Pre-Analysis Plan for "The Impact of PEJA on skills acquisition and employment outcomes"

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1 Introduction

1.1 Motivation

Apprenticeships, which provide informal on-the-job training through which a master craftsperson imparts his (or her) skills to an apprentice, are one of the main sources of skills development in Africa (Filmer and Fox, 2014; Adams et al., 2013), and they are of particular prominence in Senegal (Chort et al., 2014; Aubery and Giles, 2018). Apprenticeships differ widely by type, modality of training (especially duration), regulation and activities across the continent (Palmer, 2020), ranging from traditional apprenticeships, where skills are imparted on the job only, to *dual* apprenticeships which includes both on the job and theoretical training in class. . The few rigorous studies available suggest that apprenticeships allow young people without education to find work and to achieve greater earnings (Frazer, 2006; Monk et al., 2008; Teal, 2016; Aubery and Giles, 2018; Krafft, 2018; Hardy et al., 2019), but that the returns to participating in apprenticeships depend on the quality of accumulated skills and the ability of apprentices to start workshops of their own.

In 2019, the Government of Senegal (Ministère de la Formation professionnelle, de l'Apprentissage et de l'Insertion, MFPAI) launched a new program, *Improving Youth Employability Through Informal Apprenticeship (PEJA)*, that aims to improve the skill-acquisition features of traditional apprenticeships in Senegal. The program aims to: (1) strengthen the existing informal apprenticeship system by developing curricula, pedagogical materials and a certification process, (2) improve the training in itself by providing technical training to master crafts persons and capital grants to upgrade workshops, and to raise the socio-emotional and business skills of apprentices, and (3) to increase opportunities for apprentices who complete their training by providing them with financial assistance.

This study investigates the effect of the PEJA on apprentices and their masters, two years after the first interventions. It relies on a baseline and an endline survey, and a randomized assignment to treatment.

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1.2 Research questions

Key Research Questions:

- Does the intervention contribute to the acquisition of skills (both technical and socioemotional)?

- Does the intervention influence the duration and completion of training and access to the labor market of youth who participate in apprenticeships? Informal apprenticeships tend to be long, and qualitative interviews suggest that some master craftsmen may delay completion of apprenticeships in order to maximize a return on their investment in training apprentices. By offering a certification process, the program may plausibly bring a quicker completion to the apprenticeship period.

- What are the relative benefits of the socio-emotional training component of the intervention? How might behavioral changes after participating in socio-emotional training affect the probability of completing apprenticeships and the subsequent work outcomes of participants?

- To what extent might positive (or negative) effects of the program on skills acquisition and subsequent labor market outcomes be driven by knowledge spillovers or displacement effects?

- Does the intervention have an impact on business performance and firm composition?

- Is heterogeneity across workshops in the disciplinary environment an important determinant of heterogeneity in learning outcomes? More specifically, is the acquisition of both trade specific and socioemotional skills influenced by whether a master craftsperson uses corporal punishment as a means of disciplining apprentices? From the baseline survey, we learned that nearly 55 percent of master craftspersons use corporal punishment, or threats of corporal punishment, to discipline apprentices. A wealth of literature from the education psychology field suggests that experiencing corporal punishment can have negative effects on both cognitive and socioemotional development.

2 Description of the intervention

The PEJA project ("Improving Youth Employability through Informal Apprenticeships") seeks to facilitate skills transfer to apprentices by providing equipment grants to master craftspersons, along with providing additional training (technical skills, business skills and socio-emotional skills) to craftspersons and apprentices alike, and then introducing additional incentives for apprentices to complete formal certification of their skills. The main beneficiaries are young informal apprentices, aged 15 to 25, and their masters. It is worth noting that the program does not place youth in workshops: beneficiaries are apprentices who have selected themselves into apprenticeships before the beginning of the program. The project targets urban areas, where traditional apprenticeships are more prevalent: it is implemented in the four departments of the Dakar region and in 15 regional capitals or economic hubs (Diourbel, Fatick, Kaffrine, Kaolack, Kedougou, Kolda, Louga, Matam, Mbacke, Mbour, Saint-Louis, Sedhiou, Tambacounda, Thies, and Ziguinchor). In its first wave the program targeted workshops from 8 trades (tailoring, metalwork, woodwork, auto-mechanics, hairdressing, market gardening, refrigeration/air conditioning, processing of fruits and vegetables).

