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Thesis Title*

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Acknowledgments

I would like to thank...

Abstract

Big abstract

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Abstract

This paper uses a novel longitudinal dataset of 752 youth living in Cotonou, Benin, collected over 2 years, to analyze the school-to-work transition in a highly informal, urban environment. We conduct five waves of in-person and mobile phone surveys over three years with youth aged 20-29. We find evidence of queuing for wage jobs: relatively well-educated youth endure long periods of inactivity waiting for wage employment. Even wage jobs are informal and low-paying, and almost none fulfill the ILO formality criteria. Quantifying the transition, we find that the average youth in our sample needs between 5 and 18 months to find their first employment after graduation and between 23 and 27 months to find steady employment. Transition propensities show that casual, but full-time work following a spell of inactivity is the most common path taken; it is more likely to occur directly after graduation for men than from women. Finally, we find that youth who have transitioned to the labor market experience more life satisfaction, though no effect is detected for particular types of transitions.

2.1 Introduction

The youth population in Sub-Saharan Africa (SSA) is rapidly growing, and is expected to continue to do so for the foreseeable future. This presents both challenges and opportunities for the region. Despite recent increases in educational levels in sub-Saharan

Africa, which have increased young people's potential to become gainfully employed, youth continue to face many challenges when leaving school and seeking work: they are less likely to find quality jobs and more likely to remain unemployed than adults. Youth in low-income countries (LICs) are more likely to work informally than adults (Quintini and Martin, 2014).

The transition to the labor market marks a critical point in the productive and social development of young individuals. Delayed entry into formal employment has been shown to depress future earnings in high-income and developing countries alike (Bridges et al., 2017), while a semi-permanent state of "waithood" is commonly reported among youth (particularly males) in Sub-Saharan Africa, impeding their social integration and reducing the self-worth of those unable to find employment (Honwana, 2012; Mains, 2011).

Understanding the factors that influence the transition of young people into the labor market can help policymakers and other stakeholders to identify and implement interventions that can improve employment prospects and economic outcomes for young people in adulthood. Moreover, youth constitute a significant proportion of the population in the region, and their ability to find employment and enter the labor market has significant implications for economic growth and development. Finally, the study of youth labor market transitions can provide insights into the broader economic and social challenges facing the region, such as poverty, inequality, and gender discrimination. Additionally, studying youth labor market transitions can provide insight into the broader socioeconomic dynamics of the region and can help to inform policy decisions in other areas, such as education and training.

The dynamic process of the school-to-work transition (SWT), including all the activities of young people between full-time schooling and stable employment, is best studied with detailed, longitudinal data; as a result, most studies of the SWT have been conducted in high-income countries (Nilsson, 2019). In addition to data scarcity, the informality inherent to most youth labor markets in the low- and middle-income countries render traditional data sources insufficient for capturing all the details of the SWT. While the path from formal education to formal employment is sequential and quantifi-

able, the SWT in informal labor markets tends to be more complicated, often leading through halting periods of formal education and informal training, stints at the family household enterprise, prolonged school absences or repeated years, and periods of complete economic inactivity. Official labor market data in developing countries is too infrequent and unreliable to capture such dynamics.

In this paper, we use a novel, longitudinal dataset from a survey conducted with 752 youth from Cotonou, Benin in five waves over three years to map the school-to-work transition in an urban, highly informal economy. In order to better understand the dynamics of the SWT, we use panel data to track young people's movements between school and work as well as between different employment states.

We find that young women face longer transitions to the labor market, and many do not transition at all. Similar to findings from Latin America, we find that youth often enter casual or informal work earlier in their career, following a transitive period in formal employment, and finishing in self-employment. Urban youth transitions can thus be characterized tending towards self-employment in the informal sector, following a period of instability, with the exception of a proportion of young women, who immediately enter domestic work.

The next section describes existing work on youth SWT across the world, including transition age and duration and work on characterizing different SWT typologies. Section 2.3 presents the data and methodology. Section 2.4 contains analysis and results. Section 2.5 concludes.

2.2 Background

Both the age of graduation and the speed of transition to the labor market upon graduation are of interest to policy makers. A delayed entry into the labor force can reduce youths' lifetime potential for labor market participation and contribution to the economy, while a slow transition can result in "scarring"; that is, early periods of underemployment and unemployment that lead to wage losses and reduce the likelihood of ever returning to work. Evidence from high-income countries suggests that protracted

unemployment spells, including extended school-to-work transitions, negatively affect future earnings and employment prospects (Arulampalam, 2001; Cockx and Picchio, 2012; Emmenegger et al., 2017; Möller and Umkehrer, 2015; Mroz and Savage, 2006; Nordström Skans, 2011; Schmillen and Umkehrer, 2017). Policy makers aim to optimize factors that foster short and smooth SWTs in order to support a healthy and productive economy and ensure gainful, fulfilling employment for its youth.

The age of graduation and SWT duration is of particular interest in SSA, with its high rates of informal work and underemployment among its growing youth population. Young people aged 15-24 in SSA suffer over twice the unemployment rate of adults, albeit with high variation across countries (African Development Bank, 2016). Those youth that are employed tend to be underemployed and in informal work, leading to youth poverty, exacerbating inequality and fostering unrest and conflict, raising the scepter of youth unrest observed elsewhere in the world (Mains, 2011; Urdal, 2006). Compared to HICs, out-of-school youth in LICs are more likely to become NEET upon leaving school, and under-employment is more widespread (Quintini and Martin, 2014). Moreover, competition for limited formal jobs is intensified in the presence of rapid population growth: Manacorda et al. (2017) find that a one standard deviation increase in the rate of population growth leads to an increase in average transition duration of ∼17 months. One standard deviation increase the poverty rate leads to a reduction in transition duration of ∼17 months and an increase in probability of never attaining employment of 14 percentage points (Manacorda et al., 2017).

Two counteracting factors affect SWT duration in SSA: poverty and lack of unemployment insurance forces youth into working sooner, while increasing education and decreasing number of public sector jobs has driven up expectations without matching wage job growth (Manacorda et al., 2017). Many youth are left with no choice but to create their own employment in the face of underdeveloped private sectors. The need for savings to start a business, whether from family networks or personal saving, often lead to youth taking short stints in transitory employment in order to save up for their own business (Bridges et al., 2017; Frazer, 2006). Meanwhile, rising education rates in SSA mechanically delay the transition: as increasing numbers of youth stay in school

for longer, they enter the labor market at a more advanced age [calves2013]. More educated youth in SSA, especially university graduates, have been shown to be reluctant to work in the informal sector, preferring to wait for formal or public sector employment [serneels2007]. The reduction of public sector employment and increase in access to education in recent years are reversing the labor market conditions of the past, in which the educated had a relatively easy path to public employment.

Moreover, if education systems are not aligned with the demands of the labor market, students may graduate with skills that are not in high demand, slowing the SWT and increasing unemployment and underemployment for the most educated youth. Bandara (2019), using eight SWTS surveys from SSA, including Benin, report that about 47 and 28 percent of employed youth in their sample are overqualified and underqualified for their jobs, respectively.

First labor market experience has also been emphasized as an important component of a successful SWT in the literature. Bridges et al. (2017) use the Tanzania Household Urban Panel Survey to study how first experiences in the labor market effects future earnings, and find that school-leavers who immediately find a wage job, experience a future wage premium – particularly in the formal sector. Youth who attend private schooling in Ouagadougou, Burkina Faso were shown to be 9 percentage point more likely to find wage work as first employment (Calvès et al., 2013). The first work experience may even take place while youth are in school, though work-study statistics are often not captured in the data: using the School-to-Work Transition Surveys (SWTS), Dedehouanou et al. (2019) find that working while studying accelerates the SWT in Benin.

Another strand of literature has focused on the paths youths take in their formative years on the labor market. According to the official definition, the SWT ends with the first labor market experience. However, particularly in more informal economies, the paths taken by youth have been shown to be more turbulent than those of adults. The OECD literature suggests that there is frequent job turnover among younger workers who engage in a search process of "shopping around" temporary jobs until they find a career path, whereas the informal sector may play a similar, transitory role in developing countries, rather than being a dead-end career path. Moreover, what is deemed

a successful labor market state may change as workers gain experience and age. Cunningham and Salvagno (2011) study panel labor force surveys from Argentina, Brazil, and Mexico and find that youth tend to enter the labor market through the informal sector, where they remain for a limited time before finding a formal job; as they age, however, they leave formal wage employment to pursue a self-employed career. Looking at different income groups, the authors find that the poor experience a higher rate of entry to work upon leaving school, the same duration in jobs, and equal entry rates to formal wage employment, but are more likely to transition between states. Egel and Salehi-Isfahani (2010) find frequent transitions between formal and informal sector in Iran, independent of the level of education. Nordman and Pasquier-Doumer (2014) collect work histories from working-age individuals in Ouagadougou and find that family networks increase the probability of transition from unemployment to employment and from self-employment to wage employment (but not from wage employment to self-employment). However, the authors report that this may reflect an increasing prevalence of short-term positions in the public sector, particularly for labor market entrants.

Though not the focus of this paper, the comparative literature has also pointed to several institutional factors that may influence the age at which youth transition to the labor market, and how long this transition lasts. Nilsson (2019) discusses institutional factors such as the minimum wage, UI and wage subsidies, though studies do not point in a single direction. Local labor market conditions appear to be stronger drivers of duration than GDP, trade openness, or income distribution. Active labor market policies (ALMP) have shown promise in isolated settings: skills training and entrepreneurship promotion appear more successful than facilitation programs like job fairs or subsidies.

Though there is much heterogeneity in the data, youth from the highest-income and lowest-income countries tend to have relatively short school-to-work transitions, though youth in HICs still stay in school longer and have lower rates of inactivity after graduation Quintini and Martin (2014). It is in middle-income countries in LAC and MENA, and southern Europe where the transition duration is most prolonged. In SSA, two counteracting factors likely influence transition speed: overarching youth poverty and a lack of unemployment insurance forces youth into working sooner, while increasing

education and decreasing number of public sector jobs has driven up expectations without matching wage job growth. The effect of education on SWT duration differs across studies, though it seems that it may speed up transition in MENA and central Asian countries and lengthen it in SSA, especially at higher levels of attainment (Manacorda et al., 2017). Elsewhere, Matsumoto et al. (2010) find a strictly decreasing relationship between educational attainment and SWT duration in Egypt and Mongolia.

In sum, the literature suggests that the school-to-work transition in LICs is not that different from HICs, though there is a large variation between countries, and at the individual level can be influenced by a variety of factors, including schooling, gender, and network size. Studies of the particular paths taken by youth indicate that, at least in a sample of European and Latin American countries, many youth alternate between short stints of formal and informal employment upon graduation, transitioning to self-employment as they age. In this paper, we map out the paths for youth in an urban, highly informal labor market in SSA, which, to our knowledge, has not been attempted to date.

2.3 Data and Methodology

Data

In this paper, we use novel longitudinal survey data tracking 752 youth from the city of Cotonou, Benin's economic center and de facto administrative capital, over the course of three years. The survey was conducted by the authors with the collaboration of researchers from the University of Abomey-Calavi and the Institut National de la Statistique et de l'Analyse Économique (INSAE).

Youth were selected for the survey using a two-step sampling process. First, a census of quasi-representative administrative zones covering 4,905 households in the metropolitan area of Cotonou was conducted and served as a sample frame. Second, a sample of youth aged 20 to 29 selected randomly from the sample frame to take part in the panel survey. Because school attendance rates among younger respondents were found to be very high — more than 70% of the 15- to 19-year-olds covered by

the census — the 20-29 age range was chosen in place of the 15-29 range used by the International Labour Organization (ILO) to define youth. This was done to shift the focus of the study from schooling to labor market outcomes. Following the baseline survey in August 2019, three follow-up surveys were conducted by mobile phone in November 2019, April 2020, and September 2020 respectively. An in-person endline was conducted in the summer of 2021 for five survey waves in total.

Table A2.2 in the Appendix depicts sample attrition over the five survy waves. The panel suffers an attrition rate of between 9% and 19% per survey round, with an overall attrition rate of 34% over the course of the first year of the survey (i.e. through survey four of five). This is high but in line with other remote longitudinal surveys in developing countries (Demombynes et al., 2013, p. ballivian2015). However, a large proportion of non-respondents were recovered for the face-to-face endline, resulting in a final attrition of just 24%. The largest drop in response rate, between the first and second follow-up surveys, is likely related to the timing of the second phone-based survey, which took place in the early phases of Benin's response to the global Covid-19 pandemic. To test for biased respondent attrition, we test for equality in time-invariant characteristics across survey waves. Table A2.2 in the Appendix indicates that attrition is neither associated with respondent activity at baseline, nor with their sex, age, or education. Thus, we proceed with the analysis assuming random dropout.

Summary Statistics

Table 2.1: Descriptive Statistics by Baseline Activity

Characteristic	Overall	Baseline Activity					p-value
		In School (22%)	NEET (32%)	Self-Employed (16%)	Employed (22%)	Apprentice (8%)	
N	752	169	238	119	168	58	
Male (=1)	47%	56%	34%	49%	54%	55%	<0.001
Age at baseline	24.15 (24)	22.82 (23)	24.30 (24)	24.84 (25)	25.06 (25)	23.36 (23)	<0.001
Nationality: Beninese (=1)	97%	98%	97%	97%	98%	98%	0.9
Ethnicity: Fon (=1)	69%	62%	69%	71%	71%	83%	0.050
Religion: Christian (=1)	84%	83%	83%	83%	85%	90%	0.8
Grew up in a city (=1)	64%	66%	66%	65%	63%	57%	0.8
Employment Status							
Graduation age	22.62 (23)	23.67 (24)	22.35 (22)	21.74 (22)	22.28 (22)	23.65 (23)	<0.001
Age at first employment	23.65 (24)	24.56 (24)	23.62 (24)	22.82 (22)	23.43 (23)	24.24 (24)	<0.001
Duration of transition in years[1]	1.06 (1)	0.64 (1)	1.37 (1)	1.08 (1)	1.17 (1)	0.72 (1)	<0.001
Education							
Years of schooling	12.42 (14)	15.03 (15)	11.97 (13)	9.52 (10)	13.24 (14)	10.22 (11)	<0.001
Completed apprenticeship (=1)	20%	4.1%	18%	39%	20%	36%	<0.001
Vocational certificate: CAP (=1)	4.4%	5.9%	4.6%	2.5%	4.8%	1.7%	0.6
Primary diploma: CEP (=1)	85%	98%	82%	70%	92%	69%	<0.001
Junior high diploma: BEPC (=1)	67%	96%	60%	41%	73%	45%	<0.001
Baccalauréat: BAC (=1)	40%	72%	34%	18%	38%	19%	<0.001
2nd cycle university: Licence (=1)	15%	11%	19%	11%	20%	6.9%	0.014
3rd cycle university: Maîtrise (=1)	2.3%	1.8%	2.5%	2.5%	3.0%	0%	0.8
Parents' Education							
Father was an apprentice (=1)	33%	27%	32%	33%	35%	47%	0.075
Father completed primary (=1)	53%	60%	52%	42%	52%	60%	0.028
Father completed secondary (=1)	20%	25%	23%	13%	18%	10%	0.015
Mother was an apprentice (=1)	17%	20%	18%	14%	14%	19%	0.6
Mother completed primary (=1)	27%	30%	28%	24%	27%	28%	0.9
Mother completed secondary (=1)	6.0%	4.7%	9.7%	1.7%	7.1%	0%	0.004
Household Characteristics and Assets							
Married (=1)	20%	4.7%	28%	34%	16%	10%	<0.001
Living with parents (=1)	45%	60%	42%	37%	39%	47%	<0.001
No. of children	0.61 (0)	0.13 (0)	0.86 (0)	1.11 (1)	0.51 (0)	0.24 (0)	<0.001
People in household	5.45 (5)	5.96 (6)	5.55 (5)	5.04 (4)	5.40 (5)	4.48 (3)	0.027
Wealth index quintile	2.91 (3)	2.60 (2)	2.90 (3)	3.19 (3)	3.02 (3)	2.93 (3)	0.002
Home electrified (=1)	92%	94%	92%	92%	93%	88%	0.6
Cell Phone (=1)	76%	69%	76%	82%	76%	83%	0.060
Smartphone (=1)	54%	63%	49%	44%	61%	45%	<0.001
Motorcycle (=1)	27%	20%	23%	42%	36%	14%	<0.001
Television (=1)	39%	28%	40%	50%	43%	38%	0.003

Mean (median); %. Calculated using responses from baseline survey.
[1] To first employment.

Youth characteristics at baseline are presented for each activity in Table 2.1 above. The reported p-value reported compare the equality of means under the null hypothesis that means are equal for all activities. The average age of the youth in our sample is 24.15 years at baseline, with apprentices and youth in schooling being on average younger than the rest of the sample. Self-employed youth have less schooling than those who are employed or NEET, and at 39 percent have the highest rate of apprenticeship completion, in line with the notion that apprenticeship is a pathway to self-employment in the crafts sector as opposed to formal wage employment. The wage employed, on the other

hand, are more likely than NEET youth to hold a primary and junior high diploma, but hold baccalauréate and university diplomas at essentially the same rate: this suggests that the NEET are comprised of both under qualified youth (lacking the necessary qualifications for the most formal wage jobs) and overqualified youth (who are unable to find employment despite qualifications comparable to the wage employed.) 45 percent of youth report living with their parents, and 20 percent are married. Thus, the sample can be broadly described as urban and well-educated but still transitioning to a state of independence and financial stability.

In Table A2.3 in the Appendix, we compare the baseline characteristics of young men and women in the sample. Young women are almost twice as likely to be NEET at baseline as their male counterparts, and appear to take on the responsibilities of parenthood earlier than young men: they are more than twice as likely to be married and to have at least one child, and have 41 percent more children on average. They are also less likely than men to have a certificate or diploma at each stage of education, from primary schooling (80 percent vs 90 percent) to baccalauréat (32 percent vs 48 percent) to 2nd cycle university (11 percent vs 20 percent). There are also indications of spousal dependency: young women are much more likely to report residing in the home of their spouse or partner — virtually all respondents (99 percent) who reported "living with their spouse" were women — and less likely to own a smartphone or motorcycle, a critical means of communication and transportation in Cotonou. The difference in material wealth as captured by the wealth index is not statistically significant, however.

Many youth in Cotonou are still in school in their 20s — representing almost a third of 20-29 year-old youth in the census, and 22 percent of our sample. Even youth who have already left the education system (and thus have both less schooling on average and are less likely to continue accruing it) report having completed a mean of 11.2 years of school — much higher than the 5.7 years for 20- to 24-year-olds and the 4.4 years for 25- to 29-year-olds in Benin estimated for the year 2010 by Barro and Lee (2013)[1]. Among students in the sample, about 20 percent attend a private university, and 75 percent have to pay tuition fees. School fees vary: 30 percent of university students pay

[1]This likely reflects both rising education rates across SSA and longer schooling prevalent in urban areas relative to national figures.

negligible fees (less than 30 CHF per year), while nearly 20 percent report paying over 300,000 FCFA (490 CHF) annually. The overwhelming majority are supported financially by their parents. Few students supplement their studies with external practical training, with only 13 percent of student having participated in a (generally unpaid) internship at private firm in the year prior to the survey.

Method

Three methods are used to analyze the dynamics of youth employment in Cotonou.

First, we follow Manacorda et al. (2017) and calculate the duration of transition to first employment. Second, we estimate transition intensity matrices to calculate the rate of turnover, or the share of people that move out of or into a certain state of employment in each period under observation. Using this approach we can, for instance, determine whether youth move from self- to wage employment at a higher rate than from wage to self-employment. Third, we use optimal matching analysis to create a taxonomy of transition sequences, which we compare along individual characteristics. We also identify the most common sequences observable in the data. Finally, we discuss the impact of certain transitions on the life satisfaction of youth, the aspirations expressed by youth at different employment states, and self-reported obstacles on the SWT.

2.4 Results and Drivers

2.4.1 Labour Market Entry

We begin by quantifying three aspects of the SWT commonly reproduced in the literature: age at graduation or school-leaving, age at first employment, and transition duration to first employment. To do this, we combine retrospective employment history data, which was obtained by asking youth what their main economic activity was over the course of the past seven years, with the observed economic activity from the panel survey.

The start of the SWT is often considered the point at which youth permanently leave school Nilsson (2019). Other definitions stipulate that only youth looking for work upon

graduation are considered, to exclude youth, for instance young women predisposed to domestic work, from skewing the unemployment numbers (Matsumoto et al., 2010). The ILO's *Work4Youth* program takes school-leaving age to be the of the onset of the school-to-work transition, as do several studies of the school-to-work transition in OECD countries (e.g. Bowers (1998), Quintini et al. (2007)). We take the age of youth at the time of their last observed period in school to be their graduation age. If youth are still in school at the time of our last interview with them, we assume that we have not observed their SWT and they are excluded from these calculations. Similarly, the first employment age is the age of youth at the time of their first employment experience, provided that they do not go back to school in subsequent observations. The trasition duration is the graduation age subtracted from the age at first employment.

The second panel of Table 2.1 shows that the mean graduation age of the sample is 22.62 years, the age at first employment 23.65 years, and the resulting duration just over one year. Table A2.3 in the Appendix shows that young men leave school about 7.5 months later than women, but are not faster to find their first employment.

School-to-work transitions are longer in LICs. Chile, Turkey and South Africa have the longest time needed for 50 percent of a cohort to find work, at 5.9, 7.6 and 8.3 years, respectively (shortest times are Australia, Canada, and France at 1.0, 1.7, and 1.8). Spain and Italy have worryingly long transitions by this measure - on par with Chile. The average duration of completed transitions is also generally longer in emerging economies, though the contrast is not as stark - 2.7 for South Africa, and around 1 for most LMICs, compared to 0.3-1.0 for HICs (except Spain and Italy). Quintini and Martin (2014) report that the median school-leaving age in a sample of advanced economies was between 21 and 22 years, compared to 17-18 in LMICs such as Brazil, India, Indonesia, Mexico and Turkey and 19-20 in selected Latin American countries (Argentina, Chile and South Africa).

that when both retroactive job data and panel data is considered, 512 youth (or 68 percent) of youth finish school or training between 2013 and the penultimate survey wave, with a mean graduation age of 22 years and 7 months. Youth who secured wage employment as their first labour market experience entered the labour market at

the age of 22.57 on average, compared with age 22.64 for those who entered into self-employment and 22.66 for those whose first recorded status was NEET; however, this difference is not statistically significant.

We find that the majority of youth (over 60%) find wage or self-employment immediately after finishing their schooling or training. Youth who find wage employment immediately after entering the labour market are more likely to be male and less likely to be married with fewer children (though only the difference for sex is significant). Youth who enter the labour market as either wage employed or unemployed have 14.7 years of schooling on average, while those who enter as self-employed have approximately one year less. The NEET and wage employed also appear to have more educated parents, in contrast to the findings of Bridges et al. (2017), who find that youth who enter the labor market as self-employed in Tanzania tend to have more educated parents. The self-employed also report the highest rate of completed apprenticeship and are generally less educated - with the exception, interestingly, of 3rd cycle (master's level) university graduates, which are equally represented across the three groups. NEET youth have parents with slightly higher educational attainment, consistent with the hypothesis that wealthy families are better able to support youth through extended periods of unemployment.

Both cross-sectional and longitudinal data have been used to quantify the SWT in other studies. Cross-sectional data can be used to estimate the transition duration by subtracting the age at which 50 percent of the population has left school from the age at which 50 percent of the population has found work. Quintini et al. (2007) and Quintini and Martin (2014) use this approach to report transition duration, along with mean school-leaving and first employment ages (see Table 1). For longitudinal studies, the mean transition duration, reported for example in Quintini et al. (2007), the non-inclusion of youth still in transition will bias results. Survival analysis is often used to account for this right-censored nature of the data (Nordman and Pasquier-Doumer (2015); Manacorda et al. (2017), and several other studies in developing countries, albeit of lower quality). Manacorda et al. (2017) does this with 23 SWTS countries and reports similar transition times to the first job as Quintini, but much longer waits until

permanent employment (11 year average for five countries in SSA, including Benin).

We start by considering the differences between youth who enter the labour market in three different employment states: wage employed, self-employed, and NEET. Table A2.5 compares the baseline characteristics of a total of 512 youth whose transition to the labour market was observed, or 68% of the sample[2].

The start can, however, be conditioned by those who are unwilling to seek work while they are in school (Matsumoto & Elder, 2010), which means that it can exclude those who will not seek work after they finish their schooling.

Methodologically, both cross-sectional and longitudinal data have been used to quantify the school-to-work transition. Cross-sectional data can be used to estimate the transition duration by subtracting the age at which 50 percent of the population has left school from the age at which 50 percent of the population has found work. Quintini et al. (2007) and Quintini and Martin (2014) use this approach to report transition duration in advanced economies, along with mean school-leaving and first employment ages. For longitudinal studies, the mean transition duration, reported for example in Quintini et al. (2007), the non-inclusion of youth still in transition will bias results. Survival analysis is often used to account for this right-censored nature of the data [Nordman and Pasquier-Doumer (2015); manacorda2017]. Manacorda et al. (2017) apply survival analysis to SWTS data from 23 lower-middle and lower income countries and report similar transition times to first employment as Quintini and Martin (2014), but considerably longer transitions to permanent employment (11 year average for five countries in SSA, including Benin).

Next, we examine the first employment age, defined as the age at which youth first report being employed or self-employed, conditional on being in education for at least one year since 2013 and not returning to school in subsequent periods. Again combining employment history data the panel survey, we estimate a first employment age of 23 years and 8 months - almost precisely one year after the mean graduation age. Half of the sample reports having found their first employment experience by the age of 24, and

[2]The remainder were either in apprenticeship or schooling in the final observed period (and thus never transitioned to the labour market according to our definition) or were never in schooling or apprenticeship during the entirety of the period under observation (and to whom the school-to-work transition does not apply, as in Manacorda (2017)).

90% by the age of 27.

Finally, using measures from the combined event history and panel data, we define the transition duration as the difference between the age at graduation and the age of both first employment. The average duration of the transition to first employment is just over one year. Youth who enter as wage employed take about a month and a half longer to find a job. Those who enter the labour market as inactive (NEET), on the other hand, experience a longer transition that those who enter as wage or self-employed; however, the length of this period of inactivity is less than one year, on average.

After the age of 28 all those who start off as unemployed become self-employed. This finding provides support for the idea of 'waiting and searching', that is, individuals prefer to work in wage employment, but as the probability of getting such employment decreases, they move into self-employment. This evidence is further strengthened by the fact that the majority of the self-employed (87 percent) state their main reason for starting their own business as being because they 'could not find salaried work' (Bridges et al., 2017)

As mentioned above, the estimates provided in A2.5 may be biased, as transition age and duration can only be calculated for youth for whom we recorded a graduation age (at least one year of schooling in the observed period) and at least on subsequent period of employment. Youth who are still in apprenticeship or schooling in the last period in which they are observed are considered to be right censored (Nilsson, 2019) – as nearly one sixth of our sample is still in school or training at endline, the data is right-censored and we expect the mean age of school-leaving to be downward biased. To address this issue, we follow and apply survival analysis to the retrospective history data, following Nordman and Pasquier-Doumer (2015) and Manacorda et al. (2017). Figure A2.2 in the Appendix plots the estimated survival probability, i.e. the probability that a youth needs an additional year year to transition to the labor market after completing their schooling or training. About 83 percent of youth report at least a year to transition to the labour market, while only about 18 percent require two years or more. Only about one percent of youth who transition report being unemployed for a period of four years or longer.

The adjustment for right-censored data does not significantly alter the estimated mean transition duration: on average, young men take a year and a month to find their first employment experience, while young women require about a month longer. This estimated transition duration is considerably shorter than the one calculated for five countries in SSA by Manacorda et al. (2017), namely 25.7 months to first employment and 129.7 months to steady employment[3]. Comparison with the estimated mean transition rates from Manacorda et al. (2017), however, shows Benin to be somewhat of an outlier in SSA as well, with the lowest mean time to a first and to a permanent job among the five countries in SSA for which transition duration could be estimated.

[3]Based on SWTS surveys from five countries in SSA: Benin, Madagascar, Tanzania, Togo, Uganda.

Table 2.2: Transition Into First Employment

			Labor market status at entry		
	Transition Age	Transition Duration	Wage vs NEET	Self vs NEET	Wage vs Self
	(1)	(2)	(3)	(4)	(5)
Male (=1)	0.55**	−0.08	−0.29	0.39	−0.09
	(0.26)	(0.08)	(0.22)	(0.26)	(0.26)
Years of Schooling	−0.002	−0.02	0.01	−0.004	0.04
	(0.06)	(0.02)	(0.05)	(0.06)	(0.06)
Completed apprenticeship (=1)	0.30	−0.13	−0.43	0.77**	−0.05
	(0.35)	(0.10)	(0.31)	(0.36)	(0.33)
Primary school diploma: CEP (=1)	−0.74	0.27	−0.46	0.23	0.34
	(0.58)	(0.17)	(0.59)	(0.60)	(0.51)
Junior high diploma: BEPC (=1)	1.00**	0.18	0.19	−0.52	0.05
	(0.43)	(0.13)	(0.37)	(0.44)	(0.39)
Baccalauréat: BAC (=1)	0.66*	−0.18*	−0.44	0.29	0.19
	(0.36)	(0.11)	(0.30)	(0.37)	(0.35)
Lower vocational: CAP (=1)	−0.23	−0.05	−0.48	−0.003	0.47
	(0.57)	(0.17)	(0.48)	(0.63)	(0.56)
2nd cycle university: Licence (=1)	0.47	0.19*	0.26	−0.13	−0.07
	(0.38)	(0.11)	(0.31)	(0.40)	(0.38)
3rd cycle university: Maîtrise (=1)	0.75	0.57***	−0.02	0.26	−0.58
	(0.71)	(0.21)	(0.63)	(0.75)	(0.73)
Father was apprentice (=1)	−0.24	0.07	0.05	−0.70**	0.42
	(0.28)	(0.08)	(0.24)	(0.29)	(0.26)
Father completed primary (=1)	0.65**	−0.03	0.005	−0.06	0.22
	(0.29)	(0.09)	(0.25)	(0.29)	(0.27)
Father completed secondary (=1)	−0.78**	0.12	0.33	−1.20***	0.56
	(0.39)	(0.12)	(0.31)	(0.43)	(0.40)
Mother was apprentice (=1)	0.18	−0.10	0.28	−0.15	−0.20
	(0.34)	(0.10)	(0.28)	(0.34)	(0.34)
Mother completed primary (=1)	−0.36	−0.005	0.15	−0.03	−0.25
	(0.34)	(0.10)	(0.27)	(0.33)	(0.33)
Mother completed secondary (=1)	−0.35	−0.26	−0.22	0.01	0.49
	(0.59)	(0.17)	(0.44)	(0.62)	(0.64)
Married (=1)	0.29	0.36***	0.01	−0.08	0.01
	(0.37)	(0.11)	(0.33)	(0.39)	(0.38)
Beninese (=1)	−0.86	0.04	0.55	−1.50	−0.24
	(1.00)	(0.30)	(0.99)	(1.10)	(0.98)
Ethnicity: Fon (=1)	−0.28	0.01	−0.13	0.78**	−0.33
	(0.29)	(0.09)	(0.25)	(0.31)	(0.29)
Religion: Christian (=1)	0.90**	0.05	0.22	−0.55	0.07
	(0.36)	(0.11)	(0.32)	(0.37)	(0.35)
Grew up in a city (=1)	−0.03	0.09	−0.03	0.44	−0.41
	(0.26)	(0.08)	(0.23)	(0.27)	(0.26)
Constant	23.00***	0.92***	−0.25	0.98	−0.09
	(1.10)	(0.34)	(1.10)	(1.20)	(1.10)
Observations	417	417	386	322	322
R^2	0.10	0.09			
Akaike Inf. Crit.			564.00	432.00	453.00
F Statistic	2.30***	1.90**			
Note:					*p<0.1; **p<0.05; ***p<0.01

In Table 2.2, we estimate the effect of the educational attainment of youth and their parents on the age at transition to first employment and the duration of the transition using the following specification:

$$y_i = \alpha + E_i + X_i + \mu_i,$$

where y_i is the outcome of interest for youth i, E_i is the status at labour market entry, X_i is a vector capturing educational characteristics of youth and parents, including diplomas held, as well as time-invariant youth characteristics, and μ_i is the error term.

Columns (1) and (2) of Table 2.2 examine potential drivers of youth age at transition to first employment, while columns (3) and (4) report the determinants of the duration of this transition (in years).

Youth who enter as employed or self-employed are on average almost a year younger when they enter the labour market, and take between 9 and 10 months less time to transition, than youth whose first labour market experience is inactivity. Men enter the labor market about half a year later than women. Secondary schooling delays the transition to the labor market on average, but does not affect the transition duration. Extended university education (master's level or higher), on the other hand, is associated with a longer transition, by about six months. Youth with more educated fathers have their first employment experience at a younger age: a possible rationale for this result is that better-educated fathers have better business connections and are able to facilitate a more effective job search for their sons and daughters. Finally, we find that marriage (at baseline) is associated with a longer transition duration.

2.4.2 Transition Paths

transition intensity matrices

Transitions between activity states can be depicted for any pair of survey rounds using transition intensity matrices. transition intensity matrices can be interpreted as flows of youth between activities from the earlier time period (left-hand column) to the later time period (top row). Shown is the rate of youth at time t flowing into a column activity j from a row activity i, as a percentage of all youth in row activity i at time $t-1$. The number in parentheses shows the rate flowing from activity i into j as a percentage of all youth in column activity j at time t. For instance, the first row, second column entry of Table B2.2 shows two flow rates corresponding to transition "from school to NEET": 3.72 percent of youth in school transitioned to NEET the next year, while on av-

erage 21.95 percent of NEET youth had been in school the year before over the observed employment histories. Entries on the diagonal indicate that youth stayed in the same activity from one period to the next.

An examination of the pooled transitions between past activities using the event history data (Table B2.2 in Appendix B) summarizes a total of six transitions. It shows that schooling was still the predominant activity of youth in the seven years prior to being interviewed, accounting for over half of all observations. The most frequent transitions in relative terms (accounting for the number of youth starting from a given activity) are from NEET status into wage employment (14.97 percent) and into self-employment (10.55 percent) and from apprenticeship into wage employment (10.22 percent of apprentices) and into self-employment (9.32 percent). While we observe similar rates of transition out of school (14.14 percent each year, on average), self-employment (11.19), and wage employment (15.24), the flow of youth out of school naturally increase over time (as youth approach graduation age), while the rates out of self- and wage employment remain relatively constant over time. The activities of youth as they age are shown by gender in Figure 2.1 below.

Table B2.3 depicts the rates of transition between activities pooled across the five detailed survey rounds, resulting in average transition rates over four transitions between the years of 2019 and 2021. As expected, the rate of graduation (transition out of school) is even higher than the last period of the event history. On average, 39.7 percent of youth changed activities between each survey round, a significantly higher rate than the 17 percent observed in the event history data, reflecting both the higher instability associated with the transition phase (compared to school-age years) and, potentially, more frequent variation in youth activity, particularly after graduation, than can be captured by annual data. The most stable activity is wage employment, with a 68% retention rate across all survey rounds. The most common transitions are NEET to wage employment (128 transitions), NEET to self-employment (97), wage employed to NEET (93), self-employment to NEET (75) and school to NEET (66). School to wage employment (51) as well as self-employed to employed (48) and employed to self-employed (51) are also common. In terms of rates, the most likely transitions overall are from NEET to wage

Figure 2.1: Occupation by age (recall data)

employment (22.18 percent of NEET youth transition to wage employment in the next period) and self-employment to NEET (20.78 percent). The most common transition for youth in school is NEET in the following period (16.22 percent); for the wage employed it is NEET (16.49 percent) and for apprentices it is NEET (19.44 percent). Other frequent transitions are NEET to self-employment (16.81 percent), self-employment to wage employment (13.3 percent), and employed to NEET (16.49 percent).

Table 2.3: Activity transition matrix: Combined data, 2013-2021

	To				
From	In School	NEET	Self-Employed	Employed	Apprentice
In School	**85.68%**	**3.85%**	**2.61%**	**4.92%**	**2.95%**
Conditional	-	4.49%	3.04%	5.74%	3.44%
Female	-	5.02%	2.74%	6.04%	4.45%
Male	-	4.08%	3.28%	5.50%	2.66%
14-18	-	1.32%	1.08%	0.96%	2.15%
19-24	-	6.23%	3.94%	8.42%	4.40%
25-30	-	14.47%	11.84%	19.74%	3.95%
NEET	**1.82%**	**64.94%**	**11.17%**	**14.29%**	**7.79%**
Conditional	2.80%	-	17.20%	22.00%	12.00%
Female	2.33%	-	13.95%	15.35%	7.91%
Male	5.71%	-	37.14%	62.86%	37.14%
14-18	4.76%	-	7.14%	11.90%	21.43%
19-24	2.31%	-	16.18%	18.50%	9.83%
25-30	2.86%	-	34.29%	51.43%	11.43%
Self-Employed	**1.87%**	**4.68%**	**87.82%**	**3.75%**	**1.87%**
Conditional	2.13%	5.33%	-	4.27%	2.13%
Female	0.96%	6.22%	-	4.31%	2.87%
Male	3.61%	4.22%	-	4.22%	1.20%
14-18	0.00%	0.00%	-	0.00%	14.29%
19-24	2.90%	6.22%	-	5.39%	1.66%
25-30	0.83%	4.17%	-	2.50%	1.67%
Employed	**1.28%**	**7.23%**	**4.68%**	**84.89%**	**1.91%**
Conditional	1.50%	8.52%	5.51%	-	2.26%
Female	2.00%	18.00%	5.33%	-	2.67%
Male	1.20%	2.81%	5.62%	-	2.01%
14-18	5.00%	10.00%	10.00%	-	0.00%
19-24	1.53%	8.78%	6.49%	-	3.05%
25-30	0.85%	7.69%	2.56%	-	0.85%
Apprentice	**0.26%**	**5.25%**	**9.45%**	**10.50%**	**74.54%**
Conditional	0.35%	7.04%	12.68%	14.08%	-
Female	0.00%	11.36%	13.64%	12.88%	-
Male	0.66%	3.29%	11.84%	15.13%	-
14-18	0.00%	3.90%	2.60%	3.90%	-
19-24	0.00%	8.20%	14.75%	18.58%	-
25-30	4.17%	8.33%	29.17%	12.50%	-

Row %. First row for each activity refers to unconditional transition rate; remaining rates are conditional.

Table B2.1 in the Appendix reports the combined event history and panel data, which we will use for subsequent analyses. Over the entire observation period, youth changed

activities between periods 18.5 percent of the time. The most frequently-observed transitions overall were from school to wage employment (624), school to NEET (436) and school to apprenticeship (345), followed by inactivity to wage employment (319), school to self-employment, and apprenticeship to employment. In terms of transition rates, on the other hand, the most likely transitions appear to be NEET to employed (17.37 percent), apprentice to wage employed (12.38 percent), NEET to self-employed (10.24 percent), and apprentice to self-employed (9.8 percent). Thus, while we observe the most transitions from school in absolute terms, these are still represent only a small percentage of all youth in the school; in other words, schooling is a period relative stability for youth, whose status becomes more variable as once they enter the labour market. This variability can be interpreted as precariousness, especially for youth in self-employment and wage employment.

We note that transitions to wage employment (from either school or apprenticeship training) were more numerous than to self-employment. While this may be expected for schooling, which increases the likelihood of landing a wage job, it is less expected for apprentices, who often have their sights set on self-employment. One explanation may be that apprentices continue working for their former master trainer (or another employer) upon graduation in order to save up the capital needed to start their own business.

Flows between activity states do not capture transitions between employers. The baseline interview indicates that job turnover is indeed frequent among employed youth after graduation. Only about 50 percent of the wage employed had been working for the same employer(s) for more than a year at the time of the interview. Almost three quarters of employed youth claimed that they would like to work more hours, and 65% were actively looking for a new job at the time of the survey. We find that personal networks are central to the job search, with over 60% of working youth in our sample finding employment either through direct prior acquaintance with or family relation to the employer or through a mutual friend. Unlike Nordman and Pasquier-Doumer (2014), however, we cannot comment on the importance of these networks relative to other job search mechanisms with the data at hand.

Finally, we develop a more detailed taxonomy to capture various aspects of employment quality. To do this, we develop a new taxonomy of employment types that encompasses all wage and self-employed youth in the sample. The employment types are formal, informal, regular, casual and underemployed youth, as well as employers and independent workers. In contrast to the taxonomy used to this point (the five activity states), we now expand our analysis to states that are non-exclusive: in other words, a youth can be both formally employment and underemployed in the same period, for example[4].

Benin has a highly informal economy, with an estimated 70% of GDP and 95% of employment generated by the informal sector (Benhassine et al., 2018). As is the case in most of SSA, young workers are particularly likely to be employed in informal work. The ILO defines informal workers as all those employed by small, unincorporated firms (under five workers), the self-employed, and any wage worker not covered by social protection through their employer, including non-wage workers contributing to a family business (Sumberg et al., 2021). Indeed, of the 289 youth engaged in some income-generating activity at survey baseline (38% of the sample), over 95% would be considered informal workers by the ILO. Even using a less stringent definition of informality —one that only considers family workers, the self-employed with under five employees, and wage workers with no contract as informal — 74% of employed youth in our sample work informally.

Thus, we use an adjusted definition of formal and informal work: formal wage workers have a verbal or written contract under a single regular employer, while self-employed youth are considered formal if they hire at least five employees. We use the underemployment threshold of 35 hours per week to determine which (wage or self-employed) youth are underemployed. Second, for wage employees, we differentiate between casual work – defined as wage work with one or more employers on an irregular basis or with a single employer on an irregular/task-based payment basis - or "regular" work, i.e. a single employer with regular wages. Finally, we differentiate between self-employed who also employ others (at least one wage worker) and those who work

[4]The following pairs of definitions are exclusive, however: formal and informal, regular and casual, employer and independent worker

independently.

Table A2.4 in the Appendix shows the transition rates into these work states. As with the transition intensity matrices above, we consider transition rates from five mutually exclusive activity states; however, we only report column percentages (the percentage of youth in each column category that started from each of the five activity states). We also present these transition rates calculated separately by gender and age bracket.

In almost half the observed cases of formal work, the youth had been in wage employment in the previous period. Informal workers, on the other hand, were equally likely to have been employed or self-employed in the previous period. There are very few transitions into regular work from self-employment, school, or apprenticeship: almost three-quarters of youth with this job status were already wage employed in the previous period. This suggests that a period of casual employment is typical before youth settle into regular work; three quarters of youth with regular work were wage employed before, whereas only half of the casually employed were – with almost a quarter entering casual work from a state inactivity. Youth transitioning from NEET represent a much higher proportion of casual and underpaid workers than regular and formal workers.

Regular employees and self-employed employers transition from inactivity (NEET) at a lower rate than the other states; informal workers were self-employed in the previous period at a much higher rate than the regular and casually employed; the wage employed generally stay in employment, whether formal, informal, regular, or casual: relatively few enter self-employment. Casual work draws transitions from school at the highest rate; meanwhile, apprenticeship represent a very small fraction of previous states for transitions into any of the employment types. We note the sparse transitions to formal work: while Cunningham and Salvagno (2011) use data collected every six months and find that between 11 and 32 percent of youth in Argentina, Brazil and Mexico move into the formal sector directly after leaving school, this is only true for 2.16 percent of youth in urban Benin.

We also observe a labor demand shortage among the employed, with 73% of youth responding that they would like to work more hours than they currently do (not shown). These youth are also significantly more likely to be dissatisfied with their work. About

half of the sample was working at least a year for their employer or employers at the time of the interview; 65% of employed youth were actively looking for a new job at the time of the survey. Relatively high turnover supports the view that the issue facing African youth is a massive shortfall in labor demand, as opposed to human capital (Fox et al., 2020).

