Peer Effects Among Weavers: Evidence from a Chinese Textile Firm with a Relative Group Incentive Scheme

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Abstract

Using data on weekly efficiency for temporary weavers in a Chinese textile firm over a 21-month period from 2005-2007, this paper studies how temporary teammates affect the performance of an individual temporary weaver under a relative group incentive scheme and how such effects depend on whether the temporary teammate is a high or low productivity weaver. I find that the performance of temporary weavers is unaffected when the average ability of their temporary teammates increases. However, when dividing the temporary weavers into high and low productivity groups to exploit the innate behavioral differences between them, I find differing results. The performance of high productivity weavers is unaffected when the average ability of their high or low productivity teammates increases, while low productivity weavers shirk only when the average ability of their low productivity teammates increases. The results suggest free-riding among low productivity weavers is reduced by contagious enthusiasm to reach a higher bonus level created from the introduction of a superstar weaver to their team.

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Keywords: peer effects in the workplace, free-riding, group incentive scheme

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I. Introduction

Economists have long been interested in the study of peer effects, the notion that an individual's performance is influenced by his or her coworker's performance. These effects are common in the workplace where production of goods and services involves some kind of collaboration among workers, but are dependent on the characteristics of the workplace environment. When it is difficult for employers to measure individual performance and the payment scheme rewards each individual for the performance of the group, there is an incentive for workers to "free-ride" i.e. decrease their effort so they can earn the benefit of the group without paying the cost of effort. Several studies have examined the relationship between group incentive schemes in the workplace and free-riding, suggesting differing mechanisms for how free-riding can be reduced. Kandel and Lazear (1992) theoretically prove that peer pressure can offset free-rider effects in an organization with partnership and profit sharing. Fehr and Gächter (2000) utilize a public goods experiment to show that free-riding is significantly reduced when participants are capable of punishing others for deviating from the standard contribution of the group. Knez and Simester (2001) compare airline performance before and after the addition of a group bonus structure to the payment scheme and find that profits significantly increase despite the increased incentive to free-ride because employee monitoring mitigates the free-rider effects. Peer effects can help to moderate free-rider effects that result from the characteristics of many workplace environments through differing pathways.

Using data on weekly efficiency for temporary weavers in a Chinese textile firm over a 21-month period from 2005-2007, this paper provides evidence for free-riding in the manufacturing workplace but suggests an alternative mechanism for reducing it. I

find that the performance of temporary weavers is unaffected when the average ability of their temporary teammates increases. However, when dividing the weavers into high and low productivity to exploit their innate behavioral differences, I find differing results. The performance of high productivity weavers is unaffected when the average ability of their high or low productivity teammates increases, while low productivity weavers free-ride when the average ability of their low productivity teammates increases but not when the average ability of their high productivity teammates increases. High productivity weavers, because they are innately hard working, do not free-ride even if they think their team cannot reach a higher bonus level. Low productivity weavers, because they are innately lazy, free-ride when they think their team cannot reach a higher bonus level, but maintain their performance when they think their team can reach a higher bonus level. An increase in the average ability of their high productivity teammates, which results from the introduction of a superstar weaver, reduces free-riding among low productivity weavers by creating contagious enthusiasm that motivates them to maintain their performance instead of shirk so their team can reach a higher bonus level.

The paper is organized as follows: Section II describes the textile firm from which the data was collected. Section III explains the methodology of the econometric analysis and provides the results. Section IV discusses the results and section V concludes.

II. Background

Company information

The Nantong, Jiangsu textile firm was originally founded in 1895 as Nantong Textile Firm #1. After merging with several other textile firms to form the Jiangsu Dasheng Conglomerate in 1998, the company went from a complete state-ownership

structure to a limited state-ownership structure with 60% ownership by the state and 40% ownership by its workers. Like many other state-owned enterprises in China, the firm has experienced workforce downsizing and property rights reform, which have helped to increase revenues and profits. The firm doubled output while decreasing employment by half from 1995-2006 and has consistently ranked among the top ten textile firms in China for revenues and profits since 2000. In 2005, the company had 9,741 workers, a total of 2.2 billion yuan in assets, and revenues greater than two billion yuan annually.

Data information

The dataset includes information on characteristics, weekly production, piece rate wages, and bonuses for 326 weavers over a 21-month period from 2005 to 2007. Each weaver's production is measured by the automated looms with negligible error, recorded by the firm, and saved electronically. There are several ways to measure a weaver's performance in a textile firm. The dataset provides information on output, defect rate, and efficiency. Output is composed of first class output, which are high quality products and second-class output, which are lower quality products that are sold at lower prices. Defect rate is the amount of second-class output divided by total output. Efficiency is calculated by the firm to measure a weaver's daily performance compared to certain standards. Output is not a good measure of performance because it is determined largely by a firm production plan based on demand, giving a weaver almost no control over how much she produces. However, weavers do have considerable control over minimizing defective output, so defect rate and efficiency are better measures of performance. Efficiency is used in this paper because many weavers achieved a zero defect rate. Weavers who worked less than one day were dropped from the dataset because they would likely not

experience peer effects in this period of time and their ability cannot be accurately predicted with such limited information. Observations where a weaver recorded an efficiency below 0.1 were also dropped since they seemed to be outliers. The remaining dataset includes 18,960 weekly observations. Table 1 provides summary statistics for the weavers. The majority (~99%) of weavers are female with no secondary education and about 65% are permanent weavers, while the remaining 35% are temporary weavers.

The dataset can be divided further because the firm has two weaving divisions each with four teams. The North weaving division has 177 weavers and the South weaving division has 149 weavers with about 30 weavers on each team. However, the composition of each team changes from week to week due to employee turnover and temporary absence. It seems unlikely that the firm could have a systematic rule on team assignment of new weavers (such as knowingly assigning higher productivity weavers to the same team) since it would be impossible to know their ability without ever watching them weave, but a statistical test of the random assignment hypothesis[*] indicates that team assignment is nonrandom. The results are displayed in the appendix. Though the abilities of teammates are positively correlated with each other, which indicates that high ability weavers are systematically assigned to the same team and biases the peer effects estimates upwards, the direction of the bias actually strengthens my results.

Weaving description

Weavers operate looms to produce cloth and yarn. Because the looms are automated, it may seem that a weaver has a rather limited effect on the production of the textiles. Production does not depend on how much each individual produces, but rather

[*] The random assignment test, developed by Guyran, Kraft, and Notowidigdo (2009), checks whether high ability weavers are working with other high ability teammates at any given point in time.

on how many errors she prevents the loom machine from making. If a weaver is low productivity but she somehow has a machine that has relatively few problems, it would appear that her productivity is higher than it actually is. However, problems do arise more often than expected and a weaver is responsible for detecting early signs of problems and quickly making adjustments to the machines to avoid a resulting defective product.

Textile weaving is also a difficult job. Weavers are often operating several machines at once and are required to pay close attention to each of the machines. Weavers also wear protective masks and the looms are noisy. These aspects of the workplace make it an ideal environment for free-riding. Weavers are concerned with minimizing their own defective output, so they cannot be concerned with how other weavers are performing. The peer pressure, punishment, and monitoring mechanisms for reducing free-riding suggested by Kandel and Lazear (1992), Fehr and Gächter (2000) and Knez and Simester (2001) would not be effective as a result. The team is also an important aspect of the workplace. The firm requires that teams hold weekly meetings and weavers spend a lot of time with their teammates outside of the workplace. It also requires that teams regularly hold skill training classes and skill contests. Through these activities, the weavers become aware of their performance relative to each other.

