Renewable dismissal barriers, job security, and long-term investment: An experimental analysis

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Abstract

This article considers three different types of experimental labor contracts. We propose a new type of contract (automatic renewal) in which workers are re-hired if they satisfied the effort level required by the firm. A novel aspect of our experimental design is that workers have the chance of investing money in a long-term project in order to increase their profits. We find that renewable dismissal barriers in the labor market lead to more long-term employment relationships and higher overall productivity. These long-term relationships provide a safer environment for undertaking successful long-term projects. In sum, we find a strong relationship between what happens inside the labor market (worker's performance) and what happens outside the labor market (long-term investment).

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1. Introduction

Attaining a strong degree of stability in employment has been one of the historical main aspirations of the working population. Indeed, one of the main goals of trade unions is to achieve some kind of employment protection legislation (EPL) that introduces dismissal barriers in the labor market.[1] However, from the employer's perspective, insurmountable dismissal barriers may lead to a lack of incentives for high productivity; a familiar example is the behavior of many academics after being awarded tenure. In fact, even if a worker has the intrinsic motivation to work hard, this may be undermined by peer pressure, as other workers may be unhappy with workers who provide too much effort without incentives. This leads to the question of whether there is an optimal level or form of dismissal barrier.

There is an inter-relationship between many situations *inside* the labor market and decisions made *outside* the labor market. For instance, McDonald (2000), Adsera (2004), De la Rica and Iza (2005), Blossfeld et al. (2005) and Hondroyiannis (2010) show how the economic uncertainty inside the labor market has a significant negative impact on fertility decisions since responsible parents have children only when they are able to financially support a family. Haurin and Gill (1987), Haurin (1991), Robst et al. (1999) and Diaz-Serrano (2005) also find an unequivocal negative effect of labor-income uncertainty on the propensity to own one's own home. The economic intuition behind this evidence is that for decisions outside the labor market such as buying a house or having children, individuals take into account both their present and their projected future job situation.

In this sense, the contribution of this paper is twofold. First, this article considers experimentally both how labor market uncertainty affects decisions outside the labor market and

[1] Dismissal barriers arise, for example, in the presence of employment protection legislation (EPL), where hiring a worker beyond approbation period triggers barriers to dismissal, or in the case of relationship-specific investments that accrue over time and raise firing costs (see Mincer, 1962).

vice versa (i.e., how decisions outside the labor market influence behavior in the labor market). Second, we propose an alternative type of dismissal barrier that could satisfy workers' demand of stability without discouraging those workers to provide a high effort level once they have attained a permanent position. Our work is applicable both to many European labor markets and to public-sector employment in most developed countries.

Our baseline experimental framework is similar to that of Brown, Falk, and Fehr (2004), in which firms and workers in a labor-market setting can endogenously form long-term relationships. Firms offer contracts involving a wage and a desired effort, and workers, after accepting a contract, choose any feasible effort irrespective of the level contractually agreed upon. With the aim of investigating the interrelationship between decisions inside and outside the labor market, we introduce an additional stage (outside of the labor market) labeled *the investment stage*. For simplicity, in this stage workers decide only whether or not to undertake a *long-term project*. If a worker chooses to do so in a given period, he must pay a fixed periodical amount from then on. This project will end only when he cannot afford this fixed amount (either he becomes unemployed or his salary does not allow him to pay the fixed amount). To capture the importance of the job stability on the subjects' decisions of undertaking long-term projects, we make the profitability of the project depend crucially on the job situation. Only if subjects become employed at least eight consecutive periods does the project yield positive profits.

To analyze how the features of the labor market affect the investment decisions, we consider three different treatments. In the *baseline* treatment, there is no dismissal barrier. Firms can always end a labor relationship after any period. In the *permanent* treatment, adapted from Falk, Huffman and MacLeod (forthcoming), there is a dismissal institution present in the market, such that only the worker can end a relationship once the firm chooses to hire the worker

in two consecutive periods. In addition, once workers are protected against dismissal, firms cannot reduce their wages.[2] We also introduce a novel intermediate treatment in which the worker's performance is rewarded with the automatic renewal of his contract, *contingent upon satisfactory performance*.[3] A worker must be re-hired if he provides an effort level equal or higher than the effort demanded by the firm. In this case, the worker earns the right to get an offer in the next period from the same firm with at least the same wage.[4] This permits job security while retaining incentives.

Thus, our design allows us to analyze how some crucial decisions that people must make outside of the labor market (to undertake or not a long-term project) affect labor-market behavior (workers' performance and hiring strategies of firms) and vice versa. We also examine how the inter-relationship between decisions made outside and inside the labor market changes with respect to the presence and form of dismissal barriers. One important result is that those workers engaged in a long-term project provided higher effort levels controlling for some relevant variables such as wages. In order to check the robustness of this result, we replicate the three treatments removing the investment stage. This leads to a second key result: workers provided higher effort levels when they had the option of investing in a long-term project. That is, when workers had this option, they perceived additional incentives to enhance their performance.

Regarding the effect of the dismissal barriers on investment decisions, we find that they make subjects more reluctant to undertake an investment project. Dismissal barriers appear to act as a reference point for workers, in the sense that most seem to wait to be protected against

[2] This feature is implemented to rule out de facto dismissal by reducing wages to zero.
[3] Previous experimental literature has found that rewarding performance is an effective incentive device to increase efficiency (see, among others, Fehr, Gächter, and Kirchsteiger, 1997, and Fehr, Klein, and Schmidt, 2007).
[4] Examples for automatically renewable contracts can be found in sports; in many cases contracts are automatically renewed if the sportsman plays a previously fixed number of matches.

dismissal before investing. This ocurrs primarily in the *automatic* treatment. Indeed, workers in that labor market had considerably more successful investments.

Regarding the effect of the dismissal barriers on the labor market, a third main result is that firms perceived *permanent* dismissal barriers, where only workers can terminate the relationship, to be more risky than *renewable* ones, where the relationship terminates when workers do not satisfy the desired effort demanded by firms. This leads to a lower number of one-shot interactions and a larger number of long relationships (a firm and a worker engage in a private contract for at least 2 consecutive periods) in the *renewable* than in the *permanent* treatment. This is true with or without the possibility of investment.

In addition, given the clause in the *renewable* treatment that ensured workers that they would be rehired whenever they provided the effort level demanded by firms, we find that the distance between the desired and the actual effort was significantly smaller than in the *baseline* treatment. In fact, workers were willing to match the effort level demanded much more frequently in the *renewable* treatment. Moreover, half of the time workers provided the highest effort level. Overall, we find that the presence of renewable dismissal barriers increase firms' profits and does not decrease workers' earnings, thus leading to more efficient outcomes.

In summary, we find that the presence of dismissal barriers inside the labor market provide a safer institutional setting to undertake long-term projects more successfully outside of the labor market. In the opposite direction, we find that the possibility of undertaking long-term projects outside the labor market positively affects workers' performance inside the labor market. This holds for both permanent dismissal barriers as well as renewable ones. However, since firms are not protected against workers shirking with permanent dismissal barriers after being awarded 'tenure', they are reluctant to get involved in long-term relationships. In fact, if

we include investment profits in the aggregate earnings for workers, we see that renewable dismissal barriers yield a Pareto improvement for firms and workers over any other institution.

The remainder of the paper is organized as follows. We describe the experimental design and procedures in Section 2. We discuss some behavioral predictions in Section 3. The main results are reported in Section 4 and we conclude in Section 5.