At the level of the apprentice, the PEJA consists of the following interventions:

- *Literacy training for illiterate apprentices*. Apprentices were assigned to this treatment based on their level of formal education.
- *Business skills training*. Business skills training was provided in class. It followed the Start and Improve your Business curricula (with a focus on "Generate your business idea" and "Start your business") adapted for the apprentice population.
- *Socio-emotional skills training.* The training was provided in class and covered self-esteem, self-affirmation, sense of initiative, compliance with commitment, risk-taking, communication, problem solving, perseverance, and networking.
- *Two one-time cash transfers to enable youth to embark on a path of self-employment.* First, an economic inclusion cash transfer (US$200, with a 50 percent premium for women) provided to young apprentices, conditional on participation in the business training. Second, a performance-based cash transfer (US$216 with a 100 percent premium for women) provided to apprentices who have obtained validation of their skills.

At the master craftsperson level, the PEJA interventions aimed at benefiting apprentices indirectly through an improvement of their learning environment. This includes the following components:

- *Technical training for masters.* Once the masters' needs have been identified, the project supported a technical training (5 days in class). This activity was expected to expand the scope of technical skills transferred and to improve the quality of apprenticeship training.
- *Business skills training.* Business skills training was provided in class. It followed the Start and Improve your Business curricula (with a focus on "Improve your business").
- *Socio-emotional skills training.* The training was provided in class and covered self-esteem, self-affirmation, sense of initiative, compliance with commitment, risk taking, communication, problem solving, stress management, teamwork, conflict resolution and leadership.
- *Pedagogical skills training*. This training aimed at improving the transmission of technical skills to apprentices.
- *Capital grant to upgrade the technology used in the workshop.* Equipment (worth US$2,000 on average) was provided to masters after an assessment of their needs during the business skills training.

3 Research strategy

3.1 Sampling

This impact evaluation is conducted on the first wave of the implementation of the PEJA. Of the eight trades targeted by the first wave, our experiment focuses on five (Tailoring, woodworking, metalwork, auto mechanics, and hairdressing). The selection into the program followed the following steps. First, a call for expressions of interest was communicated to master-craftpersons in the handicraft sector, and masters were asked to fill a form with basic characteristics of their workshop (capital and labor force). After a pre-selection based on the characteristics (to eliminate workshops without eligible apprentices or of the wrong trade), workshops were visited to verify the self-reported characteristics, and a list of eligible workshops was created. Then, eligible workshops were assigned to one of the two treatments.

The survey was implemented in all localities targeted by the program, which includes Dakar (départements of Dakar, Guediawaye, Pikine and Rufisque) and 15 secondary cities in Senegal (Diourbel, Fatick, Kaffrine, Kaolack, Kedougou, Kolda, Louga, Matam, Mbacke, Mbour, Saint-Louis, Sedhiou, Tambacounda, Thies, and Ziguinchor). The survey covered all eligible workshops in the first wave of the PEJA, in the five trades targeted by the impact evaluation.

At baseline, the sample consisted of 6129 apprentices, under the supervision of 2144 masters, in 2124 workshops.[5] To be eligible, apprentices had to be between 15 and 25 years old (inclusive). This is the case for 95% of our sample. On average 2.9 apprentices were interviewed per workshop.

At endline, the sample was extended and updated by interviewing a new apprentice in every workshop where at least one apprentice was recruited since baseline and was a member of the workshop at the time of the survey.

3.2 Assignment to treatment

Assignment to the two treatment groups was done in February 2021 using Stata and QGIS. The selection protocol differs for tailors and the other four trades. The selection was performed at the workshop level. When a workshop is selected, the master and his/her apprentices are all beneficiaries of the same treatment arm. In the few cases where two sampled masters were in the same workshop, the two of them (and their respective apprentices) are allocated to the same group.

For woodworkers, metalworkers, auto-mechanics and hairdressers, the selection was stratified by trade and localities (19 localities).

