Benefits and Costs of Dual and Informal Apprenticeship in Bénin*

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Abstract

This paper evaluates the costs and benefits of apprenticeship training in the informal sector in Benin using unique matched apprentice-firm survey data. Costs and benefits for the training firm and the trainee are investigated separately. Special attention is paid to the net benefits of the *Certificat de Qualification Professionelle*, program, a national dual training program. Two cost and benefit models of differing complexity are used: in the simplest, fees comprise all benefits for the firm, while apprentice wages and benefits represent total costs. In a second, more complex model, estimates of current and future productivity, apprentice retainment by the firm, and training costs are also considered. We find that apprentices benefit from training in terms of improved competence and experience. Fees paid to the training firms account are not enough to defray the expenses associated with training, which are dominated by allowances paid to apprentices. Most firms report net costs from training, though large firms appear to benefit when apprentice productivity is considered. Participation in the CQP program is not associated in any benefits for either trainees or firms relative to non-participating apprentices.

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1 Introduction

In sub-Saharan Africa (SSA), interest in apprenticeship is on the rise. According to survey data, informal apprenticeships (also referred to as apprenticeships in the informal economy or traditional apprenticeships) are estimated to provide as much as 95 percent of technical and vocational education and training (TVET) in SSA, and in many cases account for as much as 90 percent of total employment in the crafts sector (Walther and Filipiak, 2007; World Bank, 2017). Informal sector training is seen by many policy experts as an important tool to tackle the youth employment challenge facing the continent (Filmer and Fox, 2014).

For youth who drop out of school early, informal on-the-job training is often the best alternative route to acquiring skills necessary for starting a business or seeking employment. Many African youth cannot afford to stay enrolled in formal schooling, and several studies have indeed documented positive returns to informal apprenticeship training, especially for youth with no or little education (Monk et al., 2008; Teal, 2016).

While abundant and flexible, training in the informal economy is subject to little oversight, with apprentices often exposed to inexperienced or exploitative trainers. Moreover, since informal apprenticeships are often outside formal accreditation systems, they offer limited labor market mobility relative to formal education and training schemes (World Bank, 2017). Policies introducing competency-based, nationally-accredited certification of informal apprenticeship are a potential solution to this issue, and have been introduced in countries such as Malawi and Tanzania.

In 2008, the West African country of Bénin introduced the *Certificat de Qualification Professionnelle* (CQP) program, which combines national accreditation with the dual system approach popularized in Switzerland and Germany. In the dual system, apprentices in informal firms supplement on-the-job training with weekly classroom training. Dual training entails higher costs than traditional apprenticeship, and the long-term

viability of such a scheme rests on its value proposition for apprentices, firms, and any external subsidizing sponsors (aid agencies and the government). Thus, an understanding of the cost-sharing underpinning the program is crucial for planning an incentive structure that motivates both firm and apprentice participation.

In this paper, we employ matched firm-apprentice survey data collected in two waves (2019 and 2021) to estimate the net benefit of training for firms, then investigate the impact of informal and dual system apprenticeship training on both apprentice learning and the profitability of their training firms. Outcomes are collected for CQP participants, traditional apprentices who unsuccessfully applied to the CQP program, and non-applicants, allowing us to identify the impact of dual system training and potential selection effects into CQP training.

We find that the majority of firms suffer net losses over the duration of the apprenticeship. The proportion of firms with negative net benefits from training, and the magnitude these losses, vary considerably depending on assumptions around allowances disbursed by the firms. Larger firms benefit the most, while smaller firms suffer the largest losses, suggesting that economies of scale contribute to the incentive structures surrounding firm training.

The paper proceeds as follows. Informal apprenticeship in Bénin and the CQP program are described in detail in Section 2. The survey data used for the analysis is presented in Section 2. Results are presented in Section 4. Section 5 concludes.

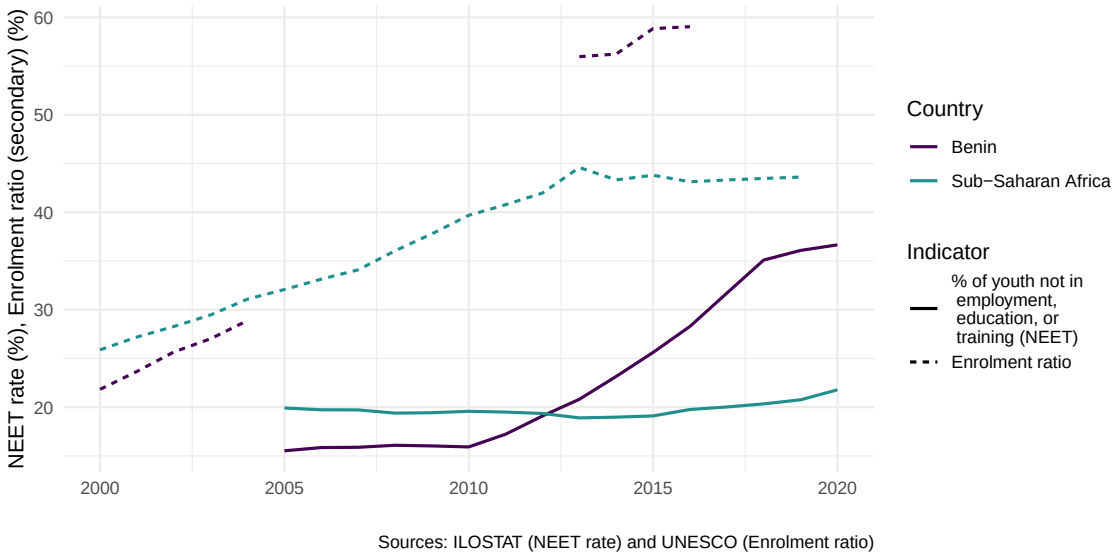
2 Country Context

In Benin, access to formal technical and vocational education and training (TVET) is conditional on finishing the second year of secondary school, equivalent to completing nine years of education. However, among 5- to 17-year-olds, the median years in education is four. As a result, only 5 per cent of secondary age youth are in TVET, totalling around 50,000 young people. (*ILO case*

study) *However, net enrolment among 12- to 19-year-olds is only around 35 per cent. All the other young people have no other choice but to turn to the informal economy to acquire skills through informal apprenticeship, which allows them to enter the labour market. It is estimated that these young people in apprenticeships account for more than 300,000.*(ILO, 2021)

Despite the relative stability of its democratic government and strategic importance as a transportation hub, Bénin (population approx. 12.1 million) performs poorly on many development indicators, ranking 158th out of 189 countries on the Human Development Index in 2020. Youth employment is a particularly pressing issue, with an alarming decrease in youth labor force participation in the past decade. As in other parts of SSA, secondary and tertiary school enrollment has seen a steady increase in the past two decades, but with the primary effect of displacing employment: according to the most recent labor force surveys, the youth employment-to-population ratio decreased by 22%, from 40% to 31%, between 2011 and 2018, compared to an 8% decrease for adults over the age of 25 over the same time period. Meanwhile, the share of youth neither in employment, education or training (NEET) increased from 17.2% in 2011 to 35.1% in 2018 (Figure 1) - one the highest rates in West Africa, and the world (ILO, 2022).

Figure 1: Rates of youth enrolment and inactivity: Bénin and SSA



As enrollment in formal education has not translated to increasing rates of youth employment, interest in promoting alternative pathways to the labor force has grown. In economies with large informal sectors, apprenticeships with small workshops are the most important source of skills for early school leavers, accounting for as much as 95 percent of TVET in SSA (Walther and Filipiak, 2007). Meanwhile only six percent of young workers are estimated to participate in formal TVET in Africa (Hofmann et al., 2022).

The International Labor Organization (ILO) defines apprenticeships as "systematic long-term training for a recognised occupation that takes place substantially within an undertaking or under an independent craftsman and should be governed by a written contract...and be subject to established standards" (Steedman, 2014). Though generally unregulated at the national level, informal apprenticeships are nevertheless structured according to the dictates of tradition and the customs of local professional associations, and are generally considered more effective at generating relevant skills than formal TVET (Ahadzie, 2009). Recent examples of investment in Bénin's apprenticeship system include $6.3 million from the World Bank's for the Benin Youth Employment Project (PEJ), completed in 2019, and a planned $16.4 million dollar investment in strengthening the TVET system starting in 2020 (World Bank, 2020).

2.1 Dual Apprenticeship in Bénin

Dual apprenticeship is a particular form of this institution, most popular in Germany and Switzerland but practiced across Europe, which combines on-the-job training with continued classroom-based general and trade-specific education. Generally, apprentices in the dual system spend between 20 and 30 percent of their training in the classroom, and train for two to four (most commonly three) years, depending on country and trade. *Theory training enables young people to acquire general education as well as technical and vocational skills.* Due to the additional costs of classroom training, investments per apprentice will

be higher, whether these are covered by the apprentice (in the form of a wage reduction), the firm, or state subsidies. Evidence from Germany suggests that dual training results in net costs in the time of training, which is recouped by firms when apprentices stay with the firm after training Pfeifer et al. (2009); though recent results suggest that net benefits during the training period are closer to neutral when the impact of hiring an apprentice on profits is compared to the hiring of similarly unskilled or semi-skilled workers on the labor market (Mohrenweiser and Zwick, 2009).

In SSA, dual apprenticeship schemes were first introduced in Bénin and Togo in the 1980s by the Hans Seidel Foundation, a German NGO, and apprenticeship reforms based on the dual system have since been introduced in Mali, Ivory Coast, Senegal, Tanzania, Togo, and Niger ILO (2020). Many of these schemes have struggled with funding issues and integration into the existing national TVET and regulatory frameworks. With their potential to simultaneously harness the abundance of informal apprenticeships and African youths' thirst for formal education, dual system apprenticeship certification schemes remain an underutilized approach in the field of TVET reform.

Bénin is an exception in this regard. Two national apprenticeship schemes were introduced during the reform of Bénin's education system in 2001: a formalization of the existing, firm-based apprenticeship program in the form of the *Certificat de Qualification aux Métiers* (CQM) certification system, and the **dual system** *Certificat de Qualification Professionnelle* (CQP) program, which promised to combine in-firm training and classroom teaching in the style of the German and Swiss systems. The CQP began curriculum planning in 2005 with technical assistance from the French Development Agency (AFD) and the Swiss Agency for Development and Cooperation (SDC), among others, and became operational in 2008. As one of the first formal, nationalized dual VET systems in Sub-Saharan Africa, it is of particular interest for regional TVET experts and will be the focus of this paper.

Officially, the CQP recognizes "professional, technological and general skills ac-

quired by the apprentice for the exercise of a professional activity" (*Decret N 2010-641*, 2010). It also allows the pursuit of further technical and professional studies upon its completion. To participate in the CQP, applicants must 1. be at least 14 years old, unless otherwise authorized by the labor inspector; 2. have a written apprenticeship contract that complies with labor laws; 3. have completed at least 6 years of formal schooling; 4. pass a national entry examination (*KOF*, 2017). Firm owners apply on behalf of the apprentices in their charge, generally through local craftsmen associations.

