{-i}$ that their computerized opponents would set in response to each P_i. In the Human (H) treatments, participants were grouped with one

another. This introduced a coordination problem: for each participant there was an element of uncertainty regarding the prices that his opponents would set.

The 2x2 interaction of these treatment variables produced four treatments: RC, NC, RH and NH. The RC served as a baseline to test for individual-level irrationalities other than money illusion. The NC introduced the possibility for first order money illusion to directly impede adjustment to the monetary shock, but ruled out a coordination problem. Participants in the RH treatment were immune from money illusion of any kind as they saw real payoffs in their income tables, but faced a coordination problem that could slow adjustment to the new equilibrium. Finally, the NH treatment allowed for nominal framing to interact with the coordination problem and provided a measure of the combined individual-level and strategic effects of money illusion.

FT found that prices adjusted instantaneously in the RC, ruling out irrationalities other than money illusion. Adjustment was somewhat slower in the NC treatment, which they offer as evidence for a low level of individual-level money illusion. In the RH, prices adjusted to the new equilibrium by the third period. However, in the NH it took the firms 13 periods to fully adjust their prices. Consequently, FT concluded that when prices are strategic complements, even a small amount of money illusion at the individual level can lead to substantial downward price stickiness. They then conducted additional experiments in the RH and NH treatments – using different income tables – in which the average equilibrium price was higher in the post-shock phase (We refer to these as the RH^+ and NH^+, though FT do not use this notation.) They found that the prices in the NH^+ fully adjusted in just four periods. The asymmetric response of prices to negative and positive shocks is consistent with the hypothesis of first order money illusion.

B. *Confounds in the Original Design*

1. Identifying money illusion in the NC treatment

Table 1 displays the real and nominal incomes that firms of both types could expect to earn in the post-shock phase under FT's nominal mapping, as well as under our own. FT's NC treatment is incapable of separating rational participants from those with first order money illusion because their nominal frame did not sufficiently inflate the nominal payoffs that could be earned by pricing above the equilibrium. A participant suffering from first order money illusion

would select the price associated with the highest nominal payoff. In FT's NC this is a price of 3 for type *x* and 9 for type *y*. But these are *also* the prices associated with the highest real payoff, which a rational participant would select. Consequently, there is no way to disentangle who actually suffered from money illusion. Moreover, the nominal inertia in their NC treatment cannot be attributed to money illusion, because participants suffering from it would have no trouble fully adjusting to the new equilibrium.

Our revised design uses $\bar{P}_{-i}(\pi_i + \bar{P}_{-i})$ to for nominal payoffs, allowing us to identify money illusion in the post-shock phase of the NC.[4] For type *x* firms, any price greater than or equal to 15 results in a higher nominal income than the equilibrium price of 3. For type *y* firms, the post shock equilibrium price is 9, but any price greater than or equal to 20 offers a higher nominal income.

2. Money Illusion vs. the Cognitive Load of Finding the Nash Equilibrium

In the computerized treatments, participants know the response of their opponents for each possible P_i. Consequently, their cognitive task essentially consists of picking their preferred payout from a list of 30 possibilities. In the human treatments, participants must coordinate to the NE with their opponents. But coordinating to the NE requires that participants first calculate what it is. In the original design the NE may be found through iterated elimination of dominated strategies, but it is highly unlikely that many participants are sufficiently familiar with game theory to make use of that method, especially in a game with 900 potential payoffs per firm type. The NE may be easier to find under the real frame, or with a positive shock under the nominal frame. In the RH there is no need to deflate payoffs, which may free up time and mental capacity for finding the optimal prices. Similarly, in the NH^+ the highest nominal payoffs were also the highest real payoffs, which may have made the equilibrium prices more obvious.

FT's experimental design does not separate finding the NE from coordinating to it. If there are asymmetries in the cognitive load of finding the NE across the human opponent treatments, these asymmetries may be mistaken for money illusion. We conducted a set of treatments to examine the effect of the cognitive challenge of the pricing task. Each participant

[4] Money illusion is not identified in the pre-shock phase of our experiments, but this is not problematic because we focus our analysis on money illusion's effects on price adjustment after the monetary shock.

was put in charge of all four firms in their group and was required to choose the prices for the firms simultaneously. In these experiments a participant had no opponent save for his or her own Self (S). We used the income tables from the human-opponent experiments to yield two negative-shock treatments (RS and NS) and one positive shock treatment (NS^+). (A positive shock treatment with the real payoff frame was not necessary for reasons explained below.)

Sessions in the RS, NS and NS^+ treatments consisted of two phases, but participants made only one set of pricing decisions per phase. In each phase the participants were given fifteen minutes to examine their income tables and choose the four prices for the firms under their control. Each participant was paid the sum of his four firms' real incomes.[5]

3. Focal Points in the Real Payoff Space

An examination of FT's RH income tables reveals a focal point that is not present in the tables for their NH treatment. Table 2 displays the real and nominal incomes in and near the equilibrium price for type *x* firms in the pre- and post-shock phases of the experiment. In the pre-shock (post-shock) table the equilibrium price rows contain seven (three) payoffs within one point of each other, making them visually striking. The equilibrium prices all possess the same payoff of 40 and offer the longest string of maximum payoffs.[6] The nominal framing not only casts the veil of money over each real payoff individually; it covers the *pattern* of real payoffs that might act as a focal point to coordinate participants' expectations.

The asymmetry in focal points between the RH and NH is a potentially serious uncontrolled variable, and may explain some or all of the difference in nominal inertia between the original RH and NH treatments. Thomas Schelling (1960) first showed that in a number of coordination games, even with very large strategy spaces, the presence of a focal point often assists players to coordinate their decisions with much greater frequency than would be predicted by game theory alone. More recent experimental work (for example, by Judith Mehta et al., 1992 and 1994; Michael Bacharach and Michele Bernasconi, 1997; Nicholas Bardsley et al., 2010) has confirmed the power of focal points in coordination games. We correct for the asymmetry in the original design by providing a visual focal point in both of these treatments by

[5] In the self-opponent treatments participants were paid 6.25 cents per point. Since each firm earns 40 points in equilibrium a participant could earn up to $10.00 per phase in addition to a their attendance bonus.
[6] Type *y* firms' tables (not shown here) exhibit the same basic patterns.

marking the maximum real payoffs in the appropriate cells with bold red font.[7] These markings were made in the tables for human opponent and self-opponent treatments. They were not used in the computer opponent treatments, as those treatments were meant to measure individual-level irrationalities apart from any coordination problem.

4. Asymmetric Best Reply Functions in the Negative and Positive Shock Treatments

Participants in all of FT's treatments with human opponents generally adopted a simple rule of thumb for selecting their prices after the first period of the post-shock phase. Namely, for any period t > T + 1 participant i tended to choose a price for the period, P_{it}, that was a best response to $\bar{P}_{-i,t-1}$. We will refer to this strategy as "adaptive best responding," or the "adaptive best response" (ABR).

The widespread use of ABR under both payoff treatments indicates that the best reply function of the payoff space drove price adjustment dynamics. In the negative shock treatments the best reply functions induced participants who chose their ABR to adjust toward the equilibrium at a rate of one price increment per period. In the positive shock treatments, however, FT used a different set of income tables from a different functional form of the real payoff function (1). The resulting best reply functions induced much faster convergence. Participants who chose their ABR in the positive shock treatments would adjust toward the equilibrium at a rate of two to three price increments per period. (Detailed support for our claim that FT's participants systematically followed the ABR and that this would lead to faster convergence in the positive shock treatments can be found in Section 1 of online Appendix A.)

A fair comparison of adjustment after each shock type requires symmetrical best response functions. Our solution was quite simple: we used the real income matrices from the negative shock experiments, but reversed the ordering of the rows and columns. This meant, for instance, that the payoff associated with the $(P_i, \bar{P}_{-i})$ combination (1,1) in a given negative shock table was associated with the combination (30,30) in the corresponding positive shock table. The

[7] For the pre-shock phase we marked every income cell that contained a real income of 40 in this manner. In the post-shock phase we marked every cell that contained a real income of 39 or 40.

resulting real payoff matrices could then be mapped into nominal payoffs in the manner described in Section I.B.1.[8]

Note that in our experimental design a deviation from the new equilibrium of ε after a positive shock is equivalent to a deviation of $-\varepsilon$ after a negative shock. Thus, results from the positive shock experiments can be compared directly to the negative shock experiments through a simple transformation of the data in which the deviations from equilibrium are multiplied by -1. Accordingly, a positive shock treatment using a real payoff frame was not necessary; our experiments with a positive shock all used a nominal payoff frame. The income tables for the NH^+ and NS^+ induced a pre-shock equilibrium price on type *x* (type *y*) firms of 22 (4). In the post-shock phase the type *x* (type *y*) equilibrium price was 28 (22). Thus, average equilibrium prices for the pre- and post-shock phases were 13 and 25, requiring an adjustment of 12 increments, just as in the negative shock experiments. Table 3 summarizes the parameters of our experimental design for all treatments.

C. *Participant Pool*

A total of 225 participants took part in the eight treatments described above. Each participant took part in only one experiment. For the experiments with human opponents, we conducted sessions with eight or more participants so that they would not know exactly who the other members of their group were. The experiments were conducted at Chapman University and the University of California, Santa Cruz, approximately half at each location. Participants were paid $7 for attending and in addition earned an average of approximately $25.30 based on their decisions in the experiment. The experiments typically lasted 70 – 90 minutes.[9]

II. Results

A. *Individual-Level Irrationalities and Money Illusion*

Participants facing computerized opponents displayed highly rational behavior. Table 4 contains the average deviation from the equilibrium price per period in the post-shock phase of

[8] Notice that this means that there is, technically speaking, no money supply in the functional form of our positive shock experiments.

[9] All experimental procedures, computerized interfaces, instructions and income tables can be found in online Appendices B, C and D.

all of our treatments with computerized or human opponents, as well as significance levels using Wilcoxon signed-rank tests with $\bar{P}_{it} - \bar{P}_t^*$ as the unit of observation, where $\bar{P}_{it}$ is the average price chosen by group i in period t.[10] Prices adjusted very quickly to the monetary shock in the RC. In the post-shock phase the average price was never more than 0.8 increments away from the equilibrium, and a substantial amount of the deviation from equilibrium was due to participants failing to submit prices before the end of the period, in which case the software submitted a random price between 1 and 30 on their behalf. If these random prices are excluded, 96 percent of participants in the RC chose the equilibrium price in period T+1, and 95 percent of all prices in the post-shock phase were exactly equal to the equilibrium. The average deviation is not statistically significant in any post-shock period at the 5 percent level, even if the random prices are included. As in FT's original experiments, we can find no evidence for individual-level irrationalities under a real payoff framing.

Unlike FT's experiments, however, there was no nominal inertia in our NC treatment. The average price in period T+1 was 0.8 increments above the equilibrium, but this is not significant at the 5 percent level. Moreover, even this slight deviation was due entirely to three participants who failed to choose a price prior to the end of the period, resulting in random price selections. *Every* firm that did submit a price in period T+1 chose their equilibrium price. In eight of the nine remaining periods of the post-shock phase the average price was exactly equal to the equilibrium, and in period T+3 it was slightly below the equilibrium. If random prices are excluded, there is only one instance in the post-shock phase of a price being selected that was not equal to the equilibrium prediction. That price yielded a nominal payoff *lower* than that of the equilibrium. In short, not a single decision in our NC was consistent with first order money illusion. Participants clearly distinguished between real and nominal payoffs, and based their decisions on the former.

B. *Finding the Equilibrium Under Real and Nominal Payoff Frames*

Although our participants did not take nominal income as a proxy for real income in the NC treatment, the nominal payoff frame hindered their ability to find the equilibrium. We focus our analysis on the $\bar{P}_i - \bar{P}^*$ (multiplied by negative one in the positive shock sessions) in the

[10] For statistical analysis in the RC and NC we organized the data into groups based on where each participant was seated in the experiment, because that determined group membership in the RH and NH treatments.

post-shock period of self-opponent treatments. Figure 1 shows the cumulative density functions of average price deviations in the RS, NS and NS^+. Notice that the median deviation from the equilibrium is greater under the nominal frame than under the real frame, and greater with a negative shock than with a positive one. Using Mann-Whitney tests we find that the deviation in the NS is significantly greater than in the RS ($p = 0.016$) and falls just short of a statistically significant difference from the NS^+ at the 5 percent level ($p = 0.052$). However, the RS and NS^+ have statistically identical distributions ($p = 0.821$).

What accounts for the added difficulty of finding the equilibrium under a positive versus a negative shock? Second order money illusion appears to explain the data. The pattern of prices set by individual participants (rather than averages at the group level) suggests that participants used real payoffs to find a range of suitable prices but allowed nominal payoffs to influence their selection of prices within this range.

In both the NS and NS^+ the participants showed a strong tendency to choose prices whose rows in the income table contained at least one bolded, red payoff, which indicated a maximum real income. In the post-shock period of the NS and NS^+ 88.2 percent and 94.7 percent of the prices respectively were within the bolded range. By conducting four Pearson's chi-square tests, each restricting the sample to the prices chosen for a single firm, we find that the likelihood of choosing a price in the bolded range was largely invariant across monetary shocks. Only for the second type *x* firm were participants significantly more likely to select such a price in the NS^+ than the NS (100 percent versus 68.4 percent, $p = 0.01$; $p > 0.5$ for all other firms).

However, within the bolded range the maximum nominal income that could be earned from a price had some effect on the frequency with which participants chose it. Figure 2 displays a histogram of all prices that were chosen within the bolded range in the post-shock period of the NS and NS^+. For ease of comparison the prices have been normalized by subtracting out the equilibrium price (and multiplying by negative one in the NS^+). The distributions are virtually identical for normalized prices of one through eight. In both treatments these corresponded with price rows in the middle of the income tables with rather moderate nominal incomes. Using Mann-Whitney tests for each of the four firms in this price range we find no significant differences between treatments ($p > 0.6$ in all cases).

There is an asymmetry between treatments for normalized prices less than one. These were the prices for which the nominal incomes were lowest in the NS and highest in the NS^+. Mann-Whitney tests for the first and second type *y* firms controlled by each participant show significant differences across treatments in this normalized price range ($p = 0.035$ and $p = 0.021$ respectively). Tests for both type *x* firms fall somewhat short of statistical significance ($p = 0.105$ and $p = 0.069$).

These results imply that second order money illusion may have a modest effect on nominal inertia. Participants primarily restricted their prices to those that could generate a maximum real payoff, but within this range they shied away from extremely low nominal payoffs and were somewhat attracted to extremely high nominal payoffs.

C. *Coordination with Human Opponents Under the Real and Nominal Frames*

Before considering the level of prices across treatments with human opponents we tested whether the adjustment dynamics in our experiments can be well described by participants following the ABR strategy. About 7 percent of participants (9 of 124) anchored on their equilibrium prices, choosing them repeatedly even when it was not the ABR to do so. Statistical analysis (described in Section 2 of online Appendix A) indicates that the remaining 93 percent of participants chose their ABR prices in the post-shock phase in all three of these treatments.[11] Therefore, we may conclude that neither first order nor second order money illusion affected the rate of price adjustment after period T+1 in the post-shock phase of the NH and NH^+.[12]

We have advanced the hypothesis that the pattern of maximum payoffs in the real income space gave the equilibrium prices salience, making them focal points for coordination in FT's experiments. Marking the maximum payoffs in bold red font should heighten the salience of the equilibrium prices in our experiments relative to theirs by making the pattern apparent to the

[11] Note that this implies that most or all participants failed to account for the fact that their opponents would also be playing their ABR. Underestimating the sophistication of one's counterparts is commonplace in normal form games (see, e.g., Miguel Costa-Gomes and Vincent Crawford, 2006 and Crawford, Uri Gneezy and Yval Rottenstreich, 2008), and in our experiments the cost of naïvely adaptive expectations was low. When all firms in a group played the ABR, the average price typically fell by one increment per period. Best responding to an expected average price of $\bar{P}^e_{-i}$ when the actual average price was $\bar{P}^e_{-i} - 1$ would never cost a firm more than \$0.10.

[12] In one NH session and two NH^+ sessions high random prices were chosen in period T+1 due to participants failing to set their prices before the time limit elapsed. These random prices affected adjustment in all subsequent periods through ABR dynamics. We exclude the data from these sessions because including them makes price adjustment in the NH^+ more similar to that of the NH, biasing the analysis in favor of our initial hypotheses.

participants under a nominal frame and perhaps even more obvious to those under a real frame. We find that adjustment is improved in our experiments relative to the original design.

Figure 3 shows the average deviation from the equilibrium price in the RH, NH and NH^+ treatments (multiplied by -1 in the latter case). The data indicate that there was a very small but statistically significant amount of nominal inertia in our RH treatment. 61 percent of participants chose their equilibrium price in the first post-shock period, and 89 percent chose a price within two price increments of the equilibrium. The average deviation from the post-shock equilibrium price was 1.2 increments in period T+1 (see Table 4). This is significant at the 1 percent level, but the deviation is very small. Recall that the equilibrium average price fell by 12 increments between periods T and T+1. A deviation of 1.2 increments means that participants lowered their prices by 10.8 increments on average, or 90 percent of the necessary adjustment.

The ABR pricing strategy quickly led participants to the equilibrium in the subsequent periods. By period T+2 the participants had lowered their prices by 95 percent of the necessary adjustment. The average price deviated by only 0.6 increments from the equilibrium on average ($p < 0.05$). After period T+2 the average price deviation was not significant, and after period T+4 *every* price that was submitted was equal to the equilibrium.

Heightening the salience of the focal point improved adjustment in our RH compared to FT's RH treatment, which had an average deviation of 3.1 in period T+1. In four of the first five post-shock periods the deviation was significantly smaller in our RH than in FT's (Mann-Whitney tests, $p < 0.02$ in periods T+1 and T+3 through T+5).

In our NH treatment the average deviation from the new equilibrium price was 5.6 ($p < 0.01$) in the first post-shock period, almost five times the deviation in the same period of the RH.[13] Because the initial price adjustment was less complete in the NH, participants took significantly longer to reach the equilibrium using the ABR strategy. The average price

[13] There is some evidence that type *y* firms in the nominal frame adjusted faster than type *x* firms. In period T+1 of our NH, the average prices of type *x* and type *y* firms were 7.5 increments and 3.9 increments above equilibrium respectively. In period T+1 of our NH^+ type *x* and type *y* firms set prices 4 increments and 3.3 increments below equilibrium, respectively. This asymmetry may be caused by participants preferring to set their prices near the middle of the income tables. The equilibrium prices are more extreme for type *x* firms (3 in the NH, 28 in the NH^+) than for type y firms (9 in the NH, 22 in the NH^+). However, using Mann-Whitney tests we find that the differences in distributions across firm types are only marginally significant in the NH ($p = 0.085$) and insignificant in the NH+ ($p = 0.222$). We find a significant difference only if we pool the data across the two treatments ($p = 0.042$).

deviation is significant in the first seven post-shock periods (see Table 4). Moreover, Mann Whitney tests using $\bar{P}_{it} - \bar{P}_t^*$ as the unit of observation show the average deviation to be higher in the NH than the RH at the 5 percent level in the same seven periods.

These results imply a somewhat weaker effect of the focal point under a nominal frame. The average price in period T+1 of FT's NH treatment was 7.1 increments above equilibrium, which is not significantly different than period T+1 of our NH (Mann-Whitney test, $p = 0.231$). However, their prices remained out of equilibrium for 12 periods. Our focal points did not significantly reduce the magnitude of nominal inertia, but did reduce its duration by 42 percent.

The asymmetry in nominal inertia between positive and negative monetary shocks persisted in our human opponent treatments. We find only the first three post-shock average prices to be significantly below the equilibrium in the NH^+ using Wilcoxon signed rank tests ($p < 0.02$ in each case). To compare decisions across monetary shock types we normalize the price deviation data from the NH^+ to $-(\bar{P}_{it} - \bar{P}_t^*)$. Using Mann-Whitney tests we find no differences between the RH and NH^+ price deviations that are significant at the 5 percent level in any of the post-shock periods. However, we *do* find that in five of the first seven post-shock periods the price deviations are significantly different between the NH and NH^+. In the remaining two periods (T+2 and T+3) the differences are marginally significant ($p < 0.08$ in each case).