Weaver division

Weavers are defined by the duration they have been working with the firm. Permanent weavers are those who entered the firm prior to 1993 and can only leave through early retirement. Weavers who retire early are paid a stipend of 450 yuan per month along with an insurance premium. Temporary weavers are those who entered the firm after 1993 and are on indefinite labor contracts that can be terminated by

management. These weavers also differ greatly in other aspects. Permanent weavers have often worked at the firm since they entered the job market, are much older, have more experience, and hold some share of the firm's equity and stocks. Temporary weavers have often just entered the firm, are much younger, lack experience, and do not hold a share of the firm. The youngest temporary weaver at the firm is 16 years old and entered the firm in 2006, while the oldest permanent weaver is 47 years old and entered the firm in 1979. Because these weavers are so different, it is unlikely that a temporary weaver would be affected by the introduction of a permanent weaver to her team. While not weaving, young temporary weavers spend most of their time with other temporary weavers who are similar in age and not with much older permanent weavers. It is reasonable to believe then that temporary weavers would be unaware of the innate ability of their permanent teammates. To confirm that temporary weavers are unaffected by the introduction of permanent weavers to their team, the hypothesis is tested statistically. Table 2 displays the results. For the purposes of this case study, only temporary weavers are considered. The remaining dataset includes 6,678 weekly observations from 101 temporary weavers. I divide the temporary weavers further into high and low productivity groups because it is expected that they will respond differently to an increase in the average innate ability of their teammates due to the inherent behavioral differences between them. Something about the high productivity weavers makes them innately hard working so it is expected that they would not free-ride, while something about the true low productivity weavers makes them innately lazy so it is expected that they would free-ride. Because textile weaving is a difficult job that earns low wages, labor turnover is high among temporary weavers. Many of them quit after three months of training to look

for another job. There is much less variation in the composition of permanent weavers within a team since it can only come from the retirement or temporary absence of these weavers, which likely do not happen frequently enough to measure peer effects. Table 3 provides summary statistics for the temporary weavers only.

Relative group pay incentive

Weavers earn extremely low wages; the average wage earned by a weaver in a month is only 1,102 yuan. This wage is primarily composed of the piece rate wage that a weaver earns based on her production for that month, but it can also include a group bonus wage that a weaver earns based on the production of her team relative to the other teams for the previous month. The team with the highest production in the previous month receives a bonus at the start of the month that is greater relative to the bonus received by the team with the second highest production. The team with the lowest production does not receive a bonus. Figure 1 displays a distribution of the bonuses received by weavers and figure 2 displays a distribution of the bonuses received by teams. The average bonus earned by a weaver in a month is 33 yuan. This amounts to about 3% of a weaver's monthly wage on average, but since some teams earn no bonus, which lowers the number for the average bonus earned, it actually amounts to greater than 3% of a weaver's monthly wage for several teams. Though this seems small, for textile weavers who earn low wages, each additional dollar earned by them is worth much more than each additional dollar earned by someone with high wages. This aspect of the firm makes it an ideal environment for free riding because weaver's can decrease their effort and still be rewarded with a bonus for the production of the team.

III. Estimating peer effects

There are two types of peer effects: contemporaneous and compositional. Contemporaneous peer effects result when a weaver's effort is influenced by the average effort of her coworkers. Compositional peer effects result when a weaver's effort is influenced by the average ability of her coworkers. Contemporaneous effects are difficult to measure because a weaver's effort is correlated with the error term. These effects are also subject to reflection bias (Manski, 1993) where the direction of causality cannot be determined. Compositional effects are not subject to the same problems because neither the error term nor the worker's effort should influence the innate ability of his or her teammates. In addition, compositional peer effects are more likely to happen in a textile workplace environment than contemporaneous peer effects because of the characteristics described earlier. A weaver has to pay close attention to the machines she is operating, making it difficult for her to observe the effort of her teammate for a long period of time. It is more likely that a weaver would glance at her teammate while she is weaving, recognize her from outside the workplace, a skill training class or a skill contest, and have a reasonable estimation of her innate ability. I employ the empirical framework of several recent studies to estimate peer effects in the workplace (Mas and Moretti, 2009, Bandiera, Barankay and Rasul, 2010, Guyran, Kraft and Notowidigdo, 2009 and Kato and Shu, 2011), which uses a comprehensive set of covariates to predict the innate time-invariant ability of each individual weaver, to guide my analytical approach. The following equation predicts a weaver's innate ability in efficiency:

$$efficiency_{it} = \alpha + a_i + \lambda M_{it} + \gamma C_{jt} + \beta dayout_{it} + \varepsilon_{it}$$

where M_{it} is a set of coworker dummy variables controlling for the presence of teammates. The dummy variable coworker1 in week t takes a value of 1 if weaver i works with weaver 1 in week t in the same team, but takes a value of zero otherwise. C_{jt} is the set of additional controls including week fixed effects and week times team fixed effects. $dayout_{it}$ is included so that I can measure each weaver's ability to maintain high quality output while holding the quantity of daily output constant.

Given a measure of time-invariant innate ability for each weaver, peer effects can now be estimated. The following first difference model is used to estimate peer effects:

$$(1)\ \Delta efficiency_{it} = \theta \Delta a_{-it} + \kappa \Delta dayout_{it} + \text{additional controls} + \Delta \varepsilon_{it}$$

where Δ indicates the first difference between week t and t-1. a_{-it} is the average ability of weaver i's teammates who are working with her in the same week t. θ measures the compositional peer effects. If θ is positive, there is a positive compositional coworker effect, which means that when a weaver is working with more able teammates, her efficiency increases. If θ is negative, there is a negative compositional coworker effect, which means that when a weaver is working with more able teammates, her efficiency decreases. If θ is zero, there is no compositional coworker effect, which means that when a weaver is working with more able teammates, her efficiency does not change. There are other controls included, all of which ensure that the estimated coefficient on Δa_{-it} is measuring the compositional peer effects. $dayout_{it}$ is necessary as a control for production pace and the tradeoff between quantity and quality. The model includes a set of variables to control for demand, including actual days worked, total number of weavers on the team at time *t* and daily output. It also includes constant to capture a firm-wide time

trend, individual fixed effects to capture individual-specific time trends, month and week fixed effects to capture firm-wide time-specific effects, and month*team fixed effects to capture team-specific time effects. There is also a control for the average effort of teammates. If a weaver's effort increases when the average innate ability of her teammates increases as a result of a compositional peer effect, it could also cause the effort of her teammates to increase through a contemporaneous peer effect. Figure 3 displays a diagram of the peer effects that equation 1 is measuring.

Table 4 displays the peer effects estimates for equation 1. Column (1) controls for month fixed effects only. In Column (2), a demand control is added to the model to see if the results change. Column (3) controls for demand only. In Column (4), team-specific time fixed effects are added to the model. The results indicate that the effect of a change in the average innate ability of a weaver's teammates on a change in a weaver's efficiency is insignificant for all specifications. When a temporary weaver who increases the average innate ability of the team is introduced, there is no effect on another temporary weaver's efficiency i.e. there does not seem to be a compositional peer effect.

