Experimenting with Focal Points and Monetary Policy

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To Jonas

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Emma Svensson Lund, November 2012

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Chapter 1

Introduction

1.1 Background

Economic experiments have provided economists with new tools to study economic behavior. First, experiments allow researchers to examine the effect of variables that may be difficult to isolate, or even measure, in field data such as cognitive biases, social norms, and risk attitudes. Second, they are particularly useful for testing and improving assumptions and predictions of how people interact in strategic environments. In strategic situations where there are many potential theoretical outcomes, experiments can thus help predict which one of the outcomes economic agents will choose.

The Nash demand game, introduced by Nash (1953), deals with how two players divide a surplus. This surplus may be the gains from trade that arise when a buyer and a seller transact. For example, if a seller holds a good that she values less compared to a potential buyer, both can be better off by trading with each other. However, first they need to agree on how to divide the difference between the buyer's and the seller's valuations. Thus, they need to engage in bargaining in order to agree on a division. Theoretically, there are many divisions in the Nash demand game that are Nash equilibria, i.e. situations where rational players cannot be better off by changing their strategies, so these equilibria do not provide much guidance on what division we should expect. Bargaining experiments, on the other hand, typically find that participants tend to split the surplus equally

(see e.g. Roth, 1995, Camerer, 2003).

One reason for why participants are likely to choose this division is that if we invite a third, impartial, party to divide the surplus, splitting it equally between the two parties is a natural choice. But if the parties believe that this will be the choice of such an arbitrator, they may choose it without her (Myerson, 1991). In this respect, the equal-split stands out from other divisions and both parties choose it because they expect that the other party will, i.e. it is a *focal point* (Schelling, 1960).

Competing focal points may, however, be induced by how the situation is described to participants in experiments. These focal points may alter participants divisions of the surplus even though the underlying game remains unchanged (see e.g. Roth and Schoumaker, 1983, Mehta et al. 1992). This effect is challenging because real-life bargaining typically come with context. Chapter 2 in this thesis uses a novel approach to experimentally investigate how a competing focal point, induced by a product with a well-known price, affects participants' division of the surplus in a Nash demand game and if there are factors related to this division. Chapter 3 expands the findings in Chapter 2 and examines if the effect of the product is eroded when participants become more experienced, and if different information feedback affects this process.

While experiments have improved our understanding of microeconomic behavior and strategic interactions, it is harder to perform experiments that examine aggregate effects in the macroeconomy caused by agents such as central banks.[1] In particular, policy-makers often wish to understand the effect of a monetary policy shock on economic growth, inflation, and employment in order to design appropriate policy. One solution is to use Vector Autoregressions, introduced by Sims (1980), together with impulse responses. With these tools, the researcher can use data on how the economy has behaved in the past and introduce a shock in one variable to see how this shock disperses to the rest of the economy and how large the impact will be on various macroeconomic variables, such as employment.

Many studies have used this approach to investigate the effects of monetary

[1]However, several economic experiments have investigated and improved our understanding of macroeconomic issues, e.g. inflation expectations, fiat money, and money illusion (see Duffy, 2008).

policy shocks but they are typically concerned with national aggregates or cross-country studies. A monetary policy shock may, however, have asymmetric effects within a country since countries often consist of an eclectic mix of geographical entities with different economic structures. These differences mean that a contractionary policy shock can have large effects in some regions and small, or none, in others. Chapter 4 in this thesis uses the VAR approach with impulse responses to examine whether a monetary policy shock causes differential effects on regional employment in Sweden and the sources of such effects.

The next three sections briefly review each of the chapters and summarize their main results and implications.

1.2 Equal-Splits or Product Prices: An Experiment

Chapter 2, co-authored with Håkan J Holm, uses a novel approach to experimentally investigate how subjects divide the surplus in a Nash demand game. It is motivated by the finding that how a game is described to subjects may influence their choices since these descriptions can affect what they perceive to be focal (e.g. Roth and Schoumaker, 1983, Mehta et al. 1992). In our main experimental treatment, we let a buyer and a seller bid for a liter of milk. This product has a market price well-known to the subject pool, and this price therefore induces an additional focal point to equal-splits.

The market frame with an actual product is appealing because, ultimately, we want to say something in general about how people are expected to act in the real world. As nicely put by Binmore and Samuelson (2006), "Real-life games come with frames that relate actions to the context in which the game is played." (p. 22). Outside the laboratory, people often bargain for physical goods and have access to some information about their historical or prevailing price. Thus, this experiment tells us something about how robust outcomes, based on abstract frames, are when controlled field factors enters the lab.

The experiment shows that some subjects choose equal-splits and others choose the price of milk. We find that self-serving bias, cognitive reflection, consumption, and to some extent personality traits, help explain why some sub-

jects are attracted to the product price. These results imply that behavioral differences are important when people choose focal points, and that experiments based on abstract frames may be misleading for understanding bargaining outcomes in real markets, where buyers and sellers typically have some idea of the price of the product.

1.3 The Persistence of Product Prices in the Lab

Chapter 3 extends the findings in Chapter 2 and examines if the product focal point is sensitive to experience and if there are factors that are related to how persistent it is. Chapter 2 shows that a product with a well-known market price can induce an additional focal point that many subjects choose even though it causes highly unequal divisions. However, the experiment only lets subjects play the product treatment once. This may be problematic since many bargaining situations are not one-shot games and initial unfamiliarity with the game may affect which choices subjects think they can make (see e.g. Bayer et al. 2009).

Repetition is a common solution to these issues and allows subjects to learn about the underlying game (Roth, 1995). Thus, even if subjects initially perceive the situation as one where they are to buy and sell the product for the prevailing market price, with repetition they may come to see the product as simply an addition to the available surplus. This implies that the product focal point may be sensitive to experience and that we may come to observe convergence towards equal-splits. However, the experience subjects gain may be affected by the amount of feedback that they receive, and the feedback they receive in the beginning of the game (Van Huyck, 1990, Binmore et al. 1993, Duffy and Feltovich, 1999).

To experimentally examine if the effect of the product is eroded with experience, I let a buyer and a seller bargain for a coca-cola for ten periods. After each period, they receive feedback on the outcome. In the full information treatment, both the buyer and the seller are updated with each other's bids and if the transaction has been successful or not. In the partial information treatment, only the buyer is updated with the seller's bid, while the seller only learns about the state

of the transaction. The latter treatment thus reflects an information asymmetry that prevails in many markets where sellers do not observe the buyer's reservation price.

The experiment finds that the difference in feedback affects the outcome, where average bids converge to equal-splits with full information but not with partial information. Initial experience influence the final outcome as there is no convergence to equal-splits for subjects that switch from the partial to the full information treatment after ten periods. In addition, the experiment finds that individual differences in cognitive reflection, consumption, and valuation, help predict subjects' repeated choice of focal point.

These results indicate that to predict how people divide the surplus in the presence of products and services that they have some idea of the price of, we may need to know who divides and what experience she has. In addition, the results also carry some implications for price adjustment. They suggest that prevailing prices may be quite resilient to adjustment since buyers and sellers may become "stuck" on them. In particular, when the seller does not observe the buyer's reservation price, which is typically the case in many markets, sellers may struggle to increase prices because they expect that buyers will not approve (see Kahneman et al. 1986).

1.4 Regional Effects of Monetary Policy in Sweden

Chapter 4 uses the VAR model, together with impulse responses, to examine the effects of a monetary policy shock on regional employment, and the sources of such effects. Many nations consist of an eclectic mix of regions with different economic and social infrastructure. These different conditions mean that monetary policy shocks can have asymmetric effects on regional economies. Despite this, few studies assess the implications of such shocks at the regional level within nations (see e.g. Carlino and Defina, 1999, Georgopoulous, 2009, Ridhwan, 2011). There is much to be learned by studying the transmission mechanism within a country since the research does not struggle with the same institutional differences as do cross-country studies such as those of the Euro Area.

To examine how regional employment responds, I apply a contractionary monetary policy shock to employment in the Swedish regions, *län*, using data from 1993:1 to 2007:4. This time period is characterized by a coherent policy environment in which explicit inflation targeting is the goal. The regions are all subject to the same overarching regulatory and financial environment, and to the same central bank, *Riksbanken*, which imposes the same policy shock across all regions.

The Swedish study complements previous regional studies of the US, Canada, Germany, the Netherlands, India, and Indonesia, in a number of aspects. First, compared to a large and fairly closed economy such as the US, exchange rate effects and foreign impulses are important in a small, open economy such as the Swedish (see e.g. Kim and Roubini, 2000). Second, the use of annual data in the Dutch, German and Indian study may cause timing issues in identifying the effects of monetary policy. Third, the number of official regions in Sweden is larger than the Canadian provinces allowing for a more systematic assessment of the transmission channels.

The results show that the Swedish regions respond asymmetrically to a contractionary monetary policy shock. Most regions experience a fall in employment while other regions do not significantly change employment. The sources of these differences seem to come from the interest and exchange rate channel where increases in the policy interest rate affects interest-sensitive output and exports. In addition, there is one group of regions that, surprisingly, see increased employment in response to the same policy shock.

These results carry implications for policy. First, they show that it is clearly insufficient to evaluate the effect of monetary policy at the aggregate level if policy-makers wish to target aversive effects on employment with fiscal policy. In addition, better geographical labor market matching processes and higher labor mobility smooths the asymmetric outcomes in regional employment when Riksbanken contracts the economy. Above all, these results emphasize the need to disaggregate studies of monetary policy to the regional level to better understand the transmission channel effects on regional economies.

References

Bayer, R-C., Renner, E., Sausgruber, R., 2009. Confusion and reinforcement learning in experimental public goods games. CEDEX Discussion Paper No. 2009-18.

Bernanke, B. S., Gertler M., 1995. Inside the black box: the credit channel of monetary policy transmission. Journal of Economic Perspectives 9 (4), 27-48.

Binmore, K., Samuelson, L., 2006. The evolution of focal points. Games and Economic Behavior 55, 21-42.

Binmore, K., Swierzbinski, J., Hsu, S., Proulx, C., 1993. Focal points and bargaining. International Journal of Game Theory 22 (4), 381-409.

Camerer, C. F., 2003. Behavioral game theory: experiments in strategic interaction. Princeton University Press, Princeton, NJ.

Carlino, G., DeFina, R., 1999. The differential regional effects of monetary policy: evidence from the U.S. states. Journal of Regional Science 39 (2), 339-358.

Duffy, J., 2008. Experimental macroeconomics. The New Palgrave Dictionary of Economics. Second Edition. In: Durlauf, S.N., Blume, L.B. (Eds.) The New Palgrave Dictionary of Economics Online. Palgrave Macmillan, www.dictionaryofeconomics.com/dictionary, June 2011.

Duffy, J., Feltovich, N., 1999. Does observation of others affect learning in strategic environments? an experimental study. International Journal of Game Theory 28, 131-152.

Georgopoulous, G., 2009. Measuring regional effects of monetary policy in Canada. Applied Economics 41, 2093-2113.

Kahneman, D., Knetsch, J. L., Thaler, R., 1986. Fairness as a constraint on profit seeking: Entitlements in the market. The American Economic Review 76 (4), 728-741.

Kim, S., Roubini, N., 2000. Exchange rate anomalies in the industrial countries: a solution with a structural VAR approach. Journal of Monetary Economics 45 (3), 561-586.

Mehta, J., Starmer, C., Sugden, R., 1992. An experimental investigation of focal points in coordination and bargaining: some preliminary results. In Decision making under risk and uncertainty: new models and empirical findings, Ed. Geweke, J., Kluwer Academic Publishers, Dordrecht.

Myerson, R.B., 1991. Game theory: analysis of conflict. Harvard University Press, Cambridge MA.

Nash, J., 1953. Two-person cooperative games. Econometrica 21 (1), 128-140.

Ridhwan, M.M., De Groot, H.L.F, Rietveld, P., Nijkamp, P., 2011. The regional impact of monetary policy in Indonesia. Tinbergen Institute Discussion Paper TI 2011-081/3.

Roth, A.E., 1995. Bargaining experiments. In Handbook of Experimental Economics, Eds. Kagel, J. H., Roth, A.E., Princeton University Press, Princeton NJ.

Roth A.E., Schoumaker, F., 1983. Expectations and reputations in bargaining: an experimental study. American Economic Review 73 (3), 362-372.

Schelling, T., 1960. The strategy of conflict, Harvard University Press, Cambridge MA.

Sims, C., 1980. Macroeconomics and reality. Econometrica 48 (1), 1-48.

Van Huyck, J.B., Battalio, R.C., Beil, R.O., 1990. Tacit coordination games, strategic uncertainty, and coordination failure. American Economic Review 80 (1), 234-248.

Chapter 2

Equal-Splits or Product Prices: An Experiment

with Håkan J Holm

2.1 Introduction

How people divide the surplus in bilateral bargaining has been the topic of much game-theoretical and experimental research (see e.g. Myerson, 1991, Roth, 1995). In games with a large number of Nash equilibria, such as the Nash demand game (NDG), the question arises on how to predict which equilibrium players reach and how they get to this point. Axiomatic solutions to this question (e.g. Nash, 1953, Kalai and Smorodinsky, 1975) propose a set of reasonable properties that need to be satisfied to derive a unique outcome. Another equilibrium selection device is focality (Schelling, 1960), where players look for something that distinguishes a particular point from others, i.e. *salience* or *prominence*. They then choose this point since they expect that others will. To identify these focal points, players may use labels, or frames, that are common knowledge for players, but that are excluded in conventional solution concepts (see e.g. Mehta et al. 1992, 1994b). This paper uses a NDG with a market frame that has competing focal points and asks how players choose equilibrium and what factors affect this selection.

One commonly observed focal point is the 50-50 split.[1] This division is the typical outcome in NDG and other bargaining experiments (see Roth, 1995 and Camerer, 2003), and it has been observed more frequently than what is predicted by the Nash bargaining solution (e.g. Nydegger and Owen, 1974, Roth and Malouf, 1979, Anbarci and Feltovich, 2011). One reason for the focality of the equal-split is due to its welfare properties, i.e. efficency and equity (Myerson, 1991). In particular, the latter property has received much interest (see e.g. Fehr and Schmidt, 1999, Bolton and Ockenfels, 2000). Framing, however, affects the robustness of the equal split.[2] This effect is specifically puzzling because it means that changes in the description of the game that do not change the underlying game alter players' decisions (Tversky and Kahneman, 1984). In particular, Mehta et al. (1992) find that randomly dealt aces from a reduced deck of cards affect the distribution of surplus in an NDG.

This paper investigates the effects of framing on the choice of focal point using a novel approach. We conduct a Nash demand game with a market frame where the price of a well-known product induce a competing focal point. This approach is appealing because it provides a natural frame for subjects, who bargain over an actual physical good. In addition, since this physical good can be seen as one aspect of the field content of an experiment, this approach also adds some insights into how robust laboratory outcomes building on abstract frames are to situations where parties typically have some information about historical prices (see Harrison and List, 2004).

In our baseline treatment, we let a buyer and a seller bid for a hypothetical good. In this treatment, the equal-split is the only focal point, so there are no reasons why players should deviate from a 50-50 split. In the other treatment, we let a buyer and a seller bid prices for a liter of milk, which is a product with a well-known market price for the subject pool. The price of milk therefore

[1] The axiomatic Nash bargaining solution (NBS) predicts that two risk-neutral players with the same disagreement point divide the surplus equally in the Nash demand game.

[2] The robustness of the 50-50 split in bargaining has also been shown to be affected by factors such as entitlements (Gächter and Riedl, 2005) and earned bargaining power (Anbarci and Feltovich, 2011). In particular, Roth and Schoumaker (1983) and Binmore et al. (1993) induce focal points by letting subjects pre-play with computers programmed to demand a specific division. They find that these induced focal points affect how much subjects demand of the cake when they later play a human opponent.

represents an additional focal point. In this treatment, the question is whether subjects will view the situation with milk simply as an addition to the available surplus to be divided or if they will view it as a situation where they should buy and sell a product at a price which is already exogenously established.

We suggest a simple separation mechanism based on heterogeneity among subjects where some subjects focus on how to split the cake and where others are affected by the product. The former group views the situation as a distribution task with a surplus to divide and therefore choose the commonly observed *equal-splits* in both treatments. These subjects can therefore be expected to bid around 50 in both the hypothetical treatment and the milk treatment. The latter group consists of those who are sensitive to changes in the frame and therefore to the *product*. These subjects can therefore be expected to bid around 50 in the hypothetical treatment and around 8, the price of milk, in the milk treatment.[3] The distinction between these two groups helps us to distinguish if there are any characteristics that are distinct for them. Thus, we do not attempt to provide general rules of selection. Instead, we try to understand the reasons behind a particular choice when there are competing focal points, which should also prove useful in situations where two or more rules can be applied (see e.g. Mehta et al. 1994a).[4]

To understand what causes subjects to choose different focal points, we propose that these two groups can be seen as the outcome of a combination of factors. For example, what subjects choose may depend on what attributes that

[3]A related reason for why players opt for the milk price is that it is a reference price. Kahneman, Knetsch and Thaler (1986) show in a much-cited paper that people have reference prices/transactions that they use as benchmarks to assess whether a firm/employer/landlord act fair or not. These reference prices depend on factors such as observed historic prices, costs, competitor's costs (see Xia et al. 2004, Ferguson, 2008). Thus, players may choose this price because they think that it is a fair price and expects that others to do the same.

[4]A number of studies investigate rules in more abstract and theoretical frameworks for how subjects choose focal points in pure coordination games. In particular, Bacharach (1993) and Bacharach and Bernasconi (1997) propose a variable frame theory of focal points in pure coordination games based on what attributes in a given situation are more available for some subjects than others (see also Janssen, 2001 and Bacharach and Stahl, 2000). Sugden (1995) suggests that players use private descriptions of games wherein strategies are identified by labels. Mehta, Starmer and Sugden (1994a) study assignment games where they test if rules of closeness, accession, and equality determine how subjects choose focal points.

come to subjects' minds in a given situation (see Bacharach, 1993, Bacharach and Bernasconi, 1997), or how easily retrievable relevant information is (see Tversky and Kahneman, 1973), or how costly it is to monitor framing information (Binmore and Samuelson, 2006). Thus, there can be several attributes or pieces of information that eventually determines which focal point a subject chooses. We approach this issue by testing a number of factors that are related to subjects' characteristics, such as cognitive sophistication, and that others are related to how strong the frame is for a subject, such as self-serving bias (Babcock et al., 1995, 1997, Konow, 2000).

The result strongly suggests that both sellers and buyers do in fact choose different focal points in the milk treatment but not in the hypothetical treatment. These multiple focal points have detrimental effects on transaction volumes. This result remains when subjects first play the hypothetical treatment and then the milk treatment. In addition, the choice of focal point seems to be self-serving, which means that buyers are more inclined to believe that sellers will choose the milk price than sellers are. We also find that some individual characteristics make it more likely to choose the milk focal point. First, subjects with a low score on a cognitive reflection test are more likely to choose the milk price than subjects with high scores in the same test. This indicates that it requires some cognitive sophistication to focus on the underlying game. Second, high consumption of the good in question (in this case milk) increases the likelihood of choosing the milk price. This result suggests that the choice of focal point may depend on availability of attributes or how easily retrievable some information is (see Tversky and Kahneman, 1973, Bacharach and Bernasconi, 1997). Finally, there is some evidence that open-minded subjects are less likely to choose the milk price, which suggests that the tendency to think in abstract terms play a role in the choice of focal point.

Together, these results imply that the search of general rules in how people choose focal points needs to take into account that there are behavioral differences between subjects, and that part of these differences are due to subjects' characteristics and others are due to the context. In addition, the results suggest that experiments building on abstract frames may be misleading for understanding bargaining outcomes in real markets, where buyers and sellers typically have some idea of the price of the product or service.

2.2 The Game and Hypotheses

This section starts by specifying the Nash demand game and the underlying mechanism behind separation in the context of the game. It then outlines hypotheses and factors that might be important in explaining separation.

2.2.1 Separation

In the Nash demand game studied here, a buyer and a seller simultaneously submit non-negative bids, $p^b, p^s \in [0, 100]$, for a good with value $v \geq 0$ to the buyer. If $p^b \geq p^s$, then there is a transaction and the buyer receives the good and the payoff $100 - p + v$, where 100 is the sum the buyer has in her budget and p is the price which is given by $p = (p^b + p^s)/2$.[5] If $p^b < p^s$ there is no transaction and both players receive zero, which means that the seller does not keep the milk.[6] In this game there are many equilibria. If we concentrate on the set of pure Nash equilibria, this set is given by $p^b = p^s$, and $(p^b = 0, p^s = 100)$. The Nash bargaining solution is given by $p = (100 + v)/2$ (Nash, 1953).[7]

When this game is presented in the context of a hypothetical good (H-treatment) with $v = 0$, the 50-50 focal point dominates since there is no actual good for which the subjects may have priors for. In this treatment, we therefore expect that bids will center around 50, where buyers put in a somewhat higher bid to secure a transaction and sellers, for similar reasons, put in a somewhat lower bid.

In a parallel treatment, we replace the hypothetical good with one liter of milk (M-treatment), a good with a well-known market price, which was around 8 at the time of the experiment. Thus, we induce a competing focal point and hypothesize that some subjects will focus on how to divide the available surplus and therefore choose *equal-splits*, i.e. bid around 50, and that others will focus on the *product*, i.e. on buying and selling milk for the given market price which is

[5] All numbers here refer to Swedish crowns (SEK), which at the time of the experiment was 0.14 USD.

[6] The disagreement point (0,0) is common in Nash demand games, and since the seller does not keep the good, we minimize endowment effects.

[7] Risk preference affects the solution theoretically but is ultimately an empirical question. We will return to this issue in section 2.2.3.

around 8.[8,9] As in the H-treatment, one can expect that buyers put in a somewhat higher bid to secure a transaction and sellers put in a somewhat lower bid for the same reasons. We state our separation hypothesis as follows:

Hypothesis 1: Buyers and sellers will separate in the M-treatment, but not in the H-treatment.

It should be noted that our distinction between the two groups do not explicitly rely on beliefs. Recent research indicates that differences between subjects ability to think strategically, i.e. levels of reasoning, may affect whether subjects take beliefs about how other subjects perceive the situation into account (see e.g. Bardsley et al. 2010). Thus, the actual bid given by a subject is the result of a process that, more or less, includes beliefs. We elicit what subjects believe their opponents will choose, on average, to evaluate how the induced focal point affects subjects' perception of the situation.

2.2.2 Experience and Self-Serving Bias

It is possible that lack of understanding of the strategic situation can explain why some focus on the *product*. If this is the case, one would expect subjects to realize the nature of the situation after playing the H-treatment once, and therefore avoid bidding around the milk price in a subsequent M-treatment. This would also make the *product* strategy less robust. Hence, our next hypothesis is as follows:

Hypothesis 2: Strategic experience obstructs separation.

In the M-treatment we deliberately try to induce competing focal points, where the outcome is affected by how subjects perceive the bargaining situation. Various economic experiments have observed that subjects suffer from self-serving

[8]To ensure that subjects were familiar with the price of milk, we elicited how much they thought a liter of milk cost at the closest general dealer. 98 percent guessed a price between 6 and 13. The modal price guess was 8.

[9]If subjects take the value of the product into account when they divide the surplus in the M-treatment, the equal-split should be marginally higher. However, whether they do or not is ultimately an empirical question and since the valuation of milk is relatively low, we disregard from it in this theoretical presentation.

biases, i.e. they think that an outcome that is favorable to them is more likely to occur (see e.g. Babcock et al., 1995, 1997, Konow, 2000). Babcock et al. (1997, p.111) conclude that "This research suggests that self-serving assessments of fairness are likely to occur in morally ambiguous settings in which there are competing "focal points" – that is, settlements that could plausibly be viewed as fair". In the M-treatment subjects can "choose" to believe that others perceive the situation in the same way as they do. It is a small step to realize that believing in the *product* is relatively more beneficial to buyers than to sellers. For buyers, focusing on the *product* will result in the tempting self-serving belief that sellers will offer low prices. For sellers on the other hand, believing in the *product* strategy is costly, and they might therefore be more inclined to believe that buyers will focus on *equal-splits*. Thus, the self-serving bias will make the buyers' beliefs about their opponents more responsive to the opportunity to (unconsciously) exploit the milk focal point in the M-treatment as a vehicle for price reductions.

Hypothesis 3: The treatment differences in beliefs will be more pronounced among buyers than among sellers.

2.2.3 Factors Affecting Individuals' Choice of Focal Point

To explain the individual variation when there are competing focal points, we study variables that predict subjects' bid in the M-treatment. Some of these variables are related to the strength of the frame for the subject, such as which role she is assigned and her relation to the product, and others are related to a subject's characteristics.

The first group of variables are denoted experimental control. These include the role that the subject have and the order of play. To start with, the role *Buyer* can affect bids. The self-serving mechanism suggests that buyers are more attracted to the milk price. On the other hand, for tactical reasons, buyers should submit higher bids, at a given focal point, than sellers to secure a transaction. Thus, these two mechanisms may counteract each other. Irrespective of this, the role of the subject is potentially important and needs to be controlled for in our analysis. Another experimental control variable is experience. If the *product* strategy is due to lack of understanding of the strategic aspects of the game, one can expect that such a strategy will be more common among subjects who play

the game for the first time, i.e. in *Period 1*, than among those who have played the hypothetical game before playing the M-treatment.

Factors related to milk consumption may also affect how attracted to the milk subjects are. First, the level of subjects' milk *Consumption* may be related to how deeply the market price is imprinted and thereby be the first thing that springs to the subjects mind. Thus, it can therefore be more difficult for a subject to think of other ways of perceiving the situation. Secondly, a subject's *Valuation* of milk may affect what she bids.

Recent research indicates that individuals' tendency to anchor is related to cognitive factors. Bergman, Ellingsen, Johanesson and Svensson (2010) demonstrate that subjects' tendency to anchor their valuations of consumer goods to irrelevant factors is negatively correlated to cognitive ability and cognitive reflection.[10] To control for the latter we include the outcome of the *CRT*-test which is designed to pick up reflective versus impulsive decision-making (see Frederick, 2005).[11] Thus, if this is the case also in the presence of milk, then it implies that some subjects may simply pick what springs to their minds without reflecting sufficiently to distinguish what other options are available in the milk treatment.

Other variables that are related to subjects' characteristics are bargaining attitude and risk preference. Subjects that have an aggressive bargaining attitude may bid a higher price as sellers and a lower bid as buyers. Thus, aggressive types will have a higher *Surplus Demand* than less aggressive types. In addition, risk attitude has implications in many game theoretic models of bargaining, and there is also some empirical evidence that this is the case (see e.g., Murnighan et al., 1988). It is therefore natural to control for *Risk aversion.*

We also include demographic variables: *Male*, *Income* and *Age*, without any strong prior expectations, but their inclusion can be justified by prior research or by economic theory. For instance, Croson and Gneezy (2009) claim that there is robust experimental evidence of gender differences in risk preferences, social

[10]The tendency to anchor on seemingly irrelevant factors was first demonstrated by Tversky and Kahneman (1974). In an influential study, they showed that subjects' estimations of the number of African countries in the UN are affected by a random number generated by a fortune wheel.

[11]Due to the number of variables included in the experiment, we only control for cognitive reflection, which is a short test of three questions. These questions are designed so that the answer that first comes to mind is incorrect and the correct answer requires cognitive reflection.

preferences and in preferences for competition. All these dimensions may affect the bargaining game in this study. In relation to the age variable, Güth, Schmidt and Sutter (2007) detected, in a large newspaper ultimatum experiment, that older subjects are more concerned with equal distribution than younger ones. The income variable can be justified on many grounds. For instance, income might affect the motivation to make an optimal choice in the experiment or the local curvature of the utility function and thereby the degree of risk-aversion.

Finally, we include a set of variables that we find interesting to explore and for which we do not have any strong prior expectations. We ask if there are specific personality traits, such as being an open-minded person, or other sociological factors that are related to choosing a particular focal point. To this end we use a personality test based on the Five Factor Model (FFM), a popular model in psychology, which maps the basic structure of all personality traits (see e.g. Goldberg, 1993).[12] To limit the number of statements that the subjects have to consider about their character in this test, we exclude some of the facets of the FFM and include the following: *Morality*, *Cooperation*, *Altruism*, *Modesty*, *Sympathy*, *Trust*, *Intellect*, *Liberalism*, *Dutifulness* (moral obligation) and *Cautiousness* (the disposition to think through possibilities before acting). In the personality test we also include a *Self monitoring* scale that measures how much an individual tries to adapt to what the situation requires. A low self-monitor acts on feelings while a high self-monitor is sensitive to the environment (Snyder, 1974).[13] Thus, we expect that a high self-monitor considers that she is in the laboratory and therefore focuses on dividing the surplus equally. The final set of exploratory variables relates to the individual's degree of social activity and includes the number of friends, *Contacts*, and *Time* spent on social networks such as Facebook.

[12]The personality test statements are available on a public domain webpage, The International Personality Item Pool (IPIP), www.ipip.ori.org along with instructions and scoring keys. Swedish translations for the statements come primarily from Martin Bäckström's online personality test lab www.pimahb.com.

[13]Self-monitoring has previously been correlated with differences in advertisement and willingness to pay for a product (Snyder and DeBono, 1985). The self-monitoring scale also comes from the IPIP website.

2.3 Experimental Design

We ran the experiments in five sessions at Lund University on May 5-7, 2010. The 126 students that participated were recruited during lectures in the introductory course in Economics. Four written experimental forms were handed out separately and we collected every form before proceeding with the next one.[14]

The students were divided into four groups; seller and buyer in the M-treatment, and seller and buyer in the H-treatment. To create these groups, we split the classroom into four equal sizes with one group in each corner of the classroom. The students were informed that they would be matched against an anonymous opposite (buyer if seller, seller if buyer) and did not know the division in the classroom. After a verbal introduction of the general purpose of the experiment, the students received written information, an identity note and instructions for the first part of the experiment. Each identity note had a unique number that the students wrote on all parts of the forms so as to remain anonymous. They also used the identity note to collect their earnings a few days after the experiment.

After reading the instructions,the students played the Nash demand game by writing down a selling price or a buying price. They also stated how much they believed that their opponent group (e.g. sellers if the subject was a buyer) would sell/buy their good for. This belief elicitation was incentivized by rewarding subjects with respect to how close their guesses were to the average opponent's bid.[15] After all the subjects had completed this first part, we collected all the forms except for the identity note. The subjects did not receive any information about the outcome of the game, i.e. the market price and whether the transaction was successful or not, and they did not know that they would play two games in a row but with different goods. For the second round of the game, the sellers and buyers switched goods (e.g. a seller in the M-treatment became a seller in the H-treatment) and we repeated the same game with these switched goods and collected the forms once they were filled in.

The third part of the experiment consisted of elicitation of valuation of milk,

[14]Instructions and transfer forms are available in Appendix A.

[15]It is well-known that, in theory, belief elicitation might trigger a hedging problem. However, unless the hedging opportunity is very prominent, it seems to be a minor problem (see Blanco et al., 2008). We therefore prioritized simplicity in the belief elicitation task.

familiarity with the actual price of milk at the present time, risk preference, bargaining attitude and the cognitive reflection test. To elicit how much every subject valued milk, we used a list of decisions between a liter of milk and an increasing sum of money. We also asked what they thought was the highest price others would pay for milk in the valuation task, and how much one liter of milk cost at the closest general dealer. We elicited risk preference through a multiple price list (see Binswanger, 1980, and Holt and Laury, 2002). To elicit bargaining attitude, we used a scenario where the subject had to decide on how to split a taxi fare with an old classmate, and the length of the taxi ride was randomly varied across the four treatment groups. The final part of the experiment consisted of the personality test and a questionnaire on demographics, milk habits and social activity information on the students. The students handed in this part once they had completed the questionnaires and left the classroom.

The experiment lasted about 60 minutes and average earnings were 200 SEK (≈$26), to be compared with 120 SEK(≈ $16), which at the time of the experiment was the average hourly pay for this age group in Sweden. Every subject received a 50 SEK show-up fee.

Table 2.1: Sequence of Play

No. subjects	**31**	**30**	**31**	**31**
Role	Seller	Buyer	Seller	Buyer
	↓	↓	↓	↓
Period 1	M-treatment		H-treatment	
	↓	↓	↓	↓
Period 2	H-treatment		M-treatment	
		↓	↓	
	Elicitations, Personality test, Questionnaire			

2.4 Results

This section presents the results from the experiment based on the hypotheses and discussion in section 2.2.

2.4.1 Separation

Our first result concerns the separation in the choice of focal point. According to Hypothesis 1, we expect that bids in the H-treatment center around the equal-split, i.e. around 50, and hence no separation. In contrast, in the M-treatment we expect separation with some bids around the milk price, 8, and some bids around the equal-split.