Notice that the pattern of nominal inertia in our RH, NH and NH^+ treatments is similar to the pattern found by FT, though smaller in magnitude and/or duration. However, this is completely explained by the cognitive load of finding the NE and second order money illusion at the individual level. We compare $\bar{P}_i - \bar{P}^*$ in the first post-shock period of our human opponent and self-opponent treatments with Mann-Whitney tests. (Notice that *i* indexes a group of four participants in the human opponent treatments and a single participant in the self-opponent treatments.) The comparisons of RH versus RS, NH versus NS and NH^+ versus NS^+ are all statistically insignificant at the 5 percent level ($p = 0.194$, $p = 0.129$ and $p = 0.268$ respectively). Consequently, we find no strategic effect of second order money illusion in our experiments.

III. Summary and Discussion

Our experiments refine and extend the work of FT, who suggest that money illusion can contribute significantly to nominal inertia in strategically complementary environments. By

controlling for strategic uncertainty, visual focal points and cognitive load we find that participants exhibit no first order money illusion, though second order money illusion plays a minor role. The presence of a focal point in our experiments reduces the duration of price stickiness compared to FT's original experiments when participants played against one another. What stickiness remains is explained by the difficulty of finding the NE among 1800 payoffs. Second order money illusion appears to explain the persistent asymmetry between price adjustment following positive and negative monetary shocks. However, this is a modest effect manifested in an apparent preference for (aversion to) high (low) nominal payoffs within a set of maximum real payoffs. These findings indicate that FT's proposed form of money illusion is not a compelling explanation for sluggish price adjustment.

Moreover, we have demonstrated that adjustment after the first post-shock period was driven primarily by the firms adaptively best responding to one another's pricing decisions. This was true in all of our experiments with human opponents as well as FT's, regardless of whether payoffs were framed in real or nominal terms. We should note, however, that in all of our experiments (and FT's) the real best response to one's opponents was always the nominal best response as well. It may be that money illusion plays a role in price adjustment if and when the real and nominal best responses diverge. Further research on this point is warranted.

Assuming validity outside the laboratory, our strong findings of ABR has implications for both theoretical and empirical work. At the theoretical level, it suggests that incorporating adaptive expectations and best reply behavior into mathematical models is an empirically valid means of generating significant persistence from shocks and out-of-equilibrium dynamics. At the empirical level it implies that monetary shocks may have real effects due to second order money illusion and the cognitive load of finding the equilibrium. However, the duration of disequilibrium behavior following an economic shock (monetary or otherwise) will depend crucially on the best response functions of the affected agents. Consequently, the magnitude of the real effects will be primarily due to agents' best response functions, not to bounded rationality.

The price-setting behavior of firms is crucial to an economy's reaction to monetary policy. Policy rules that are optimal in forward-looking models can result in detrimental outcomes in environments with backward-looking models (Andrew Levin and John Williams,

2003). For example, Alan Blinder (1987) and Lawrence Ball (1994) argue that credible disinflation policies can lead to straightforward adjustment in prices when firms are forward-looking, but lead to costly output losses when they are backward-looking. Our finding that firms set prices adaptively suggests that optimal policies designed for standard forward-looking environments may not be appropriate. Moreover, the real effects from monetary policy will persist longer in environments with adaptively responding firms.

Finally, our results serve as a reminder that subtle details of an experimental design may strongly affect participants' behavior and our perceptions of it. The nominal mapping function, best response functions and visual patterns of payoffs were all critically important in generating and assessing the sources of sticky prices. Additional features, such as the number of available strategies, may play an important role as well. The effects of nominal framing in both our paper and FT's may have been significantly reduced had participants' strategy space been condensed. Further experiments studying the effect of cognitive overload on nominal price adjustment can shed additional light on this.

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Tables

Table 1. Real and Nominal Incomes in the Post-Shock Phase of FT's NC Treatment and our revised version.

	Type *x* Firms			Type *y* Firms		
Price	Real Income (π_i)	Original Nominal Income $(\bar{P}_{-i}\pi_i)$	Revised Nominal Income $(\bar{P}_{-i}(\pi_i + \bar{P}_{-i}))$	Real Income (π_i)	Original Nominal Income $(\bar{P}_{-i}\pi_i)$	Revised Nominal Income $(\bar{P}_{-i}(\pi_i + \bar{P}_{-i}))$
1	26	181	230	5	16	25
2	35	246	295	7	21	30
3^x	**40**	**280**	329	9	28	37
4	35	246	295	13	39	48
5	26	181	230	14	56	72
6	18	125	174	20	81	97
7	12	87	136	26	129	154
8	10	80	144	35	176	201
9^y	9	84	165	**40**	**200**	225
10	9	91	191	35	176	201
11	9	99	220	26	129	154
12	9	107	251	18	89	114
13	9	114	283	12	62	87
14	9	122	318	10	60	96
15	9	130	355	9	66	115
16	9	137	393	9	73	137
17	9	145	434	9	81	162
18	8	152	476	9	89	189
19	8	159	520	9	97	218
20	8	167	567	9	105	249
21	8	174	615	9	112	281
22	8	181	665	9	120	316
23	8	188	717	9	128	353
24	8	195	771	8	135	391
25	8	202	827	8	143	432
26	8	209	885	8	150	474
27	8	216	**945**	8	157	518
28	8	223	890	8	164	564
29	6	166	853	8	171	612
30	5	128	827	8	179	**663**

x indicates the equilibrium price for type *x* firms
y indicates the equilibrium price for type *y* firms
Bold, underlined entries represent the highest income (real or nominal) for a given firm type.

Table 2. Real and Nominal Payoff Tables for Pre-shock and Post-shock Phases in FT's Experiments with a Negative Monetary Shock.

Real Frame

Pre-shock Payoff Tables

Own Price	Average Price of Other Firms									
	17	**18**	**19**	**20**	**21**[b]	**22**	**23**	**24**	**25**
7	40	39	38	38	38	38	37	35	33
8	40	40	40	39	39	39	39	38	36
9[a]	38	39	40	40	40	40	40	39	38
10	36	38	39	39	39	39	40	40	40
11	33	35	37	38	38	38	38	39	40
12	30	32	34	35	35	35	36	38	39

Post-shock Payoff Tables

Own Price	Average Price of Other Firms								
	3	**4**	**5**	**6**	**7**[b]	**8**	**9**	**10**	**11**
1	35	40	36	29	26	23	17	12	9
2	25	34	40	38	35	32	25	17	12
3[a]	18	25	34	39	40	39	34	25	18
4	12	17	25	32	35	38	40	34	25
5	9	12	17	23	26	29	36	40	35
6	7	9	12	16	18	20	27	36	40

Nominal Frame

Pre-shock Payoff Tables

Own Price	Average Price of Other Firms								
	17	**18**	**19**	**20**	**21**[b]	**22**	**23**	**24**	**25**
7	968	1032	1092	1157	1233	1310	1374	1420	1450
8	963	1044	1117	1189	1268	1349	1422	1481	1523
9[a]	939	1033	1119	1200	1281	1364	1447	1522	1581
10	899	1003	1099	1186	1268	1352	1444	1536	1616
11	850	957	1059	1151	1233	1316	1414	1521	1623
12	796	903	1006	1099	1179	1262	1363	1479	1600

Post-shock Payoff Tables

Own Price	Average Price of Other Firms								
	3	**4**	**5**	**6**	**7**[b]	**8**	**9**	**10**	**11**
1	113	175	206	209	230	247	234	222	219
2	85	154	224	262	295	321	302	274	256
3[a]	62	116	194	272	329	379	386	351	314
4	46	86	148	229	295	365	439	445	400
5	36	65	110	173	230	295	407	498	503
6	113	175	206	209	230	247	234	222	219

a indicates the firm's equilibrium price
b indicates the average equilibrium price of the other three firms

Table 3. Experimental Design Parameters

Panel A: Universal Parameters

Representation of payoffs in real frame	π_i
Representation of payoffs in nominal frame	$\overline{\boldsymbol{P}}_{-\boldsymbol{i}}(\overline{\boldsymbol{P}}_{-\boldsymbol{i}}\boldsymbol{\pi}_{\boldsymbol{i}})$
Group size	$n = 4$
End of period informational feedback	$\bar{P}_{-i}\,,\ \pi_i$
Real equilibrium payoff	40
Choice variable	$\boldsymbol{P}_{\boldsymbol{i}} \in \{\mathbf{1}, \mathbf{2}, \ldots, \mathbf{30}\}$
Number of periods pre- and post-shock in computerized treatments	T = 10
Number of periods pre- and post-shock in human treatments	T = 15

Panel B: Phase-Specific Parameters

	Negative Shock		*Positive Shock*	
Phase	Pre-Shock	Post-Shock	Pre-Shock	Post-Shock
Money Supply	42	14	--	--
Average equilibrium price, $\bar{P}^*$, for the entire group	18	6	13	25
Equilibrium price, P_i^*, for type *x*	9	3	22	28
Equilibrium price, P_i^*, for type *y*	27	9	4	22

Panel C: Data Summary for Revised Experiments by Treatment

Monetary Shock	*Payoff Framing*	*Opponents*	*Treatment Name*	*Participants*
Negative	Real	Computer	RC	24
Negative	Real	Human	RH	36
Negative	Real	Self	RS	15
Negative	Nominal	Computer	NC	24
Negative	Nominal	Human	NH	44
Negative	Nominal	Self	NS	19
Positive	Nominal	Human	NH^+	44
Positive	Nominal	Self	NS^+	19
			Total	**225**

Table 4. Average Deviation of Prices from the Equilibrium in the Post-Shock Phase. Reported Significance Levels are from Wilcoxon Signed-Rank Tests Using Group-Level Deviation as the Unit of Analysis.

	Negative Shock				**Positive Shock**
	Computerized Opponents		Human Opponents		Human Opponents
Period	Real (RC_R)	Nominal (NC_R)	Real (RH_R)	Nominal (NH_R)	Nominal (NH_R^+)
T+1	-0.4	0.8	1.2**	5.6**	-2.6**
T+2	0.7	0.0	0.6*	3.8**	-1.2*
T+3	-0.2	-0.2	0.3	4.2**	-0.6*
T+4	0.7	0.0	0.1	3.4**	-0.2
T+5	0.4	0.0	0.0	2.6*	-0.1
T+6	0.0	0.0	0.0	2.0*	0.0
T+7	0.7	0.0	0.0	1.4*	0.0
T+8	0.0	0.0	0.0	1.1	0.0
T+9	0.8	0.0	0.0	0.8	0.0
T+10	0.5	0.0	0.0	0.6	0.0
T+11			0.0	0.4	0.0
T+12			0.0	0.2	0.0
T+13			0.0	0.2	0.0
T+14			0.0	0.2	0.0
T+15			0.0	0.1	-0.8

* indicates significance at the 5 percent level
** indicates significance at the 1 percent level

Figures

Figure 1. Cumulative Density Functions of the Deviations of Average Prices from the Equilibrium in Sessions in Which Each Participant Chose All Four Firms' Prices. The Deviations Have Been Multiplied by -1 in the NS^+ to allow direct comparison.

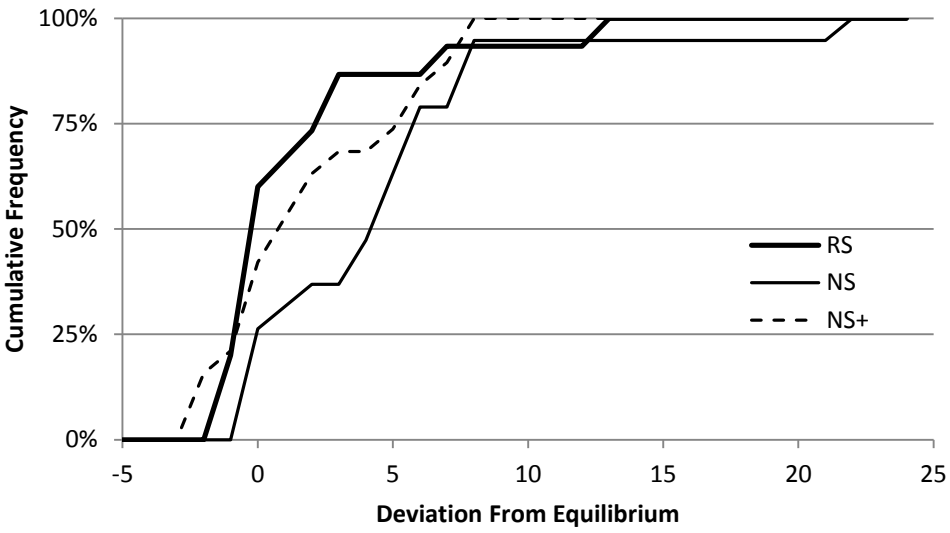


Figure 2. Histogram of the deviations from the equilibrium prices in the post-shock phase of the NS and NS$^+$ treatments within the range of prices that contained a bolded payoff. The deviations have been multiplied by negative one in the NS$^+$ to allow direct comparison.

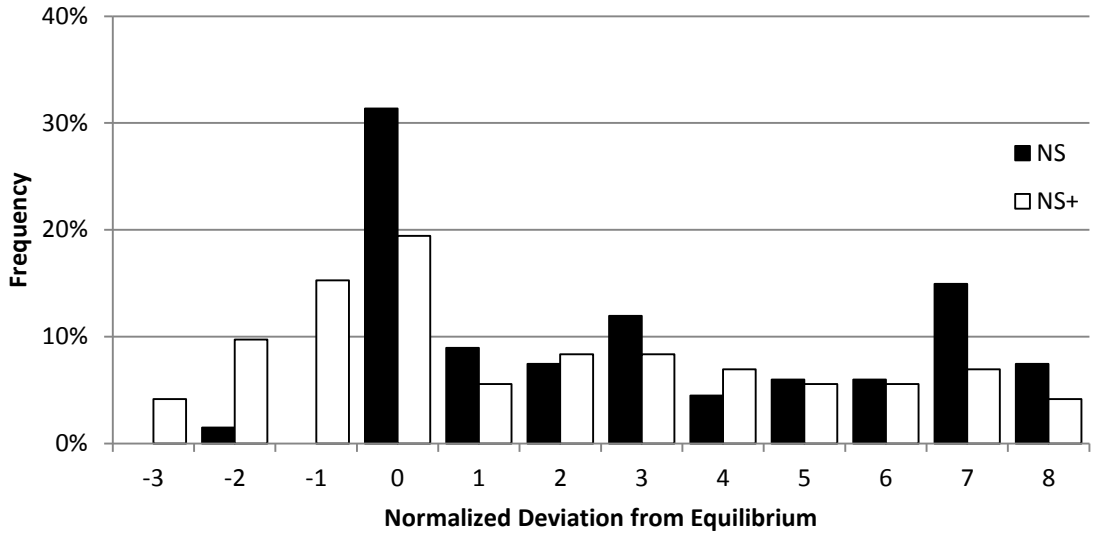
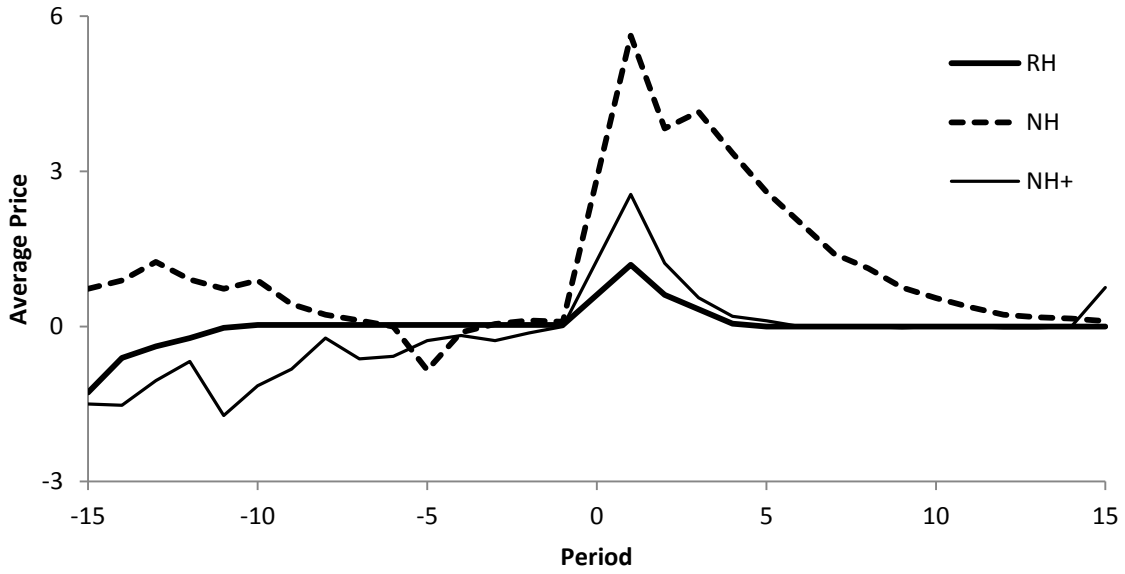


Figure 3. Evolution of Average Price Deviations from Equilibrium in Experiments with Human Opponents. Deviations in the NH+ have been multiplied by -1 to allow direct comparison.



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Online Appendices

Appendix A. Adaptive Best Responding in FT's Experiments and Our Revised Experiments

Section 1. *Statistical Analysis of Adaptive Best Response and Adjustment Asymmetries in FT's Experiments*

At the aggregate level participants' prices are well described by adaptive best responding (ABR) in FT's original experiments. After the first post-shock period, 45 percent of all prices in the NH are exactly equal to the ABR price, and 77 percent deviated by no more than one price increment. For the RH treatment, 40 percent of prices equaled the ABR and 77 percent were within one price increment.[1] We test the hypothesis that participants played their ABR more formally with the following random effects regression model:

$$P_{it} = \alpha + \beta_1 ABR_{it} + \beta_2 NH + \beta_3 NH * ABR_{it} + \mu_i + \varepsilon_{it} \quad \text{(A1)}$$

where *NH* equals one for observations in the NH and zero otherwise, ABR_{it} is the ABR price of participant *i* in period *t* and μ_i is assumed to be distributed normally with zero mean and constant variance. We clustered the standard errors by group because participants within a group were responding to one another's prices. If participants systematically followed the ABR strategy in both treatments, we would expect to find coefficient estimates of $\beta_1 = 1$ and $\alpha = \beta_2 = \beta_3 = 0$. These expectations are upheld for all three beta coefficients, and the estimate is very close to (but statistically distinct from) our expectation for α.

The regression estimates a β_1 coefficient of 0.796 ($p < 0.001$), with a 95 percent confidence interval ± 0.235 from the estimate (see Table A1). Notice that 1 lies within this interval. The estimated constant of 1.957 ($p = 0.016$) is statistically significant, but close to zero. Overall, the regression results indicate that participants in the RH set their prices slightly above the ABR. Nevertheless, the ABR strategy comes very close to describing participant behavior. Moreover, the coefficients for *NH* and $NH * ABR_{it}$ are statistically insignificant, implying that adjustment behavior was identical across the RH and NH treatments after the initial post-shock period.

[1] These percentages exclude observations for which a participant was in equilibrium in the previous period, because in equilibrium firms play their ABR by definition. Including these observations would have biased the results in favor of the ABR hypothesis. We also exclude these observations from our regression models in this section and Section 2.

Regressing model (A1) on the price data from the last T-1 periods of the positive shock experiments we find that participants also followed the ABR strategy in FT's RH^+ and NH^+ (see Table A2). The coefficients for NH^+ and $ABR_{it} * NH^+$ are statistically insignificant at the 5 percent level, implying that participants' adjustment behavior was identical in the NH^+ and RH^+ treatments. The coefficient for ABR_{it} is 0.977 ($p < 0.001$) and not significantly different from 1 at the 5 percent level. Finally, the estimated constant is statistically insignificant.

The adjustment processes in the NH and NH^+ were so similar that it is hard to believe that the asymmetry in adjustment speed was primarily due to the natures of the monetary shocks. We look instead at the underlying economic environments in these treatments. Figure A1a shows the best responses of type *x* and type *y* firms to the average price of other firms in the post-shock phase of the negative shock experiments. For any $\bar{P}_{-i}$, the vertical distance between a best response function and the 45-degree line indicates the amount by which a firm of that type should submit a price above (or below) the average price of his opponents. These vertical distances drive the dynamics of price adjustment.

To see this, assume four firms who employ the ABR strategy and, in period t, each face their own $\bar{P}_{-i,t}$. By definition, the average price of the group in that period, $\bar{P}_t$, is equal to $1/4\left(\sum_{i=1}^{4}\bar{P}_{-i,t}\right)$. Let δ_{it} represent the difference between $\bar{P}_{-i,t}$ and the best response of firm i to $\bar{P}_{-i,t}$ (i.e., the vertical distance between the 45-degree line and firm i's best response function). In period $t+1$ each firm will submit a price equal to $\bar{P}_{-i,t} + \delta_{it}$, so that $\bar{P}_{t+1} = 1/4\left(\sum_{i=1}^{4}\bar{P}_{-i,t} + \delta_{it}\right)$. It follows that the difference in average prices between periods t and $t+1$ will be equal to $\bar{\delta}_t$, the average of the δ_{it}. Consequently, asymmetries in the absolute values of the δ_{it} will determine the rate at which a group of firms will reach the equilibrium if they follow the ABR strategy. When the δ_{it} are symmetrical (i.e., $\bar{\delta}_t = 0$) the firms have reached the Nash equilibrium.

