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POST-CONFLICT RETURNS TO EDUCATION – THE CASE OF TIMOR-LESTE

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Abstract: What is it known of the economic incentives for an investment in education in a post-conflict country? What are the returns to education in such a setting? How were they affected by the conflict? Education is a key component of a peace building and reconstruction strategy but these questions were left unanswered. This article looks into them in the setting of post-conflict Timor-Leste. It reviews the theoretical foundations of returns to education and establishes the theoretical channels through which conflict impacts returns to education. It then tests these channels using a comprehensive set of indicators of conflict, providing evidence that supports the theoretical hypothesis. In the Timorese post-conflict labour market there is evidence that conflict induced a reduction of returns to education while creating a scarcity of qualified human resources, making labour more expensive. This may justify the significantly low returns to education in this post-conflict setting. The empirical analysis also uncovers significant distortions in a post-conflict labour market. This is a first response to key questions surrounding the incentive to education in post-conflict. Further research is important, to consolidate the findings.

Post-Conflict Returns to Education – the Case of Timor-Leste[1]

1- Introduction

What do we know about the economic incentives to invest in education in a post-conflict country? In the peace building and reconstruction stages of post-conflict, education is increasingly found to be an area of concern. UNESCO in its guidelines considers education to be a key strategy as it '*helps meet the psychosocial needs of children and adolescents affected by conflict*', '*provides a channel for conveying health and survival messages and for teaching new skills and values*' and '*is vital to reconstruction of the economic basis of family, local and national life and for sustainable development and peace building*' (Bensalah, 2002:11). But how much is known about what drives the demand for education in a post-conflict setting? In particular, what is it known about the economic incentives for an investment in education? What are the returns to education in a post-conflict setting?

As the nexus between peace and development - or between conflict and "*development in reverse*" as coined by Collier et al. (2003) - have become a topic of interest for research, various studies have devoted attention to the impacts of conflict on the economy. Studies such as those by Bellows and Miguel (2009), Badiuzzaman et al. (2011), Cerra and Saxena (2008) or Bisogno and Chong (2002) look into the impacts of conflict on the post-conflict economic rebound. Others, including FitzGerald et al. (2001), Blattman

[1] I would like to thank Patricia Justino, Edoardo Masset, Paola Salardi, Olga Shemyakina, Catherine Muller, Martin Greely, Alia Aghajanian, Xavier Cirrera and Elise Wach and Jennifer Constantine for their comments, feedback and other support on this and earlier versions. I would also like to thank the comments of participants in the 8th Annual HiCN Workshop on Violent Conflict and Economic Development (Aix-en-Provence, France), the 12th UKFIET International Conference on Education and Development (Oxford, UK) and a seminar held at the National University of Timor-Leste (Dili, Timor-Leste).

and Annan, (2010), Shemyakina (2011), Ibáñez and Moya (2006) or Justino et al. (2013) analysed the impact of conflict on education, in most cases finding a detrimental effect on school enrolment and attainment. Rodriguez and Sanchez (2009) found similar results and their account suggested a cause for the reduced demand for education was that there was a reduction in the expected school premium caused by the conflict. Chamarbagwala and Morán (2011), looking at Mayan communities in Guatemala, suggested that, among other factors, decreased expectations concerning the returns from education due to conflict would justify a reduction of the households' investment in education. But are these expectations confirmed? What are the links between conflict and returns from education? The current body of knowledge still leaves these questions unanswered.

This article will address both these questions, by analysing the returns to education in a country that arose from 25 years of conflict, Timor-Leste. Formerly a Portuguese colony, from 1512 until 1975, Timor-Leste was then occupied by Indonesia and ruled by its military regime from 1975 to 1999. In 2007, the year surveyed, Timor was still in a process of reconstruction, and thus represents an example of a post-conflict country. As this article shows in section 2, the process of Indonesian occupation was not uniform and the history of incidence of violence in each of the Timorese districts during the conflict is a heterogeneous one. The different experience of violence felt by each Timorese allows us to look into post-conflict Timor and analyse empirically the impacts of conflict on returns to education.

The analysis is done by exploring the microeconomic theory supporting the estimations of returns to education, considering the theoretical and empirical studies of conflict and asking the question: in what way conflict-related shocks may affect earnings and wage premiums after the resolution of the dispute? A theoretical hypothesis is proposed in

section 3: that conflict affects post-conflict earnings and returns to education through two channels. The first channel is that conflict induces lower economic activity and labour productivity, with a consequent reduction in earnings and returns to education. The second channel is the induction of reductions in labour supply and in school attainment, with a consequent scarcity of qualified human resources that may cause an increase in post-conflict earnings and in returns to education.

Adhering to the socio-economic structure of the Timorese post-conflict labour market, this study estimates returns to education using Ordinary Least Squares and Full Information Maximum Likelihood Heckman Selection Model regressions, clustered at the household level. It comprehensively explores different dimensions of the conflict that afflicted Timor, analysing different forms of violence (this includes killings but also the hunger and illness induced by military actions), while also the different nature of political control in different districts during the conflict. As seen in section 5, these indicators are tested both in the direct estimation of returns to education and in the selection model, allowing a richer scope of analysis. Endogeneity, selection bias and other sources of bias are addressed, together with robustness tests that reinforce the empirical results.

The evidence found in this study, presented in section 6, indicates that forms of violence experienced during the school life of individuals reduce the returns to education. It also indicates that the experience of extreme levels of violence, and the disruption of livelihoods and access to education arising from this cause, may create a scarcity of human resources, making them more expensive. Evidence also points to indications that the political conditions under which education took place also affect the participation in the post-conflict labour market. Further studies in other post-conflict countries may

confirm and validate whether the theoretical hypothesis presented here holds in different settings.

The empirical model of the Timorese post-conflict labour market gives added insights into the impacts of conflict, some of which may not come directly from the violence it generated but from the actions put in place for reconstruction and peace-building. Evidence presented in section 6 indicates that the "aid economy" activated in support of post-conflict countries may generate distortions in the labour market.

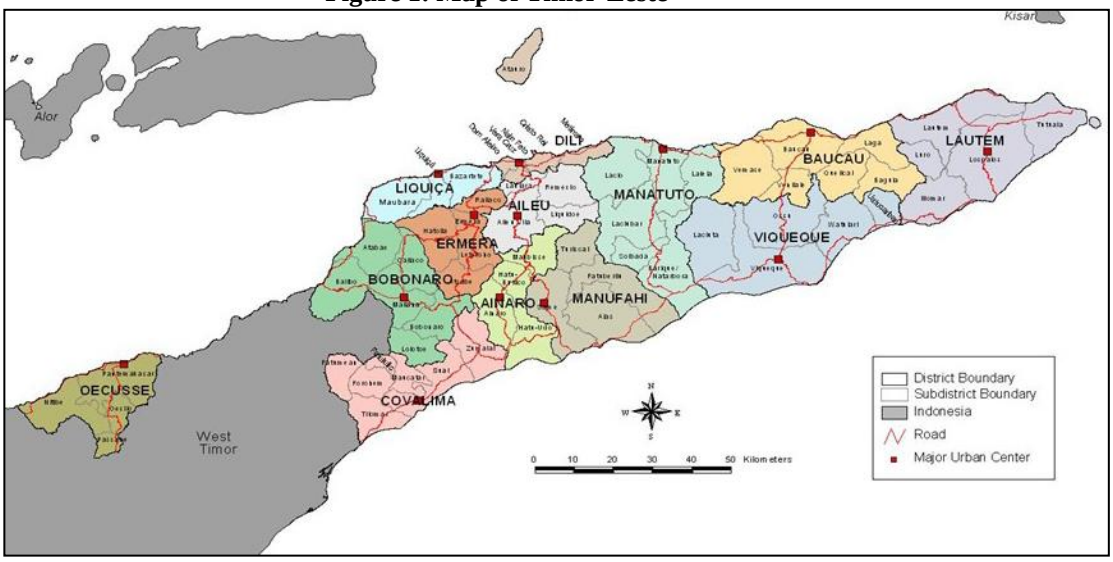
The evidence generated in this study gives, therefore, a first answer to questions that have previously been unanswered. It provides an estimate of returns to education in a post-conflict situation, comparable with those found in other settings. It also provides a first insight into the ways in which processes through which the actual conflict - but also the post-conflict labour market - affect the returns to education. Through them, it also throws light on the incentives for households regarding their planned investment in human capital.

2- Background

The setting of this analysis of returns to education in post-conflict is Timor-Leste during 2007. Timor-Leste is a young nation, which has been independent since 2002. With a relatively small territory, 14,919 km2 wide, Timor-Leste is a half-island. It neighbours Indonesia by sea in the North and East and by sea and land in the West (including the western half of the island); while Australia lies, by sea, to the South. With an estimated population of 1.2 million in 2012, Timor-Leste (hence forth designated as Timor) has seen its economy's Gross National Income (GNI) per capita[2] grow from 650 USD in 2002 to 3,620 USD in 2012 (World Bank, 2013b).

[2] The values of the Timorese GNI per capita reported here were calculated using the Atlas method.

Figure 1: Map of Timor-Leste



Source: DNE (2008)

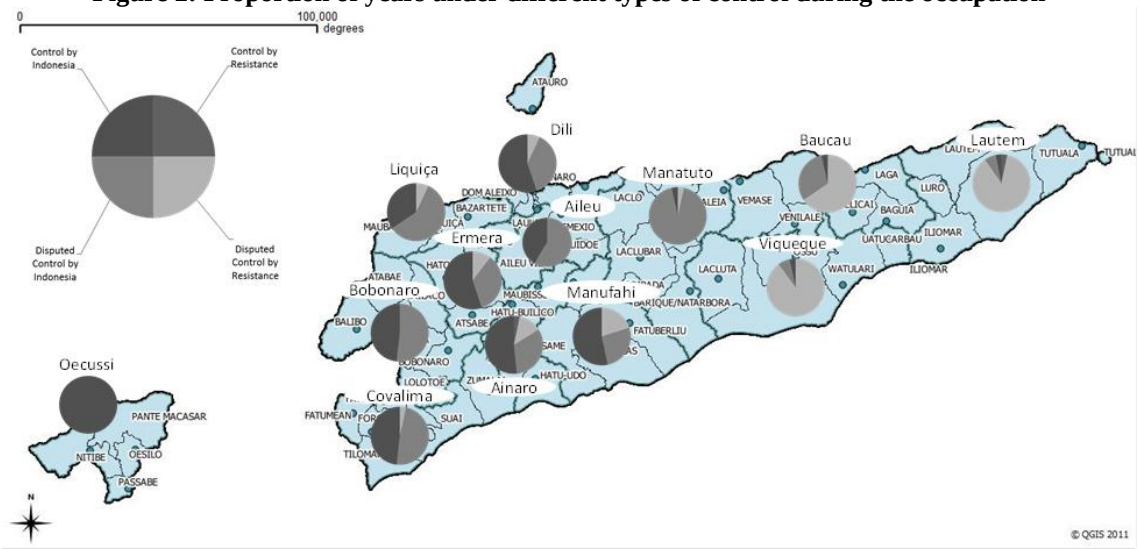
Timor is starting to explore its significant oil and natural gas reserves but its economy has not evolved much since independence. Timor is mostly a rural country, with almost three quarters of the population living in rural areas and working in agricultural activities. It is also a very young country, with half of its population below 20 years old and 41 per cent below 15 years old, according to its 2010 Census.

