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The evolution of private returns to education during post-conflict transformation

Evidence from Mozambique

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Abstract: This paper estimates how private returns to education have evolved in the context of post-conflict transformation in Mozambique. This has been characterized by rapid economic growth, significant expansion of the schooling system, but also limited structural change in a labour market dominated by small-scale agricultural activity. We find clear evidence that rates of return to education in the country have shifted over time—declining at lower levels of schooling, but remaining stable and possibly rising at the highest levels. This is consistent with increasingly convex returns, which are most evident among those in non-agricultural (wage) jobs. As such, workers today must accumulate more years of schooling to achieve the same expected return as in the past.

Keywords: returns to education, workforce, pseudo-panel, Mozambique
JEL classification: I2, J31, O15, C23

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1 Introduction

Private returns to education are widely considered to be positive and substantial. Summarizing studies from across the globe, Psacharopoulos and Patrinos (2018) estimate an average private return to each additional year of schooling of just under 10 per cent.[1] Average returns, however, subsume considerable heterogeneity. One aspect of this is varying returns at different levels of schooling. While it has been conventionally thought that returns to education follow a concave profile, implying diminishing marginal returns (e.g., Montenegro and Patrinos 2014; Psacharopoulos and Patrinos 2004), this assumption has been increasingly challenged, including in low-income countries (e.g., Barouni and Broecke 2014; Söderbom, Teal, Wambugu, and Kahyarara 2006).

A further aspect of heterogeneity in returns to schooling refers to economic structure. Various studies find that educational returns vary systematically across different sectors of the economy, particularly between those in modern versus traditional activities or public versus private firms (e.g., Girma and Kedir 2005; Lassibille and Tan 2005). Similarly, returns to schooling do not appear stable, either within countries or over time. Evidence suggests that returns may be affected (downward) by the expansion of the education system, as well as (upwards) by changes in firms' demand for skills (e.g., Colclough, Kingdon, and Patrinos 2010; Doan, Le, and Tran 2018; Galiani, Cruces, Acosta, and Gasparini 2017; Gao and Smyth 2015; Green and Zhu 2010; Hartog, Pereira, and Vieira 2001; Zhang, Zhao, Park, and Song 2005).

Taking as our point of departure the notion that supply and demand factors can influence private returns to education in complex ways, the aim of this study is to investigate how such returns have evolved in Mozambique over a period of substantial post-conflict reconstruction and transformation. As such, we contribute to the small literature on how returns to education evolve from very low average educational levels and in low-income sub-Saharan Africa, where existing evidence is scarce (e.g., Crespo Cuaresma and Raggl 2016). In doing so, we underline the critical importance of stimulating demand for (more) skilled workers as access to education improves.

2 Data, setting and methods

We use data from four rounds of nationally-representative household surveys from Mozambique undertaken in 1996/97, 2002/03, 2008/09, and 2014/15 by the national statistical agency (INE 2016). The surveys include modules on individual characteristics, employment and household consumption, which we use here. Summary statistics from the surveys are shown in Table 1, focusing uniquely on the economically active population ('workers'), aged 15 and above, for whom it is relevant to calculate educational returns.

The survey series start soon after Mozambique emerged from a prolonged and devastating conflict. In the early 1990s, it was one of the poorest countries in the world. Nonetheless, reconstruction efforts were largely successful and until recently, economic performance over the post-conflict period has been strong. Real GDP grew by around 7 per cent each year and substantial public investment (supported by foreign aid) enabled rapid increases in educational enrolment, from a low base. As shown in Table 1, in 1996/97 around half of workers had never attended school and less than four per cent had ever attended secondary schooling. By 2014/15, however, the proportion of workers with more than primary schooling had risen fivefold. Similarly, looking at new entrants to the labor market (Figure A1), while

[1] Unless otherwise stated, throughout we refer to rates of return calculated from Mincerian-type earnings functions.