For the majority of the set of $\bar{P}_{-i}$ in the post-shock phase of the negative shock experiments, the best response of type *x* firms is given by $\bar{P}_{-i} - 5$, while for type *y* firms it is $\bar{P}_{-i} + 3$. The net effect, in this range of $\bar{P}_{-i}$, is that the average price will fall by one increment per period, provided participants are playing their ABR. This is in stark contrast to the best response functions in the positive shock experiments (see Figure A1b). In those experiments, for

most $\bar{P}_{-i}$ the best responses for the type *x* and type *y* firms are $\bar{P}_{-i} - 1$ and $\bar{P}_{-i} + 7$ respectively. This implies an adjustment rate of three price increments per period. Closer to the equilibrium the best responses are $\bar{P}_{-i} - 2$ and $\bar{P}_{-i} + 6$ for an adjustment rate of two increments per period. Thus, we would expect participants playing their ABR to converge to the equilibrium at a rate of two to three times that in the negative shock treatments.

Section 2. *Statistical Analysis of Adaptive Best Response in Our Revised Experiments*

Examination of the participant-level data suggested two main pricing strategies in the post-shock phase of our experiments. The most common was to roughly follow the ABR strategy, but a minority of participants (9 of 128) repeatedly chose their equilibrium price, even when doing so was not the best response to the average price in the prior period. (Of these nine participants, only one participated in the RH treatment; the remaining eight were divided evenly between the NH and NH^+.) We refer to this practice as "anchoring" on the equilibrium. We categorize a participant as anchoring if, for a majority of the periods $t > T + 1$ in which his group was not in equilibrium in period $t - 1$, the participant set his price equal to the equilibrium when it was not the ABR to do so.

We fit the data from our three treatments with human opponents to regression model A1, adding a third dummy variable, NH^+, so that all three treatments may be analyzed simultaneously. The pricing data from those who anchored on the equilibrium was largely invariant with respect to the ABR. This tends to inflate the constant terms and depress the slope coefficients, despite the fact that only about 7 percent of participants could be described as anchoring. As a result, we report results from two models, the first using data from all participants (the full sample model) and the second excluding observations from participants who anchored on the equilibrium (the restricted sample model). In both models we exclude three observations in which the participant chose no price by the end of the period and a random price was generated for him. Table A3 displays the estimates.

Both models fit the data extremely well, with R^2 statistics exceeding 0.88 in both cases. The hypothesis that participants in the RH followed the ABR strategy is well supported. When all data is included the constant term is statistically significant (p = 0.048) but very small. Excluding data from the anchoring participants renders the constant statistically insignificant (p

= 0.715). The estimated coefficient for ABR_{it} is not significantly different from one whether we use the full sample ($\hat{\beta}_1$ =0.934, p < 0.001) or the restricted sample ($\hat{\beta}_1$ =1.001, p < 0.001). None of the interaction variables are statistically significant in either model, and except for the coefficient of NH^+ in the full sample model ($\hat{\beta}_4$ =3.280, p = 0.001), no dummy variables in either model are significant. Moreover, the significant coefficient for NH^+ in the full sample model is due to the fact that participants had different equilibrium prices to anchor on in the NH^+ than in the RH and NH. As a result, including data from the anchoring participants exaggerates differences in prices between the positive shock and negative shock treatments. Consequently, we are satisfied that price adjustment behavior was the same across all three treatments with human opponents.

Table A1. Results of Regression Model Comparing Actual Prices to the Adaptive Best Response in the Post-Shock Phase of FT's RH and NH treatments. Standard errors have been clustered by group

	Periods 22 – 40	
Regressor	Coefficient (Std. Err.)	95 percent Confidence Interval
α	1.957* (0.811)	$\pm$1.590
ABR_{it}	0.796*** (0.120)	$\pm$0.235
NH	-0.469 (1.010)	$\pm$2.916
NH*ABR_{it}	0.067 (0.137)	$\pm$0.268
Obs.	739	
Wald χ^2	261.23	
R^2	0.696	

* indicates significance at the 5 percent level
** indicates significance at the 1 percent level
*** indicates significance at the 0.1 percent level

Table A2. Results of Regression Model Comparing Actual Prices to the Adaptive Best Response in the Post-Shock Phase of FT's RH^+ and NH^+ treatments. Standard errors have been clustered by group.

	Periods 17 – 30	
Regressor	Coefficient (Std. Err.)	95 percent Confidence Interval
α	0.743 (1.50)	$\pm$2.932
ABR_{it}	0.977** (0.061)	$\pm$0.119
NH^+	2.484 (1.924)	$\pm$3.770
$NH^+ * ABR_{it}$	-0.107 (0.076)	$\pm$0.361
Obs.	298	
Wald χ^2	797.55	
R^2	0.7993	

* indicates significance at the 5 percent level
** indicates significance at the 1 percent level
*** indicates significance at the 0.1 percent level

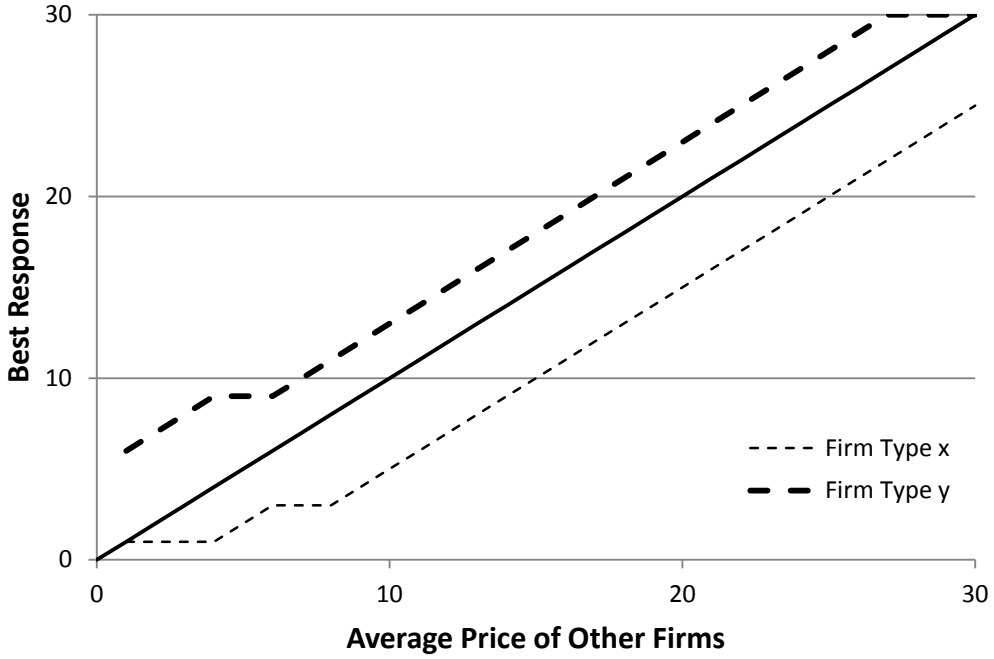
Table A3. Results of Regression Model Comparing Actual Prices to the Adaptive Best Response in the Post-Shock Phase of our revised RH, NH and NH$^+$ treatments. Standard errors have been clustered by group.

	Periods 17 - 30			
	Data from all participants		Anchoring participants excluded	
Regressor	Coefficient (Std. Err.)	95 Percent Confidence Interval	Coefficient (Std. Err.)	95 Percent Confidence Interval
α	0.371* (0.188)	±0.368	0.063 (0.173)	±0.338
ABR_{it}	0.934*** (0.036)	±0.070	1.001*** (0.021)	±0.040
NH	0.553 (0.576)	±1.130	0.822 (0.553)	±1.084
$NH^{*}\ ABR_{it}$	-0.004 (0.073)	±0.151	-0.055 (0.062)	±0.232
NH^{+}	3.280*** (1.008)	±1.976	2.226 (1.357)	±2.660
$NH^{+} * ABR_{it}$	-0.095 (0.072)	±0.332	-0.072 (0.075)	±0.292
Obs.	515		483	
Wald χ^2	36,808.84		37,250.18	
R^2	0.8866		0.8875	

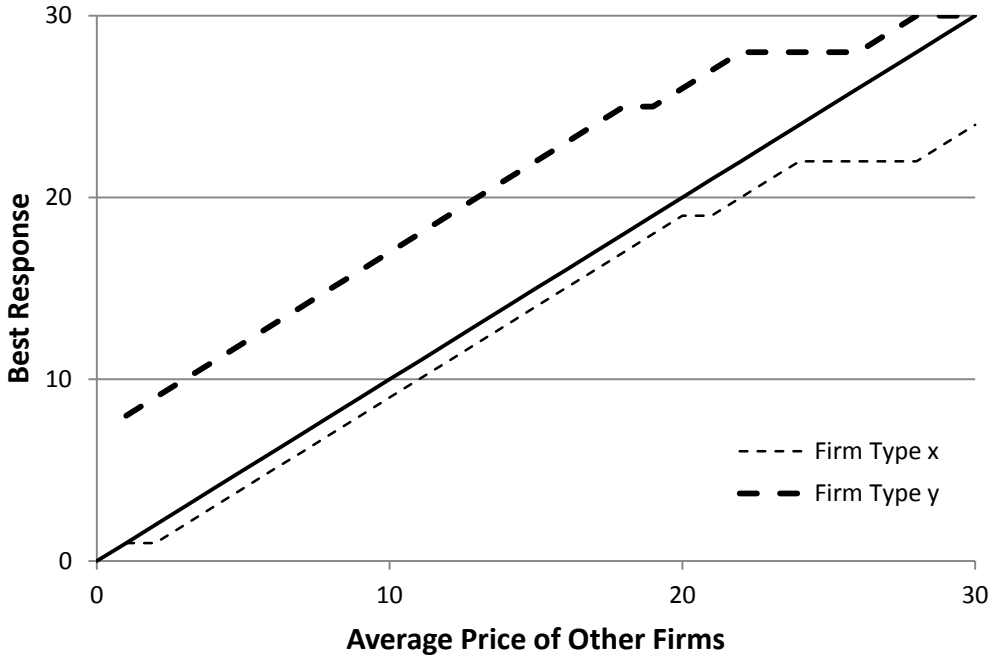
* indicates significance at the 5 percent level
** indicates significance at the 1 percent level
*** indicates significance at the 0.1 percent level

Figure A1. a) Best Response Functions in FT's Experiments with a Negative Monetary Shock, b) Best Response Functions in FT's Experiments with a Positive Monetary Shock

a)



b)



Appendix B. Software and Procedures

Participants were seated in a computer laboratory and given a set of written instructions explaining the rules of the experiment, as well as a pencil and scratch paper. An experimenter read the instructions aloud, while screenshots highlighting the functions of the computer interface were shown on all participants' computer screens. The experimenter paused at several pre-determined points in the instructions to answer questions.

We used a computer interface to display participants' income tables and allow them to enter their decisions. Features of the interface common to all treatments were as follows. The income table for each firm type was shown on a separate tab of the display window, and participants could switch between tabs to compare them. Payoffs in the income tables were designated by a white background for the table of a given participant's firm type, and a green background for the table of the opposite firm type. The prices a participant could charge were designated with a grey background in the first column of the table, and the 30 possible average prices of the other firms, which were also given a grey background, were displayed in the top row of the table.

We provided participants in the nominal payoff treatments with an "income converter" on their computer displays. If a participant entered a hypothetical P_i and $\bar{P}_{-i}$, the income converter would display the real payoff from the income table that was currently displayed. This established a sort of parity in the difficulty of deflating nominal payoffs between FT's experiments and our revised versions, which employed a more complex nominal mapping. In the original study participants could find the real payoff by entering two numbers into an ordinary calculator: the nominal payoff and the average price of other firms. In our experiments participants also had to enter two numbers into the income converter to find the real payoff: their own price and the expected average price of the other three firms.

Section 1. *Computer Interface for Experiments with Human Opponents*

Participants selected a price by clicking on one of the prices in the first column of their own income table, which also highlighted the payoffs in the corresponding row in blue. They were allowed to switch prices as often as they liked within a period before finalizing their decision. The computer interface showed each participant the average price of the other firms in

his group at the end of the period by highlighting payoffs in the appropriate column in yellow. The income cell at the intersection of the blue highlighting from the participant's price row and the yellow highlighting of the average price column was highlighted in green, and this cell contained the participant's period earnings. This gave them a clear visual cue of the results of the period. Once all participants had indicated a readiness to advance to the next period, the blue, yellow and green highlighting was removed from their screens. An experiment history could be accessed on a third tab. It listed the P_i, $\bar{P}_{-i}$, and π_i for each period that had been completed.

Section 2. *Computer Interface for Experiments with Computerized Opponents*

We followed FT's design in disclosing to participants the exact $\bar{P}_{-i}$ that the other three firms would charge in response to every possible P_i. However, while they distributed this information in tables on sheets of paper, we provided it visually on their computer screens. The computer display highlighted each payoff cell that corresponded with one of the thirty possible $(P_i, \bar{P}_{-i})$ combinations in yellow. When a participant clicked on a price in his income table, the highlighting of the cell containing the payoff he would receive was changed from yellow to green, and the other 29 payoffs in the price row were highlighted in blue. This minimized the possibility that a participant would make a mistake about the payoff (real or nominal) that he would earn for setting a given price. We considered this an important detail of the design, because participants in the NC treatment of FT's study had some trouble adjusting to the post-shock equilibrium even though their equilibrium prices generated the highest nominal and real incomes. We surmised that requiring them to look up the best replies, infer the proper income cell, and deflate the nominal income may have generated some confusion.

Section 3. *Computer Interface for Experiments with Self as Opponent*

In the self-opponent treatments participants chose four prices rather than one. Accordingly, it used the same basic interface as the human opponent treatments but provided a set of text boxes (labeled "First Type X firm", "First Type Y Firm", etc.) for the participants to enter their pricing decisions. Additionally, the history tab was removed from the interface, as the participants chose prices only once in each phase.

Section 4. *Procedures for Experiments with Computerized and Human Opponents*

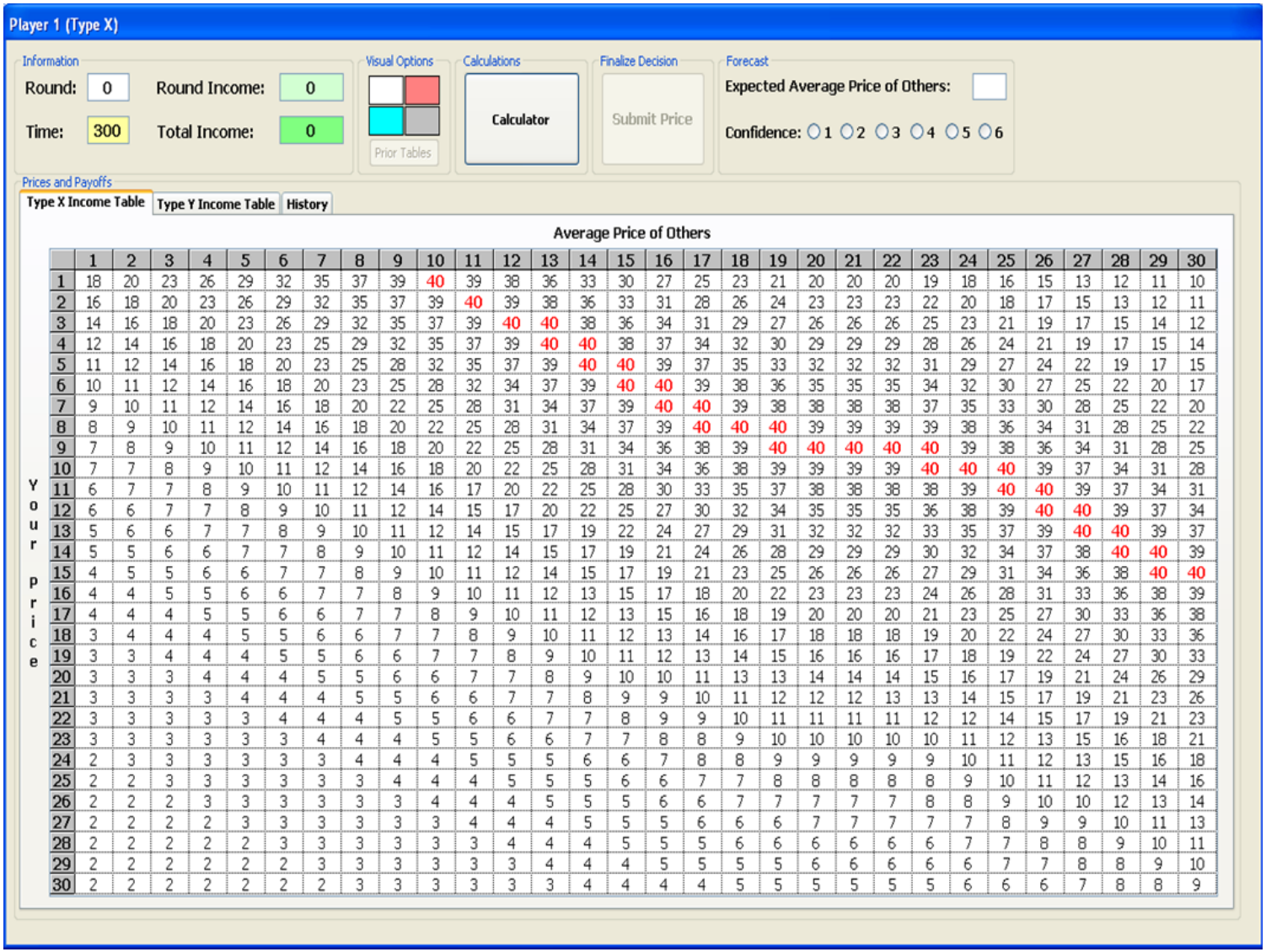
At the outset, the experimenter explained that the experiment would consist of two phases, each of which would last for T periods and use a distinct set of income tables. Participants completed a practice period using the pre-shock tables before commencing the first of the 2T periods for which they were paid. Each period lasted up to 2 minutes with the exception of the practice period, which lasted up to 5 minutes. A period ended when all participants had submitted their prices or when the time ran out. If any participant had not selected a price prior to the end of the period, the computer software randomly chose a number from a discrete uniform distribution with support $\{1, \ldots, 30\}$ and submitted that as the participant's price for the period. After period T, the income tables on participants' screens were populated with the post-shock payoffs. They were given 10 minutes to examine the new tables prior to the start of period T+1. A button on their computer display allowed participants to toggle between the pre- and post-shock tables in order to compare them. This button was disabled prior to period T+1.

Section 5. *Procedures for Experiments with Self as Opponent*

The procedures for our self-opponent experiments were the same as above with three exceptions. First, there were only two periods (one pre-shock and one post-shock), each of which allowed participants 15 minutes to select their prices. Second, the practice period was replaced with an instructions comprehension task that required the participants to calculate the $\bar{P}_{-i}$, real income and (if appropriate) nominal income for a set of pre-determined prices from four firms. This task employed a novel set of income tables distinct from the pre- and post-shock tables used in the experiment. Finally, the time limit was not enforced by submitting random prices. Participants who had not submitted their prices within 15 minutes simply received a reminder on their screens to finalize their prices immediately. Shortly thereafter a lab monitor observed each computer terminal to ensure that each participant had chosen his prices.