Figure 2.1 shows the distribution of the first round. The data clearly supports Hypothesis 1. In the H-treatment prices are set around 50 with somewhat higher bids submitted by buyers compared to sellers, possibly to secure the transaction. In the M-treatment, there is a clear indication of separation since the distributions are double peaked with a substantial mass below 30. Thus, both buyers and sellers in the M-treatment submit lower prices. The average prices among sellers are 41.5 and 51.3 in the M-treatment and H-treatment, respectively. The corresponding figures among buyers are 37.2 and 59.3. A robust rank test rejects (p=0.023, n=62 for sellers and p=0.0005, n=61 for buyers) that the distributions come from the same underlying price distribution.[16]

The presence of two focal points in the M-treatment also causes significant losses in transactions. Only 48 percent of all possible transactions take place in the M-treatment compared to 81 percent in the H-treatment and this difference is highly significant (Chi-square test, p=0.008, n=62 in period 1).

2.4.2 Experience

We now investigate if the experience of having played the game once affects bids. By inspecting the distributions in Figure 2.2, the first thing to note is that the double peaked distributions in the M-treatments and the single peaked ones in the H-treatments remain. Hence, we cannot confirm Hypothesis 2, since separation seems to be robust to experience.

If we look at how the different groups change their behavior in Table 2.2 we find that sellers who move from the M-treatment to the H-treatment increase their average bid from 41.5 to 45.1, while sellers who move from the H-treatment

[16] A robust rank test is used since the variances differ in the two treatment distributions due to separation (see Siegel and Castellan, 1988, p.137). The distributions for the groups in Figure 2.1 verify this conjecture.

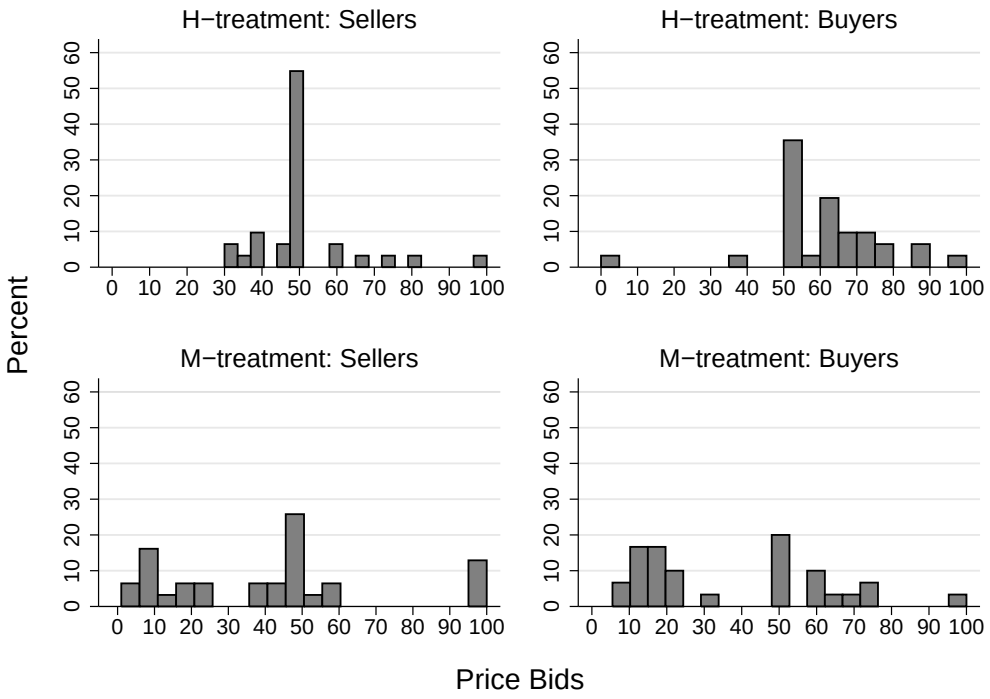

Figure 2.1: Distribution of Buyers' and Sellers' Price Bids in H-treatment and M-treatment in Period 1

to the M-treatment decrease their bids from 51.3 to 38.6. Hence, there is a tendency that the M-treatment generates the lowest prices (independently of the order). A within-subject analysis of proportion of sellers who change bids from the H-treatment to the M-treatment (irrespective of order) confirms this supposition. 26 sellers have lower bids in their M-treatment and 12 sellers have higher bids (while 24 do not change their bids).[17] We can reject the null hypothesis that the probability of increasing a bid is equal to the probability of lowering a bid in the two treatments (two-sided, Wilcoxon signed-rank test, n=62, p=0.0179). This suggests that the average sellers change their behavior to have their lowest bid in the M-treatment. Thus, a substantial fraction of the sellers are malleable to the change in the frame.

[17]In the group that first received the M-treatment, 13 increased (7 decreased) their price in the following H-treatment. In the group receiving the H-treatment first, 13 decreased (5 increased) their price in the following M-treatment.

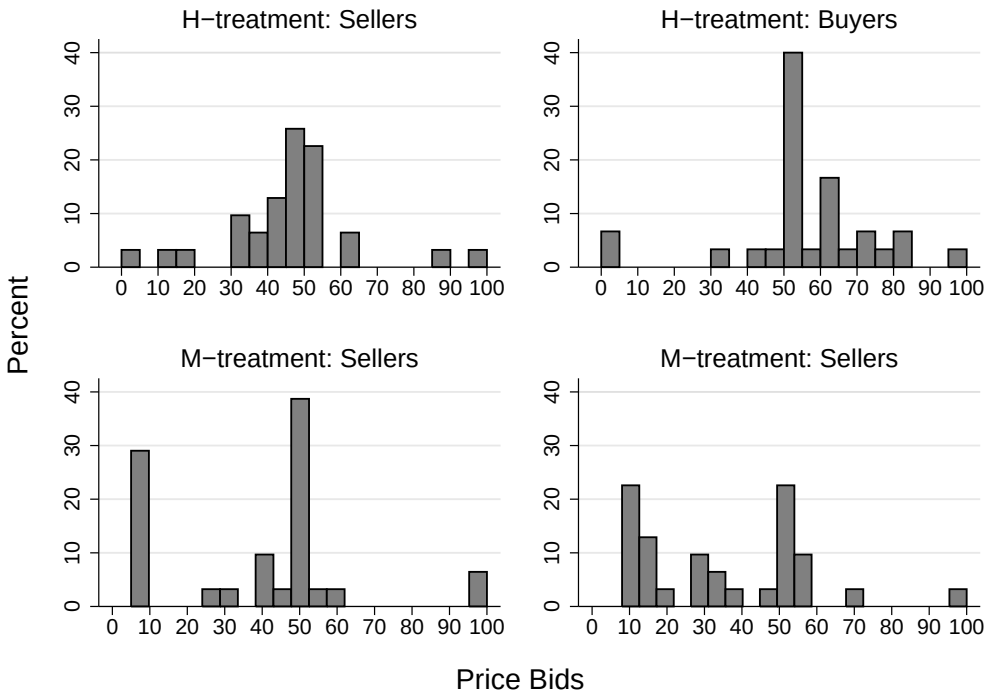

Figure 2.2: Distribution of Buyers' and Sellers' Price Bids in H-treatment and M-treatment in Period 2

We now move to the group of buyers. In the second period, the average prices set by the buyers in the M-treatment and the H-treatment are 34.9 and 53.9, respectively. If we also look at the changes in behavior, we find that buyers moving from the M-treatment to the H-treatment increase their average bid from 37 to 53.9. Those who move from the H-treatment to the M-treatment decrease their bids from 59.3 to 34.9. A within-subject analysis of the proportion of buyers who change bids from the H-treatment to the M-treatment (irrespective of order) reveals that 36 subjects have lower bids in their M-treatment and only 9 subjects have higher bids (while 16 do not change their bids).[18] Here, we can also reject the null hypothesis that the probability of increasing a bid is equal to the probability of lowering a bid in the two treatments (two-sided, Wilcoxon

[18]In the group that first received the M-treatment, 15 increased (5 decreased) their price in the following H-treatment. In the group receiving H-treatment first, 21 decreased (4 increased) their price in the following M-treatment.

signed-rank test, n=61, p=0.000). This strongly suggests that, even with some experience, buyers move in the direction of decreasing (increasing) their bids in the milk (hypothetical) treatment. A substantial proportion of buyers adapt to the change in the frame.

Table 2.2: Average Prices in the Treatment Groups in Period 1 and Period 2

Role	**Seller**	**Buyer**	**Seller**	**Buyer**
	↓ (41.5)	↓ (37)	↓ (51.3)	↓ (59.3)
Period 1	M-treatment		H-treatment	
	↓ (45.1)	↓ (53.9)	↓ (38.6)	↓ (34.9)
Period 2	H-treatment		M-treatment	

In addition, the pervasive effect on transaction volumes due to two focal points remains. The proportion of transactions in the M-treatment is still 48 percent but falls slightly to 74 percent in the H-treatment. However, the difference remains significant (Chi-square test, p=0.037, n=62).

2.4.3 Self-Serving Beliefs and Expected Payoffs

According to Hypothesis 3, we should observe a more substantial treatment effect among buyers than among sellers if subjects form self-serving beliefs about their opponents' choice of focal point since buyers benefit from coordinating on the milk price. This is indeed also the case. In the first period, the average buyer's beliefs of the average seller bid are 26.2 and 54.8 in the M-treatment and H-treatment, respectively. This gives a treatment difference in average belief of 28.6. The corresponding average beliefs among sellers, also in the first period, are 50.0 and 54.1, which gives a treatment difference of only 4.1. In the second period almost equally strong figures can be observed.

By inspecting how much the individual subjects change their beliefs between the treatments, we get an indication of whether there is a significant difference between sellers and buyers in how they react to the treatment differences. In Figure 2.3, we give the individual belief differences (H-treatment belief minus M-treatment belief) for buyers and sellers. The null hypothesis that the distri-

butions of these differences come from the same underlying distribution can be strongly rejected (two-sided, Wilcoxon-Mann-Whitney test, n=122, p=0.0002). These results support Hypothesis 3, i.e. there is a self-serving bias present. Subjects' judgements of their opponents' choice of focal point thus depend on whether they act as a seller or a buyer.

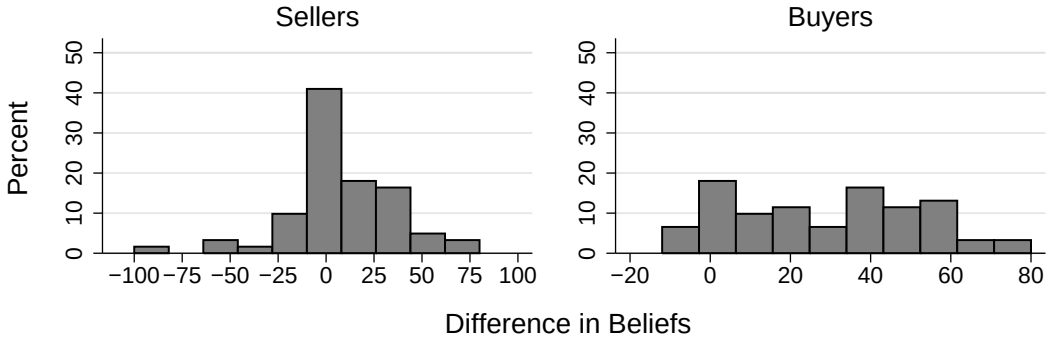

Figure 2.3: Individual Differences in Beliefs Between H-treatment and M-treatment

These role contingent treatment differences in beliefs also come through in actual bids. The average differences between the M- and H-treatment in the first period are 22.3 among buyers and 9.8 among sellers. In the second period, the differences are 19 and 6.5, respectively. The distributions of how the individual subjects change their prices also indicate that there is a significant difference between sellers and buyers. The null hypothesis that the distribution of these differences comes from the same underlying distribution can be rejected (two-sided, Wilcoxon-Mann-Whitney test, n=123, p=0.039).

It is also instructive to look at the expected payoff of different buyer and seller bids in Figure 2.4. The expected payoff curve indicates the best-responses against the observed bid distributions. In the H-treatment, the expected payment increases in seller prices up to around 50, where it drastically decreases. For buyers, the expected payoff for low bids is zero but increases rapidly as prices get closer to 50 after which the price decreases. Disregarding from some small notches, the curves in the H-treatment are single peaked with best-responses around 50. Around 50, the curves have steep parts suggesting that players are punished rather severely when they deviate from the focal point.

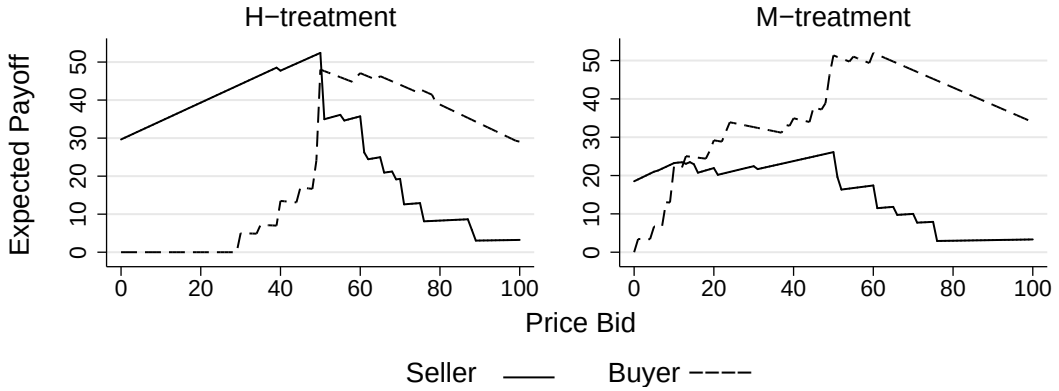

Figure 2.4: Expected Payoff of Various Bids for Buyers and Sellers in the H-treatment and M-treatment

The corresponding curves in the M-treatment are flatter. One remarkable difference between the buyers' curve in this treatment compared to the buyers' curve in the H-treatment is that the expected value rises steeply already for low values. This reflects the fact that some sellers will accept low bids with very beneficial prices to buyers. Even if low bidding buyers are relatively generously rewarded with a local maximum around 23, the global maximum is around 50. Sellers' curve in the M-treatment is even flatter than the buyers' curve which illustrates the following dilemma: If sellers bid around the market price for milk, 8, the probability for a transaction will be high, but the price will be low. On the other hand, if they increase their bids above the market price they will get a higher price but encounter a relatively low probability that it is accepted due to *product* buyers. Thus, the flat seller curve with a local maximum around the market price for milk gives a rationale for the reluctance to deviate from the milk price that a seller may experience.

2.4.4 Choosing Focal Point

In this section we further explore individual differences with respect to the chosen focal point. Those subjects that focus on the *product* bids around price of milk, i.e. around 8, in the M-treatment and around 50 in the H-treatment while those subjects that focus on the *equal-splits* bids around 50 in both treatments. Allowing for some noise and the strategic uncertainty that buyers need to set a

price not lower than the seller, we classify bids between 5 and 25 as bids around the milk price and bids between 26 and 75 as equal-split bids. The few bids below 5 and above 75 are excluded from the analysis.[19] According to Hypothesis 1, there should only be bids between 5 and 25 in the M-treatment since there is no competing focal point in the H-treatment. Thus, the treatment differences should be even more evident with classification. Table 2.3 contains the distribution of the two groups of bids in all treatments and confirms that Hypothesis 1 holds very well except for two bids in one H-treatment. Thus, to study individual differences we rely exclusively on the behavior in the M-treatment and we use the bids between 5 and 25 in as *product* bids and bids between 26 and 75 as *equal-splits* bids.

Table 2.3: Number of Bids as between 5 to 25 and 26 to 75 (in parentheses): All Treatments

	M-treatment	**H-treatment**
Seller 1st period	15 (10)	29 (0)
Seller 2nd period	19 (10)	26 (2)
Buyer 1st period	14 (15)	27 (0)
Buyer 2nd period	18 (12)	25 (0)
Total	66 (47)	107 (2)

We use a logit regression analysis on these observations where the chosen focal point is the dependent variable (*product* = 1, *equal-splits* = 0). We include several categories of variables to investigate the determinants behind a subject's choice (see section 2.2.3). These include variables relating to: i) experimental control, ii) demographics iii) risk behavior iv) milk consumption v) cognitive reflection vi) personality traits, vii) social activity. Descriptive data for our sample is presented in Table 2.5 in the Appendix 2.6.

Our estimation strategy is to include i)-ii) as control variables and then test variables iii) to v) first since these variables can be motivated either by theory

[19]In total there are ten observations that fall outside the range of these two classifications.

or by earlier research. We then separately explore the vi)-vii) variables with the variables that are significant in the first part of the analysis. In this way we reduce the problem of overfitting.

Equations 1 and 2 in Table 2.4 show that neither the experimental controls nor the demographic variables strongly predict *product*. Only *Male* is significant but at the 10 percent level. We can also see in Equation 2 that *Surplus Demand*, *Risk Aversion* and *Valuation* do not have any significant predictive power but cognitive reflection, as measured by *CRT*, is significantly and negatively associated with *product*. This is also the case with *Consumption*, which is weakly significant and has the expected sign. A Wald test shows that the insignificant variables in Equation 2 are also jointly insignificant (p=0.928).[20] *Male* becomes insignificant when we remove the insignificant variables leaving *CRT* and *Consumption* significantly correlated to the *product* as presented in Equation 3.[21]

We also want to explore if psychological and sociological variables, as measured by the personality trait indicators and social activity indicators, can help explain who responds to the product. Given the number of variables to explore and that some of them (primarily the personal trait variables) are correlated, we apply the strategy of picking out the variables that are significantly correlated to the dependent variable at the 10 percent level and we then test them separately in a model with the variables in Equation 3. From the correlations we find that *Morality* (0.25), *Modesty* (0.20), *Intellect* (-0.22), *Liberalism* (-0.24), and the aggregate facet *Openness* to experience (-0.31) are all significantly correlated to *product*.[22]

These correlations all make some sense. It is possible that moral individuals are more prone to react to prices that deviate from their historic or normal price than less moral individuals. If following moral principles is to rely on some form of behavioral rigidity, then since almost everyone has accepted the market price of a common good like milk, deviations from it may be morally provoking. *Modesty* also makes sense if one believes that choosing something other than the

[20]We use a Wald test as there are missing observations for some of the variables.

[21]A Wald test also shows that *Male* and *Valuation* are jointly insignificant and jointly insignificant with the other insignificant variables in Equation 2.

[22]We use the biserial correlation coefficient that estimates the correlation between a binary variable with an underlying normal distribution and a continuous normally distributed variable.

Table 2.4: Logistic Regression of Choice of Focal Point

Explanatory Variables	**Eq. 1**	**Eq. 2**	**Eq. 3**	**Eq.4**	**Eq.5**	**Eq.6**
INTERCEPT	1.30	1.074	0.178	0.597	0.133	2.733
	(0.585)	(0.725)	(0.674)	(0.775)	(0.933)	(0.018)
I. Experimental control						
Buyer	0.324	0.242				
	(0.419)	(0.592)				
Period 1	0.295	0.38				
	(0.462)	(0.406)				
II. Demographics						
Male	-0.719*	-0.808*				
	(0.075)	(0.089)				
Income	-0.0034	-0.0015				
	(0.334)	(0.670)				
Age	-0.062	-0.076				
	(0.579)	(0.536)				
III. Bargaining attitude						
Surplus Demand		0.0034				
		(0.690)				
IV. Risk attitude						
Risk aversion		0.0198				
		(0.872)				
V. Cognitive reflection						
CRT		-0.512**	-0.607***	-0.536***	-0.579***	-0.569***
		(0.023)	(0.002)	(0.010)	(0.005)	(0.005)
VI. Milk consumption						
Consumption		0.256*	0.274**	0.306***	0.317***	0.287**
		(0.052)	(0.019)	(0.010)	(0.009)	(0.014)
Valuation		0.066				
		(0.383)				
VII. Personality traits						
Morality				0.237		
				(0.338)		
Modesty				0.259		
				(0.268)	0.036*	
Intellect				-0.298	(0.094)	
				(0.182)		
Liberalism				-0.333	-0.039*	
				(0.130)	(0.068)	
Openness						-0.054**
						(0.017)
No. of observations	110	102	112	112	112	112
Significance of model:						
P-value (Prob > chi2)	*0.303*	*0.064*	*0.0013*	*0.0010*	*0.0005*	*0.0002*

P-values in parentheses. The Pearson correlation coefficients between the explanatory variables are below 0.35 for all correlations. Estimates of the variance inflation factors (VIFs) are no higher than 1.25. Thus, these measures do not indicate any serious multicollinearity. Tests for heteroscedasticity using a heteroscedastic probit regression in Stata on equations 5 and 6 show no significant improvement of generalizing the homoscedastic model. We only test these two as omitted variables also can cause heteroscedasticity (Cameron and Trivedi, 2009). Finally, robust standard errors do alter the results in any of the above equations.

"normal" price can be regarded as immodest and challenging. That intellectual orientation is negatively correlated to responding to the *product* seems to follow the same logic as the CRT-score, which also is negatively correlated to *product*. *Liberalism* represents a willingness to question conventions and traditional values, and a liberalist attitude is that most things should be allowed if the involved parties agree on it. Thus, when the milk price is thought of as something that is conventional or "normal", then it is reasonable that a liberalist attitude is negatively related to *product*. Finally, *Openness* is negatively correlated with *product*. This is not surprising as it consists of *Liberalism* and *Intellect*, and since it also is an indicator of the ease of thinking in abstract terms.[23,24]

In Equation 4 we include the four non-aggregate personality variables. Although none of them are individually significant, together they significantly add to the overall model and Equation 4 fits the data better than the model with only *CRT* and *Consumption* (LR-test, p=0.0576). Testing down we find that *Morality* does not seem to explain *product* at all and the best fit also excludes *Intellect*.[25] Equation 5 shows this specification with *Liberalism* and *Modesty*, both significant at the 10 percent level, and this model predicts *product* significantly better than the model with only *CRT* and *Consumption* (LR-test, p=0.038). We then test our aggregate facet *Openness* to experience with *CRT* and *Consumption*. The *Openness* indicator is highly significant and Equation 6 predicts who responds to the frame better than Equation 3 (LR-test, p= 0.013) and Equation 5 (BIC= 151.03 vs. BIC=155.39).

The results in Equation 6 tell us that if a subject consumes the average amount of milk every week and is classified as an average open individual, the probability that the subject chooses the milk focal point is 65 percent if she scores zero on the CRT-test (i.e. impulsive decision-making) and only 25 percent if she scores the maximum (i.e. reflective decision-making). If a subject is instead classified as a closed-minded individual, still consuming the average amount of milk, the probability that she chooses the milk price when scoring 0 on the CRT-

[23]To interpret the personality test scores we use a narrative provided by Johnson (2010).

[24]As we limited the number of facets due to time constraint, we have only two of the six facets in this aggregate. However, this facet can still give us an indication of cognitive openness. Openness and CRT are not significantly correlated even if they move in the same direction and therefore capture different cognitive aspects.

[25]Results are available upon request.

test is 89 percent.

2.5 Conclusions

Equal-splits has been a common finding across many bargaining experiments, also when the properties underlying theoretical approaches such as the Nash bargaining solution predict other divisions (see Roth and Malouf, 1979, Anbarci and Feltovich, 2011). Thus, the 50-50 point clearly possesses focality. However, when we introduce a competing focal point in the form of a well-known product, many subjects deviate from equal-splits in favor of trading the product for the exogenously established market price. The separation of these two groups of subjects, where some are sensitive to changes in the frame and where others focus on the division of surplus, alerts us to the difficulty in establishing general rules for how subjects choose focal points when there are two salient points. As Mehta et al. (1994a) note "When two rules conflict, each rule seems to attract some people." (p. 180). Our results imply that how subjects choose when there are competing focal points depend on both heterogeneity in subjects' characteristics, and on the strength of the frame for the subject.

Our experimental approach also relates bargaining outcomes to the field through the "nature of the commodity" (Harrison and List, 2004). It shows that for goods with established prices, the division of surplus can be highly skewed depending on the prevailing price. This casts some doubt on the prediction of equal divisions of surplus in the field, where known prices of products and services can give an advantage to one of the parties. On the other hand, the results provide interesting topics for future research such as testing the strength of this framing effect in the presence of learning, different information, or changes in the budget; or in turning the tables on the roles so that the price of the good favors the seller.

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References

Anbarci, N., Feltovich, N., 2011. How responsive are people to changes in their bargaining position? Earned bargaining power and the 50-50 norm. SWP 2012/2 Economics Series, Deakin University Australia.

Babcock, L., Loewenstein, G., Issacharoff, S., Camerer, C., 1995. Biased judgments of fairness in bargaining. The American Economic Review 85 (5), 1337-1343.

Babcock, L., Loewenstein, G., 1997. Explaining bargaining impasse: The role of self-serving biases, The Journal of Economic Perspectives 11 (1), 109-126.

Bacharach, M., 1993. Variable universe games. In Frontiers of Game Theory, ed. Binmore, K., Kirman, A., Tani, P., MIT Press, Cambridge, MA.

Bacharach, M., Bernasconi, M., 1997. The variable frame theory of focal points: an experimental study. Games and Economic Behavior 19, 1-45.

Bacharach, M., Stahl, D.O., 2000. Variable-frame level-n theory. Games and Economic Behavior 32, 220-246.

Bardsley, N., Mehta, J., Starmer, C., Sugden, R., 2010. Explaining focal points: cognitive hierarchy theory versus team reasoning. The Economic Journal 120, 40-79.

Bergman, O., Ellingsen, T., Johannesson, M., Svensson, C., 2010. Anchoring and cognitive ability. Economics Letters 107 (1), 66-68.

Binmore, K., Swierzbinski, J., Hsu, S., Proulx, C., 1993. Focal points and bargaining. International Journal of Game Theory 22 (4), 381-409.

Binmore, K., Samuelson, L., 2006. The evolution of focal points. Games and Economic Behavior 55, 21-42.

Binswanger, H.P., 1980. Attitudes toward risk: experimental measurement in rural India. American Journal of Agricultural Economics 62 (3), 395-407.

Blanco, M., Engelmann, D., Koch, A., Normann, H-T., 2010, Belief elicitation in experiments: is there a hedging problem? Experimental Economics 13 (4), 412-438.

Bolton, G.E., Ockenfels, A., 2000. ERC: A theory of equity, reciprocity, and competition. The American Economic Review 90 (1), 166-193.

Bäckström, M., PIMA HB, www.pimahb.com, April 2010.

Camerer, C. F., 2003. Behavioral game theory: experiments in strategic interaction. Princeton University Press, Princeton, NJ.

Cameron, C.A., Trivedi, P.K., 2009. Microeconometrics using Stata. Stata Press, Texas.

Croson, R., Gneezy, U., 2009. Gender differences in preferences. Journal of Economic Literature 47 (2), 448-474.

Ferguson, J.L., 2008. Fair or foul? Determining the rules of the fair pricing game. Marketing Dissertations, Paper 13, Georgia State University.

Fehr, E., Schmidt, K.M., 1999. A theory of fairness, competition, and cooperation. Quarterly Journal of Economics 114 (3), 817-868.

Frederick, S., 2005. Cognitive reflection and decision-making. Journal of Economic Perspectives 19 (4), 25-42.

Güth, W., Schmidt, C., Sutter, M., 2007. Bargaining outside the lab - A newspaper experiment of a three-person ultimatum game. The Economic Journal 117, 449-469.

Gächter, S., Riedl, A., 2005. Moral property rights in bargaining with infeasible claims. Management Science 51 (2), 249-263.

Goldberg, L.R., 1993. The structure of phenotypic personality traits. American Psychologist 48 (1), 26-34.

Harrison, G. W., List, J. A., 2004. Field experiments. Journal of Economic Literature 42 (4), 1009-1055.

Holt, C.A., Laury, S.K., 2002. Risk aversion and incentive effects. American Economic Review 92 (5), 1644-1655.

Janssen, M., 2001. Rationalizing focal points. Theory and Decision 50 (2), 119-148.

Johnson, J.A., The IPIP-NEO (International Personality Item Pool Representation of the NEO PI-R™), www.personal.psu.edu/faculty/j/5/j5j/IPIP/, May 2010.

Kahneman, D., Knetsch, J. L., Thaler, R., 1986. Fairness as a constraint on profit seeking: Entitlements in the market. The American Economic Review 76 (4), 728-741.

Kalai, E., Smorodinsky, M., 1975. Other solutions to Nash's bargaining problem. Econometrica 43 (3), 513-518.

Konow, J., 2000. Fair shares: Accountability and cognitive dissonance in allocation decisions. The American Economic Review 90 (4), 1072-1091.

Mehta, J., Starmer, C., Sugden, R., 1992. An experimental investigation of focal points in coordination and bargaining: some preliminary results. In Decision making under risk and uncertainty: new models and empirical findings, Ed. Geweke, J., Kluwer Academic Publishers, Dordrecht

Mehta, J., Starmer, C., Sugden, R., 1994a. Focal points in pure coordination games: An experimental investigation. Theory and Decision 36 (2), 165-185

Mehta, J., Starmer, C., Sugden, R., 1994b. The nature of salience: an experimental investigation of pure coordination games. The American Economic Review 84 (3), 658-673.

Murnighan, K., Roth, A., Schoumaker, F., 1988. Risk aversion in bargaining: an experimental study. Journal of Risk and Uncertainty 1 (1), 101-124.

Myerson, R.B., 1991. Game theory: analysis of conflict. Harvard University Press, Cambridge MA.

Nash, J., 1953. Two-person cooperative games. Econometrica 21 (1), 128-140.

Nydegger, R.V., Owen, G., 1974. Two-person bargaining: an experimental test of the Nash axioms. Journal of International Game Theory 3 (4), 239-249.

Roth, A.E., Malouf, M.W.K., 1979. Game-theoretic models and the role of information in bargaining. Psychological Review 86 (6), 574-594.

Roth, A.E., 1995. Bargaining experiments. In Handbook of Experimental Economics, Eds. Kagel, J. H., Roth, A.E., Princeton University Press, Princeton NJ.

Roth A.E., Schoumaker, F., 1983. Expectations and reputations in bargaining: an experimental study. American Economic Review 73 (3), 362-372.

Schelling, T., 1960. The strategy of conflict, Harvard University Press, Cambridge MA.

Siegel, S., Castellan J. Jr., 1988. Nonparametric statistics for the behavioural sciences. McGraw-Hill, New York.

Snyder, M., 1974. Self-monitoring of expressive behavior. Journal of Personality and Social Psychology 30 (4), 526-537.

Snyder, M., Bono, K.G., 1985, Appeals to image and claims about quality: understanding the psychology of advertising, Journal of Personality and Social Psychology 49 (3), 586-597.

Sugden, R., 1995. A theory of focal points. The Economic Journal 105 (430), 533-550.

The International Personality Item Pool (IPIP). www.ipip.ori.org, April 2010.

Tversky, A., Kahneman, D., 1973. Availability: A heuristic for judging frequency and probability. Cognitive Psychology 5 , 207-232.

Tversky, A., Kahneman, D., 1974. Judgement under uncertainty: Heuristics and biases. Science 185 (4157), 1124-1131.

Tversky, A., Kahneman, D., 1984. Choices, values, and frames. American psychologist 39 (4), 341-350.

Xia, L., Monroe, K.B., Cox, J.L., 2004. The Price Is Unfair! A Conceptual Framework of Price Fairness Perceptions Journal of Marketing 68 (4), 1-15.

2.6 Appendix

Table 2.5: Descriptive Statistics

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Dependent Variable					
Choice of Focal point	113	.416	.495	0	1
Experimental Control and Demographic Variables					
Buyer	123	.496	.502	0	1
Period 1	123	.496	.502	0	1
Male	122	.484	.502	0	1
Income	120	99.99	76.90	12	700
Age	122	21.37	1.84	18	28
Bargaining Attitude, Risk, and Cognitive Reflection					
Surplus Demand[a]	123	47.90	28.18	0	100
Risk aversion	112	6.40	1.97	0	10
Crtscore[b]	123	1.86	1.10	0	3
Milk Consumption					
Consumption	122	2.08	1.82	0	10
Valuation	119	7.58	3.51	0	25
Guess milk price	123	8.86	2.21	6	26
Personality Traits and Social Activity					
Trust	123	50.13	10.0	24	71
Morality	123	50.01	9.93	14	68
Altruism	123	49.89	10.0	7	69
Cooperation	123	50.05	10.1	24	72
Modesty	123	50.06	9.93	29	71
Sympathy	123	50.03	10.0	15	66
Agreeableness	123	49.93	9.90	9	68
Dutifulness	123	49.97	10.0	16	67
Cautiousness	123	49.94	9.95	27	71
Conscientiousness	123	50.03	10.03	21	72
Intellect	123	50.12	10.2	23	67
Liberalism	123	49.97	10.0	20	68
Openness	123	50.02	10.02	23	72
Selfmonitoring	123	49.96	10.0	29	73
Contacts	118	300.1	191.1	0	1450
Time spent	119	48.8	56.6	0	500

[a] Demanded share of surplus in a scenario describing how to split a taxi bill.
[b] Number of correct answers on the CRT-test. (See instructions for details).

Chapter 3

The Persistence of Product Prices in the Lab

3.1 Introduction

In games such as the Nash demand game, focality offers one way to select equilibrium. Players choose an equilibrium that is *salient* because they expect that others will choose the same (Schelling, 1960). Equal-splits is one such focal point and is a typical division of the surplus in bargaining experiments (see e.g. Roth, 1995, Camerer, 2003).[1] However, changes in the description of a game that do not alter the underlying game can give rise to other salient divisions (e.g. Roth and Schoumaker, 1983, Mehta et al. 1992). In particular, a product with a well-known market price can induce an additional focal point that many subjects choose even though it causes highly unequal divisions (Holm and Svensson, 2011). However, how robust the product focal point is when subjects become more experienced remains an open question. This paper experimentally examines the answer to this question and if there are factors that are related to how persistent the product price is.