2. Experimental design

We know of only a few experimental studies on repeated interactions in the labor market; none of these considers conditional dismissal barriers or how the presence of dismissal barriers affects the decision of undertaking long-term projects.[5] We adapt the designs from Brown, Falk, and Fehr (2004 and Falk, Huffman and MacLeod (forthcoming) for our treatments without dismissal barriers and permanent dismissal barriers, respectively, and introduce our new contractual environment with renewable dismissal barriers.

Our experiment was conducted at the University of Granada with 323 participants, who were recruited via posters in the Faculty of Economics. All sessions were run in the lab, using Z-Tree software (Fischbacher, 2007). No one was allowed to participate in more than one session. At the end of the instructions (see Appendix B), all subjects had to complete a questionnaire in order to be sure that everybody understood the experiment. There were 18 periods in each session of each treatment. On average, each person received about 20€ for a 90-minute session.[6]

[5] Brown, Falk and Fehr (2004) study how long-term relationships between trading parties can emerge endogenously in the absence of third party enforcement of contracts. Brown, Falk and Fehr (2010) examine how the emergence of relational contracts changes in a market with excess demand for labor. Falk, Huffman and MacLeod (forthcoming) focus on how permanent dismissal barriers affect contract enforcement, and on how the impact of these dismissal barriers depends on other institutional features, such as availability of bonus pay. Altmann, Falk, Grunewald and Huffman (forthcoming) give evidence of how involuntary unemployment and segmentation of labor markets may appear as a consequence of contractual incompleteness.

[6] In our experiment, we chose to have stated effort rather than real effort (e.g., stuffing envelopes or solving mazes). There is a view in some circles that stated effort is not representative of the field environment, since there is no true

We have three different types of labor contract: No Barrier, Permanent Barrier, and Renewable Barrier. A principal feature of our design is the possibility of making an external investment. In order to check robustness and obtain clear conclusions about the relationship between decisions in the labor market and in the long-term investment projects, we also conducted a treatment for each type of labor contract without the possibility of investment. Thus, we have six treatments in all.

No-barrier treatment (NT1): This treatment is adapted from Brown, Falk and Fehr (2004). There were two phases in each individual period. In the first phase firms had the opportunity to submit private and public offers. Public offers stipulated a wage, a desired effort and the firm's identification number (ID). All workers and firms could see public offers. For private offers, firms had to additionally provide a worker's ID number. Only the worker to whom the ID number belonged could see private offers. Firms could make as many private and public offers as they wanted during the market phase that lasted 150 seconds. Firms and workers could reach at maximum one trade agreement per period. Thus, if a worker accepted a firm's offer, all remaining offers submitted by that firm were immediately removed from the market. Also firms were kept constantly informed about which workers (the ID) had already accepted a contract, so as to avoid firms making a private offer to a worker that was no longer available.

If a firm and a worker agreed on a contract, they entered a second phase in which the worker chose how much effort to provide. As desired efforts were not binding, workers only

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labor involved. However, there are reasons to utilize stated effort. For one, it is possible to control the cost or disutility of effort by using stated effort. Charness and Kuhn (2011) provide a more in-depth discussion of the issue or stated and real effort. There is little experimental evidence regarding differences in behavior with these different approaches; in fact, we are only aware of one such study. Charness, Cobo-Reyes, Lacomba, Lagos, and Perez (2012) find no qualitative difference in worker behavior across stated effort and real effort. We chose stated effort for both the convenience and the feasibility of controlling the cost of effort. While we cannot claim with certainty that the results with real effort would differ qualitatively, we see no reason to believe this would be the case.

observed firm's desired efforts but chose whichever effort level they preferred. The NT2 treatment is the same except that there was only the first phase.

Repeated transactions with the same trading partner were possible because subjects had fixed identification numbers (ID) and contract offers could be addressed to specific ID numbers.[7] Therefore, a firm could make offers to the same worker in consecutive periods and, if the worker accepted the offers, a long-term relationship was established. There was a third phase in each period, where the workers had the possibility of making an investment (described below).

Permanent-barrier treatment (PT1): This treatment is adapted from Falk, Huffman and MacLeod (forthcoming). The only difference with respect to NT1 is that in this treatment a firm was compelled to offer a contract to a specific worker (private contract) providing that this worker had accepted a *private* offer from that firm in *two consecutive periods*; one might consider this to be a probationary period.[8] In this case, only the worker could end the relationship. In the contract offered to the worker, the wage had to be at least as large as the wage offered in the last private offer. Whenever the worker did not accept the private firm's offer, the firm's obligation to offer a contract to this worker ceased.

Renewable-barrier Treatment (RT1): The only difference from PT1 is that under the automatic renewal procedure, a firm only had the obligation to offer a contract to a specific worker whenever this worker made an effort *higher or equal to the desired effort* requested by the firm in a *private contract* of the previous period. That is, if in period t, the firm made a private offer to one specific worker, and the worker's actual effort is at least as firm's desired

[7] People were given a sheet with a summary table in which they could record all information of each trading period (wage, desired and actual effort, contract type, trading partner's ID, own profits, and partner's profits).
[8] In other words, if a worker accepted a private offer from a firm in period t, and then accepted a second private offer by the same firm in period $t+1$, the dismissal barrier took effect from period $t+2$ on.

effort, then the firm was compelled to offer a private contract to this worker in period $t+1$. In the private contract offered to the worker the wage had to be at least as large as the wage offered in the last private offer but here the firm could change the desired effort.[9]

The investment stage

This is a primary feature of our design. As we mentioned earlier, labor-market uncertainties highly influence subjects' decision regarding buying a house (close to our design) or having children. This stage in an attempt to analyze how the type of labor market institution may affect those important decisions out of the labor market. In this stage, workers were the only participants. After obtaining their profits in the labor market, they faced an investment decision. Firms knew the existence of the investment stage but did not know which workers had invested. Workers chose whether to invest a certain fixed amount of their profits (10 points) in a project. In order to obtain positive revenues from the investment project, workers needed to *invest for at least eight consecutive periods*. Hence, workers could only initiate an investment project before period 12.[10] Once a worker had initiated an investment project, this could result in negative revenues if the worker was unable to pay the required 10 points, either due to unemployment or low earnings in at least one of the seven subsequent periods.[11] Workers had the opportunity of investing again in a new project if their previous investments had finished.

[9] With this constraint workers may obtain at least the same "labor conditions" whenever they provide the effort desired by their employers.
[10] After period 11, the number of consecutive periods the worker could invest is less than 8, so that any investment would be lost.
[11] For simplicity subjects were not allowed to save points for future periods. Thus, they are only allowed to invest 10 points from their profits in the current period.

The no-investment treatments

In order to check robustness and obtain clear conclusions about the relationship between decisions in the labor market and in the long-term investment projects, we also conducted three treatments one for each primary treatment, in which there was no possibility of investment. These treatments are labeled NT2, PT2, and RT2.