Section 6. *Screenshots of the Computer Interface*

Figure B1. Participant Interface in Experiments with Real Payoff Framing and Human Opponents



Your price \ Average Price of Others	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	18	20	23	26	29	32	35	37	39	40	39	38	36	33	30	27	25	23	21	20	20	20	19	18	16	15	13	12	11	10
2	16	18	20	23	26	29	32	35	37	39	40	39	38	36	33	31	28	26	24	23	23	23	22	20	18	17	15	13	12	11
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12	6	6	7	7	8	9	10	11	12	14	15	17	20	22	25	27	30	32	34	35	35	35	36	38	39	40	40	39	37	34
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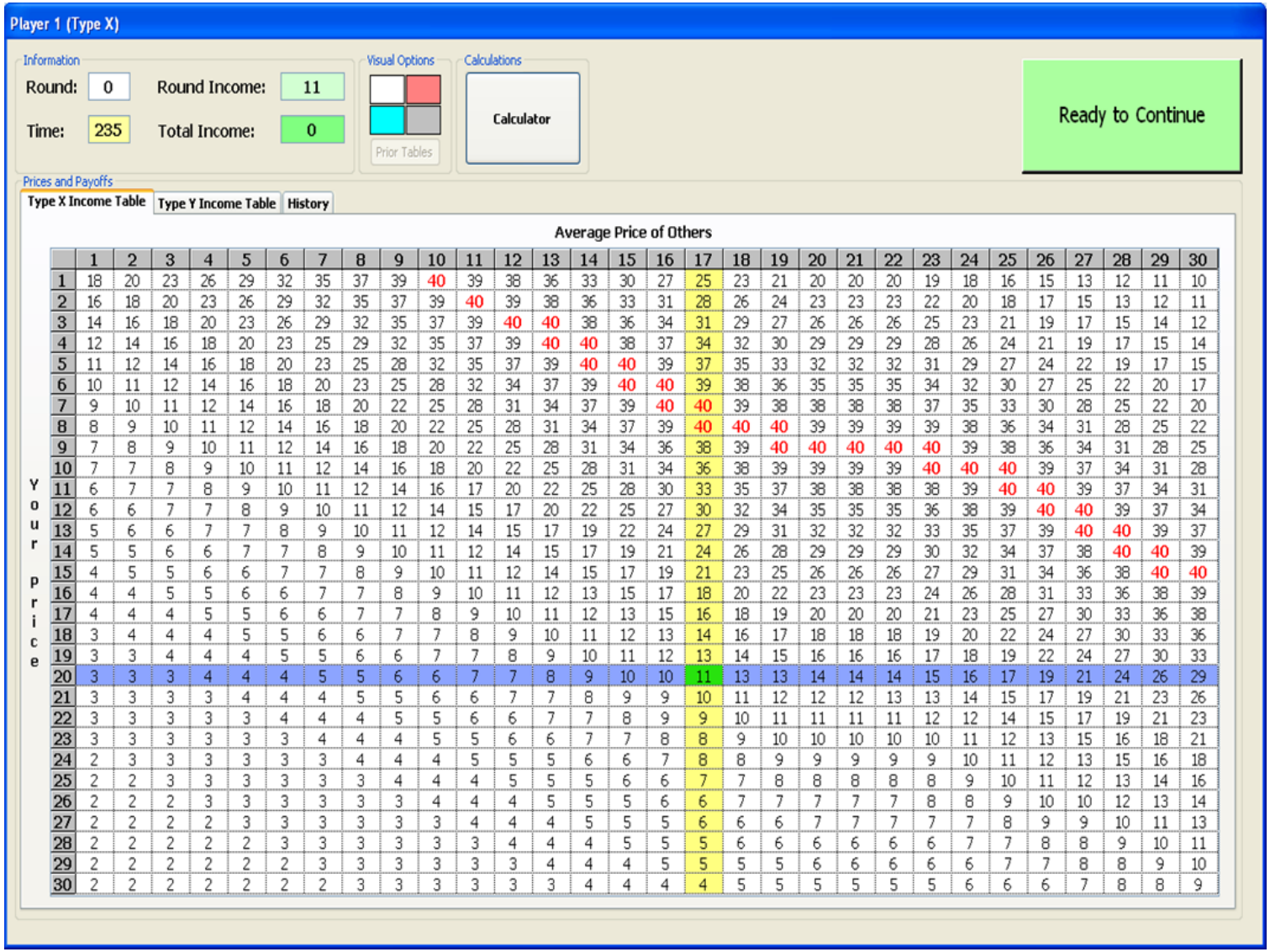
Figure B2. Price Submitted, Average Price of others Revealed in Experiments with Real Payoff Framing and Human Opponents



Your price \ Average Price of Others	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
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9	7	8	9	10	11	12	14	16	18	20	22	25	28	31	34	36	38	39	40	40	40	40	40	39	38	36	34	31	28	25
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13	5	6	6	7	7	8	9	10	11	12	14	15	17	19	22	24	27	29	31	32	32	32	33	35	37	39	40	40	39	37
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19	3	3	4	4	4	5	5	6	6	7	7	8	9	10	11	12	13	14	15	16	16	16	17	18	19	22	24	27	30	33
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22	3	3	3	3	3	4	4	4	5	5	6	6	7	7	8	9	9	10	11	11	11	11	12	12	14	15	17	19	21	23
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27	2	2	2	2	3	3	3	3	3	3	4	4	4	5	5	5	6	6	6	7	7	7	7	7	8	9	9	10	11	13
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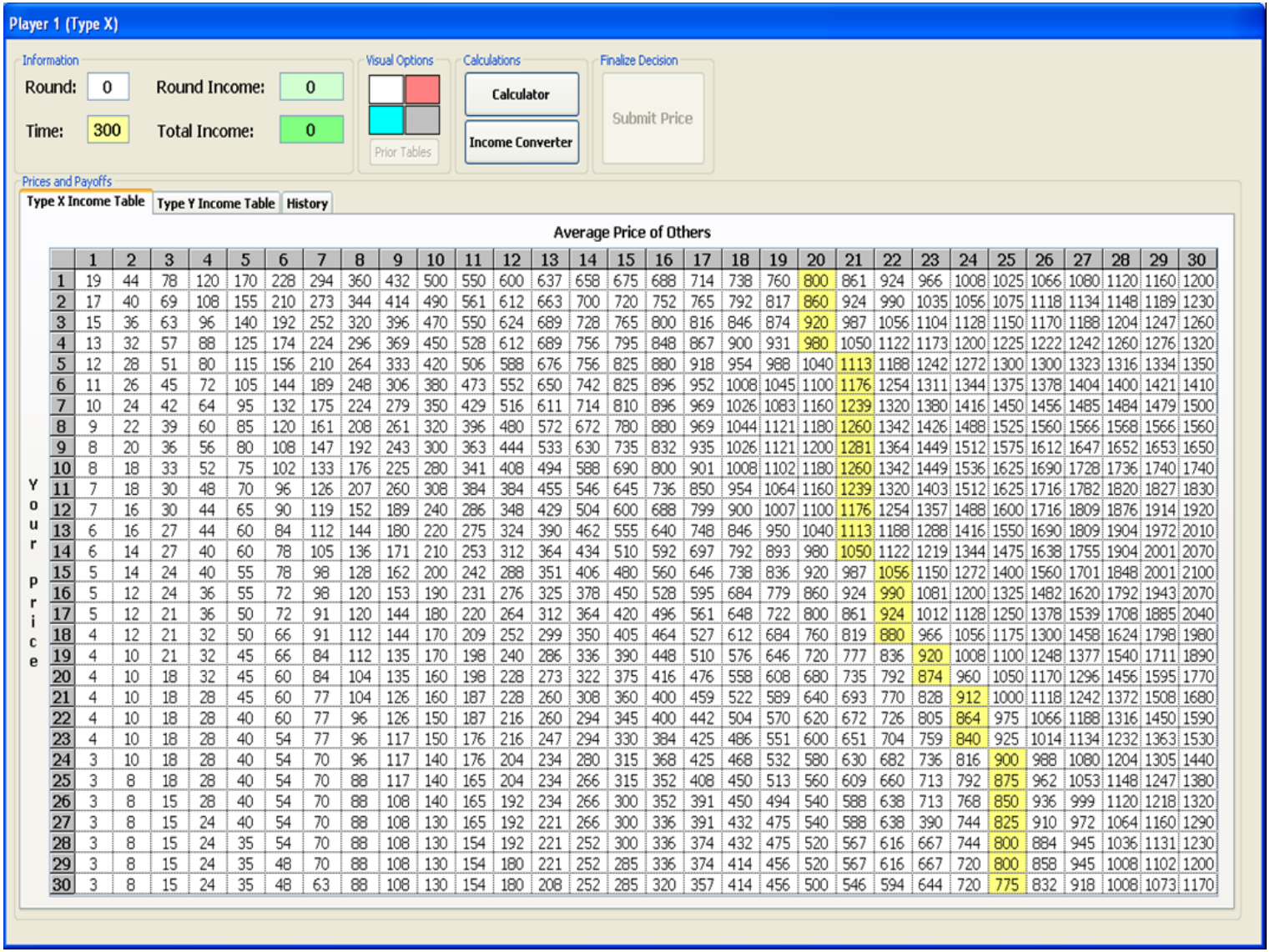
30	2	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	5	5	5	5	5	5	6	6	6	7	8	8	9

Figure B3. Participant Interface in Experiments with Nominal Payoff Framing and Computerized Opponents (Average Price of Opponents Conditional on Participant's Price Highlighted in Yellow)



Your Price \ Average Price of Others	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	19	44	78	120	170	228	294	360	432	500	550	600	637	658	675	688	714	738	760	800	861	924	966	1008	1025	1066	1080	1120	1160	1200
2	17	40	69	108	155	210	273	344	414	490	561	612	663	700	720	752	765	792	817	860	924	990	1035	1056	1075	1118	1134	1148	1189	1230
3	15	36	63	96	140	192	252	320	396	470	550	624	689	728	765	800	816	846	874	920	987	1056	1104	1128	1150	1170	1188	1204	1247	1260
4	13	32	57	88	125	174	224	296	369	450	528	612	689	756	795	848	867	900	931	980	1050	1122	1173	1200	1225	1222	1242	1260	1276	1320
5	12	28	51	80	115	156	210	264	333	420	506	588	676	756	825	880	918	954	988	1040	1113	1188	1242	1272	1300	1300	1323	1316	1334	1350
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7	10	24	42	64	95	132	175	224	279	350	429	516	611	714	810	896	969	1026	1083	1160	1239	1320	1380	1416	1450	1456	1485	1484	1479	1500
8	9	22	39	60	85	120	161	208	261	320	396	480	572	672	780	880	969	1044	1121	1180	1260	1342	1426	1488	1525	1560	1566	1568	1566	1560
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18	4	12	21	32	50	66	91	112	144	170	209	252	299	350	405	464	527	612	684	760	819	880	966	1056	1175	1300	1458	1624	1798	1980
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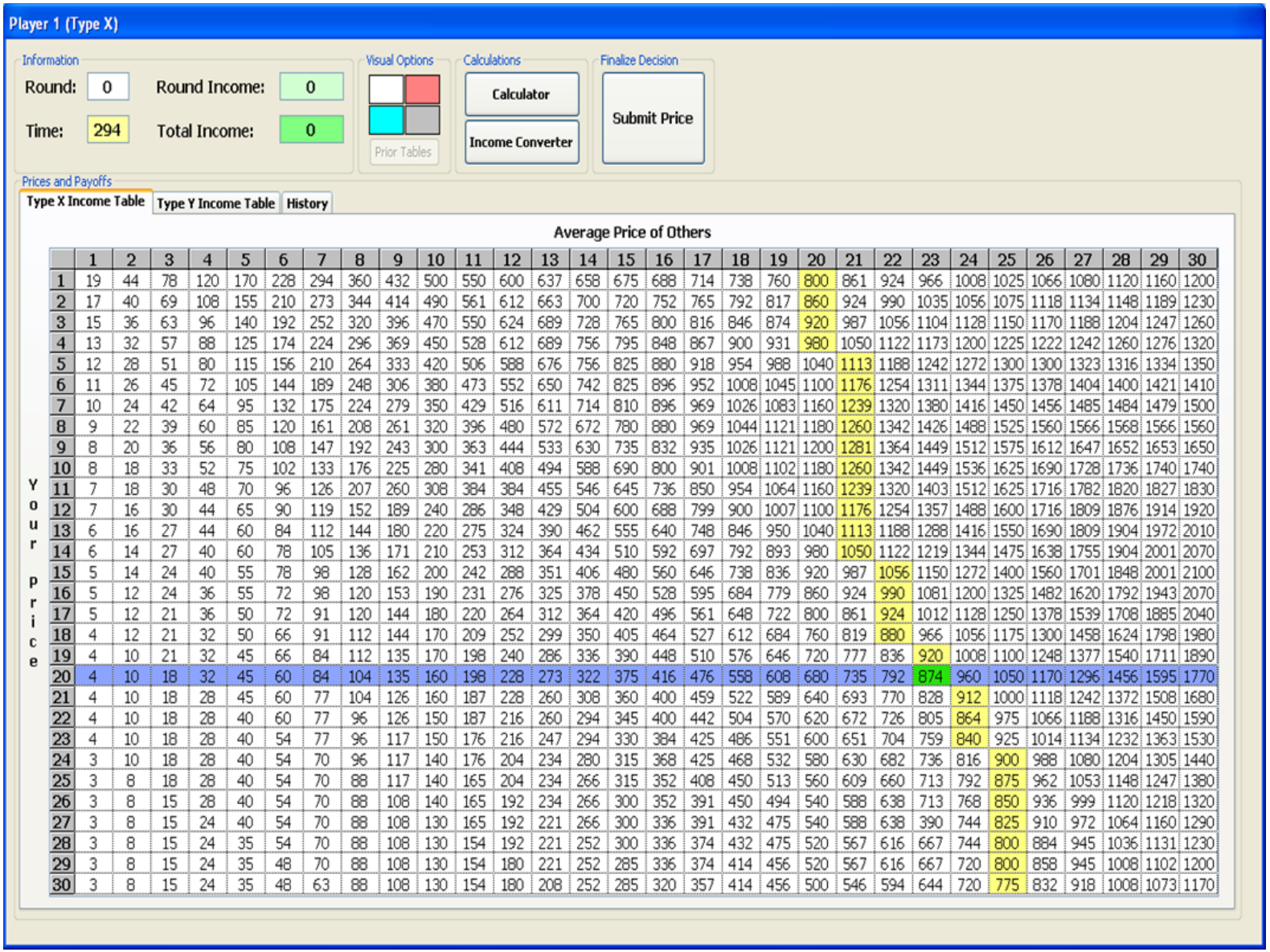
28	3	8	15	24	35	54	70	88	108	130	154	192	221	252	300	336	374	432	475	520	567	616	667	744	800	884	945	1036	1131	1230
29	3	8	15	24	35	48	70	88	108	130	154	180	221	252	285	336	374	414	456	520	567	616	667	720	800	858	945	1008	1102	1200
30	3	8	15	24	35	48	63	88	108	130	154	180	208	252	285	320	357	414	456	500	546	594	644	720	775	832	918	1008	1073	1170

Figure B4. Price Selected in Experiments with Nominal Payoff Framing and Computerized Opponents



Your price \ Average Price of Others	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	19	44	78	120	170	228	294	360	432	500	550	600	637	658	675	688	714	738	760	800	861	924	966	1008	1025	1066	1080	1120	1160	1200
2	17	40	69	108	155	210	273	344	414	490	561	612	663	700	720	752	765	792	817	860	924	990	1035	1056	1075	1118	1134	1148	1189	1230
3	15	36	63	96	140	192	252	320	396	470	550	624	689	728	765	800	816	846	874	920	987	1056	1104	1128	1150	1170	1188	1204	1247	1260
4	13	32	57	88	125	174	224	296	369	450	528	612	689	756	795	848	867	900	931	980	1050	1122	1173	1200	1225	1222	1242	1260	1276	1320
5	12	28	51	80	115	156	210	264	333	420	506	588	676	756	825	880	918	954	988	1040	1113	1188	1242	1272	1300	1300	1323	1316	1334	1350
6	11	26	45	72	105	144	189	248	306	380	473	552	650	742	825	896	952	1008	1045	1100	1176	1254	1311	1344	1375	1378	1404	1400	1421	1410
7	10	24	42	64	95	132	175	224	279	350	429	516	611	714	810	896	969	1026	1083	1160	1239	1320	1380	1416	1450	1456	1485	1484	1479	1500
8	9	22	39	60	85	120	161	208	261	320	396	480	572	672	780	880	969	1044	1121	1180	1260	1342	1426	1488	1525	1560	1566	1568	1566	1560
9	8	20	36	56	80	108	147	192	243	300	363	444	533	630	735	832	935	1026	1121	1200	1281	1364	1449	1512	1575	1612	1647	1652	1653	1650
10	8	18	33	52	75	102	133	176	225	280	341	408	494	588	690	800	901	1008	1102	1180	1260	1342	1449	1536	1625	1690	1728	1736	1740	1740
11	7	18	30	48	70	96	126	207	260	308	384	384	455	546	645	736	850	954	1064	1160	1239	1320	1403	1512	1625	1716	1782	1820	1827	1830
12	7	16	30	44	65	90	119	152	189	240	286	348	429	504	600	688	799	900	1007	1100	1176	1254	1357	1488	1600	1716	1809	1876	1914	1920
13	6	16	27	44	60	84	112	144	180	220	275	324	390	462	555	640	748	846	950	1040	1113	1188	1288	1416	1550	1690	1809	1904	1972	2010
14	6	14	27	40	60	78	105	136	171	210	253	312	364	434	510	592	697	792	893	980	1050	1122	1219	1344	1475	1638	1755	1904	2001	2070
15	5	14	24	40	55	78	98	128	162	200	242	288	351	406	480	560	646	738	836	920	987	1056	1150	1272	1400	1560	1701	1848	2001	2100
16	5	12	24	36	55	72	98	120	153	190	231	276	325	378	450	528	595	684	779	860	924	990	1081	1200	1325	1482	1620	1792	1943	2070
17	5	12	21	36	50	72	91	120	144	180	220	264	312	364	420	496	561	648	722	800	861	924	1012	1128	1250	1378	1539	1708	1885	2040
18	4	12	21	32	50	66	91	112	144	170	209	252	299	350	405	464	527	612	684	760	819	880	966	1056	1175	1300	1458	1624	1798	1980
19	4	10	21	32	45	66	84	112	135	170	198	240	286	336	390	448	510	576	646	720	777	836	920	1008	1100	1248	1377	1540	1711	1890
20	4	10	18	32	45	60	84	104	135	160	198	228	273	322	375	416	476	558	608	680	735	792	874	960	1050	1170	1296	1456	1595	1770
21	4	10	18	28	45	60	77	104	126	160	187	228	260	308	360	400	459	522	589	640	693	770	828	912	1000	1118	1242	1372	1508	1680
22	4	10	18	28	40	60	77	96	126	150	187	216	260	294	345	400	442	504	570	620	672	726	805	864	975	1066	1188	1316	1450	1590
23	4	10	18	28	40	54	77	96	117	150	176	216	247	294	330	384	425	486	551	600	651	704	759	840	925	1014	1134	1232	1363	1530
24	3	10	18	28	40	54	70	96	117	140	176	204	234	280	315	368	425	468	532	580	630	682	736	816	900	988	1080	1204	1305	1440
25	3	8	18	28	40	54	70	88	117	140	165	204	234	266	315	352	408	450	513	560	609	660	713	792	875	962	1053	1148	1247	1380
26	3	8	15	28	40	54	70	88	108	140	165	192	234	266	300	352	391	450	494	540	588	638	713	768	850	936	999	1120	1218	1320
27	3	8	15	24	40	54	70	88	108	130	165	192	221	266	300	336	391	432	475	540	588	638	390	744	825	910	972	1064	1160	1290
28	3	8	15	24	35	54	70	88	108	130	154	192	221	252	300	336	374	432	475	520	567	616	667	744	800	884	945	1036	1131	1230
29	3	8	15	24	35	48	70	88	108	130	154	180	221	252	285	336	374	414	456	520	567	616	667	720	800	858	945	1008	1102	1200
30	3	8	15	24	35	48	63	88	108	130	154	180	208	252	285	320	357	414	456	500	546	594	644	720	775	832	918	1008	1073	1170

Appendix C: Instructions for Experiments with Nominal Payoff Framing and Human Opponents

General instructions for participants

You are participating in a scientific experiment which is funded by Chapman University. The purpose of this experiment is to analyze decision making in experimental markets. If you read these instructions carefully and make appropriate decisions, you may earn a considerable amount of money. At the end of the experiment all the money you earned will be immediately paid out in cash.

Each participant is paid $7 for attending. During the experiment your income will not be calculated in dollars, but in points. The total amount of points you collect during the experiment will be converted into dollars by applying the following exchange rate:

50 points = $1.00

During the experiment you are not allowed to communicate with any other participant. If you have any questions, the experimenter(s) will be glad to answer them. If you do not follow these instructions you will be excluded from the experiment and deprived of all payments aside from the minimum payment of $7 for attending.

[Questions?]

Overview of the experiment

The following is a brief description of the experiment. A more detailed description is given below. The experiment will last for a number of rounds. All participants are in the role of firms, selling some product. In this experiment, there are two types of firms: firms of type *x* and firms of type *y*. Each firm has to choose a selling price in every round. The income you earn depends on the price you choose and on the prices the other firms within your group choose.