For tailors, the selection followed a more complex protocol to assure variation in the distance to the nearest treated workshop:[6]

1. First, we identified proximity clusters using workshop GPS locations. Two workshops within 300 meters of each other (240 meters in secondary cities) are considered part of the same cluster.
2. The 284 identified clusters were classified into three categories depending on their size: 157 clusters with only one workshop, 115 middle-size clusters and 12 large clusters.
3. For each category, a sixth of the clusters were randomly selected to be pure controls, meaning that all workshops were allocated to the control group.
4. In the remaining clusters, in each locality, workshops were randomly assigned to the two treatment groups.

The experiment allows us to distinguish between control tailors in control clusters and control tailors in treated clusters, creating an exogenous source of variation in the distance to the nearest workshop.

[5] In 20 workshops, two masters have been interviewed.

[6] The geographical sampling strategy was only implemented in the following localities: Dakar, Guediawaye, Pikine, Rufisque, Thies, Mbour, Saint-Louis, Louga, Sedhiou, Tambacounda et Ziguinchor. The rational was to exclude the cities that had a small number of clusters and were at risk of being entirely assigned to the control group.

After selection, the three groups were distributed as follows:

- 2166 apprentices and 754 masters (in 745 workshops) in the full package treatment[7]
- 1990 apprentices and 696 masters (in 690 workshops) in the alternative treatment group[8]
- 1973 apprentices and 694 masters (in 689 workshops) in the control group

3.3 Statistical power and attrition

Power calculations, adjusted after the completion of the baseline survey and assignment to treatment, suggest that there is sufficient power to identify impacts of each treatment relative to the control group. Treatments occur at the apprentice level (socio-emotional and business skills) and the workshop/artisan level (master crafts person receives training and capital grant). The power analysis thus takes the potential for intra-workshop correlation among apprentices into account (with three options: 5%, 25% and 50% of intra-workshop correlation). The higher the correlation, the lower the extra information brought by an additional apprentice surveyed in a workshop.

Under the assumption that 15% of apprentices may not be found by the end-line survey, the minimum detectable effect on probability of employment ranges between 4.0 and 5.8 percentage points (or 0.10 to 0.14 standard deviations) depending on the level of intra-cluster correlation within workshop clusters (Table 1 in annex). This suggests that we can identify effects considerably smaller than those reported elsewhere in recent research on employment impacts of apprenticeship training: Hardy and McCasland (2023) find that subsidizing apprenticeships increased the likelihood of completing training by 10 percentage points (from a mean of 25%). With respect to examining employment, Das (2021) reports that training disadvantaged youth led to an increase in labor force participation of 16 percentage points.

3.4 Data collection

Following a selection process into the PEJA, the MFPAI provided a list of masters and apprentices in five trades (tailoring, woodwork, metalwork, auto mechanics, and hairdressing) eligible to the first wave of the program. To accommodate the statistical power needs of the experiment, the entire list became the target of the baseline survey. The baseline survey was implemented from December 2020 to January 2021 by the Centre De Recherche Pour Le Développement Économique et Social (CRDES). By definition, at baseline, all interviewed apprentices were working under the supervision of one of the interviewed masters. In each workshop, 2 to 4 apprentices were interviewed. The interviews took place in the workshop. Overall, the sample consisted of 6129 apprentice and 2144 masters in 2124 workshops. Additionally, a household questionnaire was administered to the household head of the household of each apprentice. A total of 5419 households were visited, covering 5728 apprentices in the sample.

[7] For masters, the full treatment includes a capital grant to upgrade technology, technical training, business skills training, socioemotional skills training and pedagogical skills training. For apprentices, the full treatment includes literacy training, business skills training, socio-emotional skills training, a cash-transfer conditional on participation in business skills training, and a cash transfer conditional on certification.

[8] The alternative treatment leaves out socio-emotional skills training for both masters and apprentices.

Data was collected with Survey CTO, then cleaned and process using Stata.

The endline survey started on September 2023 and is expected to be completed by the end of April, 2024. The goal of the survey was to track masters and their apprentices from the baseline sample, independently to their current employment or apprenticeship status. In addition, in every workshop, a "new apprentice" was interviewed in cases when at least one apprentice joined the workshop since baseline and was still an apprentice at the time of the survey.

