Street smart – Economic decision-making among urban street dwellers

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ABSTRACT

This study provides first field evidence on the effect of financial resources on real economic decisions. A sudden increase in inventory costs tightens consumption budgets in a population of self-employed vendors of a Big Issue-type "street paper". After the budget shock, vendors become more responsive to expected demand in their stock-up decisions, and increase their inventory turnover. The timing of the behavior changes is consistent with the tightening budget having a causal impact on vendors' decisions. My findings suggest that binding budget constraints are unlikely to drive the results, indicating that cognition-related factors may be important in explaining the economic decisions of those who have little.

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1. Introduction

Poor people have been shown to make adverse economic decisions that are less common among the well-off. Examples include playing lotteries with a negative expected value (Haisley et al., 2008), not enrolling in assistance programs (Bertrand et al., 2004), and engaging in short-term borrowing subject to sky-high interest rates (e.g., Chin, 2004). Demographic factors typically associated with being poor, such as having little education (Bernheim et al., 2001) or living in circumstances that foster unfavorable outcomes (Ludwig et al., 2001; Allard et al., 2003), fail to fully explain these behaviors. Consequently, a number of recent studies ask whether having low resources relative to needs, as such, might influence the mind of a decision-maker.

Having to cope with less than you feel you need has been found to have twofold effects on the quality of decisions. On the one hand, resource scarcity may be a strain on mental capacity, degrading performance in cognitively demanding tasks (Haushofer and Fehr, 2014). Self-control issues could also arise due to poverty (Bernheim et al., 2015). On the other hand, lack of resources may lead to the emergence of a "scarcity mind-set", inducing us to engage more deeply in decisions that most affect those resources (e.g., Shah et al., 2012; 2015). Accordingly, those with little have been found more attentive to prices, more prone to trade-off thinking, and less susceptible to context effects and framing (Binkley and Bejnarowicz, 2003; Goldin and Homonoff, 2013; Shah et al., 2012; 2015).

As discussed by Carvalho et al. (2016), identifying causal links from poverty to behavior is challenging. Time and risk preferences may systematically differ between the poor and the better-off (e.g., Haushofer et al, 2013; Gloede et al., 2015), and reverse causality can confound results. To tackle the identification issue, experiments based on surveys or cognitive tasks have been conducted in laboratory settings (Shah et al., 2012; 2015) and in the field (Mani et al., 2013; Carvalho et al., 2016).

This study is first to analyze the effect of a resource shock on real economic decisions. A sudden change in the unit cost of inventory effectively makes financial resources more scarce in a population of self-employed vendors of a Big Issue-type "street paper".[1] The setting is familiar in larger cities across the globe, with mainly homeless or otherwise disadvantaged people selling magazines in order to enhance their financial situation. Vendors invest in their stock of papers by paying a fraction of the selling price for each copy. This price is unexpectedly raised, making vendors' consumption budgets tighter by tying up additional cash in inventory. In contrast to related research utilizing resource shocks that are known to be temporary (Mani et al., 2013; Carvalho et al., 2016), the shock in the current study is plausibly permanent *ex ante*, and has been so *ex post*.

The increased cost of inventories significantly alters the vendors' behavior. First, vendors become more responsive to expected demand in their stock-up decisions, which suggests that their behavior more closely corresponds to utility maximization. Second, they increase their inventory turnover, shown as more frequent stock-ups and a lower number of papers bought at a time. The findings are partly stronger in, and partly confined to, the subsample of vendors who were active both before and after the cost increase, i.e., those plausibly *reacting* to it. Evidence on the timing of the behavior changes is consistent with the tightening budget having a causal impact on vendors' decisions.

Binding budget constraints could plausibly explain the observed changes in behavior. If a vendor can no longer afford a stock-up matching expected demand with the higher price, she will have to stock up more frequently to meet demand. To assess the importance of budget constraints

[1] *The Big Issue*, established 1991 in London, UK, is the most widely known street paper in Europe. Other well-known street papers include *Street News* (launched in New York City, US, in 1989) and *StreetWise* (Chicago, US, 1992).

for vendors' decisions, I look at the subsample active in both pricing regimes, and estimate each vendor's likelihood to face a binding budget constraint. Assuming that, on average, lot sizes (the number of papers purchased at a time) in the past are informative about budget flexibility in the future, I use pre-change average lot size as a proxy for this likelihood. I find that those expected to have most slack in their budget significantly shrink their average inventory when its cost rises, while those considered likely to be budget constrained increase their average stock. While this analysis is too crude to warrant strong interpretations, I conclude that binding budget constraints seem unlikely to drive the changes I observe in vendors' behavior.

My conclusion stands in contrast to Carvalho et al. (2016), whose results suggest that lack of available resources is more important than behavioral factors in explaining the economic decisions of the poor.[2] Instead, cognition-based explanations seem more promising for the increased responsiveness to demand and quicker turnover. One possibility is that, as available resources effectively get lower due to the larger budget fraction tied up in inventory, the scarcity mind-set renders decisions closer to normative predictions. In other words, because the vendors have less, their decisions become "smart". This would be in line with Shah et al. (2015). However, several alternative explanations are also plausible. For instance, the larger budget fraction tied up in inventory may make its cost and risk more salient, and as a result, increased attention could be paid to matching stock-ups with expected demand.

Besides the existing research on poverty and decision making, my results contribute to the emerging literature studying small-scale (informal) self-employment, where evidence so far mainly comes from developing countries. Dupas et al. (2016) find that bicycle taxi drivers in Kenya are more likely to work on days when expected income is high; my result of vendors being

[2] Carvalho et al. (2016) emphasize that their finding regarding the greater importance of resource constraints is only suggestive.

responsive to expected demand is consistent with this. Underinvestment due to capital constraints (Fafchamps et al., 2014; De Mel et al., 2008) or suboptimal inventory management (Kremer et al., 2013) has been found to hurt the profitability of microenterprises; my results suggest budget constraints are not of first-order importance, and again, the fact that lot sizes generally follow expected demand indicates that inventories are reasonably managed.

Many developed economies currently face structural unemployment, with a bulk of their industrial jobs relocated or made redundant through new technology. To spur economic activity, governments seek to reactivate the long-term unemployed – often overlooked by employers (Kroft et al., 2013; Ghayad, 2013) – through programs helping them access self-employment (for such programs in the U.S., see Kugler, 2015). The results in this paper can be seen as encouraging for these reactivation efforts. They show that people with little education or entrepreneurial experience are responsive to changes in their economic environment, and appear to utilize their resources efficiently. In activities with better possibilities for achieving economies of scale, these "street smarts" could well become successful enough to eventually rise out of poverty. Creating an environment that fosters such activities could be what is left for governments to focus on.

The paper is organized as follows. The following section explains the setting of the study. Section 3 outlines my hypotheses, while Section 4 discusses the data and provides descriptive analysis. Section 5 presents the main results, and Section 6 concludes.