Table 1: Descriptive statistics of workers, by survey years

	1996/97	2002/03	2008/09	2014/15
Outcome variable				
Consumption per worker	2.3	3.1	3.1	4.2
Worker characteristics				
Female (%)	54.0	54.8	55.1	53.1
Age	33.7	34.0	33.8	34.4
Rural (%)	77.6	72.0	71.5	72.1
Years of schooling	2.0	2.4	3.3	3.9
Working pop. (10^6)	6.4	7.5	9.2	9.8
Educational profile				
No education (%)	48.7	28.0	30.8	33.6
Some primary (%)	47.7	65.2	59.1	49.2
Some secondary (%)	3.4	6.6	9.7	15.2
Above secondary (%)	0.2	0.3	0.4	2.1
Working sector				
Agriculture (%)	84.1	78.4	78.6	71.9
Family enterprise (%)	6.3	9.5	8.8	13.3
Private (%)	7.5	9.1	9.7	11.2
Public (%)	2.1	3.0	2.8	3.6

Note: Sample is economically-active population aged 15 and above; consumption per worker is in real terms, stated in the number of consumption baskets equal in value to the poverty line; family enterprises are defined as non-agricultural informal sector activities; private and public sectors refer to formal, or wage-earning activities.
Source: Own estimates.

those born in the 1970s received less than 3 years of education on average, this increased to over 5 years for those born in the 1990s.

Despite these gains, the structure of employment has changed only slowly (Jones and Tarp 2015, 2016b; Lachler and Walker 2018). As indicated in Table 1, the workforce remains predominantly agricultural, with more than 70 per cent of all workers undertaking small-scale family-based farming. Since agriculture represents a much smaller share of output (around 20 per cent), productivity differences between different economic sectors are very large (Jones and Tarp 2016a). In part, this reflects differential access to physical and managerial capital, whereby a few industries have benefited from extensive foreign capital investments but operate largely as export enclaves. So, in common with many other low-income African countries (Page and Shimeles 2015), Mozambique has not yet achieved substantial structural transformation in terms of the nature or quality of job opportunities.

The apparent divergence between supply- and demand-side labour market trends motivates our interest in *how* the private returns to education have evolved over time. To estimate the private returns to education in Mozambique we adopt a standard Mincerian approach. In contrast to the conventional focus on estimating returns for individuals who receive a wage, we seek to estimate returns to all workers in the economy. This is necessary since only a small minority receive a regular wage, implying they are a highly selective group, but also since a focus on wage-earners would be of limited *general* interest. The outcome variable is real consumption, which is also the basis for poverty measurement in Mozambique, as in other developing countries. As consumption is not observed at the individual level, we use mean household consumption per household member in the labor force. The aggregated nature of the dependent variable introduces measurement error; however, this is expected only to augment the uncertainty of our regression estimates, rather than bias the measures of educational returns.

Equation (1) summarizes our general empirical model:

$$y_{jt} = \alpha_0 + (1 + \alpha_1 s_i + \alpha_2 s_i^2) \times (1 + \beta t) \times (1 + \gamma w_i) + \theta x_i + \eta z_j + \sigma_{krq} + \varepsilon_{it} \quad (1)$$

where y is the expenditure outcome per contributing family member (in natural logarithms), i indexes individuals, j households, k provinces, r rural area, t time (in years, centered on zero in the middle of the period) and q calendar year quarters. The main explanatory variable of interest is s, which indicates the number of school grades attended by each working individual (i.e., years of schooling). Schooling enters in quadratic form to allow for non-linearities in returns, such as convexity. We also add individual- and household-specific controls, denoted x and z, respectively. The former set includes gender and potential work experience (age minus the number of years attending school), and the latter includes household size and demographic composition. The multiplicative structure of the model allows returns to schooling to vary both over time and with the type of work undertaken (w). For simplicity, the work type is defined as a dummy variable that takes a value of one for non-agricultural occupations, and zero for agriculture. This distinction is motivated by the country's employment structure (see Table 1), as well as the low technological development of the agricultural sector and its widening productivity gap in relation to more modern sectors of the economy (Jones and Tarp 2016a). Finally, σ_{krq} are province-rural and province-season fixed effects that account for common seasonal and location-specific factors affecting all households in a given time period.

We first estimate equation (1) using OLS. Such estimates, however, may be biased due to the link between schooling and innate ability, as well as other unobserved factors that influence the choice of economic activity. To address this, we estimate equation (1) in a pseudo-panel set-up (see Antman and McKenzie 2007; Deaton 1985; Warunsiri and McNown 2010). The panel is generated by collapsing the individual-level data into gender-specific means for each birth year cohort in every survey year. To address structural differences across regions in access to both education and employment opportunities, these cohort averages are calculated separately for each of the 11 spatial domains at which level the surveys are designed to be statistically representative. This procedure yields 836 panel cohorts defined by birth year, gender and location of residence.