[Questions?]

Detailed description of the experiment

The image on your screen is a screenshot of the computer display you will use to make your pricing decisions. We will refer to this screenshot several times through the course of these instructions.

The experiment is divided between two phases, the first of which consists of 15 rounds plus a practice round. You are not paid for the practice round. You should nevertheless take the practice round seriously since you may gain experience in this round. This experience helps you to make decisions in the other rounds in which you are paid. The second phase consists of an additional 15 rounds, but no practice round.

[Questions?]

Every participant is in a group with three other firms. There are two firms of type *x* and two firms of type *y* in every group. Your firm type will be displayed at the top left of your screen, and you will remain a firm of that type for the entire experiment.

In the example on your screen, the participant is a firm of type *x*. Consequently, there would be one more firm of type *x* and two other firms of type *y* in her group. If she were a firm of type *y*, there would be two other firms of type *x* and one more firm of type *y* in her group. No participant knows which persons are in his or her group. However, you will be grouped with the same participants throughout the experiment. The decisions made by other groups are irrelevant for your group.

[Questions?]

Earning points

In every round all firms simultaneously decide which selling price they wish to set for the current period. Every firm has to choose an integer price from the interval $1 \leq$ selling price ≤ 30. How much you earn depends on the price you choose and on the average price of the other three firms in your group. Independent of the firm type, the average price for every firm is calculated by the following formula:

Average price = (Sum of selling prices of <u>other</u> 3 firms) / 3

Consequently, the average price will be in the interval $1 \leq$ average price ≤ 30 and will be rounded to the nearest integer number.

Your computer display contains two income tables: one for firms of type *x* on the "Type X Income Table" tab, the other for firms of type *y* on the "Type Y Income Table" tab. The income tables are color coded. The income table with a **white** background shows the nominal income in points if **you** (or the other firm of **your type** in your group) choose a specific price and a specific average price results in that round. In the example on your screen, the participant is a firm of type *x*, so the Type X Income Table has a white background.

The income table with a **green** background shows the nominal income in points that one of the firms of the **other** type will earn if he or she chooses a specific price and a specific average price results. In the example on your screen, the Type Y Income Table has a green background, because the participant is a firm of type *x*.

[Questions?]

Both income tables display **nominal** points. However, your income at the end of the experiment is not based on nominal point income, but on **real** point income. The following relation between the two holds:

Real income = (Nominal income / Average price of other firms) – Average price of other firms

This formula holds for all firms. Because this formula may be difficult to calculate mentally, your computer display provides you with a tool to quickly calculate real income from the income tables. We will discuss this tool later in the instructions.

Notice that on both tables, some of the incomes are displayed in bold, red font. These are the **highest real incomes** that can be earned in a given round.

[Questions?]

Let's consider an example. The participant in the example on your screen is a firm of type *x*. Suppose she chose a price of 2. Suppose the average price chosen by the three other firms in her group was 4. In this case her nominal point income would be 108 points. Her real income would be 23 points; that is, (108/4) – 4.

[Questions?]

When you decide which price to choose, you do not yet know which average price will actually result in this period. Your white income table can consequently help you to calculate your real point income given your **expectation** of the average price of other firms. Given your expectation of the average price, you can read off the white table the income you would get by choosing different selling prices.

Suppose the participant in the example on your screen expects an average price of 30. If she chose a price of 17 her expected nominal income would be 2040 points, and her expected real income would be 38 points; that is, (2040/30) – 30. If she chose a price of 10, her expected nominal income would be 1740 points, and her expected real income would be 28 points; that is, (1740/30) – 30.

[Questions?]

Using the computer display to set your price

You may select a price from the income table by clicking on one of the prices in the far left column, labeled "Your Price." Clicking on a price in the white income table will highlight all of the incomes in its row in blue. The highlighted incomes show you what your earnings would be for the round for each average price the other firms in your group might set. In the example on your screen, the participant has selected a price of 15. If you want to revise your decision, you may click on a different price in the far left column.

[Questions?]

You may also click on a price when you are looking at the green income table. Doing so will highlight all of the incomes in the corresponding row in light yellow. However, be aware that

clicking on a price in the green income table will have **no impact** on the prices that the other participants in your group will choose. You should also be aware that clicking on a price in the green income table **does not count** as setting a price for your firm. To set your price, you **must** click on a price in the **white** income table.

[Questions?]

In addition to setting your own price each round, please indicate the average price that you expect the other three firms in your group to set. This price must be an integer between 1 and 30. Your forecast of the average price does not affect your income and will not be known to the other firms. Your payoff will be determined by the **actual** average price. Please try to indicate an expectation that is as exact as possible since this may help you to make your own price decision.

Along with your forecast of the average price, please select a number from 1 to 6 to indicate how confident you are that the actual average price will be equal to your forecast. The numbers stand for:

1 = I am not at all confident that my forecast will be correct
2 = I have little confidence that my forecast will be correct
3 = I am somewhat confident that my forecast will be correct
4 = I am quite confident that my forecast will be correct
5 = I am very confident that my forecast will be correct
6 = I am absolutely confident that my forecast will be correct

In the example on your screen, the participant has entered a forecast of 16 and a confidence of 4. This means that she expects the average price of the other three participants in this round to be 16, and she is quite confident in this expectation.

[Questions?]

When you have selected a price, entered a forecast and chosen your level of confidence, you may click the button labeled "Submit Price" in the upper middle portion of your screen. (The Submit Price button will be disabled until you have completed those three tasks.) Once you have submitted your price, you cannot revise your decision until the following round.

After all participants have submitted their prices, you will receive information on the average price set by the other three firms in your group. The column corresponding to the actual average price will be highlighted in yellow. Where this yellow highlighting intersects the blue highlighting from the price you have chosen for the round the income cell will be shaded green. This cell will contain the nominal point income that you have earned for the round. In the example on your screen, the participant had chosen a price of 20, while the average price of the

other three firms in her group was 17. Her nominal income of 476 points can be found in the green shaded cell, in row 20, column 17 of the white income table.

[Questions?]

Round information and the History Tab

Your computer display will provide you with some important information throughout the experiment. The upper left portion of the display contains the following information:

Round: The current round of the experiment. Note that "Round 0" is the practice round.

Time: The number of seconds remaining in the round. During the practice round you will have 300 seconds (5 minutes) to submit your price. During all other rounds you will have 120 seconds (2 minutes) to do so.

You should be aware of two things regarding the time. First, when all participants have submitted their prices, the round will end regardless of how many seconds are remaining. Second, if time runs out before you have clicked the Submit Price button, the software will automatically submit the last price you clicked on during that round. If you have not clicked on any prices during that round, the software will choose a random number between 1 and 30, and submit that as your price.

Round Income: The income, in **real** points, that you have earned in the current round. In the example on your screen, the participant's nominal point income is 476, and the average price of the other firms in her group is 17. The Round Income box displays her real income of 11 points; that is (476/17) – 17.

Total Income: The total income, in **real** points, that you have earned up to this point in the experiment. In the example on your screen, the Total Income box displays zero points. This is because the participant is in the practice round, Round 0, the results of which do not affect her earnings.

[Questions?]

In addition to this information, you can click on the "History" tab to find information from previous rounds. This includes the following:

Round: The round in which you chose a price.
Your Price: The price you set in that round.
Average Price of Others: The average price set by the other three firms in your group in that round.
Income: The income, in **real** points, that you earned in that round.

You may access the History at any time during the experiment.

[Questions?]

Advancing the experiment to the next round

At the end of each round, a green button labeled "Ready to Continue" will appear in the upper-right of your screen. Click it to indicate that you are ready to go on to the next round of the experiment.

After all participants have clicked the Ready to Continue button, the experiment will advance to the next round. The income highlighting from the price you set in the previous round will disappear, as will the average price from the previous round.

[Questions?]

Cell shading, income conversion and calculator

Your computer display contains three tools that you can use in the experiment. The first of these tools is cell shading. By default, the background of your firm type's income table is white, while the background of the other firm type's income table is green, but you may change these background colors.

To shade a cell, first click on it. A black box, or "halo," will appear around the cell. In the upper portion of your screen are four colored squares: the default color (white or green, depending on which income table is visible), red, light blue and grey. Clicking on one of these squares will assign its color to the selected income cell. In the example on your screen, the participant clicked the red square.

You may also shade multiple cells at once. First, select a set of income cells in the table in the same manner you would in a Microsoft Excel Spreadsheet: click on one cell and, holding down the left mouse button, drag your cursor to another cell; then release the left mouse button. Next, click on one of the colored squares to assign that color to all of the income cells within the halo.

You may shade cells in both of the income tables. Any cells that you shade in a given color will remain that color for the remainder of the experiment unless you choose to change it. Cell shading does not reset at the end of a round.

[Questions?]

The second tool at your disposal is the income converter. You may access the converter by clicking the button labeled "Income Converter" in the upper middle portion of your screen. The income converter can be used to quickly find the real income that will result from any combination of your price and the average price of the other firms in your group. Once you have

entered these prices in the appropriate boxes, click the button labeled "Calculate Income" to see what your income would be in real points.

When you are using the income converter, the software assumes that you want to find real incomes from the income table you are currently viewing. In the example on your screen, you can see that "Type: X" is printed at the top of the income converter because the Type X Income Table is currently visible on the participant's computer display. If you click on the Type Y Income Table tab the income converter will reset to display real point incomes from the Type Y Income Table. The income converter will only show you the real point incomes for the income table that is visible on your computer display. It will not show you any real point incomes when the History tab is selected, because neither income table will be visible.

[Questions?]

The third and final tool on your computer display is a four-function calculator. You may access the calculator by clicking on the button labeled "Calculator" in the upper middle portion of your screen. The calculator functions very similarly to the standard Microsoft calculator application.

[Questions?]

Changing the income tables in Phase 2

As stated above, the experiment will be divided between two phases. The only difference between Phase 1 and Phase 2 will be the income tables that are used. In Phase 1 the income tables will be identical to the two that you have seen in the examples on your screen. You will use these income tables for rounds 0 – 15.

After round 15 has concluded, the income tables on your screen will be replaced by new income tables. As with the original tables, the cells with the highest **real** incomes will have a bold, red font. (Note that these may be different real incomes than the highest real incomes from Phase 1.) You will have up to 600 seconds (10 minutes) to review these new tables before we begin Phase 2, consisting of rounds 16 – 30. At any time during this review period, you may click the Ready to Continue button to indicate that you are ready to proceed to round 16, and do not need the full 10 minutes for review. If all participants indicate that they are ready to continue before 10 minutes have elapsed, we will end the review period early and move immediately on to round 16.

[Questions?]

You may find it useful to compare the new income tables to the original ones. In the upper portion of your screen, beneath the colored cell shading squares, is a button labeled "Prior Tables." At any time during the review period or in rounds 16 – 30, you may click this button to see the original income tables. Any cell shading that you performed in Phase 1 will be preserved on the original tables. Additionally, you may use the payoff converter on the original income tables as well as the new ones.

To return to the new income tables, click the same button (now labeled “New Tables”) a second time. Keep in mind that in Phase 2 you cannot set your price using the original income table of your firm type. You must have the **new** table for **your** firm type visible in order to set the price for your firm.

Appendix D: Income Tables for All Firms in All Treatments

Left Column Represents Firm's Price; Top Row Represents Average Price of Other Firms

Table D1. Negative Shock, Pre-Shock Phase, Real Frame, Type *x* Firm

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	18	20	23	26	29	32	35	37	39	**40**	39	38	36	33	30	27	25	23	21	20	20	20	19	18	16	15	13	12	11	10
2	16	18	20	23	26	29	32	35	37	39	**40**	39	38	36	33	31	28	26	24	23	23	23	22	20	18	17	15	13	12	11
3	14	16	18	20	23	26	29	32	35	37	39	**40**	**40**	38	36	34	31	29	27	26	26	26	25	23	21	19	17	15	14	12
4	12	14	16	18	20	23	25	29	32	35	37	39	**40**	**40**	38	37	34	32	30	29	29	29	28	26	24	21	19	17	15	14
5	11	12	14	16	18	20	23	25	28	32	35	37	39	**40**	**40**	39	37	35	33	32	32	32	31	29	27	24	22	19	17	15
6	10	11	12	14	16	18	20	23	25	28	32	34	37	39	**40**	**40**	39	38	36	35	35	35	34	32	30	27	25	22	20	17
7	9	10	11	12	14	16	18	20	22	25	28	31	34	37	39	**40**	**40**	39	38	38	38	38	37	35	33	30	28	25	22	20
8	8	9	10	11	12	14	16	18	20	22	25	28	31	34	37	39	**40**	**40**	**40**	39	39	39	39	38	36	34	31	28	25	22
9	7	8	9	10	11	12	14	16	18	20	22	25	28	31	34	36	38	39	**40**	**40**	**40**	**40**	**40**	39	38	36	34	31	28	25
10	7	7	8	9	10	11	12	14	16	18	20	22	25	28	31	34	36	38	39	39	39	39	**40**	**40**	**40**	39	37	34	31	28
11	6	7	7	8	9	10	11	12	14	16	17	20	22	25	28	30	33	35	37	38	38	38	38	39	**40**	**40**	39	37	34	31
12	6	6	7	7	8	9	10	11	12	14	15	17	20	22	25	27	30	32	34	35	35	35	36	38	39	**40**	**40**	39	37	34
13	5	6	6	7	7	8	9	10	11	12	14	15	17	19	22	24	27	29	31	32	32	32	33	35	37	39	**40**	**40**	39	37
14	5	5	6	6	7	7	8	9	10	11	12	14	15	17	19	21	24	26	28	29	29	29	30	32	34	37	38	**40**	**40**	39
15	4	5	5	6	6	7	7	8	9	10	11	12	14	15	17	19	21	23	25	26	26	26	27	29	31	34	36	38	**40**	**40**
16	4	4	5	5	6	6	7	7	8	9	10	11	12	13	15	17	18	20	22	23	23	23	24	26	28	31	33	36	38	39
17	4	4	4	5	5	6	6	7	7	8	9	10	11	12	13	15	16	18	19	20	20	20	21	23	25	27	30	33	36	38
18	3	4	4	4	5	5	6	6	7	7	8	9	10	11	12	13	14	16	17	18	18	18	19	20	22	24	27	30	33	36
19	3	3	4	4	4	5	5	6	6	7	7	8	9	10	11	12	13	14	15	16	16	16	17	18	19	22	24	27	30	33
20	3	3	3	4	4	4	5	5	6	6	7	7	8	9	10	10	11	13	13	14	14	14	15	16	17	19	21	24	26	29
21	3	3	3	3	4	4	4	5	5	6	6	7	7	8	9	9	10	11	12	12	12	13	13	14	15	17	19	21	23	26
22	3	3	3	3	3	4	4	4	5	5	6	6	7	7	8	9	9	10	11	11	11	11	12	12	14	15	17	19	21	23
23	3	3	3	3	3	3	4	4	4	5	5	6	6	7	7	8	8	9	10	10	10	10	10	11	12	13	15	16	18	21
24	2	3	3	3	3	3	3	4	4	4	5	5	5	6	6	7	8	8	9	9	9	9	9	10	11	12	13	15	16	18
25	2	2	3	3	3	3	3	3	4	4	4	5	5	5	6	6	7	7	8	8	8	8	8	9	10	11	12	13	14	16
26	2	2	2	3	3	3	3	3	3	4	4	4	5	5	5	6	6	7	7	7	7	7	8	8	9	10	10	12	13	14
27	2	2	2	2	3	3	3	3	3	3	4	4	4	5	5	5	6	6	6	7	7	7	7	7	8	9	9	10	11	13
28	2	2	2	2	2	3	3	3	3	3	3	4	4	4	5	5	5	6	6	6	6	6	6	7	7	8	8	9	10	11
29	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	5	5	5	5	6	6	6	6	6	7	7	8	8	9	10
30	2	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	5	5	5	5	5	5	6	6	6	7	8	8	9

Table D2. Negative Shock, Pre-Shock Phase, Real Frame, Type *y* Firm

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	9	8	7	7	6	6	5	5	5	4	4	4	4	4	4	4	3	3	3	3	3	3	3	2	2	2	2	2	2	2
2	10	9	8	7	7	6	6	5	5	5	4	4	4	4	4	4	4	4	3	3	3	3	3	3	2	2	2	2	2	2
3	11	10	9	8	7	7	6	6	5	5	5	4	4	4	4	4	4	4	4	3	3	3	3	3	3	2	2	2	2	2
4	12	11	10	9	8	7	7	6	6	5	5	5	5	4	4	4	4	4	4	4	3	3	3	3	3	3	2	2	2	2
5	14	12	11	10	9	8	8	7	6	6	5	5	5	5	5	5	5	4	4	4	4	3	3	3	3	3	3	2	2	2
6	16	14	12	11	10	9	8	8	7	6	6	6	5	5	5	5	5	5	4	4	4	4	3	3	3	3	3	3	2	2
7	18	16	14	13	11	10	9	8	8	7	7	6	6	6	6	6	5	5	5	5	4	4	4	3	3	3	3	3	3	2
8	20	18	16	14	13	11	10	9	8	8	7	7	6	6	6	6	6	6	5	5	5	4	4	4	3	3	3	3	3	3
9	23	20	18	16	14	13	11	10	9	9	8	7	7	7	7	7	6	6	6	5	5	5	4	4	4	3	3	3	3	3
10	26	23	20	18	16	14	13	12	10	10	9	8	8	7	7	7	7	7	6	6	5	5	5	4	4	4	3	3	3	3
11	29	26	23	20	18	16	14	13	12	11	10	9	8	8	8	8	8	7	7	6	6	5	5	5	4	4	4	3	3	3
12	32	29	26	23	20	18	16	15	13	12	11	10	9	9	9	9	9	8	8	7	6	6	5	5	5	4	4	4	3	3
13	35	32	29	26	23	21	18	16	15	13	12	11	10	10	10	10	10	9	8	8	7	7	6	6	5	5	4	4	4	3
14	37	35	32	29	26	23	21	19	17	15	14	12	12	11	11	11	11	10	9	9	8	7	7	6	6	5	5	4	4	4
15	39	37	35	32	29	26	23	21	19	17	15	14	13	13	12	12	12	11	10	9	9	8	7	7	6	6	5	5	4	4
16	**40**	39	38	35	32	29	26	24	21	19	17	16	15	14	14	14	13	13	11	10	10	9	8	7	7	6	6	5	5	4
17	39	**40**	39	38	35	33	30	27	24	22	19	18	17	16	16	16	15	14	13	12	11	10	9	8	7	7	6	6	5	5
18	37	39	**40**	39	38	36	33	30	27	24	22	20	19	18	18	18	17	16	14	13	12	11	10	9	8	7	7	6	6	5
19	35	37	39	**40**	39	38	36	33	30	27	25	23	21	20	20	20	19	18	16	15	13	12	11	10	9	8	7	7	6	6
20	32	35	37	39	**40**	39	38	36	33	31	28	26	24	23	23	23	22	20	18	17	15	13	12	11	10	9	8	7	7	6
21	29	32	35	37	39	**40**	**40**	38	36	34	31	29	27	26	26	26	25	23	21	19	17	15	14	12	11	10	9	8	7	7
22	25	29	32	35	37	39	**40**	**40**	38	37	34	32	30	29	29	29	28	26	24	21	19	17	15	14	12	11	10	9	8	7
23	23	25	28	32	35	37	39	**40**	**40**	39	37	35	33	32	32	32	31	29	27	24	22	19	17	15	14	12	11	10	9	8
24	20	23	25	28	32	34	37	39	**40**	**40**	39	38	36	35	35	35	34	32	30	27	25	22	20	17	15	14	12	11	10	9
25	18	20	22	25	28	31	34	37	39	**40**	**40**	39	38	38	38	38	37	35	33	30	28	25	22	20	17	16	14	12	11	10
26	16	18	20	22	25	28	31	34	37	39	**40**	**40**	**40**	39	39	39	39	38	36	34	31	28	25	22	20	18	16	14	12	11
27	14	16	18	20	22	25	28	31	34	36	38	39	**40**	**40**	**40**	**40**	**40**	39	38	36	34	31	28	25	22	20	18	16	14	12
28	12	14	16	18	20	22	25	28	31	34	36	38	39	39	39	39	**40**	**40**	**40**	39	37	34	31	28	25	22	20	18	16	14
29	11	12	14	16	17	20	22	25	28	30	33	35	37	38	38	38	38	39	**40**	**40**	39	37	34	31	28	25	22	20	18	16
30	10	11	12	14	15	17	20	22	25	27	30	32	34	35	35	35	36	38	39	**40**	**40**	39	37	34	32	28	25	23	20	18