The CQP is currently available for 13 out of the more than 300 trades listed in the craft sector: auto mechanics, motorcycle mechanics, air conditioning mechanics, tailors, masons, carpenters, metalworkers, electricians, and plumbers (*Swisscontact*, 2019). This selection of trades

[1] With the goal of expanding the number of trades eligible for the CQP and CQM, the Beninese government, through the Youth Employment Project (PEJ) co-financed by the World Bank, has focused on expanding the programs to the crafts, tourism and food processing sectors in recent years. Cost sharing for the CQP program is shared by the state and the apprentice, with the state financing body for dual apprenticeship, FODEFCA, officially taking on 90 percent of the training costs (*KOF*, 2017). However, FODEFCA is largely reliant on external donor funding, and regular financing has been an issue for the program in recent years (David-Gnahoui and Ahouangnivo, 2017).

The financing of dual training comprises three main budget items: the firm/workshop, the training center and certification. While on-the-job training in the firm is paid for by the parents, training in the training center is largely financed through FODEFCA from various sources (national budget, donors, NGOs, etc.). Certification upon successful completion of the CQP exam is allocated to the national budget via the Directorate of Examinations, DEC (David-Gnahoui and Ahouangnivo, 2017).

CQP qualification is attained upon the completion of a three to four year apprentice-

[1]The CQM is available for about 50 trades.

ship with a training firm in one of the designated trades or crafts and the passing of the annual national CQP examination. Competency charts ("*matrices des compétences*") published separately for each participating trade specify the knowledge and know-how that must be acquired to obtain the diploma, and a detailed testing procedure for the skills that the holder of the diploma must possess are published in a evaluation guide (*grille evaluation*) for each trade. The final examination has a practical and a written component and is carried out by state representatives and local craftsmen. Upon successful completion, apprentices receive a nationally-recognized certificate.

Criticisms of the CQP include the lack of certified and accredited trainers at the training centers and unstable financing, which leads to high fluctuation in the number of applicants admitted to the program (David-Gnahoui and Ahouangnivo, 2017; ILO, 2020).

2.2 Empirical Evidence

In high-income countries, empirical research suggests that completing an apprenticeship improves overall labor market outcomes for participating youth, as measured by higher average rates of employment compared to national averages and both lower unemployment rates and higher earnings (up to a 20% premium) relative to graduates of compulsory formal education (OECD & International Labour Organization, 2017). Though apprenticeships are very common in West Africa [adams2013; filmer2014; Walther (2011)], there is little direct empirical evidence that has allowed researchers to draw causal inferences about the impact of apprenticeship on labor market outcomes in low-income countries. Similarly, there is little empirical evidence on the incentives for youth to participate in apprenticeship (Teal, 2016).

The few rigorous studies of traditional apprenticeship suggest that training with informal firms allow young people without education to better integrate the labor market and increase their earnings. Using survey data from Tanzania's manufacturing sector, Kahyarara and Teal (2008) find that apprentice earning rise after short-term training

and apprenticeship, but show that these gains disappear when controlling for firm fixed effects. Monk et al. (2008) show positive returns to apprenticeship for youth with little or no education (though former apprentices are also shown to have significantly lower earnings than the rest of the working population). Frazer (2006) also points to positive returns to informal training in Ghana, but, like Alfonsi et al. (2020) in Uganda, highlight the fact that skills acquired in firm-based training tend to be trade specific and thus less conducive to career progression than those acquired through formal schooling. Indeed, the sector-specific or even firm-specific nature of skills acquired in informal apprenticeship are likely the reason why self-employment is the dominant path after graduation for many apprentices. Hardy et al. (2019) find that apprenticeships shift youth out of wage work and into self-employment, reducing wages by 3%, though training under more experienced firm owners leads to increases in earnings.

Other studies suggests that firms may be the true beneficiaries of informal training. In Alfonsi et al. (2020), both formal TVET and on-the-job training increase firm profitability. McCasland and Hardy (2016) find that assigning an apprentice to informal firms in Ghana increase firm size by about half a worker, while firm revenues increase by 5-15% per apprentice. Firms not assigned an apprentice do not hire new workers, suggesting screening costs are high. In contrast, Crépon and Premand (2019) randomly match youth and informal firms in Côte d'Ivoire, and find that youth participating in dual training develop more skills, though without any impact on firm productivity.

While these studies suggest that informal apprenticeship training can have positive impacts on firm productivity, they differ from a formal cost-benefit analysis in focusing only on a subset of outcomes and cost components. Moreover, with the exception of Crépon and Premand (2019), the programs studied are traditional apprenticeships, and do not offer insight into the potential of a dual training scheme in the informal sector. The net benefits of dual apprenticeship training has been formally studied in the European context using a variety of detailed cost-benefit surveys and simulations (see

Mühlemann and Wolter (2019) for a review), but cost-benefit studies in lower-middle and low-income countries have not been undertaken until recently (Bolli et al., 2020 in Nepal; Bolli et al., 2021 in Serbia; de Amesti et al., 2021 in Chile), and are non-existent for SSA. Bolli et al. (2021) finds that larger firms are the primary beneficiaries of training, and that apprentices generate substantial productive value for training firms.

3 Methods and Data

3.1 Sampling

The data for this study was collected in two separate surveys. The first consisted of interviews with apprentices who had applied to the CQP program, and the other with the owners of these apprentices' respective training firms. The two surveys were conducted in parallel in two waves: the baseline was collected in July and August 2019 and the endline was completed in September 2021. Of the 13 participating crafts sectors participating in the program, five were chosen to maximize sample size and geographic concentration: electrical installation, carpentry, masonry, metalwork (primarily welding of gates for living compounds), and plumbing. Summary statistics for the apprentice sample are shown in Table **??**. Data on 432 apprentices working for 199 unique firms was collected at baseline. Of these firms, 155 were available for an endline survey. Data was collected for only 245 apprentices at endline; this drop-off was partially by design, to limit the duration of the interview with the firm owners (who were asked detailed questions about individual apprentices). Each firm in the sample contains at least one CQP applicant (though not necessarily a successful one), allowing us to identify the impact of participation in the program: all firms trained at least a single applicant to the CQP (though not every firm necessarily contained a participating apprentice). Detailed survey data on individual apprentices is matched from the apprentices themselves and their training craftsman.

3.1.1 Attrition

3.2 Methods

3.2.1 Apprentice Benefits

We first look at the benefits from apprenticeship accruing to the trainees themselves over the observed time period. Since the CQP program is still undergoing frequent reforms, the progress of apprentices participating in both traditional and dual training in informal firms is of interest to policy makers involved in its future development.

The benefit to apprentices takes the form of skills and competencies relevant accumulated over the course of training, which allows them to seek employment or open their own business upon graduation. In the survey, three sets of trade-specific human capital indicators were collected for each apprentice.

First, **knowledge questions** were drawn from the official competency charts for each trade and posed directly to the apprentices. Each question was a multiple choice question, and between 4 and 5 knowledge questions were posed to each apprentice. Because apprentices who did not apply to the CQP were not interviewed directly, knowledge questions were only collected for Selected into CQPs and unsuccessful CQP applicants.

Second, **competency questions** refer to sets of trade-specific tasks which were collected directly from practicing craftsmen in field interviews. Each competency is evaluated on a binary scale for each apprentice: an apprentice is either considered capable of carrying out a given task, or not. Apprentice competency was evaluated by master trainers at both baseline and endline, while apprentices were asked to self-evaluate at endline only. Between 10 and 15 competency questions were used per trade.

Finally, **experience questions** were based on the same list of trade-specific tasks, except that trainers and apprentices were asked to tally which tasks the apprentice already had performed at least once in the past. As with apprentice competency, experience was evaluated by master trainers at both baseline and endline and self-evaluated by appren-

tices at endline.

The final metric used as an indicator of apprentice human capital is the proportion of knowledge questions answered correctly and the proportion of tasks in which apprentices were deemed competent or experienced, respectively. Each metric is evaluated at baseline and endline for each individual apprentice, with the results shown in Table 2 in the Appendix. Changes in scores averaged across wave and trade are shown in Figure 6 in the Appendix. We find that apprentice knowledge indeed increased between 2019 and 2021, from an average knowledge score of 77% to 81% across all trades (paired t-test significant at the 10% level.) Mean knowledge scores increase in each individual trade, though the increase is only statistically significant for plumbing; thus, the marginally significant increase in knowledge scores is driven by improvements in a single trade.

3.2.2 Firm Benefits

Firm owners were asked to identify any costs directly or indirectly related to their training activities. These costs can be divided into two categories: **Equipment costs** comprise all costs for physical infrastructure necessary for training: **raw materials** such as cement, lumber, or scrap metal used in the course of training; **training equipment** such as workbenches, toolkits, or other machines purchased or rented specifically for training purposes, **rent** for training facilities if training was not conducted exclusively in the firm owner's workshop, and **books and any other training materials**. Firms report training costs for each category the past month; to estimate annual training costs per apprentice per year, the reported costs are thus divided by the number of apprentices training in the firm and multiplied by the number of months the firm was open in the previous year. Annual sums for training costs are reported at the firm level and thus normalized by the number of apprentices training in the firm, yielding approximate costs per apprentice per year.

Allowances are disbursed irregularly by the firm owner for small expenses such as

travel and meals. These are reported by firms at the apprentice level (separate reported allowances for each apprentice). To estimate total annual allowance expenditures per apprentice, we thus sum over all allowance categories and assume that apprentices work 20 days per month; the extrapolated monthly sum is then multiplied by the number of months the training firm was operating in the past year to arrive at an annual estimate for each apprentice.

Finally, **foregone trainer productivity** is calculated as the wage of a trained employee times the number of hours trained in the firm per year, extrapolated from the reported hours trained in the past month (as reported by the firm owner). Annual training hours are then multiplied by the number of training staff and divided by the number of apprentices benefiting from training to arrive at foregone trainer productivity per apprentice.