Another important characteristic of Timor, and one that is critical for our analysis here, is that it is a post-conflict country. Formerly a Portuguese colony, from 1512 until 1975, Timor-Leste was occupied by Indonesia and ruled by its military regime from 1975 to 1999. The process of occupation was not uniform. During the first 5 years, the Timorese Resistance secured control of wide parts of the easternmost districts. This was a period of extreme violence. Even during the years that followed, these and the southernmost districts were disputed territories, even if mostly already under Indonesian control. Other districts experienced a longer period of control by Indonesia.

Figure 2, below, summarizes the length of control by the Indonesian forces and the Timorese Resistance. For each district, the figure presents a circle indicating the proportion of the 25 years of occupation lived under 1 of 5 types of control proposed by

Kalyvas (2006). Kalyvas proposes a classification of territories according to levels of control: full control by the incumbent forces; dominant but disputed control by the incumbent forces; contested control; dominant but disputed control by rebel forces; full control by the rebel forces.

Figure 2: Proportion of years under different types of control during the occupation



Source: Map of Timor-Leste (GERTIL, 2003); graphs were calculated by the author following Kalyvas (2006), CAVR (2006) and Taylor (1999, 1990).

Each typology of control correlates with typologies of violence and with which side is expected to be enacting the given type of violence. In this analysis, Indonesia is considered the incumbent and the Timorese Resistance the rebels. Using the chronology of events offered by Taylor (1999, 1990), it is possible to construct a schedule of control over each district and year. In the Appendix A of this thesis a description and discussion of the process of attribution is presented. Figure 2 illustrates this attribution.

The Timorese Truth and Reconciliation report (CAVR, 2005) offers a thorough description of the violence endured by Timorese during the occupation. Three stages of the conflict are described: invasion and consolidation (from 1975 to 1985), stable military control (from 1985 to 1997) and the ending stage of occupation (1998 and

1999), including the referendum in 1999, its preparation phase, and the violent post-referendum period. In Figure 3, below, it is possible to perceive five peaks in the levels of killings, coinciding with the periods described. The first peak corresponds to the moment of invasion in 1975, followed by two other peaks, corresponding to the main Indonesian military campaigns to acquire and consolidate control over territory, which was still under the control of the Timorese Resistance (the first in 1978-79 and the second in 1983). These three peaks indicate extreme moments of an overall violent period, as the median line suggests. Figure 4 reveals another dimension of the violence endured by Timorese in the first stage of occupation. The number of deaths due to hunger and illness were also direct consequences of the Indonesian military operations, whose tactics entailed forced displacement into new "villages",[3] burning of crops and forests and siege tactics on villages thought to support the Resistance (CAVR, 2005). This was followed by a period of five years of famine in some districts that reportedly killed more people than the military violence. The second stage of the occupation was significantly less violent. The only spike in violence was reported in the district of Dili in 1991, namely, the massacre in Santa Cruz Cemetery, which is signalled by the fourth peak in Figure 3.

The third stage of occupation showed, again, an increase in violence and ended with a final bout of extreme violence. Following an impressive 78.5% vote for independence in the August 30th 1999 referendum, the Indonesian military (mandated by the UN to maintain security during the procedures) and the pro-Indonesia militia destroyed most of the infrastructure in the country and forced the displacement of nearly a third of the Timorese population, most of whom were later to return to an independent country under reconstruction (CAVR, 2005).

[3] Many places in Timor are named "kampung baru" (meaning "new village" in Indonesian)

In-depth life story interviews conducted in Timor during the period from July 2012 to April 2013 revealed consistent testimonies of total destruction of schools and forced displacement both in the periods of invasion and the post-1999 referendum. After both those stages, educational infrastructure had to be reconstructed. Those that lived in areas targeted by the 1978-1979 and 1983 military campaigns experienced repeated events such as destruction of infrastructure; forced displacement; loss of relatives; hunger and illness (CAVR, 2006, 2005), all of which compromised the opportunities for schooling.

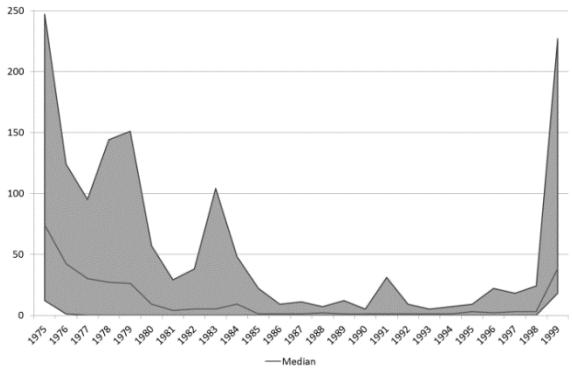


Figure 3: Civilian killed in each district (maximum, median, minimum) in each year

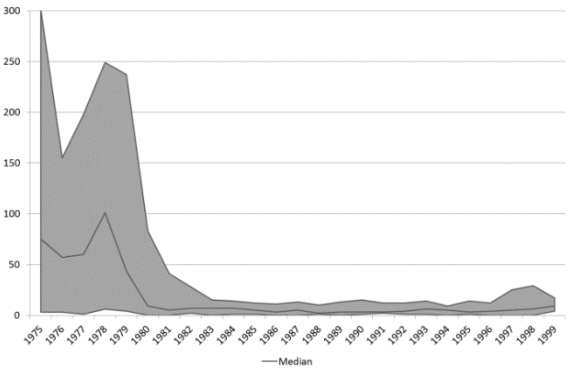


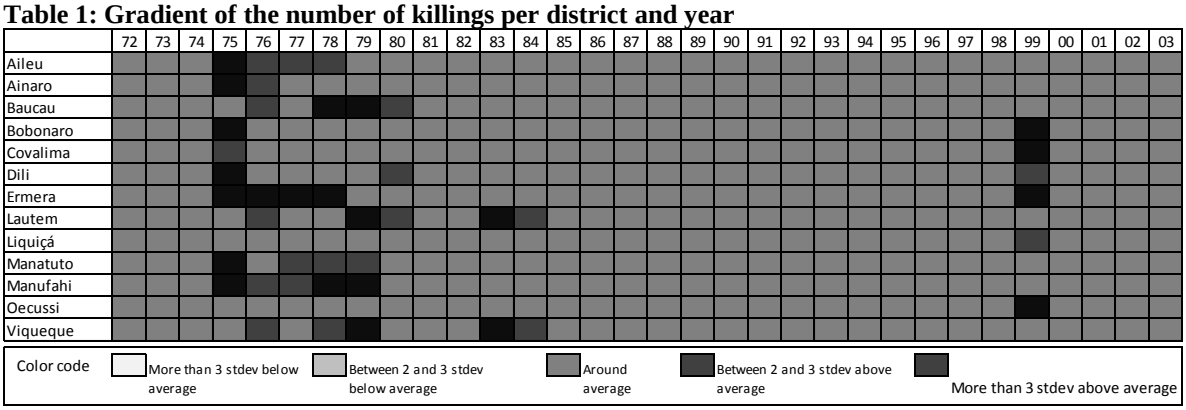
Figure 4: Deaths due to hunger and illness in each district (maximum, median, minimum) in each year

Source: Author's calculations using CAVR (2006) data.

Figure 3 and Figure 4 already give an indication that the violence that afflicted Timor during the Indonesian occupation did not affect all districts homogeneously. This was particularly evident in years of higher violence where the bandwidth between minimum and maximum violence is wider. It is also noticeable that only at the beginning and end of the occupation can we find all districts affected by violence.

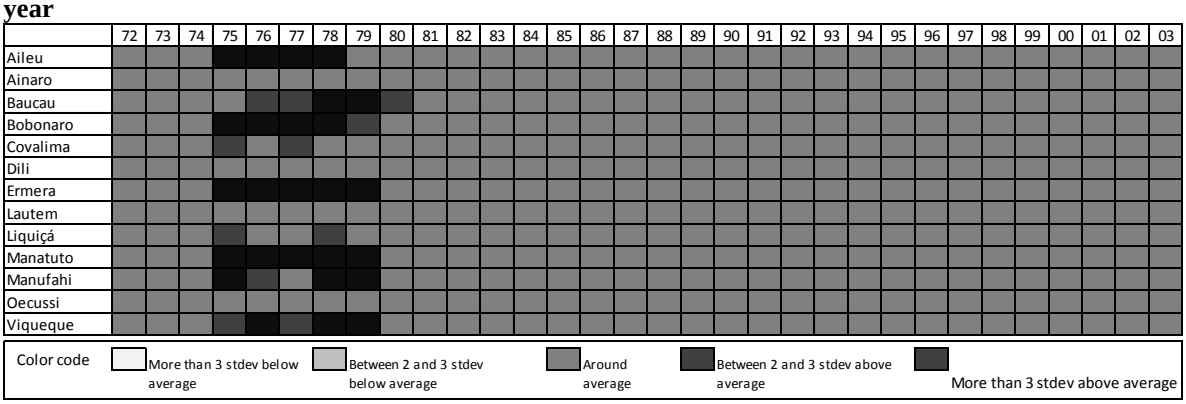
Table 4 and Table 5, below, make this heterogeneity among districts more apparent. They present gradients of violence, illustrating for each district and year the corresponding z-score relating to the number of killings and disappearances (Table 4) and the number of deaths by hunger and illness (Table 5).

Table 1: Gradient of the number of killings per district and year



Source: Author's calculations using CAVR (2006) data

Table 2: Gradient of the number of the number of deaths due to hunger and illness per district and year



Source: Author's calculations using CAVR (2006) data

The tables show that those households residing in the districts of Dili or Ainaro were relatively safe from violence, when compared to those residing in Aileu, Baucau, Ermera, Manufahi or Manatuto. It is also noticeable that those born after 1980, particularly those residing in districts relatively protected from the 1999 violence, may have experienced much lesser levels of violence than those born, or of school age, during the invasion.