3 Results

Our main results are reported in Table 2, which shows both pooled OLS and psuedo-panel estimates of the same specifications. We build-up to the full specification as follows: column (a) gives a simple pooled linear model; column (b) permits returns to be non-linear; column (c) allows variation in returns over time; and column (d) is our general model as seen in equation (1), adding variation in employment to the model. Appendix Table A1 shows analogous results obtained by replacing the continuous specification of the education variable (s) with a set of three dummy variables for different levels of education.

Looking across the results, six main findings stand out. First, the OLS and pseudo-panel results are highly consistent. While (naturally) the latter results are less precise, indicated by relatively large standard errors, both the level and shape of returns to education are similar across equivalent specifications. The pseudo-panel results, which are expected to be *less* prone to bias, point to somewhat higher returns to more years of schooling (e.g., approximately 10.5 versus 8.6 per cent in the simple linear model of columns IIa and Ia, respectively), in turn suggesting the OLS approach may be conservative but not misleading. Both these results are consistent with the 10 per cent global benchmark found by Psacharopoulos and Patrinos (2018).

Second, returns to education are non-linear, as demonstrated by the significant coefficient on the squared education term in columns Ib and IIb. Plotting the results from columns Ic and IIc, we see that returns in fact are convex to the origin (over the range of interest). This evident in Figure 1, which shows that the profile of cumulative returns to education becomes steeper with more education. More clearly, Figure

Table 2: Regression estimates of returns to education

	Pooled OLS				Pseudo-panel			
	Ia	Ib	Ic	Id	IIa	IIb	IIc	IId
Edu.	8.57***	1.23***	1.53***	4.14***	10.49***	1.72	1.60	6.07*
	(0.16)	(0.29)	(0.29)	(0.45)	(3.16)	(3.21)	(3.22)	(3.15)
Edu.^{2}		0.73***	0.73***	0.11*		0.88***	0.89***	-0.13
		(0.03)	(0.03)	(0.06)		(0.12)	(0.15)	(0.24)
Edu. $\times$ t			-0.25***	-0.26***			-0.29**	-0.19
			(0.03)	(0.05)			(0.13)	(0.20)
Edu.^{2} $\times$ t			0.01***	0.02***			0.03*	0.01
			(0.00)	(0.01)			(0.01)	(0.03)
Edu. $\times$ Non-agric.				-2.20***				-10.94***
				(0.80)				(3.80)
Edu.^{2} $\times$ Non-agric.				0.56***				1.43***
				(0.09)				(0.37)
Edu. $\times$ Non-agric. $\times$ t				-0.04				-0.17
				(0.10)				(0.46)
Edu.^{2} $\times$ Non-agric. $\times$ t				-0.01				0.00
				(0.01)				(0.04)
Non-agric. $\times$ t				0.59**				53.48***
				(0.24)				(8.10)
Non-agric.				28.21***				1.13
				(2.07)				(1.09)
t	1.62***	1.59***	2.03***	1.90***	1.30	1.38	1.68	2.29
	(0.07)	(0.07)	(0.06)	(0.09)	(3.18)	(3.16)	(3.14)	(2.99)
Exp.	2.91***	2.86***	2.81***	2.30***	2.99	2.44	2.60	1.49
	(0.11)	(0.11)	(0.09)	(0.11)	(3.16)	(3.13)	(3.15)	(3.01)
Exp.^{2}	-0.04***	-0.04***	-0.04***	-0.03***	-0.04***	-0.03***	-0.03***	-0.03***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	111,376	111,376	111,376	111,376	8,455	8,455	8,455	8,455
Adj. R^2	0.24	0.25	0.25	0.27	0.53	0.54	0.54	0.56

Significance levels: * 10% ** 5% *** 1%.

Note: Outcome is the natural logarithm ($\times$100) of average consumption expenditure per working household member; potential work experience ('exp.') is age minus years of education; t is time in years centered on 2005/06 (the middle of the period); education ('edu.') is the highest level of completed schooling. Robust standard errors clustered at the household level (OLS) or cohort-level (psuedo-panel) are shown in parentheses. Included, but not shown, control variables are the following: gender, household size, household size squared, number of household members above 65, number of household members below 15, province-rural and province-quarter interaction dummies (interaction dummies in pooled OLS only).