We summarize our treatments in Table 1:

Table 1. Treatments, sessions and subjects

Treatments	*Sessions*	*Participants*
NT1	4	68
RT1	4	68
PT1	5	85
NT2	2	34
RT2	2	34
PT2	2	34
Total	19	323

Parameters, Information and Payoff functions

All market sessions had 7 firms and 10 workers, to simulate conditions in which unemployment is present. The material payoffs for the firm, π_F , and for the worker, π_W, were given respectively by the functions:

$$\pi_F = \begin{cases} 10e - w & \text{if a contract offer was accepted} \\ 0 & \text{if no contract offer was accepted} \end{cases}$$

$$\pi_W = \begin{cases} w - c(e) & \text{if a contract offer was accepted} \\ 5 & \text{if no contract offer was accepted} \end{cases}$$

where e is the effort level provided by the worker, w is the wage offered by the firm, $c(e)$ represents the cost of effort function, and 5 was the unemployment profit in the case that a worker did not engage in a relationship. The desired effort level and the actual effort level chosen by the worker could take on integer values between 1 and 10. The rank for the wage was [1,100]. The effort cost function is shown in Table 2.[12]

Table 2. Effort levels and costs of effort

Effort *e*	1	2	3	4	5	6	7	8	9	10
Cost *c(e)*	0	1	2	4	6	8	10	12	15	18

Denote by t_{invest} the number of consecutive periods in which a worker invests. Then, the workers' payoff function from the investment stage, π_{invest}, is:

$$\pi_{invest} = \begin{cases} t_{invest} * (15 - 10) & \text{if } t_{invest} \geq 8 \\ -t_{invest} * 10 & \text{if } t_{invest} < 8 \end{cases}$$

Payoff functions for workers and firms, including the effort cost function, were common information. Participants were aware that the market would last 18 periods. It was feasible to form bi-lateral reputations, since firms learned about the effort choices of workers with whom they traded, but did not observe effort choices in interactions in which they were not a part.[13]

3. Behavioral Predictions

3.1 No-investment treatments

We start with the benchmark setting when the investment stage is not present. When standard preferences are common knowledge, the equilibrium with standard preferences is that

[12] Note that the cost function is increasing and convex.
[13] Firms received information at the end of the period about worker's ID and effort.

workers provide the minimum effort and firms offer the minimum wage that just compensates workers for the exit option in all periods (following backward-induction arguments) and in all three types of contract.

In the NT2 treatment, if firms believe that there is a sufficient proportion of "fair" workers (reciprocators in the Rabin, 1993 sense), there is also an equilibrium in which firms offer wages above the exit option, workers provide non-minimal effort (except in the last round) and long-term relationships are formed via private contracts.[14] The intuition for this result is that the possibility of future rents in the form of higher wages disciplines selfish workers to provide non-minimal effort levels until the penultimate period. Brown, Falk and Fehr (2004) and Falk, Huffman and McLeod (forthcoming) find empirical support for this equilibrium, which is also present in our experiment, although with a lower frequency. Perhaps firms in our study believe that the proportion of fair workers is lower than what firms believe in the other two studies.

In the PT2 treatment, Falk, Huffman and McLeod (forthcoming) find a negative effect once dismissal barriers are activated, since selfish workers assure themselves future rents and have no further motives to provide non-minimal effort levels. Thus, they find a decrease in effort levels in long-term relations (in relation to NT2). As a result, they find that firms are reluctant to enter long-term relationships. Our prediction is therefore that there will be fewer long-term relationships in this treatment. In fact, we replicate this result controlling for the wage effect.

We have two main predictions for the RT2 treatment. First, effort levels will be higher than in the other two types of contracts. In the early periods workers wish to signal that they are "fair" workers and worth retaining with a private contract in the next period. They will then

[14] See Brown, Falk, and Fehr (2004) for details. Fair workers respond with an increase in effort levels to high wages and with a decrease to low ones.

match the desired effort by the firms in order to be rehired in the next period.[15] The key difference with respect to PT2 is that now firms have a device to prevent workers from shirking. As a consequence, our second prediction is that there will be a larger number of long-term relationships since firms will be considerably less reluctant to form long-term relationships.

3.2 Investment treatments

We first analyze the workers' investment choices since these are made in the last stage of the game. We then consider how the existence of this stage might affect labor-market equilibria.

Workers should only invest if they believe that they will be employed for at least eight consecutive periods. In NT1, workers have no assurances that good performance with lead to clearing this hurdle, although firms may indeed choose to retain a worker in a private contract if the results have been good. In PT1, once a worker has accepted a private offer from a firm in two consecutive periods, she is assured of a permanent position and so is more likely to invest.

In RT1, workers still have control over their own destiny, but must continue to perform to a desired standard even after having received two consecutive private contracts from a firm. So we should expect investment after a worker has received a private contract.[16] On the other hand, private contracts are likely to be more common in RT1 than in PT1, tending to make investment more likely with RT1. So the prediction vis-à-vis the investment level in PT1 is unclear, although one might expect sensible firms to offer a wage that is sufficient to keep a performing worker from leaving. On this basis, we predict that the expected higher frequency of private contracts in RT1 will generate higher investment.

[15] Note that in the RT2 firms can increase the desired effort as high as they want and that workers will be rehired only if they match this desired effort.

[16] A caveat is that a worker could be concerned that the private contract offered down the road will involve high effort and a wage/desired effort combination that provides a net earning less than the 10 units needed to maintain the investment. But this was rare (three of 243 times).

How will the presence of the investment stage affect the labor market? Workers who invest (and the potential profits are attractive) will try to secure employment over at least eight consecutive periods. Firms should realize that workers who invest are likely to provide higher effort in the interest of keeping their jobs and thus avoiding losses from their investments. Thus, we predict a larger frequency of non-minimal effort levels and long-term relationships in the contracts when the investment stage is present than when there is no possibility of investment.

4. Results

We first consider how different dismissal barriers affect effort levels, wages, earnings, and the type and length of the labor relationships. We then consider how these metrics change with the possibility of making investments. Throughout this section, our nonparametric statistics reflect Mann-Whitney one-tailed tests unless stated otherwise. Table 3 presents the summary statistics for our six treatments.

[Table 3 here]

4.1. Treatments with possible investment

We first consider the effort level provided across treatments. The average effort level is significantly higher in RT1 than in NT1 and PT1 ($Z = 2.417$ and 2.493, respectively, both significant at $p = 0.008$); there is almost no difference across NT1 and PT1. Indeed, workers facing renewable dismissal barriers should provide an effort level that matches companies' desired effort to ensure being rehired in the next period. This leads to higher effort levels. In fact, we find that the distance between the desired and the actual effort is significantly smaller

than in the other two treatments.[17] Moreover, workers are willing to match the effort level demanded much more frequently in this treatment. We observe that in 80.6 percent of private contracts in RT1, workers provide an effort level at least as high as the effort desired by firms. This is significantly higher than the 42.3 percent in NT1 and 45.0 percent in PT1 (Z = -4.224 and 4.088, respectively, $p = 0.000$ for both); there is no significant difference (Z = 0.007, two-tailed test) between the rates in NT1 and PT1.

If firms (reasonably) anticipate that the presence of *renewable* dismissal barriers makes it likely that workers will provide the desired effort level, firms should request a higher effort level than in NT1. Results in Table 3 confirm this conjecture.[18] Indeed, results show that firms demanded the maximum effort level in private contracts almost half of the time (175 out 352), compared to less than one-third of the time (91 out of 288) in NT1 (Z =-2.761, $p = 0.003$). In addition, when firms demanded the maximum effort level (10) in private offers, workers provided it on average 67.72% of the time in RT1, while the maximum effort level was provided 22.24% of the time in NT1 ($Z = 3.163$, $p = 0.008$).[19]

[Table 3 here]

The dynamic generated by the renewable dismissal barriers (i.e., firms requesting a higher effort level and workers providing an effort level closer to what is desired) explains why effort levels are larger in RT1 than in NT1 and PT1.[20] The differences between average effort

[17] In RT1 the average gap between desired and actual effort is 1.32, while in NT1 it is 2.14. This difference is statistically significant ($Z = -2.582$, $p = 0.005$). The difference in the average gap between RT1 and PT1 is also significant ($Z = 2.642$, $p = 0.004$).

[18] Results in Table 3 show that desired effort levels (8.52 and 7.82 for RT1 and NT1, respectively) are significantly higher in RT1 than in NT1 ($Z = 2.041$, $p = 0.021$, individual-level data).