The history of incidence of violence in each district during the conflict, was driven - as documented by CAVR (2005) but also Taylor (1990, 1999) - by the logistics of the fight between the Indonesian military and the Resistance and presents an heterogeneous picture. The different experience of violence - felt by each Timorese depending on the district of birth, year of birth and school life - allows us to look into post-conflict Timor and analyse empirically the impacts of conflict on returns to education.

Once estimated, the returns to education in post-conflict Timor-Leste can be compared with values found in other developing countries. A brief review points to a range of values of returns to education between 3 per cent, notably for Eastern European countries,[4] and up to 15 per cent in Thailand[5] and in Brazil[6]. Focusing on Southeast Asian countries reviewed by Patrinos et al. (2008), Cambodia, Indonesia, Philippines, Singapore, Thailand and Vietnam, we can find returns to education that tend to lie in the 3-12 per cent range. Notably returns to education in neighbouring Indonesia, for male wage earners aged 25-65 year old, were estimated to be 11.4 per cent, as suggested by Patrinos et al. (2008). Once estimated, it will be possible to compare the returns to education in post-conflict Timor-Leste against these benchmarks.

The next section presents and explores the theoretical concept that will support our empirical analysis. It will be followed by the presentation of the empirical strategy and finally the discussion of the empirical evidence obtained.

3- Conceptual Framework

The seminal work on returns to education by Becker (1962) and Mincer (1974, 1958) established education as an investment in "human capital".[7] They sought to measure the returns from such an investment, defined as an education premium that more than compensates for the direct costs incurred in education and the opportunity costs resulting from a later entry into the labour market. This premium takes the form of higher wages accrued as a result of expected higher productivity among those with higher qualifications. Becker's model makes it clear that those wages are primarily driven by firms' perception of how much education contributes to higher productivity[8].

[4] As per Flabbi et al. (2008).
[5] As per Warunsiri and McNown (2010)
[6] As per Patrinos et al. (2008)
[7] The concept of education as investment in human capital was introduced by Schultz (1961).
[8] The same insight can be found in Willis (1986).

A different perspective, drawn by Spence (1973) provides insight into additional links between education and wages. In his model, education does not increase an individual's human capital. Instead, it signals to labour demand agents (firms and other employers) that an individual with higher schooling is intrinsically a more able worker and, therefore, more productive. Given a supply of differently educated workers, firms' perceptions of this signal are the main driver of wages and education premiums.

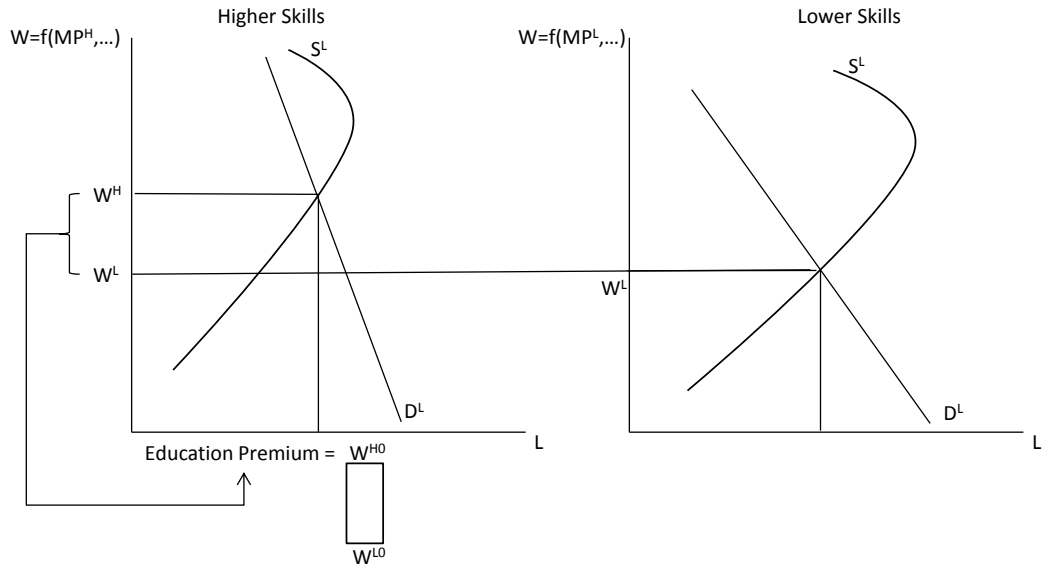
Many empirical studies on returns to education seek to isolate the contribution of education to added productivity from the notion of intrinsic ability. The aim in those approaches is to estimate the net contribution of education to increased labour productivity using wage premiums as visible indicators of returns to education. These are relevant concerns when analysing the contribution of education to economic growth. This article, however, places the focus on the microeconomics of labour and education. It seeks to estimate if, in a post-conflict setting, a household, deciding on whether to invest in education, will encounter the economic incentives that will make them pursue such investment. For such a household, it is the compounded effects of added education on the consequent wage premium (increased productivity and signal of ability) that are of concern.

The empirical estimates of returns to education are calculated from observations of several individual results derived from a matching process between the demand for labour, represented by different employers, from different sectors and industries and a labour supply represented by differently educated workers. This matching process happened in the post-conflict labour market. The economic actors in both the supply and demand side are expected to have bestowed different values on the skills being offered (and signalled) by workers, dependent on their level of education. The returns to education observed in a post-conflict labour market are, therefore, affected by shocks

that impact upon labour demand, labour supply and the quality of labour supply. Conflict theory and empirical analysis can contribute to a better knowledge of these shocks and their impact at different stages in a conflict. This study builds on that body of research to construct the first estimation of the impacts of violence on the post-conflict returns to education. This section will provide the theoretical approach to be tested empirically in section 6, below.

The impact of conflict-related violence can be constructed as the difference between the existing returns to education and those that might have prevailed if conflict had not occurred, or, if particular forms of it had not become manifest. Taking a simple generic example, one can consider that, were everything else to be held constant, and following the rationale provided by Becker (1993, 1962), a household when contemplating whether to invest in the education of one of its members, envisions the opportunity of allowing her to be hired in one of two types of employment. The labour market is, in this example, segmented in two, as depicted in Figure 5, below.

Figure 5: Model with two labour markets - education premium

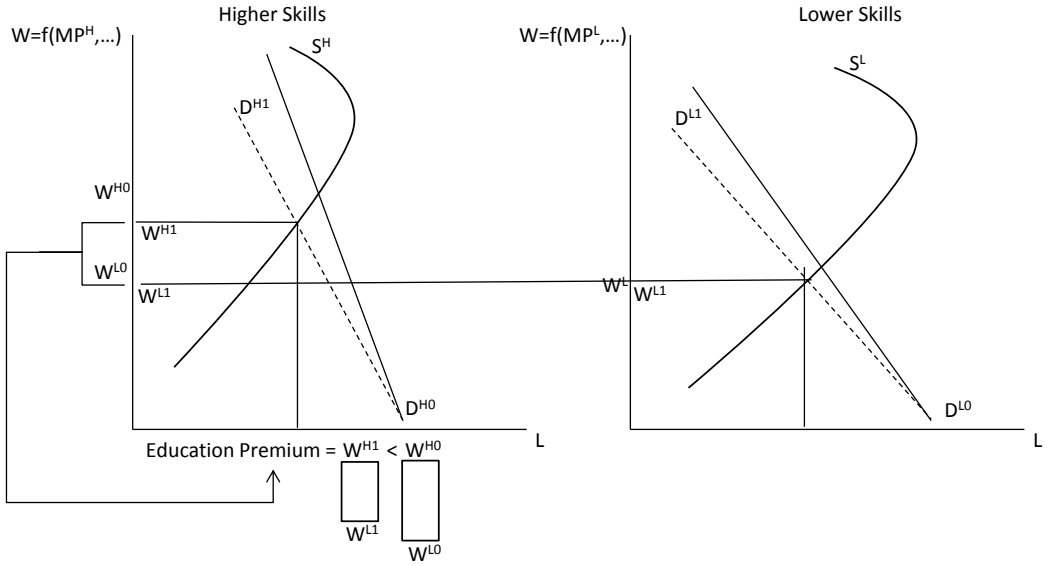


In the first segment, labour incorporates lower skills, therefore awarding lesser marginal productivity to the employers, which therefore remunerates her with a lower wage. In the second segment, labour incorporates higher skills, achieved (or signalled) through education. Expecting higher productivity, the employers are willing to pay a higher wage. Given the cost of education, one could also expect a lesser number of individuals would make the choice of entering this market, thus further increasing the equilibrium wage. In this illustration, a wage premium, $W^H - W^L$, gives the value to be gained by the household from investing in its member's education.

The emergence of conflict during the years of schooling leads to a set of effects on the labour market and on education. A first effect is a reduction of the economic activity during the conflict and after it subsides. Bellows and Miguel (2009) note that this is the most commonly expected effect of a conflict. Although, as found by Badiuzzaman et al. (2011) post-conflict reconstruction programmes tend to mitigate this effect, Cerra and Saxena (2008) establish that what we find is but a partial rebound, a recovery of half the loss in four years while the remainder takes more than a decade to be recovered. Studies such as those undertaken by Bisogno and Chong (2002) found that the effects of recovery and rebound can be differentiated across a country, with zones and economic sectors targeted by reconstruction projects benefiting more than others. Another effect is a reduction in productivity, as determined by studies such as Kondylis (2010). This may happen due to factors such as forced inactivity, as suggested by Collier and Duponche (2010), inadaptability of own skills, particularly of those displaced, following Ibáñez and Moya (2009) or due to the deterioration of the quality of education under conflict conditions, as put forward by Cranna (1994).

The impacts of this set of effects on the education premium are depicted in Figure 6, below. The reduction in productivity affects both low skilled and high skilled labour markets. If we assume that the acquisition and reproduction of knowledge and skills is progressive, any destruction of skills in the form referred to above is likely to have effects proportional to the levels of skills required. If that is the case, labour demand and the level of productivity in the higher skills labour market will reduce more than that in the lower skills labour market. Conflict will lead to lower labour demands that will lead, in turn, to expected decreases in the returns to education.