2. The setting

The *Iso Numero* magazine ("IN") was started 2011 in Helsinki, Finland, by *Kultti ry* ("the publisher"), a Finnish not-for-profit association of cultural, scientific, and advocacy magazines. Similarly to street papers like *The Big Issue* in the United Kingdom, the motivation behind

launching IN was to provide an additional source of income for anybody who needs one. The costs incurred in the publishing process are covered by income from advertisers and vendors. Most of the contents consist of reprints from the approximately 200 member magazines of the publisher, and the few journalists and staff working for IN are volunteers. In contrast to many street papers around the globe, no contents are produced by the vendors themselves. Poverty, homelessness, and social inequality are characteristic topics, but lighter subjects, such as popular culture, are also covered.

A. The vendors

"Nomadic" migrants from the EU area were one group that the publisher expected to particularly benefit from the paper. These migrants typically remain in foreign cities only for some months at a time in search of informal earnings opportunities.[3] Once a sufficient amount of money has been earned they return home, only to travel again once the savings accumulated abroad have run out. A severe shortage of work opportunities in their regions of origin appears to drive the phenomenon.[4] During their time in Helsinki many of the migrants are "homeless", sleeping in illegal encampments or abandoned buildings, for instance. Selling street papers under the brand of a local organization was seen by the publisher as a way to enhance both their legitimacy and their economic situation.

The main distribution site is a day center where the migrants are provided with daily necessities.[5] The center is operated by the Helsinki Deaconess Institute, a public utility foundation. IN was first also distributed at similar day centers providing services to permanent

[3] EU citizens can stay in any EU country for up to three months with no permit requirements.
[4] For an account of the economic strategies of migrants traveling between Slovakia and the UK, see Grill (2015).
[5] The services include showers, computers, laundry machines, and cooking facilities, along with assistance related to, e.g., housing, healthcare, work, and travel arrangements.

residents of Helsinki, but among locals, the opportunity to become a vendor was not met with enthusiasm. The few locals who are occasionally active as vendors are left out of the sample.

I interview about 10% of the vendors at the distribution site, asking questions about their background and daily life. The information summarized in Table 1 shows that the interviewed vendors, who are often in prime working age, have gone to school an average of five years, with less them half of them ever having worked for salary. The most commonly cited job is construction worker. Many used to work in Southern European countries such as Italy or Spain, but were forced to emigrate after 2009, when the European debt crisis made masses of people in these countries jobless. In Helsinki, their income sources besides selling IN include deposit bottles, begging, and, preferably due to the better pay, day-labor activities such as cleaning or snow clearing. Table 1 also shows that an average day's earnings from street papers are around 15-30 euro in the interviewed subsample of vendors, slightly more than from deposit bottles or begging. With daily consumption at 10-15 euro, a surplus of 5-10 euro per day appears typical. When asked how they decide on the number of papers to buy on a given day, the majority of the interviewed vendors stress the importance of expected demand rather than the availability of cash.

Based on discussions with vendors and social workers at the distribution site, it appears that vendors typically finance their travel by borrowing from informal moneylenders. Monthly interest rates are said to be around 50%, so in the first weeks abroad paying down debt is highly prioritized.[6] After that, a fraction of earnings is regularly sent back home to family members through cash transfer services.

[6] A common belief, cited, e.g., in the popular press, is that the earnings of these migrants, whether from street papers, begging, or something else, in the end go to criminal organizations. The same organizations would be responsible for bringing the migrants into the country. I saw no evidence of this, and in the case of IN, it seems unlikely. However, I

B. Rules and legal framework

Vendors are not employed by the publisher, but work on their own account. In taxation, the papers are considered tradeable assets, and selling them is treated similarly to trading financial securities, for instance. Trading profits are tax free in Finland until the annual value of assets sold (i.e., gross revenue) reaches 1,000 euro. This means that after 200 papers sold in a given year (250 before the increase in selling price), revenues should be self-declared to the tax authority.

Against common street paper practice, IN vendors do not need to sign a code of conduct that would prohibit selling under the influence of alcohol or drugs, for instance. Vendors are made aware, however, that (1) selling should be strictly separated from begging, so that the vendor badge or papers are not kept visible if begging, and (2) selling is only allowed outdoors in public places, not inside, e.g., public transport vehicles or stations.

C. The price change

In mid-September, 2014, the publisher noticed that roughly half of the revenue it should have received from sales earlier that year was missing. The number of papers sold to vendors during the year, according to reports from the distribution site, was far greater than what their cash balance justified. To be able to print the next issue and keep the paper alive, the publisher needed to increase the price vendors paid for the papers.

The change in pricing became effective upon publication of the next issue, October 17th, 2014. To maintain a vendor's net income per paper sold at three euro, the selling price was also

know little about the informal moneylenders that reportedly finance many vendors' travels. If they are associated with criminal organizations with coercive terms of lending, organized crime could play a significant role in the migration process, not much different from human traffickers.

raised. Before the change, a paper cost one euro for a vendor to buy, and was sold on the street for four euro. After the change, a paper costs two euro for a vendor, and five on the street.

D. Practices at the distribution site

Purchases are generally made in cash. An exception is the occasional trade-in of outdated papers, which are exchangeable on a one-to-one basis for current ones in the first weeks of a new issue. In connection to the price change, the ratio was two outdated ones (that had been purchased for the old price of one euro) for one current (worth two euro).

Refunds for unsold papers are explicitly not allowed. Due to the financially fragile situation of many vendors, however, a small number of *ad hoc* exceptions have been made. During the sample period, a refund was granted on 25 occasions, for an average of eight papers at a time.

Finally, to lower the threshold of trying, each newly registered vendor receives one free copy of the paper. Although small in size, this grant theoretically makes the cash constraint to entry redundant. With the proceeds from selling the first copy, the vendor can buy two more, and so forth.

3. Hypotheses

To establish a benchmark against which to compare my results, I first sketch an idea about the way an expected utility maximizing vendor should behave. In this setting, maximizing utility involves a tradeoff between maximizing income, which linearly increases with papers sold, and minimizing its cost. The cost of income will include (a) the cost of tying up cash in the stock of papers, thereby reducing consumption possibilities, and (b) the time spent selling, because this time could also be spent on other utility-enhancing activities. I hypothesize that when, in terms of

demand and competition, expected daily sales are high, an expected utility maximizing vendor is more active. Conditional on her stock-up frequency, this will mean increased lot size. Hence:

H1: *Conditional on expected competition and stock-up frequency, an expected utility maximizing vendor's lot size increases with expected demand.*

The increase in purchase price, from one euro to two, will enter a vendor's maximization problem as a doubling of the unit cost of inventories. On the other hand, the rise in selling price from four euro to five will increase gross income, so that net income per paper sold remains constant at three euro. Effective return on investment is halved from 3/1=300% to 3/2=150%. How should an expected utility maximizing vendor respond to these changes? [7]

For an example, imagine a vendor stocking up in the morning. Her budget for the day is 20 euro, and she expects to be able to sell 10 papers during the day. When the price of a paper is one, she would spend 10 euro, or half her budget, on a stock-up matching expected sales. When the price is two, the entire budget of 20 needs to be tied up. At the end of the day, her wealth will be 50 euro in both cases, assuming she sells all papers. In the latter case, however, she needs to give up the 10 euro "consumption backup" that will be highly valuable in case no buyers are found. In other words, the higher price, and the larger wealth fraction tied up in inventories, effectively makes the vendor poorer when papers are still in stock.