[19] For this analysis of worker's behavior in private offers, we only focus on the comparison between RT1 and NT1. We exclude PT1 since workers could have two different motivations when they receive a private offer. If workers have not reached a permanent position they could have incentives to match the effort level demanded by the company. However, once they achieve the permanent position this incentive could disappear. This fact could distort the comparison with RT1 and NT1.

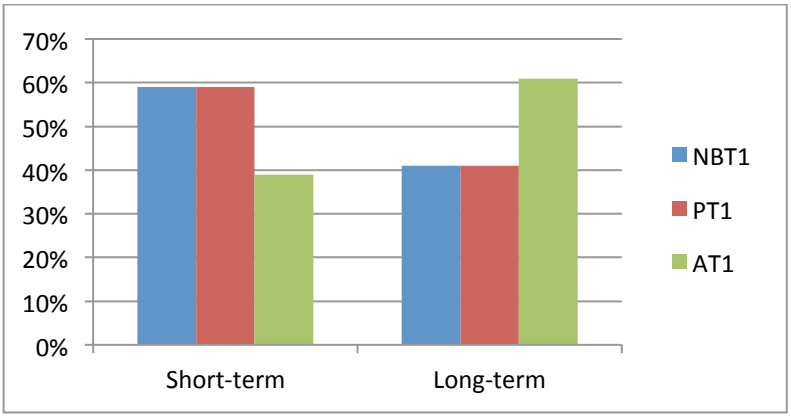
[20] Table A1 in Appendix A shows that the effort levels are larger in RT1 than in NT1, even controlling for the wage.

levels are also significant using conservative session-level data. Conservative tests using also give significant differences.[21]

Result 1: *The presence of renewable dismissal barriers generates higher effort levels than in the other conditions. Firms request higher effort levels and workers reduce the gap between desired and actual effort.*

Although Table 3 shows that the average effort levels in PT1 and NT1 are very similar in long-term relationships (6.92 and 7.58, respectively, with $Z = 0.192$, $p = 0.848$, two-tailed test),[22] this is not the case when we control for the wage. The average effort level provided per wage unit is 0.16 in NT1 and 0.12 in PT1. This difference is quite statistically significant ($Z = 2.690$, $p = 0.004$). Hence, introducing *permanent* dismissal barriers has a negative incentive effect on workers' performance. As an example, in NT1 workers provided the lowest effort level only 2% of the time, this percentage rises to 20% with permanent dismissal barriers.

Figure 1: Frequency of long-term relationships



Note: We consider a long-term relationship to be when a firm and a worker engage in a private contract for at least 2 consecutive periods.

[21] Comparing RT1 and PT1 gives $Z = 1.715$, $p = 0.043$; comparing RT1 and NT1 gives $Z = 2.309$, $p = 0.011$.
[22] This result is also supported at a session level (6.69 versus 6.73, with $Z = 0.735$, $p = 0.462$, two-tailed test).

A consequence of this result is that dismissal barriers are less risky for firms in the RT1 treatment than in the PT1 treatment. Hence, introducing *renewable* dismissal barriers should change the distribution of the duration of relationships. Figure 1 shows the length of the relationships grouped into long-term relationships (in which a firm and a worker engage in a private contract for two periods or more) and short-term relationships.[23] The most relevant issue comparing PT1 and RT1 is that 41% of the trades in PT1 were in long-term relationships compared to 68% in RT1. Pairwise statistical tests find that the rate in RT1 is significantly different than the rates in NT1 and PT1 (respectively, $Z = 2.654$, $p = 0.004$ and $Z = -3.670$, $p = 0.000$). There is no difference between the rates in NT1 and PT1.

Result 2: *Renewable dismissal barriers are triggered more frequently and as a consequence the distribution of the relationship length changes. The automatic-renewability clause generates a larger number of long relationships than contracts in the other conditions.*

Overall wages are significantly higher in RT1 than in NT1 ($Z = 2.081$, $p = 0.019$) but only insignificantly higher than in PT1 ($Z = 0.533$, $p = 0.297$, two-tailed test). However, the differences across treatments are modest when we separately consider wages in long-term and short-term relationships; in fact, wages are higher in both environments in PT1 than in RT1. Thus, the higher overall wage in RT1 is the result of the much higher proportion of long-term relationships in RT1.

Regarding earnings, renewable dismissal barriers do not substantially affect worker earnings with respect to the other two treatments. Although workers' earnings are larger in PT1 than in RT1 and larger in RT1 than in NT1, these differences are not significant ($Z = -0.966$ and -0.510 for the respective comparisons between RT1 and PT1 and between RT1 and NT1). However, firms earn considerably more (more than twice as much as in NT1 and more than 50

[23] We take this classification from Brown, Falk and Fehr (2004) and Falk, Huffman and McLeod (forthcoming).

percent more than in PT1) with renewable dismissal barriers, since effort is appreciably higher (due to the higher proportion of long-term relationships in RT1). These differences are quite significant ($Z = 3.652$, $p = 0.000$ and $Z = 2.704$, $p = 0.004$ for the respective comparisons).[24]

If we consider social efficiency (total profits) without the investment stage, results show that automatic dismissal barriers lead to a substantially better outcome than in the other contractual environments. The differences between NT1 and RT1 and between RT1 and PT1 are statistically significant ($Z = 2.383$, $p = 0.017$ and $Z = 2.501$, $p = 0.012$, respectively).

Result 3: *The presence of renewable dismissal barriers does not greatly affect workers' earnings but it does greatly increase firms' profits and total earnings.*

In order to examine in more depth the determinants of effort, we use a GLS random effects model in which the dependent variable is the effort level provided by the worker. Table 4 presents the results of different specifications in the three treatments.

[Table 4 here]

We see that *Private* has a positive and significant effect on effort in all treatments. However, specification (6) shows that once workers are protected against dismissals in PT1, they significantly reduce effort. This suggests that the positive effect of *Private* comes mainly from the first private offer received by the worker (note the much smaller coefficient in specification (5) than in the comparable specifications for NT1 and RT1). On the other hand, *Protected contract* has a positive and significant effect on effort in RT1. So a dismissal barrier contingent on effort levels is an effective device for improving workers' performance. In addition, *Desired effort* has a highly-significant positive effect on effort levels. As in a multitude of previous

[24] Firm profits are not significantly lower in PT1 than in NT1 ($Z = 0.595$, $p = 0.552$, two-tailed test) primarily because the effort level in short-term relationships is substantially higher in PT1. It seems that workers were hoping to get into long-term relationships and so contributed higher effort in this environment.

studies (e.g., Fehr, Kirchsteiger and Riedl, 1993; Brown, Falk and Fehr, 2004; Charness *et al.*, 2012) wages have a positive and significant effect on effort.

Cumulative unemployment has a negative effect on effort, which is significant in RT1 and PT1 but not in NT1. We speculate that a worker who is unemployed for many periods behaves myopically, compensating for low past earnings by reducing her effort level when hired. *Cumulative profit* has a positive and significant effect on the effort level provided by the worker. This suggests that workers improve their performance when they receive high earnings.