Table 1: Descriptive Statistics

Characteristic	Baseline	Endline
Apprentices		
N	427	240
Age	21.3 (3.4)	23.2 (3.5)
Gender		
Female	8 (2.0%)	4 (1.7%)
Male	398 (98%)	235 (98%)
CQP Status		
Selected	149 (35%)	91 (38%)
Not Selected	107 (25%)	64 (27%)
Did Not Apply	171 (40%)	85 (35%)
Experience, years	2.33 (1.38)	4.39 (1.38)
Trade		
Masonry	91 (21%)	43 (18%)
Carpentry	48 (11%)	27 (11%)
Plumbing	54 (13%)	36 (15%)
Metalworking	86 (20%)	47 (20%)
Electrical Inst.	148 (35%)	87 (36%)
Firms		
N	197 (100%)	150 (100%)
Size (calculated)	9.6 (13.9)	8.9 (10.9)
Size (reported)	6.7 (7.5)	6.6 (7.1)
Apprentices		
Total	6.1 (7.3)	6.1 (8.0)
Selected	1.78 (3.49)	1.65 (3.32)
Not Selected	3.10 (10.50)	3.05 (11.16)
Did Not Apply	1.2 (11.6)	1.1 (10.1)
Permanent employees	0.36 (1.8)	0.80 (2.8)
Paid family workers	0.06 (0.4)	0.14 (0.6)
Unpaid family workers	0.05 (0.4)	0.03 (0.2)
Occasional workers	0.83 (2.6)	0.83 (2.3)
Trade		
Masonry	45 (23%)	30 (20%)
Carpentry	24 (12%)	18 (12%)
Plumbing	26 (13%)	21 (14%)
Metalworking	39 (20%)	32 (21%)
Electrical Inst.	63 (32%)	49 (33%)

[1] N; Mean (SD); n (%)

3.2.3 Cost-Benefit Models

The accounting approach involves subtracting the costs of training from its benefits and is a simple way of estimating the value that training apprentices generates for the train-

ing firm. More advanced methods such as cost and benefit projection (Bolli et al., 2020) or simulation (Wolter and Mühlemann, 2015) can be used to estimate net benefits when firm data is lacking or in order to account for unobserved characteristics such as post-graduation productivity. In this study, we restrict ourselves to the costs and benefits described above. Benefits are taken to be the sum of the various fees paid by the apprentices' family to the trainer, as outlined in Section 4.3.1 and, in a second, more complex model, the productive activities of the apprentice during the training period. Costs are taken to be the various expenditures reported by the firm, such as training equipment and raw materials, as well as apprentice allowances, as detailed in Section 4.3.2. In the second model, foregone trainer productivity is also taken into account.

The simplest model of net benefits reduces the value of training for the firm to the direct material incomes and expenditures related to training; namely, apprenticeship fees from the apprentices and their parents, an approximation of training costs, and the total reported allowances disbursed to the apprentice. These are estimated as detailed in Sections 4.3.2 and 4.3.1 above.

The first model used to estimate net benefits accruing the firm per apprentice per year is thus:

Model I:

$$annual\ net\ benefits_i = \frac{fees\ paid_i}{4} - apprentice\ allowances_i - \frac{total\ training\ costs_j}{N_j}$$

for each apprentice i in firm j, where N_j is the total number of apprentices in firm j.

In a second approach, we keep all components of Model I and add two additional factors. First, we estimate an additional benefit of training to the firm: apprentices' net productive value to the firm. In the competitive model of labor markets (with heterogeneous wages), workers are paid their marginal productivity. We assume competitive labor markets and use detailed wage information elicited from each firm to estimate the

total productive output of apprentices. Namely, we assume apprentice productivity is equal to that of an untrained employee with no more than a primary education for the first two years of training, and increases to that of trained employee (who had trained at the training firm) for the final two years. Under these assumptions, the annual productive value generated by apprentice work amounts to the average of these two wages[2].

Second, we add to Model I an additional estimated cost of training: foregone trainer productivity. Firms estimated the hours trained on the last day the firm stopped all productive activities to train apprentices, as well as the number of days per week that such training occurred. We use this information as the basis for our estimation. We extrapolate weekly hours of training (hours trained on previous day of training x days trained per week) to annual hours by assuming four work weeks per month and multiplying by the number of months the firm owner reported being open in the previous year. As when estimating apprentice productivity, we set reported monthly wages for skilled workers (wage employees who had trained with the current firm) equal to trainer productivity and divide by the approximate hours worked in the past month to arrive at approximate hourly wage per trainer (assuming four work weeks per month and using firm-reported days open last week and hours worked on the last day). Finally, we multiply by the number of trainers and divide by the number apprentices per firm to arrive at an estimated cost, per apprentice, in terms of total foregone employee productivity resulting from training activities.

In this formulation, the net annual benefits accruing to the firm take the form:

Model II:

[2]A popular alternative to this admittedly unpolished approach involves eliciting specific tasks performed by apprentices and estimating costs savings based on the wages paid to workers who would otherwise be responsible for said tasks [@hauschildt2018]. Our firm-apprentice data did not cover specific tasks and is thus not equipped to carry out such an analysis.

$$annual\ net\ benefits_i = \frac{fees\ paid_i}{4} - apprentice\ allowances_i - \frac{total\ training\ costs_j}{N_j} + estimated\ apprentice\ productivity_i - \frac{estimated\ foregone\ productivity\ per\ trainer_j}{N_j}$$

for each apprentice i in firm j, where N_j is the total number of apprentices in firm j.

4 Results

In this section, we analyze the benefits of apprenticeship training for apprentices and training firms.

4.1 Training Firms and Dual Apprenticeship in Low Income Settings

Before proceeding with the cost and benefit analysis, we provide some background on apprenticeship training and the CQP program using apprentice and firm owner survey responses.

Though dual training is predicated on classroom teaching about once a week, we found that external training (classes or training that took place outside of their master's workshop) was not limited to CQP participants. At baseline, 32.42% of apprentices reported participating in such training in the preceding three months. However, only 43.62% of CQP participants reported doing so, despite external training being a constituent and necessary component of the CQP program's dual training structure. Interruptions due to the Covid-19 pandemic may have played an important role in extending the duration of training in the period of observation: 26.4% of apprentices reported reduced hours of training, while 14.04% reported complete work stoppages at their train-

ing firm, due to the pandemic. Covid-19 is also likely to have had an outsized impact on participants in the CQP program, 58.43% of whom reported that their training center had suspended classes. Among apprentices who participated in any external training, 89.16% reported working spending at least 10 days in this training in the preceding three months (approximately equal for the CQP subsample), while the average reported training duration was 6.67 hours. Thus, CQP apprentices reported training externally at only a marginally higher rate than apprentices who applied but were not accepted into the program.

The majority (82.81%) of apprentices reported that the training center they attended was within one hour of traveling distance. Among apprentices who attended classes or training outside their master's workshop, nearly three quarters reported that the training took place in a training center (the rest said it took place in another workshop).

Apprentices also explained their motivation for starting an apprenticeship. The most frequently cited motive was interest in the trade, followed by the promise of good earning opportunities and the insistence of the parents. They were also asked why they had chosen the craftsmen they were training with; the majority replied that they were attracted by the patron's reputation, or that their parents had made the choice in their stead. As found in previous studies of informal apprenticeship in SSA, most apprentices express a wish to start their own business after graduation (67.97%) followed by seeking employment with a different workshop (17.19%).

By combining time trained at the time of the survey with the expected graduation date, we find that apprentices expect their training to last 3.94 years, with a standard deviation of 1.21 years, in line with our assumption of four-year apprenticeships being the norm. Metalworking apprenticeships reportedly last almost a year longer than the other trades in the sample.

4.2 Impact of Informal and Dual Training on Individuals

Table 2: Change in Apprentice Knowledge

Trade	N	Baseline	N	Endline	p-value
Electrical Installation	77	0.90 (0.16)	49	0.93 (0.10)	0.4
Masonry	56	0.76 (0.19)	30	0.83 (0.20)	0.8
Carpentry	25	0.91 (0.18)	15	0.97 (0.09)	0.3
Plumbing	38	0.52 (0.12)	26	0.64 (0.16)	0.013
Metalwork	209	0.85 (0.18)	117	0.88 (0.15)	0.8
Overall	247	0.77 (0.21)	143	0.81 (0.19)	0.078

[1] Mean (SD). Proportion of correctly answered knowledge questions.
[2] Paired t-test

In Table 2 above, scores are pooled at the trade level in each wave. Alternatively, we can observe the change in scores for individuals before taking means. Individual changes in score averaged across trades are shown in Figure 5 in the Appendix. Viewed thus, improvements in competence and experience scores are much more pronounced, with apprentices in masonry doubling their experience and nearly doubling their competence (on the other hand, improvements for electrical installation appear lower compared to the case where data is pooled). However, due to attrition between the two waves, this subgroup analysis suffers from small group size, with $N = 34$ for masonry and $N = 20$ for carpentry.

Evidence of apprenticeship effectiveness is clearer when regarding the apprentice competency and experience metrics. Table 9 in the Appendix shows that mean *competency* score among all apprentices improved from 76% of tasks at baseline to 92% at endline, an improvement of .66 standard deviations. Improvements were observed across all trades, and all differences were statistically significant at standard levels (with the exception of carpentry). Similarly, apprentice *experience* improved from having performed 73% of tasks at baseline to 92% at endline, an improvement of .73 standard deviations.

Apprentices who participated in the CQP program exhibit greater improvement across all three human capital metrics than apprentices who applied but were not ac-

cepted or chose not to participate, though these differences are not statistically significant. On average, CQP apprentices improved by 14.8%, 11%, and 3.4% on their experience score, competency score, and knowledge score, respectively, while those who applied but did not participate in the program improved by 10.4%, 6% and 1.7%, respectively (see 11 in the Appendix). However, it should be noted that apprentices that did not apply to the CQP program at all made the largest strides of all: 20.6% and 15.8% on the experience and competence metrics, respectively (knowledge was not measured for non-applicants). These results are examined in greater detail using a linear regression approach in Section 4.4.

Finally, the three metrics used to measure apprentice progress are not comprehensive, in that they do not measure outcomes such as the physical and psychological well-being of apprentices, "soft skills," etc. Thus, we also examine subjective measures of apprenticeship quality captured by a 5-point Likert scale rating of the following characteristics of the firm, as perceived by the apprentice: physical safety of the workshop, the master trainer's knowledge, the master trainer's treatment of apprentices, the treatment of the apprentice by other employees and apprentices, apprenticeship benefits, apprenticeship working hours, the quality of training, and the quality of the equipment and machinery in the workshop. We observe generally positive levels of satisfaction with training quality, ranging from an average of 4 (somewhat good) to 5 (very good) on all categories except physical safety at baseline (average = 3.96) and working hours at endline (3.66). Subjective ratings are also generally constant over time. One exception is satisfaction with working hours, which decreases from an average rating of 4.07 to 3.66 - indeed, we observe an increase in reported working hours from 42 to 45 average hours worked in the past week for apprentices who applied but did not participate in the program (while CQP participants work hours remained stable). Generally, we observe no significant differences in satisfaction between CQP participants and apprentices who applied to the program but did not participate.

To summarize, satisfaction is generally high and stable among all apprentice throughout their training period, though apprentices not participating in the CQP report a sharp increase in working hours towards the tail end of their training.