Productivity division peer effects

The most important aspect of this study though is the relationship between peer effects and productivity groups. Temporary weavers are divided into these groups because it is expected that high productivity weavers will respond differently to increases in the average ability of their teammates than low productivity weavers as described earlier. Figure 4 displays a distribution of the time-invariant innate ability of the weavers, which clearly indicates that there are distinct high and low productivity groups of weavers. It would be ideal then to divide the weavers into high and low productivity

groups at the break in the distribution. However, because the true low productivity group only contains 17 weavers, there are not many weavers who have them as teammates, making it difficult to measure peer effects. The high and low productivity groups are divided at the median of the innate ability distribution so peer effects can be estimated. Some of the high productivity weavers are considered low productivity weavers as a result. The following equation is used to estimate peer effects in these groups:

$$(2)\ \Delta efficiency_{ijt} = \theta_1 \Delta a_{-ijt} + \theta_2 \Delta a_{-i-jt} + \kappa \Delta dayout_{it} + \text{additional controls} + \Delta \varepsilon_{it}$$

where j denotes weaver i's productivity group, a_{-ijt} is the average ability of weaver i's teammates who are in the same productivity group as her and who are working with her in the same week t, and a_{-i-jt} is the average ability of weaver i's teammates who are in the other productivity group and who are working with her in the same week t. θ_1 and θ_2 measure the compositional peer effects of teammates inside weaver i's productivity group and outside weaver i's productivity group respectively. If θ_1 is significant, there is a compositional coworker effect with ingroup teammates, which means that when a weaver is working with more able teammates inside her productivity group, her efficiency changes. If θ_2 is significant, there is a compositional coworker effect with outgroup teammates, which means that when a weaver is working with more able teammates outside of her productivity group, her efficiency changes. Additional control variables are the same as stated in the previous equation except this equation also includes control variables for the number of high and low productivity weavers on the team separately instead of controlling for the total number of weavers on the team. Figure 5 and figure 6 display diagrams of the peer effects that equation 2 is measuring for each group.

Table 5 and table 6 display the peer effects estimates for equation 2. The results in table 5 indicate that the effect of a change in the average innate ability of a weaver's teammates on a change in a high productivity weaver's efficiency is insignificant at the 5% level for all specifications. High productivity weavers are unaffected by increases in the average innate ability of their high productivity teammates or low productivity teammates i.e. high productivity weavers do not display a compositional peer effect with ingroup or outgroup teammates. The results in table 6 indicate that a low productivity weaver decreases her efficiency in response to an increase in the average innate ability of her low productivity teammates. For example, as the average innate ability of a weaver's low productivity teammates increases by 1 percent, the average low productivity weaver will decrease her efficiency by about 0.174 percent. This result is robust across specifications and is strengthened by the upward bias that the coefficients should have as a result of the nonrandom assignment of high productivity weavers to the same teams.

The results from this table also indicate that a low productivity weaver is unaffected by an increase in the average innate ability of her high productivity teammates. There are significant results when controlling for demand and month fixed effects, but because they are not robust across specifications, it can be concluded that the effect is insignificant. Low productivity weavers decrease their efficiency when another low productivity weaver is introduced that increases the average innate ability of the low productivity group and maintain their efficiency when a high productivity weaver is introduced that increases the average innate ability of the high productivity group i.e. low productivity weavers display a negative compositional peer effect with ingroup

teammates but do not display a compositional peer effect with outgroup teammates. Table 7 displays a summary of the results for both high and low productivity weavers.

Though the results indicate that low productivity weavers shirk when the average ability of their low productivity teammates increases, the cause of these effects is unclear since some high productivity weavers are grouped with true low productivity weavers to create the low productivity group for the reason described earlier. To resolve this problem, only weavers who have these true low productivity weavers as teammates are considered now with the hope that this change will help in understanding who is responsible for these effects. This will avoid the grouping of high and low productivity weavers together to measure peer effects and should allow for peer effects within the true low productivity group only to be measured. Figure 7 displays a distribution of the innate ability of these true low productivity weavers and their high productivity teammates. Table 8 and table 9 displays the results for equation 2 when only these weavers are considered. Like the results from table 5 for high productivity weavers, the results from table 8 indicate that the effect of a change in the average innate ability of a weaver's high and low productivity teammates on a change in a high productivity weaver's efficiency is insignificant for all specifications. High productivity weavers do not display compositional peer effects with ingroup or outgroup teammates. However, unlike the results from table 6, the results from table 9 indicate that the effect of a change in the average innate ability of a weaver's high and low productivity teammates on a change in a low productivity weaver's efficiency is insignificant for all specifications. These weavers no longer display a negative compositional peer effect with ingroup teammates.

Weavers who do not have these true low productivity weavers as teammates are also considered to check if the effects are a result of them. These weavers are innately high productivity, but some are "low productivity" for the purposes of the regression. Figure 8 displays a distribution of their innate ability and table 10 and table 11 display the results for equation 2 when only they are considered. Like the results from table 8 and table 9, the results from these tables indicate that the effect of a change in the average innate ability of a weaver's high and low productivity teammates on a change in a high and low productivity weaver's efficiency is insignificant for all specifications. High productivity weavers do not display compositional peer effects with ingroup or outgroup teammates.

IV. Discussion

The characteristics of the workplace and the relative group incentive scheme at the Nantong textile firm create an environment that is ideal for free-riding and drive peer effects among its temporary weavers. High productivity weavers are unaffected by increases in the average innate ability of high or low productivity teammates because they are innately hard working and are unlikely to shirk. They will give their best effort regardless of how close their team is to reaching a higher bonus level; they do not need a superstar weaver to motivate them. Low productivity weavers are innately lazy and are inclined to free-ride off their teammates. When the average innate ability of her low productivity teammates increases, a low productivity weaver will free-ride because she thinks that the small increase in average innate ability will not be enough for her team to reach a higher bonus level. If she believes that her team has no chance of reaching the next bonus level, there is no incentive for her to maintain her effort assuming that that her decreased effort does not cause her team to drop to a lower bonus level. However, when

the average innate ability of her high productivity teammates increases, this same weaver will maintain her efficiency instead of shirk. Teammates are not pressuring her because they are concerned with maintaining their own efficiency, are not capable of explicitly punishing her because it is not permitted by the firm, and may not even notice a difference because of the masks they are wearing and the noise from the looms. The mechanisms for reducing free-riding suggested by Kandel and Lazear (1992), Fehr and Gächter (2000) and Knez and Simester (2001) are likely not happening in this situation.

Contagious enthusiasm that results from the introduction of a superstar worker who serves as a role model to other workers and inspires them to improve their performance, as described by Mas and Moretti (2009) and Kato and Shu (2011), is a more likely mechanism for moderating these free-rider effects. Several studies have examined superstar peer effects. Agrawal, McHale and Oettl (2012) investigate how the hiring of a superstar scientist to a university biology department affects the productivity of incumbent scientists as measured by the number of publications and weighted by the number of times the publications are cited. They find that department-level productivity increases by 26% after the arrival of the superstar and that incumbent scientists who conduct research related to the superstar increase their productivity by 49% after his or her arrival. Azoulay et al. (2010) and Oettl (2012) also provide evidence for similar superstar peer effects using unexpected deaths of superstar scientists as a natural experiment. Superstar high productivity weavers have a similar effect on low productivity weavers at Nantong as superstar scientists have on incumbent scientists at these universities because of the relative group incentive scheme. Low productivity weavers do not shirk when a superstar weaver is introduced because they think that the larger

increase in average innate ability will put their team closer to reaching a higher bonus level. The introduction of a superstar weaver generates contagious enthusiasm among the low productivity weavers, inspiring them to maintain their efficiency instead of free-ride. If these weavers believe that their team has a chance of reaching the higher bonus level, they will feel that their effort could be the difference in achieving a greater bonus and that their decision to free-ride could cost themselves additional money.