4.2. Treatments without possible investment

In order to check whether the main results still hold when there is no long-term project in which to invest, we replicate the three previous treatments removing the investment stage. As before, the existence of renewable dismissal barriers leads to more long-term relationships.[25] Similarly, the presence of renewable dismissal barriers also leads firms to request higher effort levels and workers to reduce the gap between the desired and actual effort, thus providing higher effort levels. Effort levels in RT2 are significantly larger than in NT2 (Z = 2.800, p = 0.003). Desired effort levels in RT2 are significantly larger than in NT2 (Z = 2.781, p = 0.003).[26]

An intriguing result is that there is a considerable decrease of overall effort levels relative to the treatments where investment was possible. Nevertheless, if we disaggregate overall effort into effort in long- and short-term relationships, no difference is significant across treatments with the same type of contract.[27] Thus, the differences in average effort levels are due to the fact that the existence of the investment stage changes the number of long-term relationships

[25] Differences are statistically significant (Z = -3.154, p = 0.008, abd Z = 2.629, p = 0.005) for the comparisons between NT2 and RT2 and between RT2 and PT2, respectively.
[26] Moreover, differences between the desired and the effort level provided by the worker are significantly lower in RT2 than in NT2 (Z = 2.229, p = 0.013).
[27] Z = 1.131, p = 0.258; Z = 0.630, p = 0.529; Z = 0.978, p = 0.328, two-tailed tests, for the comparisons between NT1 and NT2, PT1 and PT2, and RT1 and RT2, respectively.

particularly in the NT and PT treatments (9%, 20% and 55% versus 41%, 41% and 68% in the NT, PT and RT, respectively).[28,29]

Having the possibility of investing outside the labor market provides additional incentives for workers to increase their effort levels. Choosing a high effort level increases the probability of generating longer relationships, increasing the chances of successful investment. In addition, having the investment stage as a potential second source of income gives workers room to be more generous towards firms. Table 3 shows that, as in treatments with the investment stage, the presence of renewable dismissal barriers does not decrease workers' earnings, but does increase firms' profits. In fact, while in NT2 and PT2 firms' profits are negative, in RT2 these profits are quite positive (even higher than in NT1 and PT1). It seems that giving a worker a share in the future yields dividends for the firm, while the worker earns roughly the same amount as in our main treatments (although additional investment earnings are possible as we shall see next).

Result 4: *The presence of the investment stage leads workers to provide higher effort levels. As a consequence, the distribution of the relationship length changes, generating a lower number of short-term relationships and a larger number of long relationships respect to the cases in which the investment stage is absent.*

4.3 Investment decisions

Our experimental design allows workers to make decisions outside the labor market, specifically to undertake long-term projects. Since the success of these projects crucially depends on keeping a job for at least eight consecutive periods, we group the labor relationships for the three different institutions into two categories: Relationships of one to seven periods and

[28] $Z = 3.364$, $p = 0.000$; $Z = 2.206$, $p = 0.014$; $Z = 0.161$, $p = 0.873$ (two-tailed), for the comparisons between NT1 and NT2, PT1 and PT2, and RT1 and RT2, respectively.

[29] Note that our effort levels with long-term relationships are quite similar to those found in the previous papers (without renewable dismissal barriers), but that our proportion of long-term relationships is much lower. It is possible that this reflects differences in subject pools across regions. In any case, we are confident that replications of our design in Spain would yield similar results.

relationships of eight periods or more. The labor institution that generates the largest percentage of long-lasting relationships is the renewable dismissal barrier, yielding 56 percent versus 34 percent in PT1 and 19 percent in NBT1.[30]

Table 5 shows the total number of investments initiated and the likelihood of success (positive earnings) of these investments as well as the average profit from investment.

Table 5. Investments, success rates, and profits

Category	NT1	PT1	RT1
Investments initiated (% success)	41 (29%)	37 (38%)	25 (68%)
Investments initiated with public contract (% success)	19 (21%)	18 (11%)	6 (17%)
Investments initiated with private contract (% success)	22 (36%)	19 (63%)	19 (84%)
Investments initiated with protection (% success)	--	9 (100%)	18 (83%)
Average workers' profits from investment	1.33	16.25	43.86

Success rates are low with public contracts, but much higher (essentially in PT1 and RT1) with private contracts. In the latter case, the success rate is 84%. Where a stable situation is feasible, workers may wait until they have one before making an investment. In NT1 such a stable situation is not feasible, so workers cannot wait for one and keep investing even after several failed attempts. This is not entirely foolish, since the expected payoff is still positive even with a 29 percent success rate. However, investments made under a public contract have a negative expected return in all treatments, so that these are mistakes *ex post*.

For RT1, the number of investment projects undertaken with a private contract is significantly larger than with a public contract ($Z = 2.714$, $p = 0.003$). Moreover, 18 out of 25 (72.0 percent) investments were made with a protected contract in RT1. Note that 18 out of 19

[30] The comparison between RT1 versus NT1 gives $Z = 5.391$, $p = 0.000$, and the comparison between RT1 vs. PT1 gives $Z = 3.119$, $p = 0.001$.

investments with a private contract occurred with a protected position. In PT1, however, results in only 9 out of 37 investments are initiated when subjects had a safe position and 18 out of 37 projects were initiated with a public contract; only 16 percent of all initial private contracts were renewed for a second period. So although in this case workers also have the opportunity to obtain a permanent position, the conditions for attaining it are much tougher than in RT1. If workers believe that it will be very difficult to reach a permanent contract, they will not wait until they will have obtained it to undertake a project (unlike the RT1 treatment). These results seem to support the idea that workers perceive as very difficult to reach a permanent job, so most of them undertake their investment projects without waiting for a safer position.

When we focus on when these investments were undertaken, we see that in NT1 and PT1 most investments were initiated with a public contract (61 percent in NT1 and 75 percent in PT1); in contrast, these were mostly initiated with a private contract (69 percent) in the RT1 treatment. However, there is learning over time; in the second half of the periods with investment stage (from period 6 to 11), most investments were undertaken with a private contract (72 percent, 100 percent and 92 percent in NT1, PT1 and RT1 respectively). Having a contract from a private offer increases the probability of undertaking an investment project in all three treatments by 9.24, 27.70, and 10.60 percentage points in NT1, PT1 and RT1, respectively.

Both results are quite intuitive. If workers assign a larger probability to the fact of having a contract in subsequent periods, they will undertake the investment project. Thus, a private contract could be seen as a signal of a greater chance of being rehired, leading to a greater probability of investing.[31] With protection, assigning this high probability is straightforward.

[31] In fact, in RT1 a private offer could mean (if worker provides the desired effort demanded by the company) a protected contract.

Turning to success rates, Table 5 shows that there is a much higher percentage of successful investments in RT1 than in either NT1 or PT1. The differences are statistically significant between RT1 and the other treatments ($Z = 3.052$, $p = 0.001$ for NT1and $Z = 2.311$, $p = 0.010$ for PT1), but not for the NT1-PT1 comparison. As expected, success rates were very high when workers had achieved a protected position when initiating an investment.

The higher success rates in RT1 naturally leads to larger profits from the investment project. While in NT1 and PT1 workers' average profits are 1.33 and 16.25, respectively, in RT1 profits mushroom to 43.86. Differences are statistically significant between RT1 and NT1 ($Z = 3.008$, $p = 0.001$) and RT1 vs PT1 ($Z = 1.775$, $p = 0.038$) but not between NT1 and PT1. Thus, results show that when worker have the unilateral ability to automatically renew their contracts, they earn much more with their investments.

Result 4*: The presence of renewable dismissal barriers in the labor market drives workers to undertake investment projects more selectively and generates much higher investment returns.*

What is the relationship between the decision to undertake an investment project and behavior in the labor market? To the extent that our data show a link between investment and dismissal barriers, this may have important ramifications for labor policy. Since long-term investments would seem to be rather beneficial for society, it is worthwhile to encourage these; reducing uncertainty by having appropriate dismissal barriers may be a fruitful approach.