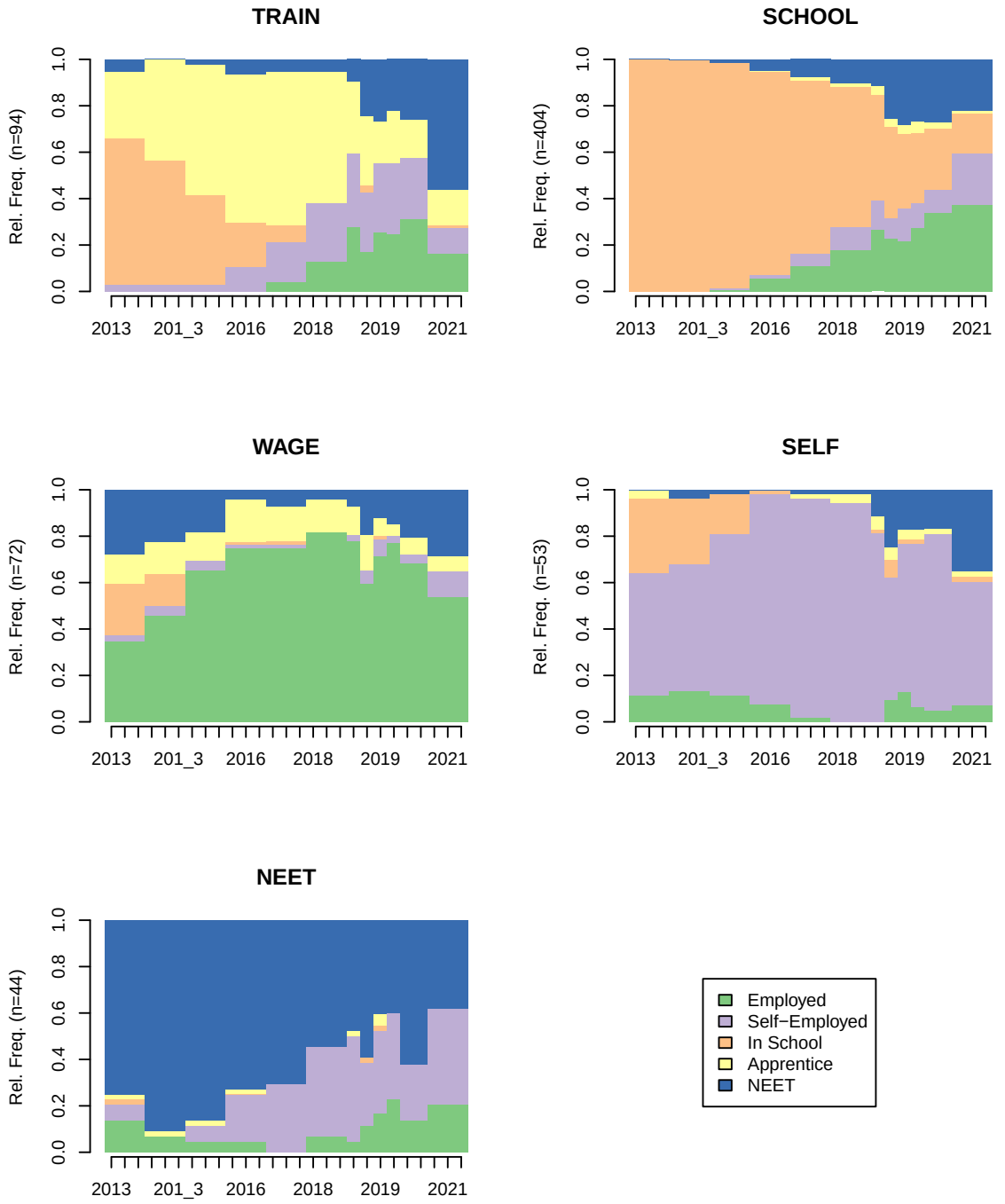
Finally, we find some striking differences in transition rates by gender: a higher percentage of males transition to formal work from school; however, this is also true for underemployment. This may indicate that males are more impatient to find work after graduation. Females are represented at higher rates than males when transitioning from NEET, which reflects the fact that many more young women are NEET than men. Males are more likely to transition from self-employment to formal work, while females are more likely to transition from self-employment to informal work and/or underemployment. Females who are formally employed, on the other hand, are less likely than males to have transitioned out of a different state than wage employment. Thus, employers appear more willing to grant formal contracts to entry-level or self-employed males than females.

Optimal Matching Analysis

Next, we employ Optimal Matching Analysis (OMA) to identify clusters of youth following similar paths during their school-to-work transition. OMA is a statistical technique that generates a measure of the similarity or difference between individual school-to-work transition sequences by comparing all pairs of sequences and performing insertions, deletions, or substitutions of single sequence elements to transform one sequence into the other (Elzinga, 2003). This method has been used to study early career patterns in Italy, Great Britain and West Germany (Scherer, 2001, 2005), the occupation career paths of Swedish women (Huang and Sverke, 2007), and the SWT of German youth (Achatz et al., 2022).

In optimal matching analysis, the cost of making a change to a sequence of states is typically measured using three types of costs: insertion, deletion, and substitution. Insertion/deletion cost is the cost of adding a new item to the sequence or removing

Figure 2.2: Occupational status distribution plots by cluster



an existing one, respectively. Substitution cost is the cost of replacing one item in the sequence with another item. Optimal matching algorithms seek to minimize the total cost of making changes to a sequence of items by choosing the combination of insertions, deletions, and substitutions that result in the lowest total cost, which serves as a measure of similarity between sequences. The distance matrix generated from this process is used in a hierarchical cluster analysis to group similar sequences into clusters. This is achieved by minimizing within-group differences and maximizing between-group differences, using Ward's fusion algorithm (Achatz et al., 2022; Dlouhy and Biemann, 2015). We use an insertion/deletion cost of 1 and a substitution cost matrix based on observed transition rates, which allows us to control for the likelihood of transitions occurring within the data [cite xx]. The TraMineR package in R (Gabadinho et al., 2011) was used to perform the analysis. We then use the R package WeightedCluster (Studer, 2013) to compute various clustering quality measures to determine the optimal number of clusters.

Descriptive statistics for each cluster are shown in Table A2.6 above, and Figure 2.2 in the Appendix plots the status distribution by year for the five identified clusters. The first cluster, which we label "TRAIN", is primarily comprised of youth who participated in apprenticeship training in the years leading up to the baseline survey. Youth begin to transition into wage employment, self-employment, or inactivity in roughly equal proportions in around 2018, with a considerable proportion shifting to inactivity at endline. As apprenticeship training is generally considered to be a reliable route to (informal sector) employment, this shift to inactivity is concerning and may be of interest to policy makers. The youth in this cluster completed about 9 years of school, with the majority dropping out before completing junior high school.

The second cluster, which we call SCHOOL, accounts for about three-fifths of the sample with 404 youth, and is dominated by formal education, especially in the period leading up to the baseline survey. The state transition plot in Figure 2.2 suggests that the extended schooling in this group (14.9 years on average, by far the most of any cluster) does increase the probability of finding employment, as this cluster exhibits the lowest rate of inactivity at endline. This cluster is characterised by the relatively low marriage

and childbearing rates of the youth and the high educational level of the parents of the youth in the cluster.

Table A2.6 indicates that this cluster completed their apprenticeships at a relatively advanced age – around the age of 22 years and 6 months – contradicting the intuitive assumption that apprentices enter the labor market sooner than youth who stay in formal schooling.

The third cluster, WAGE, is comprised of 72 youth who are primarily engaged in wage employment over the observed period. Figure 2.2 shows that most of these youth had completed their formal education by 2014 and enjoyed fairly stable employment throughout – with a small proportion transitioning to inactivity at the tail end of the period, perhaps as a result of worsening economic conditions during the pandemic. The WAGE cluster contains a latent proportion of youth in apprenticeship training, possibly suggesting that completing an apprenticeship and finding wage employment is a solid predictor of job stability. We also note that there is very little transition between wage employment and self-employment in this cluster.

The fourth, SELF, is a relatively small cluster grouping together sequences of sustained self-employment from the beginning of the observed period or transitions from schooling to self-employment prior to 2016. This is the most homogeneous cluster, with essentially only two states observed after 2015: self-employment and NEET. In this cluster, youth only begin appearing as "NEET" at the start of the panel survey. As this data is more frequent and more granular than the event history data, we can infer that youth had described their past annual activity as self-employed may have in fact experienced stretches of inactivity within those years. This may be an important consideration when using a taxonomy that includes "self-employment" but relies on recall data for infrequent time intervals.

The final and smallest cluster, NEET, comprises youth who were inactive at the beginning of the observation period and began to transition into self-employment (and to a much smaller extend, wage employment) towards the endline. This cluster is the most unique in terms of its demographics: it contains almost exclusively young women (95%) who dropped out very early (after only 6.7 years of schooling, on average – compared to

12.8 for the sample), are married at a higher rate than the sample (59% vs. 17%) and have more children on average than the sample (1.73 vs. 0.53). These can be characterised as the "stay-at-home-mothers" - and the low educational attainment and low rates of transition to wage employment are concerning indicators for policy makers interested in gender equality in the region.

Labor Market Participants

Table 2.4: Youth Participating in Labor Market - Summary Statistics

Characteristic	Overall	Female	Male	19-21	22-24	25-27	28-30
N	476	261	215	60	156	182	78
Formal employment	11%	9.6%	13%	10%	7.1%	15%	13%
Informal employment	49%	43%	56%	43%	48%	49%	54%
Working full time	40%	35%	47%	28%	40%	42%	47%
Underemployed	18%	17%	20%	22%	13%	20%	19%
Regular employment	14%	15%	14%	13%	9.0%	18%	18%
Casual worker	19%	13%	27%	15%	20%	19%	19%
Employer	6.9%	3.8%	11%	5.0%	7.1%	7.1%	7.7%
Independent	18%	20%	16%	18%	18%	18%	19%
Unemployed, looking for work	40%	47%	31%	47%	45%	36%	33%
Wage (of wage employed)							
<35,000 FCFA	28%	32%	25%	40%	29%	29%	20%
35,000-54,999 FCFA	38%	39%	38%	30%	46%	38%	30%
55,000-149.999 FCFA	30%	26%	34%	30%	21%	29%	45%
>150,000 FCFA	3.6%	3.5%	3.8%	0%	3.6%	3.8%	5.0%
Profits (of self-employed)							
<20,000 FCFA	56%	67%	44%	71%	42%	61%	53%
20,000-39,999 FCFA	19%	20%	19%	21%	19%	14%	32%
40,000-124.999 FCFA	21%	13%	30%	7.1%	35%	18%	16%
>125,000 FCFA	3.7%	0%	7.4%	0%	3.2%	6.8%	0%
Wealth index quintile	3.05	2.97	3.16				
Job Satisfaction (of wage and self-employed)[1]	3.55	3.47	3.63	3.44	3.47	3.62	3.62
Life satisfaction[1]	3.42	3.38	3.48	3.33	3.33	3.53	3.45
Where do you see yourself in five years?							
Still looking for work (NEET only)	0.8%	1.1%	0.5%	0%	0.6%	1.1%	1.3%
Working for same employer (wage employed only)	4.0%	3.8%	4.2%	0%	2.6%	6.6%	3.8%
Different/new employer	28%	28%	29%	28%	35%	24%	23%
(Still) self-employed	57%	57%	56%	52%	51%	59%	67%
In education/training	5.5%	5.0%	6.1%	10%	7.7%	2.7%	3.8%
Other	5.1%	5.4%	4.7%	10%	3.2%	6.6%	1.3%

Calculated using responses from baseline survey.
[1] Likert scale, 1 = Very dissatisfied, 5 = Very satisfied.

Table A2.9 tabulates the responses of self-employed, wage employed, and NEET youth to the question, "What do you see yourself doing in five years?" More employed youth

envision themselves starting their own business than working for their current or a different employer. Moreover, wage workers reported the lowest levels of satisfaction with their current activity. Thus, despite its common characterization as the "ideal" employment situation, wage employment appears to be neither inherently stable nor particularly satisfactory — at least in the early stages of a career. On the other hand, over a quarter of the self-employed expect to be working for an employer in five years, suggesting that many youth do not see self-employment as an absorbing state, either, but rather an intermediate step on the way to wage employment. In sum, youth expect to be in substantial flux between self- and wage employment, though a higher fraction of youth expect to be in self-employment in five years than to be employed for a wage.

When asked where they see themselves in 5 years, NEET youth were decidedly optimistic. Table A2.9 shows that only 3 percent expected to still be searching for work and over 90 percent envisaged themselves working either for themselves or an employer. The majority (70 percent) of youth in this category saw themselves running their own business. The rate of NEET youth who foresee themselves working in a wage job (24 percent) is almost double the actual wage-employed rate observed in our regional census (11.7%), however - despite this subgroup having completed less schooling than wage-employed youth on average. Within NEET, it is also possible to differentiate between active job-seekers and the inactive - those youth who have given up on looking for work. Four out of five NEET youth in the sample reported actively looking for a job at the time of the baseline survey; 74 percent of the inactive are young women who also dominated the INACTIVE cluster in the OMA analysis above. Over two thirds of youth who were NEET at baseline also reported never having been employed, and nearly half had been out of work for over six months at the time of the interview. Young job-seekers blame weak labor market demand and their own inadequate skills for their difficulties in securing employment. A shortage of employer demand and their own lack of work experience and training represent the most commonly listed difficulties: at least one of these being mentioned by 148 of 257 youth (58%) in the subsample. 26% said they did not know where to look, while 16% cited unsatisfactory working conditions or unacceptably low wages offered at available jobs. Among those responding "other", many elab-

orated on the above categories (e.g., "No jobs in political science"), pointed to their lack of means or connections, or were unable to identify any obstacles at all; three women listed maternity.

2.5 Conclusion

This paper studies the dynamics of the school-to-work transition for 752 youth aged 20-29 from urban Cotonou, Benin. A unique panel is created using mobile phone surveys; in each survey round, youth are classified into one of five groups reflecting their primary activity.

We combine reported activity history data with our panel to approximate the age of graduation and the duration of transition to the first job for each youth. In addition, we estimate transition intensity matrices and sequence analysis to describe common paths along the SWT. Finally, we discuss the impact of specific activity transitions on youth life satisfaction and the reported aspirations of youth, and the obstacles they face on the labor market.

The SWT is observed for about 68 percent of the sample, with the majority reporting a transition to wage work or self-employment in the period directly following their final year of schooling or training. Youth who enter the labor market as self-employed tend to be less educated and have parents with lower educational attainment than youth who enter the labor market as wage-employed or unemployed. Youth who do not find work in the first period after graduation wait less than a year, on average, before entering either wage or self-employment. Youth who complete university education (master's level or higher) take about six months longer to find their first job, though education up to secondary schooling does not appear to extend the duration.

Using a combination of retrospective employment history and panel data to calculate average ages of transition, we find that youth in Cotonou graduate at the age of 22 years, seven months, and find their first employment exactly a year later, on average. If the transition duration calculated for this sample were representative of the nation, it would rank Benin as a country with one of the shortest transitions to work in the world.

However, given the higher availability of non-agricultural informal work in urban areas, one expects the transition speed to be shorter in urban Cotonou than in the rest of the country.

transition intensity matrices suggest that wage employment and self-employment are stable relative to inactivity, meaning youth in employment are more likely to stay in the same type of employment than NEET youth are likely to stay inactive. However, higher rates of transition are observed for the (approximately quarterly) panel data than in yearly historical data, suggesting that annual data often used for studying the SWT may hide significant turbulence in employment status. There are relatively few transitions into regular work (with a single employer) from self-employment, schooling or inactivity, suggesting that a period of casual employment usually precedes a more stable employment relationship.

We also use optimal matching analysis to identify clusters of youth following similar transition paths. The five identified clusters reflect the five activity types used, reflecting the relative stability of states. However, youth whose paths are dominated by inactivity are shown to be almost exclusively young women with lower educational attainment and larger families.

Finally, we find that youth expect to be self-employed, not employed, even when in wage employment. This stands in contrast to the high stability of wage employed observed in the panel data.

Panel data is a useful tool for examining the dynamics of the transition process, such as how quickly young people enter the labor market, what types of jobs they obtain, and how their employment prospects change over time. Panel data can also be used to analyze the impact of different factors on the transition process, such as the quality of education, the availability of job opportunities, or the effects of policy interventions. By using panel data, researchers can gain a more nuanced and detailed understanding of the school-to-work transition in Africa, and can identify potential areas for improvement in policy and practice.

We make a unique contribution to the literature by estimating the effects of transition on youth well-being. We find that while youth who have transitioned to steady em-

ployment are more satisfied with their lives, none of the specific transitions examined, e.g. the transition from wage to self-employment, appear to have an effect on youth satisfaction. Finally, we show that mobile phone data collection are promising for tracking labor market performance, despite moderate attrition; however, we observed higher response to the in-person baseline and endline waves, despite these being more time-consuming than the follow-up surveys. Thus, while urban youth are an ideal subject for phone-based surveys due to their high literacy and relatively high phone ownership and high network coverage in cities, incentives for increasing response and reducing survey fatigue in longitudinal remote studies remains an important topic of research. On the balance, however, we agree that "the cost savings of a phone survey are substantial, as long as the questions of interest call for high frequency panel data" (Dillon 2012).

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Appendix A2

Cotonou census

Figure A2.1: Geographic Coverage of Survey

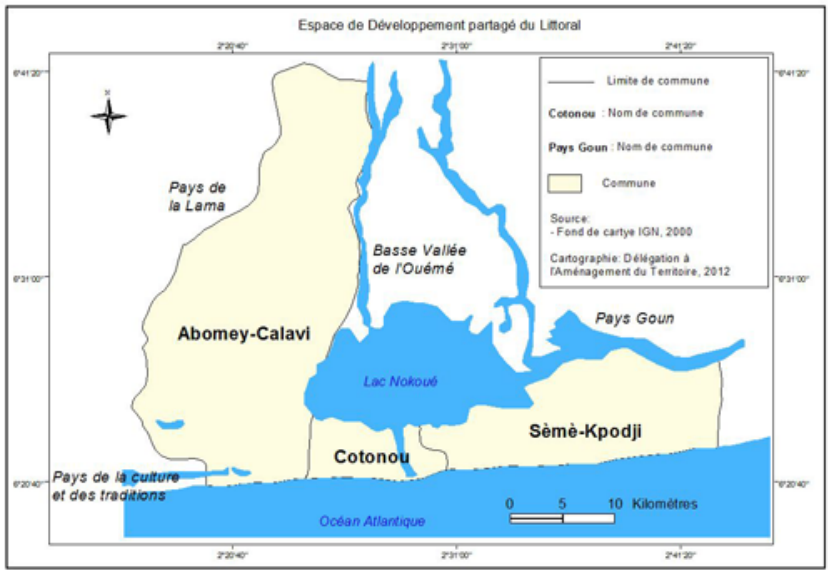


Table A2.1: Census of 13 zones de dénombrement

	Aged 15-19	Aged 20-29	Aged 30 and above
	1417 (71.64)	1144 (31.07)	87 (1.35)
In School	125 (6.32)	635 (17.25)	574 (24.35)
Other	95 (4.80)	1183 (32.13)	664 (56.68)
Self-Employed	35 (1.77)	33 (11.76)	117 (17.28)
Employed	306 (15.47)	287 (7.79)	22 (0.34)
Apprentice	1978 (100.00)	3682 (100.00)	6464 (100.00)

n, %.

Sampling and weighting

Cluster sampling was used to select the 752 youth interviewed in the face-to-face baseline survey. The twelve *départements* of Benin are subdivided into 77 *communes*, which are further subdivided into *arrondissements*. To delimit the geographic area for the census, we first manually selected five *arrondissements* from the three *communes* which constitute the Cotonou metropolitan area (Figure A2.1). The five *arrondissements* were chosen in consultation with survey partners experienced in data collection in the region to be as representative of urban Cotonou as possible.

In a second step, 15 Zones de dénombrement (ZDs) – the smallest administrative divisions in Benin – were selected from the five *arrondissements* (or clusters) and constitute the primary sampling unit (PSU) of the sample. The number of ZDs chosen per cluster was proportional to the size of the youth population in each *arrondissement* at the time of the 2016 census, such that each household in the five *arrondissements* still had an equally likely chance of being sampled and no reweighting was necessary. Eight ZDs were thus drawn from the *arrondissement* of Cotonou, two from Godomey, two from Calavi, one from Agbanglandan, and one from Ekpè.

All 4,905 households living in within the boundaries of these 15 ZDs were interviewed in person to ascertain the age and employment status (in school, in apprenticeship, employed, self-employed, or inactive) of all household members. Table A2.1 in the Appendix shows that a total of 19,032 individuals were covered by the census, with all individuals aged 20-29 in these households (excluding apprentices, due to overlap with a second study by the author[5]) constituting the sample frame for the panel survey. Survey participants were selected randomly from this pool of 3,395 youth; the survey is thus representative of youth aged 20-29 in the metropolitan area of Cotonou whose primary economic activity is not apprenticeship training.

[5]A number of apprentices appear in the final sample due to misreporting or a change in activity between the time of the census and the baseline interview.

Studying transitions as a continuous Markov processes

In Appendix B, we depict transitions between K states employment states as transition intensity matrices. Each cell of the transition intensity matrix is given by the probability of transitioning from an initial employment state i to a subsequent employment state j, which is simply given by $p_{ij} = n_{ij}/n_i$, such that the matrices in Appendix B can be depicted as

$$Q = \begin{pmatrix} p_{11} & \cdots & p_{1k} \\ \vdots & \ddots & \vdots \\ p_{k1} & \cdots & p_{kk} \end{pmatrix}$$

where n_{ij} is the number of youth making the transition from state i to j and n_i is the number of youth in the initial state i.

Transition intensity matrices alone do not allow us to make informative comparisons between subgroups, as we do not know if a higher p_{ij} indicates a preference of a subgroup for a certain transition, or simply higher turnover. To mitigate this issue, we follow Bosch and Maloney (2007) and Cunningham and Salvagno (2011) in decomposing the transition intensity matrices into two separate elements, which allow us to infer the propensity at which groups make certain transitions independent of that group's likelihood to change states.

"Since we have access to discrete panel data, rather than continuous time data, equation (1) can be interpreted as the transition probability if we assume that the discrete-time mobility process captured by our data is generated by a continuous-time homogenous Markov process. In other words, if we assume that transitions between states occur at random points in time, then a random draw of a transition in one point in time has the same probability (within a confidence interval) of a draw at any other point in time."

This rate of transition, which can be referred to as intensities (Bosch and Maloney, 2007), make differences across different groups (age groups or gender) difficult because they do not account for the likelihood of separation (i.e. changing states). For example, younger individuals are much less likely to transition out of school; thus, the rate of transition from school to, say, wage employment will be deflated relative to older youth

around graduation age, and will tell us little about the preference of younger school-leavers for wage employment relative to other options.

The method proposed by Bosch and Maloney (2007) and Bosch and Maloney (2010) and applied to youth transitions by Cunningham and Salvagno (2011) controls for the likelihood of separation by factoring Q into two elements, the rate of separation and the propensity to move, denoted by $Q = \lambda(M - I)$:

$$Q = \begin{pmatrix} -p_{11} & & \\ & \ddots & \\ & & -p_{kk} \end{pmatrix} \left(\begin{bmatrix} 0 & r_{ij} & \\ & \ddots & \\ & & 0 \end{bmatrix} - I \right)$$

where $r_{ij} = -p_{ij}/p_{ii}$ for $i \neq j$ and $i = 1, \ldots, K$ and I is the identity matrix.

The first component represents the transition probabilities independent of the rate at which different age groups leave any sector, and is called the propensity matrix. The second is the rate of transition, and is referred to as the rate of separation matrix. By decomposing the transition intensity matrix into the propensity matrix and the rate of separation matrix, we can determine if movements to employment states observed in the transition intensity matrix are reflecting greater entry of certain age groups into certain employment states or if the observed transitions are simply due to greater turnover by certain age groups in general.

Table A2.2: Sample Composition and Attrition

Characteristic	Baseline N=752	Follow-up 1 N=663	Follow-up 2 N=536	Follow-up 3 N=496	Endline N=574	p-value
Activity						<0.001
Apprentice	58 (7.7%)	40 (6.0%)	39 (7.3%)	24 (4.8%)	21 (3.7%)	
In School	169 (22%)	124 (19%)	95 (18%)	74 (15%)	60 (10%)	
Employed	168 (22%)	176 (27%)	164 (31%)	165 (33%)	185 (32%)	
Self-Employed	119 (16%)	148 (22%)	106 (20%)	93 (19%)	135 (24%)	
NEET	238 (32%)	175 (26%)	132 (25%)	140 (28%)	173 (30%)	
Baseline activity						0.31
Apprentice	58 (7.7%)	49 (7.4%)	45 (8.4%)	48 (9.7%)	51 (8.9%)	
In School	169 (22%)	151 (23%)	132 (25%)	124 (25%)	144 (25%)	
Employed	168 (22%)	153 (23%)	122 (23%)	107 (22%)	124 (22%)	
Self-Employed	119 (16%)	105 (16%)	74 (14%)	73 (15%)	94 (16%)	
NEET	238 (32%)	205 (31%)	163 (30%)	144 (29%)	161 (28%)	
Male	47%	48%	52%	52%	52%	0.26
Age	24.15 (2.67)	24.19 (2.67)	23.99 (2.65)	24.05 (2.67)	24.09 (2.67)	0.76
Years of Schooling	13.5 (4.7)	13.6 (4.6)	13.9 (4.5)	13.8 (4.5)	13.7 (4.4)	0.40

n (%); %; Mean (SD). Calculated using responses from baseline survey.

Table A2.3: Summary Statistics - By Gender

Characteristic	Overall	Gender		p-value
		Female (53%)	**Male** (47%)	
N	752	396	356	
Age at baseline	24.15 (24.00)	24.03 (24.00)	24.29 (24.00)	0.13
Nationality: Beninese (=1)	97%	96%	99%	0.043
Ethnicity: Fon (=1)	69%	69%	69%	>0.9
Religion: Christian (=1)	84%	89%	78%	<0.001
Grew up in a city (=1)	64%	65%	63%	0.6
Employment Status				
Activity at baseline				<0.001
In School	22%	19%	27%	
NEET	32%	40%	22%	
Self-Employed	16%	15%	16%	
Employed	22%	19%	26%	
Apprentice	7.7%	6.6%	9.0%	
Graduation age	22.62 (23.00)	22.27 (22.00)	22.90 (23.00)	0.004
Age at first employment	23.65 (24.00)	23.36 (23.00)	23.88 (24.00)	0.025
Duration of transition in years	1.06 (1.00)	1.13 (1.00)	1.01 (1.00)	0.2
Education				
Years of schooling	13 (15)	13 (14)	14 (15)	<0.001
Completed apprenticeship (=1)	20%	20%	20%	0.8
Vocational certificate: CAP (=1)	4.4%	4.0%	4.8%	0.6
Primary diploma: CEP (=1)	85%	80%	90%	<0.001
Junior high diploma: BEPC (=1)	67%	61%	74%	<0.001
Baccalauréat: BAC (=1)	40%	32%	48%	<0.001
2nd cycle university: Licence (=1)	15%	11%	20%	0.002
3rd cycle university: Maîtrise (=1)	2.3%	0.5%	4.2%	<0.001
Parents' Education				
Father was an apprentice (=1)	33%	32%	33%	0.9
Father completed primary (=1)	67%	67%	67%	0.9
Father completed secondary (=1)	41%	43%	38%	0.11
Mother was an apprentice (=1)	17%	18%	16%	0.5
Mother completed primary (=1)	41%	41%	41%	>0.9
Mother completed secondary (=1)	20%	19%	20%	0.9
Household Characteristics and Assets				
Married (=1)	20%	28%	10%	<0.001
Living with parents (=1)	45%	42%	49%	0.057
No. of children	1.61 (1.00)	1.87 (1.00)	1.32 (1.00)	<0.001
People in household	6.45 (6.00)	6.67 (6.00)	6.20 (6.00)	0.034
Wealth index quintile	2.91 (3.00)	2.86 (3.00)	2.96 (3.00)	0.3
Home electrified (=1)	92%	93%	92%	0.5
Cell Phone (=1)	76%	75%	76%	0.7
Smartphone (=1)	54%	47%	62%	<0.001
Motorcycle (=1)	27%	18%	38%	<0.001
Television (=1)	39%	39%	40%	0.9

Mean (median); %. Calculated using responses from baseline survey.
[1] To first employment.

Table A2.4: Transition Rates into Different Types of Work

	To						
From	Formal	Informal	Regular	Casual	Under-employed	Employer	Indep.
In School	**8.77%**	**7.88%**	**5.19%**	**10.03%**	**8.89%**	**7.04%**	**5.24%**
Female	6.25%	6.86%	5.56%	8.87%	7.28%	6.12%	4.73%
Male	10.61%	8.76%	4.86%	10.67%	10.00%	7.53%	6.12%
19-21	28.57%	26.19%	18.75%	17.65%	29.17%	37.50%	27.78%
22-24	13.89%	10.59%	8.45%	14.29%	11.00%	6.98%	7.14%
25-27	5.41%	6.71%	2.00%	10.37%	7.86%	4.00%	3.12%
28-30	3.45%	2.56%	3.85%	3.30%	3.81%	4.88%	0.00%
NEET	**20.18%**	**24.57%**	**14.07%**	**23.78%**	**24.80%**	**17.61%**	**26.97%**
Female	25.00%	32.00%	15.87%	32.26%	32.45%	24.49%	31.95%
Male	16.67%	18.25%	12.50%	19.11%	19.55%	13.98%	18.37%
19-21	42.86%	23.81%	25.00%	17.65%	16.67%	25.00%	22.22%
22-24	16.67%	25.42%	16.90%	24.76%	27.00%	6.98%	32.14%
25-27	24.32%	24.03%	15.00%	23.70%	24.29%	20.00%	25.00%
28-30	13.79%	24.10%	7.69%	23.08%	24.76%	24.39%	24.62%
Self-Emp.	**20.18%**	**31.54%**	**4.81%**	**9.74%**	**29.11%**	**58.45%**	**51.69%**
Female	14.58%	36.29%	5.56%	10.48%	33.77%	57.14%	53.85%
Male	24.24%	27.49%	4.17%	9.33%	25.91%	59.14%	47.96%
19-21	0.00%	33.33%	6.25%	17.65%	33.33%	25.00%	50.00%
22-24	22.22%	27.54%	5.63%	5.71%	30.00%	58.14%	48.81%
25-27	24.32%	31.80%	4.00%	11.85%	27.86%	64.00%	47.92%
28-30	20.69%	34.87%	5.13%	9.89%	28.57%	58.54%	60.00%
Employed	**49.12%**	**31.67%**	**74.81%**	**52.15%**	**33.15%**	**13.38%**	**11.99%**
Female	54.17%	22.00%	73.02%	45.97%	25.17%	10.20%	7.10%
Male	45.45%	39.90%	76.39%	55.56%	38.64%	15.05%	20.41%
19-21	28.57%	9.52%	43.75%	29.41%	12.50%	12.50%	0.00%
22-24	41.67%	30.08%	67.61%	49.52%	28.00%	16.28%	8.33%
25-27	45.95%	33.57%	78.00%	51.11%	35.71%	12.00%	17.71%
28-30	62.07%	36.41%	83.33%	61.54%	40.00%	12.20%	12.31%
Apprentice	**1.75%**	**4.34%**	**1.11%**	**4.30%**	**4.04%**	**3.52%**	**4.12%**
Female	0.00%	2.86%	0.00%	2.42%	1.32%	2.04%	2.37%
Male	3.03%	5.60%	2.08%	5.33%	5.91%	4.30%	7.14%
19-21	0.00%	7.14%	6.25%	17.65%	8.33%	0.00%	0.00%
22-24	5.56%	6.36%	1.41%	5.71%	4.00%	11.63%	3.57%
25-27	0.00%	3.89%	1.00%	2.96%	4.29%	0.00%	6.25%
28-30	0.00%	2.05%	0.00%	2.20%	2.86%	0.00%	3.08%

Row % reported, but do not add up to 100% as activities are not exclusive.

Table A2.5: Summary Statistics - Labour Market Entry

Characteristic	Overall	Status at Labour Market Entry			p-value
		Employed (38%)	**NEET** (37%)	**Self-Employed** (25%)	
N	512	196	190	126	
Male	54%	58%	49%	58%	0.2
Married (=1)	12%	12%	13%	13%	0.9
No. of children	1.40	1.35	1.41	1.44	0.6
Transition					
Graduation age	22.62	22.57	22.66	22.64	>0.9
Age at first employment	23.65	23.41	24.25	23.38	0.014
Duration of transition in years	1.06	0.88	1.63	0.75	<0.001
Education					
Years of schooling	14.4	14.7	14.7	13.6	0.020
Completed apprenticeship (=1)	19%	20%	14%	25%	0.044
Vocational certificate: CAP (=1)	5.1%	6.6%	4.2%	4.0%	0.4
Primary diploma: CEP (=1)	91%	93%	92%	87%	0.091
Junior high diploma: BEPC (=1)	75%	77%	79%	66%	0.017
Baccalauréat: BAC (=1)	47%	52%	49%	39%	0.075
2nd cycle university: Licence (=1)	20%	20%	23%	16%	0.3
3rd cycle university: Maîtrise (=1)	3.1%	3.1%	3.2%	3.2%	>0.9
Parents' Education					
Father was an apprentice (=1)	34%	36%	36%	30%	0.5
Father completed primary (=1)	70%	70%	75%	62%	0.040
Father completed secondary (=1)	42%	42%	49%	32%	0.008
Mother was an apprentice (=1)	18%	16%	21%	16%	0.4
Mother completed primary (=1)	45%	49%	49%	33%	0.008
Mother completed secondary (=1)	21%	22%	23%	17%	0.3

Mean; %. Calculated using responses from baseline survey.

Table A2.6: Comparison of Clusters

Characteristic	Overall	Cluster					p-value
		NEET (7%)	SCHOOL (61%)	SELF (8%)	TRAIN (14%)	WAGE (11%)	
N	667	44	404	53	94	72	
Male	51%	4.5%	54%	49%	54%	60%	<0.001
Age at baseline	24.12	25.36	23.59	25.92	23.71	25.54	<0.001
Nationality: Beninese (=1)	98%	93%	99%	98%	97%	96%	0.010
Grew up in a city (=1)	64%	57%	70%	64%	49%	53%	<0.001
Transition							
Graduation age	22.61	23.00	22.89	21.27	22.47	21.33	0.002
Age at first employment	23.64	24.57	23.98	22.27	23.49	22.14	<0.001
Duration of transition in years	1.06	1.57	1.08	1.00	0.95	1.14	0.8
Education							
Years of schooling	12.8	6.7	14.9	10.5	9.4	11.1	<0.001
Completed apprenticeship (=1)	19%	25%	7.4%	34%	48%	36%	<0.001
Vocational certificate: CAP (=1)	4.9%	0%	5.9%	5.7%	4.3%	2.8%	0.5
Primary diploma: CEP (=1)	88%	48%	99%	70%	71%	85%	<0.001
Junior high diploma: BEPC (=1)	71%	11%	91%	49%	35%	56%	<0.001
Baccalauréat: BAC (=1)	43%	2.3%	62%	30%	5.3%	18%	<0.001
2nd cycle university: Licence (=1)	16%	0%	24%	17%	1.1%	6.9%	<0.001
3rd cycle university: Maîtrise (=1)	2.5%	0%	3.7%	3.8%	0%	0%	0.090
Parents' Education							
Father was an apprentice (=1)	34%	25%	33%	28%	36%	46%	0.12
Father completed primary (=1)	54%	45%	60%	47%	50%	42%	0.014
Father completed secondary (=1)	20%	11%	26%	17%	6.4%	11%	<0.001
Mother was an apprentice (=1)	17%	2.3%	18%	21%	16%	17%	0.10
Mother completed primary (=1)	28%	23%	34%	25%	18%	17%	0.002
Mother completed secondary (=1)	6.0%	0%	8.4%	1.9%	2.1%	4.2%	0.024
Household and Assets							
Married (=1)	17%	59%	7.4%	36%	22%	24%	<0.001
No. of children	0.53	1.73	0.25	1.23	0.54	0.85	<0.001
People in household	5.40	6.07	5.48	5.26	5.23	4.92	0.3
Wealth index quintile	2.94	2.68	2.91	3.13	2.99	3.07	0.4
Home electrified (=1)	93%	82%	95%	92%	90%	89%	0.010
Cell Phone (=1)	76%	70%	73%	77%	85%	82%	0.087
Smartphone (=1)	58%	30%	68%	49%	38%	49%	<0.001
Motorcycle (=1)	29%	9.1%	29%	43%	26%	31%	0.006
Television (=1)	41%	36%	42%	49%	33%	42%	0.4

Mean; %. Calculated using responses from baseline survey.

Table A2.7: Summary Statistics - Wage Employed

Characteristic	Overall	Female	Male	19-21	22-24	25-27	28-30
N	168	77	91	18	47	72	31
Working arrangement							
One employer, regular basis	44%	55%	34%	47%	33%	46%	52%
One employer, irregular basis	41%	38%	44%	41%	50%	39%	32%
Multiple employers, irregular	12%	4.1%	18%	12%	15%	9.9%	9.7%
Family worker	3.6%	2.7%	4.4%	0%	2.2%	4.2%	6.5%
Number of workers[1]	3.96	3.71	4.16	3.56	3.77	4.22	3.87
Months worked[2]	7.9	8.2	7.7	4.4	7.2	8.8	8.8
Wage (previous month)							
<35,000 FCFA	28%	32%	25%	40%	29%	29%	20%
35,000-54,999 FCFA	38%	39%	38%	30%	46%	38%	30%
55,000-149.999 FCFA	30%	26%	34%	30%	21%	29%	45%
>150,000 FCFA	3.6%	3.5%	3.8%	0%	3.6%	3.8%	5.0%
Job satisfaction (out of 5)[3]	3.46	3.47	3.46	3.50	3.36	3.53	3.45
Life satisfaction (out of 5)[3]	3.52	3.61	3.45	3.61	3.34	3.61	3.55
Actively looking for new job	65%	58%	70%	67%	66%	62%	68%

Calculated using responses from baseline survey.
[1] Primary employer. Includes surveyed worker.
[2] Of past 12 months.
[3] Likert scale, 1 = Very dissatisfied, 5 = Very satisfied.

Table A2.8: Summary Statistics - Self-Employed

Characteristic	Overall	Female	Male	19-21	22-24	25-27	28-30
N	119	61	58	14	39	45	21
Registered business[1]	18%	6.2%	29%	0%	21%	19%	18%
Pays taxes[2]	13%	6.6%	19%	0%	2.6%	24%	14%
Trade association member	7.6%	3.3%	12%	0%	7.7%	8.9%	9.5%
Works alone (no employees)	72%	84%	60%	79%	72%	71%	71%
Number of employees[3]	3.5	1.4	4.3	1.0	5.4	2.9	2.3
Months worked of past 12	10.00	9.40	10.26	7.33	9.91	9.77	12.00
Profits (previous month)							
<20,000 FCFA	56%	67%	44%	71%	42%	61%	53%
20,000-39,999 FCFA	19%	20%	19%	21%	19%	14%	32%
40,000-124.999 FCFA	21%	13%	30%	7.1%	35%	18%	16%
>125,000 FCFA	3.7%	0%	7.4%	0%	3.2%	6.8%	0%
Apprentices trained	0.52	0.12	1.12	0.00	0.27	0.69	0.89
Job Satisfaction (out of 5, Likert scale)	3.68	3.48	3.90	3.36	3.59	3.78	3.86
Life satisfaction (out of 5, Likert scale)	3.40	3.18	3.64	3.36	3.26	3.58	3.33
Looking for new job	39%	41%	36%	64%	38%	38%	24%

Calculated using responses from baseline survey.

[1] Either registered with Benin Chamber of Commerce and Industry (CCIB), Register of Commerce and Personal Property Transaction (RCCM), National Social Security Fund (CNSS) or National Institute of Statistics and Economic Analysis (INSAE) or in possession of a professional card (carte professionnelle de commerçant, CPC) or a Unique Fiscal Identifier (IFU).

[2] Paying either Synthetic Professional Tax (Taxe Professionnelle Synthètique, TPS), taxes for public space usage (e.g. patente foraine), or any other local taxes.

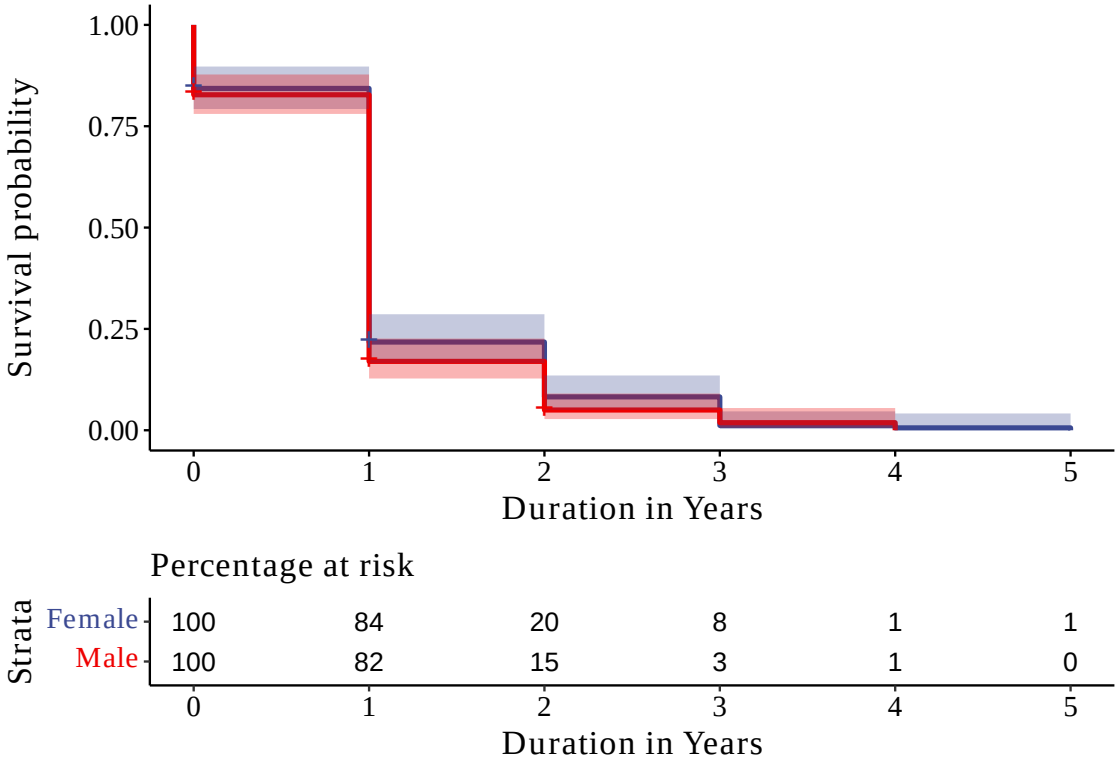
[3] Not including the business owner (i.e. the survey respondent)).

Table A2.9: Youth Aspirations

	NEET N=238	**Self-Employed** N=119	**Employed** N=168
Where do you see yourself in five years?			
Still looking for work	3.0%	-	-
Working for same employer	-	-	11%
Different/new employer	24%	29%	27%
(Still) self-employed	67%	58%	48%
In education/training	3.8%	2.5%	8.9%
Other	2.1%	11%	4.8%

Calculated using responses from baseline survey.