The cause of these effects is not completely clear though. If the free-riding effects are caused by the true low productivity weavers as is thought, then these effects should still be present when only the true low productivity weavers and their high productivity teammates are considered. However, when only these weavers are considered, the true low productivity weavers no longer display a negative compositional peer effect with ingroup teammates. Weavers who do not have these true low productivity weavers as teammates are also considered to check if the effects are a result of them, but they do not display a negative compositional peer effect either. The free-rider effects only seem to be present when some high productivity weavers are grouped with true low productivity weavers to create the low productivity group. The lack of effects when only true low productivity weavers and their high productivity teammates are considered could be explained by the small variation in innate ability among the true low productivity weavers, which may not be enough for peer effects to measured. If another true low productivity weaver is introduced to the team who has an innate ability that is only marginally higher than the focal weaver, the focal weaver may not even notice that the average innate ability of her ingroup teammates has increased and her efficiency will be unaffected. When the true low productivity weavers are grouped with some high

productivity weavers though, there is enough variation in innate ability for peer effects to be measured. If a high productivity weaver (who is considered low productivity) with innate ability much higher than the focal weaver but not high enough to be considered a superstar is introduced to the team, the focal weaver will certainly notice that the average innate ability of her ingroup teammates has increased and she will shirk. Though it is thought that the free-rider effects that are present when these weavers are grouped together are caused by the true low productivity weavers and that these effects are no longer present because of the lack in variation of innate ability among these weavers, it is still unclear whether the true low productivity weavers are responsible for these effects.

V. Conclusion

Using data on weekly efficiency for temporary weavers in a Chinese textile firm during a 21-month period from 2005-2007, this paper has provided evidence for free-riding in the manufacturing workplace and suggested an alternative mechanism for reducing it. Several other studies have suggested that peer pressure, punishment, and monitoring can offset free-riding effects in the workplace, but these mechanisms are unlikely at Nantong given its characteristics. Contagious enthusiasm that results from the introduction of a superstar weaver to a low productivity weaver's team is a more likely mechanism for reducing these effects. Superstar weavers not only increase team productivity directly because they have higher productivity, but also indirectly by inspiring their lazy low productivity teammates to maintain their productivity instead of shirk so the team can reach a higher bonus level. Though it is unclear if true low productivity weavers are responsible for the free-riding effects, these findings have important implications for the optimal organization of the workplace. The mix of workers

that maximizes firm productivity is one where superstar weavers are equally distributed throughout teams. If superstar weavers are equally distributed, each team will have a chance at reaching a higher bonus level and low productivity weavers will not free-ride.

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Table 1: Summary statistics of weavers

	Mean	Std. Dev	N
Output (in 10 meters)	113.574	45.287	18960
Defect rate (percent)	0.855	1.896	18960
Efficiency	80.226	10.494	18960
Wage	1102.759	338.067	18960
Bonus	33.722	30.193	18960
Permanent	0.648	0.478	18960
# of weavers on team	28.030	2.461	18960

Table 2: Peer effects on temporary weavers including permanent weavers

Dep. = Δeff_{ijt}	(1)	(2)	(3)	(4)
Δa_{-ijt}	0.054*	0.058*	0.054	0.063*
	(0.031)	(0.031)	(0.033)	(0.034)
Δa_{-i-jt}	-0.030	-0.055	-0.052	-0.045
	(0.074)	(0.077)	(0.084)	(0.089)
Demand control	No	Yes	Yes	Yes
Month FE	Yes	Yes	No	No
Month*Team FE	No	No	No	Yes
R^2	0.765	0.765	0.766	0.763
N	6430	6430	6430	6430

Standard errors in parentheses
All standard errors are robust and clustered at the individual level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Summary statistics of temporary weavers

	Mean	Std. Dev	N
Output	121.565	51.663	6678
Defect rate (percent)	1.108	2.116	6678
Efficiency	78.905	10.611	6678
# of weavers on team	10.311	2.461	6678
# of high productivity teammates	5.208	2.874	6678
# of low productivity teammates	5.103	2.946	6678