In our regressions in Table 4, we introduced three variables regarding the long-term project the workers could undertake outside the labor market: *long-term project*, *cumulative failed projects*, and *protected*project*, an interaction term capturing the situation in which the worker is investing when he has a protected contract. The coefficient of *long-term projects* is positive and statistically significant for all three treatments. When workers are invested in a long-

term project outside the labor market, their increase their effort. The intuition behind this result seems clear. In order to earn positive profits from the project the worker must be employed at least for eight consecutive periods. As the probability of being rehired is increasing with the effort level, workers may have additional incentives to raise their efforts in order to maximize the probability of getting a contract in subsequent periods.

This intuition does not hold in PT1, where a contract may be protected regardless of effort choices. In fact, protected workers have incentives to reduce their effort levels to increase their profits (as indicated by the negative and significant coefficient of *protected*project* on column 7 of Table 4). Nevertheless, the increase in effort by workers without a protected contract investing more than compensates for this, and the total effect of investing on effort levels is positive (as indicated by the coefficint of *long-term projects* in column 6 of Table 4).

Result 6: *When workers invest in a long-term project out of the labor market, they improve their performance inside the labor market.*

One final observation on the effect of the possibility of long-term investment is that workers are willing to provide more effort for the same wage in RT1, since higher effort (e.g. providing the desired effort) becomes indirectly quite profitable. When we combine profits from investment with worker earnings in the labor market we have a Pareto improvement, since both workers and firms benefit from renewable dismissal barriers.

5. Conclusion

We study the effect of dismissal barriers on performance and productivity in the labor market and on worker willingness to get involved in projects that require periodic investment over a considerable amount of time. Having a strong degree of stability in employment has been

one of the historical main aspirations of the working population. Trade unions have pursued employment protection (dismissal barriers) as a mechanism to help achieve this stability.

There are two polar cases. In environments such as the private sector in the U.S., dismissal is typically on an at-will basis, so that insecurity about future employment is likely to deter such investment. At the other extreme, permanent dismissal barriers (present to some degree in many European labor markets) provide little or no incentive for workers to perform at a high level. This may have a very adverse affect on worker productivity and firm profitability.

In this article, we propose a middle way: renewal dismissal barriers that are based on recent performance.[32] We find that the presence of renewable dismissal barriers in the labor market has two relevant consequences. First, overall worker productivity is higher there are renewal dismissal barriers than when there are either no dismissal barriers or irrevocable ones. Thus, renewal dismissal barriers lead to much greater firm profits and total earnings than do either other institution. Secondly, workers achieve greater labor stability. The larger number of long-term relationships corresponds to a higher effort level and, as a consequence, greater profits for firms. With regard to workers, although the larger labor stability does not improve significantly their labor earnings, it allows them to make more successful investments. So it appears that contingent renewal gives safeguards that permit long-term investments while preserving incentives for high productivity. In fact, when we combine the investment profits of workers with their earnings in the labor market, renewable dismissal barriers yield a Pareto improvement over the other institutions considered.

A caveat here is that contract renewal is based on performance and in our design performance is equal to effort levels. However, in field settings the effort level is not observable

[32] Firms should be cautious when choosing the threshold workers have to reach in order to get their renewal. If this threshold is very high, workers might feel that it is very difficult to reach the goal. This fact could discourage workers from trying to reach the threshold, leading to lower effort levels and lower firms' profits.

and may differ from performance. Thus, a dismissal-barriers contract might be applied in settings where effort is highly correlated with performance such as sports contracts (an example previously mentioned). However, when performance is only stochastically correlated to effort, results may be different.[33] Thus, it remains as an open question how the introduction of the performance as a function of effort levels (perhaps with some error) will influence behavior in both the labor market and the investment scenario.

Our results suggest that instituting renewable dismissal barriers is a policy that may well prove beneficial. Of course, while the intuition seems clear, this is only one study and so this can only be a preliminary conclusion. Certainly more research is needed on this important issue for society.

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[33] In this situation, effort levels could increase with automatic renewal since workers might be worried about the decrease in the output by negative shocks, then, they would not match the level demanded by the company and the dismissal barriers would not be activated. Along the same line, the previous situation could reduce the investment rate since there is a risk of dismissal even with high effort.

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Table 3. Average effort levels, wages and profits

Category	NBT1	PT1	AT1	NBT2	PT2	AT2
Average desired effort level	7.82 (0.25)	8.22 (0.18)	8.52 (0.20)	6.65 (0.29)	7.00 (0.53)	8.08 (0.38)
Average effort level provided	5.34 (0.36)	5.41 (0.31)	6.61 (0.38)	3.39 (0.33)	3.59 (0.50)	5.66 (0.57)
Average effort level (LTR)	7.58 (0.29)	6.92 (0.53)	7.98 (0.33)	6.69 (0.61)	6.73 (0.55)	7.55 (0.63)
Average effort level (STR)	4.32 (0.33)	5.26 (0.26)	4.72 (0.33)	3.22 (0.35)	3.41 (0.45)	4.81 (0.42)
Average wages	42.13 (2.52)	47.03 (2.70)	49.20 (3.50)	34.81 (3.87)	42.06 (6.26)	47.44 (5.04)
Average wages (LTR)	50.01 (2.76)	56.01 (2.33)	53.62 (3.58)	52.86 (5.11)	57.90 (4.94)	52.77 (5.25)
Average wages (STR)	36.51 (2.64)	41.59 (2.48)	37.76 (2.71)	33.82 (3.70)	40.69 (6.05)	40.50 (3.93)
Average worker earnings	33.36 (1.17)	37.19 (1.59)	34.78 (2.15)	31.30 (2.08)	35.91 (2.58)	34.96 (3.01)
Average worker earnings (LTR)	38.81 (1.84)	45.14 (1.78)	40.06 (2.42)	41.64 (4.63)	49.11 (4.94)	44.21 (4.28)
Average worker earnings (STR)	31.07 (1.25)	33.65 (1.40)	28.17 (1.61)	29.95 (3.27)	34.30 (5.30)	29.58 (3.25)
Average firm earnings	14.67 (2.10)	10.97 (2.31)	22.85 (1.78)	-0.06 (2.55)	-2.45 (2.40)	15.71 (2.85)
Average firm earnings (LTR)	25.36 (2.34)	13.17 (4.31)	27.78 (2.15)	14.18 (5.54)	10.63 (3.47)	24.58 (4.05)
Average firm earnings (STR)	6.43 (1.58)	10.44 (1.93)	9.25 (2.21)	2.03 (2.56)	-6.00 (2.55)	7.02 (1.59)
Average total earnings	48.72 (3.13)	49.56 (2.98)	60.59 (3.08)	30.85 (3.27)	34.60 (4.50)	53.48 (5.14)
Average total earnings (LTR)	63.67 (2.67)	58.31 (4.25)	67.85 (3.04)	55.81 (4.89)	59.74 (4.37)	68.79 (4.92)
Average total earnings (STR)	37.76 (2.60)	45.06 (2.46)	41.13 (2.78)	27.91 (2.92)	28.30 (3.66)	36.60 (3.51)
Percent LTR	41%	41%	68%	9%	20%	55%

Notes: We define a long-term relationship as when a firm and a worker engage in a private contract for at least 2 consecutive periods. Standard errors are in parentheses.