The fact that different descriptions of the same game can affect the selected

[1] Furthermore, the equal-split has been observed more often than the predicted by axiomatic solutions such as the Nash bargaining solution (e.g. Roth and Malouf, 1979, Anbarci and Feltovich, 2011).

outcome, *framing effects* (Tversky and Kahneman, 1984), is intriguing. When frames induce additional focal points that attract some subjects, one might wonder how useful abstract frames are for predicting divisions outside the laboratory. In particular, since subjects often bargain for actual products that they have some idea of the price of, equal-splits maybe poor predictors in the field (see Harrison and List, 2004). In addition, the possibility of predicting a unique division when frames induce competing focal points seem distant. Experiments that investigate general rules of selecting focal points are mainly concerned with one-shot coordination games (e.g. Mehta et al., 1994, Bacharach and Bernasconi, 1997) and the Holm and Svensson study only lets subject play the product frame once.[2] Many bargaining situations are not one-shot games, however, and initial unfamiliarity with the game may affect which choices subjects think they can make (see e.g. Bayer et al. 2009).

Repetition is commonly used to overcome these issues (see Roth, 1995). Thus, even if subjects initially perceive the situation as one where they are to buy and sell the product for the prevailing market price, repetition allows them to learn about the underlying game and they may come to see the product as simply an addition to the available surplus. Thus, the product focal point may be sensitive to experience and we may observe convergence towards outcomes observed in more abstract frames, which is typically equal-splits, when subjects are allowed to learn.[3] However, learning may be affected by the amount of information feedback that subjects receive during play (see Roth, 1995, Duffy and Feltovich, 1999), and the experience subjects gain in the beginning of the game (see Van Huyck, 1990, Binmore et al. 1993).

This paper investigates whether the focality of the conventional price of a product is eroded with experience using a repeated Nash demand game where a buyer and a seller bargain for a coca-cola. Two information treatments are employed to examine if differences in feedback affect learning and thus convergence. In the full information treatment, both the buyer and the seller are updated with

[2]Several theoretical studies investigate how players select focal points based on frames or labels (see e.g. Bacharach, 1993, Sugden, 1995, Bacharach and Stahl, 2000).

[3]Further cues to which focal point that remains may be offered by evolutionary game theory that study how focal points come about (see e.g. Young, 1996). This paper, however, uses focal points that are already established and focuses on how experience affects which focal point subjects choose.

each other's bids and if the transaction has been successful or not after each period. In the partial information treatment, only the buyer is updated with the seller's bid, while the seller only learns about the state of the transaction. The latter treatment thus reflects an information asymmetry that prevails in many markets where sellers do not observe the buyer's reservation price. Observation can affect what bids the seller is aware of and perceives to be viable and therefore convergence (see e.g. Duffy and Feltovich, 1999). To test for the effect of initial experience, subjects switch information treatment and partners after ten periods. In addition, since the choice of focal point is related to a combination of subjects' characteristics and how strong the frame is for subjects (Holm and Svensson, 2011), I test for several factors that may explain subjects choice of focal point with repetition.

The results clearly show that when subjects receive full information feedback, average bids gradually converge to equal-splits. However, with partial information feedback, average bids do not converge because half of the subjects in this treatment bid the coca-cola price. Since subjects tend to bid in the same fashion as they have adjusted to at the end of the first ten periods, average bids do not converge for those that start with partial information. Thus, initial experience clearly overrides any effect that the change in information and a new partner might cause. The reason for why average bids do not converge with partial information seems to lie in what strategies sellers perceive to be viable in the first ten periods. Subjects with partial information experiment less, and sellers seem more cautious in initiating and/or carrying through higher bids. Finally, there are also individual differences that affect the choice of focal point. Specifically, subjects who score higher on a cognitive reflection test, that value a coca-cola less, that consumes more coca-cola, and that receive full information in the first ten periods are less prone to repeatedly bid the coca-cola price.

These results provide some evidence that the product focal point is sensitive to learning but that the final outcome may be affected by small differences in initial information feedback, subjects' characteristics and their attachment to the product. Thus, they suggest that to predict how subjects will divide the surplus in the field, where they typically bargain for actual products, we need to know more of who divides and what experience she has.

The rest of the paper is organized as follows: Section 2 outlines the Nash

demand game and treatments, the adjustment and learning mechanisms, and factors that affect the choice of focal point. Section 3 presents the experimental design and section 4 analyzes the results from the experiment. Section 5 concludes.

3.2 A Repeated Nash Demand Game with Competing Focal Points

In this section, I outline the repeated Nash demand game with a product and the two information treatments. Thereafter, I discuss adjustment and learning and the potential determinants behind repeatedly choosing a specific focal point.

3.2.1 Equal-Splits versus Product Prices

The Nash demand game in this paper is a repeated version of the one-period NDG in Holm and Svensson (2011). A seller and a buyer simultaneously bid non-negative prices, $p^s, p^b \in [0, 100]$, for a good with value $v \geq 0$ in each period. The seller bids the price at which she is willing to sell the good, p^s, and the buyer bids the price at which she is willing to buy the good, p^b. If $p^s \leq p^b$, there is a transaction and the buyer's income, π^b_{trade}, is $100-p^s+v$, where 100 is the budget that the buyer has at her disposal at the beginning of the period.[4] The seller's income, π^s_{trade}, is p^s. If $p^s > p^b$, there is no transaction and both players' income is 0, which means that the seller does not keep the good.[5] Concentrating on the set of pure Nash equilibria, this set is given by $p^b = p^s$, and $(p^b = 0, p^s = 100)$. The Nash bargaining solution (NBS) is given by $p^b = p^s = (100 + v)/2$.

To investigate if subjects accommodate to an induced focal point, I use two treatments. In the baseline treatment, the seller and the buyer bargain for a hypothetical good, the H-treatments. In these treatments, $v = 0$, and since there is no additional focal point, the only salient point should be the equal-split, as observed in previous NDG experiments (see e.g. Roth and Malouf,

[4] All numbers refer to Swedish crowns (SEK), which at the time of the experiment was 0.14 USD.

[5] (0,0) is a common disagreement point in NDG, and in this game it also reduces endowment effects.

1979, Holm and Svensson, 2011). Thus, I expect that subjects will bid around 50, with somewhat higher bids for buyers and somewhat lower for sellers to secure a transaction.

In the other treatments, the C-treatments, I let subjects bargain for a well-known product, namely a coca-cola.[6] In these treatments, $v \approx 7$, and since there is now an induced focal point, I expect that some subjects will choose the market price of the product, i.e. around 7, and that others will choose to split the surplus equally, i.e. around 50.[7] This is the prediction and outcome in the product treatment in Holm and Svensson (2011).

In their experiment, subjects play both the hypothetical treatment *and* the product treatment for one period each with variations in order. With both orderings, however, they find that some subjects chose the market price of the product in the milk treatment and equal-splits in the hypothetical treatment, and that others chose equal-splits in both treatments. In this experiment, subjects only play either the H-treatments *or* the C-treatments since the focus is whether the effect of the product is eroded by learning under different information feedback.

In addition to actual bids, I elicit what subjects believe that their opponent will bid. It is clear that whether or not a subject's bid is successful or not depends on the opponent's bid.[8] Thus, beliefs show whether the presence of the product affects expectations and how subjects respond to these.

3.2.2 Information Feedback

Previous research finds that differences in information feedback can affect subjects bids (see Duffy and Feltovich, 1999, Harbaugh et al. 2007). I use a small

[6]To ensure that subjects know the price of a coca-cola, I elicit what they think a can of coca-cola costs at the closest general dealer, which was 7 at the time of the experiment. 97 percent of the subjects who participated in the C-treatments thought a can of coca-cola cost no more than 15 kronor, with the modal being 8.

[7]The equal-split is marginally higher in the C-treatments since it should include the value of the product. However, in the subsequent analysis I disregard this because the value is fairly low and there is not much empirical evidence of that subjects include this value (see section 3.4.5).

[8]Recent research on choosing focal points using frames suggest, however, that levels of reasoning may differ between subjects and that some may simply choose what springs to mind without taking into account what other subjects will choose (see e.g. Bardsley et al. 2010). Thus, the degree to which bids depend on beliefs is not obvious.

modification in feedback that fits naturally into the market frame, and that ensures that subjects easily can calculate the opponent's payoff. The difference between the two information treatments lies in different degrees of strategic uncertainty for sellers and how not observing the buyer's bids affect the outcome.

In the full information treatments, abbreviated HF in the hypothetical case and CF in the coca-cola case, both the seller and the buyer receive the same feedback after each period. Specifically, the seller learns the buyer's price, p^b, her own income from trade, π^s_{trade}, and if the transaction has been successful, $\tau \in \{yes, no\}$. The buyer learns the seller's price, p^s, her own income from trade, π^b_{trade}, and if the transaction has been successful, $\tau \in \{yes, no\}$.

In the partial information treatments, HP and CP, the buyer receives the same information feedback as in HF and CF but the seller does not receive feedback on the buyer's price. Specifically, the feedback the seller receives after each period is whether the transaction has been successful, $\tau \in \{yes, no\}$, and her income from trade, π^s_{trade}. The latter is simply the seller's price if there has been a transaction and 0 if there has been no transaction. This treatment thus resembles a market where sellers state a price and observe if the price is accepted or not, but not the highest price the buyer is willing to pay.

All information is common knowledge. Specifically, in HF and CF, a buyer knows that the seller sees her price, and the seller knows that the buyer sees her price, after each period. In HP and CP, the buyer thus knows that the seller does not see her price, and the seller knows that the buyer sees her price.

Furthermore, the same buyer and seller interact in all ten periods and after these periods, subjects switch information treatment, but not role, and play an additional ten periods against a new opponent.

3.2.3 Adjustment and Learning

The equal-split is frequently observed as an outcome in bargaining games. In particular, some subjects choose this division in also in the presence of a product focal point (Holm and Svensson, 2011). Thus, even if some subjects initially are attracted to the product, with repetition, the nature of the game should become clear and in particular the incentives for sellers to induce adjustment away from the coca-cola price towards equal-splits.

To see the underlying incentives for adjustment, consider the following example. If a seller bids 7, the approximate market price of a coca-cola, and the buyer bids the same or higher, the buyer receives 93 and the coca-cola. The seller, on the other hand, only receives 7. Even if a seller chooses this division because she expects the buyer to do so as well, it should be clear that it may be worth forgoing some transactions to persuade the buyer to increase her bid.[9] Specifically, at this price a seller can afford to forgo *eight*, of the possible ten transactions, with the same buyer, and still receive a higher expected value from the equal-split than the product focal point.[10] For a buyer, the equal-split is better than the product price if she loses more than five transactions. In addition, since subjects always interact with the same partner throughout all ten periods, the seller knows with certainty the number of failed transactions the buyer will suffer if she sticks to the product price.

Despite this, when subjects are unfamiliar with the game, and initially are attracted to the product price, adjustment is likely to depend on how subjects learn to play the game. Learning research emphasizes that adjustment is characterized by a process of adaptive behavior where subjects learn to play better strategies, i.e. adopt those that lead to higher payoffs, and discard those that are unsuccessful (see e.g. Roth and Erev, 1995, Fudenberg and Levine, 1995).[11] Subjects learn to play better strategies by experimentation with different bids, and there is also evidence that observation of others' payoffs and strategies can affect this process (see Duffy and Feltovich, 1999, Harbaugh et al. 2007). The reason for this is that by observation, subjects may learn to play new strategies, strategies they were aware of but did not think were likely to be played, or that they felt inhibited from playing (see Duffy and Feltovich, 1999 and references

[9]Note that from ultimatum games we know that people are not willing to accept bids that are too low. They would rather have nothing than agree to a highly unequal distribution (e.g. Camerer, 2003).

[10]To see this, assume that the seller receives 7 with certainty by choosing the product price. At the end of the ten periods, subjects draw one of the periods from a uniform distribution. That is, there is a 10 percent chance that each period will be chosen. Thus, the expected value is simply 7. If she forgoes transactions to reach the equal-split, two successful transactions at this price, 0.2×50, will suffice to reach an expected payoff higher than 7.

[11]Different learning rules are treated in e.g. Erev and Roth (1998), Feltovich (2000), and Camerer (2003).

therein).

Thus, in this game, it should be easier to converge to equal-splits in CF than in CP, since subjects in CP only learn through their own bids. For example, assume that a seller in CF bids 7 and the buyer bids 50. After the first period, the seller finds out that 50 is a viable bid. Thus, the seller wishes to update her bid since this yields a higher profit, but the buyer, who has observed 7, may want to lower hers to increase her profit. However, since the seller has observed her bid, she knows that the buyer has already perceived this to be an acceptable division. In CP, however, the seller does not find out that the buyer has bid 50, so she needs to figure out: first whether there are other viable divisions; second, whether the buyer will figure this out; third, whether to take the risk of testing if the buyer has figured it out and, if so, how willing she is to adjust.

In addition, learning suggests that subjects should be sensitive to failed transactions and changes in the opponent's bids, when available, since these affect their payoffs. A failed transaction should result in higher bids for buyers and in lower bids for sellers, since it increases the likelihood of a successful transaction, and thus a positive payoff, in the next period . For a seller, an increase in the buyer's bid gives her an opportunity to increase her bid and thus payoff. For a buyer, an increase in the seller's bid that does not result in a failed transaction is a signal that she needs to increase her bid to reduce the risk of a failed transaction in the next period. However, this effect may be counteracted if a buyer perceives she needs to *decrease* her bid to signal that she disapproves of future increases that lowers her payoff.

Finally, the pressing question is: if bids have not converged in CP in the first ten periods, will they do so if the subjects switch information treatment and partner? On the one hand, these two changes will allow subjects who previously played CP to use new information to update what strategies they think are viable, and since they meet new partners, they are not bound by previous play. On the other hand, a subject may have ideas from her previous play about the likely play of her opponent. Some evidence that subjects tend to stick to a division that they have played repeatedly, or that outcomes are sensitive to initial conditions and previous play is provided by Binmore et al. (1993) and Van Huyck et al. (1990, 1997).

3.2.4 Individual Determinants Behind the Choice of Focal Point

How subjects choose focal points in the presence of a product in the one-shot case seems to depend on individual characteristics and how strong the frame is for the subject (see Holm and Svensson, 2011). With repetition, some of these factors may also help explain why subjects stick to a specific focal point.

First, choosing the coca-cola price is intuitive and natural when subjects are asked to buy and sell this product. It may therefore require some reflection to perceive the situation as one where there is a surplus to divide. In addition, heterogeneity in cognitive sophistication plays a role in various settings, such as in anchoring and price valuations (Bergman et al., 2010), learning rules (e.g. Milgrom and Roberts, 1991), and coordination with frames (e.g. Bardsley et al. 2010). In particular, Holm and Svensson (2011) find that a high score on a cognitive reflection test is negatively related to choosing the product price. Thus, the cognitive reflection test, *CRT* (see Frederick, 2005), should pick up if cognitive heterogeneity is one reason for choosing the product price repeatedly.

Second, there is reason to suspect that *Risk Aversion* affects bids over time. For example, a subject may initially choose what she believes to be the less risky strategy but quickly update it once she learns about the opponent's preferences. In addition, risk matters in many game theoretic models of bargaining and there is some empirical support for this (see e.g. Murnighan et al., 1988).

Third, how subjects perceive the situation may depend on the attractiveness of the product. The subject's *Consumption* of the product may affect how imprinted a particular price is. A subject who consumes large quantities of a product may keep an extra eye on its price, or at least, observe it repeatedly even if it is unintentional. This imprinting effect should therefore have a positive effect on the likelihood of choosing the coca-cola price (see Holm and Svensson, 2011). In relation to consumption, a higher *Valuation* of a coca-cola could also be a reason for attaching a large weight to its price.

Fourth, the choice of focal point may also be affected by subjects' perceptions of fairness, and what they believe other subjects' perceptions of fairness are. In particular, there are two different types of fairness concerns that seem likely. First, Kahneman et al. (1986) find that people tend to use reference prices,

which act as benchmarks, to assess whether a seller has acted fairly or not. These reference prices come from, for instance, historic or prevailing market prices (see e.g. Xia et al. 2004). Thus, a subject may choose the product price because she regards prices which are at odds with the reference price as unfair. Therefore, subjects' *Fair pricing perceptions*, as measured by responses to the Kahneman et al. (1986) survey questions and two similar questions, may affect their bids.

A subject's choice may also depend on what she believes is the prevailing price norm, since this increases the probability of a successful transaction. Therefore, the subjects' perception of what they believe others think is a fair price strategy, *Price norm perceptions*, as measured by guessing what other subjects' answers are to the same survey questions, may influence price bids. Second, a subject who is very concerned with equal distributions and cares less about reference prices may bid more generously, for instance. These *Social preferences* help explain, for example, positive offers in dictator games (see e.g. Camerer, 2003).

Finally, I include a number of experimental and demographic control variables that may affect the choice of focal point: *Buyer*: since buyers earn more when subjects coordinate on the product price, they should be more inclined to bid around the coca-cola price. However, since they also need to bid somewhat higher than sellers to ensure a transaction, these effects may level out. *Information*: since subjects' bids may be affected by the information feedback they have received in the first ten periods (see section 3.2.3). *Age*: since older subjects seem to be more concerned with equal distributions (see Güth et al. 2007). *Female*: since it controls for possible gender effects that have proven to affect preferences for risk, competition, and social preferences (see e.g. Croson and Gneezy, 2009).

3.3 Experimental Design

The experiment was conducted in eight sessions at Lund University on November 28 - December 1, 2011, and February 29, 2012. The 138 students who participated were recruited by email from the introductory course and some intermediate courses in Economics. The first four sessions ran the coca-cola treatments (CF and CP) and the last four sessions ran the hypothetical treatments (HP and HF). In total, 82 students participated in the C-treatments and 56 in the H-treatments.

In each session, the students first received a verbal introduction of the general

purpose of the experiment after which they logged into the computer system.[12] Then all were handed an identity note and the same general instructions in writing. Each identity note had a unique number that the students used to collect their earnings a couple of days after the sessions were completed.[13]

After reading the instructions, the main treatments, i.e. the full information treatment and the partial information treatment, were run simultaneously. In each treatment there were equivalent numbers of buyers and sellers, as each buyer was randomly matched with an anonymous seller. These two formed a pair and remained together for ten periods. After the first ten periods, the subjects switched treatment, but not role, and played ten more periods against a new, anonymous and randomly matched partner. When they switched treatments, the subjects received new instructions informing them of the change in information feedback, and that they would meet a new partner.

In the main treatments, every subject made two choices in each period. The subject bid a price, p^r where $r \in \{b, s\}$, for a hypothetical good in the H-treatments, and for a can of coca-cola in the C-treatments, and tried to guess, g^r, what the other player in the pair would bid in that period. This belief elicitation was incentivized by rewarding subjects with respect to how close their guesses were to the partner's bid.

After all the subjects had stated their bids and prices, they were informed of the outcome of the period. In the F-treatments, the buyer learned the partner seller's price, p^s, and if the transaction took place, τ, her own income from trade, π^b_{trade}, and from guessing the partner's price, π^b_{guess}. The seller received information equivalent to that of the buyer. In the P-treatments, the buyer received the same information as in the F-treatment, but the seller only learned her own income from trade, π^s_{trade}, and whether the transaction took place or not, τ. In conjunction with this information, the subjects could also see a table of previous periods' outcomes.

After playing the first ten periods, the subjects randomly drew one of the ten periods from a list that stated all periods' income. Given the drawn period, they also drew whether they would receive income from trade or from guessing the

[12]The experiment was programmed and conducted with the software z-Tree (Fischbacher, 2007).

[13]Instructions are available in Appendix B.

Table 3.1: Experimental Design

Experimental Parameters				
Time:	Phase 1:	*T=10*		
	Phase 2:	*T=10*		
The subject's choice variable in period *t*:	Price Bid	$p^r \in \{0, 1, ..., 100\}$		
	Price Guess	$g^r \in \{0, 1, ..., 100\}$		
Feedback in period *t*:	Full information:		Partial Information:	
	Seller	$p^b, \pi^s_{trade}, \pi^g_{guess}, \tau \in \{yes, no\}$	Seller	$\pi^s_{trade}, \tau \in \{yes, no\}$
	Buyer	$p^s, \pi^b_{trade}, \pi^b_{guess}, \tau \in \{yes, no\}$	Buyer	$p^s, \pi^b_{trade}, \pi^b_{guess}, \tau \in \{yes, no\}$
Sequence of Play and Number of Pairs:				
		14 pairs	*14 pairs*	
Hypothetical:	Phase 1	Full information	Partial Information	
	Phase 2	Partial information	Full Information	
		20 pairs	*19 pairs*	
Coca-Cola:	Phase 1	Full information	Partial Information	
	Phase 2	Partial information	Full Information	
	Phase 3	Elicitations, Social Preferences, Questionnaire *(all subjects)*		

partner's price, and were paid according to the outcome of these two draws.[14] After playing the next ten periods, the subjects repeated this draw with the new list of transactions from the second phase and were paid accordingly.

When the main treatments were completed, subjects entered the third phase that consisted of elicitation tasks and questions. The first task elicited the subjects' valuation of coca-cola; subjects were asked, in the C-treatments only, to make a decision between money and a can of coca-cola from a list of choices where the money sum increased with each new choice. One choice was then randomly drawn and the subjects were paid according to that choice. To assess whether subjects in the C-treatments were familiar with the price of coca-cola, they were asked to guess how much a can of coca-cola cost at the closest general dealer, and were paid for an accurate guess. To elicit risk preference, the subjects faced a multiple price list (see Binswanger, 1980, and Holt and Laury, 2002).

The subjects then answered ten questions regarding fair pricing practices. Eight of those were survey questions from Kahneman et al. (1986), and two were

[14]To minimize hedging, the subject were paid only for either trade or guess (see Blanco et al. 2010).

questions about pricing practices that have become common more recently. In addition, the subjects also made incentivized guesses about what they thought were the responses of most of the other subjects to the same ten questions. A dictator game and questions on on charity, blood donation, file-sharing, and voting were used to capture social preferences. The experiment ended with a questionnaire on demographics and coca-cola consumption habits. Subjects in the H-treatments did not answer the consumption question. Table 3.1 summarizes the experimental design and participation in each treatment.

The experiment lasted about 90 minutes and subjects earned on average around 230 SEK (≈ $33) including a 100 SEK show-up fee, which can be compared to 120 SEK (≈ $17), the average hourly pay for this age group in Sweden at the time of the experiment.

3.4 Results

This section presents the results from the experiment based on the theoretical discussion in section 3.2.

3.4.1 Phase 1: Full Information

This section addresses whether the effect of the product is eroded when there is full information in phase 1. The result is that while subjects coordinate immediately around 50 in HF1, some subjects bid around the price of a coca-cola and some bid around 50 in CF1. Over time, even though average bids adjust to 50, a few subjects still bid the product price.

The first half of the left-hand graphs in Figure 3.1 and the first half of columns 2,3 and 6,7 in Table 3.2 provide evidence of this result, and show how average bids evolve over the course of the first ten periods in HF1 and CF1. Subjects in HF1 coordinate immediately around 50 and stay around this price. In CF1, average prices start at 30.9 for sellers and 22.9 for buyers and climb slowly toward 43.6 for sellers and 44.8 for buyers in period 9.[15]

[15]I refrain from using period 10 and period 20 since there are some end-of-period effects, where buyers tend to increase their bids and sellers decrease theirs. This effect may occur as players wish to secure the final transaction without having to deal with any future period

Table 3.2: Average Price Bids: All Periods

		Hypothetical				Coca-Cola			
		Full information (HF1)		Partial information (HP1)		Full information (CF1)		Partial information (CP1)	
	Period	Seller	Buyer	Seller	Buyer	Seller	Buyer	Seller	Buyer
PHASE 1	1	54.4	53.7	46.5	50.6	30.9	22.9	19.7	21.4
	2	54.5	55.9	47.2	52.9	31.0	25.2	17.9	22.2
	3	52.3	50.1	48.2	53.2	35.9	31.6	18.7	20.7
	4	54.2	52.9	50.1	52.9	32.4	37.8	20.1	20.8
	5	52.4	52.1	51.3	51.4	42.3	37.0	19.7	22.3
	6	56.7	50.3	50.9	55.8	41.9	37.4	20.9	23.2
	7	53.1	49.6	51.2	53.1	40.6	38.3	23.1	24.1
	8	51.0	49.9	50.9	52.1	41.1	41.1	22.9	27.1
	9	50.3	47.4	50.1	54.6	43.6	44.8	22.3	26.8
	10	46.1	49.2	48.5	57.8	39.7	49.7	22.2	27.3
PHASE 2		Partial information (HP2)		Full information (HF2)		Partial information (CP2)		Full information (CF2)	
	11	59.1	47.1	51.6	46.7	37.3	40.1	24.4	18.3
	12	56.3	47.8	50.3	48.8	37.1	42.0	25.4	20.5
	13	54.1	46.3	54.8	49.3	38.3	43.3	24.5	25.8
	14	54.9	48.1	53.4	48.3	36.4	45.6	24.8	24.8
	15	53.1	48.6	55.8	44.4	37.3	46.1	25.4	25.4
	16	51.1	49.7	55.1	48.4	38.0	44.4	26.8	26.2
	17	50.1	48.0	52.9	48.9	36.5	43.9	28.3	25.6
	18	50.1	50.5	55.1	48.9	37.0	44.2	25.3	29.3
	19	50.3	49.8	49.4	46.0	36.8	44.2	30.2	30.4
	20	49.6	50.5	47.9	61.6	37.4	47.3	24.6	30.4

To test if bids deviate significantly from 50, I run the following regression for buyers and sellers separately:

$$pricebid_{it} - 50 = \sum_{t=1}^{10} \alpha_t d_t + \sum_{t=1}^{10} \beta_t (1 - d_t) \tag{3.1}$$

The dependent variable thus measures the deviation from 50 for each subject i. $d_t = 1$ when the bid comes from HF1 and 0 if it comes from CF1.[16] To avoid multicollinearity, the constant is excluded. Standard errors are clustered on the subject.

There is only one significant deviation from 50 (period 6) in HF1 for sellers. In CF1, sellers bids deviate significantly from 50 until period 5. There is some

effects.

[16] I have also estimated the same regressions where I have included the valuation of coca-cola for CF1, i.e. where the dependent variable is $P_{it} - (50 + v_i/2)$ where v_i is subject i's elicited valuation of a coca-cola. The result is that the deviation is significant for a longer time in CF1, but the key result, i.e. that subjects adjust, remains.

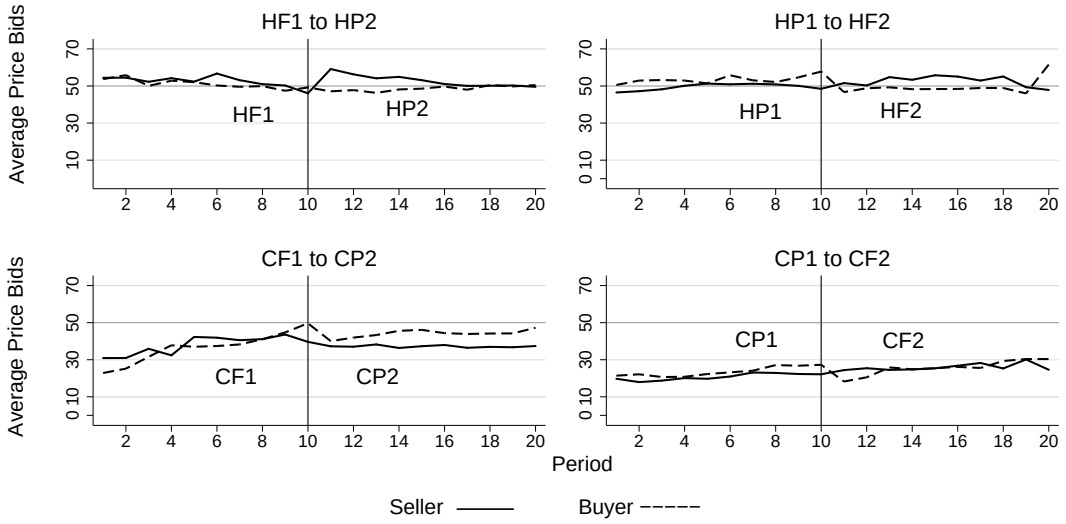

Figure 3.1: Average Price Bid Adjustment Paths: All Periods

evidence that bids deviate again in period 7 and that there are end-of-period effects in period 10. For buyers in HF1, bids deviate significantly only in period 2. For buyers in CF1, bids deviate significantly until period 8.[17] (see Appendix 3.6, Table 3.5)

The difference in average bids between HF1 and CF1 reflects the fact that a substantial share of subjects choose a bid around the market price of coca-cola in CF1. 50 percent of sellers and 55 percent of buyers in CF1 bid no higher than 15 in period 1. In contrast, in HF1 only one buyer and one seller bid no higher than 15. In fact, there are no other subjects who bid lower than 35 in period 1 in HF1. Over time, the share of sellers and buyers in CF1 who bid around the coca-cola price falls, and in period 9 the shares are 25 and 15 percent, respectively.

[17]Non-parametric robust rank tests on equal bid distributions, and T-test on averages with Welch approximations have been run for all tests using Equation 3.1 for all treatments and roles. These tests yield similar results to the regressions. Robust rank tests take into account that the variances in the two treatments may differ due to two focal points (see Siegel and Castellan, 1988, p. 137).

3.4.2 Phase 1: Partial Information

Now consider the effect of the coca-cola when there is partial information. The result is that while average bids clearly center around 50 in HP1, average bids are much lower in CP1, and they do not adjust to 50. The reason for this result is that around half of the subjects get "stuck" on the product price.

The first half of the right-hand graphs in Figure 3.1 and the first half of columns 4,5 and 8,9 in Table 3.2 present the first evidence supporting this result and show the evolution of average bids in HP1 and CP1. In HP1, average bids in period 1 start at 46.5 for sellers and 50.6 for buyers.[18] In CP1, average bids start at 19.7 and 21.4, respectively. Although bids increase slightly in CP1 over time to 22.3 and 26.8 for sellers and buyers, respectively, in period 9, bids are never higher than 27.3.

Re-estimating Equation 3.1 for each role, with $d_t = 1$ if the bid belongs to HP1 and $d_t = 0$ if the bid belongs to CP1, it strongly rejects that subject's bids are equal to 50 in CP1 in each period. In HP1, there are no significant deviations from 50 (see Appendix 3.6, Table 3.5).

The large difference in average bids between HP1 and CP1 is due to the fact that 74 percent of sellers and 58 percent of buyers in CP1 bid a price no higher than 15 in period 1, and the share of bids within this interval remains high in all periods. In period 9, the shares are 53 percent and 47 percent, respectively. In HP1, only one seller and one buyer bid in this interval in period 1, and none in any of the other ten periods.

The outcome in CP1 thus stands in stark contrast to the outcome in CF1. A comparison of average earnings in Figure 3.2 between CF1 and CP1 at different bids reveals that while transactions have a high probability of being successful for sellers at the product price, they yield low earnings.[19] Instead, the highest earnings for sellers given acceptance rates are for bids around the equal-split, disregarding a few sellers in CF1 who manage to get through bids that give them

[18] Using Equation 3.1, there are no significant differences between bids in HF1 and HP1 in any period.

[19] Average earnings are calculated as the average of the price bid category multiplied by the share of successful bids to the total number of bids in that category. The average of each price bid category yield the profit 8, 23, 38, 53, 68, 83, and 95.5 for sellers and 92, 77, 62, 47, 32, 17, and 4.5 for buyers.

most of the surplus (see section 3.4.5).

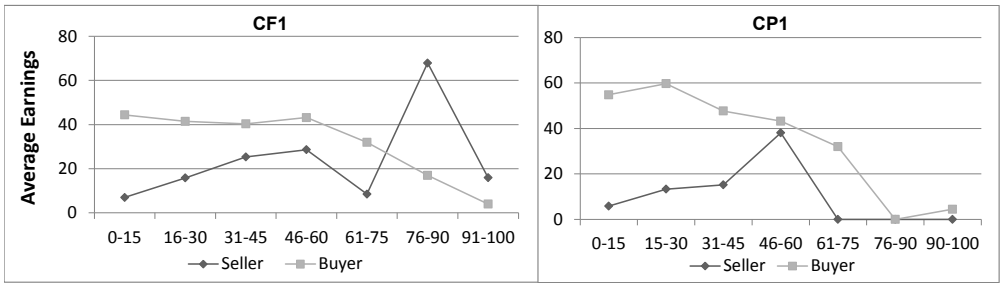

Figure 3.2: Phase 1: Average Earnings at Different Bids

For buyers in CF1, there are two points that yield almost similar high earnings given acceptance rates; the product focal point and the equal split. For buyers in CP1, the highest earnings come from bids somewhat higher than the product price, closely followed by bids around the product price. In addition, buyers in CP1 also have the highest earnings of the four groups. Thus, the combination of the presence of coca-cola and the information structure clearly benefits these buyers, and make it difficult for sellers in CP1 to induce adjustment.