Figure A2.2: Survival analysis: duration of transition to first employment



Appendix B2

Table B2.1: Activity transition matrix: Combined data, 2013-2021

			To			
From	In School	NEET	Self-Employed	Employed	Apprentice	Total
In School	84.51% (98.78%)	4.07% (20.96%)	2.83% (10.69%)	5.57% (17.63%)	3.02% (17.03%)	100.00% (165.08%)
NEET	1.96% (0.41%)	62.53% (57.29%)	11.11% (7.47%)	16.56% (9.30%)	7.84% (7.86%)	100.00% (82.32%)
Self-Employed	1.62% (0.41%)	5.57% (6.19%)	87.07% (71.01%)	3.95% (2.69%)	1.80% (2.18%)	100.00% (82.48%)
Employed	1.30% (0.36%)	8.10% (9.98%)	4.70% (4.25%)	83.95% (63.40%)	1.94% (2.62%)	100.00% (80.61%)
Apprentice	0.22% (0.05%)	6.18% (5.59%)	9.93% (6.59%)	12.58% (6.98%)	71.08% (70.31%)	100.00% (89.51%)
Total	89.61% (100.00%)	86.44% (100.00%)	115.64% (100.00%)	122.62% (100.00%)	85.68% (100.00%)	

Row %
(Column %)

Table B2.2: Activity transition matrix: Event History, 2013-2019

	To					
From	In School	NEET	Self-Employed	Employed	Apprentice	Total
In School	85.68% (98.91%)	3.85% (21.74%)	2.61% (11.36%)	4.92% (18.40%)	2.95% (17.25%)	100.00% (167.66%)
NEET	1.82% (0.35%)	64.94% (60.39%)	11.17% (8.01%)	14.29% (8.80%)	7.79% (7.50%)	100.00% (85.04%)
Self-Employed	1.87% (0.39%)	4.68% (4.83%)	87.82% (69.83%)	3.75% (2.56%)	1.87% (2.00%)	100.00% (79.62%)
Employed	1.28% (0.30%)	7.23% (8.21%)	4.68% (4.10%)	84.89% (63.84%)	1.91% (2.25%)	100.00% (78.70%)
Apprentice	0.26% (0.05%)	5.25% (4.83%)	9.45% (6.70%)	10.50% (6.40%)	74.54% (71.00%)	100.00% (88.98%)
Total	90.91% (100.00%)	85.95% (100.00%)	115.73% (100.00%)	118.34% (100.00%)	89.07% (100.00%)	

Row %
(Column %)

Table B2.3: Activity transition matrix: Panel data, pooled, 2019-2021

	To					
From	In School	NEET	Self-Employed	Employed	Apprentice	Total
In School	63.64% (78.72%)	16.22% (11.70%)	5.90% (5.87%)	12.53% (8.10%)	1.72% (5.79%)	100.00% (110.17%)
NEET	4.85% (8.51%)	52.34% (53.55%)	16.81% (23.72%)	22.18% (20.32%)	3.81% (18.18%)	100.00% (124.27%)
Self-Employed	3.32% (3.65%)	20.78% (13.30%)	61.22% (54.03%)	13.30% (7.62%)	1.39% (4.13%)	100.00% (82.73%)
Employed	3.72% (6.38%)	16.49% (16.49%)	9.04% (12.47%)	68.09% (60.95%)	2.66% (12.40%)	100.00% (108.69%)
Apprentice	6.25% (2.74%)	19.44% (4.96%)	11.11% (3.91%)	13.19% (3.02%)	50.00% (59.50%)	100.00% (74.13%)
Total	81.79% (100.00%)	125.27% (100.00%)	104.08% (100.00%)	129.29% (100.00%)	59.58% (100.00%)	

Row %
(Column %)

Table B2.4: Activity transition matrix: Baseline and follow-up wave 1

					Follow-up 1	
Baseline	In School	NEET	Self-Employed	Employed	Apprentice	Total
In School	62.25% (75.81%)	19.21% (16.57%)	8.61% (8.78%)	6.62% (5.68%)	3.31% (12.50%)	100.00% (119.34%)
NEET	6.83% (11.29%)	49.27% (57.71%)	18.05% (25.00%)	22.44% (26.14%)	3.41% (17.50%)	100.00% (137.64%)
Self-Employed	0.95% (0.81%)	11.43% (6.86%)	70.48% (50.00%)	16.19% (9.66%)	0.95% (2.50%)	100.00% (69.82%)
Employed	7.84% (9.68%)	13.73% (12.00%)	12.42% (12.84%)	63.40% (55.11%)	2.61% (10.00%)	100.00% (99.63%)
Apprentice	6.12% (2.42%)	24.49% (6.86%)	10.20% (3.38%)	12.24% (3.41%)	46.94% (57.50%)	100.00% (73.56%)
Total	84.00% (100.00%)	118.12% (100.00%)	119.76% (100.00%)	120.90% (100.00%)	57.23% (100.00%)	

Row %
(Column %)

Table B2.5: Activity transition matrix: Follow-up wave 1 and follow-up wave 2

						Follow-up 2
Follow-up 1	In School	NEET	Self-Employed	Employed	Apprentice	Total
In School	66.00% (78.57%)	12.00% (9.68%)	5.00% (5.00%)	16.00% (10.19%)	1.00% (2.63%)	100.00% (106.07%)
NEET	4.76% (8.33%)	51.02% (60.48%)	15.65% (23.00%)	21.77% (20.38%)	6.80% (26.32%)	100.00% (138.52%)
Self-Employed	8.42% (9.52%)	15.79% (12.10%)	56.84% (54.00%)	15.79% (9.55%)	3.16% (7.89%)	100.00% (93.07%)
Employed	1.59% (2.38%)	14.29% (14.52%)	11.11% (14.00%)	70.63% (56.69%)	2.38% (7.89%)	100.00% (95.48%)
Apprentice	2.86% (1.19%)	11.43% (3.23%)	11.43% (4.00%)	14.29% (3.18%)	60.00% (55.26%)	100.00% (66.86%)
Total	83.63% (100.00%)	104.52% (100.00%)	100.03% (100.00%)	138.48% (100.00%)	73.34% (100.00%)	

Row %
(Column %)

Table B2.6: Activity transition matrix: Follow-up wave 2 and follow-up wave 3

						Follow-up 3
Follow-up 2	In School	NEET	Self-Employed	Employed	Apprentice	Total
In School	67.05% (83.10%)	13.64% (9.52%)	4.55% (4.88%)	14.77% (8.61%)	0.00% (0.00%)	100.00% (106.11%)
NEET	3.74% (5.63%)	63.55% (53.97%)	13.08% (17.07%)	16.82% (11.92%)	2.80% (13.04%)	100.00% (101.64%)
Self-Employed	0.00% (0.00%)	19.28% (12.70%)	65.06% (65.85%)	14.46% (7.95%)	1.20% (4.35%)	100.00% (90.85%)
Employed	2.88% (5.63%)	17.99% (19.84%)	4.32% (7.32%)	71.94% (66.23%)	2.88% (17.39%)	100.00% (116.41%)
Apprentice	11.11% (5.63%)	13.89% (3.97%)	11.11% (4.88%)	22.22% (5.30%)	41.67% (65.22%)	100.00% (85.00%)
Total	84.77% (100.00%)	128.34% (100.00%)	98.12% (100.00%)	140.22% (100.00%)	48.55% (100.00%)	

Row %
(Column %)

Table B2.7: Activity transition matrix: Follow-up wave 3 and endline

						Endline
Follow-up 3	In School	NEET	Self-Employed	Employed	Apprentice	Total
In School	58.82% (80.00%)	19.12% (9.35%)	2.94% (2.53%)	17.65% (8.22%)	1.47% (5.00%)	100.00% (105.10%)
NEET	2.54% (6.00%)	49.15% (41.73%)	19.49% (29.11%)	27.12% (21.92%)	1.69% (10.00%)	100.00% (108.76%)
Self-Employed	3.85% (6.00%)	41.03% (23.02%)	50.00% (49.37%)	5.13% (2.74%)	0.00% (0.00%)	100.00% (81.13%)
Employed	2.05% (6.00%)	19.86% (20.86%)	8.22% (15.19%)	67.12% (67.12%)	2.74% (20.00%)	100.00% (129.18%)
Apprentice	4.17% (2.00%)	29.17% (5.04%)	12.50% (3.80%)	0.00% (0.00%)	54.17% (65.00%)	100.00% (75.83%)
Total	71.43% (100.00%)	158.33% (100.00%)	93.15% (100.00%)	117.02% (100.00%)	60.07% (100.00%)	

Row % (Column %)

Table B2.8: Activity transition matrix: Baseline and endline

						Endline
Baseline	In School	NEET	Self-Employed	Employed	Apprentice	Total
In School	31.25% (75.00%)	18.75% (15.61%)	18.06% (19.26%)	30.56% (23.78%)	1.39% (9.52%)	100.00% (143.17%)
NEET	4.35% (11.67%)	37.27% (34.68%)	31.68% (37.78%)	25.47% (22.16%)	1.24% (9.52%)	100.00% (115.81%)
Self-Employed	3.19% (5.00%)	42.55% (23.12%)	32.98% (22.96%)	21.28% (10.81%)	0.00% (0.00%)	100.00% (61.90%)
Employed	3.23% (6.67%)	18.55% (13.29%)	17.74% (16.30%)	58.06% (38.92%)	2.42% (14.29%)	100.00% (89.46%)
Apprentice	1.96% (1.67%)	45.10% (13.29%)	9.80% (3.70%)	15.69% (4.32%)	27.45% (66.67%)	100.00% (89.66%)
Total	43.98% (100.00%)	162.22% (100.00%)	110.26% (100.00%)	151.05% (100.00%)	32.50% (100.00%)	

Row % (Column %)

Chapter 3

Youth Labor Index for Low Income Countries

co-authored with Erwin Lefoll & Isabel Günther

Abstract

This paper introduces the Youth Labor Index for Lower-Income Countries (YLILI), a composite index of 10 labor market indicators specifically tailored to developing countries. The indicators are chosen based on their relevance for economies with high levels of informal work and because they can be computed for ages 15-24 and disaggregated by gender. The index rankings suggest that poor education outcomes and high working poverty rates are the main drivers of weak youth labor market outcomes, especially in sub-Saharan Africa. Labor market scores are higher for males, a result driven by the large shares of young women not in education or the workforce. The fertility rate is a strong predictor of index scores, suggesting that countries with fastest growing youth populations are also struggling to provide sufficient opportunities for decent youth employment. A webtool (https://nadel.shinyapps.io/ylili/) allows users to explore the YLILI and identify policy priorities.

3.1 Introduction

Over the past three decades, the global share of youth residing in developing countries has increased by 20 percentage points, to a little over 50 percent of all youth in 2020 (United Nations Development Programme, 2019). This share is expected to continue to rise, and with it the number of young workers entering the workforce (Roser et al., 2019). Lacking formal employment opportunities and facing unemployment without social security, youth in many low-income countries (LICs, as classified by the World Bank (2020a)) and lower-middle income countries (LMICs) must resort to work that

is irregular, underpaid, and lacking in benefits or advancement opportunities. Few can afford to be inactive for extended periods of job search after leaving school. In sub-Saharan Africa (SSA), where 40 percent of inhabitants are under the age of 15 and where youth population growth is outpacing formal job creation by a large margin, the "youth employment crisis" is increasingly also being seen as a "missing jobs" crisis (Sumberg et al., 2021). Long unemployment spells reduce productive capacity in later life, curtailing youths' earnings potential and dampening the growth prospects of the economy (Gregg and Tominey, 2005). In the worst case, persistent difficulties in transitioning to gainful work can drive youth to political unrest and violence, as has been the case in the Middle East (Urdal, 2006).

The UN has addressed this issue with its 8th Sustainable Development Goal (SDG)—full and productive employment and decent work for all, with particular emphasis on youth (and other vulnerable populations). Unfortunately, the productivity and decency of work does not lend itself to easy measurement. The unemployment rate is the most widely-used indicator for evaluating labor market strength, but it is largely uninformative in many developing countries, where low savings rates and the lack of social insurance force youth to accept underpaid, unskilled work. In such an environment, rather than indicating widespread "decent" work, low unemployment rates reflect that large segments of the youth population simply cannot afford *not* to work (Dewan et al., 2007; Zimmermann et al., 2013). Thus, to better analyze and compare youth labor markets in developing countries, a more multifaceted indicator than the unemployment rate is needed.

To this end, this paper presents the Youth Labor Index for Lower-Income Countries (YLILI)—a composite index of 10 youth labor market indicators specifically tailored to the realities of work in low- and lower-middle income countries and organized around three central themes: youth transition to work, working conditions for youth, and human capital. The YLILI builds on a related index compiled by the Swiss Economic Institute (KOF), but relies on indicators that are more relevant to and available for low-income countries. Specifically, the unemployment rate is replaced by indicators more appropriate for the measurement of highly informal economies.

A measure of youth labor market strength will ideally be youth-specific rather than pertaining to the working-age population as a whole. Youth and adults face qualitatively different conditions and obstacles on the labor market. For one, youth often experience worse outcomes than adults: according to the latest ILO statistics for LICs and LMICs, for instance, they were 20 percent (3.2 percentage points) more likely to be among the working poor and 13 percent more likely to be underemployed (ILO, 2020b). Rapid demographic and structural change also imply generational differences in the nature of work: youth face stiffer competition due to growing populations, are more likely to migrate to urban areas (de Brauw et al., 2014), and are increasingly eschewing the agricultural work of their parents and grandparents (Honorati and Johansson de Silva, 2016). All indicators used in the YLILI are thus disaggregated by age group, covering youth aged 15–24 specifically, and include youth-specific measures such as school test performance. Disaggregation by gender allows for further analysis. Current data availability allows us to generate an overall YLILI score for 54 (out of 79) low- and lower-middle income countries. An accompanying online tool (https://nadel.shinyapps.io/ylili/) allows users to view each index component in detail and compile the ranking according to custom parameters.

The YLILI suggests that, among low-income and lower-middle income countries, youth labor markets perform best in Europe and Central Asia. Meanwhile, 18 of the 20 worst-performing countries are located in SSA (Pakistan and Afghanistan being the two exceptions). The poor performance in SSA is driven primarily by high working poverty rates and low scores on measures of education. In general, education outcomes are found to vary the most across countries, and as such are the main driver of the final index rankings. Perhaps our most striking finding is that demographic patterns best predict the YLILI scores: countries with large youth populations and high fertility rates tend to perform worse on the YLILI index, particularly in the transition and education dimensions. This suggests a compounding of unfavorable demographic and labor market conditions for youth, with the highest numbers of youth entering labor markets with scarce opportunities. Thus, we conclude that prospects for youth in the poorest countries are unlikely to improve until fertility and dependency rates fall substantially.

Finally, we examine differences in YLILI scores for young men and women and find that high female inactivity rates and substantial education deficits drive the observed gender gap, particularly in countries that perform poorly on the YLILI overall.

The remainder of the paper is structured as follows. Section 3.2 describes the indicators of the YLILI and the data. Section 3.3 describes how the indicators are combined to generate the YLILI country score. Section @ref(ylili_results) presents some applications of the YLILI, including regional analysis and a breakdown by gender. Section 3.5 presents several robustness checks, and highlights potential limitations. Section 3.6 concludes and discusses some policy implications.

3.2 The YLILI Indicators

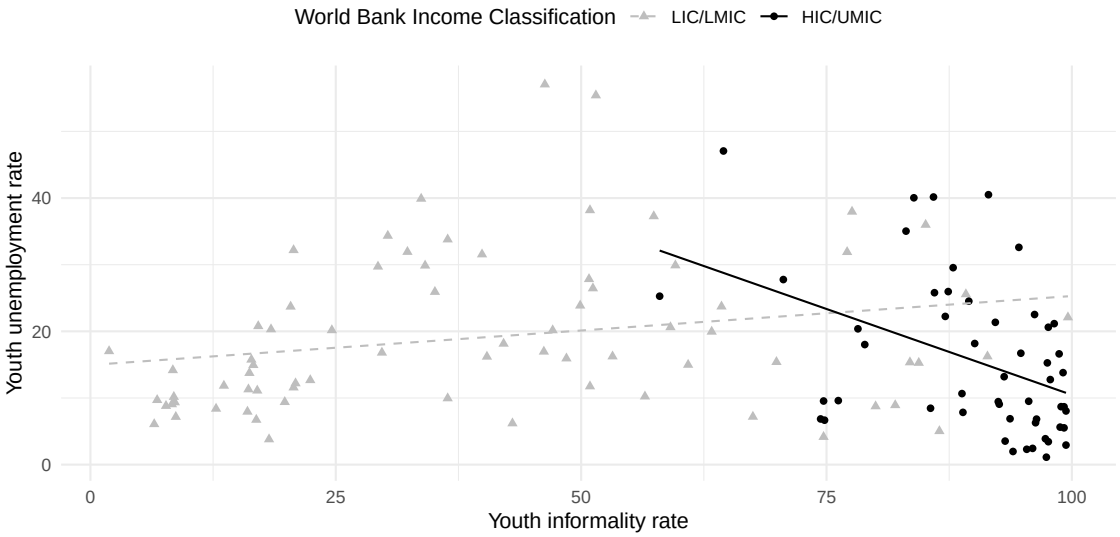
Composite indices help make complex and multidimensional phenomena more tractable by combining multiple measures into country-specific *ranks* or *progress indicators*, which in turn allow for easier comparisons across countries and over time. Thanks to their simplicity, they are often instrumental in rallying attention to an issue in policy or governance, such as corruption (the Corruption Perceptions Index), human well-being (Human Development Index, HDI) or the business environment (Ease of Doing Business Index). In some cases, indices are also used to bring attention to the misuse of a popular indicator in public discourse. In the case of the HDI, a combination of life expectancy, education and income indicators was proposed as an alternative to GDP as a measure of a country's level of development (UNDP, 1990).

The YLILI is inspired by the Youth Labor Market Index (YLMI), a composite index introduced in 2014 by the Swiss Economic Institute (KOF) and updated annually every year since (Renold et al., 2014). The YLMI is composed of 12 indicators and has helped highlight issues such as the *youth paradox*—unprecedented educational attainment going hand-in-hand with rising youth unemployment in many high-income countries. However, the YLMI's heavy sourcing of data from the EU and OECD means its usefulness is limited to the study of youth labor markets in high-income countries (Pusterla, 2015, 2016). Crucially, the index relies heavily on the unemployment rate, a

widely-cited indicator that is much more informative in high-income than low-income contexts. Unemployment rates in the poorest countries regularly fall under 5 percent, but rather than indicating well-functioning labor markets, they remain low because social security systems are weak and informal, and most people simply cannot afford to remain idle (Filmer and Fox, 2014). Families with low savings are unable to support graduates through an extended job search, leaving young people with no choice but to enter own-account employment or poorly-paid jobs below their skill level (Fields, 2012, p. margolis2014), predominantly in the informal sector (Herrera and Merceron, 2013; Sengenberger and International Labour Office, 2011).

Economic development tends to go hand in hand with the formalization of work (La Porta and Shleifer, 2014)—about 90 percent of employed youth in developing countries work in the informal sector on average, compared to less than 20 percent in high-income countries (Bonnet et al., 2018). Formal work comes with many benefits, from higher wages to employment stability and social security coverage. Thus, the fact that among LICs and LMICs, *lower* unemployment rates tend to be associated with *higher* rates of informal work—in contrast to rich countries—presents a problem for the unemployment rate as a measure of economic health (Figure 3.1. An indicator that can mean opposite things depending on development level violates a key assumption of composite indices, namely that each of the constituent indicators provides a well-ordered ranking of performance. For this reason, we exclude the unemployment rate from the YLILI.

Figure 3.1: Relationship between youth unemployment and informality by income level



In addition to the unemployment rate, the relaxed unemployment rate (the share of unemployed and discouraged workers relative to the size of the labor force), the relative unemployment rate (ratio of youth to adult unemployed) and the long-term unemployment rate (share of unemployed who have been continuously unemployed for a year or more) are all included in the KOF YLMI and pertain directly to the unemployment rate. We exclude these indicators from the YLILI as well, and replace them with measures that are more relevant for describing labor market conditions in low-income economies. For instance, the working poverty rate (living on less than $1.90 a day) and the literacy rate are generally close to zero for high-income countries (and thus not part of the YLMI), but vary meaningfully for low-income countries. Table B3.1 in the online Appendix provides a more detailed overview of the similarities and differences between the YLMI and YLILI.

We stipulate four conditions that an indicator must fulfill to be included in the YLILI. First, the indicator must be a monotonic increasing function of labor market performance. This means that it must be clear whether a higher value of an indicator is always preferred to a lower one (i.e., the higher, the better) or vice-versa. From the perspective of a policy-maker, it must be possible to rank the indicator from the worst to the best outcome. Second, the indicator must be disaggregated by different age groups, and specifically must be available for the 15 to 24 age group. Third, the indicator must be

desegregated by sex. Fourth, indicator estimates must be available for at least half of the LMICs and LICs dating back no further than 2010. We limit ourselves to indicators from four reputable compilers of international statistics: ILOSTAT, UNESCO, the World Bank, and the Demographic and Health Surveys (DHS). We retain indicators for which data is available for at least one year since 2010 for 40 or more low-income and lower-middle income countries (as of April 1st 2021, there were 79 LMICs and LICs combined according to the World Bank (2020a)).

Ultimately, we identified ten indicators that meet these conditions. We classified these into three broad dimensions that best reflect, in our view, youth labor markets in developing countries: transition from education to the labor market, working conditions, and educational background (Table 3.1). On the demand side, the transition dimension reflects economic participation and the smoothness of the transition from education to the workplace, whereas the working conditions dimension captures the quality of work. The final dimension (education) focuses on the supply side of the labor market, i.e., the skill level of job seekers. Ultimately, indicators were chosen as much based on data availability as desirability; nevertheless, it is worth noting that as with any composite index, the final choice and weighting of indicators is a value-laden interpretation of the authors. A corresponding webtool (https://nadel.shinyapps.io/ylili/) allows users to fine-tune the index to their preference and to test the robustness of the final rankings presented here. For more details on the availability of each indicator, see Section 3.6 in the online Appendix.

Table 3.1: Overview of Indicators

	Indicator	In KOF YLMI	Source	Self-computed
Transition	Share not in employment education, or training (NEET)	✔	ILOSTAT	No
	Relative working conditions ratio	×	ILOSTAT	Yes
	Skills mismatch rate	✔	ILOSTAT	Yes
Demand: Working Conditions	Working poverty rate	✔	ILOSTAT	No
	Time-related underemployment rate	×	ILOSTAT	No
	Informal employment rate	×	ILO	No
	Share in elementary occupations	×	ILOSTAT	Yes
Supply: Education	Share of youth with no secondary education	×	DHS	Yes
	Illiteracy rate	×	UNESCO	No
	Harmonized test scores	×	World Bank	No

Notes: Self-computed indicators are calculated by the authors from two or more raw indicators.

3.2.1 Transition from Education to the Labor Market

The transition category captures quantity adjustments of youth labor in developing countries. The share of youth Neither in Employment nor in Education or Training (NEET) captures the level of inactivity in the youth population, while the youth skills mismatch characterizes the degree to which the supply of youth skills meets employer demand. The relative working conditions ratio is an adaptation of the relative unemployment ratio, and compares labor market outcomes of youth to those of older workers without relying on unemployment rates.

The **share of youth NEET** captures the percentage of people aged between 15 and 24 years old who are neither in employment nor in education and training (data obtained from ILOSTAT). Hence, it refers to individuals fulfilling two mutually inclusive conditions: (i) they are not employed (i.e., are unemployed, discouraged, or inactive), and (ii) have not received any education or training in the four weeks preceding the survey (Elder et al., 2015). Young people in education include those attending full-time or part-time education, but exclude those in non-formal education and in educational

activities of very short duration (OECD and International Labour Organization, 2019). Both formally and informally employed youth are considered to be working, and are thus not counted among NEET youth. Average NEET rates are given in Table 3.1 and shown graphically in Figure B3.1 in the online Appendix. The NEET rate does not track national income in a linear manner: about 28 percent of youth in lower-middle income countries are NEET, while this rate is closer to 20 percent in both upper-middle and low income countries. High income countries have much lower youth inactivity rates, with just 11 percent youth NEET on average.

The **relative working conditions ratio** pertains to the difference in two aspects of work quality between youth and adults (aged 25+ years old): the working poverty rate and the time-related underemployment rate. The working poverty rate is expressed as the percentage of workers living below US$1.90 PPP. The time-related underemployment rate captures the proportion of working youth who are able and willing to increase their working hours and who are working under a threshold number of hours for a reference period. This threshold is determined separately by each country based on national circumstances.

The relative working conditions ratio indicator measures the degree to which working conditions differ for youth and adult workers, and thus captures whether youth enjoy labor conditions that are "typical" for their country. Youth suffering from substantially lower working conditions than the adult working population would suggest that youth engage in different jobs or tasks than adults and indicate a slower transition to decent work. We self-compute it using data from ILOSTAT as follows:

$$\text{Relative WC ratio} = \frac{\dfrac{\text{Youth work. poverty rate}}{\text{Adult work. poverty rate (25+)}} + \dfrac{\text{Youth time-related unmp. rate}}{\text{Adult time-related unmp. rate (25+)}}}{2}$$

The closer the youth and adult rates, the more the ratio tends to one, suggesting equality in working conditions between youths and adults. Taken separately, the two components of this indicator (working poverty and the underemployment rates) tend to

unity in the ideal case: when youth and adult conditions are similar. Jointly, the indicator needs to be interpreted cautiously, as a ratio above one (favoring adults) can be counterbalanced by a ratio below one (favoring youth), creating the impression of equality between generations where there is none. Youth in developing countries are about 20 percent more likely to belong to the working poor than adults, and about 13 percent more likely to face time-related underemployment. Working poverty and underemployment are higher in LICs and LMICs than higher income countries, while the differences (ratios) between youth and adult outcomes tend to be lower in relative terms.

Job mismatch is the third and final indicator in the transition dimension and refers to the difference between a worker's skill level and the level required by their employer. It accounts for two situations: (i) workers who are constrained to accept jobs for which they are overqualified or that do not match their skills/training and (ii) workers who hold jobs for which they are not qualified. Since the mid-1990s and the advent of the United Nation's Millennium Development Goals at the beginning of the 21st century, grass-roots approaches to solving poverty have mainly focused on improving the supply side of the labor market, i.e., making job-seekers more educated and skilled, and not the demand side, i.e. making new and/or better jobs available (Amsden, 2010; Gore, 2010). As a result, large numbers of over-qualified workers unable to take full advantage of their skills are common in many LMICs and LICs (Handel et al., 2016).

There are several ways to measure mismatch. One is to calculate the difference between the highest level of education attained and the dominant level of education observed for the worker's occupation (Herrera and Merceron, 2013). Unfortunately, such an indicator is not available and cannot be computed using aggregated data. Our solution is to mirror the skills mismatch indicator used in the KOF YLMI, which utilizes the unemployment rate at different levels of education. This indicator captures the extent to which workers with a certain level of education are more or less affected by unemployment than others. Because this indicator is unavailable as such, we compute it manually using unemployment data disaggregated by age and level of education from ILOSTAT as follows:

$$\text{Skills mismatch rate} = \frac{1}{2}\sum_{k=1}^{4}\left|\left(\frac{\text{Youth emp. with edu. } k}{\text{Total youth emp.}} - \frac{\text{Youth unemp. with edu. } k}{\text{Total youth unemp.}}\right)\right|$$

where k is the highest level of education completed (less than basic; basic; intermediate; advanced) and thus the higher the mismatch, the higher the rate. One shortcoming is that, since workers often have no choice but to take any job available, educational attainment can become undervalued in a saturated labor market. As a result, unemployment becomes less contingent on one's level of education, and can lead to an underestimated measurement of skill mismatch. With this caveat in mind, the youth skills mismatch rate averages just 12% globally (Table 3.1 and Figure B3.2 in the online Appendix) and rarely exceeds 20% in developing countries using this definition.

3.2.2 Working Conditions

The working conditions category aims to measure the quality and decency of employment, as promoted by SDG # 8: full and productive employment and decent work for all. We attempt to capture whether the jobs performed by youth are sufficient to keep them out of abject poverty and generate a safe and stable livelihood. We rely on four indicators of working conditions: the proportion of youth working in poverty, the youth time-related underemployment rate, the share of youth in informal employment, and the share of youth working in elementary occupations. The vulnerable employment rate is also available for LICS and LMICs, but is conceptually similar to the informality rate, leading to concerns of double-counting youth and skewing the index. Moreover, it correlates closely with a number of other indicators in the index, including the informality rate, suggesting that little information is lost when we exclude it.

The **youth working poverty rate** measures the proportion of youth working below the international poverty line set at $1.90 PPP a day, i.e., measures the proportion of working youths living in "extreme" poverty (data obtained from ILOSTAT). The first shortcoming of this indicator is that it is estimated from household surveys and thus fails to account for intra-household distribution of resources; we have to assume that re-

sources are equally distributed between members of the household. A second concern is that it splits the population into poor and non-poor, implying a substantial change in living conditions at the cutoff and neglecting important features of the income distribution (e.g., the distance of the poorest youth from the $1.90 line). Finally, since raw data for this indicator is not currently available, we rely instead on modelled estimates generated by the ILO for country-year pairs for which country-reported data is unavailable. Thus, measurement error may bias this particular indicator. We are also aware that because this indicator is based on the monetary value of a person's consumption expenditures or income, it remains silent about other dimensions of poverty (OPHI, 2015). Multidimensional measures of poverty, such as the Multidimensional Poverty Index (Alkire and Foster, 2011) aim to address this shortcoming, though aggregate data on youth working in multidimensional poverty is currently unavailable and, in most cases, income poverty is highly correlated with measured multidimensional poverty for the adult population. According to the most recent estimates from the ILO, about 12 percent of working youth globally live in extreme poverty, though they are unsurprisingly concentrated in low-income settings: 39 percent of Africa's working youth and 41.7 percent of working youth in low-income countries live below $1.90 a day. Wide variations exist between countries, as shown in Figure B3.2 in the online Appendix.

The **youth time-related underemployment rate** measures the share of youths employed who (i) are willing to work additional hours, (ii) are available to work additional hours, and (iii) worked less than a specified time threshold (combining all jobs), thus capturing the share of working youth whose productive capacity is underutilized (data obtained from ILOSTAT). The average youth-time related underemployment rate across all developing countries is about 10 percent (see Table 3.1 and Figure B3.2 in the online Appendix).

The **share of youth in informal employment** is the third indicator in the working conditions dimensions and is measured as a proportion of all working youth. According to the ILO, whether a job is categorized as informal depends on the status in employment of the worker. For own-account workers and employers, the formality of employment is determined by the formal or informal nature of their enterprise. For the employed,

the formality of employment is defined by the employment relationship of employees to their employer: informal work is not subject to national labor legislation or income taxation or entitled to social protection or certain employment benefits, in law or in practice (data retrieved from Bonnet et al. (2018)). Youth aged 15–24 are subject to the highest rates of informal work in every region of the world except Europe and Central Asia (Bonnet et al., 2018). About 96 percent of working youth in SSA and Southern Asia work in informal jobs, per the ILO (2020a). Even in Latin America, where the rate of formal wage employment is growing faster than the size of the working population, 55 percent of employed youth still work in the informal sector, leaving them particularly vulnerable to the frequent economic crises that continue to buffer the continent (ILO, 2015). As informality is associated with wage instability and precarious working conditions, this indicator is a vivid expression of the youth employment problem in developing countries.

Finally, the **share of youth working in elementary occupations** is based on the definition of the ILO's International Standard Classification of Occupations 2008 (ISCO-08). Elementary occupations include cleaners and helpers, agricultural, forestry and fishery laborers, laborers in mining, construction, manufacturing and transport, food preparation assistants, street and related sales and services workers, refuse workers. These jobs usually involve low-skilled, physical tasks which may entail high risk of injury. We self-compute this indicator by obtaining employment data disaggregated by age and occupation from ILOSTAT. About 1 out of 5 workers is employed in an elementary occupation across developing countries (Table 3.1 and Figure B3.2 in the online Appendix).

3.2.3 Education

This final dimension focuses on the supply side of the labor market, i.e., education and skills acquired by job seekers. The skills required by employers depend greatly on the structural composition and stage of development of the economy in question. To ensure comparability for a global index, we thus focus on the most fundamental skills required for gainful employment: basic literacy and the duration and quality of education. To measure the quantity of education, we employ the proportion of youth with no sec-

ondary education. To capture if youths have acquired the most basic skills relevant for employment, we use the youth illiteracy rate and a novel set of harmonized test scores.

We self-compute the **share of youth without secondary education** using data from the Demographic and Health Surveys (DHS) Program. The DHS data classifies individuals according to their highest attained level of education in one of the following 6 categories: (i) no education, (ii) some primary education, (iii) completed primary education, (iv) some secondary education, (v) completed secondary education, (vi) more than secondary education. We define no secondary education as the sum of the first 3 categories (share with no education, share with some primary education, and share with completed primary education). For simplicity, we assume that the share of female and male youth in every country is equal at any time t: the sex ratio of youth aged 15-24 is close to 1 for nearly all developing countries (CIA, 2016). We drop observations for which only female or only male data is available. Despite widespread efforts to increase school enrollment over the past three decades, about 45 percent of youth have still never pursued any secondary education (Table 3.1). Figure B3.3 in the online Appendix reveals that this is still a considerable issue in SSA, where more than 60 percent of young people have never attended a single year of secondary education (e.g., Ethiopia, Mali, Malawi, etc.).

The **youth illiteracy rate** measures the percentage of youth who are declared illiterate. It gives the most simple and straightforward indication on the overall minimum level of measurable skills attained by job seekers (data obtained from UNESCO). About one out of every five youths in developing countries is illiterate. Figure B3.3 in the online Appendix indicates that youth illiteracy rates are low globally, and that only a handful of countries still have rates above 40% (mainly located in Western Africa).

Finally, we include a set of **harmonized test scores** recently compiled by the World Bank to measure the quality of primary and secondary education. For decades, the literature exploring the impact of education on economic development has used years of schooling as a measure of human capital (e.g. Barro, 1991; Mankiw et al., 1992, among others). Using years of schooling as a proxy for human capital can be problematic, however, in that it assumes that school enrollment or attendance automatically translates

into learning. This is often not the case, particularly in low-income countries (World Bank, 2018). To address this shortcoming, we exploit so-called *harmonized test scores*, one of the 3 components of the World Bank's new human capital index (Angrist et al., 2019; Kraay, 2018). Harmonized test scores are computed from major international literacy and numeracy testing programs at the primary and secondary education levels. Evidence suggests that individuals with such basic skills have a higher likelihood of success in the labor market and that their skill remains highly valued worldwide (Vignoles and Cherry, 2020). Harmonized test scores are measured on the TIMMS (Trends in International Maths and Science Study) scale, where 300 is lowest possible score and 625 is the highest. Harmonized test scores are low in developing countries, With a mean of 380 compared to 452 in HICs/UMICs. Figure B3.3 in the online Appendix shows that harmonized test scores are particularly low in SSA, where only four countries—Kenya, Gabon, Seychelles, Mauritius—outperform the HIC/UMIC mean.

3.3 Index Construction

The basic paradigm for composite indices is to rescale indicators to ensure comparability before grouping them into "dimensions", which are then used for final aggregation. The YLILI is scaled to vary between 0 (dysfunctional labor market) and 100 (well-functioning labor market). The YLILI keeps rescaling to a minimum to ensure ease of interpretation. Eight out of the 10 indicators used are already rates, allowing us to retain raw scores without any normalization. For the two indicators that are not rates—the relative working conditions ratio and the harmonized test scores—the Min-Max normalization method is used, in line with several well-known composite indices such as the Human Development Index or the Global Competitiveness Index 4.0 (Decancq and Lugo, 2013; OECD et al., 2008). The working conditions ratio is given upper and lower bounds of 10 and 1 respectively, while the harmonized test scores are given a higher and lower bound equal to their natural scale of 300 and 625 (see section 3.6 in the Appendix for more details).

The 10 indicator scores, all on a scale of 0 to 100, are first combined into three dimen-

sion scores, which are then likewise combined to produce an aggregate index score. We use the arithmetic mean to calculate the dimension scores as well as the overall YLILI score. In other words, each dimension score is a simple average of its underlying indicators, and the YLILI score is a simple average of the three dimension scores for each country. Formally, this implies that YLILI is computed as follows:

$$\text{YLILI}_c = \sum_{d=1}^{3} \frac{1}{3} \cdot s_{dc}$$

where $s_{dc} = \sum_{i=1}^{m_d} s_{idc} \cdot w_{id}$ represents the score of dimension d for country c, w_{id} corresponds to the weight attributed to indicator i in dimension d where $\sum w_{id} = 1$, and m_d is the total number of indicators in dimension d with score different from zero. We thus assume that, in each dimension, each indicator is of equal importance. In this sense, the YLILI contends that countries need to be holistic in their approach to fostering their youth labor market and that no area—transition, working conditions, or education—should be neglected. A further advantage of attributing equal weights to each dimension is that it sets each country a level playing field to define its path to progress (WEF, 2018).

Due to the scarcity of observations for low-income countries, we compute the index by using the last available year that was reported for each indicator and country, dating back no later than 2010. Index scores were only computed for countries with a minimum of two non-missing indicators in the transition and education dimensions and three indicators in the working condition dimension (i.e., at least seven out of ten indicators from 2010 or later). For countries missing three or fewer indicators, these missing values are imputed using countries' percentile ranking in the given dimension to prevent them from skewing the index. For more detail on data availability and selection criteria, see section 3.6 in the online Appendix.

Finally, missing values are always an issue when dealing with country-level data in low-income countries. When using arithmetic means, the number of indicators included implicitly determines the weight of each indicator. The more indicators are missing in

a dimension, the more weight will be attributed to the available indicator and thus bias the overall comparability between countries, with the direction of this bias depending on the distribution of non-missing values. For this reason, estimated values are often preferred to missing values. There are numerous methods for imputing missing values. The missing data can be taken to be the average of similar units for which data exists (hot deck imputation) or regressed on the indicators in the index (OECD et al., 2008; WEF, 2018). Missing values for the YLILI are imputed by assuming that countries' relative performance is similar within a given dimension: countries' performance on non-missing indicators are computed first, then their percentile rank in a given dimension is used to impute the missing indicator.

In the end, the choices surrounding the rescaling, aggregation, time span, and imputation of data to arrive at the final YLILI were made in an attempt to maximize the number of countries covered while relying on reliable, up-to-date, and comparable indicators. However, these choices are disputable, and the webtool has been designed expressly to allow users to experiment with the YLILI construction and to arrive at their own conclusions regarding the best aggregation approach.

3.4 Results

3.4.1 The YLILI

The score distribution of each of the three dimensions and 10 constituent indicators are summarized in Table 3.2. Overall, transition scores are higher than education or working conditions scores. Youth in LICs and LMICs countries are still quite poorly educated, and appear to transition quickly to jobs with poor working conditions - possibly because they are unable to withstand extended periods of inactivity. Moreover, transition scores are close across all countries of the world ($sd = 9.25$), while wider variation exists for education ($sd = 13.56$) and, to a lesser extent, working condition scores ($sd = 10.15$). Thus, youth working poverty ($sd = 23.73$), the share of youth without secondary education (sd=17.84) and the youth illiteracy rate (sd=17.10) play a large role in determining final rankings of countries.

Table 3.2: Descriptive statistics, indicators of the YLILI

Indicator	Mean	Std. Dev	Min.	Max.	Obs.
Transition	79.54	9.25	39.74	94.15	61
Share of youth NEET	73.65	12.59	31.44	98.58	67
Relative working conditions ratio	85.53	16.22	0	100	62
Youth skills mismatch rate	78.77	11.99	46.36	95.70	61
Working conditions	63.68	10.15	26.10	87.83	65
Youth working poverty rate	73.07	23.73	3.84	100	76
Youth TR underemployment rate	89.87	11.87	28.77	100	65
Share of youth in informal employment	11.65	13.70	0.60	72.80	65
Share of youth in elementary occup.	77.71	15.56	24.07	98.16	66
Education	54.71	13.56	22.82	81.81	66
Share of youth with no secondary educ.	58.08	17.84	23.50	99.60	66
Youth illiteracy rate	81.94	17.10	30.79	100	71
Harmonized test scores	24.45	13.49	1.51	67.42	69

Notes: Most recent observations, dating back no further than 2010. Rescaled indicator scores shown—higher values always correspond to better labor market outcomes. Number of observations differ as a result of varying data availability for each indicator.

Table 3.3 shows the YLILI score for the 54 countries covered by the data, together with each country's overall score, its scores on the three constituent dimensions, its respective ranking (between 1 and 54) for the overall and dimension scores, and the mean dimension rank (for or a visual representation, see Figures B3.4 and B3.5 in the online Appendix). From the sample of low and lower-middle income countries analyzed, Ukraine scores the highest on the YLILI (84.67) with high scores in all three dimensions (all above 80), followed by Moldova, Mongolia, Kyrgyzstan, Cambodia, and Viet Nam. Niger ranks last (with an overall score of 40.54) and is joined in the bottom five by Madagascar, Mali, Afghanistan, and Rwanda. Of the 20 worst-performing countries, 18 are located in SSA, with Pakistan (34th) and Afghanistan (51st) being the two exceptions.

Figure B3.6 in the online Appendix depicts indicator scores by world region. Aside from the strong overall performance of the two Eastern European countries (Moldova and the Ukraine), visual inspection reveals no substantial differences in YLILI and its indicators across regions. The low number of countries in Eastern Europe (2), Northern Africa (4) and Latin America (4) also require that any regional averages are treated with caution. Across all regions, formality rates and harmonized test scores leave the most room for improvement.

Comparing absolute levels, SSA scores critically low (nearly 10 points lower than the next-lowest region) on the education dimension (mean= 47.9) and the working conditions dimension (mean= 56.7). The low working conditions scores are driven primarily by working poverty. On the other hand, SSA does not perform worse than the rest of the sample on the transition dimension: youth in SSA are not exposed to significantly more education-based job mismatch, larger generational gaps in working conditions, or higher NEET rates than developing countries from other regions of the world.

Table 3.3: YLILI by country, last available year

Country & Region			Mean Score				Rank				
			YLILI	Transition	Work cond.	Education	YLILI	Transition	Work. cond.	Education	Mean Rank
Ukraine	UKR	EU & C. Asia	84.67	91.82	80.40	81.81	1	3	3	1	2.33
Moldova	MDA	EU & C. Asia	83.36	88.39	87.83	73.85	2	10	1	5	5.33
Mongolia	MNG	E. Asia & Pacific	82.32	91.89	82.73	72.34	3	2	2	6	3.33
Kyrgyzstan	KGZ	EU & C. Asia	78.66	85.74	71.46	78.77	4	16	10	4	10.00
Cambodia	KHM	E. Asia & Pacific	76.69	94.15	68.42	67.50	5	1	26	11	12.67
Viet Nam	VNM	E. Asia & Pacific	75.75	73.33	72.44	81.49	6	52	7	2	20.33
Sri Lanka	LKA	South Asia	73.43	80.47	73.54	66.26	7	29	6	12	15.67
El Salvador	SLV	LA & Caribbean	72.92	75.93	70.62	72.21	8	43	14	7	21.33
Algeria	DZA	ME & N. Africa	72.39	87.85	67.79	61.54	9	11	27	20	19.33
Philippines	PHL	E. Asia & Pacific	72.12	86.94	68.78	60.64	10	13	25	26	21.33
Tunisia	TUN	ME & N. Africa	72.11	83.79	70.18	62.37	11	21	16	19	19.00
Occupied Palest. Territory	PSE	ME & N. Africa	71.50	74.58	69.69	70.24	12	49	20	8	25.67
Nepal	NPL	South Asia	70.81	80.46	67.38	64.60	13	30	29	15	24.67
India	IND	South Asia	70.22	74.71	67.14	68.81	14	47	30	10	29.00
Timor-Leste	TLS	E. Asia & Pacific	69.88	78.15	70.17	61.32	15	36	17	23	25.33
Nicaragua	NIC	LA & Caribbean	69.65	84.82	62.92	61.20	16	19	41	24	28.00
Cameroon	CMR	Central Africa	69.20	81.70	66.26	59.65	17	27	32	28	29.00
Haiti	HTI	LA & Caribbean	69.11	87.57	65.38	54.39	18	12	37	33	27.33
Myanmar	MMR	E. Asia & Pacific	68.60	73.58	68.76	63.35	19	51	24	12	30.33
Lesotho	LSO	Southern Africa	68.54	90.72	55.21	59.71	20	5	51	27	25.67
Bhutan	BTN	South Asia	68.07	66.91	75.89	61.40	21	59	4	22	28.33
Bangladesh	BGD	South Asia	66.69	75.37	69.10	55.61	22	46	23	36	34.67
Uganda	UGA	East Africa	66.67	86.46	60.25	53.15	23	14	44	38	32.00
Comoros	COM	East Africa	66.58	77.36	62.75	59.75	24	38	36	29	34.67
Honduras	HND	LA & Caribbean	66.51	78.04	60.02	61.47	25	37	45	21	32.33
Lao PDR	LAO	E. Asia & Pacific	66.39	70.59	71.38	57.20	26	54	13	32	31.33

Togo	TGO	West Africa	66.3079.4461.2058.272733422934.67
Ghana	GHA	West Africa	66.1773.5867.6957.232850283136.33
Zimbabwe	ZWE	East Africa	65.5180.3750.5765.592931601334.67
Mozambique	MOZ	East Africa	64.9778.6972.0544.193034 9 5131.33
Sudan	SDN	ME & N. Africa	64.9475.4569.8849.493145184335.33
Egypt	EGY	ME & N. Africa	64.9067.3875.1952.133258 5 4034.33
Sierra Leone	SLE	West Africa	63.3186.4956.9046.543315504837.67
Pakistan	PAK	South Asia	63.2074.6572.3042.663448 8 5236.00
Burundi	BDI	East Africa	63.0189.6442.9356.4635 7 633334.33
Senegal	SEN	West Africa	62.9479.5057.6251.713632494140.67
Zambia	ZMB	East Africa	62.6777.3054.6756.033740543543.00
Gambia	GMB	West Africa	62.5076.0663.8247.613842374742.00
Burkina Faso	BFA	West Africa	62.0083.0664.6138.333924355839.00
Liberia	LBR	West Africa	61.9790.1354.6641.1240 6 555538.67
Mauritania	MRT	West Africa	61.5677.3469.1038.264139235940.33
Tanzania	TZA	East Africa	61.3283.7350.4649.764223614242.00
Ethiopia	ETH	East Africa	60.6989.4454.7737.8643 8 536040.33
Congo DR	COD	Central Africa	60.4176.7252.2852.244441573945.67
Nigeria	NGA	West Africa	60.3381.8351.4547.704525584542.67
Malawi	MWI	East Africa	59.2281.7654.4641.434626565445.33
Angola	AGO	Central Africa	58.8667.7160.8448.024757434448.00
Benin	BEN	West Africa	58.4981.6348.6945.164828625046.67
Ivory Coast	CIV	West Africa	57.8770.1963.1740.254955405750.67
Rwanda	RWA	East Africa	57.8283.8341.9547.695021644643.67
Afghanistan	AFG	South Asia	55.8975.4655.1937.025144526152.33
Mali	MLI	West Africa	54.3469.1163.2330.675256396453.00
Madagascar	MDG	East Africa	52.4385.4026.1045.805317654943.67
Niger	NER	West Africa	40.5439.7459.0622.825461476658.00

At the country level, Table 3.3 shows that rank correlations across the three YLILI dimensions are low: performance in one dimension does not necessarily imply similar performance in the other two. Countries under-performing or over-performing on a particular dimension can be systematically identified by inspecting the standard deviation of their three dimension rankings. The most "imbalanced" countries are, in order, Liberia, Ethiopia, Bhutan, Burundi, Viet Nam, Egypt, Madagascar, Pakistan, Zimbabwe and Lesotho. The direction of the imbalance in these countries has a discernible regional pattern: transition scores for "imbalanced" countries in SSA tend to be higher than their working conditions or education scores. The two Middle East and North African (MENA) countries, Egypt and Pakistan, have working conditions scores that

are much higher relative to the rest of the sample than their education and transition scores. Viet Nam and Bhutan have transition scores that are among the lowest in the sample, despite having relatively strong education and working conditions outcomes. These discrepancies highlight that countries do not perform equally well in different dimensions of youth labor market strength and that no single dimension should be considered in isolation; they can also be useful for identifying national policy priorities.

3.4.2 Testing labor market hypotheses using the YLILI

In general, the choice of indicators for any composite index entails a trade-off between redundancy (if indicators overlap) and lost information (OECD et al., 2008). An index is most informative when the constituent indicators are not closely correlated with each other or the index itself (Noorbakhsh, 1998). Correlations between index components are depicted along with their statistical significance in Figure A3.3 in the Appendix and are generally low, reassuring us that the YLILI cannot be boiled down to a single existing measure. The three indicators in the education dimension (literacy, test scores, and no secondary schooling), however, are relatively closely correlated, with the rate of youth with no secondary schooling and the literacy rate exhibiting the strongest association (Pearson correlation coefficient= 0.67), suggesting that school attendance does lead to higher academic performance in general.

The YLILI can be used to test hypotheses about youth labor markets in low-income countries by examining the relationships between index components. We have argued that youth with no unemployment protection and low savings are less likely to be inactive, even if this means that they take on sub-optimal employment. We can test this hypothesis by examining the relationship between country transition and working condition scores, expecting faster transition and worse working conditions to be correlated. The aggregated working conditions dimension of the YLILI is indeed negatively correlated with the transition dimension, though the relationship is weak (Pearson correlation coefficient= -0.09). At the level of the individual indicators, we find a negative correlation between the NEET rate, which captures how quickly youth enter the labor market, and the working poverty rate, the underemployment rate, the elementary em-

ployment rate, and the transition dimension as a whole. In other words, countries with more inactive youth tend to have *better* working conditions and *lower* poverty rates, suggesting that youth who cannot afford to be inactive are forced to take on part-time or unskilled jobs with low wages. This supports the conjecture that a rapid transition to work, though generally a desirable feature of youth labor markets, can be offset by poor working conditions. It also supports our claim that the inclusion of both aspects is necessary for a holistic measure of youth labor market quality.

We also find a strong and significant positive correlation between the share of youth with no secondary schooling and the working poverty rate, though we remain agnostic about which direction of causality this implies. A significant negative relationship between education-based job mismatch and the rate of youth working in elementary jobs indicates that economies with higher levels of human capital (those with a lower elementary jobs rate) tend to have more education-based job mismatch. This is in agreement with a literature that claims that youth across the developing world remain under-educated and under-skilled, gains in access to schooling notwithstanding (Morsy and Mukasa, 2020). Finally, we find that all correlations *within* dimensions, if statistically significant, are positive, reassuring us of the conceptual soundness of the indicator grouping.