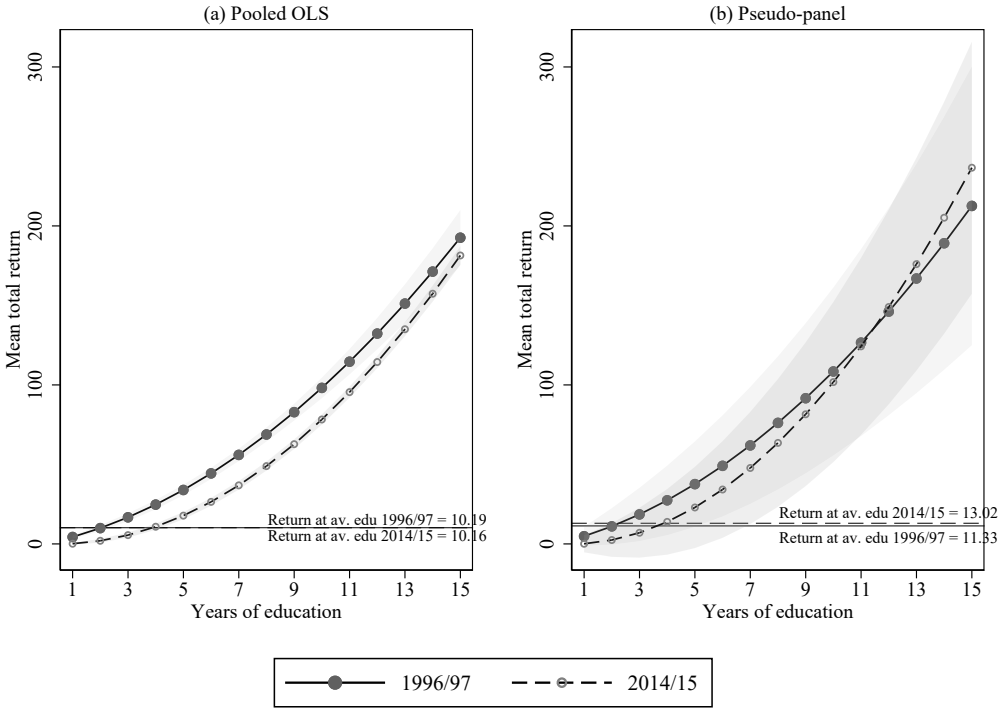
Source: Own estimates.

2 illustrates that marginal returns to an additional school year roughly double between early primary (grade 5) and end secondary (grade 12).

Third, the same figures reveal that returns to most levels of education have been falling over time. This is most clear on a cumulative basis (Figure 1), indicated by the lower position of the 2014/15 line. Nonetheless, given the increase in the average number of years of education in the workforce, from around 2 in 1995/96 to 4 in 2014/15 (see Table 1), returns to education for the average worker have remained largely unchanged over the period. This finding indicates that an increase in the average years of schooling in the working population has not translated to an increase in the overall private return to that schooling (for the average worker).

Fourth, returns to education have become more convex over time. Figures 1 and Figure 2 show that increasing convexity is primarily driven by a decline in returns to those with primary and lower secondary education. For the minority with upper secondary education or above (recall that only 2 per cent of the labor force in 2014/15 has above secondary; Table 1), marginal returns have remained the same and may even have increased (Figure 1 and 2).