The example vendor, whose budget is tight, has a high cost of tying up the additional cash required to meet expected demand. The cost could be even higher: if the initial budget was only 10 euro, borrowing would be the only way for the vendor to afford a stock-up matching expected

[7] A response to the price change may also be expected from the readers' side. In the case of a usual consumption good, an increase in price should lead to a decrease in demand. Any such response will be incorporated in vendors' demand expectations, and can be abstracted from at this point. In Section 5.D, I discuss the probability and potential implications of a demand-side response in more detail.

demand. It seems plausible she will not incur this cost, but instead makes smaller stock-ups relative to expected demand after the price change. If she does not wish to miss out on sales, her purchases will consequently become more frequent. Hence:

H2: *A budget-constrained vendor will make more frequent stock-ups after the price change.*

H2 comes with an important corollary: a vendor with slack in her budget, who needs not to worry about the consumption backup, will not change her behavior in this manner. With a daily budget of 50 euro, for instance, 10 papers can be bought in both pricing regimes without risk of ending up with an empty stomach for the day. If such a vendor changes her behavior when the unit cost of inventory rises, the change will not be forced by a binding budget constraint. As her resources do get lower *relative to needs*, however, one plausible reason for her behavior to change may be the emergence of a "scarcity mind-set", as argued by, e.g., Shah et al. (2012; 2015).

Finally, as described, a budget's tightness depends on expected demand. When expected demand is high, relatively large lots are needed to meet that demand, which means relatively large amounts of cash need to be tied up in inventories. Hence:

H3: *Any effects caused by the price change are particularly strong in times of peak demand.*

4. Data and descriptive analysis

The data mainly consist of statistics kept at the distribution site.[8] With each stock-up, the date, the vendor's ID-number, and the number of papers bought is documented. This allows the tracking of individuals through time. A file of ID-numbers and names further enables me to identify the gender and nationality of each vendor. The rest of this section further elaborates on the variables, as well as provides descriptive analysis of vendor behavior.

A. Variables

Lot size $_{i,s}$ is defined as the number of papers vendor *i* buys at stock-up *s*. Here, *i* refers to a specific vendor in the population of 351 vendors, and *s* to the stock-up number of that vendor in her personal sequence of stock-ups. For example, if *s* equals 3, we are examining the third stock-up of vendor *i*, counting from the beginning of the sample period. As seen in Table 2, the average lot size is 13. Negative values indicate refunds. Lot sizes of 100 or more appear only four times during the sample period (110 twice, 130 and 195 once each), all of them by different vendors on the day Issue 1 was published.

Stock-up frequency is measured both as the vendor-specific *# days since last stock-up* $_{i,s}$ and the weekly average *Stock-ups per vendor*. Table 2 suggests that during active spells, vendors typically stock up quite frequently, while there can be several months between these active spells. Of the 2,168 observations on the time between consecutive stock-ups, half are three days or less, but the maximum is more than a year.

[8] Keeping statistics only started with my data collection, in June 2014. Prior to this, there was no systematic bookkeeping, which perhaps contributed to the mismatch between magazines sold to vendors and the publisher's income noticed in September 2014.

Demand from the buyers' side, which is not directly observable, is controlled for in several ways. First, assuming that more vendors are active when demand is high, I control for the number of vendors buying papers on day *t* in the variable *# active vendors* $_t$. Second, I use the strong variation in vendor activity over an issue's life cycle (demonstrated in Figure 1 below) to construct rough periodic indicators of demand levels. Specifically, I split issue life cycle into three periods, counting from the date of publication: *Days 1-5* ("peak demand"); *Days 6-20* ("intermediate demand"), and the rest ("low demand").[9] Table 2 shows that almost a fifth of all stock-ups are made during the first five days, although the days only account for 8% of the sample period. Similarly, the following fifteen days continue to be busier than the rest of the life cycle: 32% of all stock-ups are made on these days, while they only cover 24% of the sample period.

Papers are mainly sold around hubs of public transit. Arguably, when more people use public transit, there is a higher chance for a vendor to find a buyer. I therefore use the daily number of people boarding the subway at the Helsinki Central railway station, the busiest subway station both in terms of passengers and IN vendors, as a further demand proxy. This number is shown in the variable *Public transit* $_t$.

Finally, people may be less willing to take the time and effort to buy a paper on rainy or cold days. To control for weather-induced demand fluctuations, I include daily temperatures and millimeter amounts of rain in some of the regressions.

I control for competition in a weekly Herfindahl index that indicates how equally the market is split among vendors. A high Herfindahl value means that purchases are dominated by

[9] Stock-ups can only be made on weekdays. These periods thus vary in their "calendar length" depending on the weekday of publication, and also on potential public holidays.

relatively few vendors. In *Herfindahl (adjusted)* shown in Table 2, I have reverted the index so that a high value means large dispersion in purchases, i.e. high competition.[10]

Individual-level statistics are shown at the bottom of Table 2. About 40% of the vendors are female. Importantly, a large fraction of vendors do not regularly engage in selling. An average vendor has bought papers on about four separate weeks during the sample period, as seen in the variable *# active weeks* $_i$. 132 of the 351 vendors only bought once during the sample period, and 143 were active during just one week. 24 vendors sold all four issues that came out during the sample period, while 89 were active both before and after the price change. An average vendor bought about 90 papers in total during the sample period.

Two vendors have claimed refunds for more papers than they paid for, making their total purchases negative. This shows that papers bought and papers sold do not match for all vendors, but papers also change hands *between vendors*. In interviews, vendors confirm that a secondary market exists, and that the vendor-to-vendor price typically equals the price paid at the distribution site. Unfortunately, the exact functioning and scope of the secondary market is beyond my analysis due to data limitations.

B. Vendor activity over the sample period

Figure 1 shows, for each week of the sample period, (1) the aggregate number of papers bought; (2) the number of vendors who bought at least once; and (3) the ratio between (1) and (2). Four issues were published during the sample period: Issue 1 in June 2014; Issue 2 in October 2014; Issue 3 in March 2015; and Issue 4 in June 2015. Issues 1, 2, and 3 were sold for

[10] The original values are on the interval (0,1]. In this adjusted version, I have also multiplied the values by 100 and shifted them downwards so that the minimum value of the distribution becomes one.

13 to 20 weeks, and their respective total sales were about 9,400, 8,600, and 7,700 copies. On Issue 4, I only have data for the first eight weeks, during which it sold about 5,700 copies.