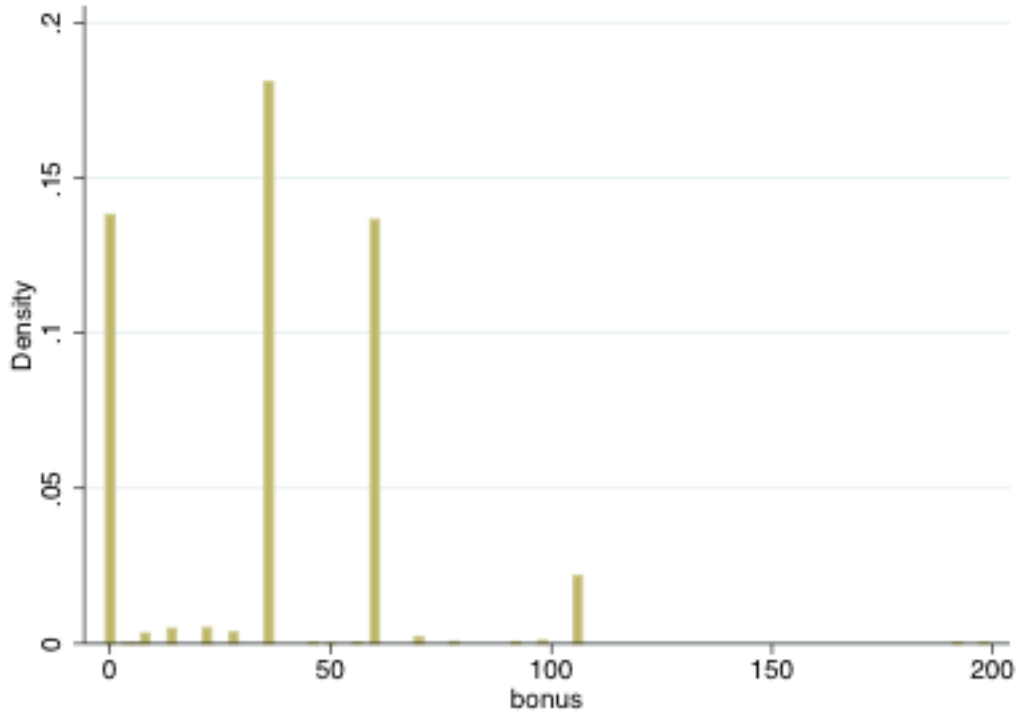

Figure 1: Distribution of bonuses received by weavers

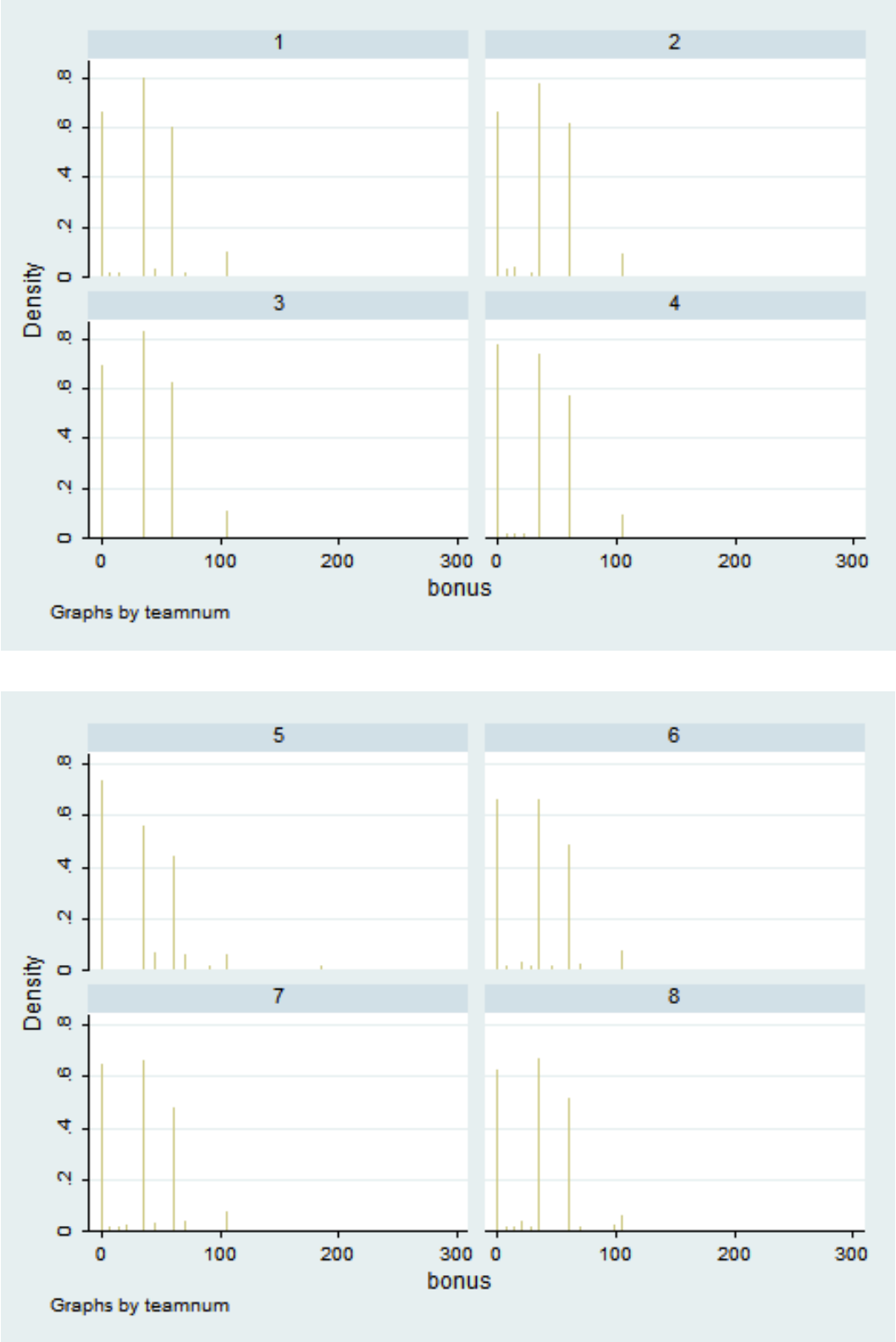

Figure 2: Distribution of bonuses received by teams

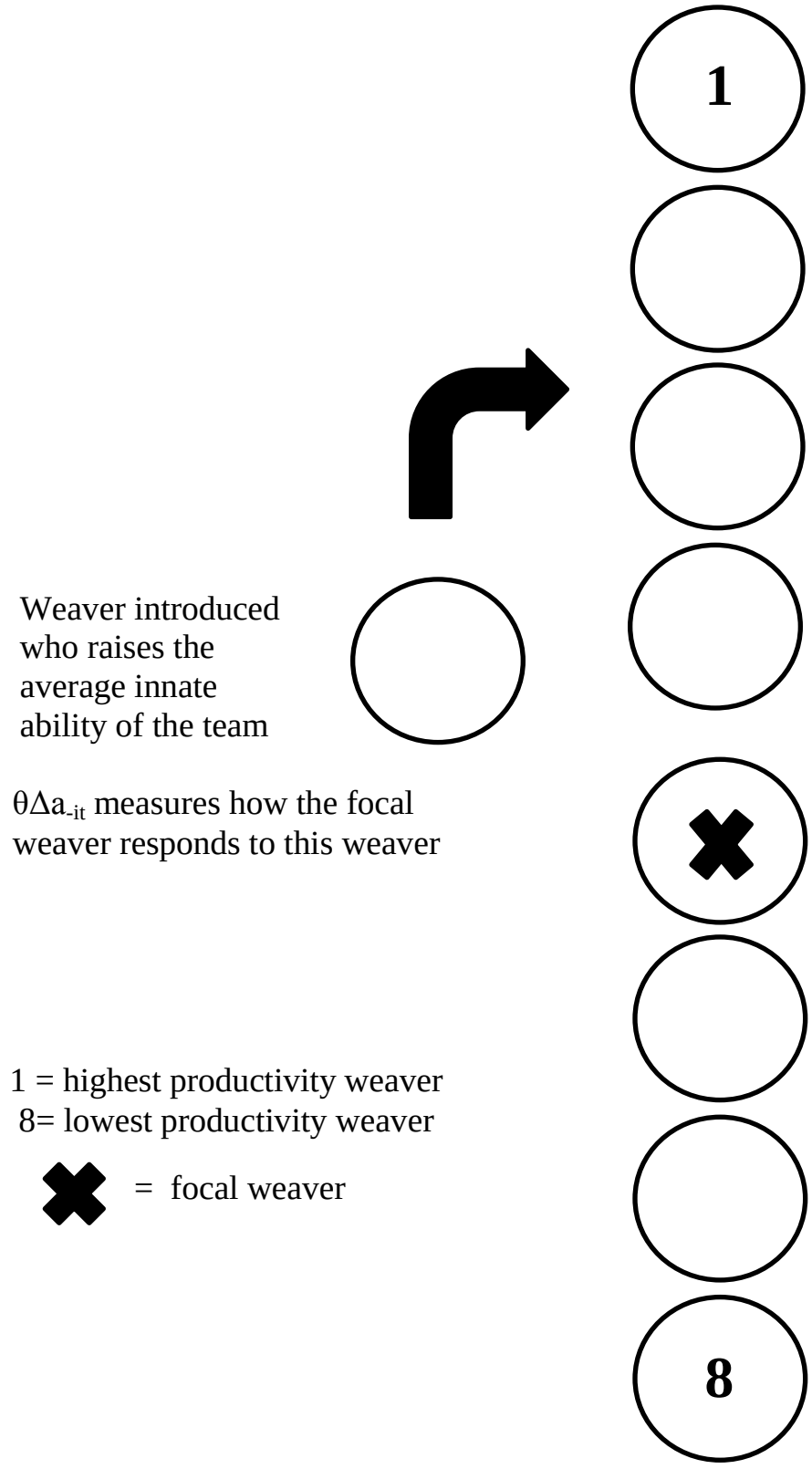

Figure 3: Diagram of the peer effects measured in equation 1

Table 4: Peer effects on temporary weavers

Dep. = Δeff_{it}	(1)	(2)	(3)	(4)
Δa_{-it}	-0.123	-0.155	-0.154	-0.195
	(0.178)	(0.172)	(0.189)	(0.192)
Demand control	No	Yes	Yes	Yes
Month FE	Yes	Yes	No	No
Month*Team FE	No	No	No	Yes
R^2	0.765	0.765	0.766	0.763
N	6430	6430	6430	6430

Standard errors in parentheses
All standard errors are robust and clustered at the individual level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