Figure 1: Predicted cumulative returns to years of schooling, by survey year

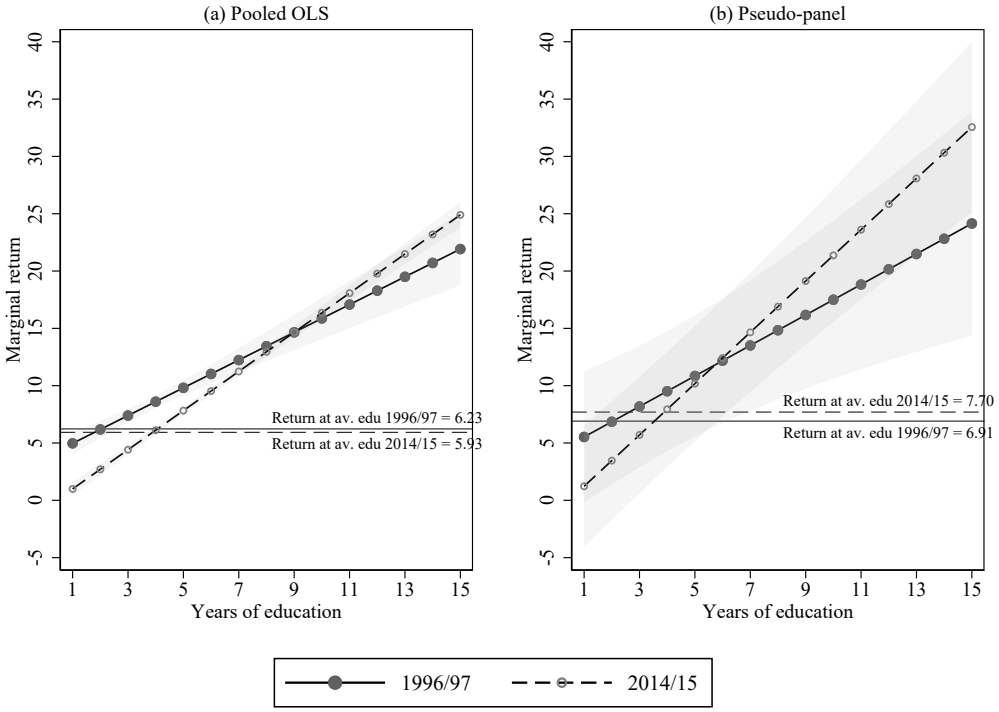


Note: Plots are predicted cumulative returns, derived from Table 2, columns Ic and IIc; horizontal lines indicate expected cumulative returns at the average level of education of workers in each survey; shaded area is 95% confidence interval, based on the linear combination of regression coefficients.
Source: Own calculations.

Fifth, there are material differences in educational returns between agricultural and non-agricultural work. As illustrated in Figure 3, derived from the full specification in columns Ic and IIc of Table 2, educational returns in the agricultural sector are flatter (more linear) than those in the non-agricultural sector. The pseudo-panel results (column IId) indeed suggest a linear profile to educational returns in the agricultural sector cannot be rejected, with a marginal return of 6.1 per cent. In contrast, returns for non-agricultural activities are substantially convex, implying lower returns at lower levels of education but much higher returns at least beyond lower secondary (10th grade).

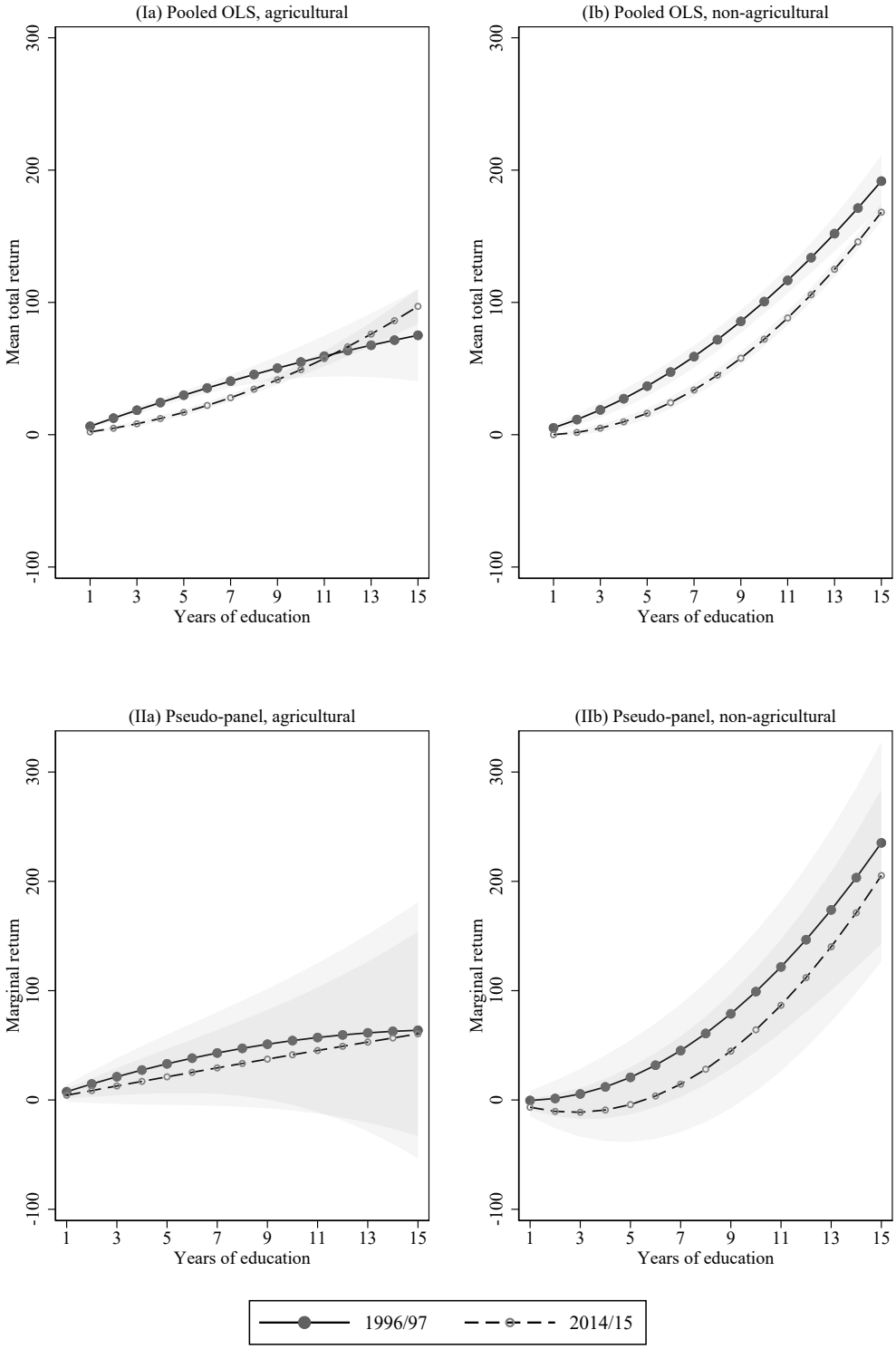
Sixth, the above findings are supported by the categorical specification of education, reported in Table A1. Both declining returns at most levels of education and an increasingly convex profile to returns are evident over time, where the latter is driven by falling returns to those with less than twelve years of education (see columns Ib and Ic for pooled OLS; columns IIb and IIc for pseudo-panel, Table A1). Figure A2 illustrates the predicted cumulative returns based on the full specification. It confirms that educational returns are generally lower in agricultural work, especially beyond primary school, and that returns are more convex in the non-agricultural sector. As such, the results from the quadratic specification are not idiosyncratic to the functional form chosen.