The clear spikes in vendor activity suggest that demand from buyers shoots up when a new issue is published, and gradually diminishes to a "base level". Vendors confirm this pattern in discussions. The fact that many vendors are only active in the first weeks of new issues suggests that for them, other income opportunities dominate during quiet times. The average size of a stock-up is large in weeks of high expected demand, but also when there are few other active vendors.

The reason for Issue 1 selling more than other issues in its initial weeks appears to be the larger number of active vendors. Purchases per vendor are similar, and even higher, in the first weeks of the following issues. Besides the publication weeks, a period that clearly stands out in Figure 1 is January and February of 2015. During these months, relatively few vendors seem to have been dominating the market, buying unusually large lots on average.

C. Lot size and stock-up frequency in the two pricing regimes

To see whether vendors behave differently in the two pricing regimes, I first make distributional comparisons of lot size and stock-up frequency between regimes. Figure 2 shows the distributions.

The main difference between the lot size distributions before and after the change is the increased occurrence of purchases of five, 15, and 25 papers at a time, with the apparent expense of 10-paper purchases. One potential reason could be that with the new price, these lots became payable with more "round" sums of money, which vendors seem to prefer. Exceptionally large lots of more than 30 papers at a time made up 6.7% of stock-ups before the price change, and 3.8% after. Whether they are considered or not, a Wilcoxon rank-sum test cannot reject the

equality of the two distributions.[11] That is, the increase in price did not shift the full-sample lot size distribution to the left, for instance, as H2 would have predicted if the sample solely consisted of budget-constrained vendors present in both regimes.

The number of days between a vendor's consecutive stock-ups is more often three or less after the price change. Situations where the preceding gap is very long, 30 days or more (4.6% of cases before the change, 10.7% after), are not reasonably comparable before and after the price change. A vendor active with Issues 1 and 4 only, for instance, can have more than 300 days between consecutive purchases, while such long breaks are not possible in the pre-change period alone. When this is taken into account, the typical number of days between stock-ups is significantly longer in the low-price regime.[12] This change is consistent with the quicker turnover hypothesized in H2, but whether it is caused by the price change cannot be inferred.

5. Results

A. Is vendor activity responsive to demand?

In Table 3, I study whether lot size increases with expected demand when other relevant factors are held constant. Specifically, I run regressions of observed lot size on measures of expected demand, controlling for stock-up frequency and expected competition. While finding a positive relation between lot size and demand will not unequivocally mean that vendors are utility maximizers, it would suggest that an average vendor's behavior is consistent with utility maximization. H1 summarized this prediction.

[11] The p-values for the full and restricted sample tests are 0.188 and 0.895, respectively.
[12] A Wilcoxon rank-sum test, including purchases where the preceding gap is 30 days or less, returns a p-value of 0.002.

Shah et al. (2015) show that the tightness of one's budget may, as such, affect decision-making. In this study's context, the increase in the paper's price led to an effective tightening of vendors' budgets. To see whether behavior consistent with utility maximization is more or less prevalent when budgets are tighter, I separately run the analysis for the pre- and post-change periods. Importantly, to see whether any differences across regimes may reflect a reaction induced by the price increase, as opposed to changes in sample composition, I also separately focus on a "restricted" subsample of vendors who were present in both pricing regimes.

The results for the full sample of vendors and the full sample period, in columns (1) and (2), suggest that the vendors' behavior is, on average, consistent with expected utility maximization. When expected demand appears high, i.e., when many vendors are active and when a new issue has just been published, lot sizes are larger. Also, when only one day has passed since the previous stock-up, meaning that a vendor has quickly sold out her papers, relatively large lots are bought.[13] On the other hand, when a second stock-up is made on a single day, it is typically smaller than average. These stock-ups often result from uncertainty in expectations. For example, a vendor might first buy five or 10 copies, but then observe that others are more optimistic about sales, and buy a few more before heading out for the day. This is suggestive of vendors actively updating their demand expectations.

Columns (4) and (6) split the sample period by the two pricing regimes. The finding consistent with utility-maximization – that lot sizes are responsive expected demand – is robust only in the high-price regime. In the pre-change period, where price is low, the number of papers purchased is less intuitively associated with the explanatory variables. While stock-ups are larger when more vendors are active, vendors accumulate, if anything, larger inventories when

[13] Time since last stock-up was included in the regression up to six days, but all the coefficients are not shown. In the full sample, the coefficient remains positive and significant up to a gap of four days.

competition is high relative to demand. Importantly, in the low-price regime, lots are no larger in the peak demand period of the first five days than during the rest of the life cycle.

Columns (3), (5), and (7) repeat the analysis for the restricted sample. Also in this subsample, responsiveness is weak in the low-price regime, but strong in the high-price regime. Furthermore, almost all the coefficients in column (7) are larger than in column (6), implying that these vendors drive the full-sample finding of greater responsiveness to expected demand when price is high. The result is in line with an interpretation where the greater responsiveness is a *reaction* to the higher price, and shows that it is not caused by differences in sample composition across regimes.

In sum, Table 3 provides evidence that behavior consistent with utility maximization, as described in H1, mainly occurs in the high-price regime, and mainly by vendors who were present in both regimes. These vendors may, for example, have reacted to the tighter budget constraints by becoming more attentive to expected demand. Alternatively, however, the results might not be driven by price, but reflect, e.g., learning over time: as experience accumulates, behavior could converge toward an equilibrium of utility maximization.

B. What causes the post-change increase in stock-up frequency?

Table 4 studies whether the price change plausibly caused the increase in stock-up frequency observed in Figure 2. The timing of the increase is examined in more detail by looking at the sample period issue by issue. If the reason for the frequency increase is the change in price, the two should occur simultaneously. The regressions control for factors that should partly determine how soon a vendor returns, such as the size of the previous stock-up. The dependent variable is defined in two alternative ways: as the number of days between the stock-ups of an individual vendor (columns 1-4), and as the weekly total number of stock-ups (by all vendors)

divided by the number of active vendors (columns 5 and 6). Vendors who were present in both periods are again separately analyzed. Finally, for comparability, columns (1)-(4) only use the first 35 weekdays (seven to eight weeks) of sales for each issue, as this is the maximum time period available for Issue 4.

First of all, columns (1) and (2) show that in the full sample, the estimated increase in average stock-up frequency is small and not statistically significant. The likely reason for this contrast to the distributional test is the restriction of data to the first 35 days of each issue. The only factor that significantly predicts the interval between stock-ups is backward-looking demand, in column (2). When the number of other vendors buying papers is high on a stock-up day, vendors tend to take a longer pause.

Importantly, however, columns (3) and (4) show that vendors in the restricted sample do stock up more frequently after the change, and that the main shift in average stock-up intervals coincides with the price increase. As seen in column (3), the unconditional means for the dependent variable in Issues 1, 2, 3, and 4 are 5.3, 4.4, 4.2, and 4.0, respectively. The backward-looking control variables have no significant impact of their own, but including them makes the frequency estimate for Issue 2 lose accuracy.