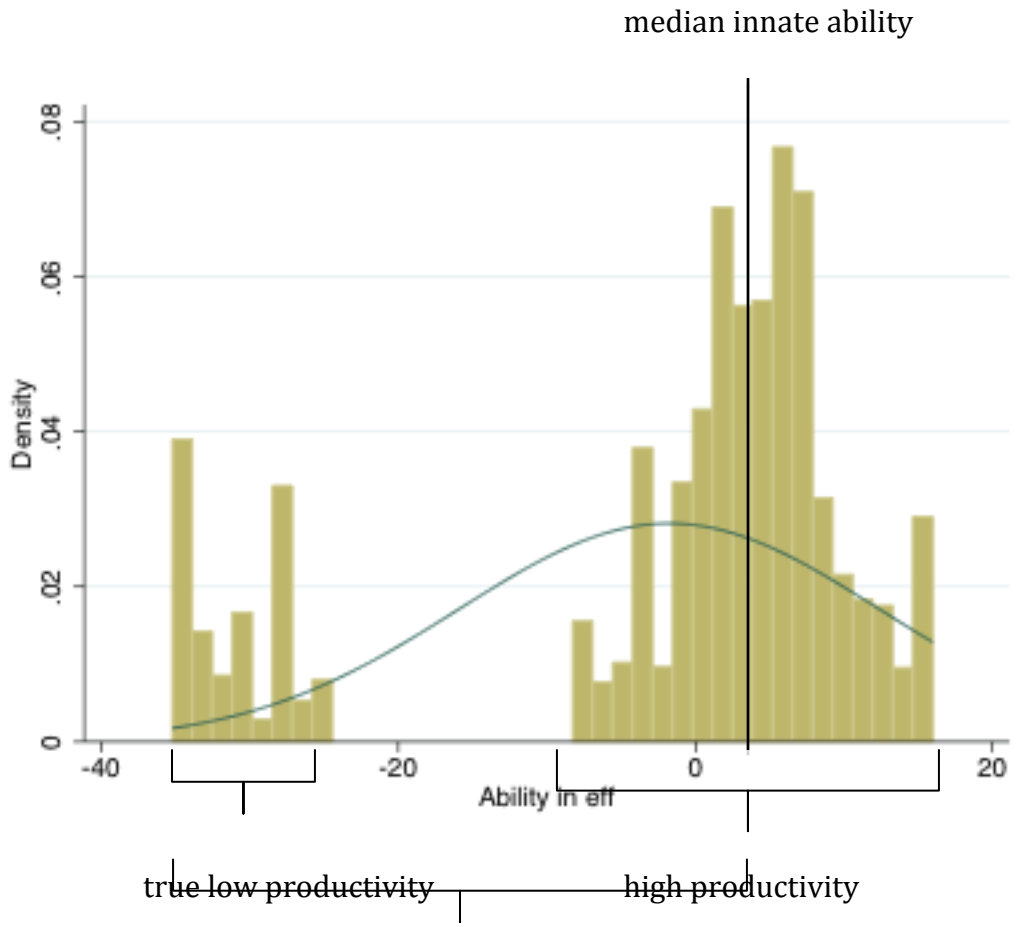

Figure 4: Distribution of the time-invariant innate ability of temporary weavers

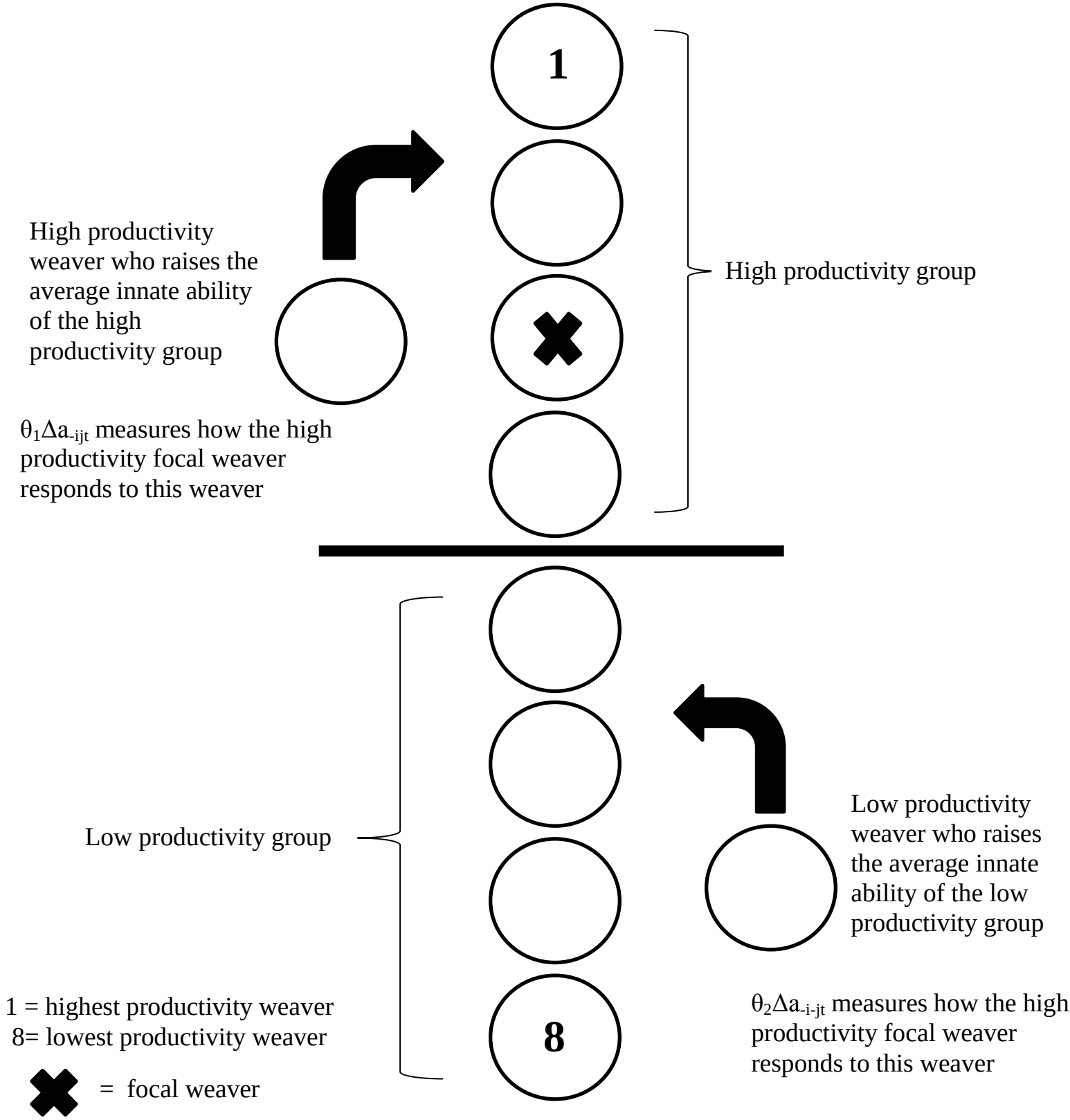

Figure 5: Diagram of the peer effects measured in equation 2 for high productivity