4.3 Impact of Informal and Dual Training on Firms

4.3.1 Benefits

In the German and Swiss context, the primary benefit of training for firms is the productive value of apprentices during and after their apprenticeship. This value is generated when the apprentices is working in the firm, performing skilled or unskilled tasks that would otherwise be carried out by the firm owner, paid employees, or unpaid labor. These benefits accumulate after graduation if the apprentice is hired for less than the labor market wage for workers of equal productivity, as well as any savings on recruitment and hiring costs (Acemoglu and Pischke, 1998, 1999a, 1999b).

In comparison to Swiss or German apprentices, youth in SSA are less likely to continue working for their training firm upon graduation. For example, in Ghana, three out of every four apprentices plan to start their own business within five years (Ahadzie, 2009; Breyer et al., 2007). Many who don't set off on their own are unable to, citing "high start-up costs, the unavailability of land and hostile planning policies tend to obstruct the ability of newly qualified craftsmen to set up on their own" (Ahadzie, 2009). Informal firms must thus recoup their costs during the training period (or within a few years) if hiring apprentices is to remain a profitable enterprise. Moreover, workshops rarely hire skilled wage employees, and thus any benefits from "screening" apprentices for their productive capabilities (i.e. wage compression) or savings in hiring costs play a relatively minor role in the training decision (Table **??**).

If this is the case, why do craftsmen in Bénin train at all? First, apprentices are the cheapest and most abundant source of labor, and can be hired to complete unskilled

tasks at little overhead. Second, if trades can be mastered relatively quickly, apprentices will provide skilled labor in the later years of their graduation (and after graduation as well, for as long as they need to work to pay off outstanding training fees or save up for their own workshop). Finally, the apprentices (or, more often, their families) traditionally pay fees to the master craftsmen in return for the provision of training (Bankolé and Nouatin, 2020; Frazer, 2006; Velenchik, 1995).

Table 3: Total apprenticeship fees reported by apprentices and firm owners

	Baseline		Endline	
Fee Type	**Apprentice**	**Firm**	**Apprentice**	**Firm**
Initiation	16.89 (55.09)	10.95 (16.44)	15.92 (35.55)	15.58 (36.59)
Training	167.18 (149.59)	144.17 (152.18)	191.69 (155.07)	145.05 (154.44)
Graduation	39.43 (79.49)	37.82 (75.39)	42.32 (78.12)	38.14 (100.51)
Materials	27.89 (33.93)	26.23 (37.24)	31.33 (33.80)	20.60 (19.38)
Contract	25.28 (60.95)	34.21 (67.95)	28.38 (64.38)	19.60 (49.84)
Application	11.41 (15.74)	12.55 (17.02)	12.77 (16.02)	17.61 (15.73)
Total	288.08 (191.06)	244.84 (184.84)	322.42 (184.87)	239.98 (167.79)

[1] Mean (SD). Fees in USD.

Fees are the simplest set of benefits to quantify, and are summarized in Table 3. General training fees account are the largest sum paid to the firms and account for over half of total fees paid. Other minor fees cover the provision of equipment and materials, application fees (pertinent for the CQP, as the master trainer must submit paperwork in their apprentices' stead), and initiation and graduation fees. In total, apprentices report paying about 175,000 FCFA (280 $US) in fees for training, while firm owner report around 160,000 FCFA (255 $US) in fees per apprentice. This indicates an minor increase in the costs of training in Benin over the past two decades: Walther and Filipiak (2007) reports total fees ranging from 50,000 to 150,000 FCFA (96-290 $US, inflation adjusted). Though generally unregulated, in some cases professional associations and public authorities step in to regulate fees, particularly those levied for initiation and graduation ceremonies.

Apprentices report significantly higher fees than firms, for this specific fee in particular. Firms may underreport fees to avoid accusations of gauging, but are at the same time likely to have more direct knowledge of all fees than apprentices, whose parents and relatives usually pay the craftsmen directly. Finally, firms report collecting higher initiation and application fees at the time of the endline survey. This may indicate a shift to fee payments to the beginning of the apprenticeship as graduation ceremonies (and the concomitant graduation fees) are phased out as legislation prohibiting graduation ceremonies is put into practice over time.

4.3.2 Costs

Figure 2: Breakdown of costs of training per apprentice

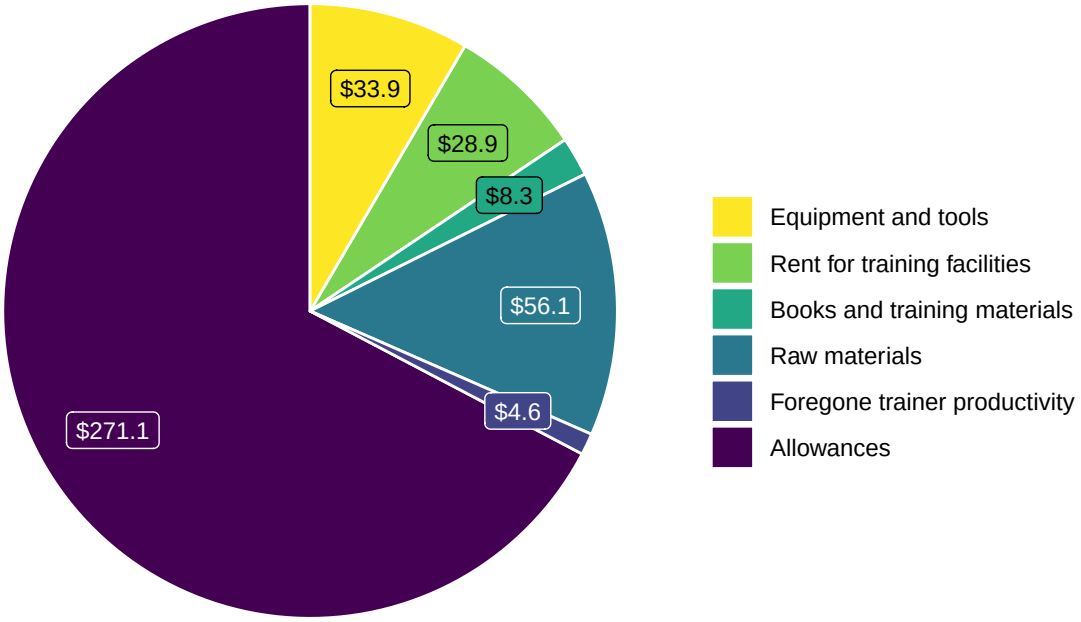


Figure 2 shows the breakdown of various costs per apprentice, averaged over both interview waves. All costs total to approximately 240,000 FCFA, or 400 $US, per apprentice per year. The largest expenses are associated with allowances and raw materials (which are particularly high in the carpentry trade). They also in line with the upper range of

costs from David-Gnahoui and Ahouangnivo (2017), who, citing Zinsou, 2012, reported total costs of 100,000 to 250,000 FCFA ($165-$413) for a complete CQP training program in 2012.

Figure 7 in the Appendix accounts for the number of apprentices training in firms and reports mean total training expenditures per firm. These total, on average, 1.4 million FCFA, or 2,325 $US, per firm, corresponding to over half of the reported annual firm revenues (4517 $US) and about 135% of reported total annual costs (1718 $US), as averaged over the two survey waves.

4.3.3 Impact (Net Benefits)

Table 4: Annual estimated net benefits of training

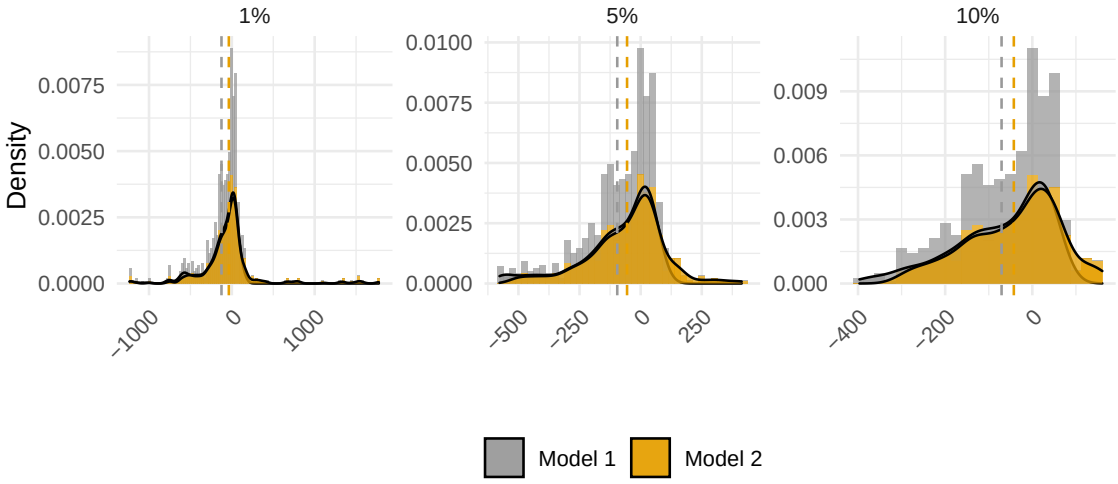
	Overall, N = 667	**Selected**	**Not Selected**	**Did Not Apply**
Model I	-130.49 (385.76)	-116.61 (409.34)	-140.22 (332.98)	-137.00 (396.75)
Model II	-32.93 (509.05)	-26.57 (512.67)	-16.01 (536.47)	-50.19 (487.91)

[1] Mean (SD)

Table 4 shows the estimated annual net benefits of training apprentices, calculated separately for apprentices who successfully applied to the CQP program, applied to the CQP program but were not accepted, and did not apply at all. Depending on which model is used, training is, on average, associated with a net loss ranging from about 30 $US to about 125 $US per apprentice per year for the training firm.

The net costs of apprenticeship according to Model I are lower for CQP apprentices, despite CQP apprentices paying the lowest fees (see Table 14 in the Appendix) and receiving higher allowances than non-applicants (and on par with unsuccessful applicants, see 13 in the Appendix). **This suggests that firms bletraining CQP participants have lower training costs per apprentice, on average, than firms without successful CQP applicants**. Estimated net benefits do not change drastically over the course of the program (Table 16 in the Appendix).