Table 4. Effort levels (by treatment) with investment stage

Variable	(1) NT1	(2) RT1	(3) RT1	(4) RT1	(5) PT1	(6) PT1	(7) PT1
Private	1.270*** (0.207)	1.014*** (0.285)	4.178*** (0.474)	5.272*** (0.357)	0.502** (0.218)	4.153*** (0.301)	4.152*** (0.282)
Protected contract			1.288*** (0.347)			-0.914** (0.373)	
Wage	0.085*** (0.005)	0.072*** (0.008)			0.086*** (0.006)		
Desired effort	0.122*** (0.027)	0.292*** (0.052)			0.135*** (0.031)		
Cumulative unemployment	-0.015 (0.017)		-0.194*** (0.052)	-0.224*** (0.053)		-0.172*** (0.050)	-0.202*** (0.049)
Cumulative profit	0.001*** (0.0003)		0.001*** (0.0004)	0.001*** (0.0003)		0.002*** (0.0006)	0.001*** (0.0005)
Cumulative failed Projects	-0.209** (0.093)		-0.010 (0.371)	0.130 (0.378)		0.095 (0.313)	0.204 (0.316)
Long-term projects	0.420** (0.176)	0.832*** (0.231)	1.104*** (0.269)			1.012** (0.416)	
Protected*project				0.853*** (0.241)			-0.601* (0.357)
Constant	-0.090 (0.116)	0.017 (0.042)	2.490*** (0.387)	2.620*** (0.380)	0.198 (0.122)	2.197*** (0.346)	2.363*** (0.342)
R-squared	0.826	0.846	0.686	0.679	0.704	0.424	0.424
N	720	720	467	467	900	591	591

Notes: These are GLS regressions with random effects, clustered by subject. Standard errors are in parentheses. ***, **, and * indicate significance at p = 0.01, 0.05, and 0.10, respectively, two-tailed tests. *Private* is a dummy variable with value 1 if the effort is provided with a private offer and is 0 otherwise. *Protected contract* is a dummy variable with value 1 if the effort is provided when the worker was protected against dismissal and is 0 otherwise. *Cumulative unemployment* is the number of periods the worker has been unemployed. *Cumulative profits* is the cumulative profits obtained by the worker. *Cumulative failed projects* is the number of past investment projects that generated losses for the worker. *Long-term projects* is a dummy variable with value 1 if the worker has initiated an investment project and is 0 otherwise. *Protected*project* is an interaction term capturing the situation in which the worker invests when she is protected against dismissal.

Appendix A

Table A1: GLS Random Effects on Effort levels

	(1) NT1 vs. RT1	(2) NT1 vs. RT1	(3) NT1 vs. PT1	(4) NT1 vs. PT1	(5) RT vs. PT1	(6) RT1 vs. PT1	(7) RT1 vs. PT1
Private	1.155*** (0.164)	1.869*** (0.201)	0.811*** (0.150)	1.721*** (0.171)	0.778*** (0.167)	1.651*** (0.197)	
Permanent contract							0.507*** (0.177)
Wage	0.079*** (0.005)		0.085*** (0.004)		0.082*** (0.005)		0.093*** (0.006)
Desired effort	0.208*** (0.030)	0.533*** (0.023)	0.141*** (0.021)	0.484*** (0.020)	0.200*** (0.029)	0.521*** (0.023)	0.206*** (0.035)
Investment	0.570*** (0.147)	0.839*** (0.167)		0.301* (0.177)		0.525*** (0.202)	
Cumulative unemployment		-0.047** (0.019)	-0.035** (0.015)	-0.045** (0.019)		-0.058*** (0.020)	
Cumulative profit		0.002*** (0.0003)	0.001** (0.0003)	0.001*** (0.0003)		0.001*** (0.0003)	
Cumulative fail		-0.113 (0.119)		0.044 (0.126)		0.127 (0.181)	0.195 (0.196)
NBT1	-0.458*** (0.142)	-0.583*** (0.153)	0.286* (0.147)	0.104 (0.246)			
AT1					0.778*** (0.208)	0.788*** (0.240)	1.066*** (0.234)
Constant	0.280*** (0.083)	0.363*** (0.127)	-0.019 (0.115)	0.237 (0.173)	-0.172 (0.125)	-0.017 (0.167)	-0.373** (0.163)
R-squared	0.834	0.771	0.748	0.651	0.768	0.697	0.758
N	1440	1440	1620	1620	1620	1620	1058

These are GLS regressions with random effects, clustered by subject. Standard errors are in parentheses. ***, **, and * indicate significance at p = 0.001, 0.05, and 0.10, respectively, two-tailed tests.

Appendix B

Instructions for the Renewable-barriers treatment with investments (RT1)[34]

1. In order to assure anonymity you have been randomly assigned a code (yellow card). At the beginning of the experiment you will receive an initial endowment of 5€. During the experiment, you can earn a higher amount of money by accumulating points. The amount of earned points will depend on your decisions and on the other participants'decisions.

2. All points that you earn during the experiment will be exchanged into Euros at the end of the experiment. The exchange rate will be 45 points = 1€. At the end of the experiment you will be paid by cash and in private.

3. There will be 17 participants, who will be divided into 2 groups: buyers and sellers. In this experiment there are 10 sellers and 7 buyers.

4. You will either be a buyer or a seller throughout the experiment. All participants have received an identification number, which they will keep throughout the experiment.

5. The experiment consists of 18 periods. In each period, buyers and sellers have to make decisions. In the following, we describe in detail how you can make your decisions in each period.

6. **Phase 1: The Trading Phase**. Each period starts with a trading phase. During the trading phase each buyer can reach a trading agreement with one seller. Buyers can submit several trading offers to sellers. As a seller you can accept one and only one of the offers submitted to you in each period. During the trading phase you will see the following screen (seller trading screen).

    a. The trading phase lasts 150 seconds. When this time elapses, the trading phase is over. Hereafter, no further offers can be submitted or accepted for this period.

    b. There are two types of offers: private and public offers.

        i. Private offers

        Each buyer has the opportunity to submit private offers to a specific seller. The selected seller will be informed about these offers and this seller alone can accept them. No other seller or buyer is informed of these offers. The offer of a buyer will contain the following information: the identification number of the buyer who submitted the offer, the price of the good, and the

[34] For our experimental procedures we follow the instructions by Falk, Huffman and MacLeod (forthcoming). The instructions were slightly modified according to the treatment.

desired quality of the good. If the seller wants to accept a private offer, he must click on the button "accept offer".

ii. Public offers

Each buyer also can submit public offers. All sellers are informed of these offers and any seller can accept them. The offer of a buyer again contains the identification number of the buyer who submitted the offer, the price of the good and the desired quality. This information is also displayed to all sellers and all buyers. If a seller wants to accept a public offer he must follow the same procedures as with private offers (click on the button "accept offer").

c. Each seller can reach only one trading agreement in each period. Once a seller has accepted one offer he cannot accept any further offers.

d. All buyers have to observe the following rules when submitting trading offers:

The price offered by the buyer may not be lower than 0 or higher than 100:

$$0 \leq \text{price} \leq 100$$

The desired quality of the buyer may not be below 1 or higher than 10:

$$1 \leq \text{desired quality} \leq 10$$

e. As long as no offer has been accepted by a seller, the buyer can make as many public and private offers as he wishes. Each offer submitted by a buyer can be accepted at any time during the trading phase.

f. Each buyer can reach only one trading agreement in each period. Once an offer of a buyer has been accepted he will be notified which seller accepted it. As each buyer can reach only one trading agreement in each period, all other offers for the buyer will be automatically cancelled.

g. Once all 7 buyers have entered a trade agreement or after 150 seconds have elapsed, the trading phase is over.

h. Buyers have no obligation to submit a trading offer, and sellers have no obligation to accept a trading offer.