4 Empirical analysis

4.1 Main explanatory Variables

The main explanatory variable is the assignment into control and treatment groups. This variable identifies workshops assigned to the full package (T1), the alternative package (T2), and to the control group (C). In addition, at endline, apprentices and master-craftspersons will self-report participation in the various components of the PEJA package of activity (trainings, cash transfers, equipment grants).

4.2 Outcomes

4.2.1 Outcomes at the apprentice level

At the apprentice level, we are interested in the impact of the program on skills accumulation, training completion and employment outcomes. In particular, we measure the following outcomes:

- Test scores
    - *Mathematics and reading test scores*. The tests are similar at baseline and endline. The mathematics test includes 11 questions. The reading test consists of a letter reading test, a syllable reading test and paragraph reading test. The scores will be computed using item response theory (mathematics score, reading score and a combined score).

    - *Socio-Emotional Skills scores*. The same tests were used at baseline and endline (72 questions in total). The skills include decision making (13 questions), personal initiative (10), perseverance (7), self-control (8), expressiveness (6), collaboration (10), negotiation (8), and listening (10). The skills will also be gathered into two composite score for intrapersonal skills (decision making, personal initiative, perseverance, self-control) and interpersonal skills (expressiveness, collaboration, negotiation, and listening). Scores will be computed using item response theory (graded response models for ordered categorical items).

    - *Technical skills*. A trade specific test was administered orally at endline. It consisted of 12 to 16 questions per trade. The scores will be computed for each trade separately using item-response theory. Additionally, apprentices were asked to report how confident they are with their knowledge of 12 trade-specific technical skills, based on the official curricula. This will be used to compute a score reflecting the self-assessment of technical skills. The score will be computed with item response theory.

- *Business skills test score*. A specific test was designed and administered at endline. The test consisted of 21 questions. Eight of those were skipped if the respondent had already started his/her business. The score will be computed using item response theory.

- Status with regard to apprenticeship training:
-
  - *Apprentice still in training* as of endline survey, whether with the baseline master or with another one.
  - *Total training duration* as of endline survey. This duration will reflect the total time spent in training for those who are no longer apprentices and the duration until the survey date for those who are still in apprenticeship.

  - *Successful completion* of the apprenticeships training. This information will either be self-reported by the apprentice or reported by masters. Completion is not defined by the obtention of a diploma but by whether an apprentice had been "liberated" by his/her master.

  - *Apprentice was certified* since baseline.

  - *Apprentice joined another master* since baseline.

- Employment and income:
  - *Employment status* as of endline survey, as defined by having worked during the last 7 days or during the last 2 months.

  - *Work intensity* as measured by the number of hours worked in the last 7 days.

  - *Type of employment* (self-employment, employee, family worker).

  - *Sector of employment* ((a) agriculture, industry, and services; (b) handicraft sector or not). The handicraft sector overlap industry and services.

  - *Income from main and secondary occupation*. This refers to the income received over the last month and the usual income for a given period.

  - *Entrepreneurship* (apprentice has created his/her own business as of endline survey).

- *Exposure to physical discipline*. At endline, prevalence of corporal punishment and psychological violence as disciplining tools will be measure indirectly (at the sample level) via a list experiment and at the individual level for a subset of apprentices.

The impact of the program on apprentices' life will also be computed on a set of secondary outcomes:

- *Marital status*, defined as being married at the time of the survey.

- *Motherhood* and *fatherhood*. Note that at baseline, only women were asked whether they had given birth.

- *Migration out of Senegal at the time of the survey*. This information is collected by the survey firm at the time as part of the tracking of apprentices. Apprentices who were living out of the country at the time of the survey were not interviewed individually but their status was reported by enumerators during the tracking effort.

4.2.2 Outcomes at the master's level

At the master's level, we will observe the impact of the project on the accumulation of skills (business and socio-emotional skills) and their status in the profession. More precisely, we will measure the following outcomes:

- Tests scores:
  - *Business skills scores*. Masters were tested for their business skills at baseline with 20 questions. In addition to the same baseline questions, the test was expanded at endline by two more questions. The score will be computed using item response theory.