Table D3. Negative Shock, Pre-Shock Phase, Nominal Frame, Type *x* Firm

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	19	44	78	120	170	228	294	360	432	**500**	550	600	637	658	675	688	714	738	760	800	861	924	966	1008	1025	1066	1080	1120	1160	1200
2	17	40	69	108	155	210	273	344	414	490	**561**	612	663	700	720	752	765	792	817	860	924	990	1035	1056	1075	1118	1134	1148	1189	1230
3	15	36	63	96	140	192	252	320	396	470	550	**624**	**689**	728	765	800	816	846	874	920	987	1056	1104	1128	1150	1170	1188	1204	1247	1260
4	13	32	57	88	125	174	224	296	369	450	528	612	**689**	**756**	795	848	867	900	931	980	1050	1122	1173	1200	1225	1222	1242	1260	1276	1320
5	12	28	51	80	115	156	210	264	333	420	506	588	676	**756**	**825**	880	918	954	988	1040	1113	1188	1242	1272	1300	1300	1323	1316	1334	1350
6	11	26	45	72	105	144	189	248	306	380	473	552	650	742	**825**	**896**	952	1008	1045	1100	1176	1254	1311	1344	1375	1378	1404	1400	1421	1410
7	10	24	42	64	95	132	175	224	279	350	429	516	611	714	810	**896**	**969**	1026	1083	1160	1239	1320	1380	1416	1450	1456	1485	1484	1479	1500
8	9	22	39	60	85	120	161	208	261	320	396	480	572	672	780	880	**969**	**1044**	**1121**	1180	1260	1342	1426	1488	1525	1560	1566	1568	1566	1560
9	8	20	36	56	80	108	147	192	243	300	363	444	533	630	735	832	935	1026	**1121**	**1200**	**1281**	**1364**	**1449**	1512	1575	1612	1647	1652	1653	1650
10	8	18	33	52	75	102	133	176	225	280	341	408	494	588	690	800	901	1008	1102	1180	1260	1342	**1449**	**1536**	**1625**	1690	1728	1736	1740	1740
11	7	18	30	48	70	96	126	160	207	260	308	384	455	546	645	736	850	954	1064	1160	1239	1320	1403	1512	**1625**	**1716**	1782	1820	1827	1830
12	7	16	30	44	65	90	119	152	189	240	286	348	429	504	600	688	799	900	1007	1100	1176	1254	1357	1488	1600	**1716**	**1809**	1876	1914	1920
13	6	16	27	44	60	84	112	144	180	220	275	324	390	462	555	640	748	846	950	1040	1113	1188	1288	1416	1550	1690	**1809**	**1904**	1972	2010
14	6	14	27	40	60	78	105	136	171	210	253	312	364	434	510	592	697	792	893	980	1050	1122	1219	1344	1475	1638	1755	**1904**	**2001**	2070
15	5	14	24	40	55	78	98	128	162	200	242	288	351	406	480	560	646	738	836	920	987	1056	1150	1272	1400	1560	1701	1848	**2001**	**2100**
16	5	12	24	36	55	72	98	120	153	190	231	276	325	378	450	528	595	684	779	860	924	990	1081	1200	1325	1482	1620	1792	1943	2070
17	5	12	21	36	50	72	91	120	144	180	220	264	312	364	420	496	561	648	722	800	861	924	1012	1128	1250	1378	1539	1708	1885	2040
18	4	12	21	32	50	66	91	112	144	170	209	252	299	350	405	464	527	612	684	760	819	880	966	1056	1175	1300	1458	1624	1798	1980
19	4	10	21	32	45	66	84	112	135	170	198	240	286	336	390	448	510	576	646	720	777	836	920	1008	1100	1248	1377	1540	1711	1890
20	4	10	18	32	45	60	84	104	135	160	198	228	273	322	375	416	476	558	608	680	735	792	874	960	1050	1170	1296	1456	1595	1770
21	4	10	18	28	45	60	77	104	126	160	187	228	260	308	360	400	459	522	589	640	693	770	828	912	1000	1118	1242	1372	1508	1680
22	4	10	18	28	40	60	77	96	126	150	187	216	260	294	345	400	442	504	570	620	672	726	805	864	975	1066	1188	1316	1450	1590
23	4	10	18	28	40	54	77	96	117	150	176	216	247	294	330	384	425	486	551	600	651	704	759	840	925	1014	1134	1232	1363	1530
24	3	10	18	28	40	54	70	96	117	140	176	204	234	280	315	368	425	468	532	580	630	682	736	816	900	988	1080	1204	1305	1440
25	3	8	18	28	40	54	70	88	117	140	165	204	234	266	315	352	408	450	513	560	609	660	713	792	875	962	1053	1148	1247	1380
26	3	8	15	28	40	54	70	88	108	140	165	192	234	266	300	352	391	450	494	540	588	638	713	768	850	936	999	1120	1218	1320
27	3	8	15	24	40	54	70	88	108	130	165	192	221	266	300	336	391	432	475	540	588	638	690	744	825	910	972	1064	1160	1290
28	3	8	15	24	35	54	70	88	108	130	154	192	221	252	300	336	374	432	475	520	567	616	667	744	800	884	945	1036	1131	1230
29	3	8	15	24	35	48	70	88	108	130	154	180	221	252	285	336	374	414	456	520	567	616	667	720	800	858	945	1008	1102	1200
30	3	8	15	24	35	48	63	88	108	130	154	180	208	252	285	320	357	414	456	500	546	594	644	720	775	832	918	1008	1073	1170

Table D4. Negative Shock, Pre-Shock Phase, Nominal Frame, Type *y* Firm

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	10	20	30	44	55	72	84	104	126	140	165	192	221	252	285	320	340	378	418	460	504	550	598	624	675	728	783	840	899	960
2	11	22	33	44	60	72	91	104	126	150	165	192	221	252	285	320	357	396	418	460	504	550	598	648	675	728	783	840	899	960
3	12	24	36	48	60	78	91	112	126	150	176	192	221	252	285	320	357	396	437	460	504	550	598	648	700	728	783	840	899	960
4	13	26	39	52	65	78	98	112	135	150	176	204	234	252	285	320	357	396	437	480	504	550	598	648	700	754	783	840	899	960
5	15	28	42	56	70	84	105	120	135	160	176	204	234	266	300	336	374	396	437	480	525	550	598	648	700	754	810	840	899	960
6	17	32	45	60	75	90	105	128	144	160	187	216	234	266	300	336	374	414	437	480	525	572	598	648	700	754	810	868	899	960
7	19	36	51	68	80	96	112	128	153	170	198	216	247	280	315	352	374	414	456	500	525	572	621	648	700	754	810	868	928	960
8	21	40	57	72	90	102	119	136	153	180	198	228	247	280	315	352	391	432	456	500	546	572	621	672	700	754	810	868	928	990
9	24	44	63	80	95	114	126	144	162	190	209	228	260	294	330	368	391	432	475	500	546	594	621	672	725	754	810	868	928	990
10	27	50	69	88	105	120	140	160	171	200	220	240	273	294	330	368	408	450	475	520	546	594	644	672	725	780	810	868	928	990
11	30	56	78	96	115	132	147	168	189	210	231	252	273	308	345	384	425	450	494	520	567	594	644	696	725	780	837	868	928	990
12	33	62	87	108	125	144	161	184	198	220	242	264	286	322	360	400	442	468	513	540	567	616	644	696	750	780	837	896	928	990
13	36	68	96	120	140	162	175	192	216	230	253	276	299	336	375	416	459	486	513	560	588	638	667	720	750	806	837	896	957	990
14	38	74	105	132	155	174	196	216	234	250	275	288	325	350	390	432	476	504	532	580	609	638	690	720	775	806	864	896	957	1020
15	40	78	114	144	170	192	210	232	252	270	286	312	338	378	405	448	493	522	551	580	630	660	690	744	775	832	864	924	957	1020
16	**41**	82	123	156	185	210	231	256	270	290	308	336	364	392	435	480	510	558	570	600	651	682	713	744	800	832	891	924	986	1020
17	40	**84**	126	168	200	234	259	280	297	320	330	360	390	420	465	512	544	576	608	640	672	704	736	768	800	858	891	952	986	1050
18	38	82	**129**	172	215	252	280	304	324	340	363	384	416	448	495	544	578	612	627	660	693	726	759	792	825	858	918	952	1015	1050
19	36	78	126	**176**	220	264	301	328	351	370	396	420	442	476	525	576	612	648	665	700	714	748	782	816	850	884	918	980	1015	1080
20	33	74	120	172	**225**	270	315	352	378	410	429	456	481	518	570	624	663	684	703	740	756	770	805	840	875	910	945	980	1044	1080
21	30	68	114	164	220	**276**	**329**	368	405	440	462	492	520	560	615	672	714	738	760	780	798	814	851	864	900	936	972	1008	1044	1110
22	26	62	105	156	210	270	**329**	**384**	423	470	495	528	559	602	660	720	765	792	817	820	840	858	874	912	925	962	999	1036	1073	1110
23	24	54	93	144	200	258	322	**384**	**441**	490	528	564	598	644	705	768	816	846	874	880	903	902	920	936	975	988	1026	1064	1102	1140
24	21	50	84	128	185	240	308	376	**441**	**500**	550	600	637	686	750	816	867	900	931	940	966	968	989	984	1000	1040	1053	1092	1131	1170
25	19	44	75	116	165	222	287	360	432	**500**	**561**	612	663	728	795	864	918	954	988	1000	1029	1034	1035	1056	1050	1092	1107	1120	1160	1200
26	17	40	69	104	150	204	266	336	414	490	**561**	**624**	**689**	742	810	880	952	1008	1045	1080	1092	1100	1104	1104	1125	1144	1161	1176	1189	1230
27	15	36	63	96	135	186	245	312	387	460	539	612	**689**	**756**	**825**	**896**	**969**	1026	1083	1120	1155	1166	1173	1176	1175	1196	1215	1232	1247	1260
28	13	32	57	88	125	168	224	288	360	440	517	600	676	742	810	880	**969**	**1044**	**1121**	1180	1218	1232	1242	1248	1250	1248	1269	1288	1305	1320
29	12	28	51	80	110	156	203	264	333	400	484	564	650	728	795	864	935	1026	**1121**	**1200**	1260	1298	1311	1320	1325	1326	1323	1344	1363	1380
30	11	26	45	72	100	138	189	240	306	370	451	528	611	686	750	816	901	1008	1102	**1200**	**1281**	1342	1380	1392	1425	1404	1404	1428	1421	1440

Table D5. Negative Shock, Post-Shock Phase, Real Frame, Type *x* Firm

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	18	26	35	**40**	36	29	26	23	17	12	9	7	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	0	0
2	12	18	25	34	**40**	38	35	32	25	17	12	9	7	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	0
3	9	12	18	25	34	**39**	**40**	**39**	34	25	18	12	9	7	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1
4	7	9	12	17	25	32	35	38	**40**	34	25	18	12	9	7	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1
5	5	7	9	12	17	23	26	29	36	**40**	35	26	18	12	9	7	5	4	3	3	2	2	2	1	1	1	1	1	1	1
6	4	5	7	9	12	16	18	20	27	36	**40**	35	26	18	12	9	7	5	4	3	3	2	2	2	1	1	1	1	1	1
7	3	4	5	7	9	11	12	14	19	26	35	**40**	35	25	18	12	9	7	5	4	3	3	2	2	2	1	1	1	1	1
8	3	3	4	5	6	8	9	10	13	18	26	35	**39**	35	25	18	12	9	6	5	4	3	3	2	2	2	1	1	1	1
9	2	3	3	4	5	6	7	7	9	13	18	25	34	**39**	35	25	17	12	9	6	5	4	3	3	2	2	2	1	1	1
10	2	2	3	3	4	5	5	6	7	9	12	18	25	34	**39**	34	25	17	12	9	6	5	4	3	3	2	2	2	1	1
11	2	2	2	3	3	4	4	4	5	7	9	12	17	25	34	**39**	34	25	17	12	9	6	5	4	3	3	2	2	2	1
12	1	2	2	2	3	3	3	4	4	5	7	9	12	17	25	34	38	34	25	17	12	9	6	5	4	3	2	2	2	1
13	1	1	2	2	2	3	3	3	3	4	5	7	9	12	17	25	33	38	34	25	17	12	9	6	5	4	3	2	2	2
14	1	1	1	2	2	2	2	2	3	3	4	5	7	9	12	17	24	33	38	34	25	17	12	8	6	5	4	3	2	2
15	1	1	1	1	2	2	2	2	2	3	3	4	5	7	9	12	17	24	33	38	33	25	17	12	8	6	5	4	3	2
16	1	1	1	1	1	2	2	2	2	2	3	3	4	5	6	9	12	17	24	33	37	33	24	17	12	8	6	5	4	3
17	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	9	12	17	24	32	37	33	24	17	12	8	6	5	4
18	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	12	16	24	32	37	33	24	17	12	8	6	5
19	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	12	16	23	32	37	33	24	17	12	8	6
20	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	11	16	23	32	37	33	24	17	12	8
21	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	11	16	23	32	36	33	24	17	12
22	0	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	11	16	23	31	36	32	24	16
23	0	0	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	11	16	23	31	36	32	24
24	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	11	16	23	31	36	32
25	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	11	16	23	31	36
26	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	11	16	23	31
27	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3	4	5	6	8	11	16	22
28	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3	4	5	6	8	11	16
29	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3	4	5	6	8	11
30	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3	4	5	6	8

Table D6. Negative Shock, Post-Shock Phase, Real Frame, Type *y* Firm

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	9	7	5	4	4	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
2	12	9	7	6	5	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
3	18	13	9	7	7	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
4	26	18	13	10	9	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
5	35	26	19	14	12	11	9	7	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
6	**40**	36	27	20	18	16	12	9	7	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	0	0	0	0	0
7	35	**40**	36	29	26	23	17	12	9	7	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	0	0	0	0
8	25	34	**40**	38	35	32	25	17	12	9	7	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	0	0	0
9	18	25	34	**39**	**40**	**39**	34	25	18	12	9	7	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	0	0
10	12	17	25	32	35	38	**40**	34	25	18	12	9	7	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	0
11	9	12	17	23	26	29	36	**40**	35	26	18	12	9	7	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1
12	7	9	12	16	18	20	27	36	**40**	35	26	18	12	9	7	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1
13	5	7	9	11	12	14	19	26	35	**40**	35	25	18	12	9	7	5	4	3	3	2	2	2	1	1	1	1	1	1	1
14	4	5	6	8	9	10	13	18	26	35	**39**	35	25	18	12	9	6	5	4	3	3	2	2	2	1	1	1	1	1	1
15	3	4	5	6	7	7	9	13	18	25	34	**39**	35	25	17	12	9	6	5	4	3	3	2	2	2	1	1	1	1	1
16	3	3	4	5	5	6	7	9	12	18	25	34	**39**	34	25	17	12	9	6	5	4	3	3	2	2	2	1	1	1	1
17	2	3	3	4	4	4	5	7	9	12	17	25	34	**39**	34	25	17	12	9	6	5	4	3	3	2	2	2	1	1	1
18	2	2	3	3	3	4	4	5	7	9	12	17	25	34	38	34	25	17	12	9	6	5	4	3	2	2	2	1	1	1
19	2	2	2	3	3	3	3	4	5	7	9	12	17	25	33	38	34	25	17	12	9	6	5	4	3	2	2	2	1	1
20	1	2	2	2	2	2	3	3	4	5	7	9	12	17	24	33	38	34	25	17	12	8	6	5	4	3	2	2	2	1
21	1	1	2	2	2	2	2	3	3	4	5	7	9	12	17	24	33	38	33	25	17	12	8	6	5	4	3	2	2	2
22	1	1	1	2	2	2	2	2	3	3	4	5	6	9	12	17	24	33	37	33	24	17	12	8	6	5	4	3	2	2
23	1	1	1	1	1	1	2	2	2	3	3	4	5	6	9	12	17	24	32	37	33	24	17	12	8	6	5	4	3	2
24	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	12	16	24	32	37	33	24	17	12	8	6	5	4	3
25	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	12	16	23	32	37	33	24	17	12	8	6	5	4
26	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	11	16	23	32	37	33	24	17	12	8	6	5
27	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	11	16	23	32	36	33	24	17	12	8	6
28	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	11	16	23	31	36	32	24	16	11	8
29	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	11	16	23	31	36	32	24	16	11
30	0	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	11	16	23	31	36	32	24	16

Table D7. Negative Shock, Post-Shock Phase, Nominal Frame, Type *x* Firm

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	19	56	114	**176**	205	210	231	248	234	220	220	228	234	252	270	304	323	360	399	420	462	506	552	600	650	702	756	812	841	900
2	13	40	84	152	**225**	264	294	320	306	270	253	252	260	266	285	304	340	360	399	440	462	506	552	600	650	702	756	812	870	900
3	10	28	63	116	195	**270**	**329**	**376**	387	350	319	288	286	294	300	320	340	378	399	440	483	506	552	600	650	702	756	812	870	930
4	8	22	45	84	150	228	294	368	**441**	440	396	360	325	322	330	336	357	378	418	440	483	528	552	600	650	702	756	812	870	930
5	6	18	36	64	110	174	231	296	405	**500**	506	456	403	364	360	368	374	396	418	460	483	528	575	600	650	702	756	812	870	930
6	5	14	30	52	85	132	175	224	324	460	**561**	564	507	448	405	400	408	414	437	460	504	528	575	624	650	702	756	812	870	930
7	4	12	24	44	70	102	133	176	252	360	506	**624**	624	546	495	448	442	450	456	480	504	550	575	624	675	702	756	812	870	930
8	4	10	21	36	55	84	112	144	198	280	407	564	**676**	686	600	544	493	486	475	500	525	550	598	624	675	728	756	812	870	930
9	3	10	18	32	50	72	98	120	162	230	319	444	611	**742**	750	656	578	540	532	520	546	572	598	648	675	728	783	812	870	930
10	3	8	18	28	45	66	84	112	144	190	253	360	494	672	**810**	800	714	630	589	580	567	594	621	648	700	728	783	840	870	930
11	3	8	15	28	40	60	77	96	126	170	220	288	390	546	735	**880**	867	774	684	640	630	616	644	672	700	754	783	840	899	930
12	2	8	15	24	40	54	70	96	117	150	198	252	325	434	600	800	935	936	836	740	693	682	667	696	725	754	783	840	899	930
13	2	6	15	24	35	54	70	88	108	140	176	228	286	364	480	656	850	1008	1007	900	798	748	736	720	750	780	810	840	899	960
14	2	6	12	24	35	48	63	80	108	130	165	204	260	322	405	528	697	918	1083	1080	966	858	805	768	775	806	837	868	899	960
15	2	6	12	20	35	48	63	80	99	130	154	192	234	294	360	448	578	756	988	1160	1134	1034	920	864	825	832	864	896	928	960
16	2	6	12	20	30	48	63	80	99	120	154	180	221	266	315	400	493	630	817	1060	1218	1210	1081	984	925	884	891	924	957	990
17	2	6	12	20	30	42	56	72	99	120	143	180	208	252	300	352	442	540	684	880	1113	1298	1288	1152	1050	988	945	952	986	1020
18	2	6	12	20	30	42	56	72	90	120	143	168	208	238	285	336	391	468	589	720	945	1188	1380	1368	1225	1118	1053	1008	1015	1050
19	2	6	12	20	30	42	56	72	90	110	143	168	195	238	270	320	374	432	513	640	777	990	1265	1464	1450	1300	1188	1120	1073	1080
20	2	6	12	20	30	42	56	72	90	110	132	168	195	224	270	304	357	414	475	560	672	836	1058	1344	1550	1534	1377	1260	1189	1140
21	2	6	12	20	30	42	56	72	90	110	132	156	195	224	255	304	340	396	456	520	609	726	897	1128	1425	1612	1620	1456	1334	1260
22	1	6	12	20	30	42	56	72	90	110	132	156	182	224	255	288	340	378	437	500	567	660	782	960	1200	1482	1701	1680	1537	1380
23	1	4	12	20	30	42	56	72	90	110	132	156	182	210	255	288	323	378	418	480	546	616	713	840	1025	1274	1566	1792	1769	1620
24	1	4	9	20	30	42	56	72	90	110	132	156	182	210	240	288	323	360	418	460	525	594	667	768	900	1092	1350	1652	1885	1860
25	1	4	9	16	30	42	56	72	90	110	132	156	182	210	240	272	323	360	399	460	504	572	644	720	825	962	1161	1428	1740	1980
26	1	4	9	16	25	42	56	72	90	110	132	156	182	210	240	272	306	360	399	440	504	550	621	696	775	884	1026	1232	1508	1830
27	1	4	9	16	25	36	49	72	90	110	132	156	182	210	240	272	306	342	399	440	483	528	598	672	750	832	945	1092	1305	1560
28	1	4	9	16	25	36	49	64	90	110	132	156	182	210	240	272	306	342	380	440	483	528	575	648	725	806	891	1008	1160	1380
29	1	4	9	16	25	36	49	64	81	100	132	156	182	210	240	272	306	342	380	420	483	528	575	624	700	780	864	952	1073	1230
30	1	4	9	16	25	36	49	64	81	100	121	156	182	210	240	272	306	342	380	420	462	528	575	624	675	754	837	924	1015	1140