7. **Phase 2: Determination of the Product Quality**. Following the the trading phase, all sellers who have reached a trading agreement then determine which product quality they will supply to their corresponding buyers.

a. The desired quality by the buyer is not binding for the seller. The seller can choose the exact quality desired by his/her buyer, but also a higher or lower product quality.

b. In order to choose the actual product quality, the seller must enter the value for the quality in the field "Determine the actual product quality" and press the "ok" button to confirm the choice. As long as the seller has not pressed "ok" he can alter his choice.

c. The product quality that you choose must be an integer between 1 and 10.

$$1 \leq \text{actual product quality} \leq 10$$

8. The seller's income:

   a. If a seller has not reached a trading agreement during a trading phase he earns an income of 5 points for that period.

   b. If a seller has accepted a trading offer, his income depends on the price he accepted and the product quality he chose to deliver. His income will be calculated as follows:

$$\text{Seller's income} = \text{Price} - \text{production costs}$$

   c. The higher the quality of the good, the higher the production costs are. The production costs for each product quality are displayed in the table below:

Quality	1	2	3	4	5	6	7	8	9	10
Production Costs	0	1	2	4	6	8	10	12	15	18

   d. The seller's income is therefore higher, the lower the quality. Furthermore, his income is higher, the higher the price offered by the buyer is.

9. The buyer's income:

   a. If a buyer does not reach a trading agreement during a trading phase he earns an income of 0 points for that period.

   b. If one of his trading offers is accepted, his income depends on the price he offered and on the quality supplied to him. The income of your buyer will be determined as follows:

Buyer's income = 10 * product quality - price

c. Therefore the higher the quality, the higher the buyer's income. At the same time his income is higher, the lower the price is.

10. The income of all buyers and sellers are determined in the same way. Each buyer can therefore calculate the income of his seller and each seller can calculate the income of his buyer.

11. Please note that buyers and sellers can incur losses in each period. These losses would have to be paid from your initial endowment or from earnings in other periods.

12. You will be informed of your income and the income of your buyer/seller on an "income screen". On the screen (see below) the following will be displayed. The buyer or seller with whom you traded, the price the selller offered, the desired quality by the buyer, the product quality supplied by the seller, and the income for the buyer and the seller in this period.

13. Please enter all the information in the documentation sheet supplied to you. After the income screen has been displayed, the respective period is concluded. Thereafter the trading phase of the following period starts. Once you have finished studying the income screen please click on the "next" button.

14. **Additional rule: "Right to get an offer"** There is one more rule to consider. If in a private offer a seller delivers a quality level at least as high as that desired by the buyer, then the seller enjoys the "right to get an offer" in the next period. That is, the buyer is obligated to offer a private contract to this seller in the next period.

    a. If the previous condition happens in a public offer, the right to get an offer is not established.

    b. The "right to get an offer" means that in the next period the buyer must make the seller an offer that is available as soon as soon as the trading phase begins. This offer consists of a price and a desired quality. The price must be at least as high as the one in the previous period.

    c. In addition to this offer, the seller with this "right" will also see the other public and private offers, which have been offered to him and the other sellers. This seller can accept the offer of "his" buyer or any other offer that has been made (private or public) by other buyers.

    d. As long as this seller has not decided which offer to select, "his" buyer cannot make another offer to this or another seller. This means that this seller can accept

the offer of "his" buyer as long as the seller has not declined it (and trading time has not elapsed).

e. The buyer will be informed about the seller's decision. If the seller accepts another buyer's offer, "his" buyer is free to make offers to other sellers. As long as the seller has not decided, all "his" buyer can do is waiting and observing the market.

f. If the seller accepts the offer of "his" buyer and the seller again delivers a quality of the product at least as buyer's desired quality, then the buyer is again compelled to offer another private contract to this seller in the next period. If and only if the seller does not satisfy the quality of the product requested by the buyer or the seller accepts the offer of another buyer does the right to receive an offer expire. This means that the right to receive an offer can only be terminated by the seller.

g. An example concerning the right to receive an offer. Assume that buyer 4 and seller 7 have reached an agreement in period 2, based on a private offer, and seller 7 has provided higher quality than was requested by the buyer. From period 3 on, seller 7 then enjoys the right to receive an offer. This means that buyer 4 has to make seller 7 an offer in the third period before the trading period begins. If seller 7 accepts and he again satisfies the desired quality by the buyer, then in period fourth, seller 7 again enjoys the right to receive an offer. That is, whenever a seller satisfies at least the desired quality requested by the buyer, the seller will enoy the right to get an offer in the next period.

15. **Phase 3: The investment phase:** This phase is only for sellers. Buyers do not have this investment phase. Buyers are aware of the investment stage for sellers but they do not know whether a seller has undertook an investment project or not. The conditions to undertake an investment project are the following ones:

    a. The seller may decide whether to initiate a project in any period prior to period 12. After period 12, it is no longer possible to initiate an investment project .

    b. The seller must have reached a trade agreement with a minimum profit of 10 points in the same period in which he decides to initiate an investment project .

    c. The cost of the project is 10 points per period invested. Therefore, the seller must reach trade agreements with a minimum profit of 10 points in every period he is investing. Otherwise, the project ends. The project also automatically ends the first period in which the seller does not reach a trading agreement.

d. If a seller decides to initiate a project, it should last at least eight consecutive periods in order to get positive profits.

e. If the project lasts at least eight consecutive periods, net profits will be:

Project costs = 10 * number of periods investing

Project returns = 15 * number of periods investing

Net profit of the project = 5 * number of periods investing

f. That is, the more consecutive periods (8 or more) that the project lasts, the higher the net profit from the investment project. For example, if a seller initiates a project in period 5 and this ends in period 15, this would mean a net profit of 55 points (5 net points for each of the 11 periods that the project is active).

g. If the project lasts less than 8 periods , net profits will be:

Project costs = 10 * number of periods investing

Project returns = 0

Net profit of the project = -10 * number of periods investing

h. That is, if the project lasts less than 8 consecutive periods, it will imply losses to the seller. For example, if a seller initiates a project in period 5 and this ends in period 10, it will mean a net loss of 60 points (10 points for each of the six periods that the project is active).

16. The experiment will not start until all participants are completely familiar with all the procedures. In order to be sure that this is the case, we kindly ask you to solve the exercises below.

17. Before starting the experiment, buyers and sellers will participate in two practice periods. These trial periods will not be added to the result of the experiment and therefore will not be remunerated.

Questionnaire

Just to be sure that you understand the instructions you have to solve a very simple test. When everyone in the room has answered correctly the test, we will start the experiment.

Question 1: A seller accepts an offer of a buyer with both a price of 60 and a desired quality of 9. The seller chooses to provide a quality of 9. Please, fill in the answers:

Seller's income = ____ Buyer's income = ____

Question 2: A seller accepts an offer of a buyer with both a price of 50 and a desired quality of 8. The seller chooses to provide a quality of 4. Please, fill in the answers.

Seller's income = ____ Buyer's income = ____

Question 3: Suppose a seller has accepted a public offer of a buyer in period 5. The buyer desires a quality of 8 and the seller delivers a quality of 9. a) Will the seller enjoy the right to get an offer in period 6? And if the offer was private, will the seller enjoy the right to get an offer in period 6? Please, circle the right answer.

a) Yes No

b) Yes No

Question 4: Suppose a seller has decided to invest in a project in period 7 and she reaches trading agreements from period 7 to period 13 with a minimum profit of 10 points in each period. However, in period 14, she does not get any trading agreement. What is the profit of the investment? Please, fill in the answers:

Project costs = _____

Project returns = _____

Net profit of the project = _____

Question 5: Suppose a seller has decided to invest in a project in period 9 and she reaches trading agreements from period 9 to period 17 with a minimum profit of 10 points in each period. However, in period 18, she does not get any trading agreement. What is the profit of the investment? Please, fill in the answers:

Project costs = _____

Project returns = _____

Net profit of the project = _____