Figure 3: Annual net benefits per apprentice (in USD), truncated at varying percentiles



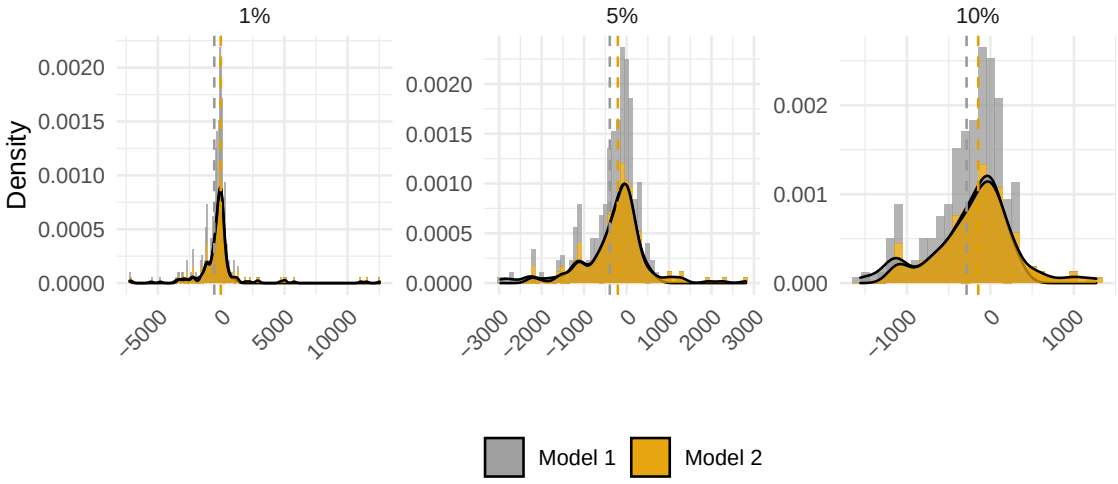
Mean benefits per apprentice total -130.49 $US when using Model I and-32.93 $US using Model II. The distributions of net benefits by individual apprentice have long left and right tails, particularly for Model II. With higher wages (reported especially by larger firms) skewing the projected apprentice productivity estimates, and the high number of apprentices in certain firms generating unrealistic annual allowance totals, Model II generates especially exaggerated numbers, extending from -4604.75 $US in losses for a single apprentice to as much 3679.34 $US in annual benefits. Such estimates should be taken with caution as they suggest apprentices generate costs and/or benefits out of proportion with reported firm accounts.

To account for such outliers, we truncate estimated net benefits per apprentice at the 1st, 5th and 10th percentiles and present the truncated distributions in a histogram and kernel density plot, shown in Figure 3. Using Model I, mean net benefits amount to -102.81 $US per apprentice when dropping the top and bottom percentile, -83.09 $US per apprentice when the top and bottom 5% are dropped, and -67.02 $US per apprentice when the top and bottom deciles are dropped. Using Model II, mean net benefits per apprentice are -22.01 $US when dropping the top and bottom percentile, -38.09 $US when the top and bottom 5% are dropped, and -36.48 $US when the top and bottom

deciles are dropped.

The distribution of net benefits per apprentice is bimodal in both models, with a concentration of firms breaking even for each apprentice trained and a second clustering of firms with annual net losses of about 100 $US per apprentice. **According to Model I, 37.24% and 34.17% of apprentices are estimated to generate a positive net benefit during training at baseline and endline, respectively; using Model II, 43.56% and 44.58% of apprentices are estimated to do so.**

Figure 4: Annual net benefits per firm (in USD), truncated at varying percentiles



We are also interested in total firm benefits from training, i.e. the net benefit from all apprentices being trained in a firm at a particular point in time. Although apprentices taken individually generate a net loss on average, it is possible that larger firms hire productive and unproductive apprentices in equal measure, leading to higher net benefits at the firm than at the apprentice level.

To generate a firm-level distribution of net benefits, apprentice benefits are averaged at the firm level. This firm-specific mean benefit is then multiplied by the number of apprentices training in the firm. This projection thus assumes that mean net benefits associated with apprentices for whom data was collected are, on average, equal to the net benefits for all unobserved apprentices in the same firm. Net firm benefits total, on

average, -626.13 $US using Model I and218.92 $US using Model II. The distribution is unimodal, with the majority of firms' net benefits clustered to the right of the mean for both models.

Truncating again at the 1st, 5th and 10th percentiles and present the truncated distributions in a histogram and kernel density plot, shown in Figure 3. Using Model I, mean net benefits amount to -463.74 $US per apprentice when dropping the top and bottom percentile, -332.55 $US per apprentice when the top and bottom 5% are dropped, and -263.62 $US per apprentice when the top and bottom deciles are dropped. Using Model II, mean net benefits per apprentice are 84.44 $US when dropping the top and bottom percentile, -60.88 $US when the top and bottom 5% are dropped, and -94.07 $US when the top and bottom deciles are dropped. Mean net benefits are thus even more sensitive to large outliers, especially positive ones, at the firm level than at the apprentice level.

According to Model I, 32.49% and 34% of firms are estimated to earn a positive net benefit from training (positive net benefits) at baseline and endline, respectively; using Model II, 39.09% are estimated to do so at baseline and 46% at endline.

Table 5: Annual firm accounts

	Overall, N = 347	**Baseline**	**Endline**
Firm size (reported)	6.65 (7.34)	6.73 (7.54)	6.56 (7.10)
Firm size (calculated)	9.27 (12.70)	9.57 (13.94)	8.87 (10.90)
Apprentices in training	6.10 (7.58)	6.12 (7.28)	6.07 (7.98)
Revenues	4,405.17 (4,917.24)	3,988.90 (4,820.09)	4,874.57 (5,000.09)
Non-wage expenses	1,640.22 (3,178.66)	1,592.98 (3,152.24)	1,703.64 (3,223.59)
Total wages	1,365.22 (2,998.90)	971.69 (2,351.66)	1,886.39 (3,628.85)
Profits (reported)	1,429.15 (2,158.81)	1,671.55 (2,633.84)	1,131.50 (1,316.66)
Profits (calculated)	1,548.60 (3,249.10)	1,701.25 (3,055.72)	1,375.08 (3,458.80)

[1] Mean (SD)

[2] Mean (SD). Revenues, expenses, and profits in USD.

In contrast to dual apprenticeship in the European context, in which apprentice wages represent the bulk of training costs, most apprentices in Bénin receive no regular wages whatsoever (see Table 12). Allowances or "pocket money" for minor ex-

penditures such as food and transportation disbursed by training firms amount to a small percentage of total training costs. On the other hand, apprenticeship fees, paid by apprentices directly to the master trainer, contribute significantly more to total firm revenues than in Swiss or German firms.

Apprentice training thus represents a relatively large fraction of firm costs, or revenues, depending on the preferred model. At the upper extreme (Model II, untruncated), the average ratio of total net training benefits to total firm revenues is 0.32 for firms that benefit from or break even on training, and the ratio of total (negative) net benefits from training to total firm expenses is 1.24. At the low-benefit extreme (the simpler Model I, untruncated), the average ratio of total net training benefits to total firm revenues is 0.14 for firms that benefit from or break even on training, and the ratio of total (negative) net benefits from training to total firm expenses is 1.22.

In other words, this implies that for firms that benefits from apprenticeship, apprenticeship fees and productivity are estimated to only contribute slightly to their total revenues. For firms that do not turn a profit on their apprentices, on the other hand, estimated training costs are actually higher on average than the total costs reported by firm owners. As more firms report making net losses on apprenticeship training than not, this implies that training is major financial burden for a high proportion of informal firms.

Finally, how do these numbers compare to evidence from high-income countries? Due to the disparities in firm size and productivity of informal firms in Bénin and training firms in Germany and Switzerland, where the majority of studies have been conducted, an informative comparison is difficult to make. Though cost-benefit studies from these countries do not report earnings data of training firms, they do suggest that whether firms recoup the costs of training depends on the firm, trade, and region. For instance, Hauschildt (2018) reports that in Germany, productive contributions of apprentices covered about 70 percent of a company's training costs, while in Switzerland, net

benefits per apprentice per year amounted to about €2,500 (Strupler and Wolter, 2012). Without a clearer understanding of future benefits and better instruments to measure apprentice productivity, the true benefit of apprenticeship training in informal firms will remain ambiguous.

4.4 Regression Analysis

In this section, we employ a linear regression approach to explore the drivers of training benefits at both the firm and apprentice level.

4.4.1 Firm-level outcomes

In addition to direct financial benefits associated with training, which are reflected by a positive balance in the net benefit calculations presented above, apprenticeship training may affect firm productivity through a variety of additional channels. For the CQP program in particular, participating apprentices may acquire skills at a faster pace than their traditional counterparts as a direct result of their theoretical training. Moreover, theoretical training may "spill over" to the master trainer and other employees in the workshop, for instance by introducing new technologies or improving knowledge about the operation of existing workshop machinery. Additional apprentices in general may improve firm productivity by encouraging the owner to hire more employees (e.g. as trainers) or through investments in additional machinery. Indeed, evidence from previous studies indicates that small firms in Uganda and Ghana, when randomly assigned apprentices to train, increased profits by up to 15% per apprentice (Alfonsi et al., 2020; McCasland and Hardy, 2016).

To estimate the effect of participating in the CQP program, and training apprentices in general, on firm size and profits (Table 5), we run a simple pooled OLS regression taking the form

$$y_{it} = a + CQP_i + apprentices_{it} + \mathbf{X}_{it} + u_{it},$$

where y_{it} is the outcome of interest, $\mathbf{X}_{it}$ is a matrix of additional covariates for firm i in wave t, and u_{it} is an error term. CQP_i is the number of CQP applicants who were accepted into the 2019 cohort of the program, while $apprentices_{it}$ controls for the total number of apprentices training with the firm (and in contrast to CQP_i is a time-varying measure).

Table 6: Firm-level regressions

	Annual revenues (USD)		Annual profits (USD)		Firm size†	
	(1)	(2)	(3)	(4)	(5)	(6)
Apprentices	105.00*	−1.90	92.00**	−52.00	0.58***	0.37***
	(58.00)	(87.00)	(45.00)	(80.00)	(0.04)	(0.09)
CQPs	57.00		86.00		0.11	
	(146.00)		(114.00)		(0.08)	
Endline	1,321.00**	1,549.00***	−132.00	−11.00	−0.20	−0.58
	(529.00)	(457.00)	(411.00)	(420.00)	(0.49)	(0.53)
Firm size†	522.00***	396.00***	−62.00	331.00***		
	(69.00)	(92.00)	(53.00)	(84.00)		
Constant	2,370.00***		1,416.00***		−0.39	
	(456.00)		(353.00)		(0.38)	
Firm FE	NO	YES	NO	YES	NO	YES
Observations	280	300	277	297	321	346
R^2	0.30	0.20	0.02	0.13	0.51	0.12
F Statistic	30.00***	9.80***	1.60	5.40***	112.00***	9.80***

Note: *p<0.1; **p<0.05; ***p<0.01
†Excluding apprentices.

Pooled OLS estimation results are shown in Columns 1, 3 and 5 of Table 6, while firm fixed effects are included in the specification shown in Columns 2, 4, and 6. Reported firm revenues increase by close to 50% between the two waves, but are offset by rising costs and wages, to the point of eliminating any observed growth in profitability. According to the pooled specifications, additional apprentices are associated with smaller gains in revenue than the hiring of other types of workers, but higher profits (about

92 $US annual profit per additional apprentice). Specifications including firm fixed effects to control for heterogeneity between firms, on the other hand, suggest that the hiring of non-apprentice employees is associated with both higher revenues and profits, while the number of apprentices is not a significant predictor of either. Regressions (5) and (6) reinforce the notion that firms hire more apprentices than non-apprentice employees: taking into account firm fixed effects, a single additional employee is associated with over three additional apprentice hires, on average. Finally, we note that the number apprentices from the 2019 cohort of the CQP program have no discernible association with firm revenues or profits.