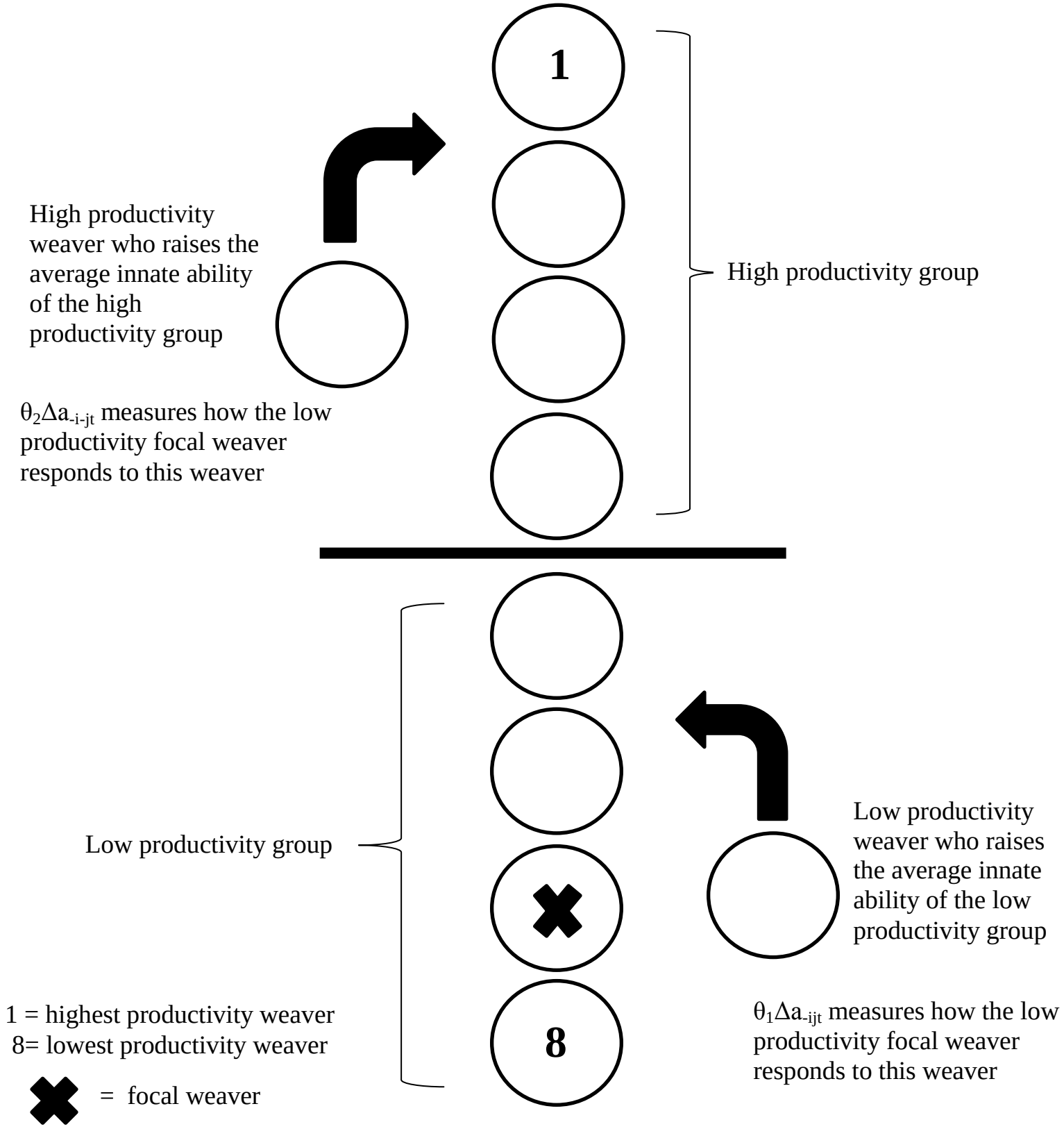

Figure 6: Diagram of the peer effects measured in equation 2 for low productivity

Table 5: Peer effects on high productivity temporary weavers

Dep. = Δeff_{ijt}	(1)	(2)	(3)	(4)
Δa_{-ijt}	-0.218	-0.169	-0.269	-0.294*
	(0.169)	(0.154)	(0.167)	(0.167)
Δa_{-i-jt}	-0.012	-0.001	0.030	0.029
	(0.075)	(0.075)	(0.080)	(0.074)
Demand control	No	Yes	Yes	Yes
Month FE	Yes	Yes	No	No
Month*Team FE	No	No	No	Yes
R^2	0.843	0.843	0.843	0.841
N	3214	3214	3214	3214

Standard errors in parentheses
All standard errors are robust and clustered at the individual level.
* p < 0.10, ** p < 0.05, *** p < 0.01

Table 6: Peer effects on low productivity temporary weavers

Dep. = Δeff_{ijt}	(1)	(2)	(3)	(4)
Δa_{-ijt}	-0.156*	-0.153**	-0.164**	-0.174**
	(0.081)	(0.064)	(0.073)	(0.071)
Δa_{-i-jt}	0.311*	0.401**	0.150	0.132
	(0.177)	(0.176)	(0.206)	(0.210)
Demand control	No	Yes	Yes	Yes
Month FE	Yes	Yes	No	No
Month*Team FE	No	No	No	Yes
R^2	0.738	0.739	0.740	0.735
N	3104	3104	3104	3104

Standard errors in parentheses
All standard errors are robust and clustered at the individual level.
* p < 0.10, ** p < 0.05, *** p < 0.01

Table 7: Summary of results in table 5 and table 6

		introduced weaver (Δa_{-ijt})	
		high	low
focal weaver (Δeff_{ijt})	high	-----	------
	low	-----	decrease

assuming the introduced weaver increases the average innate ability of their productivity group

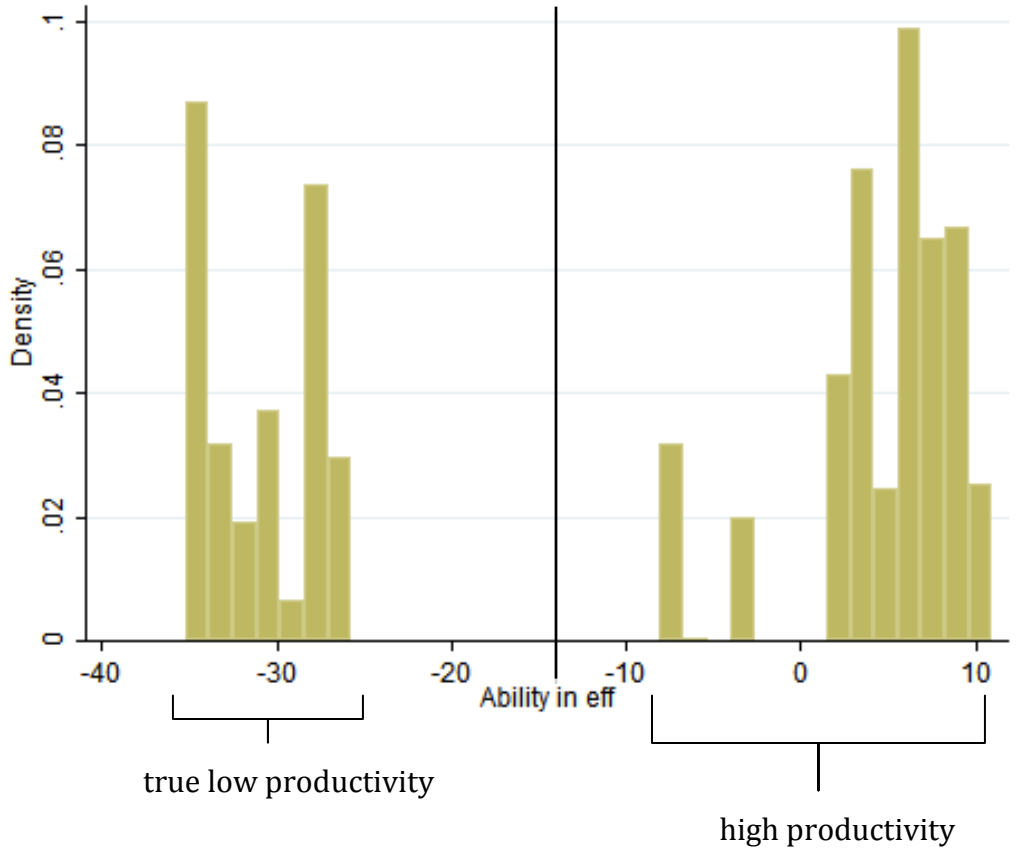

Figure 7: Distribution of the time-invariant innate ability of true low productivity weavers and their high productivity teammates