Figure 2: Predicted marginal returns to an additional year of schooling, by survey year



Note: Plots are predicted marginal returns derived from Table 2, columns Ic and IIc; horizontal lines indicate expected marginal returns at the average level of education of workers in each survey; shaded area is 95% confidence interval, based on the linear combination of regression coefficients.
Source: Own calculations.

Figure 3: Predicted cumulative returns, by estimation method, job type and survey year



Note: Plots derived from columns Id and IId in Table 2; cumulative returns indicate the expected consumption premium relative to an (averaged age) individual without education with the same job type observed in the same survey year; shaded area is 95% confidence interval, based on the linear combination of regression coefficients. Source: Own estimates.

4 Conclusion

This paper investigated the evolution of returns to education in a low-income African country over a period of significant educational expansion and economic reconstruction. Despite aggregate economic progress, there have been concerns that Mozambique's growth has not led to a deeper structural transformation of the jobs landscape (Fox and Sohnesen 2016; Jones and Tarp 2016a). Echoing these concerns, we have found that returns to education have declined at the lowest levels (i.e., for primary school grades) but remain strong and may even be increasing at the highest levels. These dynamics are consistent with a divergence between supply- and demand-side trends, namely an increase in the supply of workers, particularly at lower skill levels (due to the expansion of access to primary schooling), alongside limited productivity changes in traditional occupations (household agriculture) and a predominantly skills-biased form of technological change in the more modern sectors. As such, these results clearly indicate that private returns to education are neither linear nor static, but can be driven toward zero in dualistic economies under large-scale educational expansion. From a policy perspective, this underscores the importance of both stimulating demand for lower- and semi-skilled workers within the modern sector, as well as raising the productivity of their activities in non-wage work.