Column (5) shows that, compared to Issue 1, the weekly average number of stock-ups per vendor is higher by about 0.31 to 0.35 in all of the high-priced issues. The only real jump is seen between Issues 1 and 2, in tandem with the price change. The unconditional average is 1.47 in Issue 1, and 1.82 in Issue 2.[14] In fact, while the *maximum* of the dependent variable is 1.91 in the low-priced issue ("in no week did the average vendor stock up twice"), its 75th percentile is 2.11 in Issue 2 ("a quarter of the weeks saw the average vendor stock up at least twice"). In other

[14] The regressions in Table 4 include an unreported dummy for weeks when the issue changes, as these weeks see sales from two separate issues. This is why the unconditional averages do not exactly match those seen in the table.

words, vendors become substantially more likely to stock up several times per week, just when the unit cost of inventories is raised.

In an unreported robustness check, I further confirm that the greater average stock-up frequency does not merely reflect large behavior changes by a few individuals. Around each issue-to-issue transition, I identify the vendors who were active both pre- and post-transition. The transition from Issue 1 to Issue 2 is the only one where it is most common for the involved vendors to increase their average weekly number of stock-ups.

In H3, I hypothesized that any effects caused by the price change will be most visible when expected demand is highest. In column (6), I test this hypothesis. I proxy weekly expected demand by the number of papers bought by the average vendor that week. If the cost of inventories truly becomes an issue, several stock-ups should be seen particularly on weeks when a large number of papers is required to meet demand. The results support this idea. When price is low, the weekly number of stock-ups per vendor is unrelated to the number of papers bought that week. Once the unit cost of inventories increases, a positive, statistically significant relation emerges. With this finding included, Table 4 provides compelling evidence that the increase in turnover was caused by the higher inventory costs.

C. The role of budget constraints

The jump in the unit cost of inventories caused vendors who were present in both regimes to increase their stock-up frequency. The underlying reason, however, remains unclear. One hypothesis is that vendors face tight budget constraints, as in H2. As they cannot afford to tie up additional cash in inventories, they buy fewer papers relative to expected demand in the high-price regime. Cognition-based explanations are also plausible. For example, the tighter budget may make vendors more attentive to matching inventories with demand.

This section attempts to evaluate the extent to which binding budget constraints account for the observed behavior change. I only focus on the restricted sample, and split this subsample based on the vendors' estimated likelihood to face a tight budget. I assume that, on average, those who have been able to buy exceptionally large lots in response to high demand in the past, will also be able to do so in the future. With this rationale, the split is based on pre-change average lot size, and those in the high-group are hypothesized to be less likely to face budget constraints.

Differences in pre- and post-change behavior in the high- and low-groups are presented in Table 5. For vendors in the low-group, i.e., among those more likely to become constrained, both lot size and stock-up frequency significantly increase with the price change. For those in the high-group, on the other hand, average lot size drops by almost half, and the rise in frequency is insignificant. It seems that as a result of the big buyers diminishing their volume, the others have been able to get a larger share of the market. Vendors in the low-group significantly boost their sales in the high-price regime, as evidenced by the 50% rise in weekly papers bought.

The tests in Table 5 show that vendors who, *ex ante*, may be expected to have most slack in their budget, significantly shrink their average inventory when its unit cost rises. By contrast, those considered most likely to face binding budget constraints increase their average stock. Together, this appears inconsistent with the scenario in H2, where a budget constraint determines a vendor's reaction to the price change. While this analysis is too crude to warrant strong interpretations, I conclude that cognition-based explanations seem more promising in explaining the observed increase in turnover.

D. Are the results confounded by a potential demand-side response?

My analysis abstracts from the fact that readers may be less willing to buy the paper with the increased price. This may be seen as an issue potentially confounding my findings. In this

section, I address this concern by discussing the implications that a demand-side response might have on my results, and then arguing that the probability of such a response should be low in the first place.

The finding related to my first hypothesis – that vendors are more responsive to demand in the high-price regime – is arguably independent of the *level* of demand in either regime, as it deals with how vendors react to within-regime fluctuations. The same should apply to the third hypothesis: without taking a stand on whether market-wide demand is high or low on average, vendors will plausibly stock up many times most probably on weeks when, relative to other weeks, they buy a large number of papers.

Regarding my second hypothesis, a decrease in demand could cause behavior to change without an active decision from the vendors' side. In this case, we should witness either smaller average lots, less frequent stock-ups, or both in the high-price regime. Table 5 shows that in the restricted sample, lot size does decrease on average, but at the same time stock-up frequency goes up. As a result, there is an increase in turnover, and no significant change in the number of papers bought per week. In the full sample, Figure 2 shows no change in the distribution of lot size, and more frequent stock-ups. In sum, vendors do not become less active in the high-price regime, as they should if fewer buyers were available. The fact that a decrease in demand would force vendors stock up less frequently, keeping lot size constant, only appears to strengthen the argument that the increased turnover is a vendor-driven decision.

Finally, it appears unlikely *ex ante* that a decrease in demand should be seen in the first place. An increase in price typically leads to a decrease in demand in the context of normal consumption goods. For most buyers, a street paper is not such a good. For example, Hibbert et al. (2005) survey readers of the Big Issue in Scotland and find that "few are able to see the purchase of the magazine as purely commercial" (p. 170). There is a significant charity aspect,

and buying can be rather seen as an experience than as pure consumption. As a result, the buyers' sensitivity to price should be low (see, e.g., Wakefield and Inman, 2003; Karlan and List, 2007; Meer, 2013).

Responses to a web-based reader survey provide evidence that also *ex post*, the one-euro price increase was unlikely to affect demand. The survey, conducted in November and December, 2015, was advertised through IN's website and social media channels. While probably not representative, this sample of buyers seems valuable for understanding where IN's demand comes from. Their responses, shown in Table 6, strongly suggest that IN is rather bought for experience than for consumption, and the demographic profile indicates that paying one euro more for a paper that comes out three times per year should not be an issue.

6. Conclusion

I show that vendors of a street paper significantly alter their behavior in conjunction with a rise in their unit cost of inventories. After this cost is raised, vendors are more responsive to expected demand in their stock-up decisions, suggesting that their behavior more closely corresponds to utility maximization. They also increase their inventory turnover, as evidenced by more frequent stock-ups and a lower number of papers bought at a time. These findings are partly stronger in, and partly confined to, the subsample of vendors who were active both before and after the cost increase, i.e., those plausibly *reacting* to it. Evidence on the timing of the behavior changes is consistent with the cost increase having a causal impact on vendors' decisions.

Binding budget constraints could potentially explain my findings. A vendor whose budget is tight could not afford to tie up additional cash in inventories, and would be forced to buy fewer papers relative to expected demand in the high-price regime. To roughly evaluate the extent to which budget constraints account for the results, I categorize vendors based on their pre-change

average lot size, assuming that it reflects the extent to which they have slack in their budget. Those expected to have most slack in their budget shrink their average inventory after costs rise, and those considered most likely to be constrained increase their average stock. This suggestive result appears inconsistent with budget constraints being the main driver of behavior. However, the analysis is too crude to warrant strong interpretations.