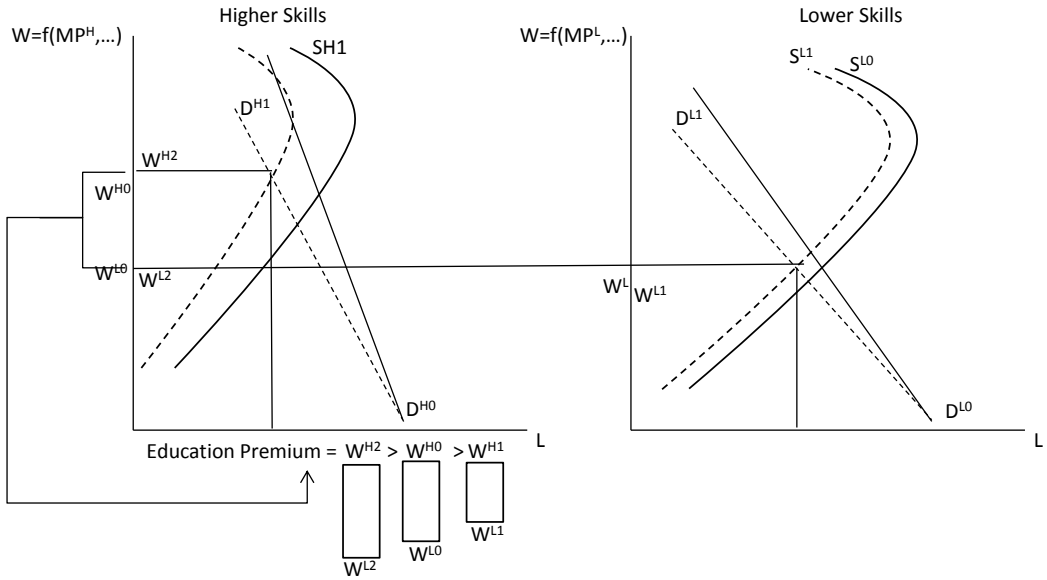
Figure 6: Model with two labour markets – reduction of productivity and economic performance



However, a second set of effects act in the opposite direction, as illustrated in Figure 7, below. Conflict destroys production and productivity but it also leads to a reduction in labour supply, due to conflict fatalities. Bircan et al. (2010) found that in conflict-afflicted countries, labour force participation stays below the long-term average during the first 10 years after the conflict. This reduction is arguably higher in what would have been a more highly skilled labour, due to a reduction in school attainment, as documented in studies such as FitzGerald et al. (2001), Stewart et al. (2001), Blattman and Annan, (2010), Shemyakina (2011) and, particularly in relation to Timor-Leste, in

Justino et al. (2013). By the same token, a correlated increase in school drop-outs and lower quality of education are documented by Evans and Miguel (2007), Ibáñez and Moya (2006) and Rodriguez and Sanchez (2009).

Figure 7: Model with two labour markets – reduction of labour supply



All other effects being constant, the reduction of labour supply may even induce a situation of relative scarcity. Conflict would then induce an increase in wages, irrespective of education. Compounded with lower school attainment, this reduction is more likely to be felt in the supply of high skilled labour. If that is the case, conflict would induce an increase in returns to education, as illustrated in Figure 7.

This brief review establishes, therefore, a theoretical hypothesis of two channels through which conflict may affect post-conflict earnings and returns to education: first, effects arising from a decrease in productivity and, second, the effects due to the scarcity of qualified human resources. The empirical analysis below will test this hypothesis in the setting of post-conflict Timor-Leste.

4- Data Description

This research used the dataset of the Timor-Leste Survey of Living Standards of 2007 (TLSLS), conducted by the Timorese National Directorate of Statistics (DNE), with the support of the World Bank and UNICEF. A representative set of 4,470 households was interviewed, with 25,000 people surveyed, from all districts of Timor-Leste.[9] From these, 15,809 were above 15 years old, of working age according to Timorese law. Only those in a subsample of 9,010 have an occupation, of which only an even smaller subsample of 1,221 people have a job that earns them a wage.

A second dataset used was the Human Rights Violations Database (CAVR, 2006) which contains 11,315 observations of human rights abuses. The observations referred to are the collected narrative statements from deponents to the Timorese Truth and Reconciliation Commission (CAVR), qualitative reports from Amnesty International, and data collected by the Timorese NGO FOKUPERS. Under the CAVR mandate, Benetech-HRDAG produced and presented calculations of human rights violations in Timor-Leste in support of the commission's final report entitled "Chega!" (CAVR, 2005).[10]

In Table 6 we can find some distinctive characteristics of the subsample of paid workers. The average hourly wage among paid workers was 1.16 US dollars, significantly above the poverty line of two US dollars a day. The proportion of women among paid workers is very clearly lower than in the representative TLSLS sample, suggesting evidence of gender segregation in the labour market. The rural/urban divide is also clear. Close to 80 per cent of the paid workers were urban dwellers, a much higher proportion than in the representative sample. The average age of the paid

[9] The enumeration process (which started in March 2006) was suspended due to the 2006 crisis and all the households interviewed before suspension were re-interviewed after the process restarted, in 2007.
[10] Translation into English: "Enough!"

workers was 37 years old in 2007. This would mean that the average paid worker would have been close to school entry age at the time of the Indonesian invasion, in 1975.

Table 3: Earnings and Education

	Paid Workers		All	
N	1,221		25,000	
Variable	Mean	SDev.	Mean	SDev.
Has a paid job	100%	-	14%	-
Hourly wage (USD)	1.16	4.11	-	-
Woman	20%	-	49%	-
Age	37	10	23	19
Household size	7	3	7	3
Resides in an urban area	79%	-	47%	-
Migrated	27%	-	8%	-
Education				
Years of Education	11	5	4	5
Completed Primary School	10%	-	13%	-
Completed Pre-Secondary School	10%	-	8%	-
Completed Secondary School	52%	-	9%	-
Completed Vocational School	1%	-	0.03%	-
Completed Graduate Education	0.1%	-	0.1%	-
Completed Postgraduate Education	4%	-	1%	-
Experience (years)	20	12	-	-

Source: Author's calculations, from TLSLS (2007).

The representative sample of the TLSLS suggests a population that does not migrate, with 92 per cent still living in the birth district. The paid worker subsample has a higher proportion of internal migrants, at 27 per cent, but this is still relatively low.[11] Notably, there are no differences in the household size between the paid workers subsample and the TLSLS sample. A look at education levels reveals striking differences. Average years of schooling among the paid workers in the subsample were almost three times higher than the sample average. One can also notice that half of the paid workers completed secondary school. This correlates with evidence collected during qualitative research: most of those employed in qualified public service positions (teachers, nurses, policemen,…) completed their education in secondary level technical schools.

The analysis of the subsample of paid workers in the TLSLS suggests an interesting disaggregation: close to 60 per cent work in public services (social services), close to 30

[11] Unfortunately, it isn't possible to track whether the individuals migrated or displaced themselves during the conflict, only whether they currently resided in a district different from that of their birth.

per cent work in private services, 7.2 per cent are in industrial activities and only 3.5 per cent are active in the primary sector, indicating that most of the employment in agriculture is not paid.

Table 4: Type of Employer

	Percent	Years of Education		Hour Wage (USD)	
		Mean	SDev	Mean	SDev
Private company, enterprise or cooperative	9%	8.6	5.5	1.3	3.2
Rural public works program	11%	11.2	4.8	0.6	0.4
Government, public sector, army	45%	11.5	4.3	1.5	5.4
State-owned enterprise	4%	11.4	4.6	0.5	0.4
Private individual	13%	6.9	4.5	0.9	4.0
NGO	15%	11.4	5.1	0.9	1.9
Other	3%	9.8	6.3	0.8	1.2

Source: Author's calculations, from TLSLS (2007).

The distribution of paid employment per type of employer, in Table 7 is also telling: the government was the major employer, either directly (hence 45 per cent were engaged in government, public sector and army, added to the 11 per cent employed in rural public works programmes, which were mostly funded through international aid programmes) or indirectly in state-owned enterprises (4 per cent). NGOs were the next most important type of employer (at 15 per cent) followed by self-employment (13 per cent) and, finally there were private companies, enterprises and cooperatives (9 per cent). This reveals familiar traits of a post-conflict setting: a very shallow formal economy, which is highly dependent on public services and the "aid economy" as its main employers. Notably, it is not the private sector that hires, on average, the most qualified workers, but the government and the "aid economy". The higher average wage is paid by employment in the public sector, although with a significant dispersion (high standard deviation), followed, at some distance, by the private sector and NGOs.

Table 8, below, is also telling. The district of Dili, capital of Timor-Leste, has a high concentration of the formal labour force, close to one third of paid employment, which is a much higher proportion than would be expected in terms of its importance in relation to the number of residents living there. This correlates with a higher proportion of those that have Tétum as the mother language. Notably, the most important ethnolinguistic group, Mambae, has a much weaker representation in the paid workers subsample. Tétum is the Timorese lingua franca and the only national language that has, alongside Portuguese, an official status.

The knowledge of Tétum appears high among all paid workers. It is followed by the knowledge of Indonesian and then by Portuguese, which is only spoken by close to half of the paid workers. However, the difference between the proportion of paid workers in the TLSLS sample that know Portuguese and the proportion of those that do so in the full sample is strikingly high, suggesting that lack of knowledge of this language may be a barrier for employment. To a lesser degree, the same can be said of English and Indonesian. These have "working language" status according to the Timorese constitution and are required for some types of employment.[12]

[12] Notably English stands as a language required for employment with many NGOs.

Table 5: Geography, Ethnicity and Language

Variable	Paid Workers	All	Variable	Paid Workers	All
			Residence		
Region 1	16%	20%	District of Dili	33%	15%
Region 2	16%	19%	Region 4	14%	20%
Region 3 except Dili	4%	11%	Region 5	17%	15%
			Ethnolinguistic Group		
Mambae	14%	23%	Galolen	2%	2%
Tetum	32%	18%	Uaimua	1%	2%
Baiqueno	16%	14%	Naueti	1%	1%
Macasae	7%	8%	Midiki	1%	1%
Bunak	6%	7%	Macalero	1%	1%
Kemak	3%	6%	Laklei	0%	0%
Tetum terik	4%	6%	Sa ani	0%	0%
Tokodete	3%	5%	Mangilih	0%	0%
Fataluku	5%	5%	Kaklun bikeli	0%	0%
			Other Language	3%	3%
			Language Barriers		
Speaks Tétum	100%	87%	Speaks Portuguese	54%	16%
Speaks Indonesian	94%	40%	Speaks English	27%	5%

Source: Author's calculations from TLSLS (2007). Note: Region 1 = districts of Lautem, Baucau and Viqueque; Region 2 = Manatuto, Manufahi and Ainaro; Region 3, excluding Dili = Aileu and Ermera; Region 4 = Liquiça, Covalima and Bobonaro; Region 5 = Oecussi.