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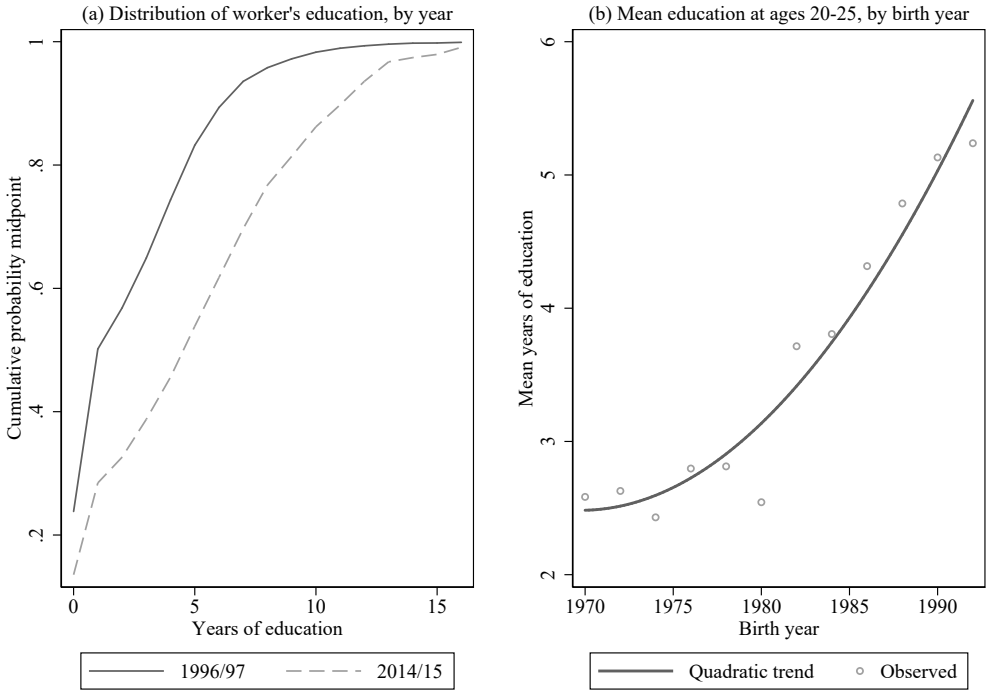
APPENDIX: additional material

Figure A1: Evolution of educational status of workers 1996/97-2014/15



Source: Own estimates.