4.4.2 Apprentice-level outcomes

Next, we examine apprentice-level effects of training on our various measures of apprentice learning outcomes, outlined in section 4.2. Similarly to the firm-level regressions, the basic specification used is

$$y_{it} = a + \sum_{j} \text{status}_{ij} + CQP_i{*}wave + \mathbf{X}_{it} + \mathbf{Z}_{jt} + u_{it}$$

where y_{it} is the outcome for apprentice i at time t, status_{ij} corresponds to apprentice status j of apprentice i in the context of the CQP program for: either successful applicant, unsuccessful applicant, or non-applicant. $\mathbf{X}_{it}$ is a column vector of apprentice characteristics, $\mathbf{Z}_{jt}$ is a column vector of training-related training characteristics, a is a constant, and u_{it} is an error term. $CQP_i{*}wave$ is a dummy for CQP apprentices interacted with survey wave, which identifies any gains in learning outcomes that can be linked with participation in the CQP.

Table 7: Apprentice regressions

	Experience				Competence			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CQP participant	−0.01	−0.005	0.16	0.16	−0.01	−0.01	−0.09	−0.09
	(0.02)	(0.03)	(0.22)	(0.19)	(0.02)	(0.03)	(0.21)	(0.16)
CQP non-applicant	−0.12***	−0.12***	0.30		−0.14***	−0.14***	0.11	
	(0.02)	(0.02)	(0.25)		(0.02)	(0.02)	(0.24)	
Endline	0.18***	0.19***	0.15***	0.11***	0.14***	0.14***	0.11***	0.06**
	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)
Firm size†	0.003**	0.003**	−0.001	−0.004	0.002**	0.002**	−0.002	−0.0001
	(0.001)	(0.001)	(0.003)	(0.004)	(0.001)	(0.001)	(0.003)	(0.003)
CQP x Endline		−0.02	−0.01	0.04		0.001	−0.0004	0.05
		(0.04)	(0.04)	(0.04)		(0.04)	(0.04)	(0.04)
Constant	0.77***	0.77***	0.70***	0.71***	0.82***	0.82***	0.90***	0.90***
	(0.02)	(0.02)	(0.18)	(0.15)	(0.02)	(0.02)	(0.17)	(0.13)
Individual FE	NO	NO	YES	YES	NO	NO	YES	YES
Observations	594	594	594	376	594	594	594	376
R^2	0.19	0.19	0.84	0.81	0.17	0.17	0.84	0.82
F Statistic	34.00***	27.00***	2.30***	2.20***	31.00***	25.00***	2.20***	2.30***

Note: *p<0.1; **p<0.05; ***p<0.01
Omitted CQP category: applied but did not participate.

Table 7 reports knowledge and competence score regressions. For each of the two measures, the first two columns report coefficient estimates without firm fixed effects; in the third column, fixed effects are added, and in the fourth column apprentices who did not apply to the CQP program are dropped from the analysis.

The results indicate that while apprentices show gains in experience and competence scores, participation in the CQP program is not associated with greater gains along these two metrics. All CQP applicants (including those not accepted into the program) receive higher scores than non-applicants. This suggests that trainers choose the more experience of their existing apprentices to apply to the dual apprenticeship program. An analogous analysis of apprentice performance on knowledge questions (which were posed directly to apprentices, rather than their trainers) shows a similar pattern (see Table 17 in the Appendix): participation in the CQP has no measurable effect on apprentice knowledge, while apprentices in the program score slightly lower

on the metric than those who apply but do not get in.

Table 8: Apprentice-level cost benefit regressions

	Annual Net Benefits in USD							
	Model I				Model II			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CQP participant	25.0	44.0	−62.0	−62.0	−7.1	6.5	−62.0	−62.0
	(39.0)	(46.0)	(581.0)	(578.0)	(51.0)	(60.0)	(676.0)	(686.0)
CQP non-applicant	4.9	5.6	37.0		−27.0	−26.0	37.0	
	(38.0)	(38.0)	(581.0)		(50.0)	(50.0)	(676.0)	
Endline	31.0	50.0	72.0	119.0	13.0	26.0	83.0	125.0
	(31.0)	(40.0)	(49.0)	(76.0)	(41.0)	(52.0)	(57.0)	(90.0)
Firm size†	0.8	0.8	−4.4	−0.3	8.9***	8.9***	1.0	14.0
	(2.2)	(2.2)	(6.2)	(9.1)	(2.9)	(2.9)	(7.3)	(11.0)
CQP x Endline		−50.0	−66.0	−110.0		−36.0	−52.0	−86.0
		(65.0)	(78.0)	(98.0)		(85.0)	(91.0)	(116.0)
Constant	−156.0***	−163.0***	37.0	33.0	−54.0	−59.0	32.0	18.0
	(33.0)	(34.0)	(411.0)	(409.0)	(44.0)	(45.0)	(478.0)	(486.0)
Indiv. FE	NO	NO	YES	YES	NO	NO	YES	YES
Observations	664	664	664	410	664	664	664	410
R^2	0.002	0.003	0.6	0.6	0.01	0.02	0.7	0.7
F Statistic	0.4	0.4	0.8	0.8	2.5**	2.0*	1.2*	1.2*

Note: *p<0.1; **p<0.05; ***p<0.01
Omitted wave: Baseline
†Excluding apprentices.

Finally, we investigate characteristics potentially associated with "valuable" apprentices: those who generate positive net benefits for their training firms. We run the same specifications as before, but use the two models of net benefits as the outcome of interest. Table 8 suggests that

Instead, apprentices at larger firms (in terms of non-apprentice employees) are shown to be associated with higher profitability, attributable to the higher wages (hence higher estimated apprentice productivity) reported by these firms.

5 Conclusion

This paper analyses the costs and benefits of apprenticeship training with informal firms in Bénin, with a particular focus on the 2019 cohort of apprentices participating in the CQP dual training program. Matched apprentice-firm data is used to (1) estimate the human capital gains accumulated by apprentices over the three-year observation period, (2) calculate the total benefits (primarily in the form of apprenticeship fees received) and (3) costs of training reported by firms, (4) calculate the net benefits accruing to firms using two models, one estimating apprentice contribution and foregone trainer productivity and one not, and (5) identify the association between apprenticeship training, and participation in the CQP program in particular, on firm profitability, apprentice human capital gains, and the net benefits accruing to firms per apprentice.

Human capital gains as measured by trainers' subjective appraisal of apprentice experience and competence were significant, with improvements of .73 and .66 standard deviation between survey waves, respectively. Gains were concentrated in the masonry and carpentry sector, in larger firms, and among apprentices who did not apply for the CQP program.

Firms in the sample were training an average of six apprentices at both baseline and endline - significantly more than wage, family, or occasional employees they hired - despite reporting net losses from training apprentices in the majority (approximately 60%) of cases. Total fees for a single apprentice amount to about 250 $US (for three to four years of training), while annual revenues per firm average about 1500 $US. Reported costs of training are significantly higher than the fees collected, however: we estimate that trainers pay around 400 $US per apprentice per year, especially when daily apprentice allowances are taken into account. When multiplied by the number of apprentices trained per firm, total training costs are indeed higher than total firm expenditures reported by the firm, suggesting that owners either underestimate their training costs or

that the method used to estimate and sum training costs used in this paper is suffering from some shortcoming.

Two cost benefit models help us understand how net benefits are distributed across firms and apprentice types. When only fees, allowances, and reported training costs are considered, firms suffer a net loss of 130.49 $US per apprentice per year, and a total of 626.13 $US when accounting for the number of apprentices trained. Using reported wages for skilled and unskilled workers to estimate apprentice productive contributions and foregone trainer productivity reduces the net estimated losses, to 32.93 $US per apprentice per year, and even a net benefit of 218.92 $US per firm when projecting total benefits at the firm level. Apprentices who do *not* apply to the CQP program are associated with somewhat lower net losses to their training firms when estimated using the first model.

Regression analysis reveals a stronger relationship between firm size (sans apprentices) and firm profits than exists for apprentice hires (CQP and otherwise). Similarly, apprentices hired at larger firms are associated with higher net benefits. There are no significant differences in effects observed for CQP applicants or CQP participants, though firms appear to select less experienced apprentices to apply for the program.

In sum, we find that training with informal firms fulfills its promise to apprentices, granting them the experience and competence to transition to self-employment upon graduation. Not all firms benefit from training on the balance, with about 60% of firms suffering net losses from training and training costs generally outpacing the apprenticeship fees paid. Dual training in the form of the CQP program generates few visible benefits, either in terms of apprentice progression or benefits to the training firm. However, the timing of the current CQP cohort, being interrupted in the middle of the training schedule due to the Covid-19 pandemic, may have contributed to lower-than-usual outcomes at both the apprentice and firm level. Nevertheless, this paper finds little support for or against the continuation of the program. Given its difficulties with

sustainable financing, and in light of criticisms centered on the administration of training centers and qualifications of classroom teachers, helping individual firms defray the high costs of traditional training, and focusing on material and equipment provision for traditional on-the-job apprenticeships, may be a better use of public financing in the short term. For the time being, in any case, dual training only represents a minuscule fraction of all apprenticeship training in the country of Bénin and across West Africa; with the slow growth of formal TVET programs, traditional apprenticeships are likely to remain a promising route for young Africans who lack the financial means or interest to pursue formal education.