The experience of conflict is also diverse, as is apparent when comparing the subsample of paid workers with the TLSLS representative sample, as per Table 9 below. As the indication of the average age of paid workers in Table 6 suggested, it is more likely that people who experienced the Indonesian invasion will be found in this subsample. This correlates with the evidence that, on average, those with paid employment witnessed higher levels of violence, namely civilians who were killed or disappeared and deaths due to hunger or illness in their birth district. Also on average, the data shows that a Timorese experienced in her life one year of extreme violence, i.e., a year where the number of killings and disappearances or deaths by hunger or illness in her birth district exceeded the yearly average by two standard deviations.[13] However, the experience of violence is more heterogeneous if the analysis is narrowed to the years of schooling.

[13]This definition follows Justino et al. (2013).

Table 6: Experience of Conflict at the birth district

	During Life Time				During School Life			
	Paid Workers		All		Paid Workers		All	
Variable	Mean	SDev.	Mean	SDev.	Mean	SDev.	Mean	SDev.
Yearly average number of civilian killed or disappeared	10	5	7	6	12	14	8	14
Yearly average number of deaths due to hunger or illness	11	8	7	7	16	22	9	18
Years under extreme killings	1	1	1	1	0.5	1	0.1	0.4
Years under extreme hunger and illness	1	2	1	1	1	1	0	1
Years in a disputed territory	13	8	7	8	5	5	1	3
Years in a territory controlled by Resistance	5	7	3	6	2	4	1	2

Source: Author's calculations, from TLSLS (2007).

While an analysis of conflict experienced during a lifetime is relevant, it mitigates the evidence of violence experienced during the key period for our analysis: the school life of individuals. As discussed above, conflict not only impacts upon the economic activity in its aftermath but hinders school attainment and school quality during it. It would therefore be advisable in an investigation to test the impacts of conflict using indicators of violence experienced during school years.

The historical data, presented in section 2, also allows for a comparison of the experience of different contexts of political control during the conflict, following the concepts of Kalyvas (2006). As explained in section 1, a schedule of control was constructed and this is used here to produce indicators of political control, namely the number of years lived under each type of control. As with other indicators, it is noticeable that paid workers lived a higher proportion of their lives in disputed territories and under the control of the Timorese resistance. The difference is even more noticeable when looking at the number of school years.

It is now clear that the violence endured by the Timorese during the 25 years of Indonesian occupation was not homogeneously experienced by all. The level of violence and the characteristics of political control in a given territory that were experienced by any one Timorese during her lifetime - and even more so during her school life - can be significantly different from that experienced by another person

depending on the district and year of her birth. These heterogeneous dimensions make it possible to empirically assess how conflict affected returns to education in post-conflict Timor-Leste. The investigation into these dimensions and issues will be undertaken following the methodology discussed in the next section.

5- Empirical Strategy

Let us, therefore, consider that for every individual $i = 1, \dots, p$ of the subsample of n individuals with a formal, wage earning, occupation, y_i represents her average hourly wage.[14] Building on Becker (1962) and Mincer (1974), the empirical model starts from an earnings equation with the following stochastic form:

$$\ln y_i = a_0 + r * S' + \beta_1 * t_i + \beta_2 * {t_i}^2 + \gamma * X_i' + \theta * {W_i}' + u_i, \quad (1)$$

where $E(u_i) = 0$, t_i corresponds to her work experience, starting immediately after completion of schooling,[15] X_i is a vector of individual, household, industry and region-specific control variables and W_i is a vector of individually specific conflict related variables. The empirical strategy explores a vector of schooling indicators, S_i, which include the years of education, s_i, as per Becker (1962) and incorporates education specific signals perceived by the labour market, building on the contribution initiated by Spence (1973). These are control variables indicating the last complete level of education, testing for the "diploma effect" – as reported in in-depth interviews

[14] This variable is calculated using the information on wages per period and number of periods worked by the individual corresponding to the last payment reported in the TLSLS questionnaire. This is chosen in order to separate income effects from possible labour supply effects, namely the likelihood of more educated individuals working more hours, as proposed by Henderson et al. (2011) and Addabbo and Favaro (2011).

[15] Experience is calculated as follows: $t_i = (A_i - s_i - b_i)$ where A_i is the current age, s_i is her number of schooling years and b_i is her age at the beginning of school. In Henderson et al. (2011), potential working experience was calculated as age minus years of schooling minus 6. Addabbo and Favaro (2011, p. 4594) advise caution regarding the use of such a measure of experience, since it does not account for periods of absence from the labour market, due to unemployment, inactivity, illness or even parenthood.

conducted in Timor as factors valued by Timorese students, trainees and employers.[16] The control variables in vector X_i encompass several covariates recommended by the literature on empirics of returns to education. Activity sector and employer type controls are constructed as part of this vector of covariates, accounting for the heterogeneity of job placements, with interrelations between the type of employer and years of education.[17] This approach allows us to assess diverse returns to education depending on type of employer. Employer heterogeneity is also controlled via the number of workers on the job.[18] Intrinsic individual characteristics and skills are also controlled for: gender, knowledge of other languages, household size,[19] migrant status, marital status and ethnicity. Finally, possible geographic segregation of markets is tested by controlling for rural/urban residence and incorporating regional dummies.[20] The conflict variables vector, W_i, includes the following set of covariates: yearly average number of civilians killed or disappeared; yearly average number of deaths due to hunger or illness; years under extreme killings; years under extreme hunger and illness; years in a disputed territory; and years in a territory controlled by the Resistance. All of these are considered in relation to the factor of whether they occurred during school life or during the wider lifetime. These covariates present a significant correlation. Therefore, each variable is tested individually and, only those proven to be significant are tested together.

An empirical analysis of returns to education in a post-conflict setting such as the Timorese has to account for the distinct characteristics of paid workers when compared

[16] This approach builds on studies, documented by Zhu (2011, p. 84) regarding the Chinese labour market, that account for non-linear returns to education through dummy variables that identify different levels of education as Heckman and Li (2004) and Knight and Song (2003).
[17] These follow the works by Willis (1986) and Verhaest and Omey (2011).
[18] As suggested by Verhaest and Omey (2011, p. 7).
[19] The latter is also found in Verhaest and Omey (2011, p. 7).
[20] Following Alves (2012).

with the general population. A selection bias is likely to affect the estimates resulting from an Ordinary Least Squares (OLS) as equation *(1)* expresses, in fact, the expected value of (log) earnings for those individuals with a paid job, i.e.:

$$E(y_i|i\ participates\ in\ the\ formal\ labor\ market).$$

This likely selection bias was first addressed by Gronau (1974) and Heckman (1976). Building on their approach it is possible to test if the experience of violence during the conflict has a significant impact on labour market participation, thus affecting earnings and returns to education. Controlling for this impact, it would be possible to correct for this bias.

Let then P_i be the probability of participating in the labour market, following a process defined by the following equation:

$$P_i = 1\{\alpha_0 + \varphi * Z_i' + \vartheta * Q_i' + v_i > 0\}, (2)$$

where $E(v_i) = 0$, Z_i is a vector of individual, household, industry and region specific control variables: age; gender; years of education; marital status; controls for command of a second language (Indonesian, Portuguese and English) to assess eventual language barriers to the labour market; control for urban/rural residence and regional controls; and controls for ethnicity. In similar fashion to the earnings models, Q_i encompasses all the conflict indicators included in W_i. The results discussed below will be based on OLS and Full Information Maximum Likelihood Heckman Selection Model[21] regressions, clustered at the household level.

Prior to discussing the empirical results, however, it is important to address other relevant sources of bias, particularly due to likely endogeneity of education and of

[21] This approach is inferred by Puhani (2000), among others, to be the best.

conflict. A clear source of endogeneity in education results from the ability bias and stems from the insight drawn out by Spence (1973). If the concern is to evaluate the impact of knowledge and skills received through education upon increased productivity - as measured through efficient wages - then some bias may exist. Higher education may correlate with (unknown) higher intrinsic skills, which in turn, are likely to correlate with a better paid job. This endogeneity effect causes returns to education to be over-estimated.

Reviews such as that of Ashenfelter et al. (1999, p. 454-456) have discussed different approaches proposed to address this type of endogeneity. In particular, there is the explicit introduction of ability proxies as controls. Griliches and Mason (1972) and Griliches (1977) used the result of IQ tests including regressions on siblings or twins considering eventual "sibling/twin effects" (i.e., the presumption that siblings or twins share the same genetically primed ability). Use was also made of Instrument Variable (IV) methodologies, particularly using parents' education as instruments of the person's own education. One may find some grounds to argue that the existing bias does not lead to an erroneous assessment of the economic behaviour of agents. Neither households (when deciding on whether their school-age members should stay in school) nor businesses (when hiring) look for a distinction between the level of schooling acquired and the inherent skills that allowed for such acquisition. Rather, it is the *perception* of higher worth of a (prospective) worker by the (prospective) employer that motivates the latter to award an education premium, as Willis (1986) stressed. If unobserved abilities were to significantly bias the employers' analysis, they would be incurred in costs which would make them observable. In some recruitment processes employers do incur those costs and applicants can be subjected to (psychometric) tests that seek to depict mathematical, logical, reading and writing - and even inter-relational - skills. However,

as documented by Jenkins (2001), Taylor, Kelty and McDonnel (2002) and Williams (2009), while these are now more popular in industrialized countries than ever before, they are still used by only up to half of the employers and mostly only for particular placements (namely in management posts). It is not clear, therefore, that market agents consider an eventual endogeneity bias in education as an obstacle to their best choice (either in relation to hiring or investment in education). This argument however, cannot overshadow the knowledge that ability, being unknown and positively correlated with education and earnings, originates an unobservable variable bias that causes returns to education to be overestimated, if no process is found to account for it.