3.4.3 Phase 1: Beliefs

If subjects choose the product price because they expect that the partner will, then the effect of the product should come through in beliefs. Running Equation 3.1 in the same way as with actual bids, but with the dependent variable $belief_{it} - 50$, leads to results similar to those for bids.

In CF1, beliefs are stickier than bids. Sellers' beliefs have adjusted in period 9 and buyers deviate until period 10. This may reflect two effects. First, sellers need to bid a lower price than buyers and buyers take this into account. Second, buyers may be inclined to believe that sellers opt for a lower bid, since this is more beneficial for buyers, i.e. a self-serving bias. However, if there is a self-serving bias, then we should observe that beliefs differ between buyers and sellers, but this is not the case.[20] In CP1, there is no adjustment for either buyers or

[20]Parameter coefficients in Table 3.6 are not significantly different when estimated with Equation 3.1, and neither are non-parametric Wilcoxon-Mann-Whitney tests on different belief distributions between buyers and sellers for each period.

sellers and beliefs are significantly lower than 50 in all periods (see Appendix 3.6 Table 3.6).[21]

In addition, many subjects best respond to these beliefs. In CF1, 46 percent of sellers bid $p^s = g^s$ and 71 percent of buyers bid $p^b \geq g^b$. In CP1, these figures are 47 and 60, respectively. Regressing bids on beliefs yields slope coefficients 0.74 and 0.89 for buyers and sellers, respectively, in CF1, and 0.93 and 1.2, respectively, in CP1. Thus, on average, sellers tend to bid slightly lower than their beliefs about the buyer's bid. Buyers in CP1 bid slightly higher than their beliefs but buyers in CF1 bid slightly lower. The reason for the latter result may be that these buyers are expecting sellers to adjust, but are reluctant to increase their bids.

3.4.4 Phase 2: Order Effects of Feedback

This section examines the effect of information when subjects switch treatments. The result is that subjects tend to bid in the same fashion as at the end of the first phase, even though the information feedback changes and they meet a new partner. This means that average bids are close to 50 in CP2, and that average bids in CF2 *do not* adjust since approximately half of the subjects stick to the product price throughout phase 2. Thus, previous experience overrides any change in bids that a new partner and new information may cause.

Figure 3.1 and the second half of Table 3.2 provide the first piece of evidence supporting this result. The left hand graphs in Figure 3.1 show the evolution of average bids for those who play F-treatments in phase 1 and P-treatments in phase 2. In HP2, subjects still coordinate around 50, even though there are initially some aggressive bids from sellers. In CP2, average bids are slightly lower for sellers and slightly higher for buyers than at the end of phase 1. This may reflect the fact that, with increased strategic uncertainty, sellers should decrease their bids and buyers should increase theirs to improve the chances of a successful transaction. The shares of subjects who bid a price no higher than 15 are still around 25 percent for sellers and 20 percent for buyers and remain about the same throughout phase 2.

The right hand graphs in Figure 3.1 show the evolution of average bids for

[21] In HF1 and HP2, there are no significant deviations from 50.

those that first play P-treatments and then play F-treatments. In HF2, subjects tend to choose 50 even if there are, as in HP2, some aggressive bids from sellers. In CF2, average bids are still low for both buyers and sellers and they do not adjust to 50. In fact, there is very little adjustment as average bids start at 24.4 for sellers and 18.3 for buyers and end around 30.2 and 30.4, respectively, in period 19. In addition, the share of subjects who bid a price no higher than 15 is around 50 percent for both buyers and sellers throughout phase 2.

In general, it seems as if subjects tend to bid similar prices in phase 2 to those they have adjusted to at the end of phase 1. To confirm that this is the case, I test if the average of bids in period 8 and 9 and bids in each period in phase 2 come from the same price bid distribution. Signed-rank tests do not reject for any of the periods or roles that bid distributions the same, except in period 11 for sellers in CP2 and buyers in CF2.[22]

3.4.5 Pairwise Interaction

This section examines the underlying dynamics in average bids at the pairwise level in the C-treatments. The result is that the adjustment process is heterogenous. In CF1, most of the pairs learn to play equal-splits, but in CP1, most pairs converge to the product price. The increased strategic uncertainty and not observing the buyers' bids seem to make sellers more susceptible in CP1 and reluctant to initiate or insist on higher bids. In both treatments, there is considerable experimentation, which leads to higher payoffs. However, there is less experimentation in phase 2, so what subjects have learned in phase 1 seems to affect their play in phase 2.

Figure 3.3 shows how the 20 pairs of subjects interact in CF1 and CP2. In each graph, the solid line represents the seller who is the same in all periods, but she faces one buyer in phase 1 and another in phase 2, the short and long dashed lines. The y-axes show bids and the x-axes periods. Consider first phase 1 where both subjects can see each other's bids. Most subjects start either at the product

[22]Furthermore, a two-sided signed-rank test for the average of bids in 8 and 9 versus the average of bids in period 13 to 19 does not reject that distributions are the same for either sellers or buyers (CF1=CP2: sellers, p=0.1415, n=20; buyers, p=0.6538, n=20. CP1=CF2: sellers, p=0.1251, n=19; buyers, p=0.8563, n=19).

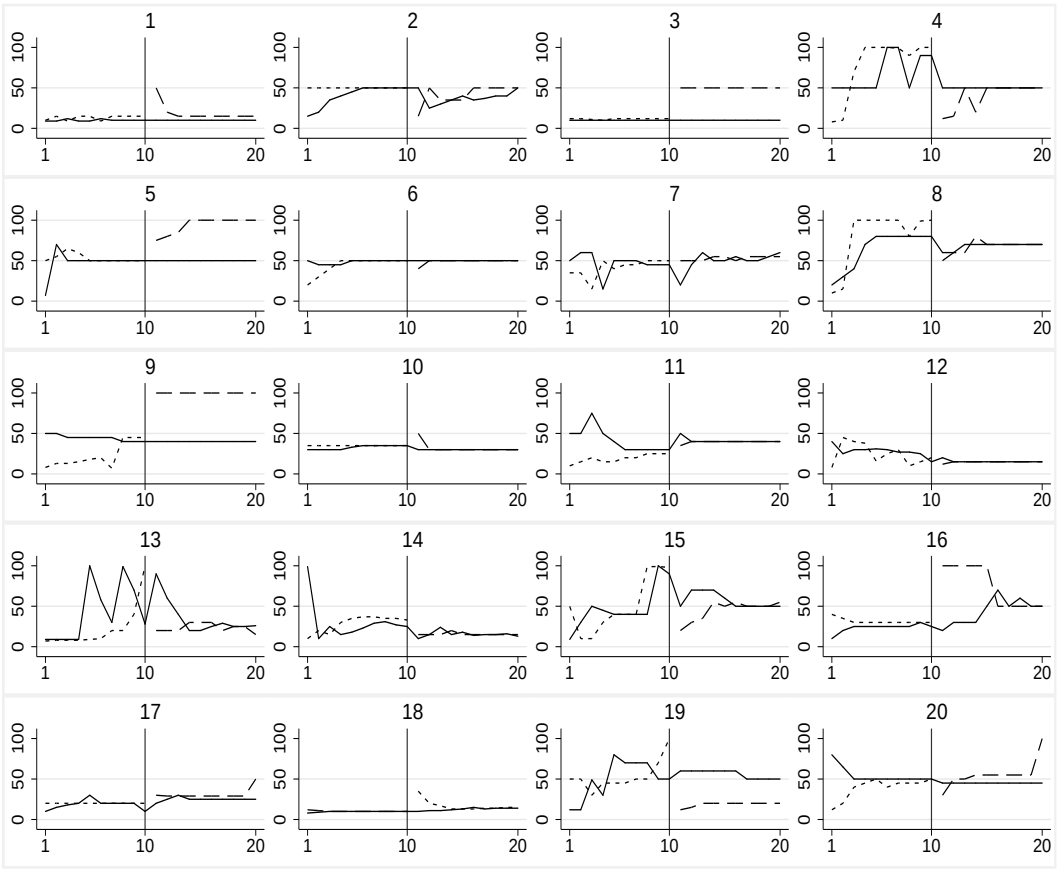

Figure 3.3: Pairwise Interaction in the C-Treatments: Full Information in Phase 1 and Partial Information in Phase 2

price or around 50. There is initial miscoordination in most pairs, but subjects' bids tend to follow each other. Some pairs are tightly coordinated in the sense that they quickly adjust to a price and then stay around that price throughout the first phase. The price they coordinate around is either the product price, or 50, or a price in between these two points (see graph 1, 3, 5, 6, 10, 16, 17, 18).

For other pairs, the bargaining process is more volatile and consists of large differences between the pair's bids with intermittent coordination on the same price (graphs 4, 7, 8, 12, 14, 15, 19). In these pairs, buyers and sellers seem to be quick to accommodate each others' bids, and for some pairs this leads to sellers getting most of the surplus (graphs 4, 8, 15, 19). There are also some

sellers who insist on a higher bid even though this leads to failed transactions in almost all ten periods (graphs 9, 11, 13, 20). Even though it may be profitable to forgo bids to induce a more profitable outcome in the following periods, it is a costly strategy in these pairs, particularly for buyers, since it leads to failed transactions in almost all periods.

Now consider periods 11 to 20 where subjects receive partial information and a new partner. In this phase, a buyer can bid a very high price to increase the chance of a successful transaction without having to reveal the bid to the seller. Four buyers follow this strategy, but for one of them the seller eventually increases her bid above 50, which causes the buyer to quickly drop her bid (graphs 3, 5, 9, 16). By the end of the 20 periods, most subjects converge to bids around 50 and some subjects converge to bids around the coca-cola price (graphs 1-7, 9, 11-12, 14-16, 18-20). Apart from these two outcomes, there are also subjects who converge to a price between 50 and the product price, i.e. around 30 (graphs 10, 13, 17). This outcome can be supported as "splitting-the-difference", the equitable outcome when parties hold opposing positions (see e.g. Farber, 1981).[23]

Overall, subjects experiment more with different bids in phase 1 than in phase 2. The average number of changes in bids in phase 1 is significantly higher than in phase 2, 4.15 and 2.45, respectively (two-sided signed-rank test on total number of changes in bids per subject in each phase, p=0.0003, n=40). The average of absolute changes in bids is also larger in phase 1, 6.61 and 3.75, respectively (two-sided signed-rank test on average size of absolute change in bids per subject in each phase, p=0.003 n=40). Since subjects have gained some experience of what they perceive to be a successful bid, and many have learned to play equal-splits during phase 1, it is reasonable that there is less experimentation.

Figure 3.4 shows the 19 pairs that start in CP1 then play CF2. First, consider phase 1. After some initial miscoordination, ten pairs have converged to the product price and only three pairs have adjusted to around 50. Compare this to Figure 3.3, where three pairs converge to the product price and seven to 50.

In some pairs, the seller initially bids around the product price. The buyer, who has first bid a higher price, observes this and, instead of sticking to a high bid that ensures a transaction, also lower her bid (graphs 23, 26, 30, 36). In some

[23]Note that Binmore et al. (1989) use split-the-difference as an outcome in bargaining games with outside options.

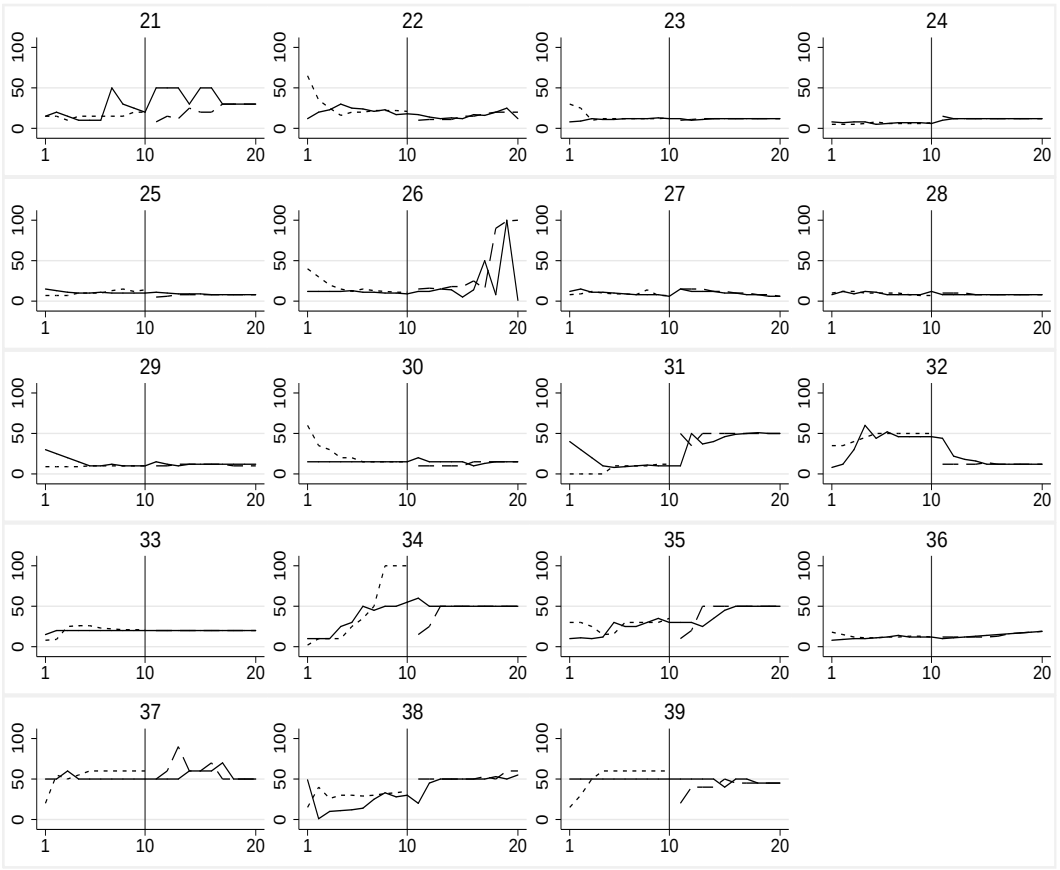

Figure 3.4: Pairwise Interaction in the C-Treatments: Partial Information in Phase 1 and Full Information in Phase 2

pairs, the seller initially bids a higher price than the buyer who has bid around the product price. When the buyer sticks to her bid, these sellers accommodate (graphs 24, 25, 27, 29, 31). The bargaining process in all these pairs thereafter centers around the product price.

There are also some pairs where there is adjustment. For some of these, adjustment comes when a seller manages to use the slack between her bid and a high bid from the buyer to sequentially increase her bids (graphs 22, 32, 38), or after a costly path of failed transactions (graph 34). In general, it seems as though sellers carry the burden of initiating adjustment and/or carrying it through but in CP1 they are more susceptible to do so since they do not learn

the buyer's bid.

Now consider phase 2 where subjects face a new partner and sellers receive information about the opposing buyer's bid. Contrary to what we have observed in CF1 in Figure 3.3, few sellers manage to use this information to successfully adjust to equal-splits. Only three pairs adjust from the product price to 50 (graphs 31, 35, 38). An additional three pairs bid around 50, but in these pairs the seller has successfully bid around this price in the first phase (graphs 34, 37, 39). At the end of the 20 periods, ten pairs have converged around the product price (graphs 23-25, 27-30, 32-33, 36) and six pairs have converged around 50. In addition, there are two "split-the-difference" outcomes (graphs 21, 22).

In terms of experimentation, subjects change their bids, on average, 4.65 times in phase 1 and 3.42 times in phase 2 (two-sided signed-rank test, p=0.0103, n=38). The averages of the absolute sizes of changes in bids are 3.75 and 3.88, respectively (two-sided signed-rank test, p=0.8904, n=38). Thus, subjects seem to experiment with different bids in both phases, but there is mixed evidence of how they experiment. First, they change their bids more times in phase 1 than in phase 2 but, on average, there is no difference in the sizes of the changes.

In addition, the sizes of price changes are larger in CF1 than in CP1, but not significantly different between CP2 and CF2 (WMW, two-sided, n=78, phase 1 p=0.0366, phase 2, p=0.9163). This provides some additional evidence that subjects are more cautious with their experimentation when they start in CP1. Overall, however, experimentation leads to higher realized average earnings and higher transaction volumes (see Table 3.7 and Table 3.8 in Appendix 3.6).

3.4.6 Regression Analysis of Feedback and Learning

This section examines how subjects respond to the feedback they receive. The result is that subjects react to failed transactions and, depending on treatment and role, the opponent's bid. How sensitive subjects are to the different factors differs between treatments and subjects' initial bids.

For each role, treatment and phase, I run a linear regression where the dependant variable is a subject's change in her price bid. The explanatory variables are lagged transaction and lagged change in the opponent's price bid. For sellers, the latter variable is excluded when they play the P-treatment. I include a time

dummy when necessary in period 10 to capture end of period effects.[24] I also run separate linear regressions on those that bid a price no higher than 15 in period 1 to see if they respond differently from average subjects. These subjects are those that initially perceive that the best strategy is to bid the product price.

Table 3.3: Learning Regressions

Dependent variable	**Change in price bid: All bids**				**Change in price bid: Bids between 0-15 in period 1**			
	CF1		**CP1**		**CF1**		**CP1**	
	Sellers	**Buyers**	**Sellers**	**Buyers**	**Sellers**	**Buyers**	**Sellers**	**Buyers**
PHASE 1								
Failed transaction, t-1	-7.143***	8.675***	-5.651***	2.997***	-5.469	9.989***	-4.333**	1.813*
	(2.350)	*(2.052)*	*(1.723)*	*(0 .816)*	*(3.092)*	*(2.860)*	*(1.860)*	*(0.914)*
Opponent's bid, t-1	0.262**	-.0326		0.133	0.417***	-0.015	-	0.155
	(0.110)	*(0.032)*	-	*(0.080)*	*(0.082)*	*(0.04)*		*(0.111)*
t10	-6.912**							
	(2.850)							
Constant	3.780**	0.018	2.186***	-0.348	2.552*	-0.720	2.357**	0.882
	(1.390)	*(0.903)*	*(0.705)*	*(0.650)*	*(1.341)*	*(1.419)*	*(0.905)*	*(0.967)*
Prob>F	*0.000*	*0.002*	*0.004*	*0.002*	*0.000*	*0.015*	*0.037*	*0.078*
R-squared	0.117	0.099	0.145	0.097	0.069	0.111	0.102	0.061
Number of observations	160	160	171	152	80	88	126	88
PHASE 2	**CP2**		**CF2**		**CP2**		**CF2**	
Failed transaction, t-1	-6.592**	7.239***	-7.245**	4.596**	-8.049*	8.270**	-7.867*	4.931**
	(0.012)	*(2.518)*	*(3.054)*	*(1.664)*	*(3.875)*	*(3.651)*	*(4.413)*	*(2.190)*
Opponent's bid, t-1	-	0.041	0.721***	0.100***	-	0.072	0.935***	0.099**
		(0.082)	*(0.240)*	*(0.032)*		*(0.093)*	*(0.195)*	*(0.038)*
Constant	1.408**	-0.717	1.167**	-0.082	1.757*	-1.087	0.293	0.156
	(0.026)	*(0.752)*	*(0.528)*	*(0.193)*	*(0.946)*	*(0.801)*	*(0.377)*	*(0.253)*
Prob.>F	*0.012*	*0.018*	*0.026*	*0.000*	*0.068*	*0.069*	*0.000*	*0.002*
R-squared	0.204	0.132	0.304	0.108	0.2342	0.241	0.362	0.089
Number of observations	180	180	171	171	90	99	126	99

*,**, *** denote significant on 10, 5, and 1 percent level. Cluster-robust standard errors are reported in parentheses.

Table 3.3 shows that for all subjects and phases, except for sellers in CF1 that bid 0-15 in period 1, failed transactions lead to significant and expected changes in bids. Sellers decrease their bids and buyers increase theirs. There is considerable variation, however, in parameter coefficients, ranging from 1.81

[24] I have also run regressions that include a time dummy for period 20 but it is not significant in any specifications. In addition, I have run regressions that include two lags for failed transactions, but the second lag is not significant. Regressions that use all 20 periods do not satisfactorily capture differences between the first and second phases and differences between, for example, full information in phase 1 and full information in phase 2.

to 9.99 for buyers and from -8.05 to -4.33 for sellers. In particular, a failed transaction leads to a smaller change in bids in CP1 than in CF1. The reason for this is that many subjects center their bargaining process around the cola price in CP1, while in CF1 most of the subjects adjust from it. This is also clear when comparing coefficient estimates between CF1 and CP1 for those who bid 0-15 in period 1, in particular buyers in CP1 whose response to a failed transaction is only 1.81.

There is also evidence that changes in the opponents' bids causes adjustment. For sellers in CF1, an increase in buyers' bids by one krona leads to a change in the sellers' bid by 0.26 for all subjects, and by 0.42 for those who bid 0-15 in period 1. Thus, sellers use the information on the buyer's bid to increase payoff. Buyers in CF1, on the other hand, do not significantly change their bids in response to changes in sellers' bids, which is likely due to counteracting effects for buyers. First, a buyer should increase her bid to ensure future transactions when a seller has increased hers. However, an increase also means that payoffs will be lower for the buyer, so she may want to lower her bid to signal to the seller that she disapproves of further increases that will decrease her payoff. Buyers in CP1 do not increase their bids to accommodate a change in sellers' bids either. Just as for buyers in CF1, to increase the probability of a successful transaction, a buyer should increase her price when the seller does, but, as is visible from Figure 3.4, some buyers decrease their bid when they observe that the seller starts off at a very low price.

Finally, when sellers are updated with the buyer's bids in CP2, they are highly responsive to changes in this variable. In particular, for those who start in the interval 0-15 in period 1, a one krona increase in buyers' bids leads to, on average, a 0.94 increase in sellers' bids, i.e. almost a one-to-one correspondence. These results suggest that sellers are more sensitive to cues when they play CF2 because they start in CP1.

3.4.7 Determinants Behind Individuals' Choices of Focal Points

In this section, I investigate whether there are individual characteristics that help predict subjects choice of focal point in the C-treatments. The result is that

there are some individual characteristics that are related to subjects' repeated choice of focal point.

As a first step to presenting evidence to support this result, I categorize bids into two different intervals that represent, with some noise and strategic uncertainty, the focal points that the subjects choose between. The product price interval contains bids between 5 and 25, and the equal-split interval contains bids between 26 and 75. This categorization accounts for 95 percent of all bids. In total, there are 798 bids between 5 and 25 and 687 bids between 26 and 75 irrespective of order, role, and treatment.

The distributions of the number of bids in the 5 to 25 and 26 to 75 intervals yield an almost mirror image of each other, so I divide the share of bids in the 5 to 25 interval into three groups based on its empirical distribution (see Appendix 3.6, Figure 3.5). The first group, *Product*, bids 75 percent or more of the times in the 5 to 25 interval. The second group, *Equal*-splits, bid 25 percent or less in this interval. The third group, *Adjust*, bids more than 25 percent but less than 75 percent.

To estimate what causes the individual variation in bids, I use a multinomial logit model with these three groups as the dependent variable.[25] To reduce the risk of overfitting, I first estimate the experimental and demographic control variables, and then I include the variables for which there are theoretical priors, i.e. *Risk*, *CRT*, and *Consumption habits*. With those variables that are significant after these two steps, I investigate *Social preferences*, *Fair pricing perceptions* and *Price norm perceptions*. Table 3.9 in Appendix 3.6 presents the descriptive data for the sample.

Table 3.4 shows the result of the regressions with the *Product* group as the baseline category.[26] Equations 1 and 2 show that receiving full *Information* in phase 1 increases the likelihood of not bidding the product price but the coefficient value is higher for *Equal* than for *Adjust*. Thus, these two groups

[25]There are 30 observations in the *Product*, 20 in *Adjust*, and 28 in *Equal*-splits, which fulfill the minimum requirement of ten observations in each group for the multinomial logit (see Hosmer and Lemeshow, 2000).

[26]The same analysis with *Equal* as the baseline category yields the same results. There are a few exceptions for *Adjust* where the significance, or in a few cases the direction, changes. This is probably due to subjects in this group bidding many times around both the product price and equal-splits.

Table 3.4: Multinomial Logit Regressions of Pricing Strategies, Baseline=*Product* group

Explanatory variables:	**Equation 1**		**Equation 2**		**Equation 3**		**Equation 4**	
	Adjust	**Equal**	**Adjust**	**Equal**	**Adjust**	**Equal**	**Adjust**	**Equal**
INTERCEPT	-5.187*	-5.003*	-0.936	-3.200	-0.516	-2.3375	-2.288	-1.129
	(2.853)	*(3.004)*	*(3.058)*	*(3.787)*	*(0.908)*	*(1.100)*	*(0.152)*	*(1.773)*
Experimental control								
Buyer	0.399	-0.128	0.699	-0.024				
	(0.615)	*(0.610)*	*(0.727)*	*(0.778)*				
Information	0.907	2.11***	1.657**	2.964***	1.717**	3.234***	1.605**	3.021***
	(0.640)	*(0.645)*	*(0.834)*	*(0.924)*	*(0.763)*	*(0.862)*	*(0.796)*	*(0.878)*
Demographics								
Female	-0.604	-0.990	0.338	-0.014				
	(0.636)	*(0.656)*	*(0.850)*	*(0.909)*				
Age	0.202	0.192	0.138	0.118				
	(0.112)	*(0.152)*	*(0.129)*	*(0.155)*				
Risk								
Risk aversion			-0.389*	-0.216				
			(0.222)	*(0.250)*				
Cognitive reflection								
CRT			0 .580	1.170***	0.684**	1.217***	0.685**	1.068***
			(0.367)	*(0.409)*	*(0.317)*	*(0.363)*	*(0.335)*	*(0.372)*
Cola consumption								
Consumption			1.221**	1.054*	0.826*	0.880*	0.823	1.035*
			(0.554)	*(0.567)*	*(0.480)*	*(0.511)*	*(0.551)*	*(0.583)*
Valuation			-0.348**	-0.305**	-0.255**	-0.263**	-0.273**	-0.304**
			(0.139)	*(0.143)*	*(0.118)*	*(0.124)*	*(0.129)*	*(0.137)*
Fair price perception								
Question 6							0.297	-0.911
							(0.513)	*(0.758)*
Guess 7							0.764	0.332
							(0.471)	*(0.533)*
Significance of Model:								
p-value (Prob.>Chi2)	*0.0033*		*0.001*		*0.0000*		*0.0000*	
Pseudo R2	0.1363		0.2624		0.2317		0.2750	
No. Obs.	78		69		73		73	

Standard errors in parentheses. *,**,*** denote significant on 10, 5, and 1 percent level. Pearson correlation coefficients between the explanatory variables are below 0.35 for all but two and below 0.45 for all. Estimates of the variance inflation factors (VIFs) are below 1.55. Hence there are no signs of serious multicollinearity.

seem to be able to use the information they receive in the first phase to different degrees. *Buyer*, *Female*, and *Age* are not significant but there is weak support for *Risk* in *Adjust*. *CRT* is highly significant for *Equal*, which confirms previous findings that higher ability to reflect upon the situation increases the likelihood of abstracting away from the product price (see Holm and Svensson, 2011).

There is also support for *Valuation* and *Consumption*. A higher *Valuation* is negatively related to the likelihood of belonging to either *Adjust* or *Equal*. Thus, a subject who values coca-cola less seems to attach less weight to the price of it. *Consumption* is, surprisingly, positively but weakly related to both groups, contrary to previous findings (see Holm and Svensson, 2011). This could be an intracultural effect between groups that consume a lot of coca-cola and groups that do not.

A Wald test for joint insignificance of *Buyer, Female* and *Age* for both groups does not reject that we can remove these (p=0.771). Once these are removed, *Risk* also turns out to be insignificant (p=0.259) for *Adjust*.[27] Equation 3 shows the result of the remaining significant variables and now *CRT* is also significant for *Adjust*. The coefficient values indicate that *CRT* affects the likelihood of belonging to *Equal* to a larger extent than *Adjust*.

To explore to what extent *Social preferences*, *Fair pricing perceptions*, and *Price norm perceptions* can explain the variation in bids, I first estimate if there is a significant correlation at the 10 percent level between them and the dependent variable. The reason for this is that many of these explanatory variables are highly correlated, particularly the *Fair pricing perceptions* and *Price norm perceptions* variables. I then estimate the variables that are significantly correlated with the groups together with the variables that are significant in Equation 3.

Question 6 (-0.298) and *Guess 7* (0.278) are significantly correlated with the dependant variable.[28] *Question 6* asks about the seller's right to protect her profit when costs increase. The negative correlation means that those who bid the product price fewer times perceive that the seller has the right to protect her

[27] *Risk* is also jointly insignificant with *Buyer, Female* and *Age* (p=0.7068).

[28] I use the poly-serial correlation coefficient that estimates the correlation between two discrete ordered variables with an underlying continuous distributions. In my case the dependent variable can take three values, 1=*Product*, 2=*Adjust*, 3=*Equal*, and many of the explanatories take four ordered integer values.

share of the surplus. *Guess 7* asks if subjects think that others believe it is fair that an airline company increases the price of fares when there are few seats left. This question reflects a market where prices fairly recently have become highly flexible. The positive correlation means that those who bid the product price more often are more prone to believe that others think the industry norm is fair. This suggests that this group is less reflective of price structures and regards a given practice as fair if it has been operating long enough.

Equation 4 shows that neither *Question 6* nor *Guess 7* is individually significant, and they are jointly insignificant too (Wald test, p=0.2061). In addition, Equation 3 predicts as well as Equation 4 (LR-test, p=0.1426). Thus, Equation 3 yields the final results, where a high score on CRT, a high valuation of coca-cola, higher consumption of coca-cola, and more information feedback in phase 1, increase the probability of belonging to *Equal*, and to a lesser extent, *Adjust*.

3.5 Conclusions

In games with many Nash equilibria, the equilibrium that is selected is ultimately an empirical question. Many experiments that use abstract frames find that subjects divide the surplus equally (see e.g. Roth, 1995). The results from this repeated NDG experiment, where buyers and sellers bargain for a coca-cola, emphasize that whether or not subjects learn to play equal-splits depends on what information feedback they receive. A small difference in seller's feedback, which resembles an information structure commonly observed outside the laboratory, causes half of the subjects to stick to the product price. This result supports previous research in emphasizing that observing others' bids is important for learning and convergence (see e.g. Duffy and Feltovich, 1999).

In addition, the outcome is also sensitive to the information feedback subjects initially receive since they tend to bid in the same fashion as they have adjusted to at the end of the first information treatment. Thus, not only does observation matter for what strategies subjects perceive to be viable, but also whether they receive this information when they start learning to play the game. This result is in line with e.g. Roth and Schoumaker (1983) and Binmore et al. (1993), who show that if a particular division has been played sufficiently many times, subjects seem to stick to it even though it yields unequal divisions. This experiment shows

that, under certain information conditions, a product with a well-known price induces similar behavior for many subjects. Finally, subjects' characteristics and their attachment to the product also influence the selected focal point. As one of the subjects said upon collecting the money he had earned in one of the sessions "Why didn't I just give [the other player] the 50 [kronor], but that price of cola is so strong...".

Together these results point to some systematic elements that are likely to erode a competing focal point to equal-splits. In addition, the results also carry some implications for price adjustment. They suggest that prevailing prices may be quite resilient to adjustment because buyers and sellers may become "stuck" on them. In particular, when the seller does not observe the buyer's reservation price, which is typically the case in many markets, sellers may struggle to increase prices because they expect that buyers will not approve, or because buyers are reluctant to accommodate (cf. Kahneman et al. 1986).

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References

Anbarci, N., Feltovich, N., 2011. How responsive are people to changes in their bargaining position? Earned bargaining power and the 50-50 norm. SWP 2012/2 Economics Series, Deakin University Australia.

Bacharach, M., 1993. Variable universe games. In Frontiers of Game Theory, ed. Binmore, K., Kirman, A., Tani, P., MIT Press, Cambridge, MA.

Bacharach, M., Bernasconi, M., 1997. The variable frame theory of focal points: an experimental study. Games and Economic Behavior 19, 1-45.

Bacharach, M., Stahl, D.O., 2000. Variable-frame level-n theory. Games and Economic Behavior 32, 220-246.

Bardsley, N., Mehta, J., Starmer, C., Sugden, R., 2010. Explaining focal points: cognitive hierarchy theory versus team reasoning. The Economic Journal 120, 40-79.

Bayer, R-C., Renner, E., Sausgruber, R., 2009. Confusion and reinforcement learning in experimental public goods games. CEDEX Discussion Paper No. 2009-18.

Bergman, O., Ellingsen, T., Johannesson, M., Svensson, C., 2010. Anchoring and cognitive ability. Economics Letters 107 (1), 66-68.

Binmore, K., Shaked, A., Sutton, J., 1989. An outside option experiment. Quarterly Journal of Economics, 104 (4), 753-770.

Binmore, K., Swierzbinski, J., Hsu, S., Proulx, C., 1993. Focal points and bargaining. International Journal of Game Theory 22 (4), 381-409.

Binswanger, H.P., 1980. Attitudes toward risk: experimental measurement in rural India. American Journal of Agricultural Economics 62 (3), 395-407.