Table D8. Negative Shock, Post-Shock Phase, Nominal Frame, Type *y* Firm

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	10	18	24	32	45	60	70	88	99	120	143	156	182	210	240	272	306	342	380	420	462	484	529	576	625	676	729	784	841	900
2	13	22	30	40	50	66	77	88	108	120	143	168	182	210	240	272	306	342	380	420	462	506	529	576	625	676	729	784	841	900
3	19	30	36	44	60	72	84	96	108	130	143	168	195	210	240	272	306	342	380	420	462	506	529	576	625	676	729	784	841	900
4	27	40	48	56	70	84	91	104	117	130	154	168	195	224	240	272	306	342	380	420	462	506	552	576	625	676	729	784	841	900
5	36	56	66	72	85	102	112	120	126	140	154	180	195	224	255	272	306	342	380	420	462	506	552	600	625	676	729	784	841	900
6	**41**	76	90	96	115	132	133	136	144	150	165	180	208	224	255	288	306	342	380	420	462	506	552	600	650	676	729	784	841	900
7	36	**84**	117	132	155	174	168	160	162	170	176	192	208	238	255	288	323	342	380	420	462	506	552	600	650	702	729	784	841	900
8	26	72	**129**	168	200	228	224	200	189	190	198	204	221	238	270	288	323	360	380	420	462	506	552	600	650	702	756	784	841	900
9	19	54	111	**172**	**225**	**270**	287	264	243	220	220	228	234	252	270	304	323	360	399	420	462	506	552	600	650	702	756	812	841	900
10	13	38	84	144	200	264	**329**	336	306	280	253	252	260	266	285	304	340	360	399	440	462	506	552	600	650	702	756	812	870	900
11	10	28	60	108	155	210	301	**384**	396	360	319	288	286	294	300	320	340	378	399	440	483	506	552	600	650	702	756	812	870	930
12	8	22	45	80	115	156	238	352	**441**	450	407	360	325	322	330	336	357	378	418	440	483	528	552	600	650	702	756	812	870	930
13	6	18	36	60	85	120	182	272	396	**500**	506	444	403	364	360	368	374	396	418	460	483	528	575	600	650	702	756	812	870	930
14	5	14	27	48	70	96	140	208	315	450	**550**	564	494	448	405	400	391	414	437	460	504	528	575	624	650	702	756	812	870	930
15	4	12	24	40	60	78	112	168	243	350	495	**612**	624	546	480	448	442	432	456	480	504	550	575	624	675	702	756	812	870	930
16	4	10	21	36	50	72	98	136	189	280	396	552	**676**	672	600	528	493	486	475	500	525	550	598	624	675	728	756	812	870	930
17	3	10	18	32	45	60	84	120	162	220	308	444	611	**742**	735	656	578	540	532	520	546	572	598	648	675	728	783	812	870	930
18	3	8	18	28	40	60	77	104	144	190	253	348	494	672	795	800	714	630	589	580	567	594	621	648	675	728	783	812	870	930
19	3	8	15	28	40	54	70	96	126	170	220	288	390	546	720	864	867	774	684	640	630	616	644	672	700	728	783	840	870	930
20	2	8	15	24	35	48	70	88	117	150	198	252	325	434	585	784	935	936	836	740	693	660	667	696	725	754	783	840	899	930
21	2	6	15	24	35	48	63	88	108	140	176	228	286	364	480	640	850	1008	988	900	798	748	713	720	750	780	810	840	899	960
22	2	6	12	24	35	48	63	80	108	130	165	204	247	322	405	528	697	918	1064	1060	945	858	805	768	775	806	837	868	899	960
23	2	6	12	20	30	42	63	80	99	130	154	192	234	280	360	448	578	756	969	1140	1134	1012	920	864	825	832	864	896	928	960
24	2	6	12	20	30	42	56	80	99	120	154	180	221	266	315	384	493	612	817	1040	1218	1210	1081	984	925	884	891	924	957	990
25	2	6	12	20	30	42	56	72	99	120	143	180	208	252	300	352	425	540	665	860	1113	1298	1288	1152	1050	988	945	952	986	1020
26	2	6	12	20	30	42	56	72	90	120	143	168	208	238	285	336	391	468	570	720	924	1188	1380	1368	1225	1118	1053	1008	1015	1050
27	2	6	12	20	30	42	56	72	90	110	143	168	195	238	270	320	374	432	513	620	777	990	1265	1440	1450	1300	1188	1120	1073	1080
28	2	6	12	20	30	42	56	72	90	110	132	168	195	224	270	304	357	414	475	560	672	836	1058	1320	1525	1508	1377	1232	1160	1140
29	2	6	12	20	30	42	56	72	90	110	132	156	195	224	255	304	340	396	456	520	609	726	897	1128	1400	1612	1593	1456	1305	1230
30	1	6	12	20	30	42	56	72	90	110	132	156	182	224	255	288	340	378	437	500	567	660	782	960	1200	1482	1701	1680	1537	1380

Table D9. Positive Shock, Pre-Shock Phase, Real Frame, Type *x* Firm

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	9	8	8	7	6	6	6	5	5	5	5	5	5	4	4	4	4	3	3	3	3	3	3	2	2	2	2	2	2	2
2	10	9	8	8	7	7	6	6	6	6	6	5	5	5	5	4	4	4	3	3	3	3	3	3	2	2	2	2	2	2
3	11	10	9	8	8	7	7	6	6	6	6	6	6	5	5	5	4	4	4	3	3	3	3	3	3	2	2	2	2	2
4	13	11	10	9	9	8	7	7	7	7	7	6	6	6	5	5	5	4	4	4	3	3	3	3	3	3	2	2	2	2
5	14	13	12	10	10	9	8	8	7	7	7	7	7	6	6	5	5	5	4	4	4	3	3	3	3	3	3	2	2	2
6	16	14	13	12	11	10	9	8	8	8	8	8	7	7	6	6	5	5	5	4	4	4	3	3	3	3	3	3	2	2
7	18	16	15	13	12	11	10	9	9	9	9	9	8	8	7	6	6	5	5	5	4	4	4	3	3	3	3	3	3	2
8	21	18	16	15	13	12	11	10	10	10	10	10	9	8	8	7	7	6	6	5	5	4	4	4	3	3	3	3	3	3
9	23	21	19	17	15	14	12	12	11	11	11	11	10	9	9	8	7	7	6	6	5	5	4	4	4	3	3	3	3	3
10	26	23	21	19	17	15	14	13	13	12	12	12	11	10	9	9	8	7	7	6	6	5	5	4	4	4	3	3	3	3
11	29	26	24	21	19	17	16	15	14	14	14	13	13	11	10	10	9	8	7	7	6	6	5	5	4	4	4	3	3	3
12	33	30	27	24	22	19	18	17	16	16	16	15	14	13	12	11	10	9	8	7	7	6	6	5	5	4	4	4	3	3
13	36	33	30	27	24	22	20	19	18	18	18	17	16	14	13	12	11	10	9	8	7	7	6	6	5	5	4	4	4	3
14	38	36	33	30	27	25	23	21	20	20	20	19	18	16	15	13	12	11	10	9	8	7	7	6	6	5	5	4	4	4
15	39	38	36	33	31	28	26	24	23	23	23	22	20	18	17	15	13	12	11	10	9	8	7	7	6	6	5	5	4	4
16	**40**	**40**	38	36	34	31	29	27	26	26	26	25	23	21	19	17	15	14	12	11	10	9	8	7	7	6	6	5	5	4
17	39	**40**	**40**	38	37	34	32	30	29	29	29	28	26	24	21	19	17	15	14	12	11	10	9	8	7	7	6	6	5	5
18	37	39	**40**	**40**	39	37	35	33	32	32	32	31	29	27	24	22	19	17	15	14	12	11	10	9	8	7	7	6	6	5
19	34	37	39	**40**	**40**	39	38	36	35	35	35	34	32	30	27	25	22	20	17	15	14	12	11	10	9	8	7	7	6	6
20	31	34	37	39	**40**	**40**	39	38	38	38	38	37	35	33	30	28	25	22	20	17	16	14	12	11	10	9	8	7	7	6
21	28	31	34	37	39	**40**	**40**	**40**	39	39	39	39	38	36	34	31	28	25	22	20	18	16	14	12	11	10	9	8	7	7
22	25	28	31	34	36	38	39	**40**	**40**	**40**	**40**	**40**	39	38	36	34	31	28	25	22	20	18	16	14	12	11	10	9	8	7
23	22	25	28	31	34	36	38	39	39	39	39	**40**	**40**	**40**	39	37	34	31	28	25	22	20	18	16	14	12	11	10	9	8
24	20	22	25	28	30	33	35	37	38	38	38	38	39	**40**	**40**	39	37	34	31	28	25	22	20	18	16	14	12	11	10	9
25	17	20	22	25	27	30	32	34	35	35	35	36	38	39	**40**	**40**	39	37	34	32	28	25	23	20	18	16	14	12	11	10
26	15	17	19	22	24	27	29	31	32	32	32	33	35	37	39	**40**	**40**	39	37	35	32	28	25	23	20	18	16	14	12	11
27	14	15	17	19	21	24	26	28	29	29	29	30	32	34	37	38	**40**	**40**	39	37	35	32	29	25	23	20	18	16	14	12
28	12	14	15	17	19	21	23	25	26	26	26	27	29	31	34	36	38	**40**	**40**	39	37	35	32	29	26	23	20	18	16	14
29	11	12	13	15	17	18	20	22	23	23	23	24	26	28	31	33	36	38	39	**40**	39	37	35	32	29	26	23	20	18	16
30	10	11	12	13	15	16	18	19	20	20	20	21	23	25	27	30	33	36	38	39	**40**	39	37	35	32	29	26	23	20	18

Table D10. Positive Shock, Pre-Shock Phase, Real Frame, Type *y* Firm

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	18	20	23	25	28	32	34	37	39	**40**	**40**	39	38	36	35	35	35	34	32	30	27	25	22	20	17	15	14	12	11	10
2	16	18	20	22	25	28	31	34	37	39	**40**	**40**	39	38	38	38	38	37	35	33	30	28	25	22	20	17	16	14	12	11
3	14	16	18	20	22	25	28	31	34	37	39	**40**	**40**	**40**	39	39	39	39	38	36	34	31	28	25	22	20	18	16	14	12
4	12	14	16	18	20	22	25	28	31	34	36	38	39	**40**	**40**	**40**	**40**	**40**	39	38	36	34	31	28	25	22	20	18	16	14
5	11	12	14	16	18	20	22	25	28	31	34	36	38	39	39	39	39	**40**	**40**	**40**	39	37	34	31	28	25	22	20	18	16
6	10	11	12	14	16	17	20	22	25	28	30	33	35	37	38	38	38	38	39	**40**	**40**	39	37	34	31	28	25	22	20	18
7	9	10	11	12	14	15	17	20	22	25	27	30	32	34	35	35	35	36	38	39	**40**	**40**	39	37	34	32	28	25	23	20
8	8	9	10	11	12	14	15	17	19	22	24	27	29	31	32	32	32	33	35	37	39	**40**	**40**	39	37	35	32	28	25	23
9	7	8	9	10	11	12	14	15	17	19	21	24	26	28	29	29	29	30	32	34	37	38	**40**	**40**	39	37	35	32	29	25
10	7	7	8	9	10	11	12	14	15	17	19	21	23	25	26	26	26	27	29	31	34	36	38	**40**	**40**	39	37	35	32	29
11	6	7	7	8	9	10	11	12	13	15	17	18	20	22	23	23	23	24	26	28	31	33	36	38	39	**40**	39	37	35	32
12	6	6	7	7	8	9	10	11	12	13	15	16	18	19	20	20	20	21	23	25	27	30	33	36	38	39	**40**	39	37	35
13	5	6	6	7	7	8	9	10	11	12	13	14	16	17	18	18	18	19	20	22	24	27	30	33	36	38	39	**40**	39	37
14	5	5	6	6	7	7	8	9	10	11	12	13	14	15	16	16	16	17	18	19	22	24	27	30	33	35	38	39	**40**	39
15	4	5	5	6	6	7	7	8	9	10	10	11	13	13	14	14	14	15	16	17	19	21	24	26	29	32	35	38	39	**40**
16	4	4	5	5	6	6	7	7	8	9	9	10	11	12	12	12	13	13	14	15	17	19	21	23	26	29	32	35	37	39
17	4	4	4	5	5	6	6	7	7	8	9	9	10	11	11	11	11	12	12	14	15	17	19	21	23	26	29	32	35	37
18	3	4	4	4	5	5	6	6	7	7	8	8	9	10	10	10	10	10	11	12	13	15	16	18	21	23	26	29	32	35
19	3	3	4	4	4	5	5	5	6	6	7	8	8	9	9	9	9	9	10	11	12	13	15	16	18	20	23	26	29	32
20	3	3	3	4	4	4	5	5	5	6	6	7	7	8	8	8	8	8	9	10	11	12	13	14	16	18	20	23	26	29
21	3	3	3	3	4	4	4	5	5	5	6	6	7	7	7	7	7	8	8	9	10	10	12	13	14	16	18	20	23	26
22	3	3	3	3	3	4	4	4	5	5	5	6	6	6	7	7	7	7	7	8	9	9	10	11	13	14	16	18	20	23
23	3	3	3	3	3	3	4	4	4	5	5	5	6	6	6	6	6	6	7	7	8	8	9	10	11	13	14	16	18	20
24	2	3	3	3	3	3	3	4	4	4	5	5	5	5	6	6	6	6	6	7	7	8	8	9	10	11	13	14	16	18
25	2	2	3	3	3	3	3	3	4	4	4	4	5	5	5	5	5	5	6	6	6	7	8	8	9	10	11	12	14	16
26	2	2	2	3	3	3	3	3	3	4	4	4	4	5	5	5	5	5	5	5	6	6	7	8	8	9	10	11	12	14
27	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	4	5	5	5	5	6	6	7	7	8	9	10	11	12
28	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	4	4	5	5	5	6	6	7	7	8	9	10	11
29	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	4	4	5	5	5	6	6	7	7	8	9	10
30	2	2	2	2	2	2	2	3	3	3	3	3	3	3	4	4	4	4	4	4	4	5	5	5	6	6	7	7	8	9

Table D11. Positive Shock, Pre-Shock Phase, Nominal Frame, Type *x* Firm

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	10	20	33	44	55	72	91	104	126	150	176	204	234	252	285	320	357	378	418	460	504	550	598	624	675	728	783	840	899	960
2	11	22	33	48	60	78	91	112	135	160	187	204	234	266	300	320	357	396	418	460	504	550	598	648	675	728	783	840	899	960
3	12	24	36	48	65	78	98	112	135	160	187	216	247	266	300	336	357	396	437	460	504	550	598	648	700	728	783	840	899	960
4	14	26	39	52	70	84	98	120	144	170	198	216	247	280	300	336	374	396	437	480	504	550	598	648	700	754	783	840	899	960
5	15	30	45	56	75	90	105	128	144	170	198	228	260	280	315	336	374	414	437	480	525	550	598	648	700	754	810	840	899	960
6	17	32	48	64	80	96	112	128	153	180	209	240	260	294	315	352	374	414	456	480	525	572	598	648	700	754	810	868	899	960
7	19	36	54	68	85	102	119	136	162	190	220	252	273	308	330	352	391	414	456	500	525	572	621	648	700	754	810	868	928	960
8	22	40	57	76	90	108	126	144	171	200	231	264	286	308	345	368	408	432	475	500	546	572	621	672	700	754	810	868	928	990
9	24	46	66	84	100	120	133	160	180	210	242	276	299	322	360	384	408	450	475	520	546	594	621	672	725	754	810	868	928	990
10	27	50	72	92	110	126	147	168	198	220	253	288	312	336	360	400	425	450	494	520	567	594	644	672	725	780	810	868	928	990
11	30	56	81	100	120	138	161	184	207	240	275	300	338	350	375	416	442	468	494	540	567	616	644	696	725	780	837	868	928	990
12	34	64	90	112	135	150	175	200	225	260	297	324	351	378	405	432	459	486	513	540	588	616	667	696	750	780	837	896	928	990
13	37	70	99	124	145	168	189	216	243	280	319	348	377	392	420	448	476	504	532	560	588	638	667	720	750	806	837	896	957	990
14	39	76	108	136	160	186	210	232	261	300	341	372	403	420	450	464	493	522	551	580	609	638	690	720	775	806	864	896	957	1020
15	40	80	117	148	180	204	231	256	288	330	374	408	429	448	480	496	510	540	570	600	630	660	690	744	775	832	864	924	957	1020
16	**41**	**84**	123	160	195	222	252	280	315	360	407	444	468	490	510	528	544	576	589	620	651	682	713	744	800	832	891	924	986	1020
17	40	**84**	**129**	168	210	240	273	304	342	390	440	480	507	532	540	560	578	594	627	640	672	704	736	768	800	858	891	952	986	1050
18	38	82	**129**	**176**	220	258	294	328	369	420	473	516	546	574	585	608	612	630	646	680	693	726	759	792	825	858	918	952	1015	1050
19	35	78	126	**176**	**225**	270	315	352	396	450	506	552	585	616	630	656	663	684	684	700	735	748	782	816	850	884	918	980	1015	1080
20	32	72	120	172	**225**	**276**	322	368	423	480	539	588	624	658	675	704	714	720	741	740	777	792	805	840	875	910	945	980	1044	1080
21	29	66	111	164	220	**276**	**329**	**384**	432	490	550	612	663	700	735	752	765	774	779	800	819	836	851	864	900	936	972	1008	1044	1110
22	26	60	102	152	205	264	322	**384**	**441**	**500**	**561**	**624**	676	728	765	800	816	828	836	840	861	880	897	912	925	962	999	1036	1073	1110
23	23	54	93	140	195	252	315	376	432	490	550	**624**	**689**	**756**	810	848	867	882	893	900	903	924	943	960	975	988	1026	1064	1102	1140
24	21	48	84	128	175	234	294	360	423	480	539	600	676	**756**	**825**	880	918	936	950	960	966	968	989	1008	1025	1040	1053	1092	1131	1170
25	18	44	75	116	160	216	273	336	396	450	506	576	663	742	**825**	**896**	952	990	1007	1040	1029	1034	1058	1056	1075	1092	1107	1120	1160	1200
26	16	38	66	104	145	198	252	312	369	420	473	540	624	714	810	**896**	**969**	1026	1064	1100	1113	1100	1104	1128	1125	1144	1161	1176	1189	1230
27	15	34	60	92	130	180	231	288	342	390	440	504	585	672	780	864	**969**	**1044**	1102	1140	1176	1188	1196	1176	1200	1196	1215	1232	1247	1260
28	13	32	54	84	120	162	210	264	315	360	407	468	546	630	735	832	935	**1044**	**1121**	1180	1218	1254	1265	1272	1275	1274	1269	1288	1305	1320
29	12	28	48	76	110	144	189	240	288	330	374	432	507	588	690	784	901	1008	1102	**1200**	1260	1298	1334	1344	1350	1352	1350	1344	1363	1380
30	11	26	45	68	100	132	175	216	261	300	341	396	468	546	630	736	850	972	1083	1180	**1281**	1342	1380	1416	1425	1430	1431	1428	1421	1440