- *The number of trades in which the CQP and CQM are awarded must be increased. Indeed, while the Benin craft trades register lists 310 trades, the CQP only covers 13 and the CQM fewer than 100. It is essential to develop the design tools needed to organize the CQP and CQM. This requires the training of a sufficient number of methodology experts across all departments nationwide. In addition to these methodology experts, trainers in all crafts and trades need to be trained in sufficient numbers.*
- *There are no qualifications that recognize the learning done by employers. As a result, some employers still refuse to enter their apprentices for the CQP or the CQM, as they think that their apprentices will become better skilled than them. In order to maintain the system, it is essential to introduce a mechanism for validating and recognizing the skills of employers.* ● *Both the apprentices and their employers show more interest in the CQM than the CQP, as the conditions for the CQP – namely required educational level (completed primary education), attendance at a (dual) training centre, preparation for and successful completion of an admission test, and the irregular financing of the FODEFCA – constitute obstacles that they cannot overcome. If these conditions are not reviewed or improved, there is a risk that the CQP will lose its candidates.*
- *Internal and external financial resources must be mobilized to manage the increased number of trades and apprentices involved in the CQP and CQM.*
- *The DEC needs to allocate or obtain timely budgetary resources to organize the CQM examinations.*
- *UCIM-B demands responsibility for organizing the CQP and CQM examinations in accordance with the West African Economic and Monetary Union (WAEMU) community code on crafts. Dialogue between this body and the ministry responsible for training should facilitate resolving the matter of the transfer of powers* (ILO, 2021)

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Appendix

Figure 5: Change in apprentice human capital scores

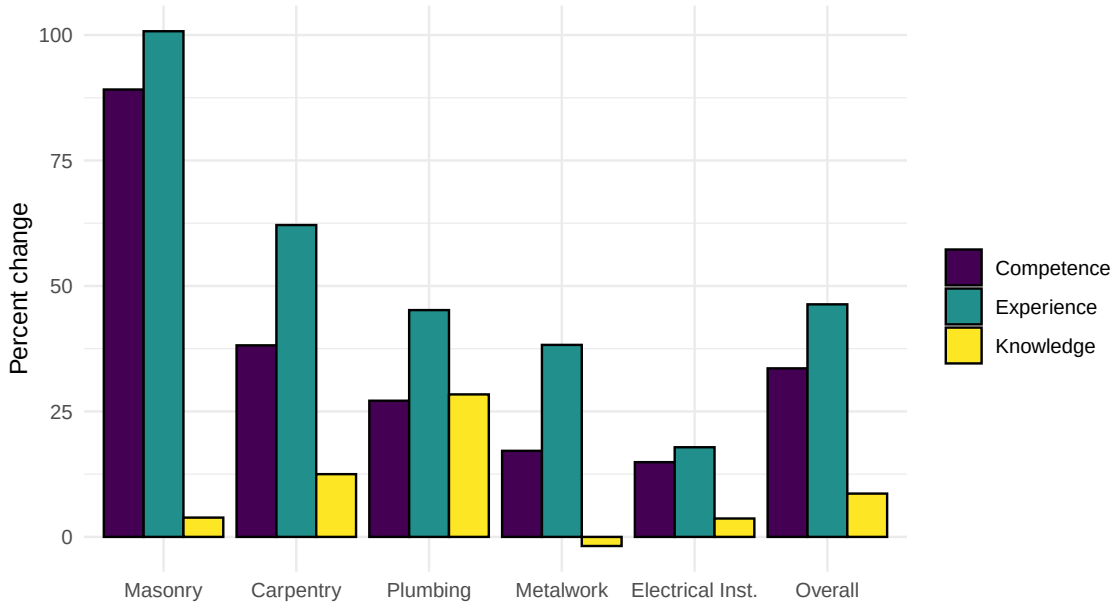

Table 9: Change in apprentice competence and experience

Group	Trade	N	Baseline	N	Endline	p-value
Competencies	Electrical Installation	125	0.80 (0.24)	69	0.96 (0.09)	<0.001
	Masonry	90	0.75 (0.22)	39	0.90 (0.18)	0.008
	Carpentry	48	0.76 (0.28)	21	0.93 (0.15)	0.14
	Plumbing	54	0.73 (0.29)	26	0.92 (0.15)	0.008
	Metalwork	86	0.75 (0.22)	38	0.86 (0.21)	0.006
	Overall	403	0.76 (0.24)	193	0.92 (0.16)	<0.001
Experience	Electrical Installation	125	0.77 (0.26)	69	0.96 (0.08)	<0.001
	Masonry	90	0.72 (0.23)	39	0.91 (0.13)	<0.001
	Carpentry	48	0.73 (0.31)	21	0.98 (0.06)	0.013
	Plumbing	54	0.66 (0.30)	26	0.89 (0.17)	0.001
	Metalwork	86	0.72 (0.24)	38	0.85 (0.15)	0.004
	Overall	403	0.73 (0.26)	193	0.92 (0.13)	<0.001

[1] Mean (SD). Proportion of tasks reported by firm.
[2] Paired t-test

Table 11: Change in apprentice human capital scores

Characteristic	**Selected**, N = 150	**Not Selected**, N = 112	**Did Not Apply**, N = 172
Competence	0.110 (0.201)	0.060 (0.165)	0.158 (0.325)
Experience	0.148 (0.222)	0.104 (0.207)	0.206 (0.314)
Knowledge	0.034 (0.185)	0.017 (0.166)	NA (NA)

[1] Mean (SD)

```
## ANOVA Table (type III tests)

##

##          Effect DFn DFd    F        p p<.05   ges

## 1      SELECTED   2 178 15.1 9.0e-07     * 0.095

## 2          wave   1 178 36.5 8.6e-09     * 0.072

## 3 SELECTED:wave   2 178  2.2 1.2e-01       0.009


## ANOVA Table (type III tests)

##

##          Effect DFn DFd    F        p p<.05   ges

## 1      SELECTED   2 178  7.2 1.0e-03     * 0.047
```

Table 10: Competency and experience, firm vs. apprentice rating

Group	Trade	N	Apprentice	N	Firm
Competencies	Electrical Installation	49	0.97 (0.06)	46	0.98 (0.05)
	Masonry	28	0.95 (0.08)	28	0.94 (0.10)
	Carpentry	14	0.92 (0.13)	16	0.95 (0.08)
	Plumbing	25	0.95 (0.13)	22	0.92 (0.15)
	Metalwork	21	0.90 (0.17)	26	0.92 (0.15)
	Overall	137	0.95 (0.11)	138	0.95 (0.11)
Experience	Electrical Installation	49	0.97 (0.06)	46	0.97 (0.06)
	Masonry	28	0.95 (0.09)	28	0.93 (0.11)
	Carpentry	14	0.95 (0.12)	16	0.99 (0.03)
	Plumbing	25	0.98 (0.06)	22	0.89 (0.17)
	Metalwork	21	0.89 (0.16)	26	0.89 (0.11)
	Overall	137	0.95 (0.10)	138	0.94 (0.11)

[1] Mean (SD). Proportion of tasks reported by apprentices and firms at endline.

```
## 2          wave   1 178 64.3 1.4e-13     * 0.122

## 3 SELECTED:wave   2 178  2.1 1.2e-01       0.009


## ANOVA Table (type III tests)

##

##          Effect DFn DFd    F     p p<.05     ges

## 1      SELECTED   1 133 4.74 0.031     * 0.02800

## 2          wave   1 133 2.60 0.109       0.00400

## 3 SELECTED:wave   1 133 0.28 0.598       0.00043
```

Figure 6: Change in apprentice human capital scores

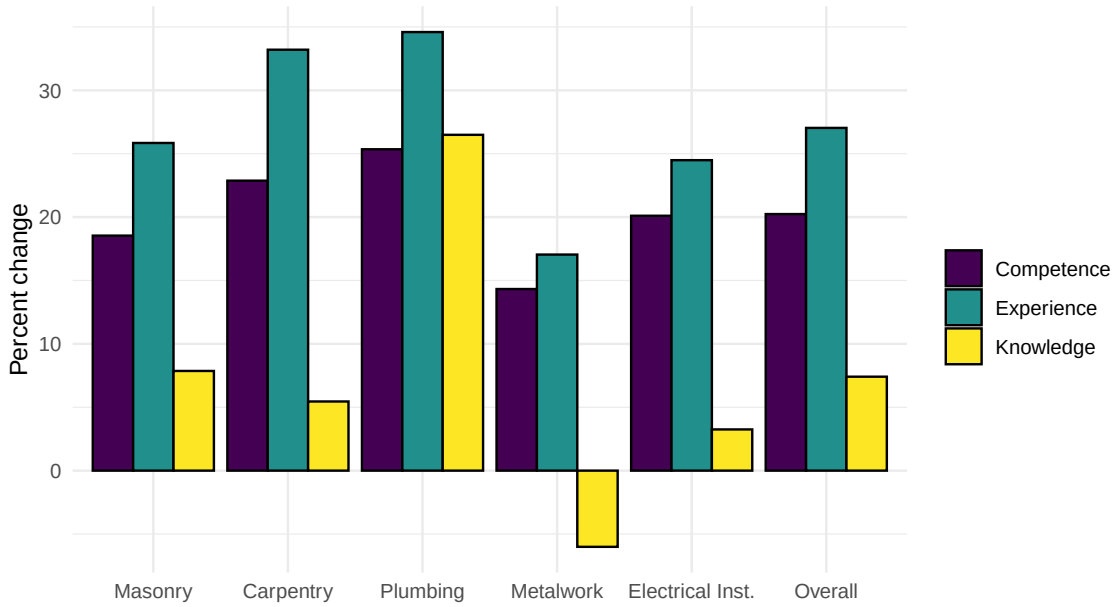

Table 13: Monthly allowances

Group	Characteristic	Overall, N = 427	Selected	Not Selected	Did Not Apply
Baseline	Food	6.66 (12.76)	5.85 (13.54)	8.45 (16.40)	6.38 (10.10)
	Transportation	5.89 (18.74)	4.67 (17.84)	7.63 (21.45)	5.92 (18.10)
	Pocket Money	14.68 (18.60)	14.45 (18.62)	16.47 (17.52)	14.02 (19.15)
	Other	0.07 (1.06)	0.00 (0.00)	0.00 (0.00)	0.14 (1.55)
	Total	27.30 (35.11)	24.98 (37.33)	32.55 (39.68)	26.46 (31.20)
Endline	Food	9.68 (8.04)	7.81 (7.17)	13.08 (7.87)	9.17 (8.56)
	Transportation	2.91 (6.58)	1.91 (4.24)	3.31 (5.65)	3.87 (9.33)
	Pocket Money	16.62 (55.33)	18.46 (61.51)	8.29 (16.49)	21.49 (68.13)
	Other	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
	Total	29.21 (54.68)	28.18 (59.64)	24.68 (18.43)	34.53 (68.50)
Overall	Food	7.50 (11.72)	6.51 (11.81)	9.98 (14.28)	6.95 (9.84)
	Transportation	5.06 (16.35)	3.75 (14.79)	6.20 (17.92)	5.50 (16.68)
	Pocket Money	15.22 (33.06)	15.79 (38.40)	13.78 (17.52)	15.54 (34.97)
	Other	0.05 (0.90)	0.00 (0.00)	0.00 (0.00)	0.11 (1.39)
	Total	27.83 (41.40)	26.05 (45.76)	29.96 (34.25)	28.10 (41.44)

[1] Mean (SD). Allowances reported in USD by firm.

Table 12: Monthly wages

	N	Baseline	N	Endline
Former apprentice (diff. workshop)	139	17 (56)	140	17 (43)
Former apprentice (same workshop)	139	19 (68)	140	15 (43)
Worker with secondary educ. or more	128	7 (35)	140	9 (52)
Worker with primary educ. or less	132	5 (30)	140	4 (34)
Paid family worker	124	4 (19)	140	4 (18)
Occassional worker	155	39 (77)	145	27 (59)
Firm owner	173	82 (88)	144	124 (95)
Traditional apprentice (first year)	172	0 (4)	140	6 (10)
Traditional apprentice (third year)	172	1 (6)	140	11 (16)
CQP apprentice (first year)	170	1 (6)	140	3 (8)
CQP apprentice (third year)	166	2 (9)	140	13 (35)

[1] Mean (SD). Monthly wages in USD.