Blanco, M., Engelmann, D., Koch, A., Normann, H-T., 2010, Belief elicitation in experiments: is there a hedging problem? Experimental Economics 13 (4), 412-438.

Camerer, C.F., 2003. Behavioral game theory: experiments in strategic interaction. Princeton University Press, Princeton, NJ.

Croson, R., Gneezy, U., 2009. Gender differences in preferences. Journal of Economic Literature 47 (2), 448-474.

Duffy, J., Feltovich, N., 1999. Does observation of others affect learning in strategic environments? an experimental study. International Journal of Game Theory 28, 131-152.

Erev, I., Roth, A.E., 1998. Predicting how people play games: reinforcement learning in experimental games with unique, mixed strategy equilibria. American Economic Review 88 (4), 848-881.

Farber, H.S., 1981. Splitting-the-difference in interest arbitration. Industrial and Labor Relations Review 35 (1), 70-77.

Feltovich, N., 2000. Reinforcement-based vs. belief-based learning models in experimental asymmetric-information games. Econometrica 68 (3), 605-641.

Frederick, S., 2005. Cognitive reflection and decision-making. Journal of Economic Perspectives 19 (4), 25-42.

Fudenberg, D., Levine, K.D., 1995. Consistency and cautious fictitious play. Journal of Economic Dynamics and Control 19, 1065-1089.

Güth, W., Schmidt, C., Sutter, M., 2007. Bargaining outside the lab - A newspaper experiment of a three-person ultimatum game. The Economic Journal 117, 449-469.

Harbaugh, W.T., Krause, K., Vesterlund, L., 2007. Learning to bargain. Journal of Economic Psychology 28, 127-142.

Harrison, G. W., List, J. A., 2004. Field experiments. Journal of Economic Literature 42 (4), 1009-1055.

Holm, H., Svensson, E., 2011. Equal-splits or market prices: an experiment. S-WoPEc No 2011:16

Holt, C.A., Laury, S.K., 2002. Risk aversion and incentive effects. American Economic Review 92 (5), 1644-1655.

Hosmer, D. W., Lemeshow, S., 2000. Applied logistic regression, 2nd edition. Wiley, New York.

Kahneman, D., Knetsch, J. L., Thaler, R., 1986. Fairness as a constraint on profit seeking: Entitlements in the market. The American Economic Review 76 (4), 728-741.

Roth, A.E., Malouf, M.W.K., 1979. Game-theoretic models and the role of information in bargaining. Psychological Review 86 (6), 574-594.

Mehta, J., Starmer, C., Sugden, R., 1992. An experimental investigation of focal points in coordination and bargaining: some preliminary results. In Decision making under risk and uncertainty: new models and empirical findings, Ed. Geweke, J., Kluwer Academic Publishers, Dordrecht

Mehta, J., Starmer, C., Sugden, R., 1994. Focal points in pure coordination games: An experimental investigation. Theory and Decision 36 (2), 165-185

Milgrom, P., Roberts, J., 1991. Adaptive and sophisticated learning in normal form games. Games and Economic Behavior 3, 82-100.

Murnighan, K., Roth, A., Schoumaker, F., 1988. Risk aversion in bargaining: an experimental study. Journal of Risk and Uncertainty 1 (1), 101-124.

Roth, A.E., 1995. Bargaining experiments. In Handbook of Experimental Economics, Eds. Kagel, J. H., Roth, A.E., Princeton University Press, Princeton NJ.

Roth, A.E, Erev., 1995. Learning in extensive-form games: experimental data and simple dynamic models in the intermediate term. Games and Economic Behavior 8, 164-212.

Roth A.E., Schoumaker, F., 1983. Expectations and reputations in bargaining: an experimental study. American Economic Review 73 (3), 362-372.

Schelling, T., 1960. The strategy of conflict, Harvard University Press, Cambridge MA

Siegel, S., Castellan J. Jr., 1988. Nonparametric Statistics for the Behavioural Sciences. McGraw-Hill, New York.

Sugden, R., 1995. A theory of focal points. The Economic Journal 105 (430), 533-550.

Urs Fischbacher (2007): z-Tree: Zurich Toolbox for Ready-made Economic Experiments, Experimental Economics 10 (2), 171-178.

Tversky, A., Kahneman, D., 1984. Choices, values, and frames. American psychologist 39 (4), 341-350.

Van Huyck, J.B., Battalio, R.C., Beil, R.O., 1990. Tacit coordination games, strategic uncertainty, and coordination failure. American Economic Review 80 (1), 234-248.

Van Huyck, J.B., Cook, J.P., Beil, R.O., 1997. Adaptive behavior and coordination failure. Journal of Economic Behavior and Organization 32, 483-503.

Xia, L., Monroe, K.B., Cox, J.L., 2004. The Price Is Unfair! A Conceptual Framework of Price Fairness Perceptions Journal of Marketing 68 (4), 1-15.

Young, P.H., 1996. The economics of convention. The Journal of Economic Perspectives 10 (2), 105-122.

3.6 Appendix

Table 3.5: Phase 1: Average Deviations from 50, Price Bids

	Full Information				Partial Information			
	Seller		Buyer		Seller		Buyer	
Period	HF1	CF1	HF1	CF1	HP1	CP1	HP1	CP1
1	4.42	-19.10***	3.71	-27.15***	-3.50	-30.26***	0.57	-28.58***
2	4.50	-19.05***	5.86**	-24.80***	-2.79	-32.05***	2.93	-27.84***
3	2.29	-14.10***	0.71	-18.45***	-1.79	-31.26***	3.21	-29.32***
4	4.21	-17.60***	2.86	-12.20*	0.14	-29.89***	2.92	-29.21***
5	2.36	-7.70	2.07	-13.00**	1.29	-30.26***	1.42	-27.68***
6	6.72**	-8.10	0.29	-12.60**	0.93	-29.05***	5.79	-26.79***
7	3.14	-9.45*	-0.43	-11.75*	1.21	-26.89***	3.07	-25.89***
8	1.00	-8.90	-0.07	-8.95	0.86	-27.11***	2.14	-22.89***
9	0.29	-6.40	-2.57	-5.25	0.07	-27.68***	4.64	-23.21***
10	-3.93	-10.35*	1.79	-0.35	-1.50	-27.84***	7.79	-22.74***
Number of subjects	*340*		*340*		*330*		*330*	

*,**, *** denote significant at 10, 5, and 1 percent level.
Cluster-robust standard errors. The constant is excluded to prevent multicollinearity.

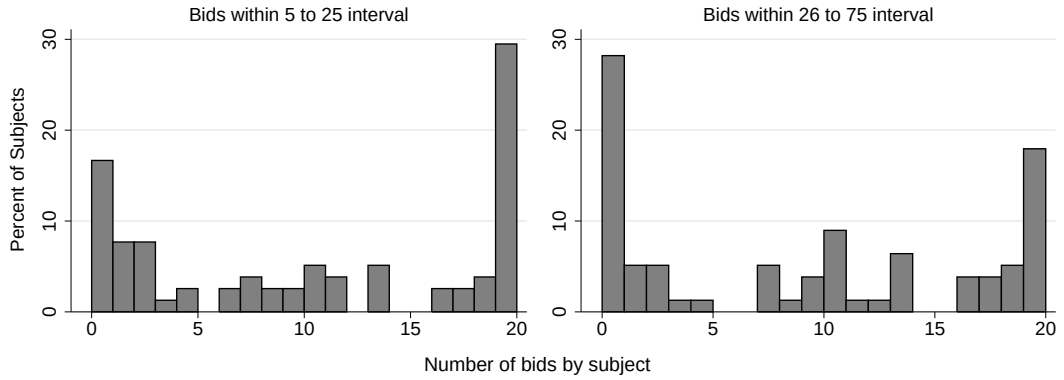

Figure 3.5: Number of Bids between 5 to 25 and 26 to 75 in the C-treatments

Table 3.6: Phase 1: Average Deviations from 50, Beliefs

	Full Information				Partial Information			
	Seller		Buyer		Seller		Buyer	
Period	HF1	CF1	HF1	CF1	HP1	CP1	HP1	CP1
1	-4.28	-18.70***	1.93	-21.55***	-6.07	-33.42***	-4.64	-29.95***
2	1.86	-17.70***	3.64	-19.60***	-0.57	-34.11***	-2.29	-33.11***
3	1.07	-20.30***	1.07	-19.75***	-0.43	-33.05***	-1.36	-31.00***
4	2.00	-17.80***	2.86	-18.25***	-0.93	-30.00***	-2.14	-30.42***
5	2.14	-14.90***	3.14	-16.40***	2.14	-28.53***	-1.71	-29.89***
6	1.79	-7.75	3.14	-13.90***	1.36	-29.53***	2.07	-29.11***
7	3.14	-10.55*	1.86	-11.00**	2.36	-28.00***	-1.21	-27.89***
8	0.64	-11.55**	2.07	-11.15**	0.50	-27.74***	0.71	-27.16***
9	-0.43	-8.00	-0.43	-11.60**	-0.57	-28.00***	0.36	-27.05***
10	3.29	-7.65	-0.79	-3.20	0.71	-27.11***	0.071	-26.89***
Number of subjects	*280*		*340*		*330*		*330*	

*,**, *** denote significant at 10, 5, and 1 percent level.

Cluster-robust standard errors. The constant is excluded to prevent multicollinearity.

Table 3.7: Transaction Volumes, Percentages

Period	HF1	HP1	CF1	CP1
1	64	57	50	53
2	79	50	50	63
3	79	64	50	63
4	93	71	75	63
5	93	79	65	68
6	79	79	60	79
7	79	64	65	74
8	86	64	75	79
9	86	79	75	68
10	100	93	95	95
Phase 1	*84*	*70*	*66*	*71*
	HP2	HF2	CP2	CF2
11	50	43	50	47
12	50	64	80	47
13	57	71	65	68
14	50	71	85	63
15	57	71	80	79
16	71	64	80	79
17	71	71	90	84
18	86	79	90	84
19	79	71	90	84
20	93	86	85	95
Phase 2	*66*	*69*	*80*	*73*

Table 3.8: Average Earnings

	CF1		CP1	
Period	Seller	Buyer	Seller	Buyer
1	6	44	5	47
2	8	42	8	54
3	15	35	11	52
4	22	53	11	51
5	24	42	13	54
6	25	35	14	65
7	22	43	19	55
8	27	48	17	60
9	30	45	17	51
10	38	57	22	73
Phase 1	*22*	*44*	*14*	*56*
	CP2		CF2	
11	11	39	8	39
12	25	55	9	38
13	21	44	16	52
14	27	58	17	46
15	28	52	21	58
16	28	52	20	59
17	33	58	19	65
18	31	59	19	65
19	33	57	23	61
20	31	54	24	71
Phase 2	*27*	*53*	*18*	*55*

Table 3.9: Descriptive Statistics of Regression Variables

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Experimental controls					
Buyer	78	0.50	0.50	0	1
Information	78	0.51	0.50	0	1
Demographics					
Age	78	22.24	2.44	19	32
Female	78	0.37	0.49	0	1
Risk					
Risk preference	74	6.14	1.83	1	10
Cognitive Reflection					
CRT	78	1.58	1.12	0	3
Consumption Habits					
Consumption	78	0.64	1.00	0	4
Valuation	73	7.40	3.55	0	15
Social Preferences					
Dictator	78	19.23	21.19	0	90
Voting	78	0.08	0.27	0	1
Charity	78	0.38	0.49	0	1
Blood donation	78	0.83	0.39	0	1
File sharing	78	0.21	0.41	0	1
Fair Pricing Perceptions					
Question 1	78	2.5	0.83	1	4
Question 2	78	1.92	0.85	1	4
Question 3	78	1.92	0.92	1	4
Question 4	78	3.23	0.85	1	4
Question 5	78	2.22	0.91	1	4
Question 6	78	1.38	0.63	1	4
Question 7	78	1.68	0.71	1	4
Question 8	78	1.72	0.72	1	4
Price Norm Perceptions					
Guess 1	78	2.69	0.83	1	4
Guess 2	78	2.35	0.88	1	4
Guess 3	78	2.28	0.82	1	4
Guess 4	78	3.28	0.90	1	4
Guess 5	78	2.42	0.95	1	4
Guess 6	78	1.46	0.68	1	4
Guess 7	78	1.94	0.80	1	4
Guess 8	78	1.97	0.76	1	4

Chapter 4

Regional Effects of Monetary Policy in Sweden

4.1 Introduction

What constitutes an optimal currency union geographically has been debated for decades. Shocks hitting a currency union can have drastic effects in some regions and small or no effects in others due to differences in economic and social infrastructure. Fundamentally, every nation is itself a currency union, in many cases comprising an eclectic mix of geographical entities forged into a nation state. This diverse regional mix has implications for economic policy. While fiscal policy can be tailored to suit the prevailing regional economic conditions, monetary policy is national by nature and its effects will depend on the regional characteristics (see Domazlicky, 1980). This paper investigates the effect of a monetary policy shock on regional employment in Sweden and the causes of potential asymmetric effects.

Many studies examine the effects of a monetary policy shock in one nation or across nations but few studies assess the implications for regions within one country. Much can be learned by examining the effects of the transmission mechanism within one country since the research does not struggle with the same institutional differences as do cross-country studies such as those of the Euro

Area/European Union.[1] A nation provides a more coherent legal, financial, and normative environment.

The vector autoregressive model, pioneered by Sims (1980), is a popular tool for assessing the monetary policy transmission mechanism. Using this approach at the regional level a number of studies find asymmetric responses to a contractionary monetary policy shock. Carlino and Defina (1999) find asymmetric effects on American state per capita income (see also Owyang and Wall, 2009) and Georgopoulous (2009) on Canadian provincial employment. In Europe, Arnold and Vrugt (2002, 2004) find differences in regional output in the Netherlands and Germany. There is also evidence from developing countries where Ridhwan et al. (2011) find asymmetric responses in regional output in Indonesia and Nachane et al. (2002) on Indian state domestic product.

This paper investigates the effect of a contractionary monetary policy shock on employment in the Swedish regions, *län*, 1993:1 to 2007:4. These regions are all subject to the same overarching regulatory and financial environment, and to the same central bank, *Riksbanken*, which imposes the same policy shock across all regions. It uses a VAR model with exogenous foreign variables and estimate impulse responses to assess the effect of a monetary policy shock on regional employment. The chosen time period is characterized by a coherent policy environment in which explicit inflation targeting has been the goal. Inflation targeting together with a switch from a fixed to a floating exchange rate in 1992, has given monetary policy a prominent role in Swedish economic policy-making, from 1993 onwards.

This paper complements the abovementioned studies of regional asymmetric effects in a number of ways. First, there are qualitative differences in the way the transmission mechanism works in a large and fairly closed economy, such as the US, and a small open economy, such as Sweden. In the latter case, foreign impulses and exchange rate effects play an important role (e.g. Kim and Roubini, 2000). Second, the studies on the Netherlands, Germany and India struggle with data issues. The use of annual data may cause timing issues in identifying the effect of monetary policy transmission, and it limits the number of observations.[2]

[1]For an overview of the problems facing the Euro Area countries see Peersman, 2004, for the legal environment see Cechetti, 1999.

[2]The data period in the Netherlands is 1973 to 1993, and in Germany 1970 to 2000 for

Third, the number of official regions in Sweden is larger than the number of Canadian provinces allowing for a more systematic assessment of the transmission channels.

The results clearly show that monetary policy has asymmetric effects across the Swedish regions. In most regions, a contractionary policy shock leads, as expected, to a significant fall in employment. These regions tend to have a larger share of employment in the goods sector than the regions where the same policy shock has no significant employment effects. This finding lends support to the interest rate channel whereby changes in the policy interest rate affects interest-sensitive industry output. There is also some support for the exchange rate channel where regions that are adversely affected have higher export intensity. Furthermore, these regions are significantly more interest-sensitive in terms of both the interest and exchange rate and credit channels, the latter proxied by the share of small firms. The credit channel alone, however, fails to explain the differences in responses. Finally, there is a group of regions that, surprisingly, respond positively to the same policy shock, increasing employment when interest rates increase.

From a policy stand point, it is clearly insufficient to evaluate the effect of monetary policy on employment at the national aggregate level. That some regions are negatively affected and others not also underlines the need for better geographical matching processes in labor markets and higher labor mobility. Furthermore, fiscal policy can be better targeted to address the adverse regional effects of monetary policy when policy-makers recognize the different responses the regions experience. The results also shed some light on Euro Area policy-making. As regions respond differently within nations, maybe we should be less concerned with comparing differences in national aggregates in the EMU and more concerned with regions within the union, which may transcend national borders.

The paper is organized as follows. Section two discusses the transmission mechanism in a small open economy and the sources of differential effects. Sec-

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the Western regions and 1992 to 2000 for the Eastern regions. In addition, the study of Dutch regions only tests for industrial composition differences and not other sources of regional differences (Arnold and Vrugt, 2002, 2004). The data period in the Indian study is 1969 to 1999 (Nachane et al. 2002).

tion three discusses the VAR methodology, sample selection, identification of the structural VAR model, and sensitivity. Section four presents the empirical results and section five offers conclusions.

4.2 Sources of Regional Differences

The literature on monetary policy transmission effects outlines two key channels through which the policy interest rate affects the real economy: the interest and exchange rate channel and the credit channel (e.g. Bernanke and Gertler, 1995, Christiano et al., 1999). The interest and exchange rate channel affects household interest-sensitive consumption and the cost of capital for fixed investment and inventories. It also contains the effect of the policy interest rate on the exchange rate and therefore on net exports. The credit channel emphasizes the effects on the ability of firms and households to borrow and depends on the financial market structure. When factors that are affected by these channels, such as industry mix, export intensity and firm size, are distributed asymmetrically across regions, differences in regional responses can occur.

4.2.1 The Interest and Exchange Rate Channel

The interest rate channel emphasizes that some industries are more sensitive to interest rate changes than others and that, when regions have different industry mixes, an increase in the policy interest rate has a greater effect on the regions with a higher share of interest-sensitive industries. Industries that produce durable goods, investment goods, and other mainly loan-financed goods, and industries such as construction and other highly capital-intensive industries tend to be more interest rate sensitive because consumers can postpone spending on their products when interest rates increase (Carlino and DeFina, 1999, ECB, 2002).

This demand effect on interest-sensitive spending is the key channel in large and fairly closed economies such as the USA and the Euro Area. In small economies with a substantial degree of international trade, the main effects are likely to come from changes in the real exchange rate (see Angeloni et al. 2002). A contractionary policy shock appreciates the exchange rate which increases the

cost of domestic goods and services relative to foreign ones and thus leads to a fall in net exports. The service sector, on the other hand, is less affected by the exchange rate effect, and it is also less interest-sensitive (ECB, 2002).

Previous regional studies confirm this role for interest-sensitive production, and to some extent exports. Specifically, Carlino and Defina (1999) find that manufacturing increases the effect of a monetary policy shock on the Gross State Product in the USA, and similar effects are found in India (Nachane et al., 2002). Georgepoulous (2009) finds that a monetary policy shock negatively affect employment in primary-based regions in Canada and, to a lesser degree in manufacturing-based regions. Much of the interest-sensitive production in the Canadian case is exported and is thereby influenced by the exchange rate while the primary-based industry is dependent on seasonal credit. Arnold and Vrugt (2002, 2004) find that the industry mix explains regional differences in output growth, or output volatility, in the Netherlands and Germany, and sectoral composition also explains differences in real output in Indonesian regions (Ridhwan et al., 2011).

Table 4.1 presents the regional data on employment in the goods and services sector and export intensity in Sweden. The region with the highest share of employment in the goods sector, and thus expected to respond more to monetary policy shocks, has 39 percent of the workforce employed in this sector. The lowest share is 17 percent. In the services sector, the region with the lowest share of employment, and thus expected to be more interest-sensitive, employs 17 percent of the workforce. The highest share in services is 56 percent.[3]

Export intensity shows the share of export to turnover in the regions' firms. The region with the highest export intensity exports 59 percent of turnover compared to the region with the lowest export intensity which exports only 9 percent of turnover. A high export intensity should make a region more vulnerable to an appreciation of the exchange rate and therefore respond negatively to a hike in the policy interest rate.

[3]The regional data in Sweden does not disaggregate further into sectors within goods and services for the full time period of this study.

Table 4.1: Regional industry mix and export intensity, averages (%)

	Goods	**Services**		**Export Intensity**
Jönköping	39.1	29.2	Gävleborg	58.6
Kalmar	38.9	26.5	Dalarna	43.6
Kronoberg	35.4	33.5	Västernorrland	41.3
Västmanland	34.1	33.8	Norrbotten	38.9
Blekinge	33.7	28.0	Västmanland	37.2
Gävleborg	33.1	30.4	Örebro	36.0
Södermanland	32.0	31.3	Västra Götaland	35.2
Östergötland	31.7	34.7	Kronoberg	34.7
Halland	31.6	34.9	Blekinge	34.5
Dalarna	31.0	30.7	Kalmar	33.0
Örebro	30.6	32.1	Södermanland	31.6
Värmland	29.6	30.9	Östergötland	31.0
Västra Götaland	29.4	38.6	Västerbotten	30.3
Gotland	29.3	31.0	Uppsala	30.1
Skåne	27.7	39.8	*NATIONWIDE*	*28.0*
NATIONWIDE	*26.9*	*39.6*	Värmland	27.8
Västernorrland	26.6	33.9	Jönköping	22.7
Västerbotten	26.4	29.3	Skåne	21.8
Norrbotten	25.0	29.5	Stockholm	20.8
Jämtland	24.9	33.7	Halland	15.5
Uppsala	23.2	33.3	Jämtland	9.8
Stockholm	16.5	55.8	Gotland	8.7
Max	*39.1*	*55.8*		*58.6*
Min	*16.5*	*26.5*		*9.8*
Standard deviation	*5.19*	*6.05*		*11.25*

Sources: Gross Regional Product, SCB. Firm exports and turnover, SCB FDB, 1997-2004. Classification according to SNI2002 in which goods production SNI 01-45 includes the primary sector, mining, manufacturing, electricity, gas, heating, and water suppliance, and construction, and services (SNI 50-95) includes hotel and tourism, education and research, consultancy, transportation, communication, and recruitment services.

4.2.2 The Credit Channel

The credit channel emphasizes the effect that interest rate increases have on the ability to borrow. Studies indicate that credit supply tends to fall after an increase in the policy interest rate and this squeeze in credit supply constrains firm and household ability to borrow (e.g. Bernanke and Blinder, 1992). The impact of such a supply squeeze depends on the available alternatives such as the possibility of issuing equity or borrowing in the bond market: large firms tend to have more such financing options available to them than do small firms (Kashyap and Stein, 1997). In addition, small firms tend to be riskier in terms of

prospects and viability, so the cost of all types of financing alternatives available for them may be higher after a monetary policy shock (Gertler and Gilchrist, 1993, Oliner and Rudebusch, 1995). A proxy for the credit channel is thus the share of small firms.[4]

Ridhwan et al. (2011) and Nachane et al. (2002) find support for the credit channel but the regional studies of the USA, Germany, and Canada, however, find little evidence that small firms affect regional production or employment (Carlino and DeFina, 1999, Arnold and Vrugt, 2004, Georgepoulous, 2009). Most of the previous studies, however, measure small firms as the number of small firms in proportion to all firms. This is problematic, as a small firm may consist of fewer than 5, 20, 50, or 250 employees. For example, in the Canadian study, there is very little variation in this variable (94.5 to 97.3 percent) which make it difficult to capture any effect of monetary policy on either output or employment. When I compare the number of small firms as a proportion of all firms and the share of employment in small firms in the Swedish regions in Table 4.2 the differences are clear.

While the number of small firms only varies between 98.8 and 99.5 percent, there are large differences in terms of their share of employment. In the region with the highest share of small firm employment, and thus the region expected to react more to monetary policy shocks, almost 60 percent of the total number of employees in the region works in a small firm. In the region with the lowest share of employees in small firms, and thus the region expected to be less sensitive, small firms employ approximately 36 percent of the total number of employees.

[4]Another way of measuring the credit channel is by the share of small banks (see Carlino and DeFina (1999). A large percentage of small banks make the credit channel more sensitive to monetary policy (Kashyap and Stein, 1997). I do not measure this source as the Swedish banking market is highly concentrated among a few large banks; the top five banks cover 90 percent of total bank assets (see Cecchetti, 1999). In addition, there is not much evidence of this role in the Euro Area studies (see Angeloni et al., 2002.)

Table 4.2: Share of employment in small firms and number of firms, (%)

	Share of employment in small firms, average*	Share of number of small firms, 2006
Halland	59.0	99.3
Jämtland	57.7	99.3
Gotland	56.3	99.5
Jönköping	55.4	98.8
Kalmar	54.4	99.1
Kronoberg	54.0	99.1
Värmland	52.6	99.3
Skåne	51.6	99.1
Västernorrland	50.6	99.2
Västerbotten	49.4	99.3
Södermanland	48.7	99.2
Västmanland	48.6	99.0
Västra Götaland	48.6	99.1
Norrbotten	48.4	99.1
Blekinge	47.5	99.0
Uppsala	47.4	99.3
Dalarna	47.1	99.3
NATIONWIDE	45.5	99.1
Östergötland	44.2	99.0
Örebro	43.6	98.9
Gävleborg	43.5	99.2
Stockholm	35.9	98.8
Max	*59.0*	*99.5*
Min	*35.8*	*98.8*
Standard deviation	*5.42*	*0.18*

A small firm is defined as employing fewer than 200 employees.
Source: Företagarna (see Appendix 4.6.1). Small firms in the private sector and agriculture as a share of the total number of firms which is comprise of private sector firms, agricultural firms, the public sector, and public sector businesses (e.g. government-owned companies, local government, and government enterprises). *Years: 1995, 1997-2002, 2005-2007

4.3 Monetary Policy Shocks and the VAR Methodology

The VAR model in conjunction with impulse responses are commonly used tools for examining the monetary policy transmission mechanism (see Christiano et al. 1999). The VAR model lets each variable depend on its own previous values and the rest of the system's previous values so that feedback effects are captured within the system. Impulse responses trace out the paths of the system variables after an exogenous, unsystematic, and unanticipated monetary policy

shock. The popularity of the VAR model is due to its flexibility and because it lets the researcher impose a minimum number of restrictions to separate the effects of these underlying, structural, shocks (Stock and Watson, 2001). The VAR model, however, is sensitive to the choice of sample period, variable selection, and identification scheme, i.e. the choice of restrictions that determine how the economic variables are related.

4.3.1 Sample Period

The sample period for the Swedish regions spans from 1993:1 to 2007:4. This choice is appropriate given that Sweden experienced a major economic crisis in the early 1990s and adopted a floating exchange rate in 1992:4. Monetary policy thereby became the key steering policy instrument. Around the same time, Riksbanken declared an explicit inflation targeting policy. Thus, with this choice of sample period I avoid the crisis and estimating over different monetary policy regimes.[5]

The choice of sample period also affects the tools available for dealing with the time series properties of macroeconomic data, which typically contain unit roots. A longer time horizon allows any cointegration relationships to be explicitly incorporated into the model, as in the Canadian regional study by Georgepoulous (2009).[6] However, even for short time periods the Indonesian study as well as a number of studies investigating the Euro Area use cointegration implicitly (Ridhwan et al. 2011, Peersman, 2004, Mojon and Peersman, 2001). Implicit cointegration means assuming the presence of cointegrating relationships by specifying the variables in levels but not testing for cointegration. Without testing, however, it is impossible to know whether or not the variables cointegrate, and even though including a correctly specified equilibrium error increases efficiency, an incorrectly specified equilibrium error will lead to incorrect inference.

Stationarity can also be achieved by removing the long-run trends by differencing, such as in the American and Indian regional studies (Nachane et al., 2002, Carlino and Defina, 1999), or using filters. First differencing, however, tends to

[5]The regional employment data changes in 2008:1 when new age groups are included.

[6]Tests for cointegration for the aggregate variables have been run but the sample is too short to yield plausible results.

aggravate high-frequency noise in the data (Stock and Watson, 1999). In the present paper, I remove the long-run information using the Hodrick-Prescott (HP) filter, a widely used filter that allows trends in the data to be non-linear and that does not suffer as much from the high frequency problem (Stock and Watson, 1999). It is an appropriate choice given the non-linearities in the regional employment trends (see Figure 4.5 in Appendix 4.6.2).[7] In the robustness section, I compare the impulse responses from the HP-filtered data to the impulse responses from implicit cointegration and first differencing.

4.3.2 Information Set

The information set of the VAR model aims to capture the expected interactions within the economy. For this purpose I define a $5x1$ vector of endogenous macroeconomic variables,

$$Y_t = [y_t, \Delta p_t, i_t, ex_t, e_t] \tag{4.1}$$

where y_t is the real domestic GDP at time t, Δp_t is the inflation rate, i_t the domestic interbank interest rate, ex_t the real exchange rate, and e_t the regional employment.[8,9] In the VAR system I also include as exogenous variables $p*_t$, world commodity prices, including both fuel and non-fuel prices, and $i*_t$, foreign short-term interbank interest rate. All variables are seasonally adjusted, logged (except for the interest rates), and HP-filtered. Figure 4.4 in Appendix 4.6.2 presents graphs for the aggregate series.

This variable selection reflects the set-up used in previous small open economy studies in which exchange rates and foreign influences affect the economy (e.g. Bjørnland, 2008, Georgepoulous, 2009). As I do not expect a small country to have significant feedback effects on the foreign variables, the foreign variables

[7]There is a debate on the properties of the HP-filter, and some have questioned whether the filter produces reliable results (e.g. Cogley and Nason, 1995). However, this claim has also been refuted (see Pedregal and Young, 2001), and the HP-filter remains popular.

[8]Appendix 4.6.1 contains detailed information on the variables.

[9]The use of the price series instead of the inflation rate introduced an output puzzle in which output increased as a result of increased interest rates. Given that Riksbanken targets the inflation rate, but not the price level, it is plausible to use the interaction between interest rates, inflation, and output.

are assumed to be exogenous. This assumption makes sense as the Swedish GDP is only approximately 3.5 percent the size of the Euro Area GDP. In addition, by imposing exogeneity on these foreign variables, I restrict the number of parameters to estimate thereby saving degrees of freedom.

The monetary policy variable is the interbank interest rate. First, Riksbanken uses the repo interest rate as its key policy instrument to control short-term interest rates, which is why the interest rate rather than monetary aggregates is a more suitable variable for monetary policy.[10] Second, markets may adjust their interest rates in anticipation of changes in the repo rate (Gerlach and Smets, 1995). For example, when the policy interest rate is expected to rise, the market interest rates may adjust in advance of the change in the repo rate. Therefore, the interbank rate takes into account market expectations.

The set of variables also includes two exogenous variables. The foreign interest rate is included to control for changes in domestic monetary policy due to foreign monetary policy shocks. World commodity prices are included to control for inflationary pressure due to negative supply shocks and forward-looking central bank behavior. For example, when the central bank expects inflation to rise it will raise the policy interest rate to curb the increasing inflation. This forward-looking behavior, if not accounted for, can otherwise generate a price puzzle, i.e. that inflation increases after a monetary policy tightening (Sims, 1992). As a consequence, many studies include the current and lagged values of this variable (see Christiano et al. 1999).

4.3.3 The Structural VAR Model

Given the information set in Equation 4.1 I define the structural VAR model using both endogenous and exogenous variables.

$$AY_t = B(L)Y_{t-1} + C(L)X_t + \epsilon_t \tag{4.2}$$

Equation 4.2 shows that the contemporaneous effects of the endogenous variables, in my case the domestic and regional variables, are found in the kxk matrix A. The lagged periods' effects are found in $B(L)$, a kxk matrix where

[10]Monetary aggregates also tend to incorporate other shocks, such as demand shocks or financial deregulation (Gerlach and Smets, 1995).

$B(L) := B_0 + B_1 L + ... + B_p L^p$ and p is the number of lags of the endogenous variables in the model.

$C(L)$ is a coefficient matrix of the exogenous variables, including deterministics, of order kxq depending on the number of exogenous variables, q, which in my specification is two. $C(L) := C_0 + C_1 L + ... + C_s L^s$ where s is the number of lags of the exogenous variables. ϵ_t is a $kx1$ vector of uncorrelated structural errors with unit variances.

I can define one structural shock per endogenous variable and since $k = 5$ in the baseline specification I define the vector of structural shocks in the baseline specification as

$$\epsilon_t = [\epsilon_t^y, \epsilon_t^{\Delta p}, \epsilon_t^{MP}, \epsilon_t^{ex}, \epsilon_t^e] \tag{4.3}$$

where ϵ_t^y is a domestic output shock, $\epsilon_t^{\Delta p}$ a domestic inflation shock, ϵ_t^{MP} a monetary policy shock, ϵ_t^{ex} a exchange rate shock, and ϵ_t^e a regional employment shock.[11] Since the monetary policy shock is the focus, I define the rest of the structural errors only loosely as is common in previous studies (e.g. Bjørnland, 2009).