Ideally, one would seek to make ability observable, namely through IQ tests. However, data limitations do not allow this to be possible when studying post-conflict returns to education in Timor-Leste. Other methods, such as regression discontinuity were found not to be possible as no fitting events were found. This leaves IV as the possible approach, tried empirically in early analysis for this study. Both parents' education attainment levels were explored as instruments. However, two constraints made that endeavour fail. On one hand, TLSLS (2007) data misses information on parents' education for nearly half of the sampled individuals, leading to a significant loss in observations to support the study. On the other hand and more significantly, due to a significant lack of investment in education during Portuguese rule and the difficulties of Indonesian occupation, the average level of attainment of the Timorese is almost insignificant, one year of education and without a significant variance. This made parents' education a very weak instrument. This situation speaks to side reservations that are raised in the review by Heckman and Urzua (2009, p. 17) regarding the application of IV namely: 'weak instruments can give biased estimates', 'IV estimates rest on strong, a priori data assumptions', 'in a heterogeneous model, different

instruments will give different estimates' and 'the IV estimate, depending on the instrument used and assumptions made will give different estimates on the return to education, which are often incorrectly interpreted'. In the same sense, Dickson and Harmon (2011, p. 1118) state: *'[E]stimates of this return vary significantly, depending on the data sets used, the assumptions made and the estimation techniques. In terms of broad methodologies, the focus on the issue of endogeneity often requires identifying assumptions that cannot be empirically tested or are, at best, somewhat fragile in estimation.'*.

With these limitations, an IV approach was also found to not be possible. Under these data constraints, it is advisable to assume that the estimates of returns to education found and presented in the following section are over-estimated.

The introduction of indicators of violence and conflict cannot overlook potential endogeneity. It may be the case that reverse causality does not occur between the variables in the left-hand side of the mincerian equation and the Heckman selection equation, measured in 2007, and the conflict indicators (all reporting to the period 1975 to 1999). However, one cannot overlook reasonable expectations of omitted variable bias or correlated measurement error. A possible omitted variable bias regarding the indicator of intensity of violence, (namely, civilians killed during school year) is the average income at the district level. Following the mincerian equation, this variable is not included in the empirical model. As discussed before, Justino and Verwimp (2006) found that in Rwanda, there was targeting of richer households. In that case, and during the conflict, one could establish reverse causality between earnings and conflict: the richer were targeted, increasing the violence directly affecting them and, endogenously decreasing average earnings. There were reports of FRETILIN elites having been targeted by Indonesian forces and some elite schools being targeted during invasion

(Felgueiras and Martins, 2006). This being the case, income level, during the conflict, would have been a cause of victimization. If income differences were to have been maintained after the conflict, even though there were post-conflict aid policies that targeted and supported those found to be more affected by the conflict, then the earlier income differences may still partly explain post-conflict differences in earnings by district. These differences would be due to economic spill-over effects: the richer districts could have been more hit by the conflict and are still the wealthiest areas. This effect, though, is not clearly apparent. Dili, the richest district in the country was one of the least affected by hunger, while Baucau and Bobonaro, the second and third richest, were among the most affected during the beginning phase of violence. In synthesis, districts where currently earnings are higher, having been relatively richer and more hit than the others during conflict, would show an unobserved bias towards an underestimation of the negative impact of this dimension of conflict.

On the other hand the endurance effects of famines provoked by the actions of protagonists from the Indonesian occupation violence may also correlate with omitted variables. The extreme events of hunger reported in Timor-Leste happened during the invasion period (1975-85) and resulted from the military tactics of encirclement and siege deployed by the Indonesian army (CAVR, 2005). These effects did not directly arise as a cause of the military action itself but as a reaction to the invasion. People fled to mountainous terrains making those the places where siege and forced displacement or village uprooting were more severe. So, although not directly causal, there is a strong correlation between having been born in a more mountainous terrain, being alive in the period 1975-85, and being a victim of the siege tactics. This would have meant experiencing periods of extreme hunger. As the level of internal migration in Timor is extremely low, people were very likely to still live in those same mountainous areas as

in 2007. Most of the more mountainous districts in Timor are also among the poorest, the exception being Baucau (the second richest) which also encompasses the second highest mountain in the country. There may, therefore, be an omitted variable guiding effects such as Timorese experiencing higher prevalence of extreme hunger and also earning lower wages. A negative impact of conflict may therefore be overestimated while an eventual positive effect may be underestimated.

Finally, one may also find omitted variable bias regarding the political control variables. Again, due to terrain conditions, the control of the Resistance was sustained for longer in the most mountainous districts (particularly those furthest to the East) and in those areas where transport infrastructure was least developed in Timor during Portuguese colonization. Although investments were put in place by the Indonesian and - after independence - in the reconstruction efforts, these same conditions remain in these districts of Timor, making them locations of lower participation in the formal labour market. To a lesser extent, these conditions also applied to districts that sustained longer periods of dispute, particularly when compared to those areas where Indonesia sustained longer territorial control. There is, therefore, a possibility of negative effects of conflict on participation in the formal labour market, tested in the first stage of the Heckman selection regression, which may have been overestimated.

While time invariant characteristics were controlled through district level and ethno-linguistic fixed effects, in order to address these sources of endogeneity, an IV approach was applied using the distance to the western border of Timor-Leste with Indonesia as an instrument. This strategy made use of the fact that the Indonesian operations' logistics were systematically supported through their western half of the island of Timor, where, namely a vast number of Timorese were forcefully displaced during the post 1999 referendum violence, as per CAVR (2005). It was also explored by Justino et

al. (2013, 2011). This allowed for stronger control but also more violence to be enacted by Indonesia in the western districts of Timor-Leste while giving more control of the easternmost district to the Resistance and making the central districts spaces where there was a higher degree of dispute. The forms of severe violence were also enabled by this logistical feature, again as reported in CAVR (2005). So, while the efforts of invasion lasted longer in the districts at a greater distance from the western border, as is shown in Figure 3 and Figure 4, above, the destruction enacted in the post-referendum period was stronger closer to the border, where pro-Indonesia militias received more support and were better armed. Therefore, as was described in historical reports, namely Taylor (1999, 1990) and CAVR (2005), the distance to the border is expected to be correlated with the indicators of conflict used. On the other hand, it is important to take into account what are the main economic centres of Timor-Leste - such as the capital Dili and Same closer to the west, Baucau and Lospalos in eastern districts and, finally Maliana near the western border. In these areas there was higher Timorese post-conflict economic activity, higher participation in the formal labour market and greater earnings. The distance of these towns and their districts to the western border differs quite significantly. In fact, there is no significant correlation between the level of economic activity at the district level and the distance to the border. This makes the latter a possible instrument in an IV approach.

The test of the IV approach using distance to the border as an instrument, however, failed to identify empirical evidence of endogeneity. Contrary to what would be expected, the distance to the border revealed itself to be a weak instrument in relation to the variables *civilian killed during school*, *number of school years in disputed districts* and *number of school years in districts controlled by the Resistance*. The Sargan test, however, revealed it to be a good instrument for *years of extreme hunger during school*.

Finally, for all the variables, the instrument failed to fulfil the exclusion restriction. In all cases, the null hypothesis of exogeneity in the Durbin-Wu-Hausman F test cannot be rejected. Therefore, this study is not able to apply an IV approach. However, the biases discussed above must be taken into consideration when analysing the results.

Bearing these data constraints in mind, the empirical model will be used to try and test the theoretical hypothesis presented in section 2. In the next section we will present and discuss the empirical results.

6- Results

Applying the empirical strategy presented in the previous section, it is possible to test the theoretical hypothesis, presented in section 3, that there are two channels through which conflict affects post-conflict earnings and returns to education. The first channel, conflict induced decreases in productivity, should reduce both earnings and returns to education. A second channel, conflict induced scarcity of qualified human resources, should increase earnings and returns to education.

These effects are tested against the backdrop of a baseline model that presumes no effects from conflict. The effects of conflict are then added to the estimation in an attempt to isolate the theoretically presumed channels. The results of the estimations are presented below in Table 10 and Table 11. The models presented are the parsimonious estimations of returns to education, resulting from the test of all covariates referred to in section 5.[22]

[22] While the selection model presented was estimated with all the variables referred to in section 5 above, the following variables were tested and dropped from the earnings models due to lack of statistical significance: number of co-workers; employer type dummies identifying Private Companies, Government, State Enterprises, Self-Employment and Other and respective interaction with Years of Education; dummies identifying completion of primary, pre-secondary, secondary and graduate education; dummies identifying command of English and Indonesian; marital status (1 for married or widow); household size and gender (1 for female).

Before addressing the earnings model, however, it is important to discuss the adequate estimation approach, looking into the Heckman selection models in Table 10. The selection model suggests the following switching variables: age; urban residence; gender (1 for a women); command of Indonesian and English languages; marital status (1 if married or a widow); and the political dimensions of the conflict (number of school years living in a disputed district and living in a district controlled by the Resistance). The signs of the estimates in the selection model follow stylized facts.[23]

The political dimension of the conflict in Timor, presented in sections 2 and 4, appears to affect participation in the labour market. In fact, those were the only conflict-related indicators found to significantly affect participation. The effect they had on earnings is neither direct nor does it directly affect returns to education. However, the indicators suggest that when controlled for other variables - including regional fixed effects - those that lived a higher number of their school years in disputed districts were more likely to participate in the formal post-conflict labour market. Meanwhile, those that lived more school years in districts controlled by the Resistance were less likely to have a role in the labour market.

The first effect may be the result of a higher need for post-conflict reconstruction work in districts that had been contested the longest, as the violence and destruction of infrastructure was most extreme in these locations. As most of the formal employment is linked with either international aid or public administration, this might justify a significant positive correlation. On the other hand, the experience of education in territories controlled by the Resistance had a negative impact on participation in the

[23] I would like to highlight, however, the signal arising from the coefficient on gender, as it suggests segregation in the labour market. This indicates that, in the Timorese economy in 2007, gender based discrimination, while not being significant once women enter the formal labour market, is significant on entry.

formal labour market. This may be derived from a higher probability of exclusion from education and also from employment opportunities during occupation. It also points to an eventual absence of positive discrimination of putative “loyalists”. These interpretations, however, should be validated by further investigation of the political dimensions of the conflict and its relation with the post-conflict labour market.