3.4.3 The YLILI and Measures of Well-Being

Next, we attempt to establish possible determinants of youth labor market performance as measured by the YLILI. To this end, we regress the overall YLILI score on a number of macroeconomic variables obtained from the World Bank Development Indicators (World Bank, 2021b) and the Ease of Doing Business rankings (World Bank, 2021a). In each regression, the most recent available observation for each indicator-country pair is used. The first five columns of Table 3.4 show the correlations between the overall country YLILI score and macroeconomic indicators of interest.

Table 3.4: Macro correlates of YLILI score

	Dependent variable: YLILI Score							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Youth unemployment rate	0.123							
	(0.132)							
HDI Score (× 100)		0.692***						
		(0.096)						
log(GDP)			6.915***			0.449	−1.711	
			(1.451)			(1.595)	(1.814)	
Youth pop. ratio (× 100)				−2.084***		−0.937**	−0.697	−0.556
				(0.464)		(0.428)	(0.465)	(0.478)
Fertility rate					−5.275***	−4.318***	−4.271***	−4.790***
					(0.681)	(0.872)	(0.868)	(1.094)
Agriculture (% of GDP)							−0.201*	−0.197
							(0.116)	(0.124)
Manufacturing (% of GDP)							−0.071	−0.125
							(0.181)	(0.188)
Exports (% of GDP)							0.069	0.027
							(0.057)	(0.065)
FDI (% of GDP)								0.495*
								(0.269)
Savings rate (% of GDP)								0.039
								(0.068)
Ease of Doing Business								−0.137
								(0.105)
Urbanization rate								0.081
								(0.068)
Access to Electricity								−0.046
								(0.056)
Observations	50	50	51	51	51	51	47	47
R^2	0.018	0.520	0.317	0.291	0.551	0.602	0.661	0.710

Note: *p<0.1; **p<0.05; ***p<0.01
Standard errors shown in parentheses. YLILI score is on a scale of 0-100.

First, we test our claim that the unemployment rate is an incomplete measure of the youth labor market strength for developing countries by regressing the YLILI score on the youth unemployment rate (column 1 of Table 3.4, and Figure A3.2 in the Appendix), and find no statistically significant relationship. Nor is the youth unemployment rate significantly correlated with any of the three dimensions of the YLILI. While this does

not allow us to make any normative statement on which is the better measure of labor market strength, it shows that the aspects captured by the YLILI— transition into the labor market, youth working conditions, and educational background—are not predicted (separately or jointly) by the youth unemployment rate alone.

The next two columns of Table 3.4 show the correlation between the YLILI score and two indicators of economic prosperity, the Human Development Index (HDI) score and GDP per capita. The HDI is a composite index measured on a scale of 0 to 1 that combines indicators of national life expectancy, per capita income and educational attainment (UNDP, 1990). Given that educational attainment accounts for a third of both the HDI and the YLILI, it is unsurprising that they are significantly correlated. A one percent increase in the HDI score is associated with about a 0.612 percent increase in the YLILI score.

Existing indices of youth well-being, such as Youth Progress Index and the Youth Development Index, have been shown to be closely correlated with GDP per capita, especially at lower income levels [Sen and Kakar (2016); lisney2018]. Thus, one might expect youth labor market conditions also to rise with incomes and productivity. We test this assumption directly by regressing YLILI on the logarithm of GDP per capita. Column (3) of Table 3.4 shows that a 1 percent increase in GDP per capita is indeed associated with a 6.4 percent increase in labor market performance for youth. The relationship between the two measures is shown in Figure A3.1 in the Appendix. However, we note that the correlation with GDP is much weaker for the YLILI ($R^(2) = 0.377$) than for the more holistic Youth Progress Index ($R^(2)$=0.857).

3.4.4 The YLILI and Demographic Change

The growth in the absolute number of youth has increased much faster in LICs and LMICs than in richer countries (Figure 3.2). At 60% of the total population, the share of youth below 25 in LICs is double that of HICs and rising (Figure A3.4 in section 3.6 of the Appendix). This youth population boom is driven primarily by demographic change in Africa, which has been underway for decades thanks in large part to plummeting child mortality (Ortiz-Ospina and Roser, 2016). The under-20 population in

Africa increased by 25.6 percent between 2009 and 2019, and is expected to outnumber the remaining population on the continent by 2070 (African Development Bank, 2019). African populations are already significantly younger than in the rest of the world (Appendix Figure A3.5), with a median age, currently at around 18 years, that is unlikely to exceed 21 before 2035. By comparison, by this time, the median person in the world will be aged 35, and the median person in East Asia will be as old as 45 (Filmer and Fox, 2014).

This "youth bulge" has implications for youth labor markets in SSA, where YLILI scores are among the lowest. On one hand, the population boom is an opportunity for growth. It has coincided with strong economic expansion in sub-Saharan Africa, with gross GDP growing an average of 4.35% per annum between 2000 and 2019, compared to 1.75% in the 20 years prior, per the World Bank. Experience from East Asia suggests that expanding working-age populations can contribute to economic transformation and rapid growth (D. E. Bloom and Williamson, 1998), boosting demand for youth labor and improving their working conditions. On the other hand, the potential for a demographic dividend in SSA is curtailed by persistently low labor productivity and savings. Moreover, high dependency ratios prevent workers from being able to save and invest, and high fertility rates keep young women confined to the home, reducing the effective size of the labor force (Eastwood and Lipton, 2011).

Figure 3.2: World youth population, 1960-2020
Source: World Population Prospects, United Nations (2019)

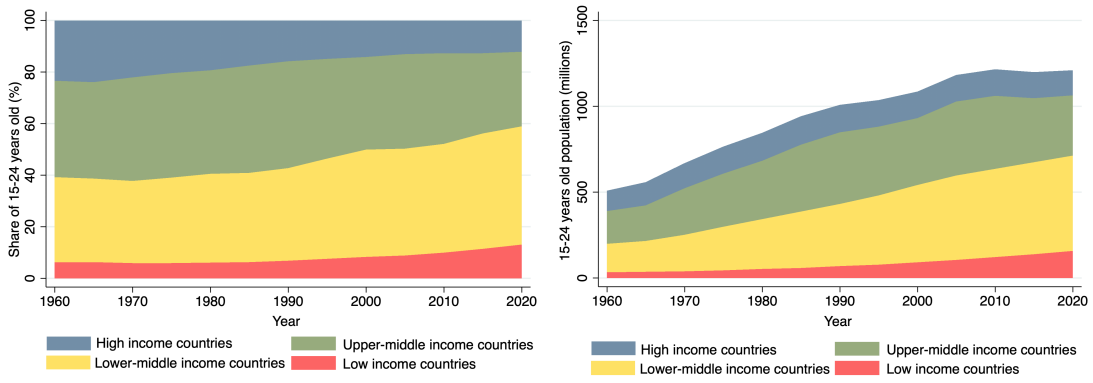


Table 3.5: Macro correlates, gender-specific YLILI and YLILI dimensions

	Dependent variable:					
	YLILI score			*Dimension*		
	Overall	Male	Female	Transition	Work. cond.	Education
log(GDP)	−1.711	−0.609	−1.711	−5.961	6.123***	−3.183
	(1.814)	(1.221)	(1.814)	(4.420)	(2.237)	(2.619)
Youth pop. ratio (× 100)	−0.697	−1.199***	−0.697	−0.199	−0.834	−1.364**
	(0.465)	(0.290)	(0.465)	(1.118)	(0.502)	(0.618)
Fertility rate	−4.271***	−2.278***	−4.271***	−3.827*	−2.129*	−6.987***
	(0.868)	(0.607)	(0.868)	(2.114)	(1.096)	(1.266)
Agriculture (% of GDP)	−0.201*	−0.135*	−0.201*	0.220	0.051	−0.591***
	(0.116)	(0.080)	(0.116)	(0.274)	(0.147)	(0.157)
Manufacturing (% of GDP)	−0.071	−0.161	−0.071	0.278	−0.021	0.031
	(0.181)	(0.121)	(0.181)	(0.432)	(0.198)	(0.261)
Exports (% of GDP)	0.069	−0.006	0.069	0.084	0.028	−0.037
	(0.057)	(0.038)	(0.057)	(0.138)	(0.070)	(0.078)
Observations	47	47	47	51	54	56
R^2	0.661	0.682	0.661	0.127	0.574	0.730

Note: *p<0.1; **p<0.05; ***p<0.01
Standard errors shown in parentheses. YLILI score is on a scale of 0-100.

While the impact of population growth on a specific labor market will depend on idiosyncratic factors such as industrial composition, informal sector size, government policy, and the country-specific elasticity of labor demand, we can still use the YLILI to provide some evidence about the broader demographic determinants of the cross-country differences in youth labor market conditions. Columns (4) and (5) of Table 3.5 present the relationship between two demographic indicators and the YLILI score. The first, the youth population ratio, is defined as the population aged 15–24 divided by the total population. This ratio ranges from 0.095 to 0.223 for LICs and LMICs, with a mean of 0.189. It has been slowly increasing for low-income countries over the past 2 decades (from 19.5 percent in 2000 to 20.2 in 2020) and decreasing for lower-middle income

countries (from 19.7 percent in 2000 to 17.9 percent in 2020). The youth population ratio is negatively correlated with the YLILI score: a one percent increase in the youth ratio is associated with a 2 point decrease on the YLILI scale. The fertility rate per country, which measures the number of births per woman and ranges from 1.262 to 6.913 and a mean of 3.72, exhibits an even stronger relationship: an additional birth per woman—slightly less than one standard deviation—is associated with a 4.6 point decrease in the YLILI score. When these two demographic variables are regressed together with GDP per capita on the YLILI score (column 6), income is no longer a statistically significant predictor of the YLILI score. In other words, the size of the youth bulge appears affect youth labor market strength, even among among countries at similar levels of economic development. This can also be seen in Figure A3.1 in the Appendix: several countries with middling income levels—e.g., Haiti, Nepal, Kyrgyzstan, and Cambodia—are still able to offer their youth relatively attractive labor conditions.

Columns (7) and (8) attempt to discern whether the structural features of an economy are able to explain differences in youth labor market performance. In model (7), we retain GDP per capita, the youth ratio, and the fertility rate, and introduce three measures of the structural composition of the economy: share of GDP in agricultural production, manufacturing, and export volume, respectively. In model (8), GDP is dropped in favor of more detailed indicators such as foreign direct investment (FDI), the national savings rate, urbanization and electrification rates, and the Ease of Doing Business index score (from the World Bank, -World Bank (2021a)). In both specifications, the two demographic variables remain highly significant at conventional levels. When controlling for income levels and demographics, more agrarian economies are found to have weaker youth labor markets. This is consistent with youth leaving work in agriculture *en masse* and characterizations of agricultural work as relatively low-productivity and low-income (Filmer and Fox, 2014). Foreign direct investment, on the other hand, is associated with better employment outcomes for youth.

We repeat this analysis for the gender-disaggregated rankings of the YLILI and the three dimensions of the overall (not gender-specific) YLILI using the preferred specification in column (7). The results are shown in Table 3.5. While higher youth ratios are

associated with worse labor market outcomes for males, high fertility rates have a much stronger negative impact on females. In other words, high fertility rates decrease labor force participation and other labor market outcomes for young women in the present (in line with Bloom et al., -David E. Bloom et al. (2009)), while reducing labor market prospects for young men in the future.

Table 3.5 also shows that different dimensions of the YLILI correlate with different macroeconomic measures. A high fertility rate, for instance, is associated with lower transition scores, likely reflecting its the detrimental effects of childbirth on female economic participation. On the other hand, richer countries experience slower youth transitions to the labor market—again, because extended periods of inactivity after leaving school is a luxury that youth in lower-income countries cannot afford. In contrast to the overall YLILI score, the working conditions dimension score *is* predicted by GDP per capita, even after controlling for demographic variables. Thus, even if economic growth is not a solution to all aspects of the youth employment problem, it can still lead to short-term improvements by alleviating youth working poverty, underemployment, and work informality. Finally, education outcomes are shown to be worse for countries with higher youth ratios (possibly via overburdened education systems) and fertility rates (higher dropout rates for females).

3.4.5 The gender YLILI

All of the component indicators of the YLILI are disaggregated by gender, allowing us to make cross-country comparisons of male- and female-specific YLILI scores, as well as analyze YLILI gender gaps within and between countries.

Encouraging gains have been made in female access to education, literacy, and maternal mortality in the past two decades, though progress on labor market equality has been slower. Labor force participation rates in particular remain much lower for women than men in most developing countries. Regional levels of female labor force participation (FLFP) are heterogeneous and are not predicted by GDP, female education, or fertility (Klasen, 2019). FLFP is relatively low in Southern Asia and MENA, for instance, despite rapid declines in fertility and expanding female access to education and relatively high

in both Eastern Europe and Central and East Asia. FLFP is also high in SSA, despite relatively low female education attainment, low incomes, and high fertility rates in the region. In fact, while youth labor force participation is decreasing—most of the world, it is increasing for young women in SSA—albeit from a low baseline (ILO, 2020a).

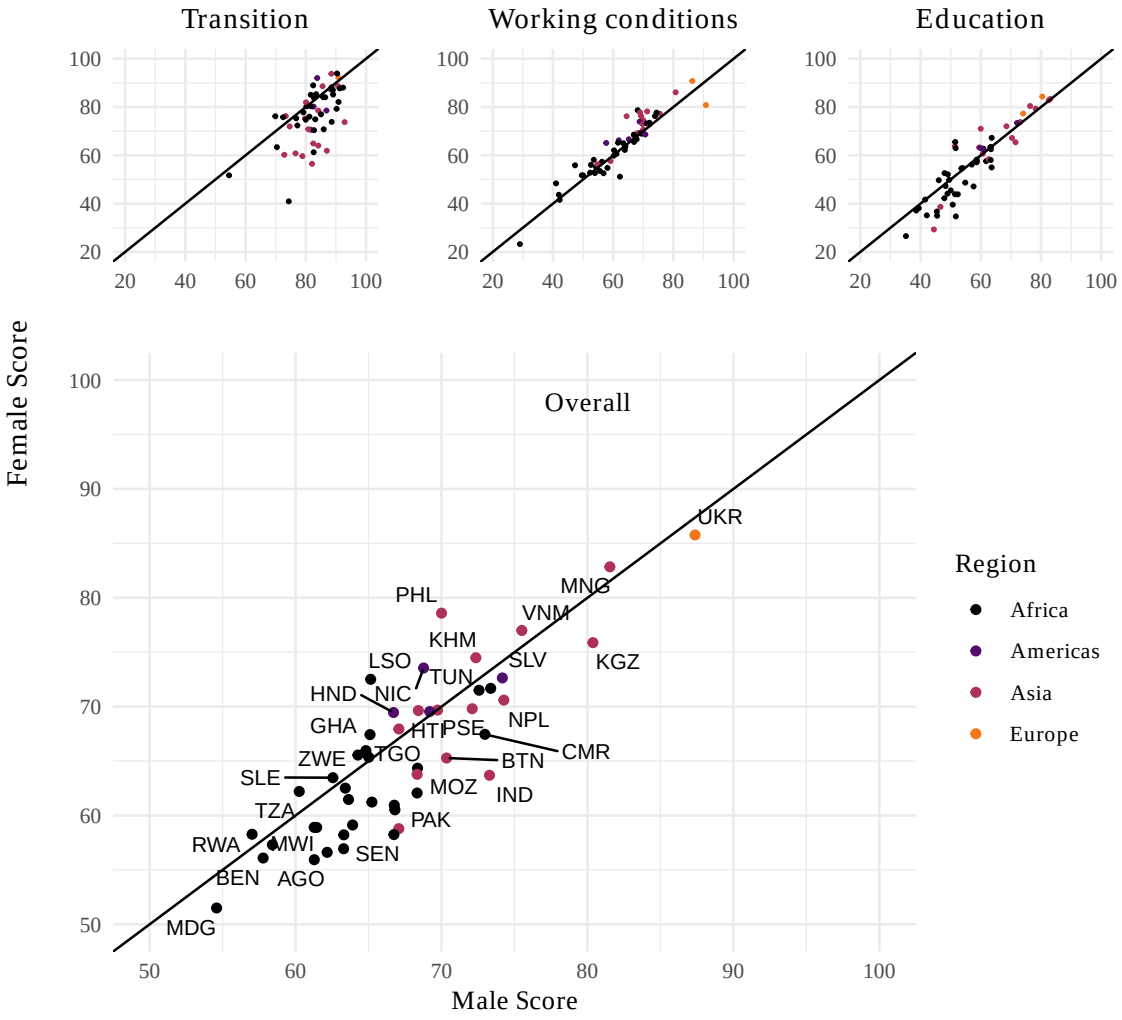
Other gender inequalities remain pronounced in parts of the developing world. Reliable data on the gender wage gap in low-income countries is scarce, but limited evidence also shows significant variation, from 20 percent in Mozambique and Pakistan to more than 80 percent in the Ivory Coast (World Bank, 2011). A recent study shows that as countries get richer, women tend to concentrate into an ever smaller number of occupations (even as they branch out into new sectors) —thus perpetuating gender segregation in the workplace (Borrowman and Klasen, 2020). Women in low-income countries work in the informal sector at higher rates than men: they are less likely to be an employer, own land, or have control over their finances, particularly in SSA and Southern Asia (Ortiz-Ospina and Roser, 2018), and up to three times more likely to be a contributing family worker (Bonnet et al., 2018). Such gender-based labor market inequalities start young and can hamper prospects for growth in the long term (UNDP, 2019).

Average dimension and indicator scores for the gender-specific YLILI are presented in Table B3.6 in the Appendix. Labor market conditions in LICs and LMICs favor young men by an average of just under 3 points on the YLILI scale. There is a negative and marginally significant correlation between the gender difference in YLILI score and the aggregated YLILI itself: countries in which women are most disadvantaged are Afghanistan (ranked 51st out of 54 overall on the YLILI), India (14th), Senegal (36th), and Pakistan (34th), while the Philippines (10th overall), Lesotho (20th), Nicaragua (16th), Honduras (25th) and Ghana (28thst) are among the countries with a higher female than male YLILI (see Tables B3.5 and B3.7 in the online Appendix for country-by-country performance and Figure 3.3 for a visual representation). We find no relationship between the national gender gap and GDP per capita.

The dimension scores for male and females are shown across the top panel of Figure 3.3. The gender differences are largest on the transition dimension, with a mean tran-

sition score of 82.3 for men and 75.56 for women. The gender gap in transition scores is driven primarily by high inactivity among young women: the average NEET rate for female youth in our sample is 33.5 percent, compared to 17.7 percent for males— significantly higher than the global gap (31.1 percent for females versus 13.9 percent for males (ILO, 2020a)). Developing countries with the most exacerbated gender differences in the NEET rate are Afghanistan, Yemen, Pakistan, Bangladesh, and India, suggesting that regional cultural attitudes play an important role in determining female labor market participation.

Figure 3.3: YLILI score by gender



Conditional upon entering the labor market, young women appear to enjoy a higher quality of work than young men, scoring 0.74 points higher on the working conditions dimension. Countries at the top of the YLILI rankings in particular have lower rates of

female informal and elementary work (Table B3.7 in the online Appendix). However, these rates only pertain to youth participating in the labor market, and thus neglect the substantial numbers of women working as caregivers or unpaid household laborers (ILO, 2020a), who are reflected instead in higher NEET rates for women.

Finally, while countries in our sample appear to have only a minor gender imbalance in the education dimension—1.86 points higher for males—there is significant underlying variation between countries and within individual indicators. Women outperform men on harmonized test scores on average, with high female performance in the Occupied Palestinian Territory, Egypt, the Sudan, Moldova, and Algeria. However, they perform poorly in test scores and literacy rates. Young women face substantial education deficits in countries that perform poorly on the YLILI overall, with Niger, Afghanistan, Chad, Angola, and Benin being among the worst performers in terms of both literacy and secondary school attainment.

To investigate a possible determinant of these gender differences in youth labor markets, we examine the relationship between the YLILI gender gap and the Council onf Foreign Relations Women's Workplace Equality Index (which is measured on a scale from 0 to 100 and is based on seven indicators: accessing institutions, building credit, getting a job, going to court, protecting women from violence, providing incentives to work, and using property). We observe a strong positive linear correlation (0.33, significant at $p < 0.001$) between the female YLILI and the CFR Index and a strong negative correlation (-0.156, significant at $p < 0.0001$) between the YLILI gender gap and the CFR Index, suggesting that institutional and legal protections for women in the workplace can help reduce gender inequalities in youth labor markets.

3.5 Robustness

An important consideration when evaluating the usefulness of the YLILI is its sensitivity to the choice of indicators and aggregation methods used in its construction. Though data availability was the main determinant of which indicators were included, the methodological choices described in Section 3.3 still leave many degrees of freedom.

Regardless of the final combination of indicators, the index should be robust to the inclusion or exclusion of any particular variable, as well to choices regarding the number of included variables, the way they are aggregated, and the choice of whether and how to impute missing observations. To test the robustness of the YLILI, we observe the changes in scores and rankings when different specifications are used.

Five measures are summarized in Table 3.6. For index scores, we report the correlation between the scores generated by alternative index specifications and the original YLILI score, along with the standard deviation of their differences. For country rankings, we compute the Spearman correlation along with the mean and maximum rank differences between the original YLILI and proposed alternatives. We conduct these tests for 12 specifications: ten consisting of the same aggregation and imputation method, but dropping a single indicator (resulting in indices containing nine indicators). One specification was generated using the geometric mean to aggregate across indicators and dimensions, and one using raw data only (without imputation).

Table 3.6: Alternative specifications

	no neet	no relative wc	no mismatch	no workingpov	no underemp	no informal	no elementary	no nosecondary	no literacy	no test scores	geometric	raw
Pearson's r	0.982	0.987	0.983	0.953	0.981	0.981	0.975	0.980	0.990	0.983	0.939	0.926
Std dev. of score diff.	1.499	1.388	1.450	2.389	1.505	1.541	1.816	1.556	1.129	1.545	2.593	3.454
Spearman's ρ	0.968	0.985	0.972	0.927	0.976	0.976	0.965	0.967	0.982	0.977	0.924	0.924
Mean rank diff.	2.704	1.926	2.704	4.333	2.481	2.370	2.852	2.926	1.852	2.964	7.413	9.926
Max. rank diff.	12	7	10	16	9	12	12	10	9	11	15	24

Notes: Correlations and differences relative to specification using 10 indicators, arithmetic mean, and imputed values.

Scores and rankings for all countries were recalculated with the alternative specifications and are shown in Table B3.8 in the online Appendix. Scores and ranks remain highly correlated with the original YLILI when a single variable is dropped, indicating that the index is not overly dependent on the inclusion of any particular measure. Alternative specifications impact the countries in the middle of the index much more than those at the extremes. Neither score nor rank correlation drops below 0.9 for any of

the alternative specifications studied. Removing the youth working poverty rate causes the largest overall changes in scores and reordering of rank, with countries changing rank by 4.3 positions on average. When the geometric rather than the arithmetic mean is used to aggregate both the indicators into dimensions and dimensions into the final YLILI score, rankings and scores when using the two indicator aggregation methods remain strongly correlated despite the significant shift in the absolute scores (Figure B3.9 in the online Appendix). Certain scores and ranks change when data is not imputed, with India moving ranks by an entire 24 positions (from rank 14 with imputed data to rank 38 without), as depicted in Figure B3.10 in the online Appendix. Given the conceptual justification for imputation, however, this is only reassuring that imputation is necessary for delivering consistent results.

As with any composite index, several caveats and limitations warrant discussion. In general, composite indices have faced increased scrutiny even as their popularity has increased in recent years. A common critique, leveled at the HDI in particular, concerns the implicit trade-offs resulting from the aggregation of indicators: in the HDI, the inclusion life expectancy and GNI implies a value of an additional year of life in terms of economic output, for instance (Ravallion, 2012). None of the 45 indicator pairs in the YLILI imply "shadow prices" this problematic, though the youth working poverty indicator could be juxtaposed with less "economic" components of the YLILI, such as the literacy rate, in order to level a criticism along similar lines.

While a historical YLILI time series would have been ideal for studying policy impacts and changes in youth labor markets over time, the infrequency and scarcity of retrospective data ultimately proved to be insurmountable. Although labor market statistics for LMICs and LICs have become more frequent and reliable in recent years, administrative data quality in some countries remains so poor that two SDG subgoals were aimed at data collection capacity. For instance, the NEET rate, the primary indicator for tracking progress on youth employment for SDG 8, was last collected in 2005 in Congo and 2002 in Guinea, and it is not available on the ILO database at all for several lower-middle income countries, including Morocco and Tajikistan. With improved data coverage, future editions of the YLILI may be able to provide insights about changes in

youth labor market strength over time.

3.6 Discussion

In the decades to come, youth working populations are expected to boom in many low-income and lower-middle income countries. Providing opportunities for decent and gainful work for youth while facing the dual headwinds of persistent informality and slow structural change will be a key challenge for policymakers. The Youth Labor Index for Low-Income Countries offers a holistic, quantitative picture of LIC and LMIC youth labor market strength, with an explicit focus on the quality of work for youth, to help measure progress on this development goal and to provide guidance for policy decisions.

Despite data limitations, we are able to generate the YLILI for 54 out of 79 LMICs and LICs. Countries in SSA represents the bulk of the sample, and generally perform poorly on the YLILI compared to the rest of the developing world. Scores in SSA are particularly low for working poverty, education quality, and secondary school completion. Transition smoothness, as measured by rates of inactivity, differences in working conditions for youth and adults, and job mismatch, are fairly homogeneous for the entire sample, while important variation exists across countries for both working conditions and education scores. The high variation in education outcomes in particular drives the final ordering of the YLILI rankings. Gender differences are most apparent in the transition dimension, with low female labor force participation, particularly in Southern Asia, standing as a major obstacle to achieving labor market equality in the developing world. The YLILI gender gap is negatively correlated with the CFR Workplace Equality Index, suggesting that institutional and legal protections for women in the workplace are important tools that may help reduce gender inequalities in youth labor markets.

Our most striking finding is the degree to which the YLILI score is predicted by demographic patterns, specifically the ratio of youth to adults in the working population and the fertility rate. Countries with very young populations score considerably worse on the YLILI, especially when only data for males is used. Meanwhile, income

is not predictive of youth labor market strength once demographic characteristics are accounted for, suggesting that population growth puts youth labor markets under pressures that cannot simply be alleviated through higher economic growth. Higher youth population ratios are associated with worse education outcomes, signaling that rapidly growing populations are stretching the capacities of their education systems to a breaking point. However, among the macroeconomic determinants considered, fertility rates are the best predictor of YLILI scores, particularly for women. The birth of a child has been shown to shorten the working lives of women by as much as two years on average (David E. Bloom et al., 2009). We find that this negative impact extends to youth labor markets as a whole: an additional birth per female at the national level is associated with a 4.6 point decrease in the (overall) YLILI score, or about 0.6 of a standard deviation. The likely channels are decreases in economic activity and educational attainment resulting from childbearing, both of which factor into the YLILI.

Existing indices similar to the YLILI in construction have aimed to capture youth quality-of-life more generally. The Youth Development Index combines 18 measures of youth education, health and well-being, employment opportunity, and political and civic participation to rank 183 countries (Sen and Kakar, 2016). The Youth Progress Index combines 60 indicators to measure a similar concept, but explicitly excludes economic variables to allow for comparisons with GDP (Lisney and Krylova, 2018). Both indices suggest that youth well-being is very tightly correlated with per-capita income, especially at lower income ranges, but they do not share our explicit focus on labor market outcomes. In contrast, we only find a weak correlation between per-capita GDP and youth labor market strength: for instance, the fourth-ranked country on the YLILI score, Kyrgyzstan, has the same GDP per capita as the 46th-ranked country, the Ivory Coast. When controlling for demographic characteristics, income is only correlated with youth working conditions, but not the YLILI index score itself.

How can the YLILI help policymakers improve youth labor markets in developing countries? First, the global score gives a sense of how far the country is from the ideal state (=100). It also gives a sense of the relative position of the country compared to other LICs and LMIcs. Second, the breakdown of the index into ten indicators and three

dimensions allows users to identify the most pressing issues facing a given economy. For instance, the index suggests that Pakistan should focus on improving education, on which it scores 30 points lower than on the other two dimensions. In contrast, Zimbabwe should focus on enhancing its working conditions: nearly half of its working youth are employed in elementary occupations, placing it in the bottom 7 percent of developing countries. Finally, the fact that the index is age- and gender-specific allows policymakers to obtain insights for targeted groups of the population. The accompanying webtool is designed to facilitate this process by allowing users visualize the index, download the underlying data, and directly compare countries along the various index components.

Finally, the YLILI shows the usefulness of detailed, gender-disaggregated data, and could still be vastly improved with more comprehensive national statistics. The fact that we were unable to generate a score for 25 countries—almost a third of the sample—-despite relatively relaxed requirements (e.g., including data up to a decade old), highlights the data scarcity which makes the study of youth labor markets a challenge (Jerven, 2013). We note that even major compilers of international statistics such as Our World in Data, which have conducted numerous detailed analyses of topics related to the SDGs, do not have a page dedicated to the youth employment crisis at this time. Improving statistical capacity would thus be a major step towards an improved YLILI and towards more effective policies addressing the youth employment challenge.

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Appendix A3

Index Construction

The working conditions ratio and harmonized test scores indicators are converted into a unit-less "progress score" ranging from 0 to 100 using the standard Min-Max method as follows:

$$s_{idc} = \left(\frac{\text{value}_{idc} - \min_{id}}{\max_{id} - \min_{id}}\right) \cdot 100$$

where s_{idc} represents country c's score for indicator i—which ranges from 0 to 100—for indicator i from dimension d. value_{idc} denotes country c's observed value for indicator i. $\min_{id}$ is the value of indicator i at, or below which the score is 0. $\max_{id}$ is the value at, or above which the score is 100.

The challenge is to determine the value of both variables $\min_{id}$ and $\max_{id}$. Depending on the indicator, this could be a policy target, the theoretical max/min value, the most practical max/min value from a scaling perspective, a number derived from statistical analysis of the distribution, etc. Difficulties arise when the indicator is not naturally bounded, as in the case of the relative working conditions ratio (and thus of both ratios that construct it, i.e. the working poverty ratio and the time-related underemployment ratio). As described in the text, the working conditions ratio is given higher and lower bounds of 10 and 1, while for the harmonized test score the natural bounds of 300 and 625 (the lowest and highest possible scores, respectively) are used.

A further design choice concerns the method of aggregation across indicators and dimensions. In most applications, this is either additive, such that individual components are summed to form the aggregate, or multiplicative, in which case it becomes the product of the parts. If indicators are rescaled before aggregation, the analogs of these two approaches become the arithmetic and the geometric mean, respectively. The current HDI uses both: in taking the average of two measures of school attainment, it uses the arithmetic mean at the dimension level, but takes the geometric mean of the three dimensions to arrive at the index score.

Geometric means are more appropriate for comparing items measured on different

scales. The majority of the YLILI indicators are on the natural 0-100 percentage scale, but vary somewhat in distribution. It has also been suggested that multiplicative aggregation is more appropriate when good performance on all component dimensions is required simultaneously for a high aggregate score (Sagar and Najam, 1998), i.e., a country cannot score reasonably well while completely failing in a particular dimension. When using arithmetic means, changes in components enters the aggregate in absolute terms. For example, an increase from 1% to 2% in a given indicator would increase the aggregate by 1% times the weight of the indicator. If using the geometric mean, on the other, the change in the aggregate would reflect the relative change in the indicator—100% times its weight. A comparison of the two methods reveals close agreement in the final index scores (see Section 3.5); we refer to the score generated using the arithmetic mean in this paper due to its easier intuitive interpretation.

Index Correlations

Figure A3.1: Correlation, YLILI score and GDP per capita

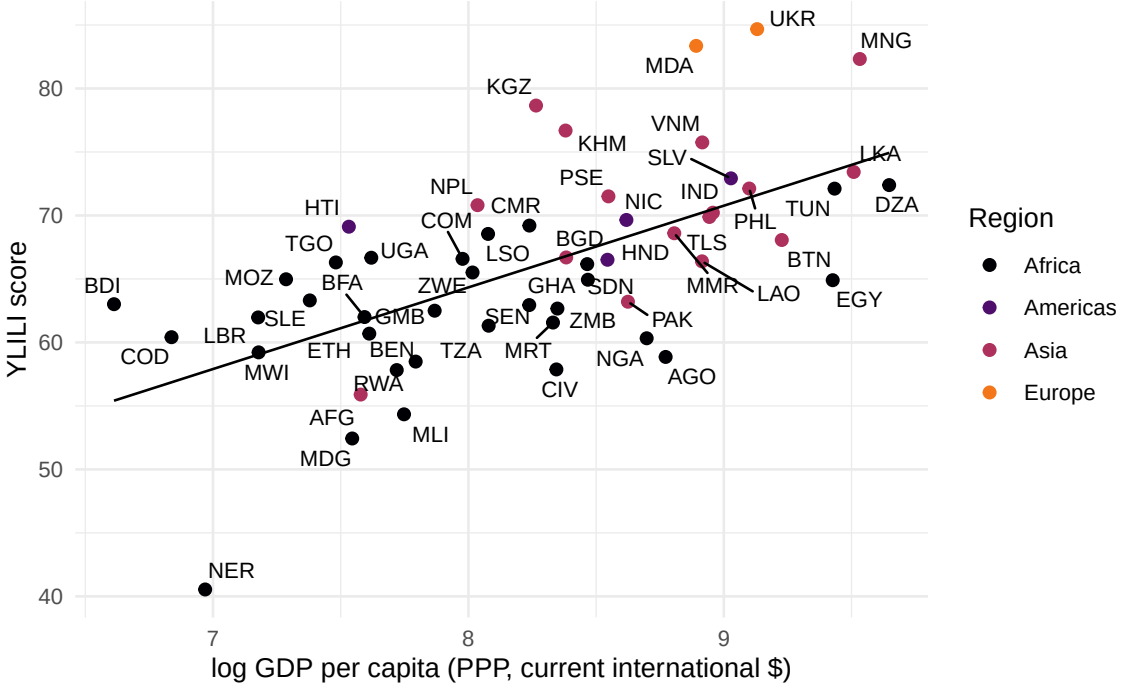


Figure A3.2: Correlation, YLILI score and national youth unemployment rate

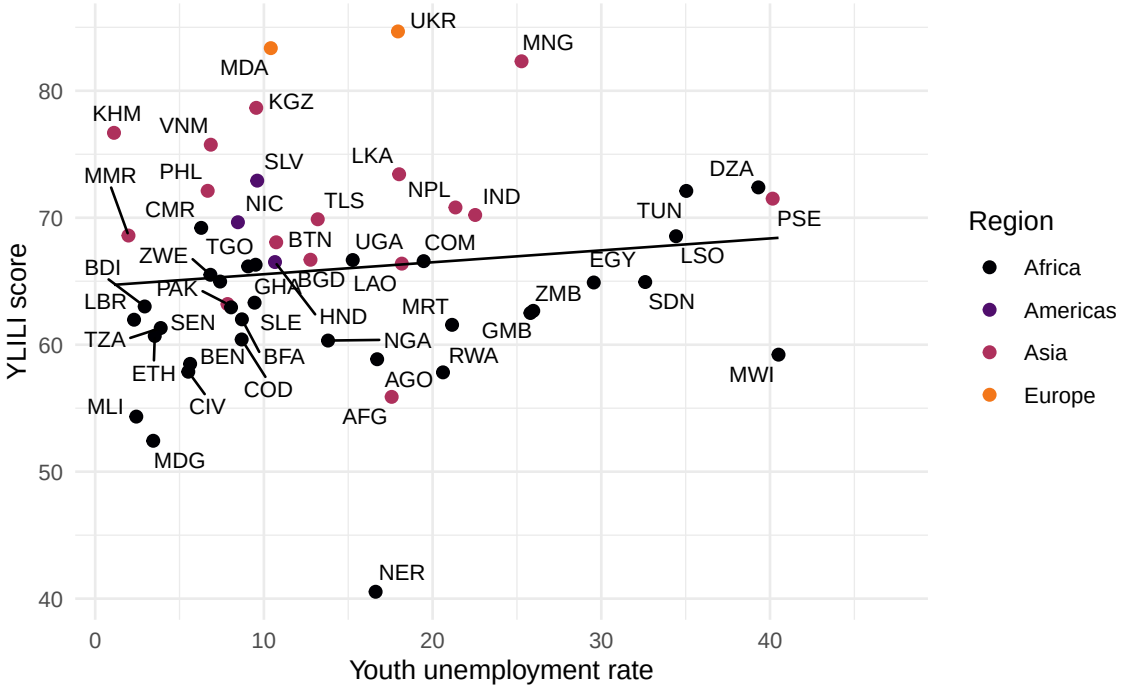
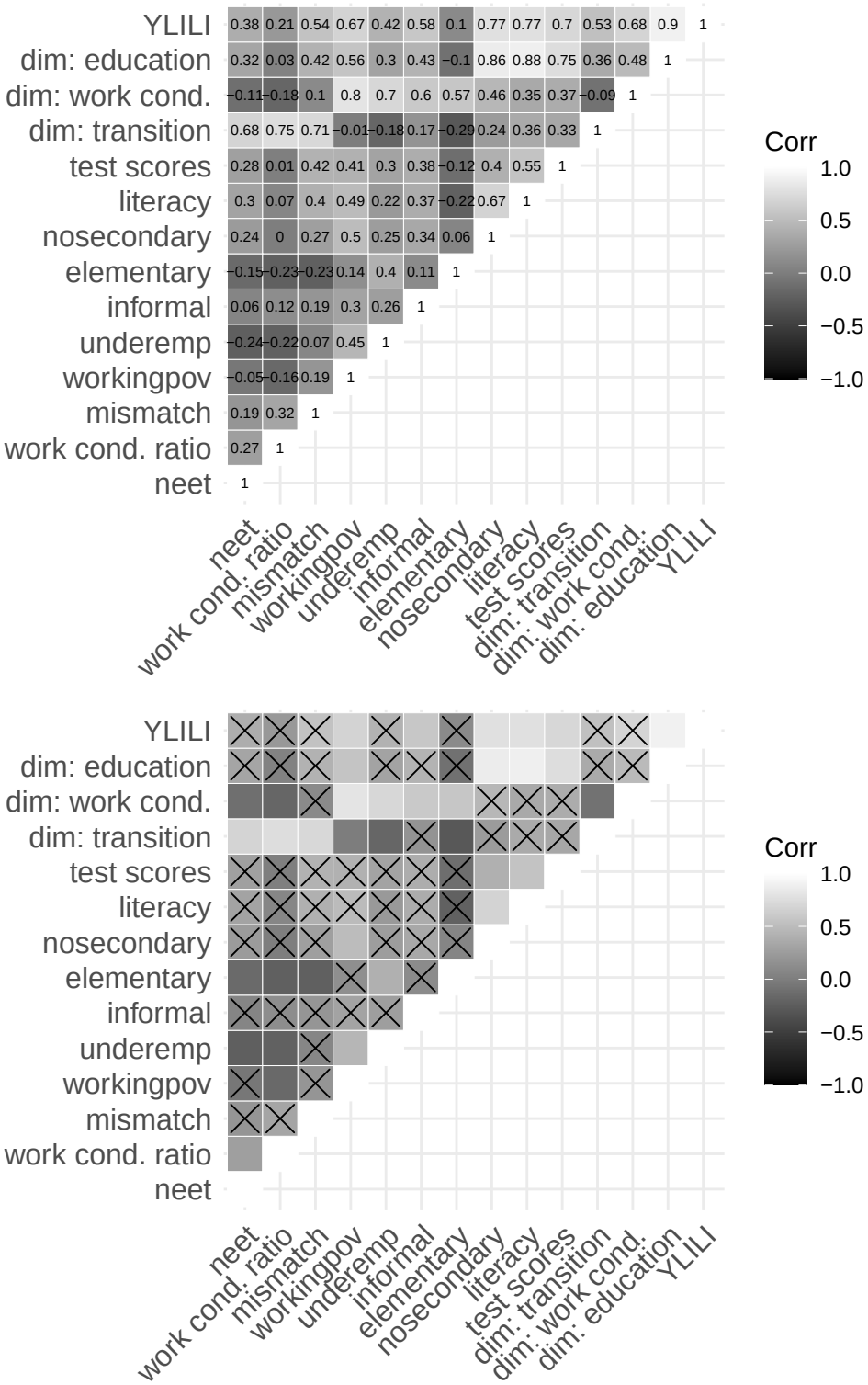


Figure A3.3: Correlation matrix (× = insignificant at $p < 0.05$)



Demographics by Income Level

Figure A3.4: Share of world population by age group, 1960-2020
Source: World Population Prospects, United Nations (2019)

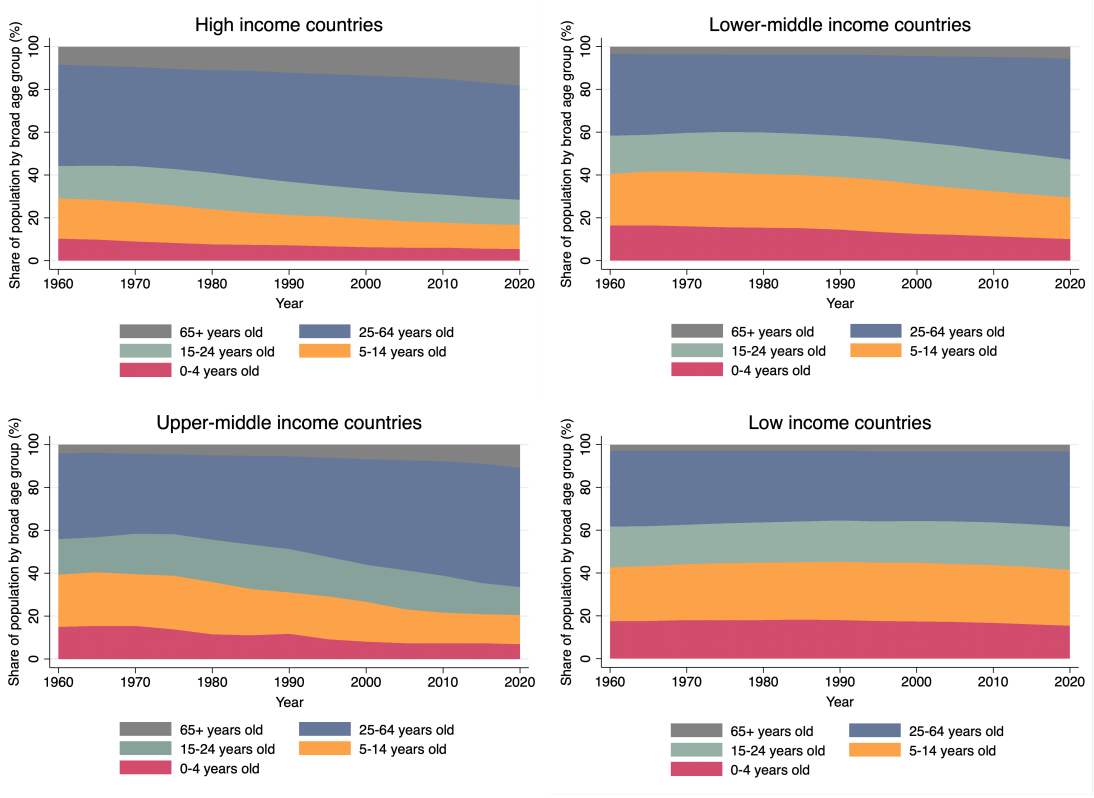
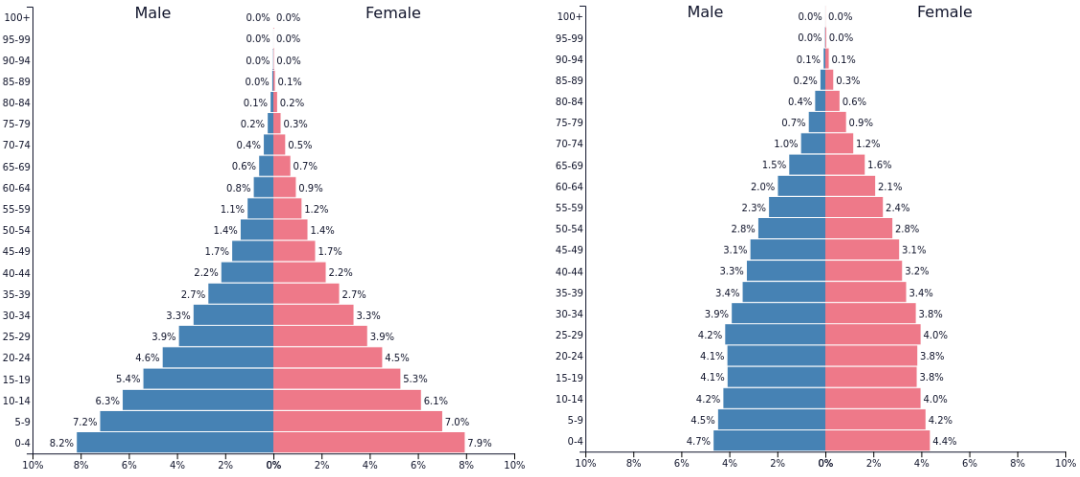


Figure A3.5: Population pyramids for sub-Saharan Africa (left) vs. the world (right)
Source: World Population Prospects, United Nations (2019)



Appendix B3

Availability of Indicators

Table B3.1 shows the indicators included in the KOF Youth Labor Market Index (Renold et al., 2014) and the corresponding YLILI indicator, if available. While grouping into dimensions remained roughly similar for the two indices, most indicators from the KOF YLMI were dropped or replaced in the YLILI, either for lack of availability or because more relevant indicators were needed for developing economies.