  - *Socio-emotional skills*. The same tests were used at baseline and endline (33 questions in total). The skills include empathy (7 questions), collaboration (7), interpersonal influence (4), expressiveness (4), emotional regulation (5) and personal initiative (6). The skills will also be gathered into two composite score for intrapersonal skills (personal initiative and emotional regulation) and interpersonal skills (interpersonal influence, expressiveness, empathy and regulation). Scores will be computed using item response theory (graded response models for ordered categorical items).

- Status in the profession
  - *Master artisan is still operating his business* as of the endline survey.

  - *Number of apprentices in charge* as of endline survey.

  - *Master artisans got certified* since baseline.

- Attitudes toward disciplinary measures

4.2.3 Outcomes at the business level

- Business performance:
  - *Business failure* as of endline survey. This define a business that was no longer operating at the time of the survey.
  - Logarithm of *sales*, *profit* and *master's income*. For sales and profit, this refers to sales and profit made over the last month and the last year. For master's income, it refers to the month before the survey.

- Business structure / vertical integration:
  - *Business size* as measured by the total number of workers and the number of apprentices and number of compagnons.

- *Business workforce composition* as measured by the shares of apprentices and of compagnons among workers.
- *Retention of apprentices (or apprentice turnover)*, as measured by the share of baseline apprentices who are still members of the workshop and the number of new apprentices hired since baseline.
- *Human capital of new apprentices*. This will be measured by the level of education (years of formal education, technical education), mathematics skills, reading skills, and socio-emotional skills (decision making, personal initiative, perseverance, self-control, expressiveness, collaboration, negotiation, and listening). Those variables will only be computed in workshops where at least one apprentice got hired since baseline and was still working at the time of the endline survey.

4.3 Balancing tests

Balancing tests were conducted with baseline data across a range of apprentices, masters and business characteristics. There was balance across both treatments and control.

4.4 Treatment effects

4.4.1 Effect of the PEJA on apprentices and masters

4.4.1.1 Intention to treat

To measure the impact of the PEJA on outcomes at the apprentice level, we will estimate the following models for apprentices $(1.a)$ and masters $(1.b)$:

$$Y_{ij} = \beta_0 + \beta_1 T_j + \beta_2 X_i + \beta_3 Z_j + \mu_c + \varepsilon_{ij} \quad (1.a)$$

$$Y_j = \beta_0 + \beta_1 T_j + \beta_3 Z_j + \mu_c + \varepsilon_j \quad (1.b)$$

where Y_{ij} is an outcome of interest for apprentice *i* under the supervision of master *j* as observed at endline, and Y_j is an outcome of interest for master *j*. T_j is an indicator for assignment to treatment, at the workshop level. X_i is a vector of apprentices' characteristics at baseline. Z_j is a vector of workshop and masters' characteristics at baseline. μ_c are city/neighborhood and/or trade fixed effects. Estimated via OLS, the coefficient $\hat{\beta}_1$ estimates the intent to treat effect. Depending on the specification, T_j will either identify all treated workshops (in both treatment groups), or workshop in each of the treatment groups separately. The comparison between the two treatment groups will estimate the specific effect of the assignment to a socio-emotional skills training. To correct for attrition, we plan to weight observations by their inverse probability of selection into the endline survey.

For outcomes for which a baseline measurement exists (socio-emotional skills, literacy and numeracy skills for apprentices; socio-emotional skills and business skills for masters), we plan to use a value-added model and a double difference specification. First, the value-added model will take the following form for apprentices $(2.a)$ and masters $(2.b)$:

$$Score_{ijt} = \beta_0 + \beta_1 T_j + \beta_2 X_i + \beta_3 Z_j + \beta_4 Score_{ijt-1} + \mu_c + \varepsilon_{ij} \quad (2.a)$$

$$Score_{jt} = \beta_0 + \beta_1 T_j + \beta_3 Z_j + \beta_4 Score_{jt-1} + \mu_c + \varepsilon_j \quad (2.b)$$

where $Score_{ijt}$ is the test score at endline of apprentice *i*, under the supervision of master *j*; $Score_{jt}$ is the score at endline for master *j*; and $Score_{ijt-1}$ and $Score_{jt-1}$ are the lagged scores measured at baseline.