The identification issue in the structural VAR-modeling for short-run restrictions refers to how to impose the restrictions on the contemporaneous effect matrix for the endogenous variables. I can rewrite equation 4.2 in the reduced form by premultiplying with the inverse of the contemporaneous coefficient matrix, $S := A^{-1}$

$$Y_t = D(L)Y_{t-1} + E(L)X_t + u_t \tag{4.4}$$

where $D(L) := SB(L)$, $E(L) := SC(L)$ and $S\epsilon_t := u_t$ The last term shows that the reduced form errors, u_t, are linear combinations of the structural errors, $Au_t = \epsilon_t$. Thus, I can estimate equation 4.4, solve it for the endogenous variables and calculate impulse responses due to a shock in one of the structural errors provided that we have imposed enough restrictions on A.[12] Rewrite the reduced

[11] In the robustness section, I allow for spill-overs from nearby regions in the information set so that $k = 6$ and we have an additional structural error ϵ_t^{ecomp} that is a regional spill-over shock.

[12] There is also the possibility of imposing long-run restrictions on the coefficient matrix for the endogenous variables but here I focus on the short-run since they yield plausible results in the ensuing analysis.

form equation 4.4

$$F(L)Y_t = E(L)X_t + u_t \tag{4.5}$$

where $F(L) := I_5 - D_1L - .... - D_pL^p$. Let $F(L)^{-1} := G(L)$ so that the final form is given by

$$Y_t = G(L)E(L)X_t + G(L)S\epsilon_t \tag{4.6}$$

Since X_t is exogenous, it will not be affected by shocks to the structural errors so I can focus on identifying the short-run dynamics of the endogenous variables. Given my choice of Y_t I set up the system with the short-run restrictions as follows

$$\begin{bmatrix} y_t \\ \Delta p_t \\ i_t \\ ex_t \\ e_t \end{bmatrix} = G(L) \begin{bmatrix} S_{11} & 0 & 0 & 0 & 0 \\ S_{21} & S_{22} & 0 & 0 & 0 \\ S_{31} & S_{32} & S_{33} & 0 & 0 \\ S_{41} & S_{42} & S_{43} & S_{44} & 0 \\ 0 & 0 & 0 & 0 & S_{55} \end{bmatrix} \begin{bmatrix} \epsilon_t^y \\ \epsilon_t^{\Delta p} \\ \epsilon_t^{MP} \\ \epsilon_t^{ex} \\ \epsilon_t^e \end{bmatrix} \tag{4.7}$$

This identification scheme structures the economy in the following way. As advocated by e.g. Bernanke and Blinder (1992), aggregate output and inflation do not respond contemporaneously to monetary policy shocks but monetary policy does respond contemporaneously to shocks in output and in inflation. These restrictions represent the sluggish response of prices and output compared with the responses of financial variables. Since I will impose a shock in the monetary policy error, which is ordered below aggregate output and inflation, the ordering between output and inflation does not matter for the responses to the monetary policy shock. This follows from a generalization of Proposition 4.1 by Christiano et al. (1999 p. 82) (see Bjørnland, 2008).

Monetary policy does not react to the exchange rate within the same period. Instead the exchange rate reacts to monetary policy within the same period and to all other aggregate variables. Allowing the exchange rate to respond to all other aggregate variables is appropriate since it is a forward-looking asset price (e.g. Cushman and Zha, 1997, Kim and Roubini, 2000). However, the assumption that monetary policy does not respond contemporaneously to the exchange rate is not trivial since disregarding possible simultaneous effects between the

exchange rate and monetary policy could result in either a price puzzle or that the exchange rate depreciates when the policy interest rate increases, i.e. an exchange rate puzzle (e.g Bjørnland, 2008, 2009). However, the restriction that the exchange rate does not affect monetary policy within the same period is not uncommon in the VAR open-economy literature (e.g. Peersman, 2004, Georgepoulous, 2009). In addition, it is plausible that Sweden, since adopting a flexible exchange rate, does not, at least explicitly, control the value of the krona, and therefore the effect of an exchange rate movement should not feed into the policy interest rate within the same quarter.[13]

The final restriction in the S matrix tells us that regional employment is not affected by monetary policy within the same quarter, nor does it affect the aggregate variables within the same quarter. That monetary policy does not contemporaneously affect regional employment follows the same logic as in the case of aggregate output. This restriction is similar to that of Carlino and DeFina (1999), who do not allow for a contemporaneous interaction between the regional variables and the aggregate variables, including monetary policy.

4.3.4 Sensitivity and Expected Responses in the Aggregate Economy

As the VAR model does suffer from sensitivity due to the sample period, variable selection, and identification scheme, VAR practitioners often evaluate the model outcome in terms of the absence of a number of puzzles. This means that the empirical results do not lead to unexplainable or contradictory outcomes, such as the price puzzle.

In the standard Mundell-Fleming-Dornbusch model and many of the more recent small-open economy theoretical frameworks with price stickiness, the interest rate works through both the interest rate and the exchange rate channels (see e.g. Lane, 2001, and Corsetti, 2007 for summaries of New Open Economy Macroeconomics models).[14]

[13]To allow both the monetary policy and exchange rate to respond to each other simultaneously, one can impose a long-run restriction, so that monetary policy have no long-run effects on the exchange rate (see Bjørnland, 2008). This approach is not used here as the short-run restrictions do not suffer from the price or exchange rate puzzle.

[14]The effects in the new frameworks with micro foundations depend, however, on the as-

Typically, contractionary monetary policy increases market interest rates and causes an inflow of capital to the country from abroad, causing the home currency exchange rate to appreciate. This appreciation increases the cost of domestic goods and services relative to foreign ones, causing net exports to fall. Simultaneously, higher interest rates reduce consumption and make borrowing more expensive so that demand for interest-sensitive consumption and investment falls. The two effects cause aggregate demand and thus aggregate output to fall. The fall in aggregate output exerts a downward pressure on prices, and inflation falls. In sum, a contractionary monetary policy shock affects the exchange rate directly but tends to affect output and inflation with some delay.

In general, VAR results on a contractionary monetary policy shock indicate that aggregate output tends to fall, as do employment, profits, and other monetary aggregates. The price level also falls but much slower (Christiano et al. 1999). Studies of small open economies find that the exchange rate overshoots, i.e. it appreciates and then gradually returns to its initial value (e.g Kim and Roubini. 2000). Thus, given that the impulse responses conform to these general results and that there are no puzzles, I assume that the model behaves well and that the identification scheme captures the economy's dynamics following an exogenous contractionary monetary policy shock.

4.4 Empirical Results

This section presents the empirical results, starting with the specification of the aggregate model and the 21 regional ones. It then presents the responses of the aggregate economy to a monetary policy shock, continuing with the responses of regional employment. The regional responses clearly show that there are asymmetric effects and I investigate if differences in industry mix, export intensity, and small firms explain why they differ. To assess the sensitivity of the results, the robustness section tests alternative specifications.

sumptions on preferences, the form of nominal stickiness, and the financial structure.

4.4.1 Specification

ADF tests of the 21 regional employment series in levels indicate that a unit root is present in all but five series that are trend-stationary and one that seems to be stationary with a constant. The aggregate data series in levels also contain unit roots, except for inflation. Once I detrend all the series using the HP-filter, the ADF tests reject the presence of a unit root (see Table 4.5 in Appendix 4.6.2).

The lag length in all specifications varies between one and three. The choice of lags is based primarily on the LR-test and secondarily on the SC and HQ information criteria. Fixed lag lengths of one and two have been run for all the specifications as well. There is little difference between them, though for some regions, too short a lag length clearly fails to account for the actual dynamics of those regions. At the same time, a longer lag length than necessary means that I may lose precision in the forecasts (Lütkepohl, 2005). I present the results for a fixed lag length of two in the robustness section. The two exogenous variables, $i*_t$ and $p*_t$ are only significant for one lag, so I include the contemporaneous effect and the first lag in all specifications.

A number of impulse dummies that take the value of 1 for a quarter and 0 otherwise account for outliers: 1994:3, 1995:2, 1996:2, 1997:3, 1999:1, 2000:2, and 2003:1. These were chosen sequentially by adding a dummy for the largest outlier, re-estimating the system, running diagnostic tests, and removing the next largest outlier if necessary.[15] In the robustness section I run all the specifications without including these dummies. Without them, there is a small price puzzle and an initial depreciation of the exchange rate when the interest rate increases, but the general results of the regional impulse responses for employment remain intact.

I also account for some outliers at the regional level when necessary in the individual specifications.[16] Except for the dummy in 2005:2, when there is a time series break due to a change in the definition of the employment data, it is more difficult to pinpoint the cause of the dummies at this level, as they can

[15] In economic terms, these dummies pick up the noise from the aftermath of the early 1990s economic crisis at the beginning of the sample, the IT crash in 2000, and what seems to be a cost shock in 2003.

[16] There is one regional dummy each in ten of the 21 specifications, and two regional dummies each in three of them.

be affected by much smaller changes. However, these dummies do not appear to affect the responses, only the error bands.

With these specifications there is no instability (i.e. no roots outside the unit circle), no heteroscedasticity, and no non-normality. There is no autocorrelation in most of the models though five of the 21 regional models retain some autocorrelation in the third or fourth lag. Table 4.6 in Appendix 4.6.2 summarizes the tests.[17]

4.4.2 Aggregate Economy Responses

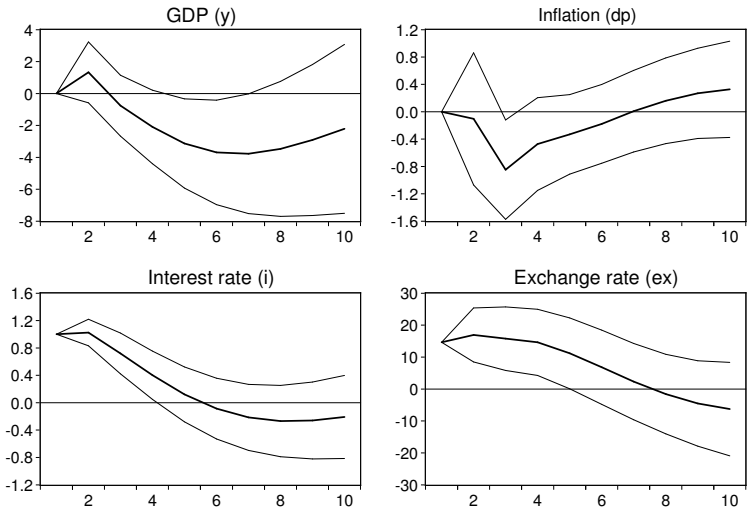

Figure 4.1: Response of aggregate economy to a 100-basis-point monetary policy shock

Figure 4.1 shows the impulse responses to a monetary policy shock of 100 basis points at the aggregate level for ten quarters.[18] The upper and lower lines around the thick solid response line are the 90 percent error bands.[19] The y-axes measure deviations from the trend, in percent for output, inflation, the exchange rate, and employment, and percentage points for the interest rate.

[17]Further diagnostic tests are available from the author upon request.

[18]A longer time horizon added very little information and due to increased uncertainty over the longer time frame, the error bands quickly grew very large.

[19]90 percent error bands using Monte Carlo simulations with 2500 replications.

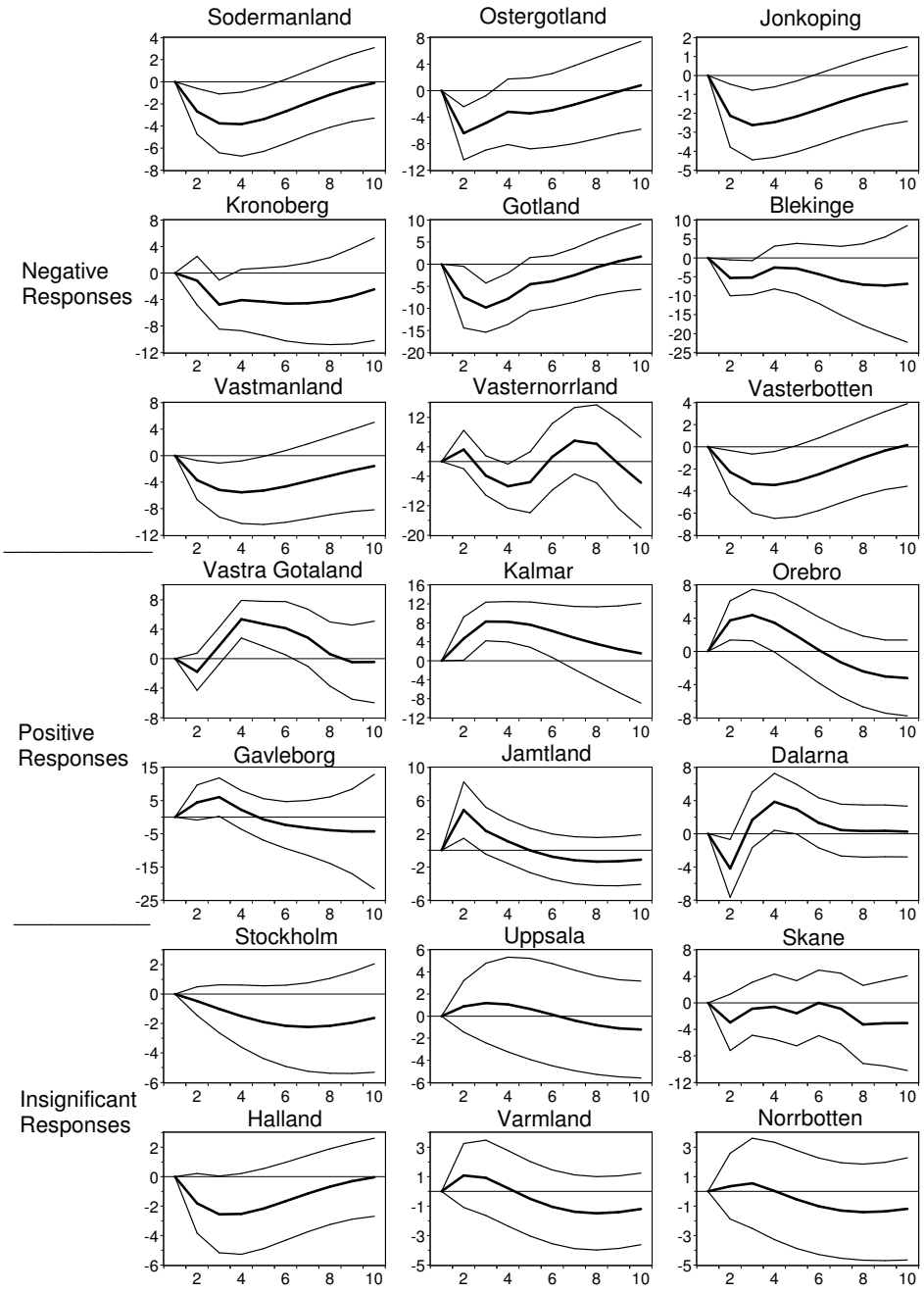

Figure 4.2: Regional employment responses to a 100-basis-point monetary policy shock

The graphs reveal that, as the interest rate initially increases, the exchange rate overshoots, peaking in period 2, after which it begins to depreciate toward its initial value. Inflation falls, but the fall is not significant until after around three quarters. Output increases initially but insignificantly. The increase in output seems to occur with the second lag and is not present when the lag length is one. After about a year, output falls significantly and then starts to return to its initial level. Thus, the model specification and information set seem to capture the sluggish response of inflation and output as well as the overshooting of the real exchange rate.[20]

These results are very satisfactory, as they concur with the theoretical predictions and with the outcomes of other open-economy studies (e.g. Kim and Roubini, 2000). Given this, I have some evidence that I have identified exogenous monetary policy shocks in this system and that the underlying model works. Furthermore, these aggregate results hold for all regional specifications, though with some initial noise in the regional systems that have three lags. However, this is not surprising due to the number of parameters to estimate in the case of three lags.

4.4.3 Asymmetric Regional Responses

Figure 4.2 shows the employment responses in the regions due to a 100-basis-points monetary policy shock. The regions clearly experience asymmetric effects. While employment, as expected, falls significantly in response to a contractionary monetary policy shock in nine of the 21 regions, five regions experience a significant increase in employment and one experience a significant cyclical pattern with an effect that seems mainly positive.[21] In the remaining six regions, the employment responses to the monetary contraction are not significant.

When I evaluate the significant periods only, the responses also differ in terms

[20]Villani and Warne (2003) find similar effects and durations using a bayesian cointegrated structural VAR on quarterly Swedish data 1975:1 to 2001:4. Similar results are also obtained by Lindé et al. (2009) using a VAR model on quarterly Swedish data 1986:1 to 2002:4.

[21]The initial negative effect seems to be sensitive (see robustness section), and the accumulated response of Dalarna show that with a sustained monetary policy shock the positive response over the long horizon remains. Thus I classify this region as positive in the remainder of the analysis.

Table 4.3: Estimated effect of a 100-basis-point monetary policy shock

	Max (%)	**Average(%)**	**Cumulative (%)**	**Max period**	**Duration**
Gotland	-9.83	-8.37	-25.11	3	3
Västernorrland	-6.70	-6.70	-6.70	4	1
Östergötland	-6.44	-5.66	-11.31	2	2
Västmanland	-5.53	-4.92	-19.69	4	4
Blekinge	-5.28	-5.25	-10.50	2	2
Kronoberg	-4.77	-4.77	-4.77	3	1
Södermanland	-3.84	-3.42	-13.68	3	4
Västerbotten	-3.46	-3.03	-9.09	4	3
Jönköping	-2.62	-2.34	-9.38	3	4
Dalarna	3.85 (-4.19)	3.85 (-0.17)	3.85 (-0.34)	4 (2)	1 (2)
Örebro	4.36	4.04	4.04	3	2
Jämtland	4.85	4.85	4.85	2	1
Västra Götaland	5.36	4.74	14.22	4	3
Gävleborg	6.04	6.04	6.04	3	1
Kalmar	8.29	7.02	35.12	3	5

Only periods when the response is significant are included. Cumulative effect is the cumulative impact of the deviation of employment from trend which is the sum of the response over the significant duration. *Dalarna is classified as a positive response. The effect when the initial negative effect is included is indicated within parentheses.

of magnitude, timing, and duration (see Table 4.3). The maximum effect ranges from -9.8 percent to +8.3 percent, occuring between the second and the fourth quarter after the shock. The average effects over the significant periods range from -8.7 to +7.02 percent and the effects last one to five quarters. Furthermore, the cumulative effect, calculated as the sum of the responses over the significant periods, is sizeable.

Even though the size of the effects depends on the size of the monetary policy shock, which in my case is fairly large, the magnitude of the response to the shock clearly differs among regions. Overall, when Riksbanken unexpectedly contracts the economy, employment in the Swedish regions responds very differently, in terms of direction, magnitude, timing, and persistence.

It is also of interest to evaluate how the effects are distributed geographically. Figure 4.3 reveals that most of the the positive responses occur along the western side of the country near the Norwegian border while most of the negative responses follow the eastern coast. Despite this, there appears to be no clear-cut geographic pattern in how the regions respond.

Figure 4.3: Geographic overview of regional responses

4.4.4 Causes of Asymmetric Regional Responses

Inspection of the responses and the sources of monetary transmission channels presented in section 4.2 reveals no salient pattern explaining the differences in responses. To estimate what causes the asymmetric effects, I divide the regions into three groups, as in Figure 4.2. The negative responses are those that experience a fall in employment, the positive experience an increase, and the insignificant do not experience a significant change in employment.

For the negative and insignificant responses, I test for differences in the distribution of the share of employment in the goods sector and services sector, export intensity, and two subjective rankings of interest rate sensitivity. For the positive, I do not test these differences as I have no clear priors in terms of the chosen factors why they should cause an increase in employment.

The first of the two subjective rankings that I test is the *Equal rank*, which is simply the average of the rank order of the region when sorted according

to highest interest sensitivity in terms of largest goods sector, highest export intensity, and largest share of small firms. In this ranking, 1 is the highest rank and 21 is the lowest rank. The second ranking is the *Weighted rank*, which adds extra weight to export intensity, as I expect the exchange rate channel to be strong in Sweden and as the response of the exchange rate to a monetary contraction is highly significant.[22]

Table 4.4 shows that the regions that respond negatively compared with those that have insignificant responses all have averages that are as theoretically expected. The regions that respond negatively tend to have, on average, a higher share of employment in the goods sector, a smaller share in services, more export intensity, and a larger share of small firms. They also rank higher in terms of both compounded measures of interest sensitivity.

Statistical tests confirm that the difference between the two groups is highly significant for the goods sector and the two rankings. This means that, also for Sweden, there is evidence that different share of interest-sensitive industry causes asymmetric responses. Furthermore, a region that responds negatively tends to rank as more interest sensitive, having a larger share of employment in the goods sector, higher export intensity, and more small firms. Individually, export intensity is weakly significant. Thus, there is some evidence that the exchange rate channel also matters for a highly export-dependent country such as Sweden. The small firm proxy on its own, however, is not significant. Thus, as in most previous regional studies, I find little support for the credit channel.

Table 4.4 also shows that there are no noteworthy differences between the negative and the positive group, except for higher export intensity. Both the American and Canadian studies find similar positive short-run responses though these are not significant for the Canadian provinces and effects disappear in the US states in the long-run. While one can expect insignificant responses for the regions with low shares of small firms, low export intensity, and small goods sectors, it is more difficult to explain the positive responses. One possibility is that the regions are net importers, so that the resulting appreciation caused by the policy rate increase lowers the cost of production and therefore increases employment. However, there is no suitable regional data to test this conjecture.

[22]The weight is 0.4 as the average share of aggregate export to GDP was 40 percent during the sample period.

Table 4.4: Regional responses and sources of asymmetric effects, averages

	Insignificant	**Negative**	**Positive**	**Critical Value (U-value)**
	n=6	n=9	n=6	column (2) vs. column (3)
Small firms	49.15	50.53	49.12	0.314
	(7.69)	*(4.00)*	*(5.80)*	
Goods	25.60	32.03	31.32	3.306***
	(5.42)	*(4.17)*	*(4.61)*	
Services	37.35	31.62	32.01	-1.295
	(9.71)	*(2.45)*	*(4.00)*	
Export intensity	25.81	30.22	36.01	1.392*
	(8.28)	*(9.57)*	*(15.89)*	
Equal rank	13.83	9.67	10.17	-2.478**
	(3.83)	*(2.78)*	*(2.76)*	
Weighted rank	13.90	9.79	9.91	-2.882**
	(3.58)	*(2.80)*	*(2.84)*	

Standard errors in parentheses. ***, **, and * denote significance at 1, 5, and 10 percent level. U-value from robust rank order test, which is a non-parametric test that does not assume equal variances. Critical values for small samples are obtained from Feltovich (2005). The tests are one-sided as I expect small firm, goods, and export intensity to be lower, and services and ranks to be higher higher in the negatively significant group than in the insignificant group. T-tests of unequal averages with unequal variances using Welch approximation for degrees of freedom yield the same results but fails to find significance for export intensity.

Nonetheless, when I compare averages in the regional share of employment in the production sectors where the nation as a whole are net importers, for available years, the average is higher in the positively responding regions compared to the insignificant (3.78 and 2.85 respectively). However, this difference is not significant.[23]

4.4.5 Robustness

To assess the robustness of the results I compare the above baseline regional specifications with a number of alternative specifications, namely inclusion of spill-over effects, no dummies, fixed lag length, and a shorter sample. To assess

[23]I have also compared averages between positively responding regions and insignificantly responding regions in public sector employment, and import turnover according to firm size for those regions where there is data, but there is little difference.

the effect of HP-filtering on the results, I compare the baseline specifications with impulse responses using implicit cointegration and first differencing.

In the first alternative specification, I remove all dummies, aggregate and regional, and run all models using the same lag length as in the baseline. In the second specification, I include the average of the nearby regions' share of employment in the baseline specification to account for spill-over effects from other regions. As the regions differ in size, the number of employed is divided by the size of the region's workforce. As the companion regions introduce new dynamics, I allow the lag length and regional dummies to differ from the baseline. Furthermore, since the nearby regions' employment is also a real variable, I do not allow this variable to respond contemporaneously to the aggregate variables or to the regional variable. Instead, any spill-over effects will show up in the lag structure. The same restriction is imposed by Carlino and DeFina (1999) for the US economy to deal with potential spatial autocorrelation between regions.

The third specification uses a shorter sample beginning in 1997:1 thereby removing the years following the early 1990s economic crisis. In this specification, I allow for a different lag length, as in most cases one lag is now sufficient and the system quickly becomes unstable with more. The largest aggregate dummy in 2003:1 and a few regional dummies are also included. Finally, I impose a fixed lag length for all regions in the baseline specification. The choice of two lags comes from the aggregate baseline, which has two lags where, in particular, the Swedish interest rate reacts in the second lag.

Using these alternative specifications, it is clear that the responses differ little from the baseline in terms of direction, whether negative, insignificant or positive. However, the timing, duration, and to some extent, the magnitude do differ. This is not surprising, as I allow for different dynamics in the lag specification when necessary. Figures 4.6 to 4.7 in Appendix 4.6.2 show the four alternative specifications for the regional employment versus the baseline.

To assess the effect of HP-filtering the data, I run two alternative specifications where in one I use the data in levels, to allow for implicit cointegration, and in the other I use first differencing to remove non-stationarity. To make it more comparable, I use the same specification in terms of lags and dummies as for the baseline and only change the transformation of the data series.[24] In general,

[24]I have also run specifications using the preferred lag length and dummies with similar

the direction of the responses remain the same and implicit cointegration and the HP-filter corresponds well. However, first differencing yields more noisy and short-lived responses, implying that first differencing may remove too much information and does not deal well with the non-linearities in the data. Figures 4.8 to 4.9 in Appendix 4.6.2 show the implicit cointegration and first differencing specifications for the regional employment versus the HP-filtered baseline.

To assess the robustness of the aggregate results, I run one specification without dummies and one with a shorter sample length for the HP-filtered baseline. I also run one specification with implicit cointegration and one with first differencing. When I remove the dummies, there is a small price puzzle and the exchange rate initially depreciates somewhat. This initial noise is probably due to a combination of increasing interest rates to curb inflation in the early 1990s, following the crisis, and a large depreciation of the exchange rate that followed the floatation of the exchange rate in 1992. The short sample length is similar to the baseline and shows that the dummies seem successful in removing the noise after the crisis.

The choice of data transformation for the aggregate series yield the same results as the baseline but with more noise in the first differencing and a more short-lived effect. Figure 4.10 in Appendix 4.6.2 shows the robustness results for the aggregate model.

4.5 Conclusions

Studies of regional responses to common monetary policy shocks analyze whether there are asymmetric effects across geographical entities. This paper uses a structural VAR model with exogenous foreign variables and finds that monetary policy has asymmetric effects on employment in the Swedish regions. For most regions, an increase in the interest rate causes a significant fall in regional employment. For another group of regions, the employment response is insignificant. Similar to other studies on the transmission mechanism, one of the causes of these differential effects seem to stem from the interest rate channel and emphasizes the role of interest-sensitive output. There is also some evidence that the exchange

results.

rate channel matters for a small open economy, such as Sweden. In addition, one group of regions, surprisingly, responds positively to the same policy shock by increasing employment when interest rates increase.

These results have a number of policy implications. First, they show that it is clearly insufficient to evaluate the effect of monetary policy at the aggregate level if policy-makers wish to target aversive effects on employment with fiscal policy. In addition, better geographical labor market matching processes and higher labor mobility smooths the asymmetric outcomes in regional employment when Riksbanken contracts the economy. Second, for Euro Area-policy making, they imply that we may need divert attention from the national level to the regional to understand how to efficiently use economic policy to ease aversive effects of ECB shocks.

Above all, as monetary policy have different effects across regions within a country and as most studies have focused on the national level, there is a need to disaggregate studies of monetary policy, particularly within cross-country currency unions, to the regional level to better understand the transmission channel effects on regional economies.

Acknowledgments

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References

Angeloni, I., Kashyap, A., Mojon, B., Terlizzese, D., 2002. Monetary transmission in the Euro Area: where do we stand? ECB Working Paper No. 114.

Arnold, I.J., Vrugt, E.B., 2002. Regional effects of monetary policy in the Netherlands. International Journal of Business and Economics 1 (2), 123-134.

Arnold, I.J., Vrugt, E.B., 2004. Firm size, industry mix and the regional transmission of monetary policy in Germany. German Economic Review 5 (1), 35-39.

Bernanke, B.S., Blinder, A.S., 1992. The federal funds rate and the channels of monetary transmission. The American Economic Review 82 (4), 901-921.

Bernanke, B.S., Gertler M., 1995. Inside the black box: the credit channel of monetary policy transmission. Journal of Economic Perspectives 9 (4), 27-48.

Bjørnland, H., 2008. Monetary policy and exchange rate interactions in a small open economy. Scandinavian Journal of Economics 110 (1), 197-221.

Bjørnland, H., 2009. Monetary policy and exchange rate overshooting: Dornbusch was right after all. Journal of International Economics 79 (1), 64-77.

Carlino, G., DeFina, R., 1999. The differential regional effects of monetary policy: evidence from the U.S. states. Journal of Regional Science 39 (2), 339-358.

Cecchetti, S., 1999. Legal structure, financial structure, and the monetary policy transmission mechanism. Federal Reserve Bank of New York, Economic Policy Review 5 (2), 9-28.

Christiano, L. J., Eichenbaum, M., Evans, C. L., 1999. Monetary policy shocks: what have we learned and to what end? in Handbook of Macroeconomics, Vol 1A, eds. Taylor, J. B., Woodford, M., Elsevier: Amsterdam.

Cogley, T., Nason, J. M., 1995. Effects of the Hodrick-Prescott filter on trend and difference stationary time series: implications for business cycle research. Journal of Economic Dynamics and Control 19 (1-2), 253-278.

Corsetti, G., 2007. New open macroeconomics. C.E.P.R Discussion Papers 6578.

Cushman, D., Zha, T., 1997. Identifying monetary policy in a small open economy under flexible exchange rates. Journal of Monetary Economics 38 (3), 433-448.

Domazlicky, B., 1980. Regional business cycles: a survey. Regional Science Perspectives 10, 15-34.

ECB, 2002. Recent findings on monetary policy transmission in the euro area. ECB Monthly Bulletin, Oct. 2002.

Feltovich, N., 2005. Critical values for the robust rank-order test. Communications in Statistics - Simulation and Computation 34 (3), 525-547.

Georgopoulous, G., 2009. Measuring regional effects of monetary policy in Canada. Applied Economics 41, 2093-2113.

Gerlach, S., Smets, F., 1995. The monetary transmission mechanism: evidence from the G-7 countries. Bank of International Settlements, Working paper no. 26.

Gertler, M., Gilchrist, S., 1993. The role of market imperfections in the monetary transmission mechanism: arguments and evidence. The Scandinavian Journal of Economics 95 (1), 43-64.

Kashyap, A.K., Stein, J.C., 1997. The role of banks in monetary policy: a survey with implications for the European monetary union. Economic Perspectives 21 (5), 2-15.

Kim, S., Roubini, N., 2000. Exchange rate anomalies in the industrial countries: a solution with a structural VAR approach. Journal of Monetary Economics 45 (3), 561-586.

Lane, P.R., 2001. The new open economy macroeconomics: a survey. Journal of International Economics 54 (2), 235-266.

Lindé, J., Nessén, M., Söderström, U., 2009. Monetary policy in an estimated open-economy model with imperfect pass-through. International Journal of Finance and Economics 14, 301-333.

Lütkepohl, H., 2005. New Introduction to Multiple Time Series Analysis. Springer-Verlag GmbH:Berlin Heidelberg.

Nachane, D.M., Ray, P., Ghosh, S., 2002. Does monetary policy have differential state-level effects? an empirical evaluation. Economic and Political Weekly, 23 November, 2002.

Mojon, B., Peersman, G., 2001. A VAR description of the effects of monetary policy in the individual countries of the Euro Area. ECB Working Paper No. 92.

Oliner, S.D., Rudebusch, G.D., 1995. Is there a bank lending channel for monetary policy? Federal Reserve Bank of San Francisco Economic Review 2, 3-20.

Owyang, M.T., Wall, H.J., 2009. Regional VARs and the channels of monetary policy. Applied Economic Letters 16, 1191-1194.

Pedregal, D., Young, P., 2001. Some comments on the use and abuse of the Hodrick-Prescott Filter. Review on Economic Cycles 2.

Peersman, G., 2004. The transmission of monetary policy in the Euro Area: are the effects different across countries? Oxford Bulletin of Economics and Statistics 66 (3), 285-308.

Ridhwan, M.M., De Groot, H.L.F, Rietveld, P., Nijkamp, P., 2011. The regional impact of monetary policy in Indonesia. Tinbergen Institute Discussion Paper TI 2011-081/3.

Sims, C., 1980. Macroeconomics and reality. Econometrica 48 (1), 1-48.

Sims, C., 1992. Interpreting the macroeconomic time series facts: the effects of monetary policy. European Economic Review 36 (5), 975-1000.

Stock, J.H., Watson, M.W., 1999. Business cycle fluctuations in US macroeconomic time series. In Handbook of Macroeconomics, Vol 1A, Eds. Taylor, J.B., Woodford, M., Elsevier: Amsterdam.

Stock, J.H., Watson, M.W., 2001. Vector autoregressions. Journal of Economic Perspectives 15 (4), 101-115.

Villani, M., Warne, A., 2003. Monetary policy analysis in a small open economy using bayesian cointegrated structural VARs. Sveriges Riksbank Working Paper Series 156.