Table B3.1: Comparison with KOF YLMI

	KOF Indicator	YLILI equivalent	Comment
Transitions	Relative unemployment ratio	Relative working conditions ratio	—
	Incidence of long-term unemployment rate	—	Not appropriate
Working conditions	Temporary worker rate	—	No data available
	Involuntary part-time worker rate	—	No data available
	Atypical working hours rate	—	No data available
	In work, at risk of poverty rate	Working poverty rate	—
	Vulnerable employment rate	Vulnerable employment rate	—
Education	Formal education and training rate	—	No data available + not appropriate
	Skills mismatch rate	Skills mismatch rate	—
Activity	Unemployment rate	—	Not appropriate
	Relaxed unemployment rate	—	Not appropriate
	NEET rate	NEET rate	—

The availability of the indicators of the YLILI is highly scattered across countries and over time. For instance, data on the share of youth NEET is only available one year for Senegal, while it is available 12 years for Bolivia. To get around this issue, we compute the index by taking the last available year data was reported. It is possible that the last

available year for indicators frequently date more than 10 years back, masking potential developments in labor market conditions and resulting in misleading comparisons. Hence we restrict the sample to data dating no further back than 2010. A trade-off thus exists between the number of countries for which the YLILI can be generated and the degree of conservatism of established rules regarding the set of indicators to include: the higher the number of countries for which the YLILI can be generated, the weaker the established rules and vice-versa.

Table B3.2 shows the number of available indicators by year for all developing countries since the year 2000. Ideally, the country-year YLILI would have been generated by using all 10 indicators, i.e., the number of available indicators would have been equal to 10 for all 79 countries of the sample on a yearly basis. Unfortunately, limited administrative data on the labor market is a familiar problem across the developing world and Table B3.2 confirms this: about half of the 79 countries analyzed for this index only have data on less than 3 indicators in any year and no country has all 10 indicators in any year since 2000.

Table B3.2: Number of available indicators by year

Year	Number of available indicators 0 1 2 3 45678	9	10	Total number of countries
2020	1066 1 0 02000	0	0	79
2019	4 51 6 6 05610	0	0	79
2018	2 7 271952367	1	0	79
2017	2 1028 9 54395	4	0	79
2016	6 4014 5 14450	0	0	79
2015	5 3417 5 35451	0	0	79
2014	4 2813 7 86921	1	0	79
2013	6 3311 9 55460	0	0	79
2012	5 33 9 1166621	0	0	79
2011	6 3413 7 73522	0	0	79
2010	5 32151052910	0	0	79
2009	5 45 9 5 74400	0	0	79
2008	4 5113 4 13201	0	0	79
2007	6 5010 6 30310	0	0	79
2006	5 4615 5 42200	0	0	79
2005	6 4519 3 13200	0	0	79
2004	5 5515 3 10000	0	0	79
2003	6 59 8 6 00000	0	0	79
2002	6 6210 1 00000	0	0	79
2001	5 5613 3 11000	0	0	79
2000	6 3829 4 20000	0	0	79

Despite this sample restriction, one obvious limitation is that distinct years are pooled together, which prevents comparisons within and between countries over time. On the other hand, the major advantage of this method is that it includes the maximum possible number of indicators for each country and hence exploits all the available information.

Table B3.3 provides an overview of the coverage of each indicator by year since 2010. The table shows that the last available year of the vast majority of indicators date no further back than 2014. For instance, more than 80% of countries gathered data for the share of youth NEET since 2014 (among those who did gather data for the share of youth NEET since 2010).

Table B3.3: Coverage of indicators (%) by year, last available year

Year	Share of youth NEET	Relative working conditions ratio	Youth skills mismatch rate	Youth working poverty rate	Youth time-related under. rate	Share of youth in informal emp.	Share of youth work. in EO	Share of youth with no sec. educ.	Youth illiteracy rate	Harmonized test scores
2010	3.08	6.12	1.85	0.00	5.45	5.88	0.00	2.38	1.41	0.00
2011	3.08	2.04	7.41	0.00	1.82	9.80	0.00	9.52	0.00	0.00
2012	3.08	6.12	5.56	0.00	5.45	11.76	1.85	7.14	1.41	0.00
2013	3.08	8.16	9.26	0.00	7.27	11.76	9.26	7.14	0.00	0.00
2014	12.31	16.33	14.81	0.00	14.55	17.65	11.11	14.29	9.86	0.00
2015	1.54	2.04	3.70	0.00	1.82	7.84	11.11	19.05	14.08	0.00
2016	6.15	2.04	3.70	0.00	5.45	7.84	1.85	16.67	5.63	0.00
2017	26.15	20.41	22.22	0.00	20.00	23.53	20.37	4.76	12.68	0.00
2018	13.85	14.29	11.11	0.00	12.73	3.92	12.96	11.90	52.11	0.00
2019	24.62	22.45	16.67	100.00	21.82	0.00	25.93	7.14	2.82	0.00
2020	3.08	0.00	3.70	0.00	3.64	0.00	5.56	0.00	0.00	100.00

Finally, Table B3.4 indicates how many indicators were utilized to compute the YLILI score for each country. In theory, the maximum possible number of indicators is 10. However, because of data availability, the number of indicators utilized to compute the index varies between countries. In order to take into consideration all dimensions of the labor market and to generate an index as comparable as possible between countries while maximizing the number of countries, we decide that the index can only be generated if there are a minimum of 2 indicators in the transition and education dimensions and 3 indicators in the working condition dimension (7 indicators in total). Table B3.4

shows that the vast majority of countries comprise at least 7 out of 10 indicators ($>$ 80% of indicators), however, we advise that interpretations from the index should be made with caution. Overall, the YLILI could be computed for 54 out of 79 countries.

Table B3.4: Availability of indicators, last available year

Country name	Country abbreviation	Transition (# out of 3)	Working cond. (# out of 4)	Education (# out of 3)	Total # of indicators	YLILI computed?
Benin	BEN	3	4	3	10	Yes
Burkina Faso	BFA	3	4	3	10	Yes
Bangladesh	BGD	3	4	3	10	Yes
Ivory Coast	CIV	3	4	3	10	Yes
Cameroon	CMR	3	4	3	10	Yes
Ethiopia	ETH	3	4	3	10	Yes
Ghana	GHA	3	4	3	10	Yes
Gambia	GMB	3	4	3	10	Yes
Honduras	HND	3	4	3	10	Yes
Cambodia	KHM	3	4	3	10	Yes
Myanmar	MMR	3	4	3	10	Yes
Nepal	NPL	3	4	3	10	Yes
Pakistan	PAK	3	4	3	10	Yes
Rwanda	RWA	3	4	3	10	Yes
Senegal	SEN	3	4	3	10	Yes
Togo	TGO	3	4	3	10	Yes
Timor-Leste	TLS	3	4	3	10	Yes
Tanzania	TZA	3	4	3	10	Yes
Uganda	UGA	3	4	3	10	Yes
Zambia	ZMB	3	4	3	10	Yes
Zimbabwe	ZWE	3	4	3	10	Yes
Afghanistan	AFG	3	3	3	9	Yes
Egypt	EGY	3	4	2	9	Yes
Kyrgyzstan	KGZ	2	4	3	9	Yes
Lao PDR	LAO	3	4	2	9	Yes
Liberia	LBR	2	4	3	9	Yes
Sri Lanka	LKA	3	4	2	9	Yes
Moldova	MDA	3	4	2	9	Yes
Madagascar	MDG	3	4	2	9	Yes
Mali	MLI	2	4	3	9	Yes
Mongolia	MNG	3	4	2	9	Yes
Mozambique	MOZ	2	4	3	9	Yes
Philippines	PHL	3	4	2	9	Yes
Occupied Palestinian Territory	PSE	3	4	2	9	Yes
Sierra Leone	SLE	2	4	3	9	Yes

El Salvador	SLV	3	4	2	9	Yes
Viet Nam	VNM	3	4	2	9	Yes
Burundi	BDI	2	3	3	8	Yes
Congo DR	COD	2	3	3	8	Yes
Comoros	COM	3	2	3	8	Yes
Haiti	HTI	3	2	3	8	Yes
Lesotho	LSO	2	3	3	8	Yes
Mauritania	MRT	3	3	2	8	Yes
Malawi	MWI	2	3	3	8	Yes
Niger	NER	2	3	3	8	Yes
Nicaragua	NIC	3	3	2	8	Yes
Angola	AGO	2	2	3	7	Yes
India	IND	2	2	3	7	Yes
Nigeria	NGA	2	2	3	7	Yes
Tunisia	TUN	2	3	2	7	Yes
Ukraine	UKR	2	3	2	7	Yes
Bhutan	BTN	2	2	2	6	Yes
Algeria	DZA	2	2	2	6	Yes
Sudan	SDN	2	2	2	6	Yes
Bolivia	BOL	3	4	1	8	No
Cape Verde	CPV	3	4	1	8	No
Eswatini	SWZ	1	4	2	7	No
Yemen	YEM	3	3	1	7	No
Guinea	GIN	1	2	3	6	No
Kenya	KEN	2	1	3	6	No
Morocco	MAR	1	3	2	6	No
Papua New Guinea	PNG	2	1	3	6	No
Solomon Islands	SLB	2	3	1	6	No
Chad	TCD	1	2	3	6	No
Vanuatu	VUT	1	2	2	5	No
Congo	COG	0	1	3	4	No
Kiribati	KIR	1	2	1	4	No
Central African Republic	CAF	0	1	2	3	No
Djibouti	DJI	2	1	0	3	No
Micronesia	FSM	1	2	0	3	No
Tajikistan	TJK	0	1	2	3	No
Uzbekistan	UZB	0	1	2	3	No
Eritrea	ERI	0	1	1	2	No
Guinea-Bissau	GNB	0	1	1	2	No
South Sudan	SSD	0	0	2	2	No
Korea DPR	PRK	0	1	0	1	No
Somalia	SOM	0	1	0	1	No
Sao Tome and Principe	STP	0	0	1	1	No
Syrian Arab Republic	SYR	0	1	0	1	No

Geographic distribution of YLILI scores

Figure B3.1: Indicators of the transition dimension depicted by country

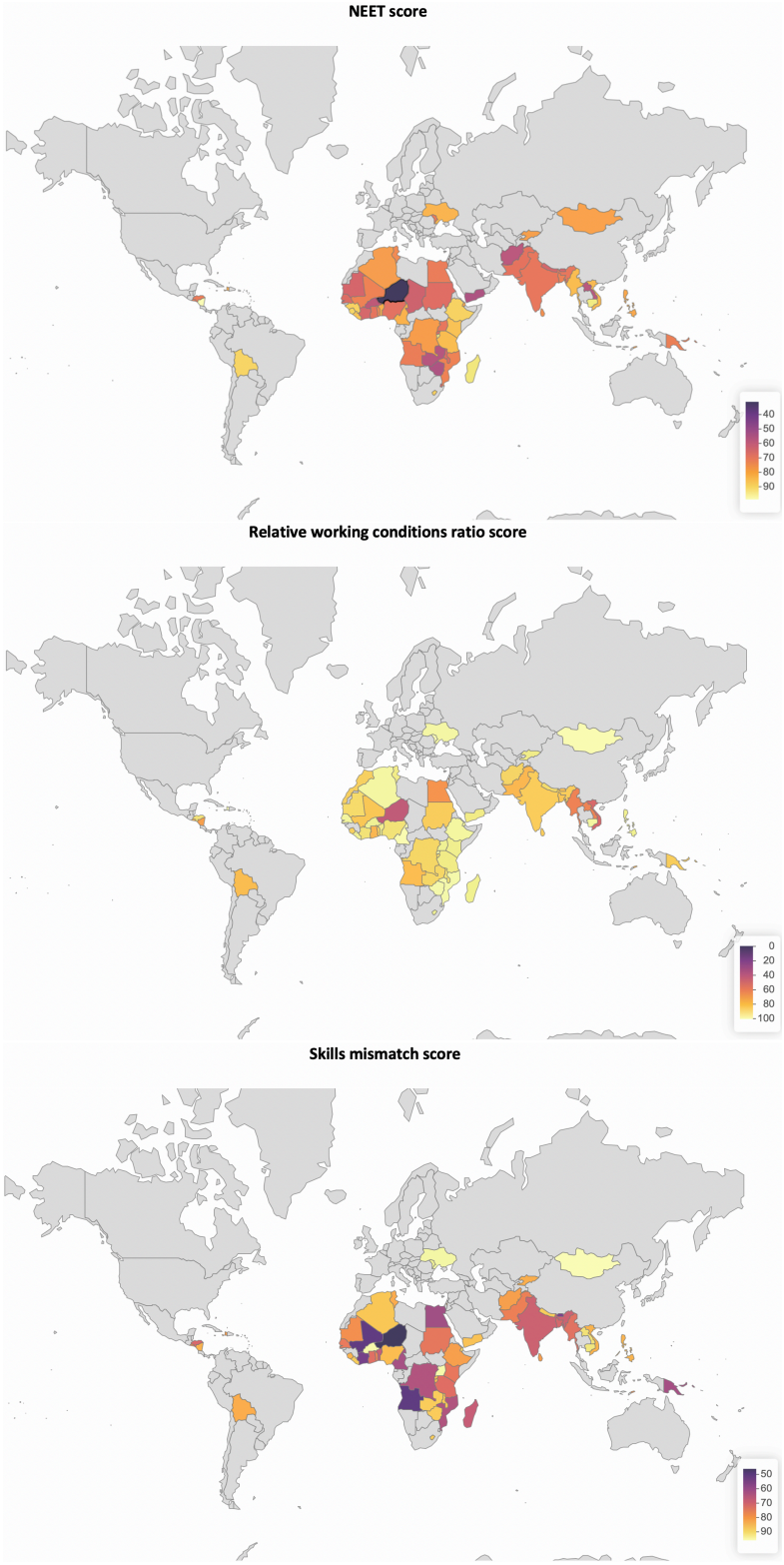


Figure B3.2: Indicators of the working conditions dimension depicted by country

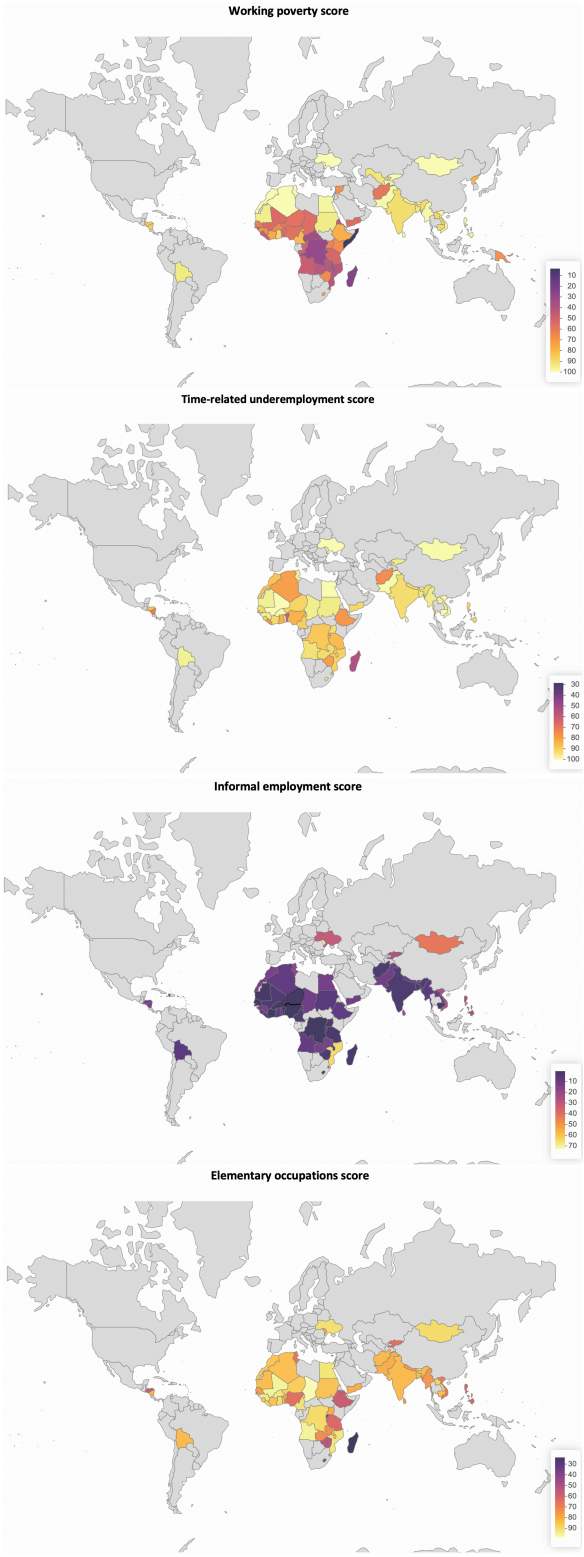


Figure B3.3: Indicators of the education dimension depicted by country

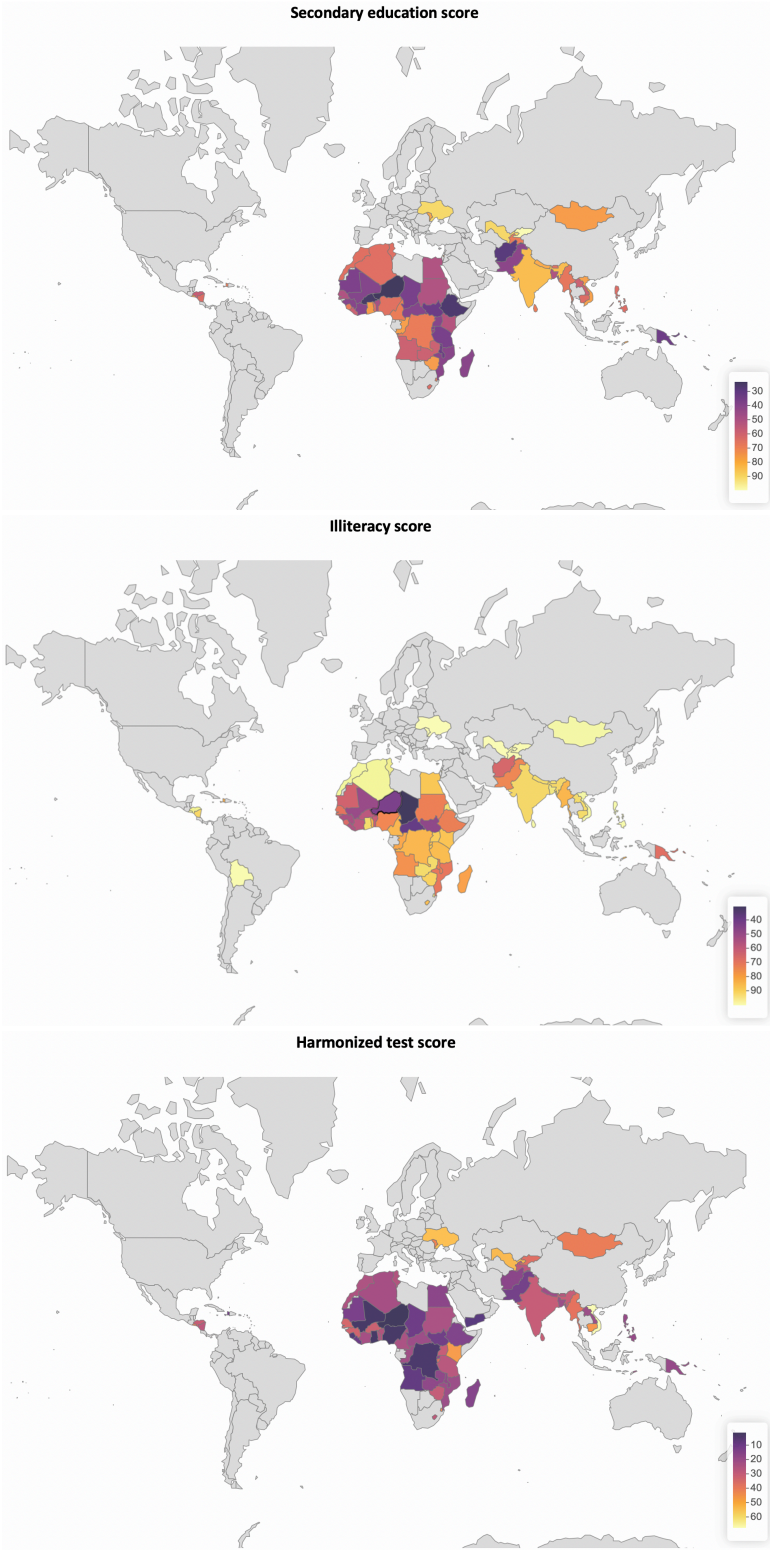


Figure B3.4: Total YLILI depicted by country

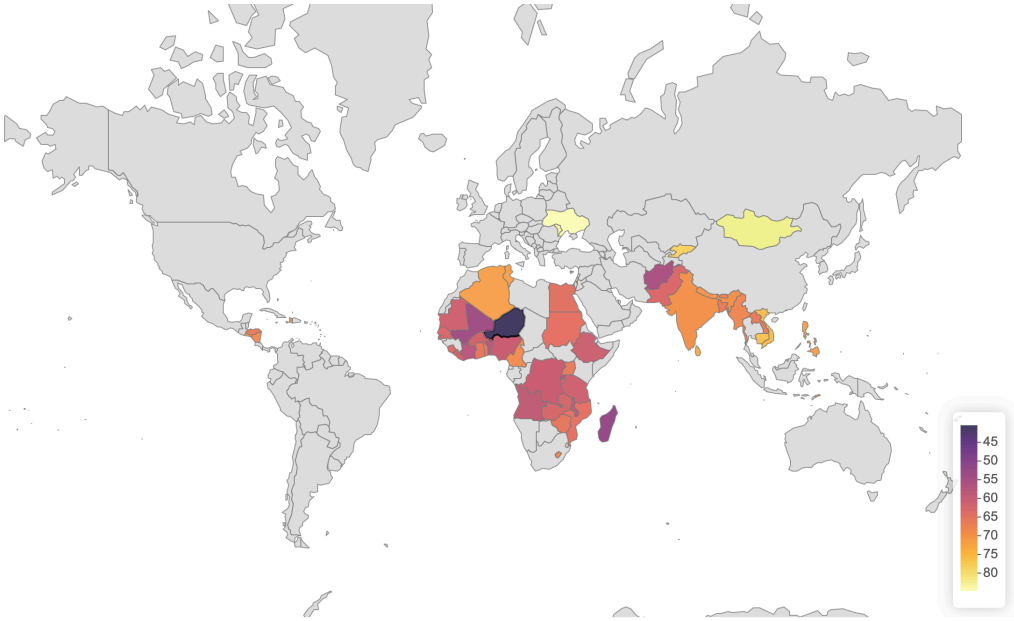


Figure B3.5: Dimensions of the YLILI depicted by country

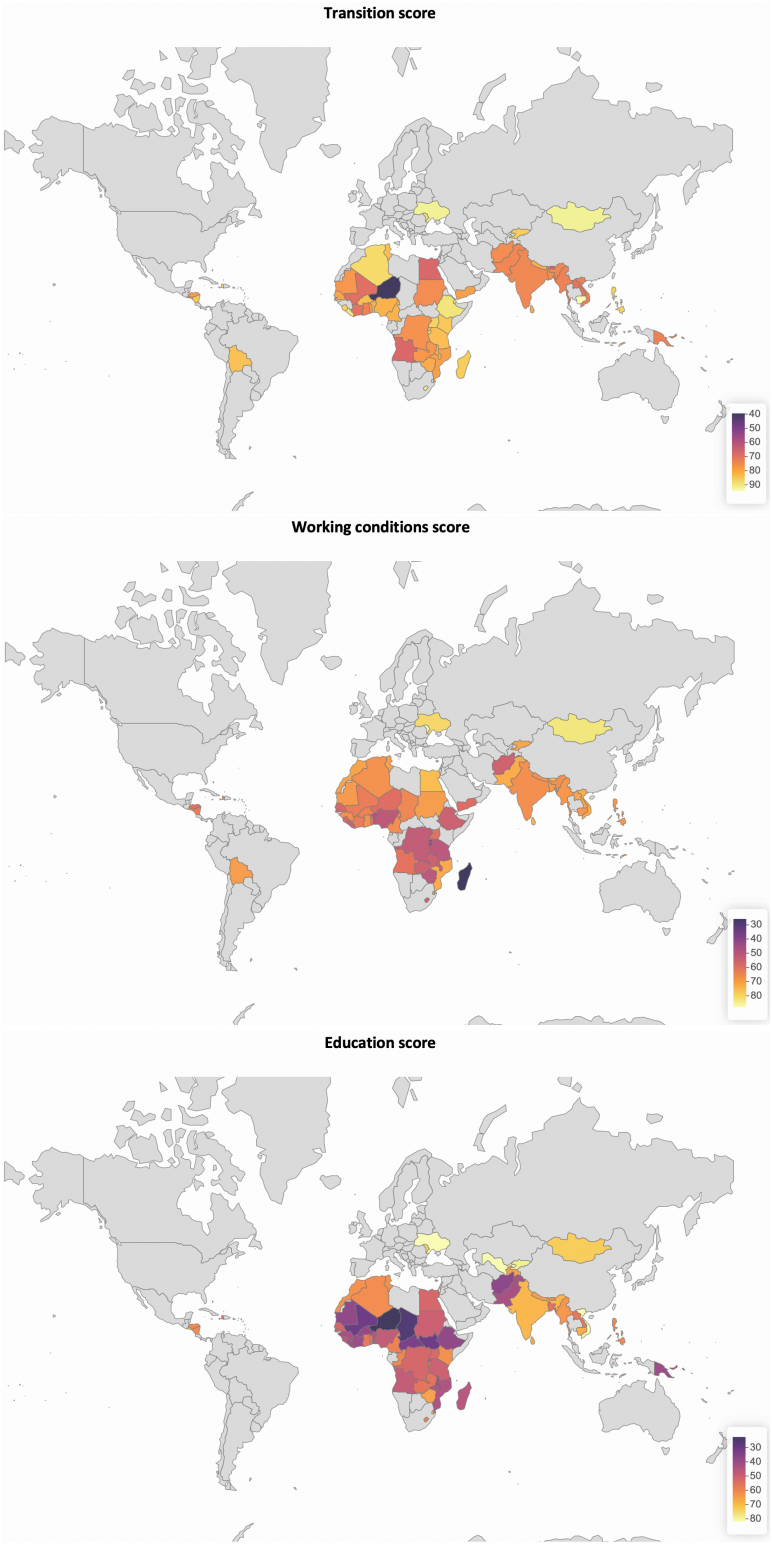
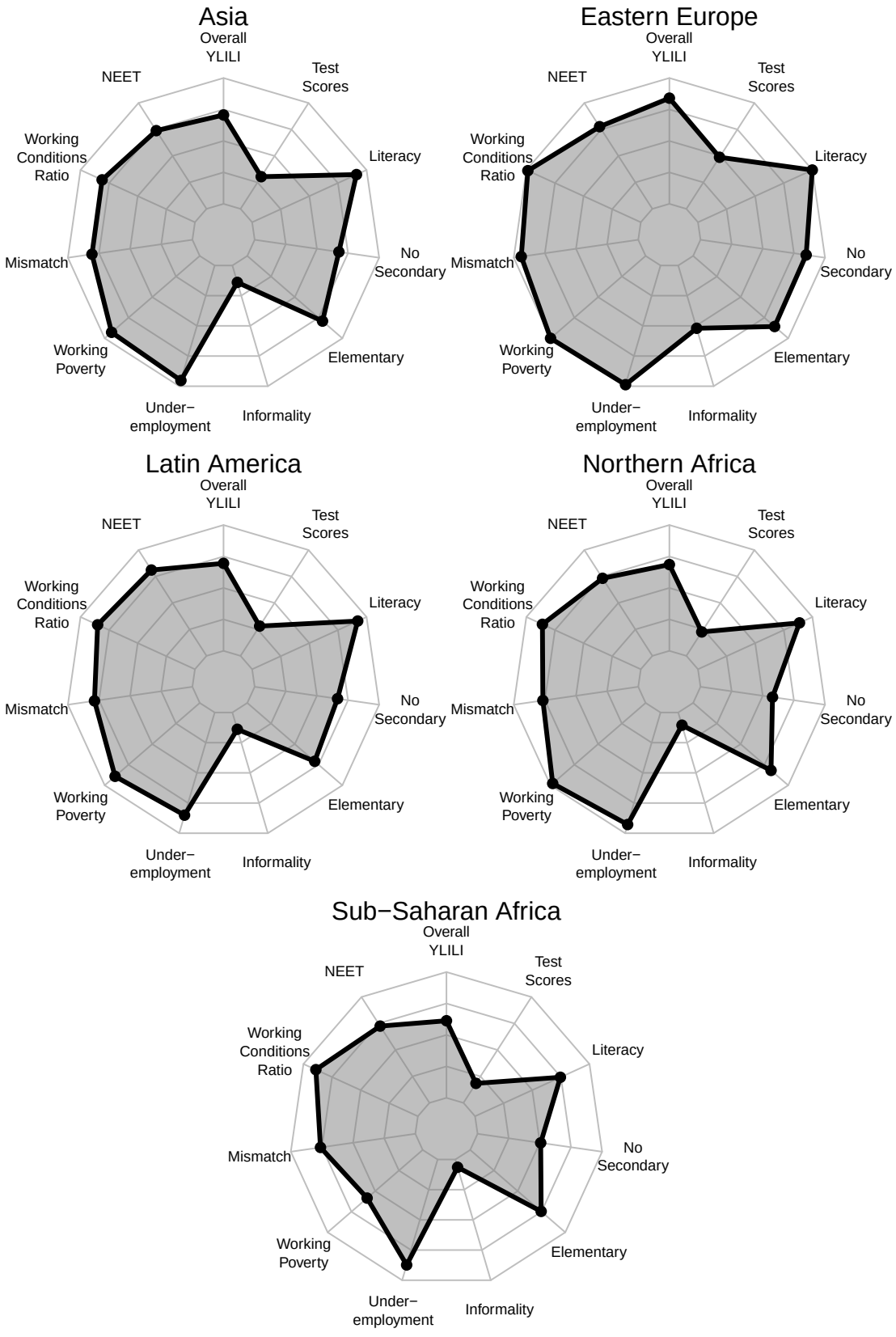


Figure B3.6: Spider charts by world region



The gender YLILI

Table B3.5: YLILI by country and gender, last available year

Country		Region	Male	Female	Δ	Rank (Male)	Rank (Female)
Ukraine	UKR	EU & C. Asia	87.38	85.77	1.60	1	1
Mongolia	MNG	E. Asia & Pacific	81.54	82.85	-1.31	2	2
Kyrgyzstan	KGZ	EU & C. Asia	80.38	75.88	4.50	3	5
Moldova	MDA	EU & C. Asia	80.27	NA	NA	4	NA
Viet Nam	VNM	E. Asia & Pacific	75.51	77.00	-1.50	5	4
Nepal	NPL	South Asia	74.27	70.60	3.67	6	12
El Salvador	SLV	LA & Caribbean	74.17	72.64	1.53	7	8
Tunisia	TUN	ME & N. Africa	73.37	71.68	1.69	8	10
India	IND	South Asia	73.29	63.70	9.59	9	27
Cameroon	CMR	Central Africa	72.97	67.46	5.52	10	19
Algeria	DZA	ME & N. Africa	72.57	71.51	1.07	11	11
Cambodia	KHM	E. Asia & Pacific	72.36	74.50	-2.14	12	6
Occ. Palestine	PSE	ME & N. Africa	72.11	69.81	2.30	13	13
Bhutan	BTN	South Asia	70.35	65.28	5.07	14	24
Philippines	PHL	E. Asia & Pacific	70.00	78.59	-8.59	15	3
Timor-Leste	TLS	E. Asia & Pacific	69.73	69.69	0.05	16	14
Haiti	HTI	LA & Caribbean	69.19	69.55	-0.36	17	16
Nicaragua	NIC	LA & Caribbean	68.78	73.55	-4.78	18	7
Myanmar	MMR	E. Asia & Pacific	68.42	69.64	-1.22	19	15
Togo	TGO	West Africa	68.36	64.35	4.01	20	25
Lao PDR	LAO	E. Asia & Pacific	68.33	63.78	4.55	21	26
Mozambique	MOZ	East Africa	68.33	62.07	6.26	22	32
Bangladesh	BGD	South Asia	67.08	67.95	-0.87	23	18

Pakistan	PAK	South Asia	67.08	58.79	8.28	24	40
Egypt	EGY	ME & N. Africa	66.81	60.52	6.28	25	36
Sudan	SDN	ME & N. Africa	66.76	60.95	5.82	26	35
Senegal	SEN	West Africa	66.74	58.25	8.49	27	42
Honduras	HND	LA & Caribbean	66.72	69.46	-2.75	28	17
Zambia	ZMB	East Africa	65.23	61.23	4.00	29	34
Lesotho	LSO	Southern Africa	65.15	72.51	-7.36	30	9
Ghana	GHA	West Africa	65.10	67.43	-2.33	31	20
Uganda	UGA	East Africa	65.02	65.35	-0.33	32	23
Comoros	COM	East Africa	64.82	65.96	-1.14	33	21
Zimbabwe	ZWE	East Africa	64.27	65.56	-1.28	34	22
Liberia	LBR	West Africa	63.91	59.13	4.78	35	37
Mauritania	MRT	West Africa	63.79	NA	NA	36	NA
Gambia	GMB	West Africa	63.63	61.47	2.16	37	33
Burundi	BDI	East Africa	63.41	62.51	0.89	38	30
Congo DR	COD	Central Africa	63.31	58.23	5.08	39	43
Mali	MLI	West Africa	63.29	56.95	6.34	40	45
Sierra Leone	SLE	West Africa	62.56	63.48	-0.92	41	28
Ivory Coast	CIV	West Africa	62.17	56.62	5.55	42	46
Ethiopia	ETH	East Africa	61.45	58.91	2.54	43	39
Angola	AGO	Central Africa	61.28	55.94	5.34	44	48
Nigeria	NGA	West Africa	61.28	58.91	2.37	45	38
Afghanistan	AFG	South Asia	61.13	49.88	11.25	46	50
Tanzania	TZA	East Africa	60.26	62.21	-1.96	47	31
Malawi	MWI	East Africa	58.41	57.31	1.10	48	44
Benin	BEN	West Africa	57.78	56.09	1.69	49	47
Rwanda	RWA	East Africa	57.02	58.28	-1.25	50	41

Madagascar	MDG	East Africa	54.59	51.50	3.08	51	49
Burkina Faso	BFA	West Africa	NA	62.91	NA	NA	29
Niger	NER	West Africa	NA	29.30	NA	NA	51

Table B3.6: Mean YLILI dimension and indicator scores by gender

	Male	Female	Δ
YLILI score	**67.48**	**64.58**	**2.91**
Transition	82.73	75.56	7.17
Share of youth NEET	82.32	66.54	15.79
Youth skills mismatch rate	81.02	75.52	5.50
Relative working conditions ratio	84.85	84.63	0.22
Working conditions	62.80	63.55	-0.74
Youth working poverty rate	74.88	74.77	0.12
Youth TR underemployment rate	90.66	88.90	1.77
Share of youth in informal employment	11.31	11.60	-0.29
Share of youth in elementary occup.	74.36	78.92	-4.56
Education	56.92	54.62	2.29
Share of youth with no secondary educ.	62.12	59.23	2.88
Youth illiteracy rate	85.60	80.62	4.98
Harmonized test scores	23.04	24.02	-0.98

Notes: Most recent observations, dating back no further than 2010. Rescaled indicator scores shown—higher values always correspond to better labor market outcomes.

Table B3.7: YLILI by country, dimension and gender, last available year

		Transition				Working conditions				Education			
Country		M	F	Δ	Rank.	M	F	Δ	Rank.	M	F	Δ	Rank.
Ukraine	UKR	90.89	92.20	-1.31	5(3)	90.81	80.81	10.00	1(3)	80.43	84.32	-3.89	3(1)
Moldova	MDA	80.42	NA	NA	40.00	86.30	90.79	-4.49	2(1)	74.08	77.29	-3.21	6(6)
Mongolia	MNG	90.74	88.64	2.10	7(6)	80.76	86.11	-5.35	3(2)	73.13	73.79	-0.66	7(7)
Kyrgyzstan	KGZ	92.90	73.75	19.15	2(41)	69.99	74.54	-4.54	12(12)	78.23	79.35	-1.12	4(5)
Cambodia	KHM	88.50	93.78	-5.28	14(2)	67.90	69.04	-1.14	24(22)	60.67	60.67	0.00	21(24)
Viet Nam	VNM	74.65	71.95	2.70	51(43)	69.29	76.25	-6.96	17(9)	82.58	82.81	-0.22	2(3)
Sri Lanka	LKA	80.09	81.93	-1.84	43(21)	71.30	78.16	-6.86	9(5)	NA	NA	NA	NA
El Salvador	SLV	81.65	70.58	11.08	35(46)	68.79	73.93	-5.14	21(13)	72.06	73.41	-1.34	8(8)
Algeria	DZA	89.08	85.17	3.91	10(15)	67.79	66.63	1.16	25(30)	60.85	62.73	-1.88	20(21)
Philippines	PHL	85.57	88.61	-3.04	21(7)	64.46	76.17	-11.71	32(11)	59.98	71.00	-11.02	23(10)
Tunisia	TUN	88.61	73.84	14.77	12(40)	68.14	78.69	-10.55	23(4)	63.37	62.52	0.85	15(22)
Occ. Palestine	PSE	78.88	59.67	19.21	47(55)	68.91	77.73	-8.82	20(6)	68.53	72.03	-3.50	11(9)
Nepal	NPL	84.17	78.49	5.68	23(28)	67.11	67.91	-0.80	28(26)	71.54	65.40	6.14	9(14)
India	IND	82.07	56.46	25.61	34(56)	67.41	67.46	-0.04	27(27)	70.38	67.18	3.21	10(12)
Timor-Leste	TLS	79.77	75.23	4.53	45(37)	69.95	70.60	-0.65	13(18)	59.47	63.23	-3.75	25(18)
Nicaragua	NIC	83.81	92.01	-8.20	25(4)	61.85	66.21	-4.36	39(31)	60.67	62.44	-1.77	22(23)
Cameroon	CMR	90.24	79.25	10.99	9(26)	66.93	65.53	1.40	29(33)	61.76	57.60	4.16	19(30)
Haiti	HTI	88.39	87.22	1.17	15(12)	65.18	66.65	-1.47	31(29)	54.01	54.79	-0.77	34(35)
Myanmar	MMR	73.36	76.25	-2.89	53(32)	68.49	69.32	-0.83	22(19)	63.40	63.35	0.05	14(17)
Lesotho	LSO	90.39	93.87	-3.48	8(1)	53.55	58.14	-4.59	54(44)	51.51	65.52	-14.02	39(13)
Bhutan	BTN	72.88	60.21	12.67	54(54)	75.51	77.23	-1.72	4(8)	62.65	58.40	4.25	18(25)
Bangladesh	BGD	80.83	70.79	10.05	39(44)	68.99	69.31	-0.31	19(20)	51.41	63.76	-12.34	41(15)
Uganda	UGA	85.79	84.07	1.72	20(17)	60.21	59.85	0.36	44(43)	49.05	52.13	-3.08	45(38)

Comoros	COM	72.47	75.79	-3.32	55(35)	63.37	64.99	-1.62	37(37)	58.62	57.11	1.51	27(32)
Honduras	HND	82.59	80.17	2.42	31(25)	57.70	65.12	-7.42	47(36)	59.86	63.10	-3.24	24(19)
Lao PDR	LAO	76.59	60.79	15.80	50(53)	69.77	72.92	-3.15	15(16)	58.64	57.63	1.01	26(28)
Togo	TGO	81.19	76.01	5.18	38(34)	60.29	62.05	-1.76	43(41)	63.60	54.98	8.62	13(34)
Ghana	GHA	69.88	76.16	-6.28	57(33)	66.85	68.54	-1.69	30(25)	58.58	57.60	0.98	29(29)
Zimbabwe	ZWE	79.20	77.78	1.43	46(29)	50.01	51.65	-1.64	58(57)	63.61	67.24	-3.63	12(11)
Mozambique	MOZ	85.95	70.78	15.17	19(45)	71.14	73.19	-2.05	10(15)	47.90	42.23	5.67	49(48)
Sudan	SDN	82.62	61.27	21.35	30(52)	69.68	68.96	0.72	16(23)	47.99	52.61	-4.62	48(37)
Egypt	EGY	74.35	40.94	33.41	52(58)	74.42	77.67	-3.25	5(7)	51.65	62.95	-11.30	38(20)
Sierra Leone	SLE	82.45	88.97	-6.52	33(5)	56.27	57.33	-1.06	49(46)	48.96	44.13	4.83	46(45)
Pakistan	PAK	82.49	64.89	17.60	32(48)	72.14	72.84	-0.70	7(17)	46.60	38.65	7.96	50(52)
Burundi	BDI	91.28	87.71	3.57	4(11)	41.94	43.66	-1.72	62(60)	57.00	56.17	0.84	31(33)
Senegal	SEN	83.15	74.91	8.23	27(38)	62.22	51.16	11.07	38(58)	54.85	48.67	6.18	32(41)
Zambia	ZMB	82.73	70.40	12.32	29(47)	54.36	55.08	-0.73	52(50)	58.62	58.22	0.40	28(26)
Gambia	GMB	76.82	75.31	1.50	49(36)	64.05	63.63	0.43	34(38)	50.03	45.48	4.55	43(44)
Burkina Faso	BFA	NA	81.85	NA	(22)	61.66	65.21	-3.55	40(34)	41.54	41.68	-0.14	56(49)
Liberia	LBR	92.38	88.02	4.36	3(10)	53.94	52.65	1.28	53(54)	45.41	36.72	8.70	53(55)
Mauritania	MRT	80.19	NA	NA	42.00	69.12	69.06	0.06	18(21)	42.06	35.14	6.92	55(56)
Tanzania	TZA	81.64	85.06	-3.42	36(16)	49.59	51.73	-2.14	59(56)	49.53	49.84	-0.31	44(39)
Ethiopia	ETH	88.99	87.01	1.98	11(13)	56.80	52.56	4.24	48(55)	38.56	37.15	1.41	59(54)
Congo DR	COD	79.97	74.76	5.21	44(39)	52.34	52.81	-0.47	56(53)	57.61	47.10	10.50	30(43)
Nigeria	NGA	85.06	76.99	8.07	22(31)	47.33	55.85	-8.52	60(49)	51.44	43.88	7.56	40(46)
Malawi	MWI	80.24	80.31	-0.07	41(24)	55.58	53.50	2.08	50(52)	39.41	38.12	1.29	58(53)
Angola	AGO	70.40	63.37	7.03	56(50)	61.08	60.60	0.48	42(42)	52.37	43.85	8.52	36(47)
Benin	BEN	81.63	80.32	1.30	37(23)	41.03	48.38	-7.35	63(59)	50.68	39.57	11.11	42(51)
Ivory Coast	CIV	77.22	72.35	4.87	48(42)	63.78	62.52	1.27	36(39)	45.50	34.98	10.52	52(57)
Rwanda	RWA	82.80	83.59	-0.79	28(19)	42.22	41.57	0.66	61(61)	46.05	49.68	-3.63	51(40)

Afghanistan	AFG	84.17	64.01	20.15	24 (49)	54.81	56.33	-1.53	51 (47)	44.42	29.29	15.13	54 (59)
Mali	MLI	90.88	82.10	8.79	6 (20)	63.87	62.22	1.65	35 (40)	35.13	26.53	8.60	60 (60)
Madagascar	MDG	86.46	84.03	2.43	18 (18)	29.01	23.22	5.80	64 (62)	48.30	47.27	1.03	47 (42)
Niger	NER	NA	16.09	NA	(59)	58.12	54.79	3.33	46 (51)	28.45	17.03	11.42	62 (62)
Bolivia	BOL	86.87	78.54	8.33	17 (27)	70.69	68.61	2.08	11 (24)	NA	NA	NA	NA
Congo	COG	NA	NA	NA	NA	NA	NA	NA	NA	63.31	58.04	5.27	16 (27)
Cape Verde	CPV	54.53	51.70	2.83	59 (57)	52.61	56.01	-3.40	55 (48)	NA	NA	NA	NA
Djibouti	DJI	88.55	88.14	0.40	13 (9)	NA	NA	NA	NA	NA	NA	NA	NA
Micronesia	FSM	NA	NA	NA	NA	67.53	NA	NA	26.00	NA	NA	NA	NA
Guinea	GIN	NA	NA	NA	NA	NA	NA	NA	NA	51.70	34.71	16.99	37 (58)
Kenya	KEN	83.40	85.32	-1.92	26 (14)	NA	NA	NA	NA	53.58	54.59	-1.01	35 (36)
Kiribati	KIR	NA	NA	NA	NA	52.05	66.01	-13.96	57 (32)	NA	NA	NA	NA
Morocco	MAR	NA	NA	NA	NA	73.90	76.23	-2.33	6 (10)	63.21	63.42	-0.21	17 (16)
Papua New Guinea	PNG	67.03	77.10	-10.08	58 (30)	NA	NA	NA	NA	39.46	41.12	-1.67	57 (50)
Solomon Is.	SLB	95.14	88.19	6.95	1 (8)	69.77	67.02	2.75	14 (28)	NA	NA	NA	NA
Eswatini	SWZ	NA	NA	NA	NA	72.04	73.49	-1.45	8 (14)	NA	NA	NA	NA
Chad	TCD	NA	NA	NA	NA	64.17	NA	NA	33.00	33.46	18.22	15.24	61 (61)
Tajikistan	TJK	NA	NA	NA	NA	NA	NA	NA	NA	76.38	80.41	-4.03	5 (4)
Uzbekistan	UZB	NA	NA	NA	NA	NA	NA	NA	NA	83.05	83.32	-0.27	1 (2)
Vanuatu	VUT	NA	NA	NA	NA	61.39	65.13	-3.74	41 (35)	54.80	57.52	-2.72	33 (31)
Yemen	YEM	86.98	61.89	25.09	16 (51)	59.10	57.64	1.47	45 (45)	NA	NA	NA	NA