If having to cope with insufficient resources, as such, leads to adverse economic decisions, a self-reinforcing cycle of poverty may arise. While a number of important contributions have recently been made, evidence on the effect of financial resources on decision-making is, as it stands, mixed. The current study adds one piece to the puzzle, but cannot conclusively reveal the mechanisms at play. This is a promising area for future research to explore.

While the income from selling street papers will alone be insufficient for lifting a vendor out of poverty, the activity can be important through the legitimately earned economic independence it provides. Inner city crime rates, for instance, have been reduced according to the police in cities where street papers have been introduced (Swithinbank, 1997). Other forms of supported self-employment, promoted by governments around the globe in efforts to activate their long-term unemployed, may arguably have similar effects. My results further encourage these efforts, suggesting that those who have little are likely to efficiently employ their resources.

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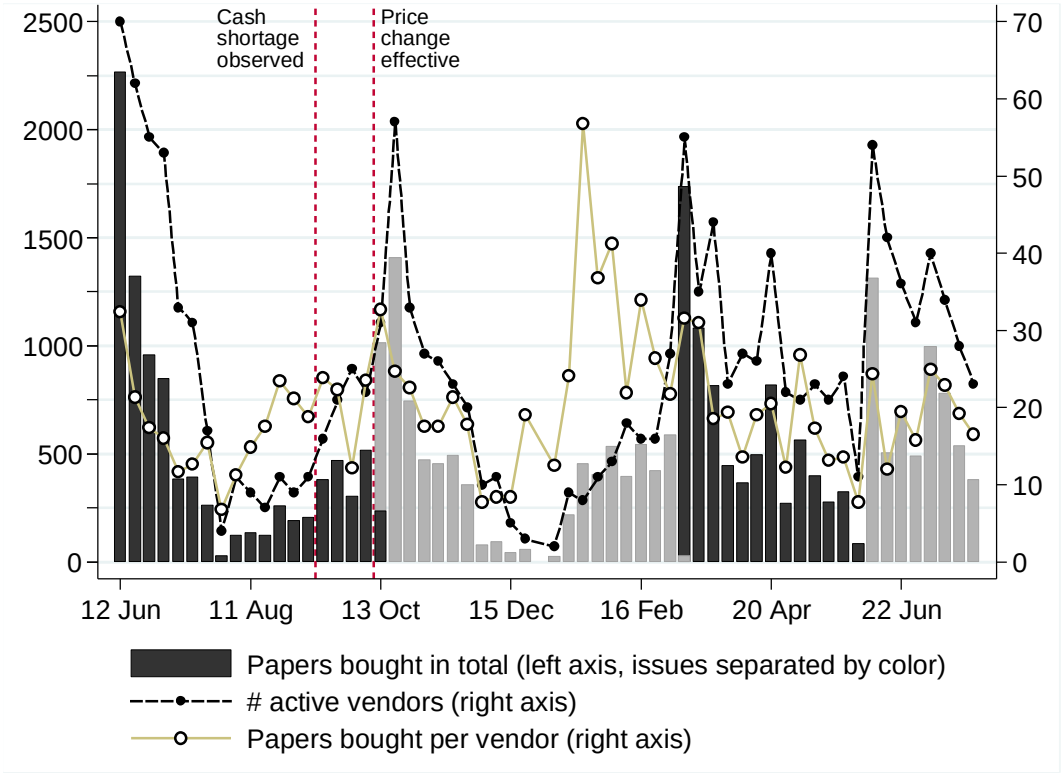

Figure 1. Weekly total and per-vendor purchases during the sample period

The figure depicts vendor activity by calendar week, starting Thursday June 12th 2014 and ending Tuesday July 28th 2015. The bars depict the combined purchases made by all vendors during a week, with values on the left axis. The color of the bars changes when a new issue comes out. If a new issue came out in the middle of a calendar week, that week's bar is split into two colors proportionally to the sales of the old and the new issue. The black dots describe the weekly number of vendors making at least one stock-up, with values on the right axis. The white dots describe the total number of papers bought divided by the number of active vendors, with values on the right axis.

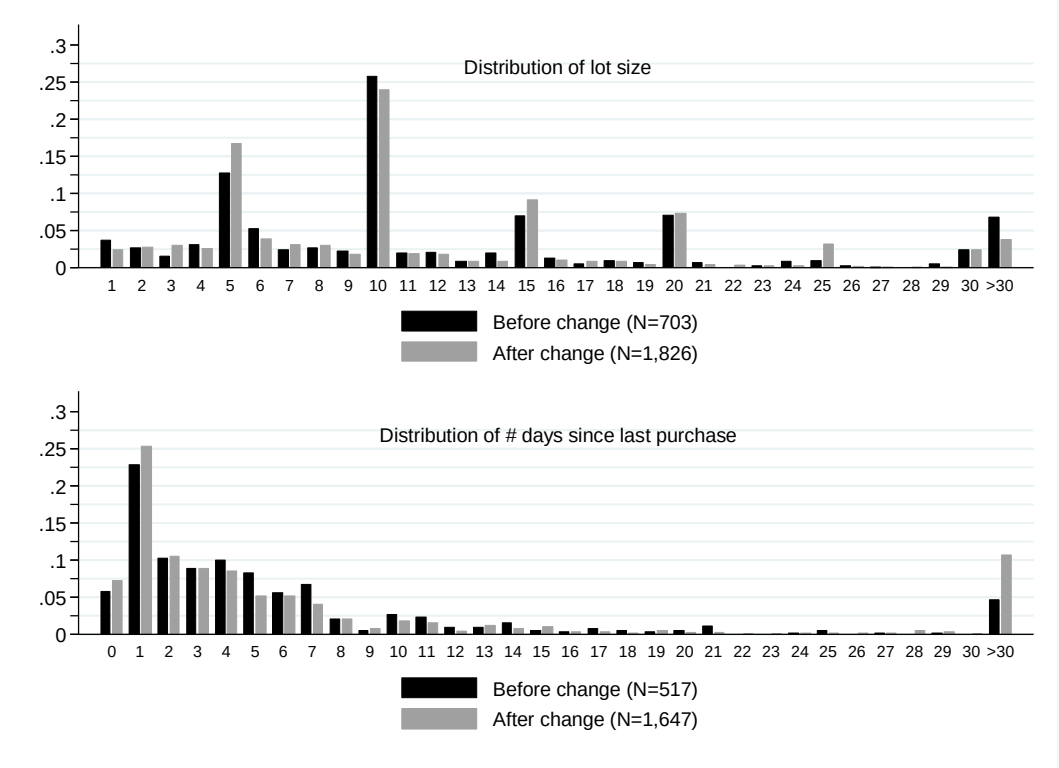

Figure 2. Distributions of lot size and stock-up interval before and after the price change

The top graph shows how often, proportionally, a given lot size occurred before and after the price change. Lot sizes of more than 30, as well as negative lot sizes (refunds), are excluded from the analysis. In the bottom graph, the variable of interest is changed to the interval between a vendor's consecutive stock-ups. Intervals of more than 30 days are excluded from the analysis.