Table 8: Peer effects on high productivity temporary weavers with true low productivity teammates

Dep. = Δeff_{ijt}	(1)	(2)	(3)	(4)
Δa_{-ijt}	-0.205	-0.189	-0.270	-0.338
	(0.194)	(0.191)	(0.193)	(0.199)
Δa_{-i-jt}	-0.048	-0.042	-0.008	-0.018
	(0.107)	(0.099)	(0.111)	(0.106)
Demand control	No	Yes	Yes	Yes
Month FE	Yes	Yes	No	No
Month*Team FE	No	No	No	Yes
R^2	0.812	0.812	0.819	0.819
N	1519	1519	1519	1519

Standard errors in parentheses
All standard errors are robust and clustered at the individual level.
* p < 0.10, ** p < 0.05, *** p < 0.01

Table 9: Peer effects on true low productivity temporary weavers

Dep. = Δeff_{ijt}	(1)	(2)	(3)	(4)
Δa_{-ijt}	-0.057	-0.057	-0.041	-0.024
	(0.050)	(0.054)	(0.046)	(0.048)
Δa_{-i-jt}	-0.147	-0.141	-0.103	0.100
	(0.093)	(0.102)	(0.156)	(0.152)
Demand control	No	Yes	Yes	Yes
Month FE	Yes	Yes	No	No
Month*Team FE	No	No	No	Yes
R^2	0.810	0.811	0.819	0.815
N	1274	1274	1274	1274

Standard errors in parentheses
All standard errors are robust and clustered at the individual level.
* p < 0.10, ** p < 0.05, *** p < 0.01

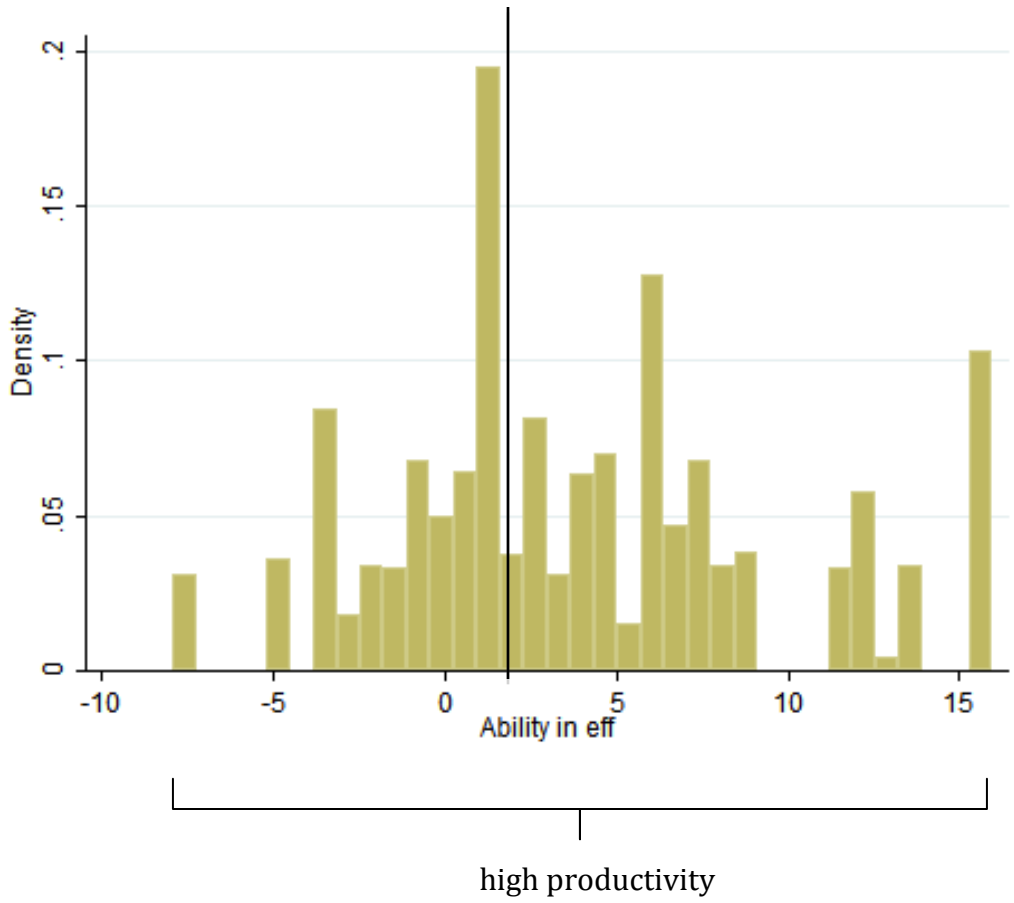

Figure 8: Distribution of the time-invariant innate ability of weavers who do not have true low productivity weavers as teammates

Table 10: Peer effects on high productivity temporary weavers without true low productivity teammates

Dep. = Δeff_{ijt}	(1)	(2)	(3)	(4)
Δa_{-ijt}	-0.069	-0.013	-0.162	-0.105
	(0.273)	(0.250)	(0.313)	(0.295)
Δa_{-i-jt}	0.075	0.106	0.047	0.053
	(0.112)	(0.109)	(0.152)	(0.156)
Demand control	No	Yes	Yes	Yes
Month FE	Yes	Yes	No	No
Month*Team FE	No	No	No	Yes
R^2	0.842	0.842	0.843	0.843
N	1786	1786	1786	1786

Standard errors in parentheses
All standard errors are robust and clustered at the individual level.
* p < 0.10, ** p < 0.05, *** p < 0.01

Table 11: Peer effects on high productivity temporary weavers who are considered low productivity without true low productivity teammates

Dep. = Δeff_{ijt}	(1)	(2)	(3)	(4)
Δa_{-ijt}	-0.171*	-0.142	-0.116	-0.122
	(0.097)	(0.084)	(0.115)	(0.124)
Δa_{-i-jt}	0.468	0.495*	0.285	0.155
	(0.314)	(0.283)	(0.267)	(0.281)
Demand control	No	Yes	Yes	Yes
Month FE	Yes	Yes	No	No
Month*Team FE	No	No	No	Yes
R^2	0.790	0.790	0.793	0.792
N	1774	1774	1774	1774

Standard errors in parentheses
All standard errors are robust and clustered at the individual level.
* p < 0.10, ** p < 0.05, *** p < 0.01

Table A1: Random assignment within a team

Dep. = Δeff_{it}	(1)	(2)
a_{-i}	-8.741***	-9.684***
	(1.768)	(1.638)
$a_{-i} - a_{-it}$	8.764***	9.701***
	(1.765)	(1.642)
Week FE	No	Yes
Team FE	Yes	Yes
R^2	0.578	0.595
N	6678	6678

a_{-it} is the average ability of weaver i's teammates in week t. a_{-i} is the average ability of all of weaver i's teammates including those not working in week t.
Standard errors in parentheses
All standard errors are robust and clustered at the individual level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$