Figure B3.7: Gender differences in YLILI score

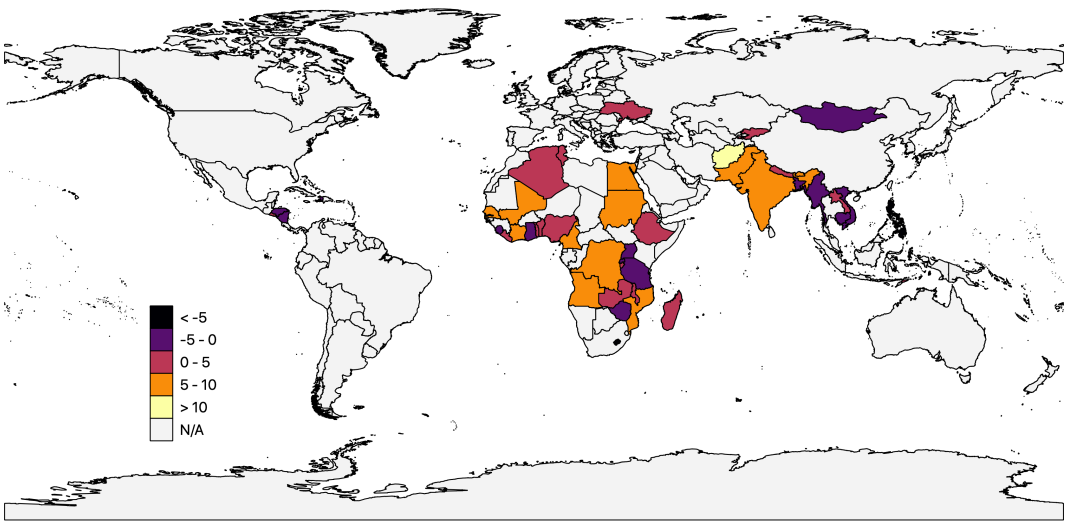
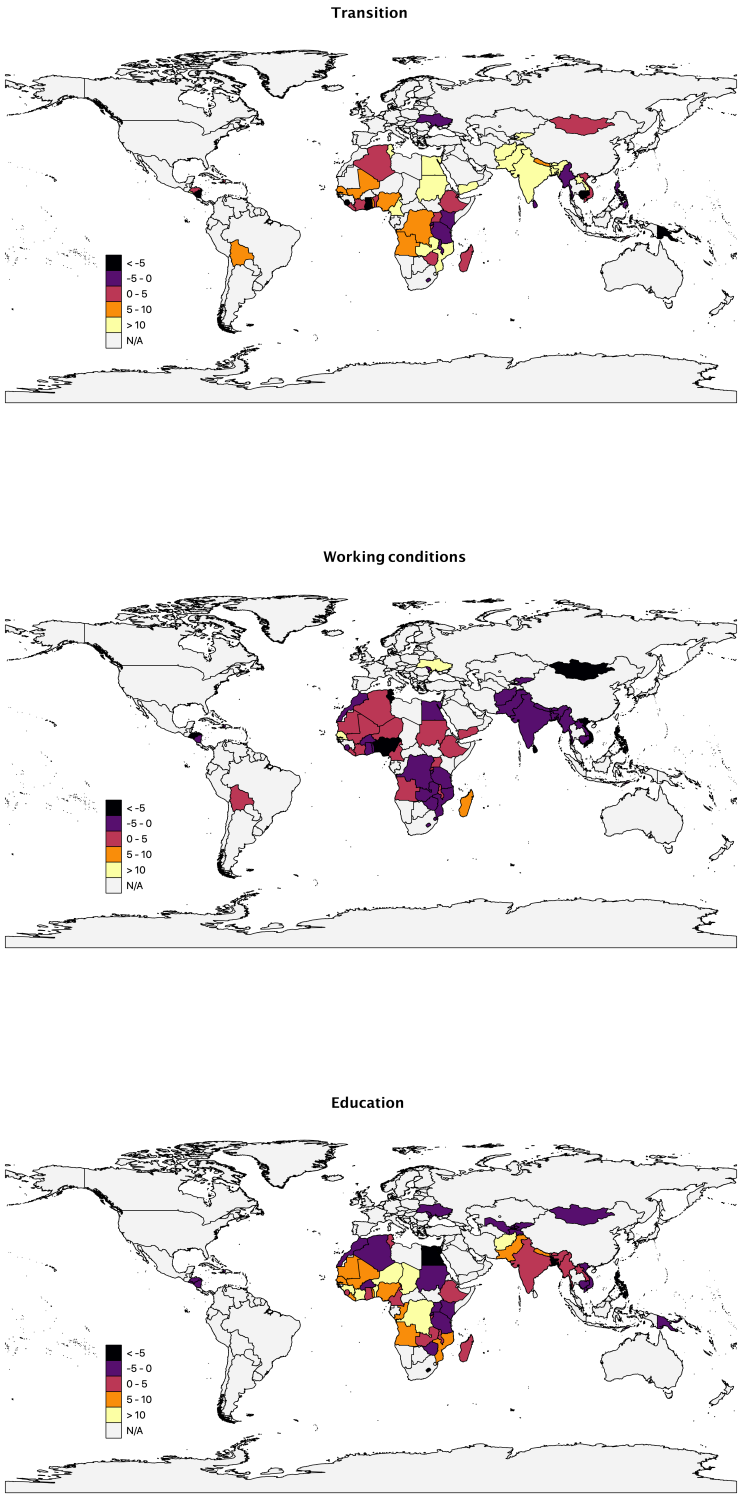


Figure B3.8: Dimensions of the YLILI depicted by country



Robustness

Table B3.8: Alternative specifications (new ranking)

country	YLILI	no neet	no relative wc	no mismatch	no workingpov	no underemp	no informal	no elementary	no nosecondary	no literacy	no test scores	geometric	raw
Ukraine	84.67 (1)	86.06 (2)	83.74 (1)	84.22 (1)	83.77 (1)	83.79 (1)	89.5 (1)	84.55 (1)	83.2 (1)	81.65 (1)	89.17 (1)	80.87 (2)	87.74 (1)
Moldova	83.36 (2)	86.13 (1)	81.42 (2)	82.52 (2)	81.97 (2)	82.16 (2)	84.24 (4)	83.57 (2)	82.48 (2)	79.03 (2)	88.56 (2)	80.93 (1)	82.48 (2)
Mongolia	82.32 (3)	84.25 (3)	81.03 (3)	81.69 (3)	81.34 (3)	81.41 (3)	86.16 (2)	82.16 (3)	81.55 (3)	77.94 (3)	87.48 (3)	78.65 (3)	81.55 (3)
Kyrgyzstan	78.66 (4)	79.7 (4)	77.32 (5)	78.94 (4)	77.62 (4)	77.95 (4)	83.84 (5)	80.56 (4)	75.18 (6)	75.16 (4)	85.63 (4)	72.78 (4)	78.94 (5)
Cambodia	76.69 (5)	76.73 (5)	76.24 (6)	77.1 (5)	77.39 (5)	76.46 (5)	84.52 (3)	77.78 (5)	77.35 (4)	72.57 (6)	80.15 (5)	61 (12)	76.69 (6)
Viet Nam	75.75 (6)	73.89 (7)	79.49 (4)	73.88 (6)	72.89 (6)	72.63 (7)	78.8 (7)	75.25 (6)	76.23 (5)	72.93 (5)	78.1 (10)	71.64 (5)	76.23 (8)
Sri Lanka	73.43 (7)	74.2 (6)	72.79 (7)	73.28 (7)	71.77 (7)	71.97 (8)	78.3 (8)	73.68 (8)	72.93 (7)	68.01 (8)	79.34 (6)	66.98 (7)	72.93 (12)
El Salvador	72.92 (8)	73.57 (10)	72.63 (8)	72.57 (8)	70.8 (12)	71.28 (10)	77.09 (12)	73.59 (9)	72.15 (8)	68.63 (7)	77.99 (12)	68.32 (6)	72.15 (13)
Algeria	72.39 (9)	73.86 (8)	70.82 (11)	72.5 (9)	71.44 (9)	73.14 (6)	79.13 (6)	72.76 (11)	71.92 (9)	66.41 (11)	78.85 (8)	60.17 (14)	79.34 (4)
Philippines	72.12 (10)	73.07 (12)	70.8 (12)	72.5 (10)	71.45 (8)	71.89 (9)	77.45 (10)	74.49 (7)	71.58 (11)	65.71 (15)	79.07 (7)	63.85 (10)	71.58 (14)
Tunisia	72.11 (11)	73.61 (9)	70.5 (14)	72.22 (12)	70.82 (11)	71.1 (11)	77.74 (9)	73.54 (10)	71.67 (10)	66.47 (10)	78.19 (9)	63.97 (9)	67.12 (21)
Palestine	71.5 (12)	73.01 (13)	71.56 (10)	69.94 (16)	68.63 (21)	68.81 (17)	75.76 (17)	71.32 (13)	70.41 (12)	66.66 (9)	77.45 (13)	64.02 (8)	70.41 (16)

Nepal	70.81 (13)	73.44 (11)	69.4 (16)	69.58 (19)	68.93 (20)	69.35 (15)	76.25 (15)	70.62 (14)	68.19 (15)	66.18 (14)	78.06 (11)	58.86 (16)	70.81 (15)
India	70.22 (14)	70.92 (14)	68.62 (17)	71.11 (13)	69.42 (17)	69.19 (16)	76.57 (13)	70 (16)	67.64 (18)	66.41 (12)	76.61 (14)	56.93 (20)	61.82 (38)
Timor-Leste	69.88 (15)	69.73 (16)	70.21 (15)	69.71 (18)	69.64 (16)	68.04 (19)	75.73 (18)	68.42 (21)	67.03 (23)	66.18 (13)	76.44 (15)	58.03 (19)	69.88 (17)
Nicaragua	69.65 (16)	67.35 (25)	71.86 (9)	69.73 (17)	69.65 (15)	70.87 (12)	75.56 (19)	69.98 (18)	69.23 (13)	64.58 (18)	75.13 (18)	61.96 (11)	67.18 (20)
Cameroon	69.2 (17)	68.99 (19)	66.24 (22)	72.38 (11)	70.92 (10)	70.12 (13)	77.29 (11)	69.98 (17)	67.54 (20)	64.96 (17)	75.1 (19)	54.96 (24)	69.2 (18)
Haiti	69.11 (18)	70.07 (15)	67.04 (21)	70.23 (14)	69.77 (14)	69.61 (14)	76.45 (14)	70.25 (15)	66.75 (24)	64.35 (19)	76.24 (16)	53.83 (27)	76.44 (7)
Myanmar	68.6 (19)	66.68 (30)	70.5 (13)	68.61 (21)	66.52 (25)	66.76 (20)	74.23 (20)	68.47 (20)	68 (16)	65.03 (16)	72.77 (22)	58.42 (18)	68.6 (19)
Lesotho	68.54 (20)	68.83 (20)	67.77 (18)	69.03 (20)	69.87 (13)	68.4 (18)	75.98 (16)	72.75 (12)	67.85 (17)	64.06 (20)	73.73 (21)	55.31 (23)	74.68 (10)
Bhutan	68.07 (21)	68.46 (22)	65.66 (23)	70.08 (15)	66.44 (27)	66.54 (21)	73.24 (21)	67.08 (23)	67.56 (19)	62.79 (22)	73.85 (20)	60.54 (13)	75.3 (9)
Bangladesh	66.69 (22)	67.15 (26)	65.5 (24)	67.42 (23)	65.53 (30)	65.34 (25)	73.16 (22)	66.29 (25)	67.47 (21)	60.15 (31)	72.46 (23)	50.16 (34)	66.69 (22)
Uganda	66.67 (23)	69.44 (18)	65.28 (26)	65.29 (28)	67.86 (23)	65.47 (23)	73.01 (23)	66.51 (24)	68.84 (14)	60.63 (27)	70.55 (30)	51.33 (32)	66.67 (23)
Comoros	66.58 (24)	67.47 (24)	67.68 (20)	64.6 (30)	65.42 (31)	64.53 (29)	71.55 (27)	65.35 (28)	65.11 (29)	63.16 (21)	71.48 (28)	56.32 (21)	73.53 (11)
Honduras	66.51 (25)	67.54 (23)	64.37 (29)	67.62 (22)	66.45 (26)	66.26 (22)	72.64 (25)	68.92 (19)	67.22 (22)	60.67 (26)	71.64 (26)	58.44 (17)	66.51 (24)
Laos	66.39 (26)	68.5 (21)	67.7 (19)	62.96 (36)	63.11 (38)	62.42 (35)	69.73 (34)	63.17 (38)	66.23 (25)	60.51 (29)	72.42 (24)	56.02 (22)	66.23 (26)
Togo	66.3 (27)	67.05 (27)	65.14 (27)	66.71 (25)	68.37 (22)	65.04 (27)	72.76 (24)	65.93 (26)	65.22 (27)	61.96 (23)	71.72 (25)	53.95 (26)	66.3 (25)
Ghana	66.17 (28)	66.84 (28)	65.4 (25)	66.26 (26)	64.93 (33)	65.41 (24)	71.73 (26)	64.75 (30)	62.88 (37)	60.29 (30)	75.33 (17)	44.38 (42)	66.17 (27)
Zimbabwe	65.51 (29)	69.7 (17)	62.53 (34)	64.3 (31)	66.1 (28)	64.94 (28)	71.3 (28)	67.21 (22)	63.65 (33)	61.37 (24)	71.51 (27)	52.61 (31)	65.51 (29)

Mozambique	64.97	(30)	65.86	(34)	61.72	(35)	67.35	(24)	69.31	(18)	65.22	(26)	67.31	(42)	65.02	(29)	65.56	(26)	60.52	(28)
Sudan	64.94	(31)	66.31	(31)	63.38	(31)	65.12	(29)	63.48	(37)	63.36	(30)	70.86	(29)	64.27	(31)	64.69	(31)	61.02	(25)
Egypt	64.9	(32)	64.12	(37)	64.73	(28)	65.85	(27)	62.89	(39)	62.69	(34)	69.98	(32)	63.33	(37)	65.09	(30)	58.89	(36)
Sierra Leone	63.31	(33)	62.74	(39)	63.5	(30)	63.69	(32)	66.83	(24)	63.36	(31)	70.08	(31)	63.6	(34)	59.72	(43)	59.96	(33)
Pakistan	63.2	(34)	64.14	(36)	62.58	(33)	62.9	(37)	61.06	(46)	61.02	(40)	68.35	(37)	62.56	(39)	63.39	(35)	57.89	(38)
Burundi	63.01	(35)	62.32	(42)	63.14	(32)	63.58	(34)	69	(19)	63.26	(32)	70.72	(30)	65.78	(27)	65.19	(28)	57.72	(39)
Senegal	62.94	(36)	65.05	(35)	60.12	(38)	63.66	(33)	64.74	(36)	62.31	(36)	69.88	(33)	63.58	(35)	63.05	(36)	59.98	(32)
Zambia	62.67	(37)	66.06	(32)	61.04	(36)	60.9	(44)	64.77	(35)	60.56	(41)	67.17	(43)	62.17	(41)	62.32	(39)	56.66	(41)
Gambia	62.5	(38)	66.77	(29)	59.45	(42)	61.28	(42)	60.72	(47)	60.5	(42)	67.06	(44)	63.36	(36)	60.53	(42)	59.24	(35)
Burkina Faso	62	(39)	66.01	(33)	59.96	(39)	60.03	(47)	62.48	(41)	59.68	(46)	67.84	(39)	60.2	(46)	64.25	(32)	58.67	(37)
Liberia	61.97	(40)	62.51	(41)	61.04	(37)	62.35	(39)	65.74	(29)	63.25	(33)	69.29	(35)	62.19	(40)	59.12	(45)	59.59	(34)
Mauritania	61.56	(41)	63.71	(38)	59.73	(40)	61.26	(43)	59.98	(49)	59.81	(45)	67.71	(41)	60.9	(44)	61.63	(40)	57.28	(40)
Tanzania	61.32	(42)	61.09	(44)	59.7	(41)	63.15	(35)	64.91	(34)	62.1	(38)	68.99	(36)	64.03	(32)	63.56	(34)	55.32	(44)
Ethiopia	60.69	(43)	60.68	(45)	59.42	(43)	61.98	(40)	62.37	(42)	62.28	(37)	68.22	(38)	64.02	(33)	62.67	(38)	54.88	(46)
DR Congo	60.41	(44)	60.09	(47)	58.7	(45)	62.44	(38)	65.29	(32)	60.47	(43)	67.75	(40)	60.35	(45)	57.69	(48)	54.96	(45)
Nigeria	60.33	(45)	62.53	(40)	58.82	(44)	59.63	(48)	62.08	(43)	59.85	(44)	66.72	(45)	61.39	(43)	57.39	(49)	55.77	(43)
Malawi	59.22	(46)	61.66	(43)	57.69	(46)	58.3	(49)	62.71	(40)	57.97	(48)	64.86	(49)	58.58	(49)	60.61	(41)	53.97	(48)

Mozambique	68.84	(34)	59.29	(15)	65.86	(28)														
Sudan	69.1	(32)	53.38	(28)	56.42	(48)														
Egypt	70.72	(29)	54.75	(25)	65.09	(30)														
Sierra Leone	70.25	(31)	46.07	(39)	63.69	(31)														
Pakistan	68.33	(36)	51.27	(33)	63.2	(32)														
Burundi	66.13	(40)	42.37	(48)	61.7	(39)														
Senegal	65.79	(41)	44.51	(41)	62.94	(33)														
Zambia	69.02	(33)	53.12	(30)	62.67	(34)														
Gambia	67.72	(38)	53.26	(29)	62.5	(35)														
Burkina Faso	63.07	(46)	43.61	(43)	62	(37)														
Liberia	67.19	(39)	46.34	(38)	62.35	(36)														
Mauritania	65.78	(42)	43.58	(44)	60.03	(44)														
Tanzania	65.07	(44)	47.52	(36)	61.32	(41)														
Ethiopia	64.53	(45)	47.33	(37)	60.69	(42)														
DR Congo	68.6	(35)	34.77	(53)	54.71	(49)														
Nigeria	67.81	(37)	35.42	(51)	51.25	(53)														
Malawi	63.07	(47)	48.01	(35)	53.61	(50)														

Angola	58.86 (47)	58.12 (51)	56.75 (47)	61.7 (41)	62.01 (44)	58.13 (47)	65.28 (47)	57.98 (50)	57.09 (51)	53.96 (49)	65.53 (43)	45.34 (40)	60.16 (43)					
Benin	58.49 (48)	58.3 (50)	56.36 (48)	60.81 (45)	61.82 (45)	61.48 (39)	66.36 (46)	59.93 (47)	57.9 (47)	55.86 (42)	61.71 (49)	43.3 (45)	58.49 (45)					
Côte d'Ivoire	57.87 (49)	58.71 (49)	54.42 (50)	60.49 (46)	58.75 (51)	57.37 (50)	64.96 (48)	57.98 (51)	57.95 (46)	54.85 (47)	60.83 (50)	40.65 (49)	57.87 (46)					
Rwanda	57.82 (50)	60.59 (46)	55.44 (49)	57.43 (50)	60.32 (48)	57.66 (49)	64.41 (50)	62.07 (42)	59.32 (44)	51.36 (50)	62.79 (48)	42.49 (47)	57.82 (47)					
Afghanistan	55.89 (51)	58.8 (48)	53.98 (51)	54.9 (53)	56.76 (53)	55.39 (52)	61.38 (51)	54.8 (52)	57.26 (50)	51.16 (51)	59.25 (51)	43.1 (46)	61.62 (40)					
Mali	54.34 (52)	53.64 (52)	52.03 (52)	57.34 (51)	57.14 (52)	53.27 (53)	61.27 (52)	53.65 (53)	52.85 (53)	51.09 (52)	59.07 (52)	34.83 (52)	52.03 (52)					
Madagascar	52.43 (53)	51.13 (53)	50.86 (53)	55.31 (52)	59.01 (50)	56.48 (51)	60.79 (53)	58.98 (48)	53.3 (52)	46.53 (53)	57.46 (53)	37.3 (50)	53.3 (51)					
Niger	40.54 (54)	41.93 (54)	40.26 (54)	39.44 (54)	38.53 (54)	35.75 (54)	43.19 (54)	36.05 (54)	40.43 (54)	37.1 (54)	44.09 (54)	23.25 (54)	36.75 (54)					

Figure B3.9: Comparison of aggregation methods

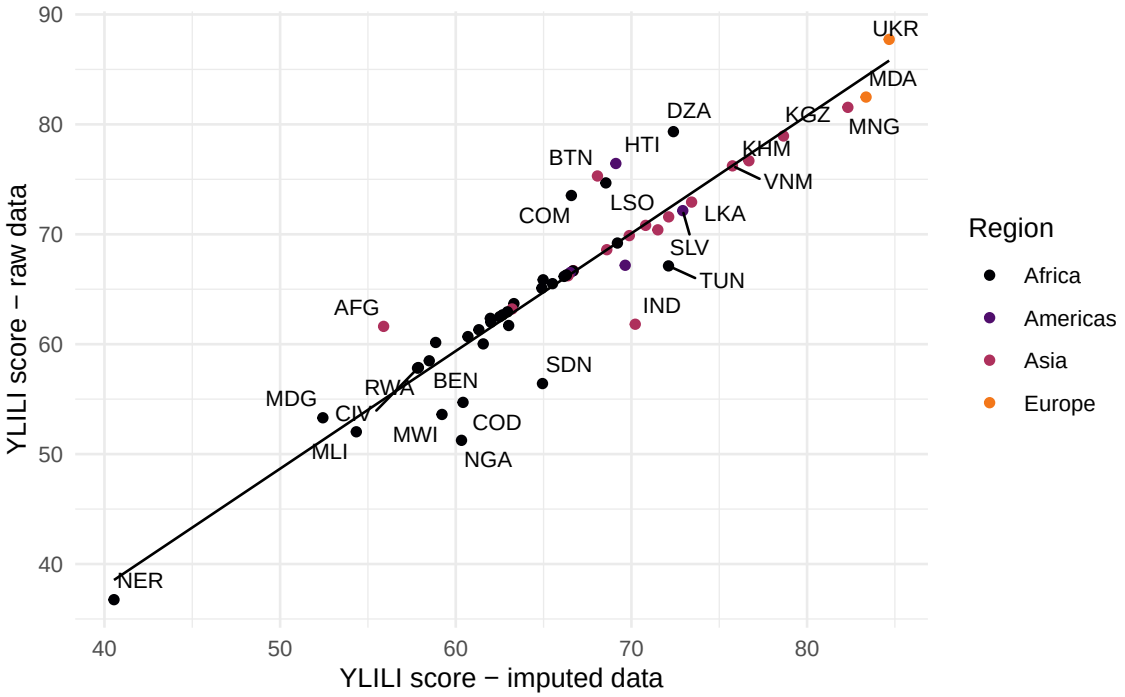
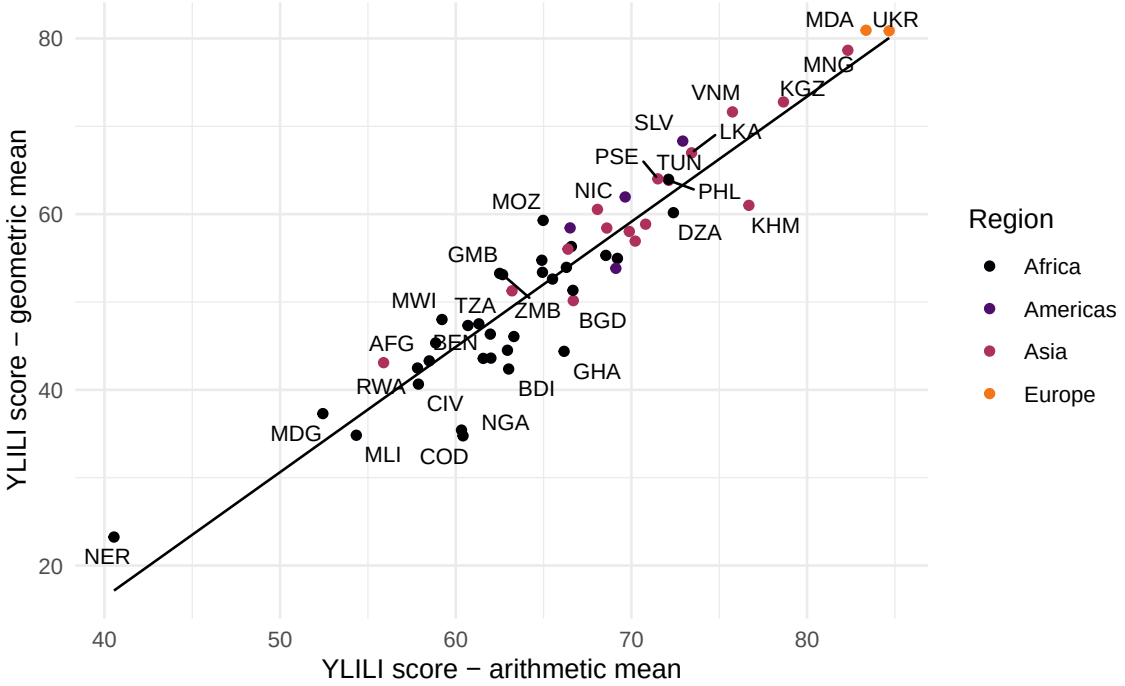


Figure B3.10: YLILI with and without imputation



Chapter 4

Costs and Benefits of the Dual System in the Context of Traditional Apprenticeship in Bénin

co-authored with Sylvain Kpenavoun, Esaïe Gandonou, Guy Nouatin & Rubain Bankole

Abstract

Traditional apprenticeships are an important source of skills for early school leavers in developing countries. Usually private arrangements between parents and informal firms, apprenticeship quality and costs are not subject to oversight or regulation, and the various transactions taking place between apprentice and firm have not been carefully documented to date. This paper sheds light on the institution of traditional apprenticeship through a study of a national apprenticeship reform called the CQP, which combines in-firm training with a weekly classroom component. Using two waves of surveys with firm owners and apprentices, we analyze the human capital gains and material costs and benefits associated with training. We find that the program did not generate improvements in apprentice skill or in firm profitability, possibly due to a strong selection of older, overqualified candidates into the program. We do find that traditional apprenticeship on the whole improves apprentices' sector-specific knowledge and experience. Fees paid by apprentices are found to be commensurate with the allowances they receive from the trainers, contradicting earlier work which suggest that firms use fees for financing. Estimates suggest that apprentice productivity must be substantial for firms to break even on training. The high proportion of apprentices as a fraction of the total workforce in firms, combined with the tendency for apprentices to leave their training workshop after graduation, suggests that apprentice productive contributions to the training firms are indeed substantial.

4.1 Introduction

In sub-Saharan Africa (SSA), interest in apprenticeships is on the rise. In countries with largely informal economies, traditional apprenticeships (also referred to as apprenticeships in the informal sector or informal apprenticeships) are one of the most important sources of skills for early school leavers, accounting for as much as 80 percent of technical and vocational training (TVET)[1] and for as much as 90 percent of total employment in the crafts sector (Adams et al., 2013; Filmer and Fox, 2014; Walther and Filipiak, 2007; World Bank, 2018). As increasing numbers of youth in SSA suffer from a lack of labor attachment, underemployment, and poverty, informal sector training is seen by many policy experts as an important tool for tackling the youth employment challenge.

In contrast to formal TVET, which usually takes place exclusively in the classroom, traditional apprentices train on-the-job in informal sector microenterprises or workshops. Traditional apprenticeships involve a private contractual arrangement between an aspiring apprentice — usually a school leaver between the age of 14 and 18 — or his or her parents, and a master craftsman (MC) who agrees to train the apprentice for a duration of about three to four years for a fee (Bas, 1989). Upon completion of the apprenticeship, the MC usually issues a certificate acknowledging the training; some apprentices continue to work for the same or for another workshop wage employees, though most seek to start their own business given access to sufficient capital (Frazer, 2006). While unregulated at the national level, informal apprenticeships are nevertheless structured according to the dictates of tradition and the customs of local professional associations, and, in the context of highly informal economies, are generally considered to be more effective than formal TVET at delivering the skills demanded by the labor market (Ahadzie, 2009).

Despite their attractiveness as a source of skills for young school leavers, the unregulated nature of traditional apprenticeships also gives rise to a number of potential market failures that may negatively affect their provision and have led to calls for their reform (Walther, 2011). For instance, in the absence of complete, enforceable contracts, firms may be unable to commit to providing general skills training (Acemoglu and Pischke, 1998, 1999; Dustmann and Schönberg, 2012). Apprentice productivity may also be so low that subsistence levels (paid in the form of "chop money" by the firm owner) are greater than the returns to training, resulting in its under-provision. Firms may also fear "poaching" of newly trained apprentices by competitors — a particularly salient problem for small enterprises, which experience higher employee turnover and offer fewer opportunities for career advancement (Mcintosh et al., 2011) — though evidence of this is limited for the African context.

Quality is also affected by the unregulated nature of informal apprenticeships, and may have adverse consequences for participating youth: apprentices may be exposed to inexperienced trainers who keep them in their apprenticeship for too long (Bas, 1989), or experience limited labor market mobility into for-

[1] According to a survey of five countries, 20 percent of youth aged 25-34 had participated in an apprenticeship in the past, though participation varied by country and was as high as 35 percent in Ghana; in contrast, only 1 percent were enrolled in formal TVET, and about 9 percent in tertiary education (Filmer and Fox, 2014). A more recent estimate of enrollment in formal TVET is 6 percent across SSA (Hofmann et al., 2022)

mal sector wage jobs due to the lack of formal accreditation systems (Acemoglu and Pischke, 2000; Alfonsi et al., 2020; World Bank, 2018). Policy makers have been increasing interested in reforms to address such market failures. such as the competence-based, nationally-accredited certification of informal apprenticeship which has recently been introduced in countries including Niger, Togo, Malawi and Tanzania.

An alternative reform is the introduction of a classroom component to an otherwise traditional apprenticeship, producing a hybrid "dual system" comparable to that of the Swiss and German variety (Walther, 2011). Dual systems promise to increase training quality by introducing a state-regulated classroom component, while also improving the signalling ability of apprentices by offering official, nationally-recognized certification. 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, Côte d'Ivoire, Senegal, Tanzania, Togo, and Niger (ILO, 2020c; Walther, 2011). Many of these schemes have struggled with financing, MC engagement, and integration into the existing national TVET and regulatory frameworks; nevertheless, with its potential to simultaneously harness the abundance of training firms in the informal sector and the growing demand among parents and youth for formal education, dual system formalization remains a promising approach to TVET reform.

In this paper, we analyze the impact of a national dual system program on participating apprentices and firms in Bénin. The program, called *Certificat de Qualification Professionnelle* (CQP), appends weekly classroom training at a local training center to otherwise traditional in-firm apprenticeship training in an informal firm. Using two waves of apprentice-firm survey data collected for 427 apprentices training in 197 firms, we assess the impact of this weekly classroom training component on learning outcomes, and estimate the marginal effect of apprentice participation in dual system training on firm size and profits.

Studies of vocational training interventions combining on-the-job and classroom teaching in middle-income countries have reported modest yet persistent increases in earnings together with mixed impacts on employment (Alzúa et al., 2016; Attanasio et al., 2017, 2011; Card et al., 2011; Ibarrarán et al., 2019, 2014). Similar interventions in LICs have been characterized by low take-up, high dropout, and low efficacy (see Blattman and Ralston, 2015; Ghisletta et al., 2021; Tripney and Hombrados, 2013 for an overview). These programs tend to be shorter than the one studied in this paper (up to several months, rather than years), and focus on employment in the formal rather than the informal sector. To our knowledge, only one paper has attempted to quantify the impact of dual-system training in Sub-Saharan Africa: in a randomized experiment in Côte d'Ivoire, Crépon and Premand (2019) found that youth offered a stipend for an apprenticeship that combined 12 to 24 months of on-the-job training with theoretical classes at local training institutions earned 15 percent more after three years, were involved in more complex and non-routine tasks[2], and received training certification at a higher rate than non-treated youth. We study a similarly structured dual training program, but one that is about twice as long and does not involve any direct subsidies or

[2]Enrollment in subsidized dual apprenticeship training increased the likelihood of undertaking non-routine analytical tasks by .24 standard deviations (SDs) and non-routine interpersonal tasks by 0.08 SDs relative to non-treated traditional apprentices. A task intesity index was found to be .21 SDs lower for dual apprentices, suggesting that dual apprentices were involved in a wider range of tasks.

eliminate fees.

A related literature studies the incentive structure behind the dual system by analyzing the costs and benefits of apprenticeship for the training firm. A number of such studies have been conducted in the European context with the aid of surveys and simulations (see, e.g., Mühlemann, 2016; Mühlemann and Wolter, 2014; Mühlemann and Wolter, 2019), but have only recently begun to generate interest in lower-middle and low-income countries. Examples include Bolli et al. (2021), who find that training costs outweigh benefits in Serbia (with larger firms suffering smaller losses), and Bolli et al. (2020), who show that training firms in Nepal generally profit from training, with little variation in net benefits across firm size. To our knowledge, ours is the first rigorous cost-benefit study of dual training conducted in SSA.

Though traditional apprenticeships are very common in West Africa and across SSA, there is limited direct empirical evidence of their impact on the skills or labor market outcomes of apprentices. Long-term returns to informal training have been shown to be quite heterogeneous in Ghana, benefiting youth with lower levels of education the most (Monk et al., 2008). An experimental study in Uganda found that six months of in-firm training measurably improved apprentices' skills, and that these skills persisted two to three years after the end of training (Alfonsi et al., 2020). However, skills acquired in informal training tend to be firm-specific, and thus more likely to lead to self-employment than to quick career progression in the formal sector than formal schooling (Alfonsi et al., 2020; Frazer, 2006; Hardy et al., 2019).

Studies from SSA also suggest that informal apprenticeship training tends to have positive effects on microenterprise growth and profitability. Using data on formal manufacturing firms from Kenya, Zimbabwe and Ghana, Rosholm et al. (2007) observed a significant wage increase (of about 20%) in firms that trained in the previous 12 months, with large firms benefiting more than small ones. Hardy and McCasland (2022) found that randomly assigning an apprentice to informal firms in Ghana increased firm size by about half a worker, and firm revenues by 5-15 percent per apprentice. While Crépon and Premand (2019) look at the impact of fee subsidies on firms' apprentice and employee stocks, they did not estimate the change in size or revenues that a firm can expect from hiring additional apprentices. Our study is thus the first, to our knowledge, to report the impact of dual system training in SSA on firm size and profits.

Finally, a number of studies have examined the financial arrangements between traditional apprentices and informal firms. Velenchik (1995) studies the structure of apprenticeship contracts in small informal firms in Ghana, identifies three main transactions between apprentice and firm — apprentice wages, fees and allowances — and distinguishes between two broad types of contracts, namely those with and those without training fees. She finds that firms that do not charge fees are smaller and tend to offer more specific training. Velenchik (1995) and Frazer (2006) also suggest that training fees may be a substantial source of financing for some firms, but do not provide estimates of the allowances, wages and other training costs that these fees are meant to offset. This study attempts to fill this gap.

We find that, in general, all apprentices gain trade-specific human capital over the three observed years of training. However, we are unable to show that participation in dual system training contributes to additional learning. Youth with low learning scores at baseline make the largest gains in human capital

over the course of the study; since we observe that MCs send older, more educated and more experienced apprentices to apply for the CQP program, this could explain the low level of efficacy observed for dual training.

In terms of financial arrangements, we find that fees paid by apprentices are not enough to cover the costs of their training in general, and the regular allowances they receive from their MC in lieu of wages in particular. Though estimating apprentice productivity presents a challenge with the available data, we find that between 60 and 67 percent of firms benefit from their training activities when apprentice productivity is accounted for (the vast majoritiy face net losses when it is not). While larger firms generate positive net benefits from training on average, smaller firms consistently report losses.

The paper proceeds as follows. Informal apprenticeship in Bénin, the CQP program, and the survey data used for the analysis are presented in Section 4.2. Results are presented in Section @ref(cqp_results). Section 4.4 concludes.

4.2 Data and Methods

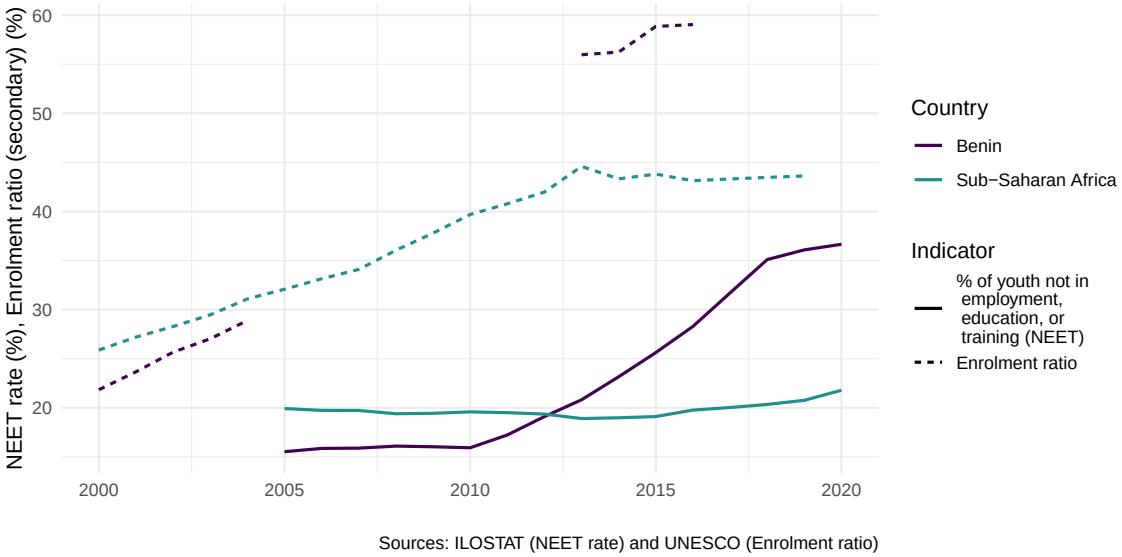
4.2.1 Country Context

Despite the relative stability of its democratic government and strategic importance as a transportation hub for West Africa, Bénin (population approx. 12.1 million) performs poorly on many development indicators, ranking 158th out of 189 countries on the 2020 Human Development Index. Youth employment is a particularly pressing issue, with youth labor force participation decreasing from 53.9 percent in 2003 to 32.8 in 2018[3]. As in other parts of SSA, secondary and tertiary school enrollment has seen a steady increase in the past two decades, coinciding with a sharp decrease in the youth employment rate: according to the most recent labor force surveys, the youth employment-to-population ratio decreased by 20 percent, from 40 to 31.5 percent, between 2010 and 2018, compared to an 13 percent decrease for adults age 25 or older over the same time period[4]. Meanwhile, the share of youth neither in employment, education or training (NEET) increased from 17 percent in 2011 to 35 percent in 2018 (see Figure 4.1) — one the highest rates in West Africa, and the world (ILO, 2022).

[3]According to the National Household Survey, Enquête de Suivi de l'Enquête Modulaire et Intégrée sur les Conditions de Vie des Ménages (HIES). The labor force is the sum of all persons in a given age range who are employed and those who are unemployed. The youth labor force participation rate is the total size of the labor force aged 15-24, as a percent of the population in the same age range.

[4]The employment-to-population ratio is the proportion of a country's population in a given age range that is employed. Youth are defined to be aged 15-24.

Figure 4.1: Rates of youth enrollment and inactivity: Bénin and SSA



Sources: ILOSTAT (NEET rate) and UNESCO (Enrolment ratio)

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 Bénin, entry into formal technical and vocational education and training (TVET) begins after the completion of the second year of secondary school, or nine years of education. Yet across the country, the median number of years spent in the education system is just four; only five percent of youth of secondary school age are enrolled in TVET (ILO, 2021), in line with the six percent of young workers estimated to participate in formal TVET across SSA (Hofmann et al., 2022). Thus, rather than formal TVET, it is informal apprenticeship that is the primary conduit into the labor market for early school leavers in Bénin, with as many as 300,000 young men and women estimated to be in training (ILO, 2021). 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, 2020b).

In 2005, the government of Bénin announced a restructuring of traditional apprenticeship in the informal sector. Two national apprenticeship schemes were introduced: a formalization of informal, firm-based apprenticeship called the *Certificat de Qualification aux Métiers*, which introduced a national certificate for the completion of traditional training, and the dual system *Certificat de Qualification Professionnelle* (CQP) program, which sought to combine in-firm, firm-specific training with more general classroom-based teaching, and to accredit the training though a separate nationally-recognized certificate. The three stated objectives of the CQP reform were to (i) offer practical and theoretical training to youth under apprenticeship contracts in the craft sector (ii) train a high-performance labor force; and (iii) improve the productivity and profitability of workshops in the craft sector (Davodoun, 2011).

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 installers, tailors, masons, carpenters, metalworkers

(primarily welding of gates for living compounds), electricians, and plumbers[5]. To participate in the CQP, applicants must (i) be at least 14 years old, unless otherwise authorized by the labor inspector; (ii) have a written apprenticeship contract that complies with labor laws; (iii) have completed at least 6 years of formal schooling; (iv) pass a national entry examination; and (v) receive funding from the Fonds de Développement de la Formation Professionnelle Continue et de l'Apprentissage (FODEFCA), the government body responsible for procuring and distributing funding for the program (KOF Swiss Economic Institute, 2017). Firm owners apply on behalf of the apprentices already in their charge, generally through local craftsmen associations. After three to four years of training, CQP apprentices may attempt the final examination, which takes place on one date a year for the entire nation, has a practical and a written component, and is overseen by state representatives and local craftsmen. Upon successful completion of this exam, apprentices receive a nationally-recognized certificate.

The main government organs tasked with the administration of the CQP are the national TVET directorate (DETFP), which is in charge of apprentice recruitment and training center accreditation, the Direction of Test and Exam Services (DEC), in charge of the entrance and exit examinations, and FODEFCA (Nouatin et al., 2019). 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. In 2012, management of the program passed from Swisscontact, a Swiss NGO, entirely into the hands of FODEFCA (Nouatin et al., 2019). 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 Swiss Economic Institute, 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 costs of training to the firm, the administration of the vocational training center, and expenses for entry tests, the final examination, and certification. While on-the-job training in the firm is paid for by the apprentice or their parents, activities in the vocational training centers are largely financed through FODEFCA from various sources (national budget, donors, NGOs, etc.). Certification upon successful completion of the CQP is allocated to the national budget via the Directorate of Examinations, DEC (David-Gnahoui and Ahouangnivo, 2017).

4.2.2 Sampling and Attrition

The data for this study was collected in two separate surveys. The first consisted of interviews with apprentices who had applied to the 2019 cohort of the CQP program, who took the entrance exam on the 5th of November, 2018. The second survey was conducted with the firm owners, or master craftsmen, of the apprentices' respective training firms. To allow for trade-level controls and to reduce travel distances

[5]This selection of trades was based at least in part on existing trades from early experimental dual training programs to take advantage of existing training center infrastructure. The CQM is available for about 50 trades.

for interviews, apprentices were randomly selected from a subsample of all CQP applicants: those training in electrical installation, carpentry, masonry, metalwork or plumbing workshops, and training in the southernmost regions of Bénin.

Table 4.1: Apprentice Sampling

CQP Status	Explanation	Apprentice Survey	Firm Survey
Selected into CQP	Applied to CQP in 2019 through master craftsmen. Passed exam and was admitted to program.	Random sampling from list of all CQP applicants in five chosen trades and from southern Bénin)	Master craftsman assesses *at most* two apprentices, randomly chosen from all CQP selected/not selected in firm at baseline.
CQP applicant but **Not Selected**	Applied to CQP in 2019 through master craftsmen. Was not admitted due to exam score or lack of proximate training center.	Random sampling from list of all CQP applicants in five chosen trades and from southern Bénin)	Master craftsman assesses *at most* two apprentices, randomly chosen from all CQP selected/not selected in firm at baseline.
Did Not Apply to CQP	Did not apply to CQP. Training as traditional apprentice.	N/A	Master craftsman lists *up to* 5 apprentices who did not apply to CQP. Assesses only one, randomly chosen at baseline.

In addition to questions regarding training practices and firm performance, master craftsmen were asked to assess specific apprentices training at their firm. Up to two CQP applicants per firm[6] were selected for this exercise. In addition, a single apprentice who had not applied to the CQP was assessed by the craftsman

[6]Only CQP applicants who had participated in the apprentice survey could be assessed individually by MCs.

in a similar manner, if there was such an apprentice training in the firm[7]. The sampling procedure for choosing the apprentices for these personal assessments is summarized in Table 4.1 above.

The baseline wave for the two surveys was collected in July-August 2019. The apprentice survey included questions on training characteristics, employment outcomes, their own skills and competences, and the perceived quality of their training, while the firm survey included questions on worker characteristics, wages, and firm expenses and revenues. We additionally surveyed all MCs about the firm's training practices and expenses, as well as their perception of up to three individual apprentices' skills, experience, diligence, efficiency, learning ability, and so on (sampling procedure detailed above). Data on 427 apprentices working for 197 unique firms was collected at baseline. Descriptive statistics for apprentices and firms are shown in Table 4.2 below.

[7]As the apprentice survey consisted only of applicants to the program, the only data on non-applicants comes from master craftsmen.