Table 14: Fees reported by firm

Group	**Characteristic**	**Selected**, N = 149	**Not Selected**, N = 107	**Did Not Apply**, N = 171
Baseline	Initiation	9.31 (13.21)	11.28 (21.16)	12.14 (15.64)
	Training	80.41 (110.32)	117.40 (132.92)	213.87 (164.88)
	Graduation	37.77 (74.45)	30.32 (72.71)	42.28 (77.83)
	Materials	25.40 (37.86)	24.78 (35.33)	27.80 (37.98)
	Contract	44.03 (74.81)	35.53 (70.66)	25.03 (58.71)
	Application	13.31 (17.03)	11.15 (16.13)	12.74 (17.57)
	Total	190.39 (152.39)	209.43 (161.14)	314.63 (202.33)
Endline	Initiation	19.34 (47.58)	16.45 (34.10)	9.52 (14.31)
	Training	85.51 (128.53)	134.83 (152.04)	237.82 (147.63)
	Graduation	59.44 (125.34)	29.94 (90.98)	17.56 (60.24)
	Materials	18.83 (16.53)	25.10 (19.18)	18.98 (22.67)
	Contract	21.34 (52.90)	17.90 (45.73)	18.77 (49.97)
	Application	17.83 (14.25)	19.94 (17.24)	15.08 (16.10)
	Total	207.81 (159.47)	226.71 (173.61)	296.56 (161.55)
Overall	Initiation	12.98 (30.92)	13.14 (26.56)	11.46 (15.32)
	Training	82.28 (117.04)	123.72 (139.89)	220.08 (160.60)
	Graduation	45.38 (95.71)	30.19 (79.21)	35.75 (74.26)
	Materials	22.99 (31.86)	24.89 (30.63)	25.52 (34.83)
	Contract	35.72 (68.37)	29.17 (63.22)	23.39 (56.51)
	Application	14.97 (16.18)	14.34 (17.02)	13.35 (17.19)
	Total	196.57 (154.82)	215.55 (165.33)	309.89 (192.31)

[1] Mean (SD). Fees reported in USD by firm.

Figure 7: Breakdown of total costs of training per firm

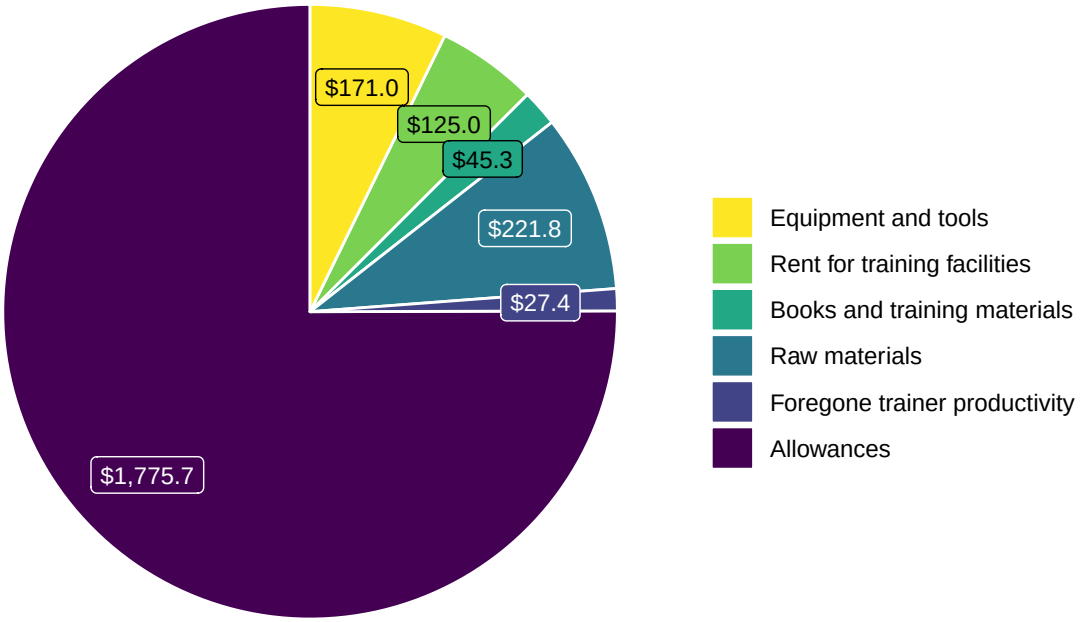

Table 15: Summary of firm costs

Characteristic	**Overall**, N = 347	**Baseline**, N = 197	**Endline**, N = 150
Rent	28.89 (67.44)	28.32 (64.41)	29.51 (70.79)
Equipment	33.89 (76.23)	35.82 (85.63)	31.80 (64.71)
Books	8.31 (48.51)	10.00 (60.00)	6.46 (31.71)
Raw materials	56.06 (182.99)	66.32 (207.33)	44.89 (152.07)
Foregone trainer prod.	4.56 (16.12)	4.28 (17.86)	5.10 (12.09)
Allowances	271.07 (422.17)	256.64 (327.84)	298.65 (561.55)

[1] Mean (SD). Fees reported by firm, in USD.

Table 16: Net benefits

Group		**Overall**, N = 427	**Selected**	**Not Selected**	**Did Not Apply**
Baseline	Model II	-141.16 (340.42)	-116.20 (334.33)	-163.51 (383.92)	-148.92 (316.64)
	Model III	-34.24 (485.26)	-18.93 (488.84)	-51.17 (523.80)	-37.00 (458.87)
Endline	Model II	-111.51 (455.59)	-117.29 (511.04)	-101.29 (220.77)	-113.01 (523.52)
	Model III	-30.59 (549.88)	-39.10 (552.05)	42.77 (556.19)	-76.72 (543.56)
Overall	Model II	-130.49 (385.76)	-116.61 (409.34)	-140.22 (332.98)	-137.00 (396.75)
	Model III	-32.93 (509.05)	-26.57 (512.67)	-16.01 (536.47)	-50.19 (487.91)

[1] Mean (SD)

[2] Mean (SD). Annual net benefits per apprentice in $US.

Table 17: Knowledge regressions

	Knowledge							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CQP participant	−0.04**	−0.05*	0.10	0.10	−0.05*	−0.04*	−0.01	−0.01
	(0.02)	(0.03)	(0.18)	(0.18)	(0.03)	(0.03)	(0.03)	(0.03)
Endline	0.05**	0.04	0.02	0.02	0.04	0.04	−0.004	−0.004
	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)	(0.08)	(0.08)
CQP x Endline		0.01	0.02	0.02	0.01	0.01	0.03	0.03
		(0.04)	(0.03)	(0.03)	(0.04)	(0.04)	(0.09)	(0.09)
Experience					0.0004	0.01	0.01	0.01
					(0.01)	(0.01)	(0.01)	(0.01)
Firm size						−0.003	−0.003	−0.003
						(0.002)	(0.002)	(0.002)
Total apprentices						0.01***	0.01***	0.01***
						(0.002)	(0.002)	(0.002)
Total instructors							−0.02	−0.02
							(0.01)	(0.01)
Days trained per week							−0.01	−0.01
							(0.01)	(0.01)
Duration, last training							0.003	0.003
							(0.01)	(0.01)
External training							−0.04	−0.04
							(0.03)	(0.03)
Constant	0.79***	0.79***	0.50***	0.50***	0.79***	0.74***	0.74***	0.74***
	(0.02)	(0.02)	(0.13)	(0.13)	(0.03)	(0.03)	(0.05)	(0.05)
Individual FE	NO	NO	YES	YES	NO	NO	NO	NO
Observations	390	390	390	390	390	389	253	253
R^2	0.02	0.02	0.87	0.87	0.02	0.08	0.11	0.11
F Statistic	4.60**	3.10**	3.40***	3.40***	2.30*	5.70***	3.10***	3.10***

Note: *p<0.1; **p<0.05; ***p<0.01
Omitted CQP category: applied but did not participate.

Table 18: Allowances per apprentice per year, reported by firm

Assumption	Bound	**Overall**, N = 347	**Baseline**, N = 197	**Endline**, N = 150
12 months/year | 20 days/month	lower	176,000 (96,000)	172,384 (96,000)	182,647 (96,000)
	mid	191,291 (126,000)	184,154 (126,000)	204,923 (126,000)
	upper	240,273 (156,000)	232,523 (156,000)	255,077 (156,000)
(F) months/year | 20 days/month	lower	150,955 (96,000)	144,515 (88,000)	162,794 (96,000)
	mid	163,999 (102,000)	155,266 (99,000)	180,683 (119,250)
	upper	205,858 (143,000)	196,498 (120,000)	223,737 (156,000)
12 months/year | 4 x (F) weeks/month	lower	207,917 (115,200)	202,714 (115,200)	217,482 (115,200)
	mid	225,880 (151,200)	216,399 (151,200)	243,992 (151,200)
	upper	283,559 (187,200)	273,109 (187,200)	303,523 (187,200)
(F) months/year | 4 x (F) weeks/month	lower	179,743 (112,000)	170,931 (105,600)	195,941 (115,200)
	mid	195,064 (118,800)	183,383 (109,200)	217,378 (145,800)
	upper	244,636 (156,000)	231,850 (136,800)	269,060 (187,200)
12 months/year | 4 x (A) weeks/month	lower	220,471 (134,400)	204,383 (124,800)	273,081 (134,400)
	mid	238,771 (149,800)	218,059 (142,800)	312,022 (176,400)
	upper	300,617 (187,200)	275,869 (168,000)	388,141 (218,400)
firm months | 4 x (A) weeks/month	lower	192,323 (100,800)	174,176 (100,800)	251,670 (100,800)
	mid	208,273 (111,000)	186,961 (109,200)	283,645 (132,300)
	upper	261,635 (144,800)	236,540 (124,800)	350,388 (187,200)

[1] Mean (Median). (F): reported by firm; (A): reported by apprentices.

Table 19: Allowances per apprentice per year, reported by apprentice

Assumption	Bound	**Overall**, N = 347	**Baseline**, N = 197	**Endline**, N = 150
12 months/year | 4 weeks/month	lower	120,396 (120,000)	113,623 (96,000)	152,432 (144,000)
	mid	160,189 (144,000)	152,846 (120,000)	194,919 (192,000)
	upper	199,944 (167,952)	192,033 (143,952)	237,360 (239,952)
(F) months/year | 4 weeks/month	lower	99,802 (72,000)	92,720 (70,000)	133,297 (132,000)
	mid	133,925 (96,000)	126,194 (88,000)	170,486 (176,000)
	upper	168,017 (119,952)	159,640 (109,956)	207,637 (219,956)

[1] Mean (Median). (F): reported by firm; (A): reported by apprentices.