Table A1: Regression estimates using education categories

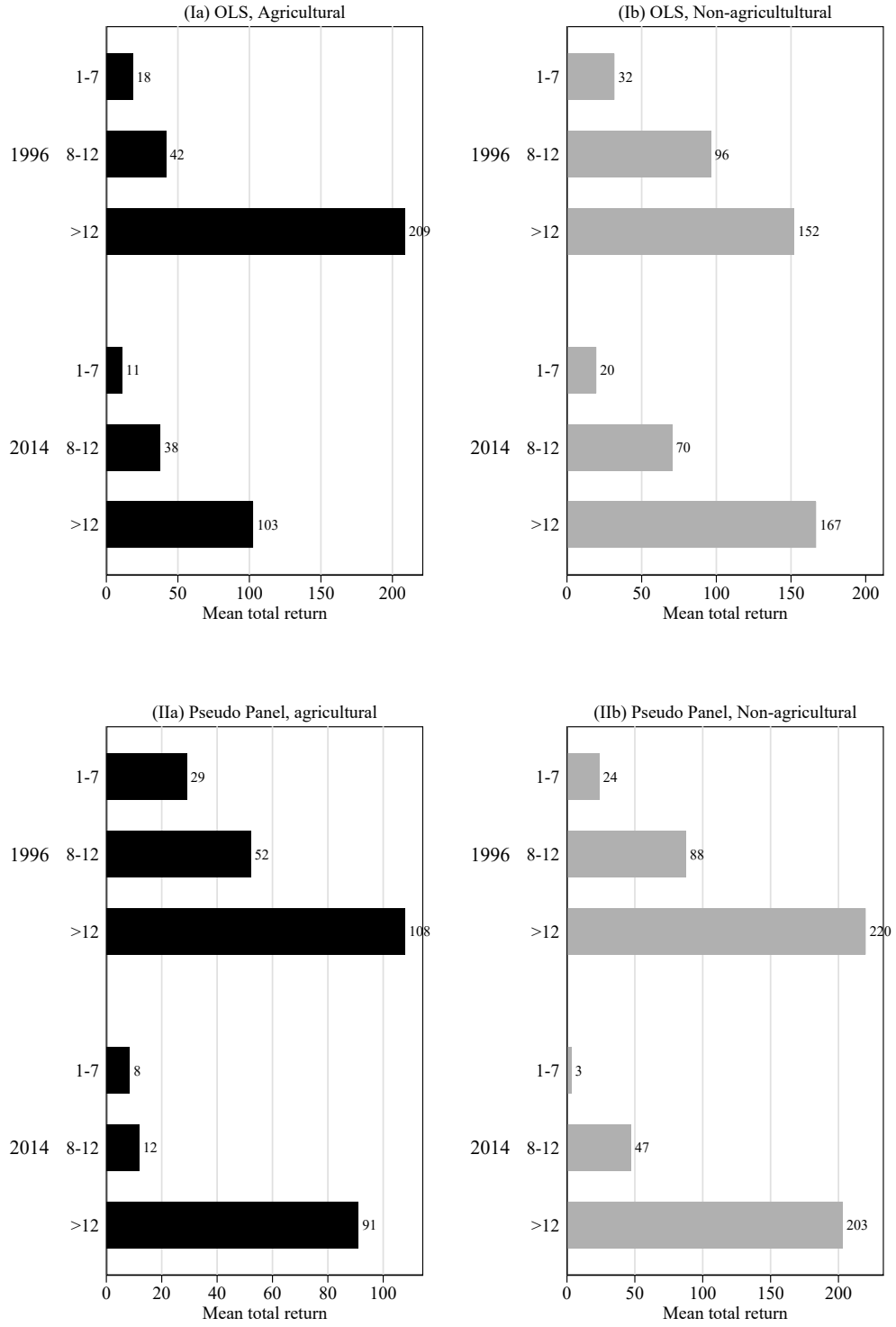
	Pooled OLS			Pseudo-panel		
	Ia	Ib	Ic	IIa	IIb	IIc
Grades 1-7	17.15***	17.33***	14.74***	18.33***	15.88***	18.76***
	(0.82)	(0.82)	(0.83)	(3.95)	(4.09)	(4.37)
Grades 8-12	73.09***	76.19***	43.16***	66.42***	63.63***	32.04**
	(1.68)	(2.11)	(2.38)	(9.91)	(9.95)	(12.94)
Grades >12	174.65***	164.35***	109.55***	203.74***	193.29***	99.47**
	(3.82)	(6.34)	(37.95)	(21.15)	(29.53)	(49.91)
Grades 1-7 $\times$ t		-0.35***	-0.42***		-1.03***	-1.15***
		(0.10)	(0.10)		(0.37)	(0.42)
Grades 8-12 $\times$ t		-0.98***	-0.94***		-0.58	-2.24**
		(0.24)	(0.23)		(0.68)	(0.87)
Grades >12 $\times$ t		1.41**	1.02		1.79	-0.94
		(0.70)	(0.73)		(3.14)	(3.17)
Grades 1-7 $\times$ Non-agric.			10.44***			1.13**
			(2.41)			(0.44)
Grades 8-12 $\times$ Non-agric.			38.86***			-5.27
			(3.14)			(11.97)
Grades >12 $\times$ Non-agric.			49.80			35.41**
			(37.52)			(16.33)
Non-agric.			25.87***			112.18*
			(2.38)			(61.20)
t $\times$ Non-agric.			0.29**			48.00***
			(0.14)			(9.93)
t	1.84***	2.08***	2.03***	5.71***	6.51***	4.98***
	(0.07)	(0.09)	(0.09)	(1.02)	(1.02)	(1.03)
Exp.	2.39***	2.36***	1.89***	-1.77*	-1.87*	-0.84
	(0.11)	(0.11)	(0.11)	(0.99)	(0.98)	(0.97)
Exp.^{2}	-0.03***	-0.03***	-0.02***	-0.03***	-0.03***	-0.03***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	111,376	111,376	111,376	8,455	8,455	8,455
Adj. R^2	0.22	0.23	0.26	0.54	0.54	0.56

Significance levels: * 10% ** 5% *** 1%.

Note: Outcome is the natural logarithm ($\times$100) of average consumption expenditure per working household member; selected coefficients shown; t is time in years; potential work experience ('exp.') is age minus years of education; education ('edu.') is highest level of completed schooling. Standard errors clustered at the household (pooled OLS) or cohort (pseudo-panel) level are shown in parentheses. Included, but not shown control variables are the following: gender, household size, household size squared, number of household members outside labour age (members above 65, members below 15), interaction between time and wage, province-rural and province-quarter interaction dummies (province interaction dummies in pooled OLS only).

Source: Own estimates from household survey series.

Figure A2: Total average returns to schooling, OLS and pseudo panel estimates by year and educational level



Note: Plots derived from columns Ic and IIc in Table A1; cumulative returns indicate the expected consumption premium relative to an (averaged age) individual without education with the same job type observed in the same survey year.
Source: Own estimates.