Table D12. Positive Shock, Pre-Shock Phase, Nominal Frame, Type *y* Firm

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	19	44	78	116	165	228	287	360	432	**500**	**561**	612	663	700	750	816	884	936	969	1000	1008	1034	1035	1056	1050	1066	1107	1120	1160	1200
2	17	40	69	104	150	204	266	336	414	490	**561**	**624**	676	728	795	864	935	990	1026	1060	1071	1100	1104	1104	1125	1118	1161	1176	1189	1230
3	15	36	63	96	135	186	245	312	387	470	550	**624**	**689**	**756**	810	880	952	1026	1083	1120	1155	1166	1173	1176	1175	1196	1215	1232	1247	1260
4	13	32	57	88	125	168	224	288	360	440	517	600	676	**756**	**825**	**896**	**969**	**1044**	1102	1160	1197	1232	1242	1248	1250	1248	1269	1288	1305	1320
5	12	28	51	80	115	156	203	264	333	410	495	576	663	742	810	880	952	**1044**	**1121**	**1200**	1260	1298	1311	1320	1325	1326	1323	1344	1363	1380
6	11	26	45	72	105	138	189	240	306	380	451	540	624	714	795	864	935	1008	1102	**1200**	**1281**	1342	1380	1392	1400	1404	1404	1400	1421	1440
7	10	24	42	64	95	126	168	224	279	350	418	504	585	672	750	816	884	972	1083	1180	**1281**	**1364**	1426	1464	1475	1508	1485	1484	1508	1500
8	9	22	39	60	85	120	154	200	252	320	385	468	546	630	705	768	833	918	1026	1140	1260	**1364**	**1449**	1512	1550	1586	1593	1568	1566	1590
9	8	20	36	56	80	108	147	184	234	290	352	432	507	588	660	720	782	864	969	1080	1218	1320	**1449**	**1536**	1600	1638	1674	1680	1682	1650
10	8	18	33	52	75	102	133	176	216	270	330	396	468	546	615	672	731	810	912	1020	1155	1276	1403	**1536**	**1625**	1690	1728	1764	1769	1770
11	7	18	30	48	70	96	126	160	198	250	308	360	429	504	570	624	680	756	855	960	1092	1210	1357	1488	1600	**1716**	1782	1820	1856	1860
12	7	16	30	44	65	90	119	152	189	230	286	336	403	462	525	576	629	702	798	900	1008	1144	1288	1440	1575	1690	**1809**	1876	1914	1950
13	6	16	27	44	60	84	112	144	180	220	264	312	377	434	495	544	595	666	741	840	945	1078	1219	1368	1525	1664	1782	**1904**	1972	2010
14	6	14	27	40	60	78	105	136	171	210	253	300	351	406	465	512	561	630	703	780	903	1012	1150	1296	1450	1586	1755	1876	**2001**	2070
15	5	14	24	40	55	78	98	128	162	200	231	276	338	378	435	480	527	594	665	740	840	946	1081	1200	1350	1508	1674	1848	1972	**2100**
16	5	12	24	36	55	72	98	120	153	190	220	264	312	364	405	448	510	558	627	700	798	902	1012	1128	1275	1430	1593	1764	1914	2070
17	5	12	21	36	50	72	91	120	144	180	220	252	299	350	390	432	476	540	589	680	756	858	966	1080	1200	1352	1512	1680	1856	2010
18	4	12	21	32	50	66	91	112	144	170	209	240	286	336	375	416	459	504	570	640	714	814	897	1008	1150	1274	1431	1596	1769	1950
19	4	10	21	32	45	66	84	104	135	160	198	240	273	322	360	400	442	486	551	620	693	770	874	960	1075	1196	1350	1512	1682	1860
20	4	10	18	32	45	60	84	104	126	160	187	228	260	308	345	384	425	468	532	600	672	748	828	912	1025	1144	1269	1428	1595	1770
21	4	10	18	28	45	60	77	104	126	150	187	216	260	294	330	368	408	468	513	580	651	704	805	888	975	1092	1215	1344	1508	1680
22	4	10	18	28	40	60	77	96	126	150	176	216	247	280	330	368	408	450	494	560	630	682	759	840	950	1040	1161	1288	1421	1590
23	4	10	18	28	40	54	77	96	117	150	176	204	247	280	315	352	391	432	494	540	609	660	736	816	900	1014	1107	1232	1363	1500
24	3	10	18	28	40	54	70	96	117	140	176	204	234	266	315	352	391	432	475	540	588	660	713	792	875	962	1080	1176	1305	1440
25	3	8	18	28	40	54	70	88	117	140	165	192	234	266	300	336	374	414	475	520	567	638	713	768	850	936	1026	1120	1247	1380
26	3	8	15	28	40	54	70	88	108	140	165	192	221	266	300	336	374	414	456	500	567	616	690	768	825	910	999	1092	1189	1320
27	3	8	15	24	40	54	70	88	108	130	165	192	221	252	285	320	357	414	456	500	546	616	667	744	800	884	972	1064	1160	1260
28	3	8	15	24	35	54	70	88	108	130	154	192	221	252	285	320	357	396	437	500	546	594	667	720	800	858	945	1036	1131	1230
29	3	8	15	24	35	48	70	88	108	130	154	180	221	252	285	320	357	396	437	480	546	594	644	720	775	858	918	1008	1102	1200
30	3	8	15	24	35	48	63	88	108	130	154	180	208	238	285	320	357	396	437	480	525	594	644	696	775	832	918	980	1073	1170

Table D13. Positive Shock, Post-Shock Phase, Real Frame, Type *x* Firm

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	8	6	5	4	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
2	11	8	6	5	4	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
3	16	11	8	6	5	4	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
4	22	16	11	8	6	5	4	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
5	31	23	16	11	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
6	36	31	23	16	11	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
7	32	36	31	23	16	11	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
8	24	32	36	31	23	16	11	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0	0
9	16	24	32	36	31	23	16	11	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0
10	12	17	24	33	36	32	23	16	11	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1
11	8	12	17	24	33	37	32	23	16	11	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1
12	6	8	12	17	24	33	37	32	23	16	12	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1
13	5	6	8	12	17	24	33	37	32	24	16	12	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1
14	4	5	6	8	12	17	24	33	37	32	24	17	12	9	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1
15	3	4	5	6	8	12	17	24	33	37	33	24	17	12	9	6	5	4	3	3	2	2	2	2	2	1	1	1	1	1
16	2	3	4	5	6	8	12	17	25	33	38	33	24	17	12	9	7	5	4	3	3	2	2	2	2	2	1	1	1	1
17	2	2	3	4	5	6	8	12	17	25	34	38	33	24	17	12	9	7	5	4	3	3	2	2	2	2	2	1	1	1
18	2	2	2	3	4	5	6	9	12	17	25	34	38	33	25	17	12	9	7	5	4	3	3	3	3	2	2	2	1	1
19	1	2	2	2	3	4	5	6	9	12	17	25	34	38	34	25	17	12	9	7	5	4	4	3	3	3	2	2	2	1
20	1	2	2	2	3	3	4	5	6	9	12	17	25	34	**39**	34	25	17	12	9	7	5	4	4	4	3	3	2	2	2
21	1	1	2	2	2	3	3	4	5	6	9	12	17	25	34	**39**	34	25	18	12	9	7	6	5	5	4	3	3	2	2
22	1	1	1	2	2	2	3	3	4	5	6	9	12	17	25	35	**39**	34	25	18	13	9	7	7	6	5	4	3	3	2
23	1	1	1	1	2	2	2	3	3	4	5	6	9	12	18	25	35	**39**	35	26	18	13	10	9	8	6	5	4	3	3
24	1	1	1	1	1	2	2	2	3	3	4	5	7	9	12	18	25	35	**40**	35	26	19	14	12	11	9	7	5	4	3
25	1	1	1	1	1	1	2	2	2	3	3	4	5	7	9	12	18	26	35	**40**	36	27	20	18	16	12	9	7	5	4
26	1	1	1	1	1	1	1	2	2	2	3	3	4	5	7	9	12	18	26	35	**40**	36	29	26	23	17	12	9	7	5
27	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	7	9	12	18	25	34	**40**	38	35	32	25	17	12	9	7
28	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	7	9	12	18	25	34	**39**	**40**	**39**	34	25	18	12	9
29	0	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	7	9	12	17	25	32	35	38	**40**	34	25	18	12
30	0	0	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	7	9	12	17	23	26	29	36	**40**	35	26	18

Table D14. Positive Shock, Post -Shock Phase, Real Frame, Type *y* Firm

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	16	24	32	36	31	23	16	11	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0
2	11	16	24	32	36	31	23	16	11	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1
3	8	11	16	24	32	36	31	23	16	11	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1
4	6	8	12	17	24	33	36	32	23	16	11	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1
5	5	6	8	12	17	24	33	37	32	23	16	11	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1	1
6	4	5	6	8	12	17	24	33	37	32	23	16	12	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1	1
7	3	4	5	6	8	12	17	24	33	37	32	24	16	12	8	6	5	4	3	3	2	2	2	1	1	1	1	1	1	1
8	2	3	4	5	6	8	12	17	24	33	37	32	24	17	12	9	6	5	4	3	3	2	2	2	1	1	1	1	1	1
9	2	2	3	4	5	6	8	12	17	24	33	37	33	24	17	12	9	6	5	4	3	3	2	2	2	2	2	1	1	1
10	2	2	2	3	4	5	6	8	12	17	25	33	38	33	24	17	12	9	7	5	4	3	3	2	2	2	2	2	1	1
11	1	2	2	2	3	4	5	6	8	12	17	25	34	38	33	24	17	12	9	7	5	4	3	3	2	2	2	2	2	1
12	1	1	2	2	2	3	4	5	6	9	12	17	25	34	38	33	25	17	12	9	7	5	4	3	3	3	3	2	2	2
13	1	1	1	2	2	2	3	4	5	6	9	12	17	25	34	38	34	25	17	12	9	7	5	4	4	3	3	3	2	2
14	1	1	1	2	2	2	3	3	4	5	6	9	12	17	25	34	**39**	34	25	17	12	9	7	5	4	4	4	3	3	2
15	1	1	1	1	2	2	2	3	3	4	5	6	9	12	17	25	34	**39**	34	25	18	12	9	7	6	5	5	4	3	3
16	1	1	1	1	1	2	2	2	3	3	4	5	6	9	12	17	25	35	**39**	34	25	18	13	9	7	7	6	5	4	3
17	1	1	1	1	1	1	2	2	2	3	3	4	5	6	9	12	18	25	35	**39**	35	26	18	13	10	9	8	6	5	4
18	1	1	1	1	1	1	1	2	2	2	3	3	4	5	7	9	12	18	25	35	**40**	35	26	19	14	12	11	9	7	5
19	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	7	9	12	18	26	35	**40**	36	27	20	18	16	12	9	7
20	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	7	9	12	18	26	35	**40**	36	29	26	23	17	12	9
21	0	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	7	9	12	18	25	34	**40**	38	35	32	25	17	12
22	0	0	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	7	9	12	18	25	34	**39**	**40**	**39**	34	25	18
23	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	7	9	12	17	25	32	35	38	**40**	34	25
24	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	7	9	12	17	23	26	29	36	**40**	35
25	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	7	9	12	16	18	20	27	36	**40**
26	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	7	9	11	12	14	19	26	35
27	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	8	9	10	13	18	26
28	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	6	7	7	9	13	18
29	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	5	5	6	7	9	12
30	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	4	4	4	5	7	9

Table D15. Positive Shock, Post -Shock Phase, Nominal Frame, Type *x* Firm

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	9	16	24	32	40	48	63	80	99	110	132	156	182	210	240	272	306	342	380	400	441	484	529	576	625	676	729	784	841	900
2	12	20	27	36	45	54	63	80	99	120	132	156	182	210	240	272	306	342	380	420	441	484	529	576	625	676	729	784	841	900
3	17	26	33	40	50	60	70	80	99	120	143	156	182	210	240	272	306	342	380	420	462	506	529	576	625	676	729	784	841	900
4	23	36	42	48	55	66	77	88	99	120	143	168	182	210	240	272	306	342	380	420	462	506	552	576	625	676	729	784	841	900
5	32	50	57	60	65	72	84	96	108	130	143	168	195	210	240	272	306	342	380	420	462	506	552	600	650	676	729	784	841	900
6	37	66	78	80	80	84	91	104	117	130	154	168	195	224	240	272	306	342	380	420	462	506	552	600	650	702	729	784	841	900
7	33	76	102	108	105	102	105	112	126	140	154	180	195	224	255	272	306	342	380	420	462	506	552	600	650	702	756	784	841	900
8	25	68	117	140	140	132	126	128	135	150	165	180	208	224	255	288	306	342	380	420	462	506	552	600	650	702	756	812	841	900
9	17	52	105	160	180	174	161	152	153	160	176	192	208	238	255	288	323	342	380	420	462	506	552	600	650	702	756	812	870	900
10	13	38	81	148	205	228	210	192	180	180	187	204	221	238	270	288	323	360	380	420	462	506	552	600	650	702	756	812	870	930
11	9	28	60	112	190	258	273	248	225	210	209	216	234	252	270	304	323	360	399	420	462	506	552	600	650	702	756	812	870	930
12	7	20	45	84	145	234	308	320	288	260	253	240	247	266	285	304	340	360	399	440	462	506	552	600	650	702	756	812	870	930
13	6	16	33	64	110	180	280	360	369	340	297	288	273	280	300	320	340	378	399	440	483	506	552	600	650	702	756	812	870	930
14	5	14	27	48	85	138	217	328	414	420	385	348	325	322	315	336	357	378	418	440	483	528	552	600	650	702	756	812	870	930
15	4	12	24	40	65	108	168	256	378	470	484	432	390	364	360	352	374	396	418	460	483	528	575	624	675	702	756	812	870	930
16	3	10	21	36	55	84	133	200	306	430	539	540	481	434	405	400	408	414	437	460	504	528	575	624	675	728	756	812	870	930
17	3	8	18	32	50	72	105	160	234	350	495	600	598	532	480	448	442	450	456	480	504	550	575	624	675	728	783	812	870	930
18	3	8	15	28	45	66	91	136	189	270	396	552	663	658	600	528	493	486	494	500	525	550	598	648	700	728	783	840	870	930
19	2	8	15	24	40	60	84	112	162	220	308	444	611	728	735	656	578	540	532	540	546	572	621	648	700	754	783	840	899	930
20	2	8	15	24	40	54	77	104	135	190	253	348	494	672	**810**	800	714	630	589	580	588	594	621	672	725	754	810	840	899	960
21	2	6	15	24	35	54	70	96	126	160	220	288	390	546	735	**880**	867	774	703	640	630	638	667	696	750	780	810	868	899	960
22	2	6	12	24	35	48	70	88	117	150	187	252	325	434	600	816	**952**	936	836	760	714	682	690	744	775	806	837	868	928	960
23	2	6	12	20	35	48	63	88	108	140	176	216	286	364	495	656	884	**1026**	1026	920	819	770	759	792	825	832	864	896	928	990
24	2	6	12	20	30	48	63	80	108	130	165	204	260	322	405	544	714	954	**1121**	1100	987	902	851	864	900	910	918	924	957	990
25	2	6	12	20	30	42	63	80	99	130	154	192	234	294	360	448	595	792	1026	**1200**	1197	1078	989	1008	1025	988	972	980	986	1020
26	2	6	12	20	30	42	56	80	99	120	154	180	221	266	330	400	493	648	855	1100	**1281**	1276	1196	1200	1200	1118	1053	1036	1044	1050
27	2	6	12	20	30	42	56	72	99	120	143	180	208	252	300	368	442	540	703	900	1155	**1364**	1403	1416	1425	1326	1188	1120	1102	1110
28	2	6	12	20	30	42	56	72	90	120	143	168	208	238	285	336	408	486	589	760	966	1232	**1426**	**1536**	**1600**	1560	1404	1288	1189	1170
29	1	6	12	20	30	42	56	72	90	110	143	168	195	238	270	320	374	450	532	640	798	1034	1265	1416	1575	**1716**	1647	1484	1363	1260
30	1	4	12	20	30	42	56	72	90	110	132	168	195	224	270	304	357	414	494	580	693	858	1058	1200	1350	1612	**1809**	1764	1595	1440

Table D16. Positive Shock, Post -Shock Phase, Nominal Frame, Type *y* Firm

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1	17	52	105	160	180	174	161	152	153	160	176	192	208	238	255	288	323	342	380	420	462	506	552	600	650	702	756	812	870	900
2	12	36	81	144	205	222	210	192	180	180	187	204	221	238	270	288	323	360	380	420	462	506	552	600	650	702	756	812	870	930
3	9	26	57	112	185	252	266	248	225	210	209	216	234	252	270	304	323	360	399	420	462	506	552	600	650	702	756	812	870	930
4	7	20	45	84	145	234	301	320	288	260	242	240	247	266	285	304	340	360	399	440	462	506	552	600	650	702	756	812	870	930
5	6	16	33	64	110	180	280	360	369	330	297	276	273	280	300	320	340	378	399	440	483	506	552	600	650	702	756	812	870	930
6	5	14	27	48	85	138	217	328	414	420	374	336	325	308	315	336	357	378	418	440	483	528	552	600	650	702	756	812	870	930
7	4	12	24	40	65	108	168	256	378	470	473	432	377	364	345	352	374	396	418	460	483	528	575	600	650	702	756	812	870	930
8	3	10	21	36	55	84	133	200	297	430	528	528	481	434	405	400	391	414	437	460	504	528	575	624	650	702	756	812	870	930
9	3	8	18	32	50	72	105	160	234	340	484	588	598	532	480	448	442	432	456	480	504	550	575	624	675	728	783	812	870	930
10	3	8	15	28	45	66	91	128	189	270	396	540	663	658	585	528	493	486	494	500	525	550	598	624	675	728	783	840	870	930
11	2	8	15	24	40	60	84	112	153	220	308	444	611	728	720	640	578	540	532	540	546	572	598	648	675	728	783	840	899	930
12	2	6	15	24	35	54	77	104	135	190	253	348	494	672	795	784	714	630	589	580	588	594	621	648	700	754	810	840	899	960
13	2	6	12	24	35	48	70	96	126	160	220	288	390	546	735	864	867	774	684	640	630	638	644	672	725	754	810	868	899	960
14	2	6	12	24	35	48	70	88	117	150	187	252	325	434	600	800	**952**	936	836	740	693	682	690	696	725	780	837	868	928	960
15	2	6	12	20	35	48	63	88	108	140	176	216	286	364	480	656	867	**1026**	1007	900	819	748	736	744	775	806	864	896	928	990
16	2	6	12	20	30	48	63	80	108	130	165	204	247	322	405	528	714	954	**1102**	1080	966	880	828	792	800	858	891	924	957	990
17	2	6	12	20	30	42	63	80	99	130	154	192	234	280	360	448	595	774	1026	**1180**	1176	1056	943	888	875	910	945	952	986	1020
18	2	6	12	20	30	42	56	80	99	120	154	180	221	266	330	400	493	648	836	1100	**1281**	1254	1127	1032	975	988	1026	1036	1044	1050
19	2	6	12	20	30	42	56	72	99	120	143	180	208	252	300	368	442	540	703	920	1176	**1364**	1357	1224	1125	1144	1161	1120	1102	1110
20	2	6	12	20	30	42	56	72	90	120	143	168	208	238	285	336	408	486	589	760	987	1254	**1449**	1440	1350	1352	1350	1260	1189	1170
21	1	6	12	20	30	42	56	72	90	110	143	168	195	238	270	320	374	450	532	640	819	1034	1311	**1536**	1575	1586	1593	1484	1334	1260
22	1	4	12	20	30	42	56	72	90	110	132	168	195	224	270	304	357	414	494	580	693	880	1104	1392	**1600**	**1716**	**1782**	1736	1566	1440
23	1	4	9	20	30	42	56	72	90	110	132	156	195	224	255	304	340	396	456	540	630	748	920	1176	1425	1586	1755	**1904**	1827	1650
24	1	4	9	16	30	42	56	72	90	110	132	156	182	224	255	288	340	378	437	500	588	682	805	984	1200	1352	1512	1792	**2001**	1950
25	1	4	9	16	25	42	56	72	90	110	132	156	182	210	255	288	323	378	418	480	546	638	736	864	1025	1144	1269	1540	1885	**2100**
26	1	4	9	16	25	36	56	72	90	110	132	156	182	210	240	288	323	360	418	460	525	594	690	792	900	988	1107	1316	1595	1950
27	1	4	9	16	25	36	49	72	90	110	132	156	182	210	240	272	323	360	399	460	504	572	644	720	825	910	999	1148	1363	1680
28	1	4	9	16	25	36	49	64	90	110	132	156	182	210	240	272	306	360	399	440	504	550	621	696	775	858	918	1036	1218	1440
29	1	4	9	16	25	36	49	64	90	110	132	156	182	210	240	272	306	342	399	440	483	550	598	672	750	806	891	980	1102	1260
30	1	4	9	16	25	36	49	64	81	110	132	156	182	210	240	272	306	342	380	440	483	528	598	648	725	780	837	924	1044	1170