4.6 Appendix

4.6.1 Data Appendix

In the following, i is the average Swedish three-month interbank rate (Riksbanken); $i*$ is the average German three-month interbank rate until 1998 and thereafter the Euro Area average three-month interbank rate (Datastream); ex is the seasonally adjusted real effective exchange rate (CPI-based) (IMF), where an increase means that the real exchange rate appreciates; y is the seasonally adjusted Swedish real GDP in factor prices (Statistics Sweden); dp is the Swedish average quarterly inflation rate (Statistics Sweden) where the CPI series is first seasonally adjusted using an X11-filter and logged before differencing; and p* is the prices of fuel and non-fuel commodities (IMF).

Regional employment is the number of employed in a region (AKU, Statistics Sweden) and seasonally adjusted using an X11-filter. In the employment data there is a time series break in 2005:2 due to EU harmonization but the break mainly affects unemployment data and not employment data (Statistics Sweden). Graphically, there is no obvious break in the data series and no statistical evidence of the break in most regions. Further breaks occur due to a switch of borders in two regions, but the breaks are not statistically significant.

All variables are expressed in logs and multiplied by 100, except for the nominal interest rates, which are divided by 4 to make them quarterly comparable. The variables are then detrended using the HP-filter ($\lambda = 1600$).

The data on small firms come from Företagarna (1996, 1998, 1999, 2002, 2006, 2007, 2008), and the data on export intensity from Statistics Sweden's database on Swedish firms (FDB, 1997-2004).

4.6.2 Tables and figures

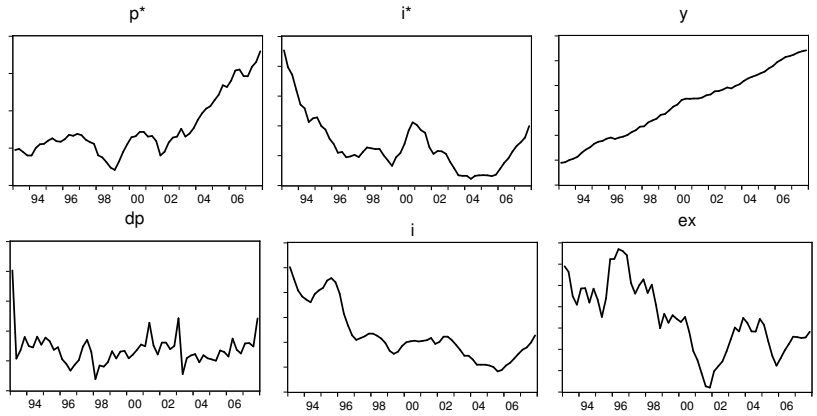


Figure 4.4: Aggregate data, in logs

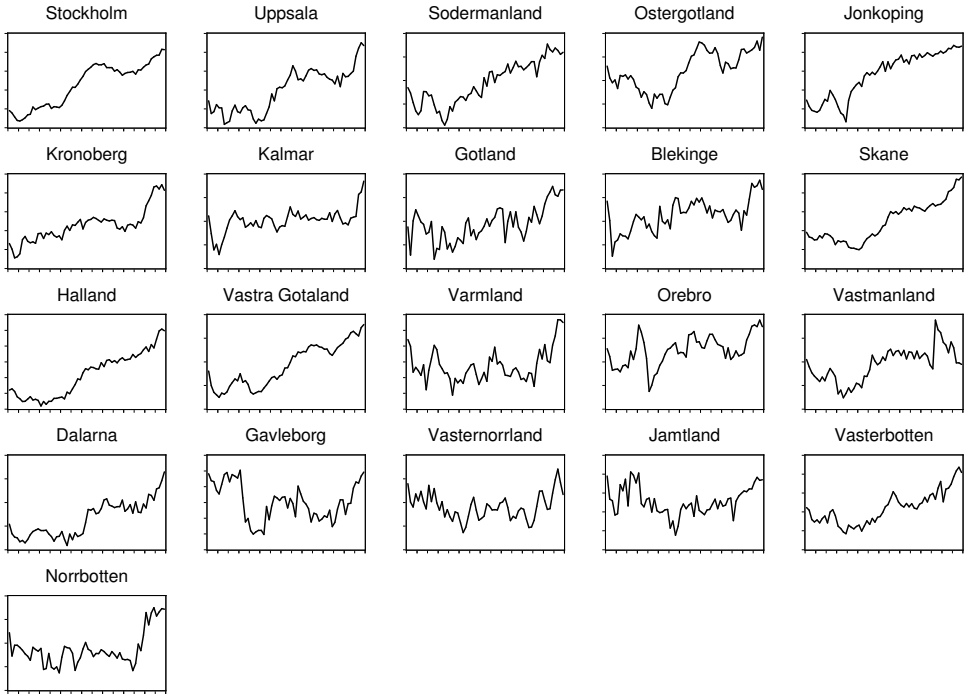


Figure 4.5: Regional employment, seasonally adjusted, in logs

Table 4.5: Unit root tests, logs, seasonally adjusted, p-values

	ADF-test, level			ADF-test, HP-filtered
AGGREGATE	**Trend+constant**	**Constant**	**No deterministics**	**No deterministics**
y	0.58	0.81	1.00	0.015**
dp		0.00***	0.00***	0.000***
i	0.48	0.28	0.28	0.000***
ex	0.39	0.27	0.49	0.000***
i*	0.77	0.09*	0.25	0.022**
p*	0.95	0.99	0.97	0.000***
REGIONAL				
Stockholm	0.26	0.53	1.00	0.025**
Uppsala	0.29	0.93	0.93	0.003***
Södermanland	0.01**			0.000***
Östergötland	0.40	0.84	0.84	0.007***
Jönköping	0.20	0.80	0.95	0.000***
Kronoberg	0.58	0.91	0.96	0.000***
Kalmar	0.33	0.70	0.85	0.000***
Gotland	0.01***			0.000***
Blekinge	0.00***			0.000***
Skåne	0.69	1.00	0.99	0.022**
Halland	0.23	1.00	1.00	0.001***
Västra Götaland	0.02**			0.000***
Värmland	0.15	0.16	0.74	0.000***
Örebro	0.14	0.24	0.77	0.000***
Västmanland	0.07*	0.23	0.65	0.000***
Dalarna	0.29	0.96	0.93	0.000***
Gävleborg	0.61	0.19	0.68	0.002***
Västernorrland	0.94	0.66	0.80	0.013**
Jämtland	0.51	0.01***		0.000***
Västerbotten	0.16	0.88	0.88	0.000***
Norrbotten	0.91	0.94	0.87	0.005***

***, **, and * denote significance at 1, 5, and 10 percent levels.

Table 4.6: Misspecification tests, p-values

	Lag length	**No serial correlation LM test at lag 1; 2; 3; 4**	**Multivariate normality Doornik-Hansen**	**No hetero-skedasticity**
AGGREGATE	2	0.29; 0.75; 0.29; 0.68	0.96	0.62
Stockholm	1	0.58; 0.62; 0.15; 0.47	0.78	0.98
Uppsala	1	0.58; 0.89; 0.13; 0.71	0.74	0.63
Södermanland	1	0.44; 0.64; 0.073; 0.79	0.81	0.95
Östergötland	2	0.20; 0.98; 0.74; 0.92	0.98	0.74
Jönköping	1	0.47; 0.72; 0.28; 0.79	0.63	0.97
Kronoberg	2	0.75; 0.17; 0.38; 0.51	0.91	0.72
Kalmar	2	0.31; 0.87; 0.04**; 0.05**	0.89	0.93
Gotland	2	0.16; 0.49; 0.51; 0.80	0.38	0.92
Blekinge	2	0.25; 0.29; 0.50; 0.14	0.81	0.93
Skåne	3	0.44; 0.51; 0.57; 0.71	0.82	0.53
Halland	1	0.48; 0.29; 0.18; 0.16	0.86	0.74
Västra Götaland	3	0.52; 0.95; 0.58; 0.25	0.47	0.49
Värmland	1	0.45; 0.53; 0.12; 0.51	0.87	0.86
Örebro	1	0.58; 0.73; 0.11; 0.02**	0.15	0.98
Västmanland	1	0.16; 0.61; 0.15; 0.28	0.74	0.98
Dalarna	2	0.32; 0.81; 0.54; 0.59	0.29	0.73
Gävleborg	2	0.18; 0.42; 0.12; 0.74	(0.95)	0.61
Västernorrland	3	0.16; 0.69; 0.58; 0.71	0.91	0.63
Jämtland	1	0.44; 0.35; 0.31; 0.35	0.63	0.52
Västerbotten	1	0.81; 0.51; 0.01***; 0.17	0.32	0.91
Norrbotten	1	0.16; 0.14; 0.04**; 0.18	0.53	0.90

***, **, and * denote significance at 1, 5, and 10 percent levels.

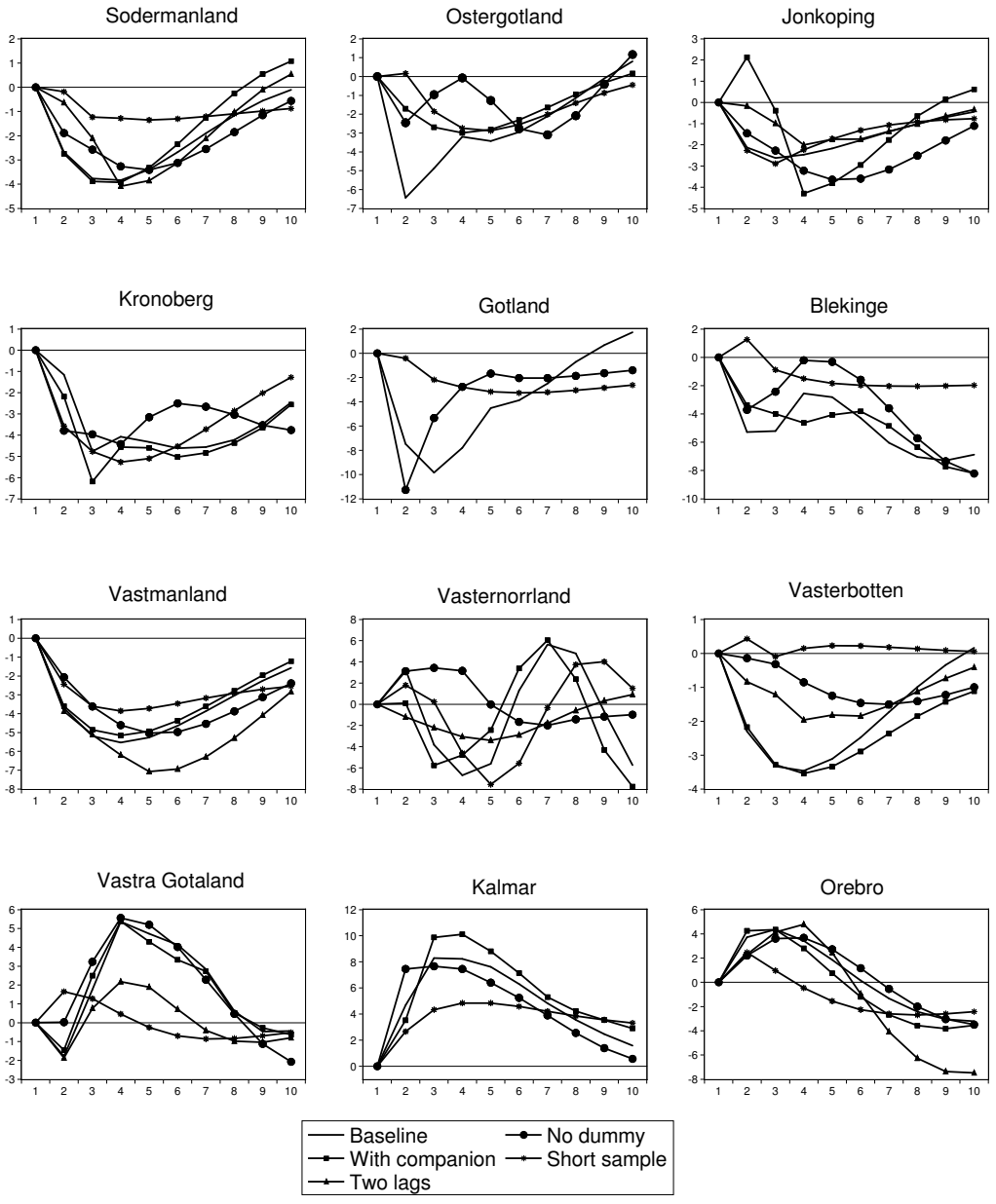


Figure 4.6: Robustness

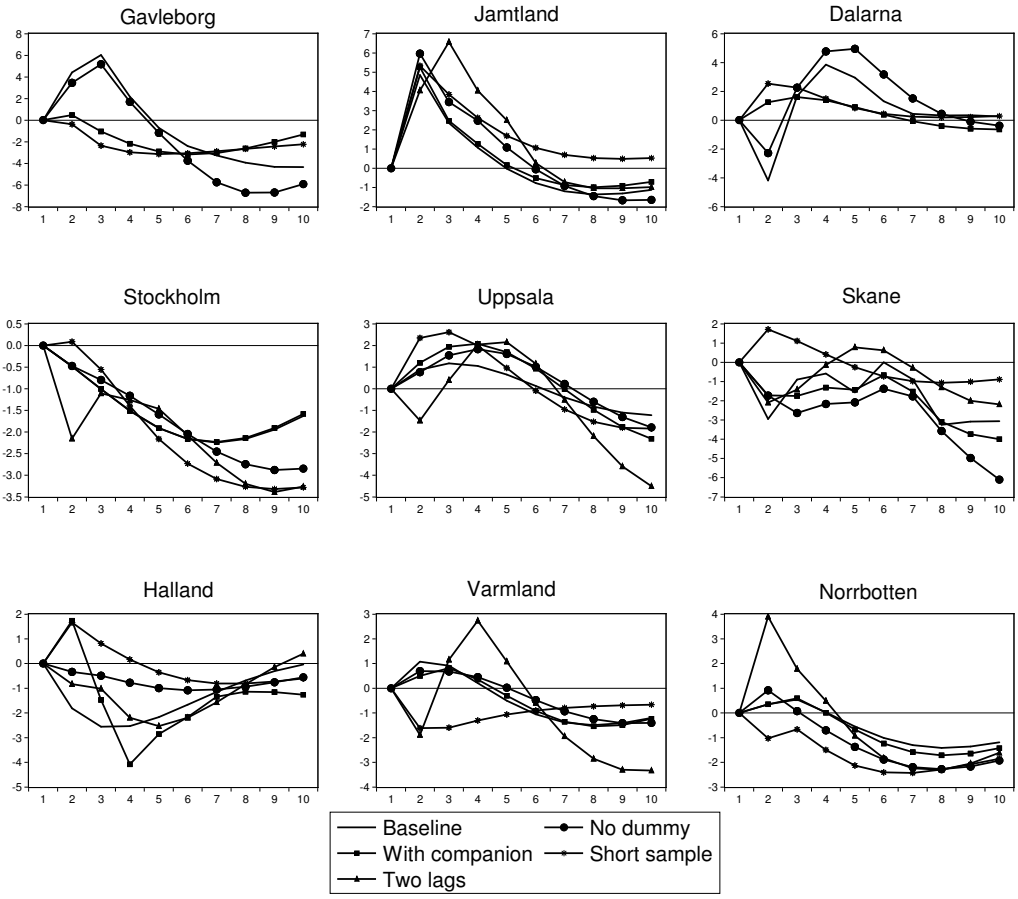


Figure 4.7: Robustness

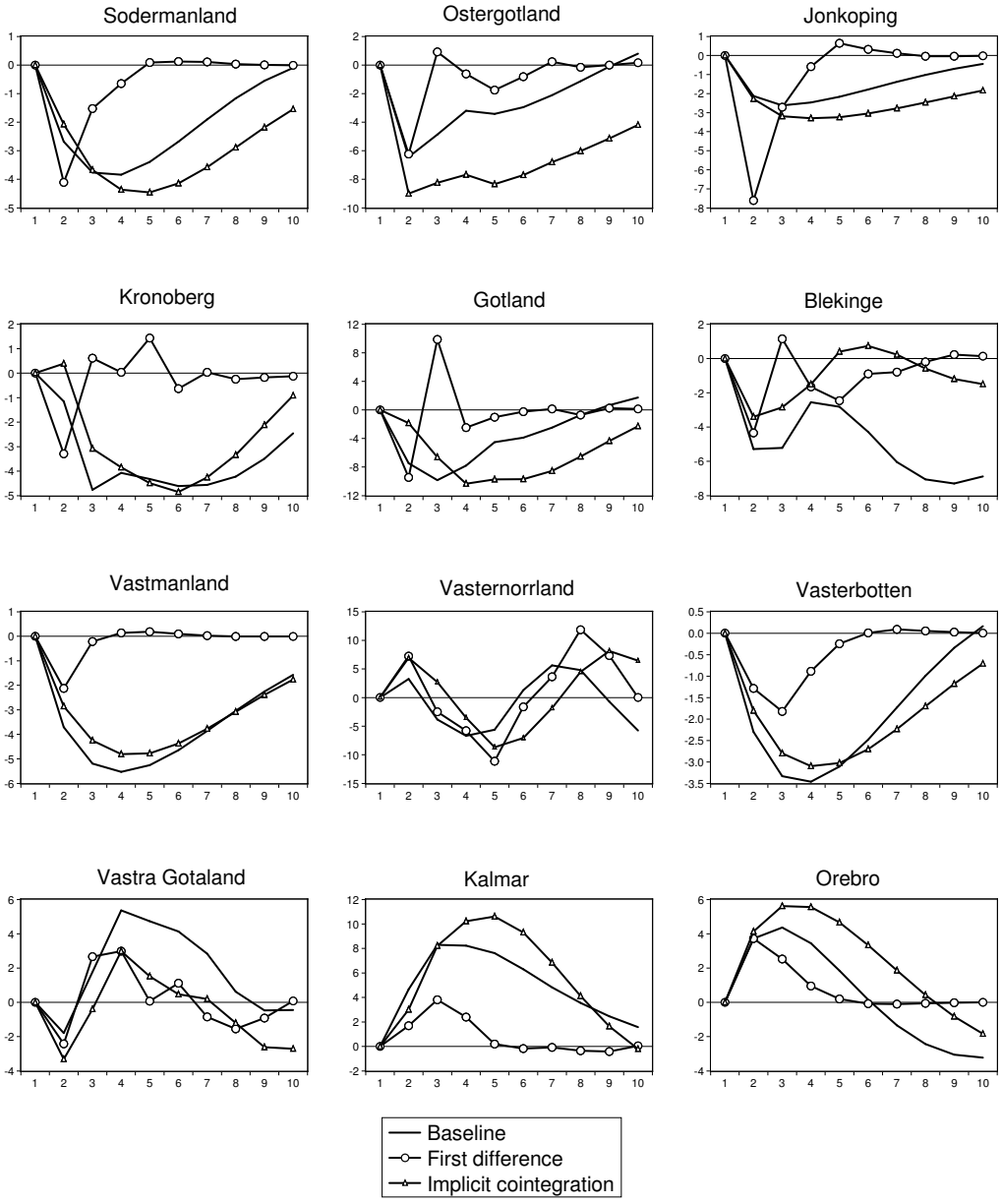


Figure 4.8: Robustness

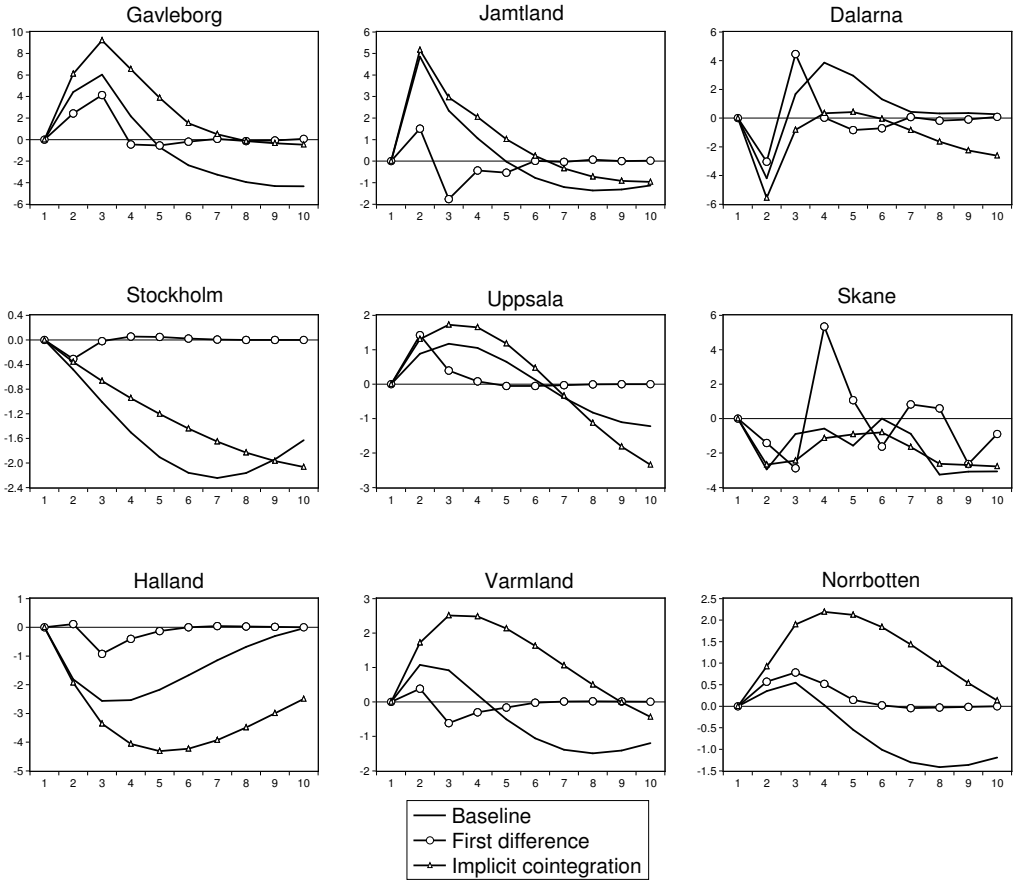


Figure 4.9: Robustness

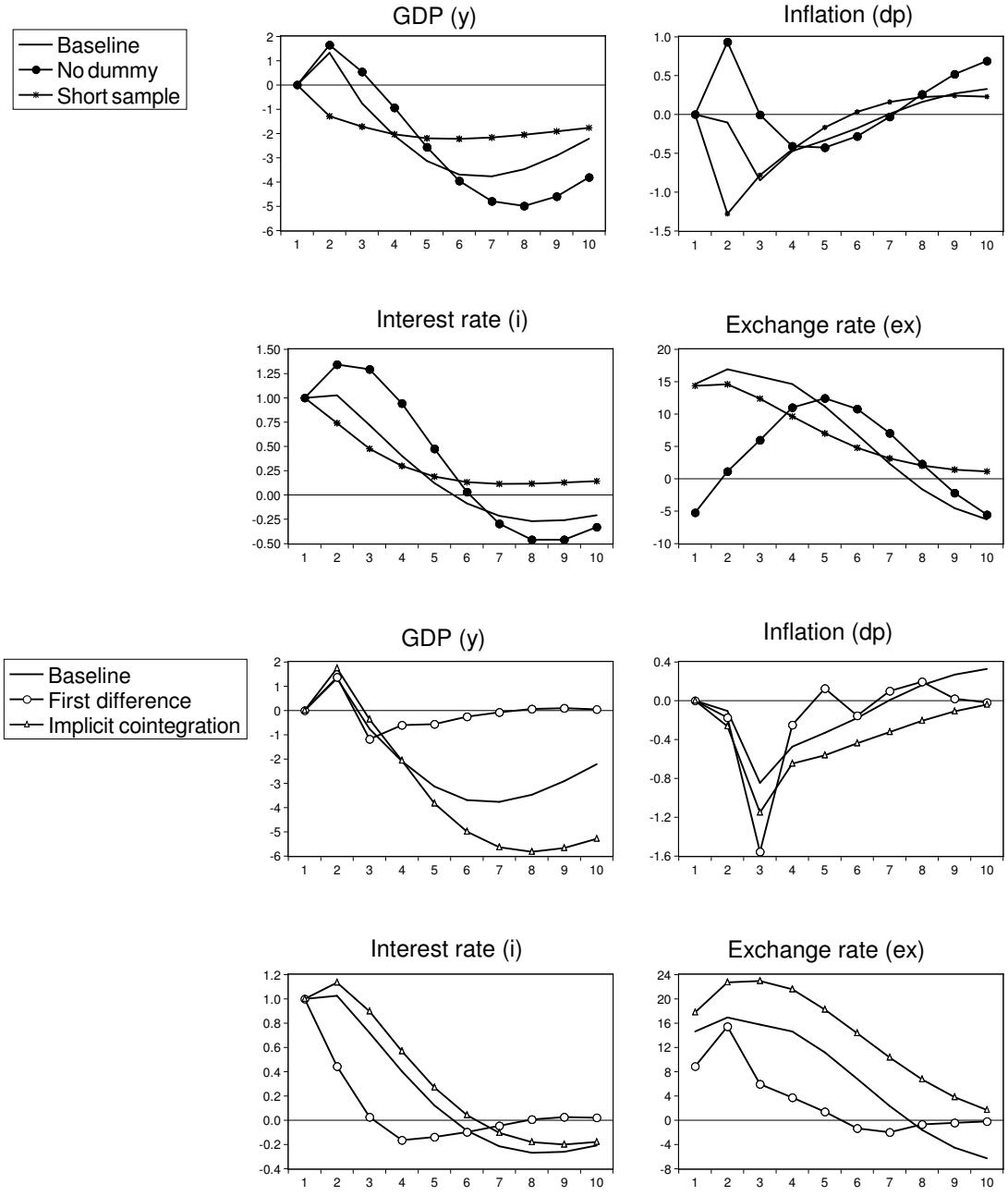


Figure 4.10: Robustness

Appendices

Appendix A

Experiment Instructions: Chapter 2

Information about the study

This study consists of a number of parts where you will make choices or answer questions. The purpose of the study is to gain a deeper understanding of economic behaviour. In some parts you will earn money and/or goods that will be paid to you in the form stated in the formulary. You should know that there are strict rules in economic experiments in that what is said in the instructions is true.

In some cases, your answers will be matched against another participant's answer. You will only be matched against the same participant once.

Your answers will only be used for research purposes and will be kept strictly confidential.

It is important to remain silent during the study. If you have any questions, please raise your hand.

Read the instructions carefully.

You will receive what you earned according to the formulary a couple of days after the study in connection with your lectures.

To collect your earnings you need to save your ID note.

Good luck!

Emma Svensson Håkan Holm

If you have any questions about the study, please contact Emma Svensson, emma.svensson@nek.lu.se , 046-222 95 50

1SM.

State the number of your ID note_____

You are a seller of one litre of medium-fat milk (see below). You will be matched with an anonymous buyer. The buyer has 100 kr in budget that can only be used to buy your carton of milk. Your task is to set a selling price for the milk. At the same time, the buyer sets the price that he/she is willing to pay for the milk.

If your price is the same or lower than the buyer's price, the transaction will take place. The buyer pays you the average of your price and the buyer's price. You keep what you get as payment for the milk. The buyer gets the milk and keeps the amount that remains.

If your price is higher than the buyer's price there will be no transaction and neither you nor the buyer receive anything.

Arithmetic example: Assume that your selling price is Ps and that the buyer offers to pay Pk. If Ps≤Pk, then the final price is (Ps+Pk)/2=P and the transaction takes place. You receive P and the buyer receives 100-P and the milk. If Ps>Pk, then both receive 0 and you do not keep the milk.

The buyer has received the same information as you about the situation.

Now you will state your selling price.

My selling price for the milk is_____kr.

Your good:

You will also guess what the buyers on average are willing to buy the milk for. You can earn money on a good guess. We will collect answers from all sellers in this study and among these we will randomly select every tenth seller who will receive 100 kr minus 1 krona for each krona that the guess differs from the average.

I believe that the buyers on average offer to pay _____kr for the milk.

1KM.

State the number of your ID note_____

You are a buyer and you have 100 kr in your budget. You will be matched with an anonymous seller that has one litre of medium-fat milk (see below). Your task is to set the price that you are willing to pay for the milk and you can only use your budget to trade with the seller. At the same time, the seller sets the price that he/she is willing to sell the milk for.

If your price is the same or higher than the seller's price, the transaction will take place. What you will pay is given by the average of your price and the seller's price. You receive the milk and the amount that is left. The seller receives the amount you paid.

If your price is lower than the seller's price there will be no transaction and neither you nor the seller receive anything.

Arithmetic example: Assume that the seller's price is Ps and that you offer to pay Pk. If Ps≤Pk, then the final price is (Ps+Pk)/2=P and the transaction takes place. You receive 100-P and the milk and the seller receives P. If Ps>Pk, then both receive 0 and the seller does not keep the milk.

The seller has received the same information as you about the situation.

Now you will state your purchasing price.

My purchasing price for the milk is_____kr.

The seller's good:

You will also guess what the sellers on average are willing to sell the milk for. You can earn money on a good guess. We will collect answers from all buyers in this study and among these we will randomly select every tenth buyer who will receive 100 kr minus 1 krona for each krona that the guess differs from the average.

I believe that the sellers on average are willing to sell the milk for_____kr.

1SH.

State the number of your ID note_____

You are a seller a hypothetical good that we call X. You will be matched with an anonymous buyer. The buyer has 100 kr in budget that can only be used to buy your X good. Your task is to set a selling price on X. At the same time, the buyer sets the price that he/she is willing to pay for X.

If your price is the same or lower than the buyer's price, the transaction will take place. The buyer pays you the average of your price and the buyer's price. You keep what you get as payment for X. The buyer keeps the amount that remains.

If your price is higher than the buyer's price there will be no transaction and neither you nor the buyer receive anything.

Arithmetic example: Assume that your selling price is Ps and that the buyer offers to pay Pk. If Ps≤Pk, then the final price is (Ps+Pk)/2=P and the transaction takes place. You receive P and the buyer receives 100-P. If Ps>Pk, then both receive 0. You do not keep a real good since X is a hypothetical good.

The buyer has received the same information as you about the situation.

Now you will state your selling price.

My selling price for the X good is_____kr.

You will also guess what the buyers on average are willing to buy the milk for. You can earn money on a good guess. We will collect answers from all sellers in this study and among these we will randomly select every tenth seller who will receive 100 kr minus 1 krona for each krona that the guess differs from the average.

I believe that the buyers on average offer to pay _____kr for X.

1KH.

State the number of your ID note_____

You are a buyer and you have 100 kr in your budget. You will be matched with an anonymous seller that has a hypothetical good that we call X. Your task is to set the price that you are willing to pay for X and you can only use your budget to trade with the seller. At the same time, the seller sets the price that he/she is willing to sell the X for.

If your price is the same or higher than the seller's price, the transaction will take place. What you will pay is given by the average of your price and the seller's price. You receive the amount that is left. The seller receives the amount you paid.

If your price is lower than the seller's price there will be no transaction and neither you nor the seller receive anything.

Arithmetic example: Assume that the seller's price is Ps and that you offer to pay Pk. If Ps≤Pk, then the final price is (Ps+Pk)/2=P and the transaction takes place. You receive 100-P and the seller receives P. You do not receive a real good since X is a hypothetical good. If Ps>Pk, then both receive 0. The seller does not keep a real good since X is a hypothetical good.

The seller has received the same information as you about the situation.

Now you will state your purchasing price.

My purchasing price for X is_____kr.

You will also guess what the sellers on average are willing to sell the milk for. You can earn money on a good guess. We will collect answers from all buyers in this study and among these we will randomly select every tenth buyer who will receive 100 kr minus 1 krona for each krona that the guess differs from the average.

I believe that the sellers on average are willing to sell the milk for_____kr.

3.

State the number of your ID note_____

Now you will make choices between one litre of medium-fat milk and a sum of money. Your task is simply to choose between milk and money in sixteen different decisions. For each tenth participant we will randomly choose one of the decisions and these participants will receive what they stated in that decision situation (see arithmetic example below). You are supposed to only switch between the milk column and the money column once.

Example:

Decision	Option X	Option Y
1	X_1	Y_1
2	X_2	Y_2
3	X_3	Y_3

Circle your preferred option:

Decision	Milk	Money
1	1 litre of milk	1 kr
2	1 litre of milk	2 kr
3	1 litre of milk	3 kr
4	1 litre of milk	4 kr
5	1 litre of milk	5 kr
6	1 litre of milk	6 kr
7	1 litre of milk	7 kr
8	1 litre of milk	8 kr
9	1 litre of milk	9 kr
10	1 litre of milk	10 kr
11	1 litre of milk	11 kr
12	1 litre of milk	13 kr
13	1 litre of milk	15 kr
14	1 litre of milk	20 kr
15	1 litre of milk	25 kr
16	1 litre of milk	30 kr

Arithmetic example: Assume that you are one of the participants whose answer is selected. From the sixteen decisions you have made, decision x is randomly selected. If you have circled milk in that option you will receive one litre of milk. If instead you have circled y kr in that option you will receive y kr.