Table 4.2: Descriptive Statistics

	Overall		By baseline status			
Characteristic	**Baseline**	**Endline**	**Selected**	**Not Selected**	**Did Not Apply**	**p-value**
Apprentices						
N	427	240	149	107	171	
Age	21.3 (3.4)	23.2 (3.5)	21.7 (2.8)	22.3 (4.1)	20.1 (3.2)	<0.001
Male	98%	98%	99%	98%	97%	>0.9
Trade						<0.001
Masonry	21%	18%	19%	23%	22%	
Carpentry	11%	11%	13%	6.5%	12%	
Plumbing	13%	15%	17%	11%	9.4%	
Metalworking	20%	20%	28%	12%	19%	
Electrical Inst.	35%	36%	22%	47%	38%	
Years in training	2.33 (1.38)	4.39 (1.38)	2.52 (1.24)	2.64 (1.30)	1.92 (1.48)	<0.001
Education						
None	2.5%	3.3%	0%	0.9%	6.0%	
<Primary	15%	15%	6.0%	6.5%	30%	
Primary	22%	21%	21%	32%	17%	
Secondary	57%	57%	66%	59%	45%	
Technical	2.0%	2.5%	2.7%	0.9%	2.0%	
Tertiary	1.5%	1.3%	3.4%	0.9%	0%	
Status at endline						<0.001
Still training	-	73%	92%	69%	55%	
Graduated	-	17%	6.7%	29%	21%	
Dropped out	-	2.5%	1.1%	1.7%	3.6%	
Unknown	-	7.1%	0%	0%	20%	
Firms						
N	197	150				
Apprentices trained						

Summary statistics from the baseline survey show the sample to be predominantly male youth who, though of average age for an apprenticeship at 21.3 years (ILO, 2022), are significantly more educated than is typical for traditional apprentices, with over half having completed at least some secondary schooling. Successful applicants to the CQP have higher education attainment than unsuccessful applicants; all applicants have higher attainment than non-applicants. Applicants also have more experience coming into the CQP than the required six months, with the average applicant having trained for 1.93 years at the time of application. Non-applicants are younger, less educated, and less experienced than applicants at baseline, suggesting that master craftsmen send their most able and veteran apprentices to stand for the dual training entrance exam. This may indicate that the CQP is perceived by MCs as something more akin to a continuing education rather than an entry-level apprenticeship program.

The majority of training firms are small workshops comprising the firm owner — the master trainer — and several apprentices. Two firm sizes are shown in Table 4.2: those stated directly by the firm owner in response to the question, "How many people (including you and your apprentices) are currently working in your business?" and those calculated by the author by summing the number of apprentices, partners, paid and unpaid family workers, and occasional workers reportedly participating in firm activities. Using self-reported size, 94.81% of firms employed a total of five people or less (including the owner) at baseline and 96.79 percent of firms employed no more than ten (97.18% and 99.53 percent, respectively, using author-calculated size). Thus, training firms in the sample are small, in line with observations from the informal sector in Ghana (Frazer, 2006; Velenchik, 1995), but also roughly similar to the size distribution of a sample of Swiss firms reported by Mühlemann et al. (2007)[8].

The endline survey was conducted in August-September 2021. Overall apprentice attrition in our sample, at 43.8%, is clearly very high, even when compared to studies in similar contexts: for instance, Crépon and Premand (2019) and Hardy et al. (2019) both report youth attrition of around 10%, though it is generally common for studies of training programs to be affected by high rates of attrition (McKenzie, 2017). Both youth non-response and firm non-response[9] drive attrition in our sample. We assess the severity of this problem by testing for differences between retained and attritted apprentices in terms of relevant baseline characteristics such as CQP participation, trade, or socioeconomic variables. Tables A4.1 in the Appendix gives no indication of such differences. In Table A4.2, also in the Appendix, we estimate a logit model where attrition is a function of CQP status at baseline and other apprentice characteristics; again, we find no systematic bias. At only 1 percent, reported program dropout among CQP participants retained in the sample is very low compared to similar studies, e.g. Crépon and Premand (2019) who report 31.2% dropout for dual apprenticeships and 32.5% for traditional apprenticeships. Sample attrition may

[8]Our sample has a higher density of firms with three to nine employees, whereas the Swiss sample (which includes non-training firms) has a higher density of firms with three total employees or fewer. This shift can be explained by the large number of apprentices in the Béninese training firm sample: at baseline, the average firm employed about four apprentices for every other type of employee, or a total of 6 apprentices.

[9]Data on apprentices who had not applied to the CQP was only obtained from firm owners, and is thus only subject to firm attrition.

be correlated with program dropout, but we are unable to test for this possibility with the available data. Finally, despite starting with comparable experience at baseline, unsuccessful applicants to the CQP are more likely to have graduated after three years than CQP participants — Covid-19 related interruptions to training and the single annual CQP examination date both likely contributed to the low graduation rate of CQP apprentices after three years.

Similarly, of 197 firms interviewed at baseline, only 150 could be contacted at endline, for an overall firm attrition rate of 23.9%. Tables A4.3 and A4.4 in the Appendix likewise suggest that firm attrition was not correlated with key firm characteristics such as size or profitability, though a logit model of attrition shows that firms with a higher proportion of CQP participants among their apprentices are somewhat more likely to exit the sample.

4.2.3 Estimating Apprentice Benefits

We first examine the benefits accruing to apprentices over the observed time period of three years. These benefits can be separated into two categories: human capital gains and material benefits.

Human capital gains are measured using a set of trade-specific scores measured separately for each apprentice at baseline and endline. These amount to a simplified version of the "task approach" utilized in the technological change literature (Crépon and Premand, 2019; see Dicarlo et al., 2016). Unlike the general tasks used to measure skills in the task approach, however, we measure apprentice knowledge by means of a short test based on CQP curricula. 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, the knowledge score was only measured for CQP applicants. The questions are reproduced in Appendix 4.4.

Our measures of competence and experience, on the other hand, are based on a short roster of tasks drafted in collaboration with local craft experts and practitioners, an approach similar to that employed by Hardy et al. (2019) (all tasks are shown in Appendix 4.4). Firms were asked to assess apprentices on this series of 10 to 15 trade-relevant tasks[10], and the percentage of tasks in which apprentices are deemed competent or experienced (on a binary scale) constitute their score in each of the two measures. Similar to the task approach, this method allows for worker-level measurement of ability and experience based on tasks performed. Each apprentice received a score in each of the three dimensions.

Regression analysis is then used to examine the impact of dual training on these three measures of apprentice learning. We use the specification

$$y_{it} = a + \sum_j \text{status}_{ij} + \sum_k \text{status}_{ik} \times Endline_t + Endline_t + \mathbf{X}_{it} + \mathbf{Z}_{jt} + u_{it}$$

where y_{it} is the outcome for apprentice i at time t, status_{ij} corresponds to apprentice status j of apprentice

[10]Apprentices were asked to self-evaluate their competence at endline using the same metric. Self-evaluation was not initially planned and thus unavailable at baseline.

i in the context of the CQP program: either successful applicant, unsuccessful applicant, or non-applicant, and $\sum_k \text{status}_{ik} \times Endline_t + Endline_t$ are the interaction of a CQP participation dummy and survey wave and a dummy for CQP non-applicants and survey wave. These interactions identify any gains in learning outcomes that can be linked to CQP participation. $\mathbf{X}_{it}$ is a column vector of apprentice characteristics, $\mathbf{Z}_{jt}$ is a column vector of training-related firm characteristics, a is a constant, and u_{it} is an error term.

Finally, we assess the material benefits of training accruing to the apprentice, calculated simply as total fees paid less allowances received. These two categories of transactions between MC and apprentices are described in greater detail in the next section.

4.2.4 Estimating Firm Benefits

Table 4.3: Components of net benefit accounting

			Model				
	Estimate	**Assumptions**	**I**	**II**	**III**	**IV**	**V**
Benefits							
Annual fees	Total fees / 4	Four year training duration	×	×	×	×	×
Annual apprentice productivity	Average of monthly wages of experienced and inexperienced employee × # of months/year operational	Wages equal to productivity. Apprentice prod. equal to that of untrained employees for first two years and trained employee for final two years			×	×	×
Costs							
Annual allowances	Daily allowances × 20 days × # of months/year operational	Apprentices work 20 days/month	×	×	×	×	×
Annual training expenses	Total monthly training expenses / # of apprentices × # of months/year operational	All reported training expenses are recurring		×		×	×
Annual lost trainer productivity	Monthly wages of experienced employee × estimated hours of training per month × # of trainers/apprentice × # of months/year operational	Wages equal to productivity. All trainers in firm stop working simultaneously when firm pauses activities to train apprentices.					×

Firm benefits were calculated using the accounting approach (Gambin et al., 2013; Mühlemann and Wolter, 2014), which relies on survey data from training firms to identify and quantify the costs and benefits arising from training provision. It has only recently started being applied in lower-middle income countries (Bolli et al., 2020, 2021; Renold et al., 2018). The accounting approach subtracts the costs of training from its benefits and is a simple way of estimating the value that training apprentices generates for the training firm. In a second step, we use regression analysis to assess the impact of hiring additional apprentices, both traditional and CQP dual trainees, on firm outcomes.

The components of the accounting approach used in this study are summarized in Table 4.3. Firms receive two primary benefits from training apprentices: apprenticeship fees and the apprentices' productive contributions to the firm. Training fees can be paid in full before the commencement of training or split into payment at the beginning, during, and at the conclusion of training (Velenchik, 1995). Five categories of fees were reported by both apprentices and MCs: entry fees, formation (or general training) fees, liberation (or graduation) fees paid at the conclusion of training, fees as compensation for the materials and equipment used in training, contract fees, and application fees[11]. Fees were reported as the total paid for the entirety of the apprenticeship; we assume four-year apprenticeships to estimate annual ammounts.

The second benefit of training for firms, apprentices' net productive contributions, were not reported explicitly by the firm owners and thus needed to be estimated with the aid of several assumptions. First, we assume the competitive model of labor markets (with heterogeneous wages), in which workers are paid the marginal product of their labor. Second, 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 for the final two years[12], and we use detailed wage information reported by firm owners to estimate the average annual productivity over the course of a four-year apprenticeship. Under these assumptions, the annual productive value generated by apprentice work amounts to the average of these two wages.

Costs of apprenticeship for the firm are categorized into three categories: allowances, training expenses, and lost trainer productivity. 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. Alternative estimates using different workload assumptions or substituting firm-reported with apprentice-reported figures are shown in Table A4.8 and Table

[11]Fees are often paid in kind rather than in cash.

[12]This is a simplification of the approach used by @bolli2020, in which apprentice productivity is estimated to increase linearly from that of an unskilled worker to that of a skilled worker between defined points in their training. A popular alternative to this 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.

A4.9 in the Appendix.

To help estimate the training costs paid by the firm, owners were asked to identify any costs directly or indirectly related to their training activities. Specific training costs include equipment costs, which comprise all costs for physical infrastructure necessary for training; raw materials such as cement, lumber, or scrap metal used for demonstration or practice purposes; training equipment such as workbenches, toolkits, or other machines purchased or rented specifically for apprentices; rent for training facilities if training was not conducted exclusively in the MC's workshop; and books and any other training materials. Firms reported the training costs in each category for the month prior to the interview; to estimate annual training costs per apprentice per year, the reported firm-level costs are 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.

An additional cost paid by the training firm comes in the form of time lost by training staff when they would have otherwise been engaged in productive activities. Lost trainer productivity is, like apprentice productivity, estimated using wage data. Hourly wages for skilled employees were calculated from monthly wage data and multiplied by the number of hours that the workshop stopped all productive activities to train apprentices in the previous week, as reported by MC. This estimate is burdened by the largest number of assumptions: it is uncertain whether all employees who train apprentices in the firm (a number reported by the MC) stop work entirely while the workshop takes a break to train; whether the majority of lost productivity occurs during these breaks, or in the otherwise normal operation of the firm during which they must also tend to the apprentices. Moreover, the total duration of these breaks in the past week is a very small sample from which to extrapolate to annual costs. Lacking a better method, we report these estimates as the final cost component.

Net benefits were calculated by subtracting some or all of the costs listed above from some or all of the benefits. The simplest model, Model I in 4.3 above, reduces the value of training accruing to the firm to the direct material incomes and expenditures from training; namely, apprenticeship fees from the apprentices and their parents, an approximation of training costs, and the total reported allowances disbursed to the apprentice. Models II and III add training expenses and estimated apprentice productivity, respectively, while Model IV combines all four components. Model V includes all costs and benefits, including lost trainer productivity.

In a final step, we study the effect of hiring apprentices, both traditional and those participating in the CQP, on firm size and profits by estimating the following regression:

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

where y_{it} is the outcome of interest, CQP_i is the number of CQP applicants who were accepted into the 2019 cohort of the program. $apprentices_{it}$ controls for the total number of apprentices training with the firm and not participating in the CQP program (and in contrast to CQP_i is a time-varying measure), while $\mathbf{X}_{it}$ is a matrix of additional covariates for firm i in wave t, $Endline_t$ is a dummy variable denoting survey wave, a is a constant, and u_{it} is an error term.

4.3 Results

4.3.1 Impact of Informal and Dual Training on Individuals

Table 4.4: Change in apprentice human capital

	N	Baseline	N	Endline	Difference	p-value[3]
Competence[1]						
Electrical Installation	125	0.80 (0.24)	69	0.96 (0.09)	0.09	<0.001
Masonry	90	0.75 (0.22)	39	0.90 (0.18)	0.14	0.008
Carpentry	48	0.76 (0.28)	21	0.93 (0.15)	0.12	0.14
Plumbing	54	0.73 (0.29)	26	0.92 (0.15)	0.15	0.008
Metalwork	86	0.75 (0.22)	38	0.86 (0.21)	0.09	0.006
CQP Selected	143	0.81 (0.21)	82	0.95 (0.11)	0.11	<0.001
CQP Not Selected	95	0.84 (0.19)	56	0.94 (0.10)	0.06	0.017
Did Not Apply	165	0.68 (0.28)	55	0.84 (0.22)	0.16	<0.001
Overall	**403**	**0.76 (0.24)**	**193**	**0.92 (0.16)**	**0.11**	**<0.001**
Experience[1]						
Electrical Installation	125	0.77 (0.26)	69	0.96 (0.08)	0.11	<0.001
Masonry	90	0.72 (0.23)	39	0.91 (0.13)	0.20	<0.001
Carpentry	48	0.73 (0.31)	21	0.98 (0.06)	0.19	0.013
Plumbing	54	0.66 (0.30)	26	0.89 (0.17)	0.21	0.001
Metalwork	86	0.72 (0.24)	38	0.85 (0.15)	0.13	0.004
CQP Selected	143	0.78 (0.24)	82	0.93 (0.11)	0.15	<0.001
CQP Not Selected	95	0.80 (0.21)	56	0.94 (0.11)	0.10	0.001
Did Not Apply	165	0.65 (0.29)	55	0.87 (0.16)	0.21	<0.001

First, we investigate whether dual training was successful in realizing its primary objective — increasing the human capital stock of apprentices. To do so, we study the changes in the three human capital indices described in Section 4.2.3 over the observed training period of three years. The changes in the human capital index scores presented in Table 4.4 indicate that informal apprenticeship training is successful in improving sector-specific human capital of the youth in our sample, both for dual training participants and traditional apprentices: overall competence scores increased by 0.46 SDs, experience scores by 0.58 SDs, and knowledge by 0.13 SDs. Significant improvements in competence and experience are observed for apprentices who participated in, unsuccessfully applied to, and did not apply to the CQP alike, though apprentices who did not apply to the CQP show the largest gains in competence and experience as assessed by their MC. This result is in line with the observation that MCs appear to send youth who are already relatively experienced (and educated) to apply for dual training.

A paired t-test also indicates significant improvements in competence and experience between baseline and endline across all trades (improvement in competence for plumbing apprentices is marginally insignificant at standard significance levels). On the other hand, gains in the knowledge metric are not statistically significant for any single trade except plumbing - hence, the overall increase in knowledge is driven by results from plumbing apprentices alone. As the average knowledge scores at baseline were significantly lower for plumbing apprentices than for apprentices in other trades, this result may indicate a shortcoming in the metric itself, which was composed of only up to five questions which did not seem to pose a major challenge for most apprentices in the other four trades. Improvement in knowledge was marginally significant ($p < 0.10$) for CQP participants but not for CQP applicants who were not selected ($p < 0.5$).

Although mean human capital accumulation is higher for participating CQP apprentices than non-selected CQP applicants across the three indices, this does not translate into statistically significant differences between the two group (Table A4.6 in the Appendix). Nor do we observe a significant effect of dual training on the competence and experience indices when apprentices who did not apply to the CQP are added to the control group. To check if apprentices agree with their MC's assessments of their ability, a self-assessment was included in the apprentice survey at endline. Table A4.5 in the Appendix suggests that the two assessments are in general agreement for both the experience and the competence index (the exception again being limited to the plumbing trade, where MCs were relatively critical in their assessment of apprentices' abilities).

Table 4.5: Effects of training on human capital development

	Experience			Competence			Knowledge		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CQP Selected (reference)									
CQP Not Selected	−0.004	−0.0002	−0.02	0.002	0.01	−0.002	0.04*	0.03	−0.01
	(0.02)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.02)	(0.03)	(0.02)
CQP Did Not Apply	−0.10***	−0.12***	−0.13***	−0.11***	−0.12***	−0.13***			
	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)			
Endline	0.17***	0.14***	0.12***	0.13***	0.10***	0.09***	0.06**	0.07**	0.05**
	(0.02)	(0.04)	(0.04)	(0.02)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)
CQP Not Selected x Endline (reference)									
CQP Selected x Endline		0.01	0.02		0.03	0.04		−0.02	0.002
		(0.05)	(0.05)		(0.04)	(0.04)		(0.04)	(0.03)
CQP Did Not Apply x Endline		0.08	0.09*		0.06	0.07			
		(0.05)	(0.05)		(0.05)	(0.05)			
Baseline years of training[1]	0.06***	0.06***	0.06***	0.05***	0.05***	0.06***	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Firm Size[2]	−0.003	−0.003	−0.002	−0.001	−0.0003	0.001	−0.004	0.004	0.004*
	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)
Total Apprentices in Firm	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01**	0.01**	0.01***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.61***	0.62***	0.62***	0.64***	0.64***	0.63***	0.68***	0.69***	0.72***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Trade FE	NO	NO	YES	NO	NO	YES	NO	NO	YES
Observations	523	523	523	523	523	523	353	353	353
R^2	0.30	0.31	0.33	0.30	0.30	0.33	0.08	0.08	0.46
F Statistic	37.00***	28.00***	21.00***	37.00***	28.00***	21.00***	6.00***	5.00***	29.00***

Note: *p<0.1; **p<0.05; ***p<0.01

[1]Prior to baseline survey

[2]Excluding apprentices.

Table 4.6: Effects of training on human capital, excluding CQP non-applicants

	Experience			Competence		
	(1)	(2)	(3)	(4)	(5)	(6)
CQP Selected (reference)						
CQP Not Selected	−0.003	−0.002	−0.02	0.003	0.01	−0.004
	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
Endline	0.14***	0.14***	0.13***	0.12***	0.11***	0.09***
	(0.02)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)
CQP Not Selected x Endline (reference)						
CQP Selected x Endline		0.003	0.02		0.02	0.04
		(0.04)	(0.04)		(0.04)	(0.04)
Baseline years of training[1]	0.04***	0.04***	0.04***	0.03***	0.03***	0.03***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Firm size[2]	−0.01**	−0.01**	−0.01**	−0.002	−0.002	−0.0005
	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)
Total apprentices in firm	0.004*	0.004**	0.003	0.004*	0.004**	0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.69***	0.69***	0.70***	0.72***	0.72***	0.70***
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)
Trade FE	NO	NO	YES	NO	NO	YES
Observations	338	338	338	338	338	338
R^2	0.19	0.19	0.24	0.16	0.16	0.20
F Statistic	15.00***	13.00***	10.00***	13.00***	11.00***	8.30***

The estimated effects of training presented in Table 4.5 confirm that apprentice human capital, as measured by the three indices, increases after three years, and that apprentices who do not apply to the CQP program score somewhat lower on the competence index. Higher baseline experience and competence scores for CQP applicants suggest that trainers send their more able apprentices to apply for dual training. The selection process for the program itself, however, does not favor more experienced apprentices according to our metrics (i.e. is as good as random).

The regression estimates suggest that the amount of time the apprentice had trained with the MC prior to the baseline survey, as well as the total number of apprentices training in the same firm as the interviewed apprentice, are correlated with somewhat higher index scores. Participation in the CQP program is shown to have no detectable effect on human capital accumulation, even when the sample is restricted to applicants to the CQP program only (Table 4.6 in the Appendix).

Table 4.7: Annual costs and benefits accruing to apprentice

Characteristic	Overall	CQP Selected	CQP Not Selected	Did Not Apply	p-value[3]
Apprentice survey:					
Fees					
Entry	4.22 (13.77)	3.35 (8.35)	5.52 (19.15)	-	0.3
Formation	41.80 (37.40)	40.32 (35.60)	43.98 (40.02)	-	0.5
Liberation	9.86 (19.87)	10.00 (19.64)	9.65 (20.32)	-	>0.9
Materials	6.97 (8.48)	7.31 (9.39)	6.47 (6.94)	-	0.4
Contract	6.32 (15.24)	6.42 (15.67)	6.17 (14.65)	-	>0.9
Application	2.85 (3.94)	3.12 (4.14)	2.45 (3.61)	-	0.2
Total	72.02 (47.76)	70.52 (48.98)	74.24 (46.09)	-	0.6
Allowances[1]	207.28 (289.76)	206.68 (319.95)	208.09 (245.55)	-	>0.9
Allowances net fees[2]	**134.17 (310.94)**	**141.60 (348.47)**	**123.60 (249.63)**	**-**	**0.7**
Firm survey:					
Fees					
Entry	2.74 (4.11)	2.33 (3.30)	2.82 (5.29)	3.03 (3.91)	0.3
Formation	35.95 (38.04)	20.10 (27.58)	29.04 (33.19)	53.47 (41.22)	<0.001
Liberation	9.26 (18.70)	9.44 (18.61)	7.26 (17.86)	10.30 (19.28)	0.4
Materials	6.56 (9.31)	6.35 (9.47)	6.20 (8.83)	6.95 (9.49)	0.8
Contract	8.46 (16.92)	11.01 (18.70)	8.70 (17.52)	6.18 (14.60)	0.050
Application	3.09 (4.24)	3.30 (4.25)	2.70 (4.00)	3.14 (4.38)	0.6
Total	66.06 (44.54)	52.53 (36.63)	56.72 (38.85)	83.08 (48.31)	<0.001
Allowances					
Food	70.57 (147.07)	61.57 (158.26)	89.31 (190.63)	68.07 (113.25)	0.5
Transport	60.88 (195.20)	46.23 (188.52)	79.61 (227.49)	62.18 (184.29)	0.6
Pocket money	145.96 (183.74)	135.30 (169.17)	172.89 (197.68)	140.85 (186.83)	0.5
Other	0.65 (10.64)	0.00 (0.00)	0.00 (0.00)	1.39 (15.52)	0.6
Total	489.37 (1,021.21)	583.89 (1,398.96)	632.85 (949.56)	272.50 (332.72)	0.012
Allowances net fees[2]	**438.85 (1,062.80)**	**560.26 (1,459.98)**	**593.45 (996.10)**	**195.68 (337.65)**	**0.008**

Mean (SD). Amounts in $US per apprentice per year, calculated using responses from baseline survey. Annual fees assume apprenticeship duration of four years.

[1] Apprentices were only asked about total allowances received

Table 4.7 shows estimates of the apprentices' net cost of training, taking into account training fees and allowances, as outlined in Section 4.2.3. Overall, apprentices receive more in allowances from their trainer over the course of the training period (assuming a four-year training duration) than they (or their parents) pay in total fees. Mean net benefits amount to about 82000 FCFA (135 $US) per apprentice per year according to apprentices' own estimates and 256000 FCFA (423 $US) according to the firm survey.

Formation fees (i.e. general training fees) constitute the largest transfer from the apprentice to the MC. Apprentices report significantly higher fees than the MC, for the formation fee in particular. Firms may under-report 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.

According to the figures reported by apprentices, there is no difference between CQP participants and those who applied but were not accepted into the CQP program in terms of fees, allowances, or net benefits. According to MCs, on the other hand, there are large and significant differences in fees paid and allowances received across CQP status, resulting in significant differences in net benefits. Namely, MCs report charging lower fees (in particular formation fees) and distributing higher allowances to CQP applicants (successful and unsuccessful) than to non-applicants. This amounts to 281 $US more paid per year by non-applicants per year, on average[13]

[13]These figures are difficult to explain, as most CQP applicants would have established the terms of their agreement with the MC several years before actually applying to the dual system program, and there is no apparent reason why dual system applicants should be charged less than other apprentices. One possibility is a reporting bias: we have seen that CQP applicants had been training longer at the time of the baseline survey: thus, any fees paid at the onset of training would have been paid earlier by these apprentices than non-CQP apprentices, resulting in possible recall bias on the part of the trainers.

4.3.2 Impact of Informal and Dual Training on Firms

Table 4.8: Annual costs and benefits per apprentice accruing to firm

Characteristic	N	Overall	CQP Selected	CQP Not Selected	Did Not Apply	p-value[2]
Benefits						
Fees[1]	403	65.30 (44.66)	50.74 (36.67)	57.68 (39.33)	83.08 (48.31)	<0.001
Apprentice prod.	1141	1,075.59 (1,172.98)	869.20 (1,050.46)	1,246.57 (1,294.84)	1,118.48 (1,183.45)	0.4
Total	**1041**	**1,140.89 (1,198.06)**	**939.01 (1,059.45)**	**1,302.16 (1,343.08)**	**1,195.75 (1,212.34)**	**0.5**
Costs						
Allowances						
Food	266	70.57 (147.07)	61.57 (158.26)	89.31 (190.63)	68.07 (113.25)	0.5
Transport	266	60.88 (195.20)	46.23 (188.52)	79.61 (227.49)	62.18 (184.29)	0.6
Pocket money	266	145.96 (183.74)	135.30 (169.17)	172.89 (197.68)	140.85 (186.83)	0.5
Other	266	0.65 (10.64)	0.00 (0.00)	0.00 (0.00)	1.39 (15.52)	0.6
Total[1]	360	489.37 (1,021.21)	583.89 (1,398.96)	632.85 (949.56)	272.50 (332.72)	0.012
Training costs						
Rent	229	26.83 (59.79)	24.18 (52.84)	40.90 (80.34)	19.55 (47.29)	0.10
Equipment	226	32.61 (81.94)	24.75 (50.81)	56.15 (129.04)	24.98 (63.74)	0.046
Books	224	8.93 (44.17)	7.65 (40.66)	12.32 (51.90)	7.96 (42.41)	0.8
Raw materials	223	44.10 (140.23)	55.07 (187.93)	46.60 (107.48)	30.62 (92.12)	0.5
Total	229	110.69 (233.24)	110.95 (251.60)	149.32 (249.61)	82.63 (196.58)	0.2
Lost trainer prod.	245	36.08 (45.78)	37.68 (47.11)	30.40 (38.00)	37.97 (48.74)	0.6
Total	**96**	**666.56 (698.44)**	**676.45 (673.07)**	**876.90 (805.36)**	**464.40 (582.52)**	**0.082**
Net Benefits						
Model I	341	-437.12 (1,047.68)	-547.64 (1,422.47)	-588.98 (979.25)	-195.68 (337.65)	0.008
Model II	198	-480.28 (661.41)	-571.18 (764.74)	-638.96 (670.01)	-237.96 (413.50)	0.001
Model III	75	726.77 (1,275.80)	444.72 (1,169.03)	811.85 (1,468.62)	1,005.74 (1,162.53)	0.3
Model IV	31	631.55 (1,406.07)	78.33 (1,264.37)	1,209.68 (1,683.05)	588.84 (691.70)	0.14
Model V	28	686.67 (1,378.91)	-8.33 (1,298.95)	1,525.25 (1,460.55)	580.85 (688.28)	0.031

Mean (SD). Amounts in $US per apprentice per year. Calculated using responses from baseline survey, except training costs which were not elicited until endline. Net benefits are not computed for rows with missing data for any categories included in a given model. Mean net benefit estimates may deviate from sums of the relevant categories as a result.

[1] Fees and allowances reported by firm owner. Annual fees assume apprenticeship duration of four years,

Next, we study the net benefits from apprenticeship training accruing to firms. We also investigate whether the firms training more CQP apprentices experience higher productivity growth over the three-year period under investigation.

To first measure benefits in an accounting sense, we use the five "models" summarized in Table 4.3 and described in detail in Section 4.2.4. Table 4.8 above shows the annual costs and benefits estimated per apprentice, group by CQP status. Mean net benefits range from -437 $US to 687 $US per apprentice per year, depending on the model used. Apprentice allowances and productivity are the decisive factors determining whether training is profitable for a given apprentice; the sign of the mean of each of the net benefit models thus hinges on the inclusion of the apprentice productivity variable (not included in Models I and II; included in Models III-V).

Firm owners report receiving around 261 $US in total fees per apprentice, or 65 $US per year (assuming 4 years of training). This implies a minor increase in the costs of training in Bénin over the past two decades: for instance, Walther and Filipiak (2007) report total fees ranging from 50,000 to 150,000 FCFA (96-290 $US, inflation adjusted). Formation fees represent the largest single fee 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. As we have seen, apprentices who do not apply to the CQP pay higher training fees and receive less in allowances (both differences significant at the 5 percent level). This also contributes to the significantly lower net costs for this group when estimated with Models I and II.

Apprentice productivity is calculated using firm-level wage information, an approach similar to apprenticeship cost-benefit studies by Wolter and Mühlemann (2015), Mühlemann et al. (2018), Bolli et al. (2020), and Bolli et al. (2021) and described in Section 4.2.3. The annual productivity estimates reported in Table 4.8 are an order of magnitude higher than the estimated annual benefits from training fees. Because the wage data necessary for estimating apprentice productivity is not available for many of the small firms in the sample, however, apprentice productivity can only be estimated for about a quarter of the sample.

Total expenses for training amount to 676 $US per year for CQP participants, and 660 $US per year for all others. These estimates suggest a significant increase in the costs of training for CQP apprentices over the past decade: David-Gnahoui and Ahouangnivo (2017), citing Zinsou (2012), reported total costs of 100,000 to 250,000 FCFA ($165-$413) for a complete CQP training program in 2012, a total that is exceed by reported expenditures for rent, equipment, books, and raw materials alone (for a four-year apprenticeship) in our data.

Allowances paid to apprentices by MCs comprise the largest reported cost of training for firms, accounting for 73.42% of all training costs. Table 4.8 shows that allowances disbursed to CQP participants and CQP applicants are significantly higher than to non-applicants; as applicants tend to be older and more experienced apprentices, this may suggest that apprentice productivity (or at least their remuneration) tends to increase over time. Expenditures on equipment, raw materials and rent for training spaces, grouped together as non-wage training costs, are the second-largest expenditure for firms and average

111$US, while lost trainer productivity only totals about 36$US — an order of magnitude less than the estimated expenditure on allowances. These various costs of training per apprentice reported by the MCs are summarized in Figure A4.2 in the Appendix.

The distributions of per-apprentice net benefits have long left tails for Models I and II and long right tails for Models III-V (plotted with their means in Figure A4.4 in the Appendix). The left tails are a consequence of the high number of apprentices in a number of firms generating unrealistic annual allowance totals. These are more than compensated by apprentice productivity estimates when included in Models III, IV, and V, skewing the distribution to the right for these models. For models excluding apprentices' productive contributions to the firm (Model I and Model II), we find that apprentices who applied to the CQP program (selected and not selected) are significantly more costly to train (incur higher net costs) on average than non-applicants, on account of the higher allowances MCs report they receive. Only 5-11 percent of apprentices generate positive net benefits when productivity is left unaccounted for (Models I and II). When apprentice productivity is included in the estimate in Models III, IV, and V, 68-71 percent of apprentices are estimated to provide a net benefit to their training firm.

Estimates for Models III-V are only available for a small number of apprentices due to the requirement that net benefits only be computed when data for all cost and benefit categories included in the respective model are available. The variance in benefits is high, ranging from net benefits of 4000 $US to net costs of 2000 $US per apprentice per year. Though large in magnitude, the differences in net benefits between the three CQP groups are not statistically significant due to the limited sample and high variance for Models III and IV. Differences in net benefits are, however, significant for Model V, which includes all cost and benefit categories: CQP apprentices are nearly break-even, while unsuccessful CQP applicants generate benefits of -8.33 $US and non-applicants generate net costs of 580.85 $US. Unfortunately, net benefits could only be estimated for 28 apprentices using this model. When only unsuccessful CQP applicants are used as the control group, net benefits are significantly lower for CQP participants according to Models IV and V (see Table A4.11 in the Appendix). Further tabulations can be found in the Appendix: Table A4.12 compares baseline and endline results, while Table A4.13 reports cost and benefit estimates by trade.

Table 4.9: Annual net benefits per firm

		Firm size[1]			
	Overall, N = 196	**[1,4]**, N = 54	**(4,6]**, N = 52	**(6,10]**, N = 44	**(10,107]**, N = 46
Firm Accounts					
Revenues	3,989 (4,820)	2,059 (1,656)	2,700 (2,301)	4,034 (5,233)	8,028 (6,757)
Wage bill	977 (2,357)	272 (473)	601 (951)	783 (994)	2,446 (4,380)
Non-wage expenses	1,600 (3,159)	810 (734)	952 (1,298)	1,473 (2,037)	3,368 (5,666)
Total expenses	2,585 (4,461)	1,082 (959)	1,564 (1,777)	2,256 (2,615)	5,866 (7,799)
Profits (reported)	1,672 (2,634)	951 (966)	1,374 (1,247)	1,567 (1,957)	3,040 (4,646)
Profits[2] (calculated[2])	1,701 (3,056)	993 (1,390)	1,393 (1,776)	1,861 (4,551)	2,849 (3,518)
Projected benefits					
Fees	349 (366)	116 (102)	246 (176)	374 (249)	715 (518)
Apprentice prod.	8,359 (13,033)	191 (165)	1,269 (1,339)	2,804 (3,099)	17,280 (16,049)
Total	8,887 (13,241)	363 (255)	1,334 (1,400)	3,148 (3,203)	17,860 (16,023)
Projected costs					
Allowances	3,224 (7,758)	871 (2,083)	2,150 (3,544)	2,681 (4,607)	7,823 (14,026)
Training costs	518 (1,110)	191 (322)	385 (539)	810 (1,887)	822 (1,191)
Lost trainer prod.	181 (421)	72 (86)	97 (103)	136 (190)	423 (768)
Total	3,190 (4,441)	927 (626)	2,302 (2,299)	5,566 (8,254)	5,546 (3,806)
Net benefits					
Model I	-2,963 (7,778)	-774 (2,180)	-1,928 (3,551)	-2,324 (4,536)	-7,187 (14,014)
Model II	-3,199 (8,563)	-574 (518)	-2,163 (2,403)	-3,267 (5,625)	-8,315 (16,940)
Model III	5,574 (12,052)	-571 (792)	-198 (1,142)	1,134 (4,091)	11,488 (15,537)
Model IV	6,431 (12,457)	-1,039 (757)	-574 (1,290)	1,225 (6,979)	11,520 (14,510)
Model V	6,593 (12,285)	-1,108 (777)	-617 (1,296)	4,001 (4,911)	11,187 (14,678)

Mean (SD). Net benefits per firm estimated using baseline data. Projected costs, benefits, and net benefits calculated as mean values for all observed apprentices in firm times reported number of apprentices trained. Amounts in $US.

[1] Firms size calculated by author as sum of all reported workers in firm, including apprentices and occasional and family workers.

[2] Profits recalculated by author as difference between reported revenues (first row) and reported expenses (second row).

In a small number of firms, differences in net benefits for individual firms results in apprentices with both positive and negative net benefits to appear in the same firm, resulting in an ambiguous net benefit for the firm. Moreover, we would like to determine the size of the total costs and benefits of apprenticeship training — i.e., for all apprentices in the firm — relative to total firm revenues and expenditures. To this end, we estimate firm-level net benefits, calculated as the average costs and benefits of all observed apprentices in a given firm multiplied by the total number of apprentices training at that firm[14]. Firm-level net benefits of training are then calculated using Models I-V from before, and are shown in Table 4.9 above.

Mean estimated benefits per firm average range from -2410 $US per year to 1250 $US per year, with the large variance in estimates once again driven by apprentice productivity estimates. Table 4.9 reports estimates by firm size, showing that the largest firms in the sample, through significantly higher reported wages, benefit from significantly higher estimated apprentice productivity. Allowances are, as in the individual-level estimations, by far the largest cost related to training. Firm-level aggregation suggests that our methodology may in fact overestimate apprentice allowances: for all but the smallest firms, total estimated allowances are on average higher than total firm expenditures reported by the firm.

As with the individual-level estimates, the majority of firms are clustered around zero net benefits for all cost-benefit models, with long left and right tails depending on the model used. Models I and II exhibit long left tails, while Models III-V have long right tails, albeit for fewer observations (plotted with their means in Figure A4.5 in the Appendix). According to Models I and II, 9 and 3 percent of firms are estimated to earn a positive net benefit from training (positive net benefits) respectively; when apprentice productivity is included in the estimate, this rises to 73, 67, and 60 percent, according to Models III, IV, and V, respectively.

[14]As training costs are reported at the firm level and apprentice and trainer productivity estimates were based on firm-reported wage schedules and training frequency, we in effect only extrapolate fee and allowance totals.

Table 4.10: Firm-level regressions

	log Revenues					log profits					log Firm size[1]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
No. of Apprentices:											
log CQP Selected	0.05	0.02	0.08	0.08	0.08*	0.02	0.05	0.03	0.03	0.06**	0.04
	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.07)	(0.08)	(0.02)	(0.03)	(0.03)
log CQP Not Selected/Did Not Apply	0.29**	0.24*	0.23*	0.28**	0.23**	0.20	0.20	0.23	0.05	0.05	0.03
	(0.08)	(0.09)	(0.09)	(0.10)	(0.10)	(0.13)	(0.13)	(0.15)	(0.06)	(0.06)	(0.06)
Endline	0.33*	0.41*	0.56**	0.49**	−0.21	−0.16	−0.10	−0.21	−0.11	0.02	−0.05
	(0.13)	(0.16)	(0.18)	(0.21)	(0.16)	(0.22)	(0.25)	(0.31)	(0.11)	(0.12)	(0.13)
log Firm Size[1]		0.43**	0.40**	0.34**		0.42*	0.41*	0.50**			
		(0.13)	(0.13)	(0.15)		(0.19)	(0.19)	(0.23)			
log CQP Selected x Endline		−0.12*	−0.01			−0.05	0.18		−0.10**		−0.01
		(0.07)	(0.12)			(0.09)	(0.16)		(0.05)		(0.07)
MC Age			0.02*				0.01				0.01
			(0.01)				(0.02)				(0.01)
MC Years of Schooling			0.01				0.01				0.003
			(0.02)				(0.04)				(0.01)
Registered Firm[2]			0.34				−0.14				0.34**
			(0.24)				(0.35)				(0.14)
Trade Association			−0.32				−0.18				0.21
			(0.26)				(0.38)				(0.15)
Training Frequency[3]			−0.03				0.10				−0.03
			(0.10)				(0.14)				(0.05)
Constant	7.40***	7.30***	7.30***	6.80***	7.00***	6.90***	6.80***	6.10***	1.30**	1.20***	0.94***
	(0.13)	(0.23)	(0.23)	(0.56)	(0.17)	(0.33)	(0.34)	(0.96)	(0.10)	(0.10)	(0.33)
Trade FE	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	YES
Observations	252	112	112	107	200	82	82	78	130	130	124
R^2	0.08	0.19	0.21	0.33	0.05	0.11	0.11	0.20	0.03	0.07	0.19
F Statistic	7.40***	6.40***	5.80***	3.20***	3.60**	2.30*	1.90	1.10	1.30	2.30*	1.90**

Note: *p<0.1; **p<0.05; ***p<0.01

[1]Excluding apprentices.

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, firms may experience positive spillovers from training, for instance through introduction to a new technology or learning how to better operate machinery already in the workshop. 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, reported increased profits of up to 15% per apprentice (Alfonsi et al., 2020; Hardy and McCasland, 2022).

The results from OLS regressions on three firm outcomes are shown in Table 4.10. We find that firm which sent more apprentices to the CQP did not report higher firm revenue or profit growth over the three years under observation. Firms with more non-apprentice workers are found to be more profitable on average after controlling for the number of apprentices training in the firm. Firms with more apprentices, on the other hand, generate higher revenues (after controlling for non-apprentice workers), but these revenues to not translate to higher profitability: a 10 percent increase in the number of apprentices is associated with revenue increases of about 2.5 percent, but not with any significant changes in profits. This suggests that apprentices' productive contributions are often offset in large part by the costs of their training. Finally, we note that reported firm revenues increase by close to 50% between baseline and endline, but are offset by rising costs and wages, to the point of eliminating any observed growth in profitability.

4.4 Conclusion

This study of informal apprenticeship makes several contributions to the literature. First, it is one of the first papers to contrast the efficacy of dual system training in the informal sector to informal apprenticeship. Second, it analyses the benefit of apprenticeship training from the perspective of both the apprentices and the training firms.

Our findings show that, after three years of training, there are no measurable benefits of dual training in terms of human capital accumulation or firm outcomes. Applicants to the CQP as a group progress less than non-applicants, likely because CQP applicants tend to be older, more experienced, and better educated. There are several possible explanations for this disappointing result: most importantly, disruptions to the training schedule as a result of the Covid-19 pandemic caused many days of theoretical teaching to be grouped into longer sessions or to be cancelled outright. However, funding disruptions, poor attendance of theoretical classes, and insufficient trainer qualification at the vocational centers may have also negatively influenced learning outcomes. These and other issues discussion are at the center of an ongoing discussion concerning the history and implementation of the CQP program (Bankolé and Nouatin, 2020; David-Gnahoui and Ahouangnivo, 2017; Davodoun, 2011), to which our study contributes valuable

empirical evidence.

We also find that informal apprenticeship training in general improves apprentice human capital: faced with the same battery of sector-specific knowledge questions after three years, apprentices' scores increased by .13 standard deviations, while their master trainers' assessment of their competence and experience on a series of sector-specific tasks increased by 0.46 SDs and 0.58 SDs, respectively.

Finally, the results suggest that while informal apprentices in Bénin generally receive no formal wages, small, irregular allowances disbursed to youth for small expenses nevertheless contribute significantly to total firm expenditures. 89 percent of apprentices receive more in allowances than they pay in fees when apprenticeships are assumed to last four years. The average apprentice receives 437 $US more per year in allowances than he or she pays in fees assuming a four year apprenticeship — a significant proportion of total firm revenues. Considering that the average firm reported training 6 apprentices (68.4 percent of all workers in the firm), it becomes clear that apprentices' productive contributions to the firm must be substantial.

Measuring contributions using skilled and unskilled wages and reported hours worked results in very high apprentice productivity estimates, and only for a fraction of firms. These estimates suggest that apprentices contribute about 1100 $US in productive contributions per year. An alternative would be to assume that, due to perfectly competitive markets, firms break even on training. If we assume that allowances and reported monthly training costs are the only expenses related to training, and apprentice fees and productivity the only benefits, firm responses suggest an apprentice productivity equal to480 $US annually. Firms' total net benefits from apprenticeship training are large and positive when these estimated apprentice productivity are included (especially for large firms), and nearly as large but negative when they are excluded. Our contribution is to highlight the relative importance of apprentice productivity and allowances in cost-benefit analyses of informal apprenticeship, though our data does not allow us to pinpoint precise net benefits for all firms.

The first policy recommendation stemming from this research is to encourage master craftsmen to send younger, less experienced youth to apply to the CQP program. First, this is the target group of the program, and second, theoretical training is likely to be more effective if it coincides with practical training, rather than taking place after most of the practical skills have been attained.

Second, we suggest an increased emphasis on the quality and regularity of classroom training. Ensuring that vocational centers employ certified trainers, providing teacher training, and returning to a weekly schedule for theoretical training.

Third, to encourage regular apprentice attendance and incentivize MCs to release their apprentices to dual training once a week, dispense allowances from the training center. These allowances would be budgeted under FODEFCA's contributions to the CQP. This paper finds that allowances represent the largest cost related to training for firms; a 20 percent reduction in this cost should provide a significant incentive ensuring regular apprentice attendance.

In summary, our results show the tangible and significant skill acquisition that informal apprenticeship

can provide. Apprentices in our sample are the beneficiaries of both human capital and financial capital from their master trainers. However, the number of apprentices hired relative to other workers suggests that apprentices repay their firms through substantial productive contributions. This suggests a model of informal apprenticeship that diverges from previous models, which emphasize the role of fees exchanged for specific human capital rather than productive contributions exchanged for allowances.