Table 1. Summary statistics from vendor interviews

This table summarizes the information from vendor interviews conducted at the distribution site. The *Has worked*-dummy indicates whether a vendor has ever worked for salary. *Years worked* is the number of years worked for salary. *Bottles* is a dummy indicating if a vendor also collects bottles to earn money, *Other* includes income sources such as cleaning, snow clearing, and playing music on the street. *Mean daily income* includes daily income from the listed income sources on a typical day, as reported by the vendors. Similarly, *Mean daily consumption* reflects spending on consumption on a typical day. Under *Most important consideration* are vendors' responses to the following question: When stocking up, which of the following three factors is most important in limiting the number of papers you buy?

	Average	Min	Median	Max	St. dev.	N
Age	32.16	16	30	55	10.15	38
Female	0.32	0	0	1	0.47	38
Romanian	0.84	0	1	1	0.37	38
Schooling (years)	5.39	0	6.5	12	4.19	38
Has worked (dummy)	0.45	0	0	1	0.50	38
Years worked	11.43	1	8.5	34	9.36	14
Income sources besides paper:						
- Bottles	0.71	0	1	1	0.46	38
- Begging	0.29	0	0	1	0.46	38
- Other	0.13	0	0	1	0.34	38
Mean daily income						
- From paper	31.42	8	25	140	28.37	37
- From bottles	15.41	2	10	125	22.81	27
- From begging	13.05	5	15	20	5.85	11
- From other sources	75.00	20	50	175	59.79	5
Mean daily consumption	12.31	3.50	10	25	5.45	37
Most important consideration:						
- Money	0.24	0	0	1	0.44	37
- Storage capacity	0.08	0	0	1	0.28	37
- Expected demand	0.68	0	1	1	0.48	37

Table 2. Descriptive statistics

The table summarizes the information on stock-ups. *Lot size* $_{i,s}$ is the number of papers vendor *i* buys at stock-up *s*. *# days since last stock-up* $_{i,s}$ is the first difference of vendor *i*'s stock-up date. *Days 1-5* (*6-20*) [*20+*] are time periods since an issue's publication, indicating when a given stock-up was done. *# active vendors* $_t$ is the number of vendors who made a stock-up on day *t*. *Public transit* $_t$ is the number of people boarding a Metro train at the Helsinki Central railway station on day *t*. *Rain (mm)*$_t$ is the millimeter amount of rain, and *Temperature (°C)* $_t$ the average Celsius temperature on day *t*. *Herfindahl (adjusted)* is the weekly value of an adjusted Herfindahl index, whose higher value indicates that weekly total purchases are more equally distributed across vendors. *Stock-ups* (*Papers*) *per vendor* is the weekly total number of stock-ups made (papers bought) divided by the number of vendors stocking up at least once that week. *# active weeks* $_i$ is the number of calendar weeks on which vendor *i* made at least one stock-up. *Total # stock-ups* $_i$ is the number of stock-ups made by vendor *i* during the sample period. *Total # papers* $_i$ is the number of papers bought by vendor *i* during the sample period.

	Average	Min	Median	Max	St. dev.	N
Stock-up level statistics:						
Lot size $_{i,s}$	12.28	-20	10	195	11.07	2,559
# days since last stock-up $_{i,s}$	15.38	0	3	385	43.24	2,168
Days 1-5 (dummy)	0.19	0	0	1	0.40	2,559
Days 6-20 (dummy)	0.32	0	0	1	0.47	2,559
Days 20+ (dummy)	0.49	0	0	1	0.50	2,559
Daily statistics:						
# active vendors $_t$	9.59	1	8	56	7.19	247
Public transit $_t$	24,164	13,508	24,721	31,803	2,662	247
Rain (mm) $_t$	1.70	0.00	0.10	26.60	3.86	247
Temperature (°C) $_t$	8.63	-10.70	8.50	24.70	7.06	247
Weekly statistics:						
Herfindahl (adjusted)	42.01	1.00	45.16	50.15	9.54	59
Stock-ups per vendor	1.69	1.00	1.67	2.69	0.37	59
Papers per vendor	20.27	6.75	19.08	56.75	8.84	59
Vendor statistics:						
Female (dummy)	0.38	0	0	1	0.49	351
# active weeks $_i$	4.25	1	2	48	5.58	351
Total # stock-ups $_i$	7.17	1	2	94	12.04	351
Total # magazines $_i$	88.21	-6	25	1,509	174.90	351

Table 3. Determinants of lot size

The table presents results from OLS regressions where each vendor is individually followed from stock-up to stock-up. In the "Restricted" sample, only the vendors who were active both before and after the price change are included. The dependent variable, *Lot size* $_{i,s}$, is the number of papers vendor *i* buys at stock-up *s*. *# active vendors* $_t$ is the daily number of vendors who made a stock-up. *Herfindahl (adjusted)* is the weekly value of an adjusted Herfindahl index, whose higher value indicates that weekly total purchases are more equally distributed across vendors. The *Days 1-5*-dummy indicates if stock-up *s* was made during the first five days following an issue's publication. In the specifications labeled "Controls included", the following variables are included but not reported: *Public transit* $_t$ (the number of people boarding a Metro train at the Helsinki Central railway station on day *t*); calendar month dummies; daily millimeter amount of rain and average Celsius temperature; and vendor characteristics including gender, nationality, and the number of stock-ups made until the one analyzed. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively, and heteroscedasticity-corrected t-statistics are in parentheses below the coefficients.

Time period	Full			Pre-change		Post-change	
Full / Restricted sample	F	F	R	F	R	F	R
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Time since last stock-up $_{i,s}$							
- 0 days	-1.344**	-2.064***	-2.438**	-2.483	1.732	-2.250***	-3.281***
	(-2.05)	(-2.71)	(-2.31)	(-1.41)	(0.57)	(-2.70)	(-3.04)
- 1 day	2.539***	2.165***	2.916***	0.404	1.016	2.410***	3.069***
	(6.03)	(4.19)	(4.32)	(0.36)	(0.62)	(4.05)	(4.07)
# active vendors $_t$	0.154***	0.193***	0.249***	0.267***	0.486***	0.170***	0.214***
	(4.94)	(4.91)	(4.42)	(2.83)	(3.44)	(3.66)	(3.28)
Herfindahl (adjusted) $_t$	-0.178***	-0.152	-0.145	0.371**	0.383	-0.470***	-0.304*
	(-3.05)	(-1.47)	(-1.14)	(2.08)	(1.42)	(-3.39)	(-1.78)
Days 1-5 (dummy)	1.901***	2.159**	2.459*	-2.150	-2.656	2.772**	2.781*
	(3.00)	(2.21)	(1.86)	(-0.93)	(-0.69)	(2.34)	(1.80)
Constant	16.856***	6.686	1.577	-36.213**	-41.721**	12.298**	3.045
	(6.71)	(1.19)	(0.22)	(-2.57)	(-2.01)	(2.19)	(0.43)
Controls included	No	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.067	0.131	0.153	0.096	0.131	0.163	0.199
N	2,136	2,136	1,333	500	305	1,636	1,028