Now you will guess what the other participants have stated as the highest price that they are willing to pay for one litre of medium-fat milk in the task above (milk or money). We will collect all answers from the participants in this study except yours and calculate the average highest price. The highest price is the price given by the number of kronor in the decision you last circled milk. You will guess what the others have stated on average and you may round off to the closest whole krona.

Every tenth participant will receive 100 kr minus 30 kr for each krona that the guess differs from the average highest price. If the guess differs by more than 3 kr, then 0 is paid.

I believe that the highest price that the others have stated for one litre of medium-fat milk on average is_____kr.

You will now guess how much one litre of medium-fat milk costs (rounded to the closest whole krona) at ICA Tuna next to the School of Economics and Management. You will receive 10 kr if your guess is correct and otherwise nothing. State your guess in whole kronor.

I guess that one litre of medium-fat milk at ICA Tuna costs_____kr.

4.

State the number of your ID note_____

You will now make choices between two options explained below. You can earn money on one of your choices and how much you earn depends on the outcome of that decision.

For each decision there are two options and probabilities for different payoffs. These probabilities determine your chances of receiving a high or low payoff. We randomly select one of your decisions and then make a draw where your payoff is determined by the probabilities in that option. Thus the outcome of the draw and the option you have circled in that decision determine your earnings. The highest amount you can earn is 58 kr and the lowest 1,50 kr. (see arithmetic example on the next page)

We offer you two different options, A or B.
Circle the option that seems preferable to you in each and every decision below:

Example:

Decision	Option A	Option B
1	A_1 kr with probability z_1% and A_2 kr with probability y_1 %	B_1 kr with probability z_1% and B_2 kr with probabiity y_1 %
2	A_1 kr with probability z_2% and A_2 kr with probability y_2 %	B_1 kr with probability z_2% and B_2 kr with probabiity y_2 %
3	A_1 kr with probability z_3% and A_2 kr with probability y_3 %	B_1 kr with probability z_3% and B_2 kr with probabiity y_3 %

Decision	**Option A**	**Option B**
1	30 kr with probability 10% and 24 kr with probability 90%	58 kr with probability 10% and 1.50 kr with probability 90%
2	30 kr with probability 20% and 24 kr with probability 80%	58 kr with probability 20% and 1.50 kr with probability 80%
3	30 kr with probability 30% and 24 kr with probability 70%	58 kr with probability 30% and 1.50 kr with probability 70%
4	30 kr with probability 40% and 24 kr with probability 60%	58 kr with probability 40% and 1.50 kr with probability 60%

5	30 kr with probability 50% and 24 kr with probability 50%	58 kr with probability 50% and 1.50 kr with probability 50%
6	30 kr with probability 60% and 24 kr with probability 40%	58 kr with probability 60% and 1.50 kr with probability 40%
7	30 kr with probability 70% and 24 kr with probability 30%	58 kr with probability 70% and 1.50 kr with probability 30%
8	30 kr with probability 80% and 24 kr with probability 20%	58 kr with probability 80% and 1.50 kr with probability 20%
9	30 kr with probability 90% and 24 kr with probability 10%	58 kr with probability 90% and 1.50 kr with probability 10%
10	30 kr with probability 100%	58 kr with probability 100%

Arithmetic example: Assume that decision x is randomly selected where the probability of a high payoff is z% and the probability of a low payoff is y%. We draw between a high and a low payoff according to the probabilities z% and y%. If the outcome is high you earn 30 kr if you have chosen option A and 58 kr if you have chosen option B in decision x. If the outcome is low you will earn 24 kr if you have chosen option A and 1.50 kr if you have chosen option B in decision x.

5KJA.

State the number on your ID note_____

In this part of the study we would like you to consider a scenario.

Scenario:
You meet a classmate from elementary in the taxi line. You suggest that you both share a taxi since you are heading in the same direction. First you pass your classmate's house that is situated approximately half way to your house. The price for a taxi ride to your classmate's house is 100 kr and the price to your house is 200 kr irrespective of whether you stop at the classmate's or not. When you arrive at the classmate's house you settle the payment. Of the 200 kr that the taxi ride will cost in total, how much do you believe your classmate should pay?

I believe my classmate should pay_____kr.

Now you will guess how much other people think the classmate should pay. We will collect all answers from the participants in this study except yours and calculate the average suggestion of how much the classmate should pay. Every tenth participant will receive 200 kr minus 1 kr for each krona that the guess differs from the average. How much do you think the others believe the classmate should pay on average?

I guess the others believe that the classmate should pay_____kr on average.

5LJA.

State the number on your ID note_____

In this part of the study we would like you to consider a scenario.

Scenario:
You meet a classmate from elementary in the taxi line. You suggest that you both share a taxi since you are heading in the same direction. First you pass your house that is situated approximately half way to your classmate's house. The price for a taxi ride to your house is 100 kr and the price to your classmate's house is 200 kr irrespective of whether you stop at your house or not. When you arrive at your house you settle the payment. Of the 200 kr that the taxi ride will cost in total, how much do you believe your classmate should pay?

I believe my classmate should pay_____kr.

Now you will guess how much other people think the classmate should pay. We will collect all answers from the participants in this study except yours and calculate the average suggestion of how much the classmate should pay. Every tenth participant will receive 200 kr minus 1 kr for each krona that the guess differs from the average. How much do you think the others believe the classmate should pay on average?

I guess the others believe that the classmate should pay_____kr on average.

5KKA.

State the number on your ID note_____

In this part of the study we would like you to consider a scenario.

Scenario:
You meet a classmate from elementary in the taxi line. Your classmate suggests that you both share a taxi since you are heading in the same direction. First you pass your classmate's house that is situated approximately half way to your house. The price for a taxi ride to your classmate's house is 100 kr and the price to your house is 200 kr irrespective of whether you stop at the classmate's or not. When you arrive at the classmate's house you settle the payment. Of the 200 kr that the taxi ride will cost in total, how much do you believe your classmate should pay?

I believe my classmate should pay_____kr.

Now you will guess how much other people think the classmate should pay. We will collect all answers from the participants in this study except yours and calculate the average suggestion of how much the classmate should pay. Every tenth participant will receive 200 kr minus 1 kr for each krona that the guess differs from the average. How much do you think the others believe the classmate should pay on average?

I guess the others believe that the classmate should pay_____kr on average.

5LKA.

State the number on your ID note_____

In this part of the study we would like you to consider a scenario.

Scenario:
You meet a classmate from elementary in the taxi line. Your classmate suggests that you both share a taxi since you are heading in the same direction. First you pass your house that is situated approximately half way to your classmate's house. The price for a taxi ride to your house is 100 kr and the price to your classmate's house is 200 kr irrespective of whether you stop at your house or not. When you arrive at your house you settle the payment. Of the 200 kr that the taxi ride will cost in total, how much do you believe your classmate should pay?

I believe my classmate should pay_____kr.

Now you will guess how much other people think the classmate should pay. We will collect all answers from the participants in this study except yours and calculate the average suggestion of how much the classmate should pay. Every tenth participant will receive 200 kr minus 1 kr for each krona that the guess differs from the average. How much do you think the others believe the classmate should pay on average?

I guess the others believe that the classmate should pay_____kr on average.

6.

State the number of your ID note_____

In this part of the study we would like you to answer three short questions. You can earn money by answering correctly. We will randomly choose every tenth participants' answers and pay 30 kr for each correct answer to the following three questions:

1. A tennis racket and a ball cost 110 kr in total. The tennis racket costs 100 kr more than the ball. How much does the ball cost? _____kr

2. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? _____ minutes

3. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? _____ days

7.
State the number on your ID note_____

This is the final part of the study where you will consider a number of statements about your personality traits. Describe yourself as you generally see yourself in relation to other people that you know. Try to avoid describing how you feel right now and try to describe yourself as you usually see yourself. There are five alternatives and you need to consider all statements. Do not think too long about each statement but instead pick the alternative you immediately think suits you.

I; I am; I believe that	**Very Inaccurate**	**Moderately Inaccurate**	**Neither Accurate Nor Inaccurate**	**Moderately Accurate**	**Very Accurate**
Trust others	□ 1	□ 2	□ 3	□ 4	□ 5
Use others for my own ends	□ 1	□ 2	□ 3	□ 4	□ 5
Love to help others	□ 1	□ 2	□ 3	□ 4	□ 5
Would make a good actor	□ 1	□ 2	□ 3	□ 4	□ 5
Keep my promises	□ 1	□ 2	□ 3	□ 4	□ 5
Love a good fight	□ 1	□ 2	□ 3	□ 4	□ 5
Like to solve complex problems	□ 1	□ 2	□ 3	□ 4	□ 5
Put on a show to impress people	□ 1	□ 2	□ 3	□ 4	□ 5
Believe that I am better than others	□ 1	□ 2	□ 3	□ 4	□ 5
Believe that laws should be strictly enforced	□ 1	□ 2	□ 3	□ 4	□ 5
Sympathize with the homeless	□ 1	□ 2	□ 3	□ 4	□ 5
Am likely to show off if I get the chance	□ 1	□ 2	□ 3	□ 4	□ 5
Jump into things without thinking	□ 1	□ 2	□ 3	□ 4	□ 5
Believe that others have good intentions	□ 1	□ 2	□ 3	□ 4	□ 5
Am the life of the party	□ 1	□ 2	□ 3	□ 4	□ 5
Cheat to get ahead	□ 1	□ 2	□ 3	□ 4	□ 5

Am good at making impromptu speeches	□ 1	□ 2	□ 3	□ 4	□ 5
Am concerned about others	□ 1	□ 2	□ 3	□ 4	□ 5
Tell the truth	□ 1	□ 2	□ 3	□ 4	□ 5
Like to attract attention	□ 1	□ 2	□ 3	□ 4	□ 5
Can't stand confrontations	□ 1	□ 2	□ 3	□ 4	□ 5
Use flattery to get ahead	□ 1	□ 2	□ 3	□ 4	□ 5
Avoid philosophical discussions	□ 1	□ 2	□ 3	□ 4	□ 5
Think highly of myself	□ 1	□ 2	□ 3	□ 4	□ 5
Believe that there is no absolute right or wrong	□ 1	□ 2	□ 3	□ 4	□ 5
Feel sympathy for those who are worse off than myself	□ 1	□ 2	□ 3	□ 4	□ 5
Make rash decisions	□ 1	□ 2	□ 3	□ 4	□ 5
Trust what people say	□ 1	□ 2	□ 3	□ 4	□ 5
Hate being the centre of attention	□ 1	□ 2	□ 3	□ 4	□ 5
Take advantage of others	□ 1	□ 2	□ 3	□ 4	□ 5
Am indifferent to the feelings of others	□ 1	□ 2	□ 3	□ 4	□ 5
Break rules	□ 1	□ 2	□ 3	□ 4	□ 5
Insult people	□ 1	□ 2	□ 3	□ 4	□ 5
Have difficulty understanding abstract ideas	□ 1	□ 2	□ 3	□ 4	□ 5
Have a high opinion of myself	□ 1	□ 2	□ 3	□ 4	□ 5
Have conservative opinions	□ 1	□ 2	□ 3	□ 4	□ 5
Would not be a good comedian	□ 1	□ 2	□ 3	□ 4	□ 5
Am not interested in other people's problems	□ 1	□ 2	□ 3	□ 4	□ 5
Rush into things	□ 1	□ 2	□ 3	□ 4	□ 5
Distrust people	□ 1	□ 2	□ 3	□ 4	□ 5
Obstruct others' plans	□ 1	□ 2	□ 3	□ 4	□ 5
Take no time for others	□ 1	□ 2	□ 3	□ 4	□ 5
Don't like to draw attention to myself	□ 1	□ 2	□ 3	□ 4	□ 5
Break my promises	□ 1	□ 2	□ 3	□ 4	□ 5
Get back at others	□ 1	□ 2	□ 3	□ 4	□ 5
Am not interested in theoretical discussions	□ 1	□ 2	□ 3	□ 4	□ 5

Boast about my virtues	□ 1	□ 2	□ 3	□ 4	□ 5
Believe that we should be tough on crime	□ 1	□ 2	□ 3	□ 4	□ 5
Try not to think about the needy	□ 1	□ 2	□ 3	□ 4	□ 5
Act without thinking	□ 1	□ 2	□ 3	□ 4	□ 5

Background information

Finally we would like you to answer a number of questions about yourself.

1) Estimate how many litres of milk you buy on average each week:_____litre

2) What brand do you usually buy (e.g. Arla, Skånemejerier)?:

_____

3) What kind of milk do you usually buy (e.g. 1 litre of ecological non-fat milk, 1.5 litre of 3% fat milk, 1 litre of oatmilk):

_____

4) If you are enrolled in a programme at Lund University, please state which one:

_____

5) If you are taking independent courses, please tick: _____

6) Did you study at a Swedish elementary school?

Yes, the entire time in Sweden:_____ Yes, some time in Sweden:_____
No:_____

7) Age: _____ years

8) Man:_____ Woman:_____

9) Estimate your yearly gross income including your student grant and student loan:_____ kr

10) Are you a member of a social network on the internet such as Facebook or MySpace?
Yes, one:_____ Yes, several:_____ No:_____

11) If you answered yes, which social network do you on average spend most time on?

_____

12) Estimate how many contacts (friends) you have on the network you stated in 11):

_____friends

13) Estimate how much time you spend on average each day on social networks:

_____minutes each day

You have now completed the study. Hand in the formulary. Remember to save and bring your ID note so that you can collect your earnings.

Thank you for your participation!

Appendix B

Experiment Instructions: Chapter 3

General written instructions given to all the participants.

Information about the study

This study consists of a number of parts where you will make choices or answer questions. The purpose of the study is to gain a deeper understanding of economic behavior. In some parts you will earn money and/or goods that will be paid to you in the form stated in the instructions. You should know that there are strict rules in economic experiments in that what is said in the instructions is true.

Your answers will only be used for research purposes and will be kept strictly confidential.

It is important to remain silent during the study. If you have any questions, please raise you hand.

In some parts of the experiment, your answers will be matched against another participant's answer and what you earn will depend on your choice and the choice of the participant you are matched with. In these parts, you may occasionally have to wait until the other participant has made his/her choice(s).

Read the instructions carefully.

You will receive what you have earned during the experiment a couple of days after the study in connection with your lectures.

To collect your earnings you need to save your ID note.

Good luck!

Emma Svensson

If you have any questions about the study, please contact Emma Svensson, emma.svensson@nek.lu.se, 046-222 95 50

The following role specific instructions were shown on each subject's computer screen.

Instructions for sellers in CF1.

You are a seller of a can of coca-cola (33cl) and your task for 10 periods is to state the price at which you are willing to sell the coca-cola.

You will be randomly matched with an anonymous buyer who has a budget of 100 kr in each period. You will be matched with the same buyer in all 10 periods. The buyer states the price he/she is willing to pay for the cola at the same time as you state the price at which you want to sell the coca-cola. The buyer can only use the budget to trade with you.

If your price is the same or lower than the buyer's price, a transaction will take place. The buyer pays you the price you have stated and receives the cola and what remains of the budget. You receive what the buyer has paid for the cola.

If your price is higher than the buyer's price there will be no transaction and neither you nor the buyer will receive anything.

Arithmetic example: Assume that the buyers price is p^b and you want to sell the cola for p_s. If $p_s \leq p_b$ then the final price is p_s and trade takes place. You receive p_s and the buyer receives $100 - p_s$ and the cola. If $p_s > p_b$ both receive 0 kr and the seller does not keep the cola.

[After each period you will receive information on the buyer's price and if a transaction has taken place and your income in that period. In the same way the buyer will receive information on your price and if a transaction has taken place and his/her income.]

The buyer has received the same information about the situation as you have.

Now state the price at which you are willing to sell a can of coca-cola by typing it in the box. Click in the box and write your price in numbers.

State your price:

In each period you will state what you believe the buyer you are matched with is willing to pay for the coca-cola. You will receive 40 kr minus 1 kr for each krona your guess deviates from the the price.

The buyer will not find out what you have guessed.

Now state what you believe the buyer is willing to pay for the can of cola by typing your guess

in the box on the computer screen.

My guess is:

After the role specific instructions, all the subjects received the following instructions on the draw:

You can earn money on your choices. After the final period, one of the periods will be drawn randomly together with one of your choices, trade or guess, and you will be paid according to whatever you have earned in that period.

Arithmetic example: If period x is drawn and guess is drawn you will receive what you earned on your guess in period x.

Help: Click in the empty box. State your price, an integer between 0 and 100. Click on the OK-button when you are done.

The instructions for sellers in CP were the same as for as sellers in CF but the text in brackets [] was replaced by:

After each period you will receive information on whether a transaction has taken place and your income in that period. The buyer will receive information on your price and if a transaction has taken place and his/her income.

Instructions for buyers in CF1

You are a buyer and your task for 10 periods is to state the price you are willing to pay for a can of coca-cola (33cl).

In each period you have 100 kr in your budget. You will be randomly matched with an anonymous seller who has a coca-cola. You will be matched with the same seller in all 10 periods. The seller will state the price he/she is willing to sell the can of coca-cola for at the same time as you state the price you are willing to pay for the coca-cola. You can only use your budget to trade with this seller.

If you price is the same or higher than the seller's, then a will transaction take place. You pay the price the seller has set. You receive the coca-cola and keep what remains of your budget. The seller receives the sum you have paid.

If your price is lower than the seller's price there will be no transaction and neither you nor the seller will receive anything.

Arithmetic example: Assume that the seller's price is p_s and that you offer to pay p_b. If $p_s \leq p_b$ the final price is p_s and trade takes place. You receive $100 - p_s$ and the coke and the seller receives p_s. If $p_s > p_b$ both receive 0 kr and the seller does not keep the coca-cola.

[After each period you will receive information on the seller's price and if a transaction has taken place and your income in that period. In the same way the seller will receive information on your price and if a transaction has taken place and his/her income.]

The seller has received the same information about the situation as you have.

Now state the price you are willing to pay for a can of coca-cola by typing your price in the box. Click in the box and write you price in numbers.

State your price:

In each period you will state what you believe the seller you are matched with is willing to sell the coca-cola for. You will receive 40 kr minus 1 kr for each krona your guess deviates from the price.

The seller will not find out what you have guessed.

Now state what you believe the seller is willing to sell the can of cola for by typing your guess in the box on the computer screen.

My guess is:

The instructions for buyers in CP were the same as for as buyers in CF but where the text in brackets [] was replaced by:

After each period you will receive information on the seller's price and if a transaction has taken place and your income in that period. The seller will not receive information on your price but will receive information on whether a transaction has taken place and his/her income.

In the hypothetical treatment, the instructions were in principle the same, but the coca-cola was replaced by the good X. For example, for sellers in HF, the instructions were:

You are a seller of a a hypothetical good that we can call X and your task for 10 periods is to state the price at which you are willing to sell X.

You will be randomly matched with an anonymous buyer who has a budget of 100 kr in each period. You will be matched with the same buyer in all 10 periods. The buyer states the price he/she is willing to pay for X at the same time as you state the price at which you want to sell X. The buyer can only use the budget to trade with you.

If your price is the same or lower than the buyer's price, a transaction will take place. The buyer pays you the price you have stated and receives what remains of the budget. You receive what the buyer has paid.

If your price is higher than the buyer's price there will be no transaction and neither you nor the buyer will receive anything.

Arithmetic example: Assume that the buyers price is p^b and you want to sell the X for p_s. If $p_s \leq p_b$ then the final price is p_s and trade takes place. You receive p_s and the buyer receives $100 - p_s$. The buyer does not receive the good since X is a hypothetical good. If $p_s > p_b$ both receive 0 kr. You do not keep the good since X is a hypothetical good.

[After each period you will receive information on the buyer's price and if a transaction has taken place and your income in that period. In the same way the buyer will receive information on your price and if a transaction has taken place and his/her income.]

The buyer has received the same information about the situation as you have.

Now state the price at which you are willing to sell X by typing it in the box. Click in the box and write your price in numbers.

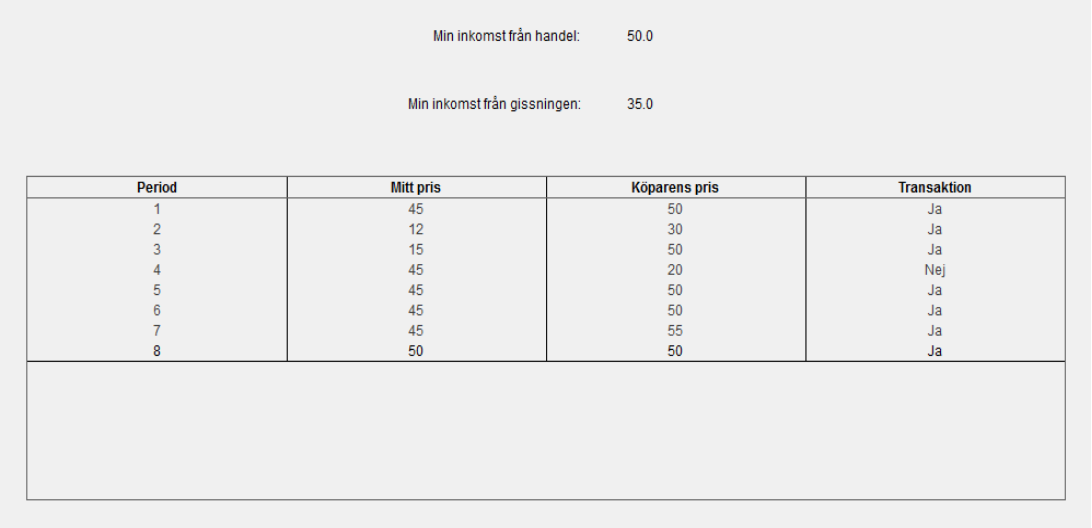
State your price:

In each period you will also state what you believe the buyer you are matched with is willing to pay for X. You will receive 40 kr minus 1 kr for each krona your guess deviates from the the price.

The buyer will not find out what you have guessed.

Now state what you believe the buyer is willing to buy X for by stating your guess in the box on the computer screen.

After all the subjects had stated their prices and guesses, the computer screen displayed information on the present period's outcome according to what information feedback treatment they were in; it also displayed a list of previous periods' outcomes. Figure B.1 and Figure B.2 are the screens displayed in the F- and P-treatment for sellers.

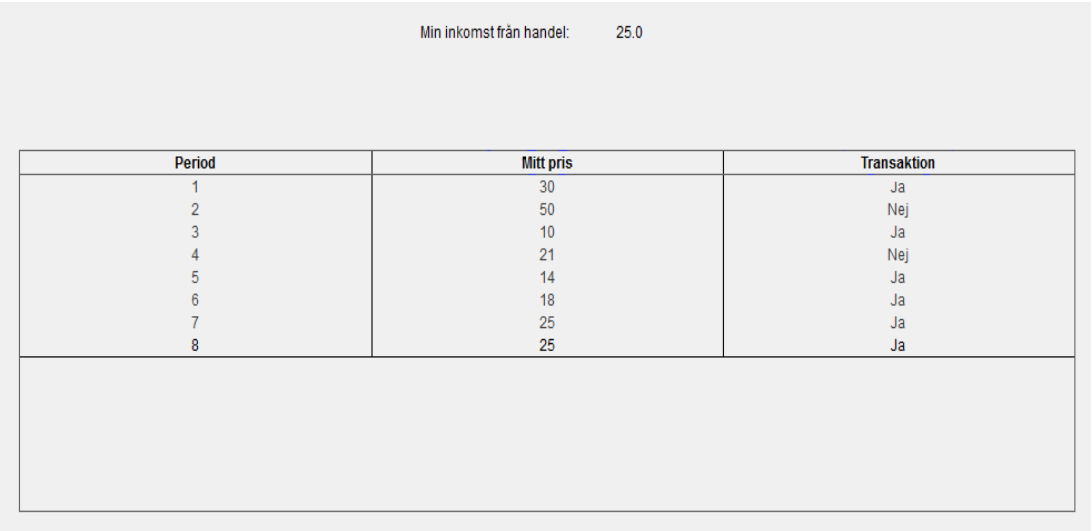


Min inkomst från handel: 50.0

Min inkomst från gissningen: 35.0

Period	Mitt pris	Köparens pris	Transaktion
1	45	50	Ja
2	12	30	Ja
3	15	50	Ja
4	45	20	Nej
5	45	50	Ja
6	45	50	Ja
7	45	55	Ja
8	50	50	Ja

Figure B.1: Seller Full Information Feedback Screen



Min inkomst från handel: 25.0

Period	Mitt pris	Transaktion
1	30	Ja
2	50	Nej
3	10	Ja
4	21	Nej
5	14	Ja
6	18	Ja
7	25	Ja
8	25	Ja

Figure B.2: Seller Partial Information Feedback Screen

In phase 2, the following text was displayed above the full set of instructions that were the same as above. The text in brackets [] is role specific:

Sellers who have played F-treatment in phase 1 and P-treatment in phase 2

[Now state a price for another 10 periods. The instructions are the same as before except that you will no longer receive information about your opponent's price after each period.]

You will be randomly matched against a **new** anonymous opponent who will be the same throughout all 10 periods.

Sellers who have played P-treatment in phase 1 and F-treatment in phase 2

Now state a price for another 10 periods. The instructions are the same as before except that you will now receive information on your opponent's price after each period.

Buyers who have played F-treatment in phase 1 and P-treatment in phase 2

Now state a price for another 10 periods. The instructions are the same as before except your opponent will no longer receive information on your price.

Buyers who have played P-treatment in phase 1 and F-treatment in phase 2

Now state a price for another 10 periods. The instructions are the same as before except that your opponent will now receive information on your price.

After subjects had played the 20 periods as instructed above, they received the following instructions for the different elicitation tasks and the questionnaire. However, subjects in the H-treatments did not answer the coca-cola valuation and price familiarity; they did not answer the question on average coca-cola consumption either.

Coca-cola valuation

Now make choices between a can of coca-cola and a sum of money for 16 different decisions in the list on the right. One of the periods will be drawn randomly and you will receive what you have chosen in that decision (see the arithmetic example). You are only supposed to switch between cola and money once.

Val	Cola eller pengar
1	○ cola ○ 1 kr
2	○ cola ○ 2 kr
3	○ cola ○ 3 kr
4	○ cola ○ 4 kr
5	○ cola ○ 5 kr
6	○ cola ○ 6 kr
7	○ cola ○ 7 kr
8	○ cola ○ 8 kr
9	○ cola ○ 9 kr
10	○ cola ○ 10 kr
11	○ cola ○ 11 kr
12	○ cola ○ 13 kr
13	○ cola ○ 15 kr
14	○ cola ○ 20 kr
15	○ cola ○ 25 kr
16	○ cola ○ 30 kr

Now make your choice:

Arithmetic example: From the 16 decisions you have made, decision x is randomly selected. If you have ticked cola in that decision you will receive a can of coca-cola. If you have ticked y kr in that decision, you will receive y kr.

Coca-cola price familiarity

Now guess how much a 33 cl can of coca-cola costs (rounded to the closest whole krona) at ICA Tuna next to the School of Economics and Management. You will receive 10 kr if your guess is correct and nothing otherwise. State your guess in whole kronor.

I guess that a can of coca-cola at ICA Tuna costs:

Risk

Now choose between the two options explained below. You can earn money on one of your choices and how much you earn depends on the outcome of that choice.

For each choice there are two options and probabilities of different payoffs. These probabilities determine your chances of receiving a high or low payoff. We randomly select one of your choices and then make a draw where your payoff is determined by the probabilities in that option. Thus the outcome of the draw and the option you have ticked in that choice determine your earnings. The highest amount you can earn is 58 kr and the lowest 1.50 kr. (see arithmetic example on the next page)

We offer you two different options, A and B. Tick the option that seems preferable to you in each and every choice.

Arithmetic example: Assume that choice x is randomly selected where the probability of a high payoff is z% and the probability of a low payoff is y%. We draw either a high or a low payoff according to the probabilities z% and y%. If the outcome is high you will earn 30 kr if you have chosen option A and 58 kr if you have chosen option B in choice x. If the outcome is low you will earn 24 kr if you have chosen option A and 1.50 kr if you have chosen option B in choice x.

VAL	ALTERNATIV A	ALTERNATIV B	JAG VÄLJER
1	30 kr med sannolikhet 10% **och** 24 kr med sannolikhet 90%	58 kr med sannolikhet 10% **och** 1,50 kr med sannolikhet 90%	○ A ○ B
2	30 kr med sannolikhet 20% **och** 24 kr med sannolikhet 80%	58 kr med sannolikhet 20% **och** 1,50 kr med sannolikhet 80%	○ A ○ B
3	30 kr med sannolikhet 30% **och** 24 kr med sannolikhet 70%	58 kr med sannolikhet 30% **och** 1,50 kr med sannolikhet 70%	○ A ○ B
4	30 kr med sannolikhet 40% **och** 24 kr med sannolikhet 60%	58 kr med sannolikhet 40% **och** 1,50 kr med sannolikhet 60%	○ A ○ B
5	30 kr med sannolikhet 50% **och** 24 kr med sannolikhet 50%	58 kr med sannolikhet 50% **och** 1,50 kr med sannolikhet 50%	○ A ○ B
6	30 kr med sannolikhet 60% **och** 24 kr med sannolikhet 40%	58 kr med sannolikhet 60% **och** 1,50 kr med sannolikhet 40%	○ A ○ B
7	30 kr med sannolikhet 70% **och** 24 kr med sannolikhet 30%	58 kr med sannolikhet 70% **och** 1,50 kr med sannolikhet 30%	○ A ○ B
8	30 kr med sannolikhet 80% **och** 24 kr med sannolikhet 20%	58 kr med sannolikhet 80% **och** 1,50 kr med sannolikhet 20%	○ A ○ B
9	30 kr med sannolikhet 90% **och** 24 kr med sannolikhet 10%	58 kr med sannolikhet 90% **och** 1,50 kr med sannolikhet 10%	○ A ○ B
10	30 kr med sannolikhet 100%	58 kr med sannolikhet 100%	○ A ○ B

CRT

Now answer three short questions. You can earn money by answering correctly.

Every tenth participants' answers will be selected and for each correct answer these participants will receive 30 kr.

1. A tennis racket and a ball cost 110 kr in total. The tennis racket costs 100 kr more than the ball. How much does the ball cost?

2. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?

3. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?

Dictator

You will now receive 100 kr that you will divide between yourself and another participant.

The other participant is anonymous and is not the same as you traded with earlier in the experiment.

Your opponent will receive the sum you offer and you will keep the rest.

Every tenth participants' answer will be selected and these will receive what they have decided to keep out of the 100 kr and their opponent will receive the rest.

Now state how much you would like to give out of the 100 kr.

I would like to give:

Fair price perceptions

Now answer some questions.

Question 1: A small internet café has one employee who has worked in the café for six months and earns 90 kr per hour. Business continues to be satisfactory, but a factory in the area has closed and unemployment has increased. Other small shops have now hired reliable workers at 70 kr an hour to perform jobs similar to those done by the internet café employee. The owner of the internet café reduces the employee's wage to 70 kr. Please rate this action as:

Completely fair / Acceptable / Unfair / Very unfair

Question 2: A hardware store has been selling snow shovels for 150 kr. The morning after a large snowstorm, the store raises the price to 200 kr.

Question 3: A grocery store has several months supply of crisp bread in stock which it has on the shelves and in the storeroom. The owner hears that the wholesale price of crisp bread has increased and immediately raises the price on the current stock of crisp bread.

Question 4: An internet book shop sells travel books. Each time a customer views a book, this information is saved and the next time the customer views the same book the price increases for that book.

Question 5: A grocery store has stores in many communities. Most of them face competition from other groceries. In one community the chain has no competition. Although its costs and volume of sales are the same there as elsewhere, the chain sets prices that average 5 percent higher than in other communities.

Question 6: Suppose that, due to a transportation mixup, there is a local shortage of lettuce and the wholesale price has increased. A local grocer has bought the usual quantity of lettuce at a price that is 30 cents per head higher than normal. The grocer raises the price of lettuce to customers by 30 cents per head.

Question 7: A flight company sells flight journeys without hotel within the Nordic countries. When the flight company has many available seats on a flight route, the price is low. The fewer the seats that are available on the route, the higher is the price of a flight ticket.

Question 8: A small factory produces tables and sells all that it can make at 2000 kr each. Because of changes in the price of materials, the cost of making each table has recently decreased by 400 kr. The factory reduces its price for the tables by 200 kr.

Price norm perceptions

In this part, the subjects answered the same questions as in the fair price perception part, but with the following header text:

Now state what you believe the others' answers are to the same questions. Guess what alternative most of the others have chosen. You can earn money on your answers. Each tenth participant's answers will be drawn randomly and for each correct answer, the participant will receive 20 kr. Now tick the alternative that you believe most of the others have chosen (your answer will not be included in what most of the others have chosen).

Questionnaire

Now answer some questions about yourself.

1. Estimate how many liters of coca-cola you buy on average each week.
2. Did you vote in the parliamentary elections in 2010?
3. Have you donated money to charity in the last year?

4. Have you donated blood in the last five years?
5. Do you think that it is okay to file share?
6. Your age:
7. Man or woman?
8. Are you a student at the introductory level (level A) in Economics, the intermediate (B/C courses), or advanced level?
9. Have you participated in any experiment in Economics earlier while studying in Lund?