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Appendix A4

Table A4.1: Apprentice attrition

Characteristic	**Baseline**, N = 427	**Endline**, N = 240	**p-value**
Age	21.3 (3.4)	21.2 (3.4)	0.7
Male	98%	98%	>0.9
Education			>0.9
Primary	91 (22%)	51 (21%)	
Secondary	230 (57%)	136 (57%)	
<Primary	61 (15%)	35 (15%)	
Technical	8 (2.0%)	6 (2.5%)	
Tertiary	6 (1.5%)	3 (1.3%)	
None	10 (2.5%)	8 (3.3%)	
CQP status			0.5
Selected	149 (35%)	90 (39%)	
Not Selected	107 (25%)	59 (25%)	
Did Not Apply	171 (40%)	84 (36%)	
Training experience, years	2.33 (1.38)	2.39 (1.38)	0.5
Trade			
Masonry	0 (NA%)	0 (NA%)	
Carpentry	0 (NA%)	0 (NA%)	
Plumbing	0 (NA%)	0 (NA%)	
Metalworking	0 (NA%)	0 (NA%)	
Electrical Inst.	0 (NA%)	0 (NA%)	

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

[2] Wilcoxon rank sum test; Fisher's exact test; Pearson's Chi-squared test

Table A4.2: Likelihood of apprentice attrition

	All apprentices		Excluding non-applicants	
	(1)	(2)	(3)	(4)
CQP Selected (reference)				
CQP Not Selected	0.22	−0.47	−0.52	−0.85
	(0.26)	(0.42)	(0.45)	(0.62)
CQP Did Not Apply	0.46**	0.17		
	(0.23)	(0.41)		
Masonry (reference)				
Carpentry		0.04	0.52	0.55
		(0.52)	(0.70)	(0.91)
Plumbing		−0.81	−1.10*	−0.72
		(0.51)	(0.66)	(0.89)
Metalwork		0.94	2.60**	2.50**
		(0.60)	(1.10)	(1.30)
Electrical Inst.		−0.30	−0.23	−2.00
		(0.43)	(0.60)	(1.20)
Baseline Experience[1]		0.06	0.01	0.03
		(0.14)	(0.19)	(0.35)
log Firm size[2]		0.36	0.24	0.68
		(0.32)	(0.43)	(0.60)
Apprentices in Firm		−0.03	−0.02	0.05
		(0.03)	(0.04)	(0.06)
Household Size				0.15
				(0.09)

Table A4.3: Firm attrition

Characteristic	**Baseline**, N = 197	**Endline**, N = 150	**p-value**
Apprentices trained			
Total	5.4 (4.7)	5.5 (4.6)	0.7
Selected	1.20 (1.82)	1.08 (1.55)	0.9
Not Selected	1.47 (2.68)	1.44 (2.84)	0.8
Did Not Apply	2.7 (3.1)	2.9 (3.2)	0.6
Firm size			
Total (calculated)	8.8 (9.1)	8.9 (9.9)	>0.9
Total (reported)	6.7 (7.5)	6.9 (7.9)	0.9
Permanent employees	0.36 (1.75)	0.31 (1.90)	0.4
Paid family workers	0.0561 (0.3536)	0.0336 (0.2149)	0.6
Unpaid family workers	0.0510 (0.3615)	0.0470 (0.3737)	0.7
Occasional workers	0.83 (2.62)	0.74 (2.67)	0.5
Trade			>0.9
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] Mean (SD); n (%)

[2] Wilcoxon rank sum test; Pearson's Chi-squared test

Table A4.4: Likelihood of firm attrition

	attr				
	(1)	(2)	(3)	(4)	(5)
Total apprentices	−0.05				
	(0.05)				
No. of CQP Selected	0.18*	0.15*	0.16	0.26**	0.20**
	(0.11)	(0.09)	(0.11)	(0.13)	(0.10)
No. of CQP Not Selected		0.02	0.03	−0.03	0.01
		(0.06)	(0.06)	(0.07)	(0.06)
No. of CQP Did Not Apply		−0.09	−0.09	−0.19**	−0.11*
		(0.06)	(0.07)	(0.09)	(0.06)
log Annual Profits (reported)			−0.18		
			(0.17)		
log Firm Size[1]				0.25	
				(0.50)	
Masonry (reference)					
Carpentry					−0.38
					(0.60)
Plumbing					−1.30**
					(0.68)
Metalwork					−0.88
					(0.54)
Electrical Inst.					−0.52
					(0.46)
Constant	−1.10***	−1.10***	1.30	−0.89	−0.58
	(0.26)	(0.26)	(2.20)	(0.65)	(0.37)

Figure A4.1: Firm size distributions

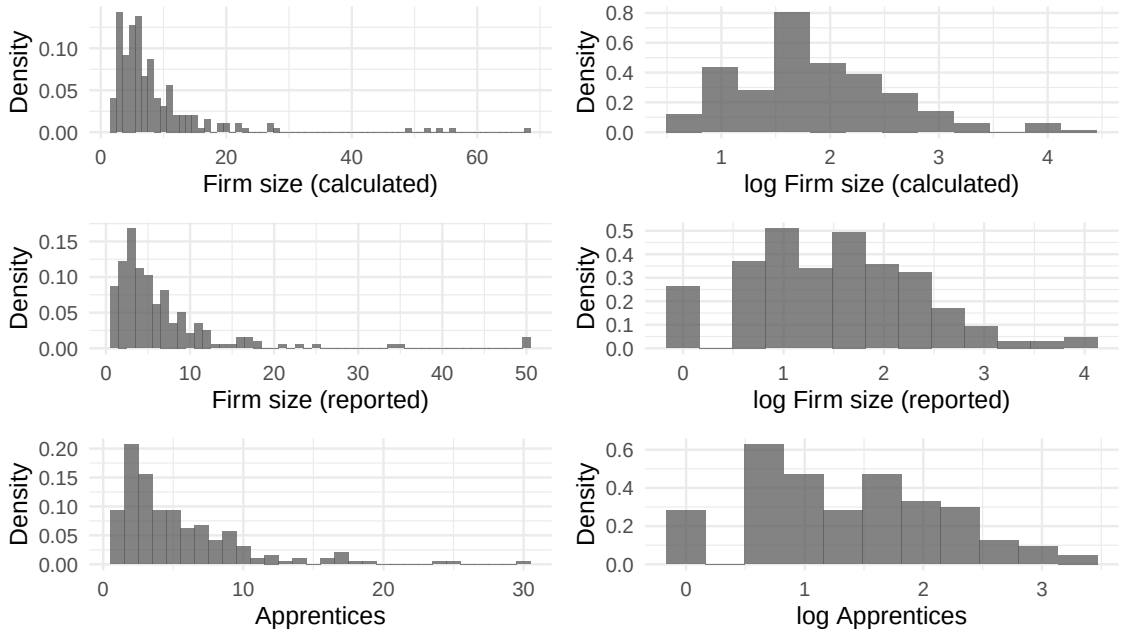


Table A4.6: Change in apprentice human capital scores

	CQP Selected, N = 150	**CQP Not Selected**, N = 112	**Did Not Apply**, N = 172	**p-value**[3]
Competence[1]	0.110 (0.201)	0.060 (0.165)	0.158 (0.325)	0.12
Experience[1]	0.148 (0.222)	0.104 (0.207)	0.206 (0.314)	0.12
Competence[1]	0.110 (0.201)	0.060 (0.165)		0.3
Experience[1]	0.148 (0.222)	0.104 (0.207)		0.5
Knowledge[2]	0.034 (0.185)	0.017 (0.166)		0.8

Mean (SD). Change in human capital indices between baseline and endline.

[1] Percent of trade-specific tasks apprentice is deemed competent in (competence) or has already successfully attempted (experience), as reported by MC. Total of 10-15 tasks, depending on trade.

[2] Percent of trade-specific knowledge questions answered correctly by apprentice. Total of 4 or 5 questions, depending on trade.

[3] Analysis of variance for three groups, Wilcoxon rank sum test for two groups

Table A4.5: Competence and experience, MC vs. apprentice assessment

Group	Trade	N	Apprentice	N	Firm	p-value[1]
Competence	Electrical Installation	49	0.97 (0.06)	46	0.98 (0.05)	0.7
	Masonry	28	0.95 (0.08)	28	0.94 (0.10)	>0.9
	Carpentry	14	0.92 (0.13)	16	0.95 (0.08)	0.5
	Plumbing	25	0.95 (0.13)	22	0.92 (0.15)	0.7
	Metalwork	21	0.90 (0.17)	26	0.92 (0.15)	0.4
	CQP Selected	79	0.95 (0.11)	82	0.95 (0.11)	0.6
	CQP Not Selected	58	0.95 (0.10)	56	0.94 (0.10)	0.9
	Overall	**137**	**0.95 (0.11)**	**138**	**0.95 (0.11)**	**0.6**
Experience	Electrical Installation	49	0.97 (0.06)	46	0.97 (0.06)	0.9
	Masonry	28	0.95 (0.09)	28	0.93 (0.11)	0.9
	Carpentry	14	0.95 (0.12)	16	0.99 (0.03)	0.5
	Plumbing	25	0.98 (0.06)	22	0.89 (0.17)	0.019
	Metalwork	21	0.89 (0.16)	26	0.89 (0.11)	0.8
	CQP Selected	79	0.96 (0.10)	82	0.93 (0.11)	0.2
	CQP Not Selected	58	0.95 (0.09)	56	0.94 (0.11)	>0.9
	Overall	**137**	**0.95 (0.10)**	**138**	**0.94 (0.11)**	**0.3**

Mean (SD). Proportion of trade-specific tasks apprentice is deemed competent in (competence) or has already successfully attempted (experience), as reported by MC. Total of 10-15 tasks, depending on trade. Comparison only possibly at endline as apprentices were not asked to self-assess competence and experience at baseline.

[1] Wilcoxon rank sum test

Table A4.7: Monthly allowances

Group	Characteristic	Overall, N = 427	CQP Selected	CQP 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)

Mean (SD). Amounts in $US.

Table A4.8: 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	290.91 (158.68)	284.93 (158.68)	301.90 (158.68)
	mid	316.18 (208.26)	304.39 (208.26)	338.72 (208.26)
	upper	397.15 (257.85)	384.34 (257.85)	421.61 (257.85)
(F) months/year | 20 days/month	lower	249.51 (158.68)	238.87 (145.45)	269.08 (158.68)
	mid	271.07 (168.60)	256.64 (163.64)	298.65 (197.11)
	upper	340.26 (236.36)	324.79 (198.35)	369.81 (257.85)
12 months/year | 4 x (F) weeks/month	lower	343.66 (190.41)	335.06 (190.41)	359.47 (190.41)
	mid	373.36 (249.92)	357.68 (249.92)	403.29 (249.92)
	upper	468.69 (309.42)	451.42 (309.42)	501.69 (309.42)
(F) months/year | 4 x (F) weeks/month	lower	297.10 (185.12)	282.53 (174.55)	323.87 (190.41)
	mid	322.42 (196.36)	303.11 (180.50)	359.30 (240.99)
	upper	404.36 (257.85)	383.22 (226.12)	444.73 (309.42)
12 months/year | 4 x (A) weeks/month	lower	364.41 (222.15)	337.82 (206.28)	451.37 (222.15)
	mid	394.66 (247.60)	360.43 (236.03)	515.74 (291.57)

Table A4.9: 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	199.00 (198.35)	187.81 (158.68)	251.95 (238.02)
	mid	264.77 (238.02)	252.64 (198.35)	322.18 (317.36)
	upper	330.49 (277.61)	317.41 (237.94)	392.33 (396.61)
(F) months/year | 4 weeks/month	lower	164.96 (119.01)	153.26 (115.70)	220.33 (218.18)
	mid	221.36 (158.68)	208.59 (145.45)	281.80 (290.91)
	upper	277.71 (198.27)	263.87 (181.75)	343.20 (363.56)

[1] Mean (Median)

Mean (Median). (F): reported by firm; (A): reported by apprentices. Amounts in $US.

Figure A4.2: Breakdown of mean annual training costs per apprentice

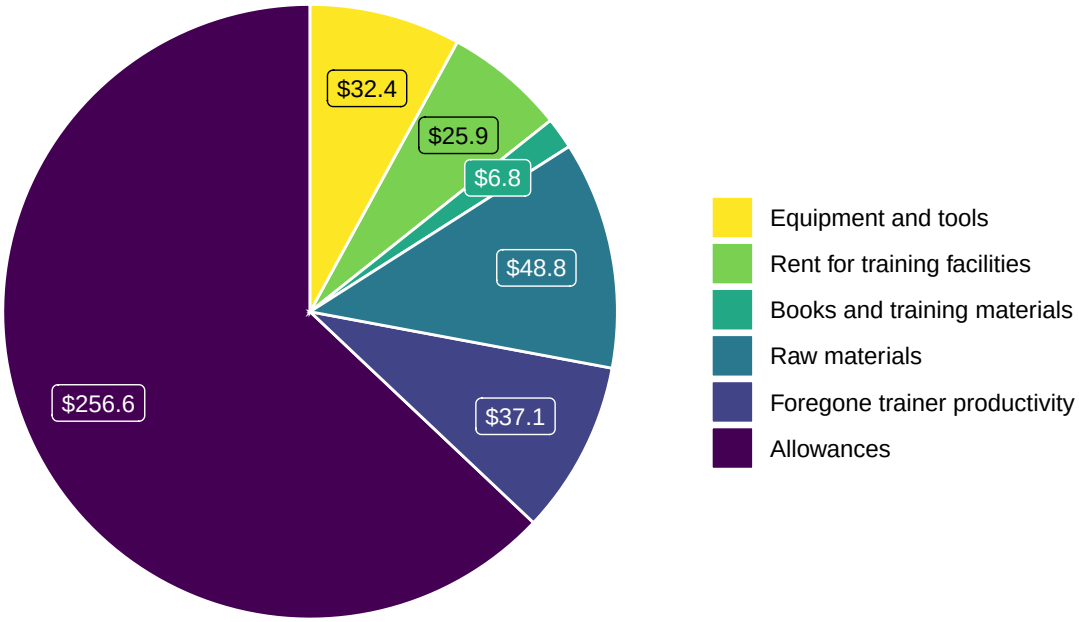


Figure A4.3: Breakdown of mean annual training costs per firm

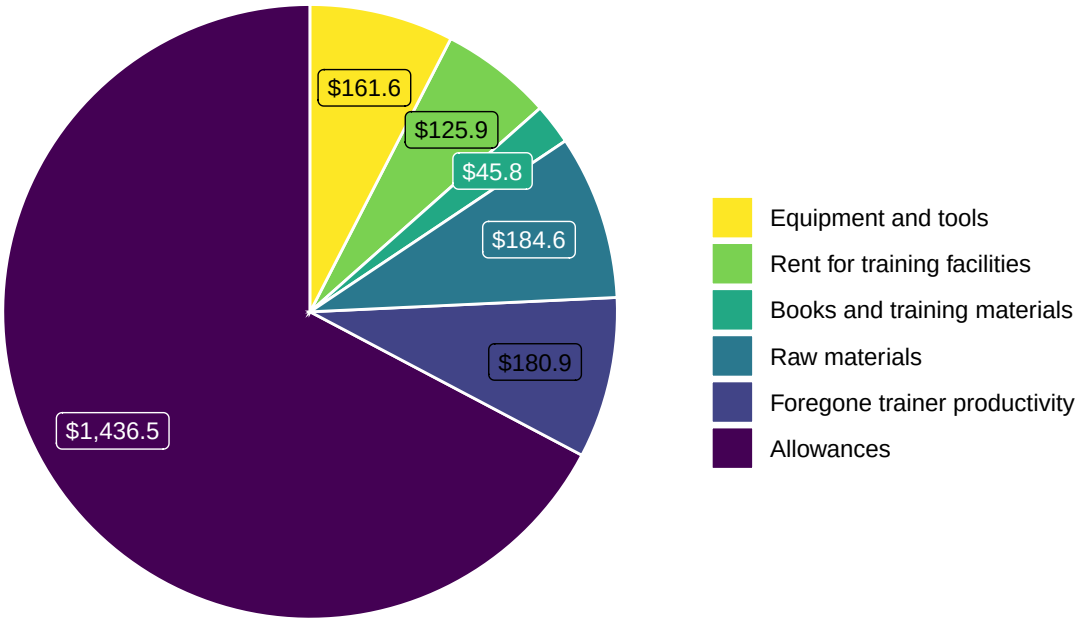
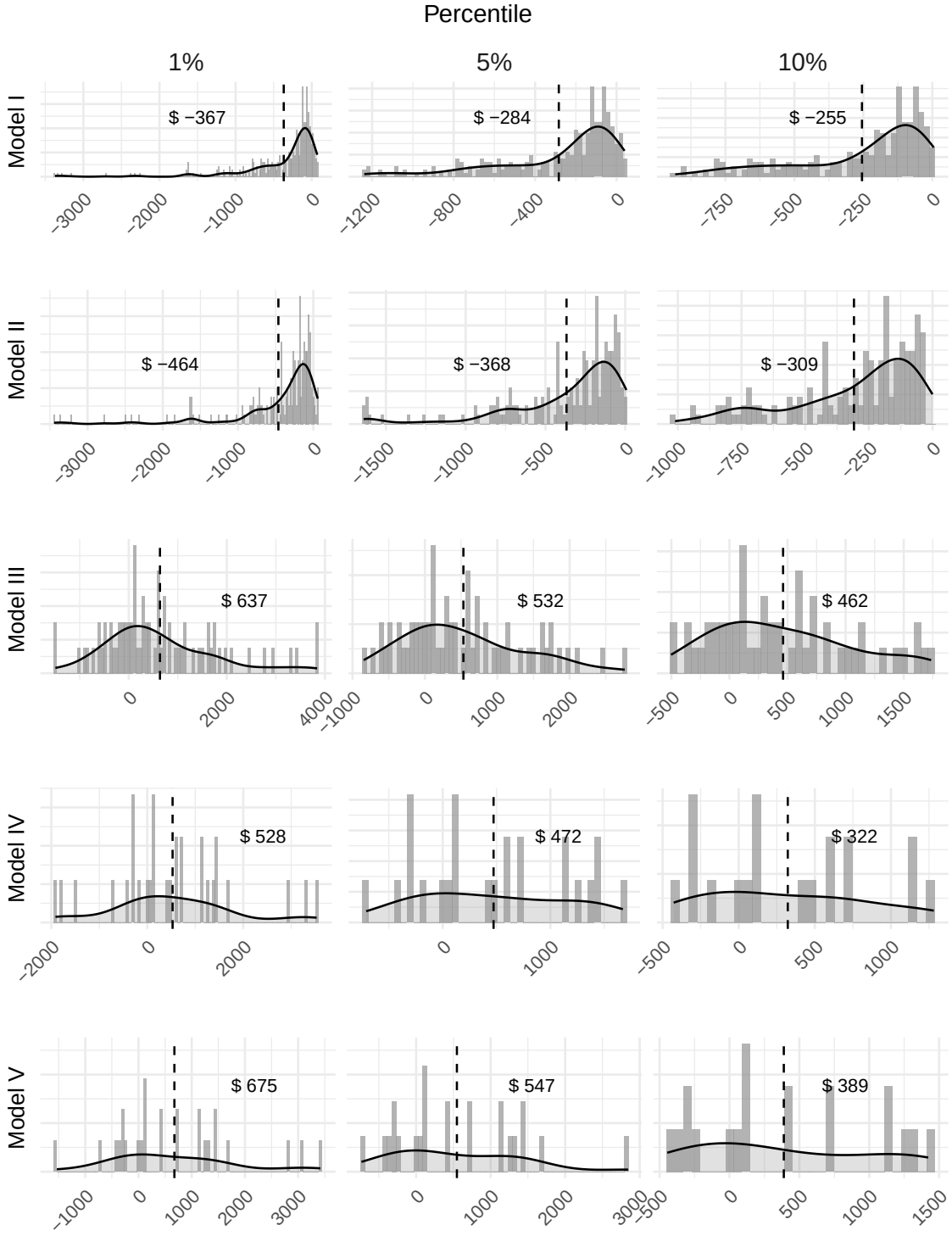
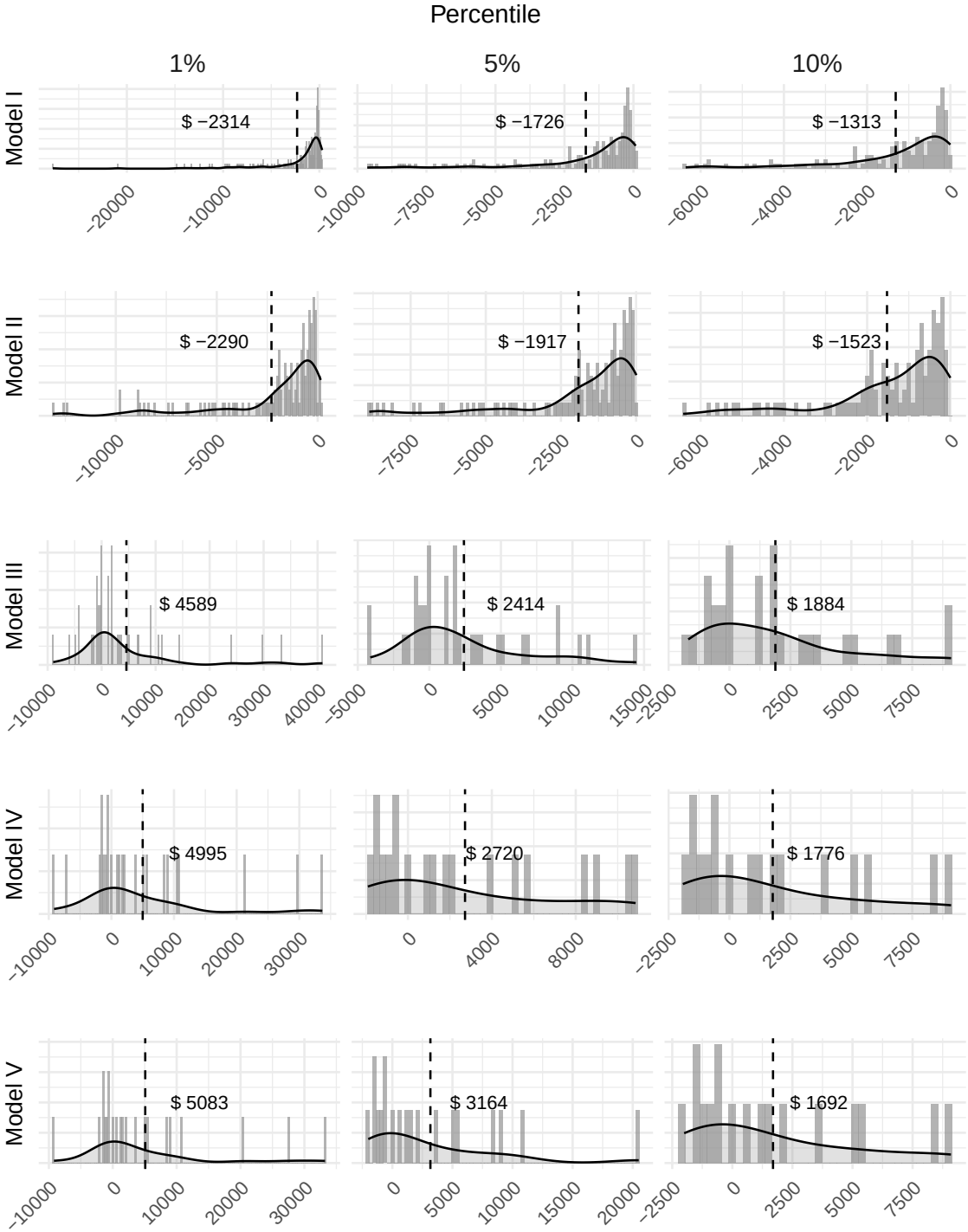


Figure A4.4: Distribution of net benefits per apprentice



Net benefits estimated using baseline data and truncated at first, fifth and tenth percentiles. Density on y−axis. Labelled dotted line indicates mean of truncated distribution.

Figure A4.5: Distribution of net benefits per firm



Net benefits estimated using baseline data and truncated at first, fifth and tenth percentiles. Firm benefits calculated as mean net benefits of all observed apprentices in firm times reported number of apprentices trained. Density on y−axis. Labelled dotted line indicates mean of truncated distribution.

Table A4.10: 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 \\$US.

Table A4.11: Annual costs and benefits per apprentice, CQP applicants only

Characteristic	N	Overall	N	CQP Selected	N	CQP Not Selected	p-value
Benefits							
Fees[1]	243	53.60 (37.86)	143	50.74 (36.67)	100	57.68 (39.33)	0.2
Entry	231	2.53 (4.24)	135	2.33 (3.30)	96	2.82 (5.29)	0.4
Formation	231	23.82 (30.29)	135	20.10 (27.58)	96	29.04 (33.19)	0.027
Liberation	231	8.54 (18.29)	135	9.44 (18.61)	96	7.26 (17.86)	0.4
Materials	231	6.29 (9.19)	135	6.35 (9.47)	96	6.20 (8.83)	>0.9
Contract	231	10.05 (18.22)	135	11.01 (18.70)	96	8.70 (17.52)	0.3
Application	231	3.05 (4.15)	135	3.30 (4.25)	96	2.70 (4.00)	0.3
Apprentice prod.	62	1,039.62 (1,172.56)	34	869.20 (1,050.46)	28	1,246.57 (1,294.84)	0.2
Total	**59**	**1,099.04 (1,195.77)**	**33**	**939.01 (1,059.45)**	**26**	**1,302.16 (1,343.08)**	**0.3**
Costs							
Allowances[1]	235	604.73 (1,225.89)	135	583.89 (1,398.96)	100	632.85 (949.56)	0.8
Food	141	72.79 (171.96)	84	61.57 (158.26)	57	89.31 (190.63)	0.3
Transport	141	59.73 (205.04)	84	46.23 (188.52)	57	79.61 (227.49)	0.3
Pocket money	141	150.50 (181.49)	84	135.30 (169.17)	57	172.89 (197.68)	0.2
Other	141	0.00 (0.00)	84	0.00 (0.00)	57	0.00 (0.00)	
Training costs	147	126.35 (250.66)	88	110.95 (251.60)	59	149.32 (249.61)	0.4
Rent	147	30.89 (65.54)	88	24.18 (52.84)	59	40.90 (80.34)	0.13
Equipment	144	36.96 (90.62)	88	24.75 (50.81)	56	56.15 (129.04)	0.042
Books	143	9.48 (45.27)	87	7.65 (40.66)	56	12.32 (51.90)	0.5
Raw materials	142	51.79 (161.19)	87	55.07 (187.93)	55	46.60 (107.48)	0.8
Lost trainer prod.	141	34.69 (43.60)	83	37.68 (47.11)	58	30.40 (38.00)	0.3
Total	**66**	**758.45 (730.85)**	**39**	**676.45 (673.07)**	**27**	**876.90 (805.36)**	**0.3**
Net Benefits							

Table A4.12: Annual costs and benefits per apprentice, by wave

	N	Overall	N	Baseline	N	Endline	p-value
Benefits							
Fees[1]	591	64.73 (43.35)	403	65.30 (44.66)	188	63.51 (40.49)	0.9
Entry	579	3.11 (6.23)	391	2.74 (4.11)	188	3.90 (9.15)	0.2
Formation	579	36.05 (38.19)	391	35.95 (38.04)	188	36.26 (38.61)	0.6
Liberation	579	9.19 (20.76)	391	9.26 (18.70)	188	9.03 (24.54)	0.012
Materials	579	6.07 (8.16)	391	6.56 (9.31)	188	5.07 (4.85)	0.4
Contract	579	7.30 (15.69)	391	8.46 (16.92)	188	4.87 (12.43)	0.020
Application	579	3.51 (4.18)	391	3.09 (4.24)	188	4.38 (3.93)	<0.001
Apprentice prod.	241	760.05 (977.48)	114	1,075.59 (1,172.98)	127	476.80 (644.26)	<0.001
Total	**203**	**841.72 (996.42)**	**104**	**1,140.89 (1,198.06)**	**99**	**527.44 (585.80)**	**<0.001**
Costs							
Allowances[1]	470	463.58 (955.16)	360	489.37 (1,021.21)	110	379.17 (693.82)	0.023
Food	368	77.08 (134.55)	266	70.57 (147.07)	102	94.05 (92.90)	<0.001
Transport	368	52.46 (170.87)	266	60.88 (195.20)	102	30.51 (73.78)	>0.9
Pocket money	368	157.37 (380.71)	266	145.96 (183.74)	102	187.12 (660.95)	0.001
Other	368	0.47 (9.05)	266	0.65 (10.64)	102	0.00 (0.00)	0.5
Training costs	466	109.15 (219.01)	229	110.69 (233.24)	237	107.65 (204.80)	>0.9
Rent	466	28.54 (63.68)	229	26.83 (59.79)	237	30.20 (67.31)	>0.9
Equipment	460	32.38 (75.06)	226	32.61 (81.94)	234	32.16 (67.92)	0.8
Books	456	8.80 (41.76)	224	8.93 (44.17)	232	8.68 (39.40)	>0.9
Raw materials	454	41.08 (135.13)	223	44.10 (140.23)	231	38.16 (130.26)	>0.9
Lost trainer prod.	331	33.60 (45.59)	245	36.08 (45.78)	86	26.54 (44.52)	0.12
Total	**135**	**622.24 (647.58)**	**96**	**666.56 (698.44)**	**39**	**513.15 (492.00)**	**0.2**
Net Benefits							
Model I	442	-404.86 (980.27)	341	-437.12 (1,047.68)	101	-295.95 (700.14)	0.011
Model II	299	-454.58 (679.06)	198	-480.28 (661.41)	101	-404.20 (713.08)	0.2
Model III	132	403.62 (1,203.22)	75	726.77 (1,275.80)	57	-21.58 (954.96)	0.003
Model IV	88	121.25 (1,180.94)	31	631.55 (1,406.07)	57	-156.28 (940.73)	0.005
Model V	54	295.69 (1,111.39)	28	686.67 (1,378.91)	26	-125.38 (457.68)	0.012

Mean (SD). Amounts in $US per apprentice per year, calculated using responses from baseline survey.

[1] Fees and allowances reported by firm owner. Annual fees assume apprenticeship duration of four years, annual allowances assume apprentices work 20 days a month.

Table A4.13: Annual costs and benefits per apprentice, by trade

		Trade					
	Overall	**Masonry**	**Carpentry**	**Plumbing**	**Metalwork**	**Electrical Inst.**	**p-value**
Benefits							
Fees[1]	65.30 (44.66)	70.17 (38.53)	56.97 (42.03)	49.98 (28.28)	52.06 (44.50)	78.34 (49.66)	<0.001
Entry	2.74 (4.11)	1.80 (2.65)	1.74 (2.18)	2.47 (3.58)	1.05 (1.75)	4.62 (5.45)	<0.001
Formation	35.95 (38.04)	36.74 (29.00)	33.28 (30.91)	21.31 (32.39)	27.26 (33.17)	46.84 (45.52)	<0.001
Liberation	9.26 (18.70)	15.04 (20.84)	9.87 (17.95)	1.99 (5.77)	7.81 (17.74)	9.38 (20.44)	0.001
Materials	6.56 (9.31)	8.39 (9.26)	5.34 (5.86)	2.89 (3.35)	7.16 (12.96)	6.90 (8.88)	<0.001
Contract	8.46 (16.92)	3.68 (10.44)	7.78 (17.15)	19.21 (22.95)	6.74 (14.86)	8.24 (16.72)	0.3
Application	3.09 (4.24)	4.62 (3.96)	4.39 (4.09)	2.10 (3.72)	2.99 (3.98)	2.28 (4.48)	<0.001
Apprentice prod.	1,075.59 (1,172.98)	1,480.90 (1,306.63)	1,118.65 (1,328.96)	1,666.12 (298.76)	482.72 (382.95)	819.63 (1,087.83)	<0.001
Total	**1,140.89 (1,198.06)**	**1,683.73 (1,396.03)**	**1,013.33 (1,182.41)**	**1,694.46 (319.67)**	**537.43 (366.98)**	**884.07 (1,110.78)**	**<0.001**
Costs							
Allowances[1]	489.37 (1,021.21)	502.98 (868.71)	264.34 (237.20)	429.50 (708.59)	264.85 (342.57)	749.79 (1,564.54)	<0.001
Food	70.57 (147.07)	82.21 (82.86)	34.68 (54.89)	38.02 (67.32)	68.44 (79.16)	99.56 (266.47)	<0.001
Transport	60.88 (195.20)	49.33 (84.00)	46.62 (65.40)	57.22 (82.98)	4.39 (26.35)	133.42 (369.79)	<0.001
Pocket money	145.96 (183.74)	230.00 (228.63)	101.14 (114.89)	80.15 (68.54)	90.81 (147.42)	169.81 (201.63)	<0.001
Other	0.65 (10.64)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	2.71 (21.69)	0.5
Training costs	110.69 (233.24)	139.64 (200.16)	126.09 (339.41)	52.95 (99.52)	75.19 (107.92)	137.34 (289.99)	0.090
Rent	26.83 (59.79)	18.82 (40.33)	3.99 (9.65)	6.31 (26.40)	28.76 (47.40)	45.48 (83.14)	<0.001
Equipment	32.61 (81.94)	68.13 (140.03)	6.60 (18.41)	21.98 (39.25)	11.26 (25.83)	41.26 (86.88)	<0.001
Books	8.93 (44.17)	8.29 (25.58)	0.35 (1.78)	6.90 (14.26)	0.00 (0.00)	18.30 (71.27)	0.006

Table A4.14: Annual net benefits per firm, by wave

	N	Overall	N	Baseline	N	Endline	p-value
Firm Accounts							
Revenues	300	4,405 (4,917)	159	3,989 (4,820)	141	4,875 (5,000)	0.002
Wage bill	344	1,365 (2,999)	196	972 (2,352)	148	1,886 (3,629)	<0.001
Non-wage expenses	342	1,640 (3,179)	196	1,593 (3,152)	146	1,704 (3,224)	0.2
Total expenses	340	3,027 (5,183)	195	2,572 (4,453)	145	3,639 (5,989)	<0.001
Profits (reported)	303	1,429 (2,159)	167	1,672 (2,634)	136	1,132 (1,317)	0.029
Profits (calculated[2])	297	1,549 (3,249)	158	1,701 (3,056)	139	1,375 (3,459)	0.7
Projected benefits							
Fees	317	370 (451)	189	347 (366)	128	403 (553)	>0.9
Apprentice prod.	128	5,655 (13,455)	47	8,359 (13,033)	81	4,086 (13,526)	0.011
Total	117	6,063 (13,708)	46	8,887 (13,241)	71	4,234 (13,786)	0.011
Projected costs							
Allowances	269	2,783 (6,783)	185	3,207 (7,741)	84	1,848 (3,803)	0.006
Training costs	292	497 (1,071)	144	511 (1,116)	148	483 (1,029)	>0.9
Lost trainer prod.	169	199 (506)	111	181 (421)	58	233 (640)	0.6
Total	103	3,430 (4,838)	70	3,190 (4,441)	33	3,938 (5,628)	0.6
Net benefits							
Model I	258	-2,500 (6,838)	180	-2,947 (7,759)	78	-1,469 (3,814)	0.005
Model II	206	-2,681 (7,150)	128	-3,174 (8,534)	78	-1,870 (3,861)	0.034
Model III	86	2,773 (9,640)	43	5,574 (12,052)	43	-28 (5,171)	0.10
Model IV	68	2,040 (9,146)	25	6,431 (12,457)	43	-513 (5,158)	0.034
Model V	43	2,717 (10,714)	23	6,593 (12,285)	20	-1,740 (6,316)	0.013

Mean (SD). Net benefits per firm estimated using baseline data. Projected costs, benefits, and net benefits calculated as mean values for all observed apprentices in firm times reported number of apprentices trained. Amounts in $US.

[1] Firms size calculated by author as sum of all reported workers in firm, including apprentices and occasional and family workers.

[2] Profits recalculated by author as difference between reported revenues (first row) and reported expenses (second row).

Table A4.15: Annual net benefits per firm, by trade

		Trade					
	Overall, N = 197	**Masonry**, N = 45	**Carpentry**, N = 24	**Plumbing**, N = 26	**Metalwork**, N = 39	**Electrical Inst.**, N = 63	**p-value**
Firm Accounts							
Revenues	3,989 (4,820)	4,924 (5,760)	4,999 (4,256)	2,696 (3,246)	3,498 (4,993)	3,477 (4,447)	0.021
Wage bill	972 (2,352)	2,304 (4,254)	880 (1,392)	642 (1,182)	277 (560)	609 (1,147)	<0.001
Non-wage expenses	1,593 (3,152)	1,318 (2,216)	1,415 (1,757)	653 (828)	1,131 (1,338)	2,528 (4,882)	0.016
Total expenses	2,572 (4,453)	3,622 (5,559)	2,333 (2,835)	1,295 (1,770)	1,411 (1,607)	3,138 (5,639)	0.002
Profits (reported)	1,672 (2,634)	2,567 (4,557)	2,243 (1,408)	1,202 (1,428)	1,007 (1,381)	1,266 (1,158)	<0.001
Profits (calculated[2])	1,701 (3,056)	1,243 (2,957)	2,569 (2,369)	1,449 (1,506)	1,967 (4,672)	1,662 (2,572)	0.14
Projected benefits							
Fees	347 (366)	317 (256)	212 (178)	219 (195)	273 (332)	526 (485)	<0.001
Apprentice prod.	8,359 (13,033)	8,719 (11,196)	11,109 (22,156)	9,124 (2,244)	4,161 (6,282)	7,990 (13,047)	0.4
Total	8,887 (13,241)	9,472 (11,545)	11,347 (22,106)	9,235 (2,157)	4,531 (6,864)	8,542 (13,216)	0.4
Projected costs							
Allowances	3,207 (7,741)	2,529 (3,775)	1,640 (2,966)	4,733 (17,348)	1,541 (2,198)	4,865 (6,332)	<0.001
Training costs	511 (1,116)	532 (723)	404 (564)	215 (367)	341 (659)	792 (1,739)	0.2
Lost trainer prod.	181 (421)	148 (200)	408 (1,038)	254 (477)	96 (92)	194 (435)	>0.9
Total	3,190 (4,441)	3,144 (2,226)	1,236 (854)	2,009 (2,835)	1,910 (3,123)	6,173 (7,359)	0.005
Net benefits							
Model I	-2,947 (7,759)	-2,373 (3,872)	-1,470 (3,004)	-4,515 (17,220)	-1,245 (2,052)	-4,454 (6,299)	0.004
Model II	-3,174 (8,534)	-2,748 (2,869)	-995 (910)	-5,419 (19,345)	-1,465 (2,461)	-4,325 (5,315)	<0.001
Model III	5,574 (12,052)	6,553 (9,848)	8,494 (17,498)	7,780 (1,858)	291 (4,639)	4,190 (13,916)	0.3
Model IV	6,431 (12,457)	7,385 (11,698)	2,772 (7,030)	7,368 (2,441)	767 (1,901)	7,792 (17,945)	0.8

Table A4.16: Firm-level regressions with firm fixed effects

	log revenues (USD)		log profits (USD)		log Firm size[1]	
	(1)	(2)	(3)	(4)	(5)	(6)
Non-CQP apprentices	−0.01		−0.93**		−0.33*	
	(0.21)		(0.37)		(0.18)	
CQP Selected		−0.11		−0.94**		−0.33**
		(0.18)		(0.38)		(0.16)
Total apprentices	0.38*	0.36*	−2.10***	−2.00***	−0.20	−0.30*
	(0.20)	(0.19)	(0.48)	(0.48)	(0.15)	(0.15)
Endline	0.32	0.30	−0.88	−1.00		
	(0.24)	(0.23)	(0.78)	(0.77)		
Firm FE	YES	YES	YES	YES	YES	YES
Observations	126	134	94	101	143	156
R^2	0.20	0.24	0.74	0.69	0.11	0.14
F Statistic	1.90	2.60*	6.50**	6.00**	2.00	3.20*

Note: *p<0.1; **p<0.05; ***p<0.01

[1]Excluding apprentices

Appendix B4

Table B4.1: Tasks used for assessment of competence and experience

French	English
Masonry	
Lecture d'un plan de construction	Reading a building plan
Identification des différents types de briques	Identifying different types of bricks
Composition du béton de fondation	Composition of foundation concrete
Composition du béton de la dalle	Composition of slab concrete

French	English
Élévation	Drafting an elevation
Chaînage bas	Low trussing
Chaînage haut	High trussing
Réalisation des pentes	Pouring out inclined surface
Pose des hourdis	Laying down slabs
Réalisation des poutres	Installing beams
Réalisation des feuillures	Installing rabbets
Cimentage du plafond	Cementing a ceiling
Cimentage du sol	Cementing a floor
Pose des chapes	Laying the floorboards
Réalisation d'un devis pour une construction	Drawing up an estimate
Carpentry	
Prise de mesure des portes et fenêtres	Measurement of doors and windows
Prise de mesure des tables et chaises	Measurement of tables and chairs
Pointage du bois	Scoring of wood
Rabotage	Planing
Ponçage	Sanding
Savoir faire le mastic	Knowing ho to make sealant
Assemblage pour la construction d'une chaise	Chair assembly
Assemblage pour la construction d'une table	Table assembly
Identification des différents bois utilisés	Identification of different woods used
Identification des différentes coupures de bois	Identification of different wood cuts
Réalisation de devis pour un produit	Drawing up an estimate for a product
Plumbing	
Lecture d'un plan de plomberie	Reading a plumbing plan
Grattage de tuyau	Pipe scraping
Collage des raccords	Attachment of fittings
Pose des tuyaux	Laying of pipes
Réservation des attentes aux poteaux	Securing pipes at the posts

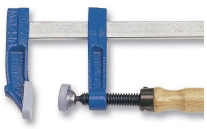
French	English
Canalisation des tuyaux dans les fausses septiques et puisards	Piping in septic tanks and sumps
Canalisation d'un bâtiment	Piping a building
Canalisation pour l'alimentation en eau froide	Piping for cold water supply
Réalisation d'un devis	Drawing up an estimate
Pose apparente des appareils sanitaires	Installation of exposed sanitary appliances
Metalworking	
Lecture du plan de construction de l'ouvrage	Reading a construction plan
Identification des types de feuilles de tôles	Identifying different types of sheet metal
Identification des types de barres de fer	Identifying the different types of iron bars
Prise de mesure des feuilles de tôles	Measuring the sheet metal
Découpage des feuilles de tôles pour la formation de la charpente	Cutting of sheet metal for the frame
Prise de mesure pour la formation des fenêtres	Window measurements
Prise de mesure pour la formation des portails	Gate measurements
Prise de mesure pour la formation des charpentes	Frame measurement
Réalisation des cadres pour les fenêtres	Making the frames for the windows
Réalisation des cadres pour les portails	Making the frames for the gates
Pose des serrures	Fitting the locks
Assemblage des feuilles de tôles pour la formation des fenêtres	Assembly of sheet metal for windows
Assemblage des feuilles de tôles pour la formation des portails	Assembly of sheet metal for gates
Assemblage des feuilles de tôles pour la réalisation des charpentes	Assembly of sheet metal for joining of frames
Réalisation d'un devis pour un ouvrage	Drawing up an estimate
Electrical Inst.	
Lecture d'un plan d'électricité	Reading an electrical plan
Conception d'un plan d'électricité	Designing an electrical plan

French	English
Installation du barrage de terre	Installing an earth barrier
Tubage du sol	Soil casing
Tubage de la dalle	Tubing the floor slab
Serrage des boîtiers et coffrets	Clamping of boxes and cabinets
Pose des lampes	Installation of lamps
Pose des prises	Installation of sockets
Installation des disjoncteurs dans les coffrets	Installation of circuit breakers
Réalisation d'un devis	Drawing up an estimate

Figure B4.1: Questions for metal workers

Which of the following is called a baguette?



What is the name of this tool?

- Folding machine
- Welding machine
- Pliers
- Tabletop drilling machine

Which of the following is an "angle iron"?




A right angle has how many degrees?

- 45°
- 90°
- 100°
- 360°

What measurements do you need to use for a gate that is 1m wide and 2m high? (1m x 2m)

- 45°
- 90°
- 100°
- 360°

Figure B4.2: Questions for plumbers

What is this object used for?



What is the following tool used for?

- To measure the amount of fluid in a pit or other container
- To grip or clamp certain objects
- To check right angles
- To dig holes

A right angle has how many degrees?

- 45°
- 90°
- 100°
- 360°

Which of the following is a “coupler“ (or “coupling“)?

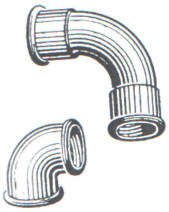
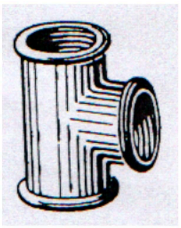
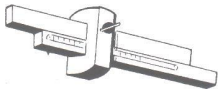





Figure B4.3: Questions for carpenters

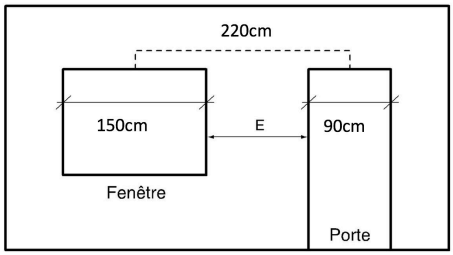
What is this object used for?

- To level a piece of wood
- To taper a piece of wood
- To control right angles
- To grip or clamp certain objects

Which of the following is called a hand plane?



According to the following diagram, what is the distance E between the window and the door?



- 0.5 m
- 1 m
- 1.5 m
- 2 m

What is the name of the circled object?

- Tenon
- Tapering jig
- Mortice
- Pied divan

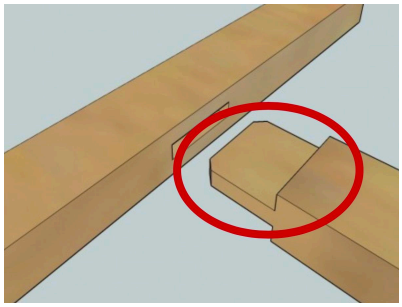
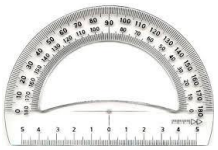


Figure B4.4: Questions for masons

Which of these tools is called a compass?





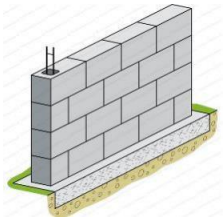
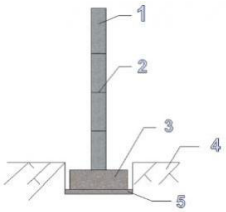

What is this tool used for?

- To measure height
- To dig holes
- To trace or measure angles
- To close the joints between plates by smoothing the mortar

A right angle has how many degrees?

- 45°
- 90°
- 100°
- 360°

In the figures below, indicate the number corresponding to each part of the structure.

___Building joint
___Binding concrete
___Concrete foundation block
___Natural soil (TN)
___Agglomerate

What are the correct proportions for mixing plaster?

- 1 packet of cement, 2 wheelbarrows of sand and 1 wheelbarrow of gravel
- 1 packets of cement, 2 wheelbarrows of sand and water
- 3 packets of cement, 2 wheelbarrows of sand and water
- 1 packets of cement, 3 wheelbarrows of sand and water

Figure B4.5: Questions for electricians

What is the name of this tool?

- Tellurometer
- Multimeter
- Levels
- Circuit board

What is this tool used for?

- To measure resistance in ohms
- To measure current
- To measure voltage
- To fasten the end of a conductive cable

Electric resistance is typically measured in what units?

- Ampere
- Ohm
- Volt
- Joule

Which of the following is called a circuit breaker?

What is the name of this object?

- Electrical outlet
- A switch
- A domino
- A button

Chapter 5

Conclusion