Table 7: Heckman selection models

	Simple Mincer		Baseline Model		Violence experienced during school year		School years exposed to extreme violence		Both channels	
	(1) OLS β/(se)	(2) Heckman β/(se)	(3) OLS β/(se)	(4) Heckman β/(se)	(5) OLS β/(se)	(6) Heckman β/(se)	(7) OLS β/(se)	(8) Heckman β/(se)	(9) OLS β/(se)	(10) Heckman β/(se)
Heckman Selection Model										
Constant		-3.564***		-3.555***		-3.872***		-3.379***		-3.872***
		(0.135)		(0.135)		(0.150)		(0.133)		(0.150)
Age		0.013***		0.013***		0.014***		0.013***		0.014***
		(0.002)		(0.002)		(0.003)		(0.002)		(0.003)
Years of Education		0.093***		0.093***		0.083***		0.060***		0.083***
		(0.006)		(0.006)		(0.007)		(0.007)		(0.007)
Urban		0.420***		0.422***		0.475***		0.464***		0.475***
		(0.057)		(0.057)		(0.066)		(0.060)		(0.066)
Gender (1 = Woman)		-0.751***		-0.751***		-0.679***		-0.717***		-0.680***
		(0.061)		(0.061)		(0.066)		(0.060)		(0.066)
Speaks Bahasa Indonesian		0.479***		0.475***		0.606***		0.450***		0.606***
		(0.088)		(0.088)		(0.098)		(0.087)		(0.098)
Speaks Portuguese		0.481***		0.474***		0.537***		0.506***		0.537***
		(0.058)		(0.058)		(0.063)		(0.059)		(0.063)
Speaks English		0.153*		0.159**		0.149*		0.189**		0.148*
		(0.079)		(0.079)		(0.082)		(0.081)		(0.082)
Is Married or a Widow(er)		0.975***		0.976***		0.739***		0.783***		0.739***
		(0.086)		(0.086)		(0.100)		(0.095)		(0.100)
Number of school years in disputed districts						0.075***		0.072***		0.074***
						(0.010)		(0.010)		(0.010)
Number of school years in districts controlled by the Resistance						-0.037***		-0.029**		-0.037***
						(0.013)		(0.013)		(0.013)
Individual & Household Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sectorial Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ethnicity Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ath ρ		-0.078		-0.191**		-0.251***		-0.192**		-0.242***
		(0.086)		(0.080)		(0.084)		(0.079)		(0.084)
Ln σ		-0.036		-0.104**		-0.109**		-0.100**		-0.112**
		(0.044)		(0.043)		(0.049)		(0.044)		(0.049)
N	1195	20976	1195	20976	1119	20698	1195	20774	1119	20698
R^2	0.050		0.185		0.165		0.187		0.167	
Log-likelihood	-1651.07	-149349.87	-1559.39	-146221.00	-1441.86	-124797.31	-1557.68	-141129.03	-1440.31	-124767.57
χ^2		0.823		5.678		8.948		5.835		8.248
p-value		0.364		0.017		0.003		0.016		0.004

Source: Author's computations using TLSLS (2007) and CAVR (2006); Notes: * p<0.10, ** p<0.05, *** p<0.01

By observing the χ^2 tests in columns (2), (4), (6), (8) and (10) and correspondent p-values it can be established that selection bias affects the OLS estimates, as the hypothesis of independent equations is rejected in all models with the exception of the simplest, and rather incomplete, mincerian formulation in columns (1) and (2). Therefore, the results of the earnings model in Table 11 will focus on the Heckman estimates.

The analysis of the baseline model gives some insights into a post-conflict labour market. The simple mincerian equation (see columns (1) and (2) in Table 11) presents the stylized results, with returns to education amounting to 3.0%-3.9%, in the lower band of comparable countries reviewed in section 2, above. The complete baseline model (see columns (3) and (4) in Table 11) presents some evidences that the average returns to education indicated in the first model do not represent an economy-wide reality but result from some specific factors. There is also evidence of a more than proportional earnings premium being awarded to those that completed technical and vocational training or a postgraduate degree. Those with command of the Portuguese language also seem to have gained a higher wage, when controlling for other factors. It is not clear whether these premiums result from productivity enhancing skills or are, instead, signals of particular market preferences or scarcity of human resources[24]. A final factor is revealed by the decomposition of the earnings structure according to the type of employer. Only two types of employer seemingly have wage profiles that give an education premium: rural public works programmes and NGOs.

[24] This may be the case of the command of Portuguese language having an effect. It was reintroduced in Timor, adopted as official language and initially as language of education after independence. However, only 16% of the TLSLS representative sample stated they could speak it.

Table 8: Mincerian equations

	Simple Mincer		Baseline Model		Violence experienced during school year		School years exposed to extreme violence		Both channels	
	(1) OLS β/(se)	(2) Heckman β/(se)	(3) OLS β/(se)	(4) Heckman β/(se)	(5) OLS β/(se)	(6) Heckman β/(se)	(7) OLS β/(se)	(8) Heckman β/(se)	(9) OLS β/(se)	(10) Heckman β/(se)
Earnings model										
Constant	-1.389***	-1.150***	-1.749***	-1.226***	-1.994***	-1.334***	-1.754***	-1.250***	-1.968***	-1.339***
	(0.189)	(0.327)	(0.339)	(0.406)	(0.369)	(0.476)	(0.358)	(0.445)	(0.378)	(0.485)
Years of Education	0.039***	0.030**	0.015	-0.002	0.037***	0.013	0.017	-0.002	0.037***	0.014
	(0.011)	(0.014)	(0.012)	(0.014)	(0.014)	(0.017)	(0.012)	(0.014)	(0.014)	(0.017)
Experience	0.032***	0.029**	0.017*	0.008	0.017	0.003	0.014	0.003	0.015	0.002
	(0.010)	(0.011)	(0.010)	(0.010)	(0.012)	(0.014)	(0.011)	(0.013)	(0.012)	(0.014)
Experiences^2	-0.001***	-0.001***	-0.000**	-0.000*	-0.000	-0.000	-0.000*	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Finished Vocational School			0.336**	0.356**	0.319**	0.430**	0.340**	0.431**	0.342**	0.442**
			(0.147)	(0.165)	(0.151)	(0.189)	(0.151)	(0.171)	(0.156)	(0.193)
Finished Graduate School			0.775***	0.701***	0.642**	0.549**	0.782***	0.709***	0.671**	0.577**
			(0.252)	(0.242)	(0.277)	(0.267)	(0.263)	(0.256)	(0.287)	(0.274)
Works in a Rural Public Works			-0.722***	-0.712***	-0.157	-0.189	-0.734***	-0.729***	-0.198	-0.219
Programme (RPW)			(0.248)	(0.237)	(0.292)	(0.284)	(0.236)	(0.228)	(0.285)	(0.279)
Education x (RPW)			0.037*	0.037*	-0.007	-0.003	0.038*	0.039**	-0.004	-0.001
			(0.020)	(0.019)	(0.022)	(0.022)	(0.019)	(0.019)	(0.022)	(0.021)
Works in an NGO (NGO)			-0.398	-0.420*	-0.447	-0.502*	-0.398	-0.433*	-0.460	-0.509*
			(0.248)	(0.247)	(0.290)	(0.286)	(0.248)	(0.249)	(0.291)	(0.287)
Education x (NGO)			0.042*	0.044**	0.046*	0.051**	0.043*	0.047**	0.046*	0.051**
			(0.022)	(0.022)	(0.025)	(0.025)	(0.022)	(0.022)	(0.025)	(0.025)
(A) Yearly average kills and disappearances during school years in the birth district					0.008	0.009			0.005	0.007
					(0.006)	(0.006)			(0.007)	(0.007)
Education x (A)					-0.001	-0.001*			-0.001	-0.001
					(0.001)	(0.001)			(0.001)	(0.001)
(B) Number of school years experiencing extreme deaths by hunger/illness in the birth district							0.146*	0.129*	0.138	0.104
							(0.081)	(0.078)	(0.097)	(0.094)
Education x (B)							-0.011*	-0.010	-0.008	-0.006
							(0.006)	(0.006)	(0.007)	(0.007)
Individual & Household Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sectorial Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ethnicity Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: Author's computations using TLSLS 2007 and CAVR 2006; Notes: * p<0.10, ** p<0.05, *** p<0.01

These results, which hold in almost all the empirical models analysed in Table 11, are important because they may reflect an important distortion in the labour market of Timor and eventually those in other post-conflict countries. They are particularly important because these two employers represent the "aid industry" in Timor and because the empirical models show no significant returns to education for other types of employment. Notably, there are no significant returns to education for the average worker of the main employer – the Timorese Government.

The introduction of conflict indicators in the empirical mincerian models, in columns (5) to (10), completes the analysis of the Timorese labour market as a case study of a post-conflict setting. Having tested the set of indicators of conflict described in sections 2 and 4, this study only finds two dimensions of the Timorese conflict that may have affected earnings and returns to education. These factors are, first, yearly average kills and disappearances, during school years and in the birth district (see columns (5), (6), (9) and (10) in Table 11); and, second, the number of school years in which there had been an experience of extreme deaths by hunger/illness in the birth district (see columns (7), (8), (9) and (10) in Table 11). Notably, this study only finds evidence of significant impacts from violence being experienced on earnings and returns to education if that violence was experienced during the school years.

The significant dimension of the Timorese conflict relates to levels of physical violence experienced during the school years. As per Table 9, an average Timorese paid worker lived her school years in an environment where 12 people per year (1 per month) were killed because of Indonesian military operations, Resistance actions or other conflict-related events. This experience closely correlates with impacts experienced in the households, such as the loss of family members or having a member with a disability (Evans and Miguel, 2007; Ibáñez and Moya, 2006; Justino, 2009). It also correlates with

impacts experienced in the area of residence and education, with similar effect factors such as the destruction of infrastructure or increased difficulty in accessing education (Ichino and Winter-Ebmer, 2004; Lai and Thyne, 2007). The coefficients of the interaction between the first indicator of violence and years of education (in columns (5) and (6)) point to a correlative reduction of the returns to education of 0.1 per cent per person killed in every year of education. An average Timorese would experience, therefore, a reduction of 1.2 per cent in the absolute value of returns to education due to the exposure to violence (killings and disappearances) in her birth district during her school years. This evidence is in accordance with the first theoretically hypothesized channel of impact, through which conflict may affect earnings and returns to education.

The second dimension of the conflict relates to extreme events experienced by the Timorese during the conflict, namely extreme deaths due to hunger and illness. Although it correlates with the previous dimension, what is analysed here is the length of time during which extreme levels of violence, or their consequences, were experienced by the individual and during her school life. In particular, this second significant dimension of conflict is the number of school years during which the individual witnessed extreme numbers of deaths due to hunger and illness in her birth district. As reported in section 2, the periods of extreme levels of hunger and death by illness during the Timorese conflict happened in the first period, namely, during the invasion and consolidation of the Indonesian military power. They correlated with forced displacements (inside the same district or even subdistrict) and burnings of crops (CAVR, 2005). The level of disruption of livelihoods was extreme. Reports from interviewed Timorese during field research speak of a period where many families spent periods of months in the woods, with poor nourishment and either little or no access to schooling (in the form of popular education provided by volunteers and resistance

fighters). Looking at column (8) in Table 11, there seems to be no evidence of a significant impact of this dimension from the Timorese conflict on post-conflict returns to education.[25] However, there is an estimated significant increase of 0.13 in the log of hourly wage earnings, or 1.14 USD in the hourly wage per year, related to extreme violence experienced, from an average wage of 1.16 USD, as presented in Table 11, above. This evidence seems to partially support the theoretical hypothesis of a scarcity effect on earnings but not on returns to education.