Alternatively, we will use a double difference specification of the following form for apprentice-level $(3.a)$ and master level $(3.b)$ outcomes:

$$Score_{ijt} = \beta_0 + \beta_1 T_j + \beta_2 P_t + \beta_3 T_j * P_t + \beta_4 X_i + \beta_5 Z_j + \mu_c + \varepsilon_{ij} \quad (3.a)$$
$$Score_{jt} = \beta_0 + \beta_1 T_j + \beta_2 P_t + \beta_3 T_j * P_t + \beta_5 Z_j + \mu_c + \varepsilon_j \quad (3.b)$$

where P_t takes the value 1 for observations in the endline survey. In that case, the program impact will be estimated by coefficient β_3.

4.4.1.2 Treatment on the treated

As we don't expect all apprentices assigned to treatment to receive benefits, we will estimate a treatment on the treated (TOT) effect using assignment as an instrument. As the program consisted of several components, we will measure the TOT for each of the component received by apprentices (business skills training, socio-emotional skills training, literacy training and cash transfer) and masters (technical skills training, pedagogical training, business skills and socio-emotional skills training, equipment grant) separately. Participation in each component of the PEJA are self-reported by apprentices and masters at endline.

4.4.1.3 Heterogeneous treatment effects

The PEJA is likely to affect apprentices in a different way depending on their gender (as men and women face different constraints and opportunities on the labor market) and their experience in the trade. Similarly, female artisans might react differently to the benefits of the PEJA. We will examine the heterogenous treatment effect of the PEJA by gender of the apprentice and masters. To do this, we will focus on apprentices and masters in tailoring, the only trade in our sample that includes workers of both genders. Specifically, we will estimate the following equations for apprentices $(4.a)$ and masters $(4.b)$:

$$Y_{ij} = \beta_0 + \beta_1 T_j + \beta_2 Female_i + \beta_3 Female_i * T_j + \beta_4 X_i + \beta_5 Z_j + \mu_c + \varepsilon_{ij} \quad (4.a)$$
$$Y_j = \beta_0 + \beta_1 T_j + \beta_2 Female_j + \beta_3 Female_j * T_j + \beta_5 Z_j + \mu_c + \varepsilon_j \quad (4.b)$$

where $Female_i$ and $Female_j$ takes the value 1 if the apprentice or master is female and 0 otherwise.

Secondly, using a similar equation on the whole sample, we will investigate to what extent the program has a different impact with regard to the age and experience of the apprentices. To do this, we will interact the treatment variable with age and years of experience variables (as continuous of categorical variables).

4.4.2 Displacement effect

In order to test the presence of displacement effect in a job placement program, the analysis will be restricted to apprentices and artisans in tailoring workshops, as the geographic sampling strategy was only implemented for this trade, and who were assigned to the control group. If any, treated workshops in the control group will be excluded from this sample of analysis. We will estimate the equations for apprentice-level $(5.a)$ and master-level outcomes $(5.b)$:

$$Y_{ij} = \beta_0 + \beta_1 D_j + \beta_2 X_i + \beta_3 Z_j + \mu_c + \varepsilon_{ij} \quad (5.a)$$

$$Y_j = \beta_0 + \beta_1 D_j + \beta_3 Z_j + \mu_c + \varepsilon_j \quad (5.b)$$

where Y_{ij} is the outcome of interest for apprentice *i*, under the supervision of master *j*, and Y_j is the outcome of interest for master *j*. As in previous equations, X_i is a vector of apprentices' characteristics at baseline; Z_j is a vector of workshop and masters' characteristics at baseline, and μ_c are city/neighborhood fixed effects. The variable D_j will measure the distance to treatment in three forms:

- First, D_j will take the value 1 if the apprentice was in a control workshop in a treatment cluster at baseline and 0 if he was in a workshop in a control cluster. In this case, β_1 will measure the effect of being untreated in a treatment cluster.

- Secondly, D_j will be the minimum distance to a treated workshop.

- Lastly, D_j will be the intensity of treated workshop around the control workshop. It will be measured as the number and share of treated workshop in a defined perimeter around the workshop.

4.5 Standard errors adjustments

Standard errors will be clustered at various level depending on the outcome (apprentice- or master craftsperson-level) and the sample (all trades or tailors only). Two considerations are guiding the decision. First, the treatment was allocated at the workshop level, and every eligible apprentice in the workshop at baseline was assigned to the same treatment group. Secondly, the random assignment into treatment was stratified by *département* and trade. Lastly, the two-step geographical sampling for tailors relied on the creation of "selection clusters", a subdivision of the *département* level.