Table 4. Stock-up frequency issue by issue

The table presents results from OLS regressions. In the "Restricted" sample, only the vendors who were active both before and after the price change are included. The dependent variable in columns 1-4, *# days since last stock-up* $_{i,s}$, is the first difference of vendor *i*'s stock-up date. In columns 5 and 6, the dependent variable is the weekly total number of stock-ups, aggregated across vendors, divided by the number of different vendors making at least one stock-up that week. The *Issue*-dummies indicate during which issue a stock-up was made. *# active vendors* $_{s-1}$ is the number of vendors who made a stock-up on the day vendor *i* made her previous stock-up. *Lot size* $_{i, s-1}$ is the number of papers vendor *i* bought at her previous stock-up. *Weekly # papers bought per vendor* is the weekly total number of papers bought, aggregated across vendors, divided by the number of different vendors making at least one stock-up that week. The *Weather and public transit*-controls include the daily millimeter amount of rain, the daily average Celsius temperature, and the daily number of people boarding a Metro train at the Helsinki Central railway station (in thousands). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively, and heteroscedasticity-corrected t-statistics are in parentheses below the coefficients.

Dependent variable	# days since last stock-up $_{i,s}$				Total # stock-ups / # active vendors	
Data format	Panel (time unit *s* = stock-up # $_i$)				Weekly cross-section	
Full/Restricted sample	F	F	R	R	F	F
	(1)	(2)	(3)	(4)	(5)	(6)
Issue 2 (dummy)	-0.301	0.089	-0.983*	-0.905	0.351***	-0.162
	(-0.69)	(0.19)	(-1.79)	(-1.54)	(2.99)	(-0.58)
Issue 3 (dummy)	-0.493	-0.233	-1.101**	-1.045*	0.313***	-0.382
	(-1.09)	(-0.48)	(-1.98)	(-1.78)	(2.82)	(-1.53)
Issue 4 (dummy)	-0.520	-0.242	-1.384**	-1.331**	0.334***	-0.236
	(-1.20)	(-0.53)	(-2.53)	(-2.31)	(3.07)	(-0.73)
# active vendors $_{s-1}$		0.052**		0.010		
		(2.51)		(0.50)		
Lot size $_{i, s-1}$		-0.015		-0.004		
		(-1.17)		(-0.26)		
Weekly # papers bought						0.009
per vendor						(0.82)
x I.(Issue = 2)						0.022*
						(1.84)
x I.(Issue = 3)						0.039***
						(3.25)
x I.(Issue = 4)						0.025
						(1.66)
Constant	4.920***	3.975***	5.343***	5.164***	1.456***	1.181***
	(16.06)	(7.90)	(12.75)	(8.25)	(22.66)	(2.69)
Weather, public transit	No	No	No	No	No	Yes
R^2	0.001	0.008	0.009	0.009	0.189	0.753
N	1,371	1,371	809	809	59	59

Table 5. Pre-change lot size and response to price change in restricted sample

In the table, only vendors who bought papers both before and after the change are analyzed. These vendors are further divided into two groups: those whose average lot size before the price change was below median ("Small lots before change"), and those at or above median ("Large lots before change"). *Lot size* is the number of papers a vendor buys at a single stock-up. *# stock-ups per week* is the average number of stock-ups a vendor made on weeks when he stocked up at least once. *Papers per week* is the average total number of papers a vendor bought on weeks when he stocked up at least once. *# stock-ups in total* is the total number of stock-ups made by a vendor during the pre- and post-change periods. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively, based on a two-tailed t-test for differences in means.

Small lots before change (N = 43)							
	Median			Mean			
	Pre	Post	Diff.	Pre	Post	Diff.	t-stat
Lot size	8.37	10.00	1.63	7.83	10.70	2.87***	(2.72)
# stock-ups per week	1.00	1.29	0.29	1.28	1.46	0.18*	(1.68)
Papers per week	10.00	14.83	4.83	9.94	15.71	5.78***	(3.53)
# stock-ups in total	2.50	4.00		4.40	11.24		
Large lots before change (N = 42)							
	Median			Mean			
	Pre	Post	Diff.	Pre	Post	Diff.	t-stat
Lot size	18.80	12.33	-6.47	23.73	13.34	-10.39***	(-4.18)
# stock-ups per week	1.25	1.50	0.25	1.47	1.60	0.14	(1.11)
Papers per week	27.00	20.00	-7.00	32.80	22.11	-10.69***	(-2.93)
# stock-ups in total	3.50	7.00		4.71	11.90		
All (N = 85)							
	Median			Mean			
	Pre	Post	Diff.	Pre	Post	Diff.	t-stat
Lot size	12.00	10.67	-1.33	15.87	12.04	-3.84**	(2.38)
# visits per week	1.25	1.36	0.11	1.37	1.53	0.16*	(1.92)
Papers per week	15.67	16.00	0.33	21.50	18.95	-2.55	(-1.07)
# stock-ups in total	3.00	5.00		4.56	11.57		

Table 6. Who buys the paper and why?

The table presents a selective summary of responses to a web-based survey aimed at the readers of IN. Responses to the item "I find the reduction of poverty and inequality (1) not at all important; (2) …; (5) very important" are summarized in the variable *Importance of IN "mission"*. *Knows vendor's profit* indicates whether a respondent knows that vendors get 3€ for a paper sold. *Motivation for buying* indicates why a respondent says to buy the paper; one or more alternatives could be chosen, and in addition to the ones shown there was an open option. *Would like more issues* summarizes responses to a question asking whether IN should appear more often than the current three times per year. *Preferred price for future issues* shows whether a respondent reported finding the current 5€ price appropriate or wishing to pay more/less for the paper in the future. *Age*, *Master's degree*, and *Annual income* are as indicated by respondents, who were asked to place themselves in the appropriate bracket or bin.

	Fraction of respondents	N
Considers reduction of poverty and inequality "very important"	95.1 %	265
Knows vendor's profit	95.1 %	266
Motivation for buying:		
- Enjoy contents	70.1 %	261
- To support vendors	96.9 %	261
Would like more issues per year	67.3 %	260
Preferred price for future issues:		
- Higher	6.1 %	263
- Same	90.9 %	263
- Lower	3.0 %	263
Female	79.5 %	239
Age:		
- Under 30	15.1 %	238
- 30-39	30.3 %	238
- 40-49	24.4 %	238
- 50-59	11.8 %	238
- Over 60	18.5 %	238
Master's degree	48.7 %	238
Annual income in euro:		
- Less than 15,000	17.2 %	239
- 15,000 - 25,000	12.1 %	239
- 25,000 - 50,000	29.7 %	239
- 50,000 - 75,000	18.0 %	239
- 75,000 - 100,000	7.5 %	239
- More than 100,000	5.0 %	239