Columns (9) and (10) present an attempt to test the effects of both conflict dimensions previously discussed, by including them in the same empirical model. Although the signs of the coefficients are maintained, the high correlation between the two channels gives them loose statistical significance. An investigation into what channel is more prevalent may be conducted in other settings, where this colinearity is less prevalent.

As mentioned before, the impacts of conflict were empirically tested against the backdrop of a comprehensive empirical mincerian model, presented in columns (3) and (4), and expanded in the remaining columns of Table 11, through the addition of the conflict indicators. Table 11 shows only the significant conflict indicators.

[25] The OLS estimation would suggest negative and significant negative effects (1% reduction per year of extreme conflict experienced). The Heckman estimate is of the same value but not significant.

Table 9: Robustness tests in Returns to Education: testing the robustness of conflict variables

	Simple Mincer		Adding Signals		Adding individual and household controls		Adding regional, sectorial and employer type controls		Adding ethnicity controls (complete model)	
	OLS β/(se)	Heckman β/(se)	OLS β/(se)	Heckman β/(se)	OLS β/(se)	Heckman β/(se)	OLS β/(se)	Heckman β/(se)	OLS β/(se)	Heckman β/(se)
Earnings Model										
(A) Yearly average kills and disappearances during school years	0.0093	0.0102	0.0092	0.0102	0.0102	0.0110	0.0102	0.0113*	0.0081	0.0094
	(0.0076)	(0.0076)	(0.0076)	(0.0076)	(0.0077)	(0.0077)	(0.0071)	(0.0065)	(0.0064)	(0.0060)
Education x (A)	-0.0012	-0.0012*	-0.0011	-0.0012*	-0.0013*	-0.0013*	-0.0011	-0.0013**	-0.0009	-0.0011*
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0006)
(B) Number of school years experiencing extreme deaths by hunger/illness in the birth district	0.1614*	0.1608*	0.1590*	0.1593*	0.1577*	0.1633*	0.1814**	0.1676**	0.1463*	0.1293*
	(0.0878)	(0.0860)	(0.0879)	(0.0860)	(0.0868)	(0.0853)	(0.0822)	(0.0795)	(0.0808)	(0.0780)
Education x (B)	-0.0115	-0.0113	-0.0111	-0.0111	-0.0118*	-0.0121*	-0.0127*	-0.0121*	-0.0107*	-0.0099
	(0.0072)	(0.0071)	(0.0072)	(0.0071)	(0.0071)	(0.0070)	(0.0066)	(0.0065)	(0.0064)	(0.0062)

Source: Author's computations using TLSLS (2007) and CAVR (2006); Note: These robustness tests use the Heckman Selection model equation estimated in the main regressions; * p<0.10, ** p<0.05, *** p<0.01.

A set of tests was devised to assess whether the results were robust. A first test analyses whether the coefficients of indicators related with conflict are affected by the introduction of those covariates that construct the baseline model. As is noticeable in Table 12, above, the value of the coefficients does not change significantly.

Another robustness test focuses on the assumptions used to construct some of the covariates. The main assumption relates to the age of enrolment in school. The analysis presumes an enrolment age of six. According to official Timorese indicators (Ministry of Education, 2012), the average age at enrolment at the beginning of the 2012/13 school year was 6.4 years, with an upper-bound in the in the 1 per cent significance confidence interval of 7.9 years. Robustness checks are performed on all variables that were constructed using age of enrolment assumptions: experience and experience squared; average levels of violence experienced during the school years; years of extreme violence experienced during the school years; number of school years living in a disputed district; and living in a district controlled by the resistance. In Table 13 it can be seen that assuming the age of entry to be seven or eight years old does not alter the values of the coefficients greatly and, in fact, suggests higher statistical significance.

Table 10: Robustness tests in Returns to Education: testing the robustness to alternative age of entry

Conflict channel	Violence experienced during school years						School years exposed to extreme violence					
Enrolment at age	6		7		8		6		7		8	
	OLS β/(se)	Heckman β/(se)	OLS β/(se)	Heckman β/(se)	OLS β/(se)	Heckman β/(se)	OLS β/(se)	Heckman β/(se)	OLS β/(se)	Heckman β/(se)	OLS β/(se)	Heckman β/(se)
Earnings Model												
(A) Yearly average kills and disappearances Violence experienced during school years	0.0081 (0.0064)	0.0094 (0.0060)	0.0138* (0.0071)	0.0149** (0.0068)	0.0136*** (0.0041)	0.0143*** (0.0039)						
Education x (A)	-0.0009 (0.0007)	-0.0011* (0.0006)	-0.0013* (0.0007)	-0.0015** (0.0007)	-0.0014*** (0.0005)	-0.0015*** (0.0005)						
(B) Number of school years experiencing extreme deaths by hunger/illness in the birth district							0.1463* (0.0808)	0.1293* (0.0780)	0.1726** (0.0824)	0.1536* (0.0808)	0.1962** (0.0911)	0.1746* (0.0902)
Education x (B)							-0.0107* (0.0064)	-0.0099 (0.0062)	-0.0123* (0.0064)	-0.0112* (0.0063)	-0.0139** (0.0070)	-0.0125* (0.0070)
Heckman Selection Model												
Number of school years in disputed districts		0.0746*** (0.0104)		0.0730*** (0.0104)		0.0703*** (0.0102)		0.0719*** (0.0100)		0.0701*** (0.0100)		0.0671*** (0.0098)
Number of school years in districts controlled by the Resistance		-0.0370*** (0.0132)		-0.0348*** (0.0134)		-0.0314** (0.0137)		-0.0290** (0.0128)		-0.0267** (0.0130)		-0.0237* (0.0132)

Source: Author's computations using TLSLS (2007) and CAVR (2006); Note: These robustness tests use the Heckman Selection model equation estimated in the main regressions; * p<0.10, ** p<0.05, *** p<0.01.

A final robustness test focuses on the assumption of extreme violence. The empirical model assumes that violence in one year and one district is extreme if the indicator of interest exceeded the mean for all years and districts by two standard deviations or more. Under an assumption of normally distributed observations, that would mean that 97.5 per cent of the observations are below that value. Robustness tests are conducted assuming two other alternative thresholds: an excess of one standard deviation and an excess of three standard deviations above the mean. This test only applies to the indicator of the number of years under extreme levels of deaths by hunger and illness in the district. As would be expected, one can notice in Table 14 that the values of the coefficients tend to increase as the threshold is set higher, while keeping close to the estimations presented above. There are indications, however, that a threshold of only one standard deviation in excess of the mean would be insufficient to signal extremely disruptive levels of violence.

Considering the evidence from the tests conducted, the empirical results of this study appear to be robust.

Table 11: Regression Estimates of Returns to Education – Robustness test – Threshold of Extreme Violence

Threshold of extreme violence	Mean + 1 Standard deviation		Mean + 2 Standard deviation (baseline)		Mean + 3 Standard deviation	
	OLS β/(se)	Heckman β/(se)	OLS β/(se)	Heckman β/(se)	OLS β/(se)	Heckman β/(se)
Earnings Model						
(B) Number of school years experiencing extreme	0.1252*	0.1090	0.1463*	0.1293*	0.2013*	0.1872*
deaths by hunger/illness in the birth district	(0.0720)	(0.0693)	(0.0808)	(0.0780)	(0.1107)	(0.1039)
Education x (B)	-0.0092	-0.0085	-0.0107*	-0.0099	-0.0150*	-0.0146*
	(0.0057)	(0.0055)	(0.0064)	(0.0062)	(0.0091)	(0.0086)

Source: Author's computations using TLSLS 2007 and CAVR (2006); Note: These robustness tests use the Heckman Selection model equation estimated in the main regressions; * p<0.10, ** p<0.05, *** p<0.01.

7- Conclusion

Post-conflict countries look to education with hope, as a signal of re-acquired normality, a tool for reconstruction, and an investment in a future without conflict. This hope, however, has to be matched by the construction of a post-conflict economy that provides the needed incentives for education. This article analysed the effect of conflict on returns to education in Timor-Leste a few years after the end of 25 years of violent military occupation.

The evidence uncovered in this study points to some significant results. It indicates that forms of violence experienced during the school life of individuals reduce the returns they could otherwise take from further years of education. It also indicates that the experience of extreme levels of violence - and the disruption to livelihoods and access to education arising from this - may create a scarcity of human resources, making them more expensive. This happens while their productivity has lowered due to the effects of the factors in the first channel. Evidence also points to an indication that political conditions under which education occurred also affected the participation in the post-conflict labour market. The evidence of a scarcer (and therefore more expensive), less qualified labour force, arising as a consequence of violence makes it evident that conflict reduces the economic incentives for education. This may explain why a post-conflict country is likely to have lower returns to education than other, comparable, countries.

This study also shows that the challenges to the promotion of higher investment in education in a post-conflict country happen not only because of the conflict its people experienced but also because of the economic post-conflict setting. The Timorese evidence points out that returns to education are only significant for those involved in professional projects currently funded and supported by international cooperation

efforts, either directly in NGOs or in public projects originated and funded by international initiatives. This may not be a surprising result. Public administrations are generally bounded by the social contract not to have extremely high wages while securing “fair” (usually higher than market) wages for less qualified work. It is, in general, the private sector that tends to generate the income incentives for education. However, as previously signalled, post-conflict countries tend to have a depressed private sector. If not surprising, this situation creates a distortion in the labour market, drawing the most qualified labour out of national organizations and the national economy. It also provides signals that preferable learning options for young Timorese will be those academic programmes that are more likely to increase their employability in projects supported by international aid programmes. This acts to the detriment of both the national government and national private initiatives. In settings of economic and governance fragility, the insights provided by the evidence collected here should drive the actors of international development cooperation and national governments to analyse and improve both hiring and remuneration policies, particularly for those relatively few people with higher qualifications. Failing to do so may endanger the contribution of education to strengthening post-conflict countries. It may lead, instead to brain-drain dynamics and to a public service provision competition between international actors and (the body that needs to be the ultimate provider) the State. In the end, instead of strengthening the process of peace-building and reconstruction, it may lead to new forms of fragility.

8- References

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