Therefore, we will follow the the following strategies to cluster standard errors:

- In models with apprentice-level outcomes, standard errors will be clustered either at the workshop level or at the *département*-trade level.
- In models with master-craftsperson-level, standard errors will be clustered at the *département*-trade level.
- When the analysis is restricted to the tailors, standard errors will be clustered at the "selection clusters" level.

As we are examining several outcomes from two alternative randomized treatments, we will also use appropriate approaches to multiple hypothesis testing to assess robustness of results to false discovery and familywise error.

5 Research Team

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Appendix – Power calculation

What is the minimum effect size of the overall impact of the PEJA on the probability to complete the apprenticeships training, acquisition of skills and labor market outcomes? To answer this question, our strategy is to compare apprentices receiving the full treatment, including both socioemotional skills training and trade specific training (distributed in 763 workshops, with 2.8 apprentices per workshop), to apprentices in the control group (in 695 workshops). Table 1 presents the hypothetical power calculations for the comparison between the two groups of workshops. This sample size (4170 apprentices in 1458 workshops in total) would have sufficient power to detect a minimum effect that ranges from 3.7 to 5.7 percentage points (equivalent to 0.09 to 0.14 standard deviations) on the probability of employment, depending on the power considered (0.8 or 0.9) and the magnitude of the intra-cluster correlation (0.05, 0.25 and 0.5).4 The power calculation takes the potential attrition of apprentices into account. Under the assumption of a 15% attrition rate among apprentices, the minimum detectable effect on the probability of employment ranges between 4.0 and 5.8 percentage points (equivalent to 0.10 to 0.14 standard deviations). 5 Alternatively, the power calculation can be conducted on other potential outcomes, such as apprenticeship duration, self-employment, probability of having their own clients while in training and test scores

Table 1 - Hypothetical Power (comparison between two groups)

Probability of employment

Clustering and selection at workshop level

	With Intra-Cluster Correlation of 0.05		With Intra-Cluster Correlation of 0.25		With Intra-Cluster Correlation of 0.50	
	Power (k)		Power (k)		Power (k)	
	0.8	0.9	0.8	0.9	0.8	0.9
Number of clusters in treatment group	763		763		763	
Number of clusters in control group	695		695		695	
Cluster size	2.8		2.8		2.8	
Intra-cluster correlation	**0.05**		**0.25**		**0.5**	
Significance level	0.05		0.05		0.05	
Probability of employment	0.79		0.79		0.79	
Standard deviation	0.41		0.41		0.41	
Total sample size (number of apprentices)	4170		4170		4170	
Minimum detectable effect						
In percentage points	3.7 p.p.	4.3 p.p.	4.3 p.p	5.0 p.p.	4.9 p.p.	5.7 p.p.

In standard deviations	*0.091*	*0.105*	*0.105*	*0.12*	*0.12*	*0.14*
Cluster size with 15% attrition	2.431		2.431		2.431	
Sample size with attrition	3544		3544		3544	
Minimum detectable effect (with attrition)						
In percentage points	0.0399	0.0462	0.045	0.0521	0.0506	0.0585
In standard deviations	*0.097*	*0.113*	*0.11*	*0.127*	*0.123*	*0.143*

Table 2 presents the minimum detectable effect for those outcomes when comparing two groups of 763 and 695 workshops respectively. Potential test scores outcome include scores from literacy, numeracy, business skills and socio-emotional skills. A baseline score has been measured for those outcomes, considerably enhancing the statistical power of the sample.

Table 2 - Minimum detectable effect
(comparison between two groups of 763 and 695 workshops with 2.81 apprentices per workshop)

Intra-cluster correlation=0.25 ; Power=0.8 ; Significance level = 0.05

Potential outcomes	Mean	S.D.	Minimum detectable effect	
			Full sample	With attrition
Training duration (in years)	4.43	2.73	0.287	0.300
Probability of having own clients	0.38	0.49	0.051	0.053
Probability of being self-employed	0.25	0.43	0.0452	0.0472
Standardized test score	0	1	0.105	0.110