Journal of Demographic Economics, **83**, 2017, 111–127.
doi:10.1017/dem.2016.28

PARENTAL MORBIDITY, CHILD WORK, AND HEALTH INSURANCE IN RWANDA

Maame Esi Woode
Aix-Marseille University Aix-Marseille University (Aix-Marseille School of Economics) ORS PACA

Marwân-al-Qays Bousmah
Aix-Marseille University Aix-Marseille University (Aix-Marseille School of Economics), CNRS and EHESS

Raouf Boucekkine
Aix-Marseille University (IMéRA and Aix-Marseille School of Economics), CNRS and EHESS, Senior member of the Institut Universitaire de France

Abstract Measuring direct and indirect effects of extending health insurance coverage in developing countries is a key issue for health system development and for attaining universal health coverage. This paper investigates the role played by health insurance in the relationship between parental morbidity and child work decisions. We use a propensity score matching technique combined with hurdle models, using data from Rwanda. The results show that parental health shocks have a substantial influence on child work when households do not have health insurance. Depending on the gender of the sick parent, there is a substitution effect not only between the parent and the child on the labor market, but also between the time the child spends on different work activities. Altogether, results reveal that health insurance protects children against child work in the presence of parental health shocks.

Keywords: Health shocks, Child work, Health insurance, Rwanda, Propensity scores, Hurdle model

JEL Classification: I13, I15, J22, O12

1. INTRODUCTION

When households face income shocks, they resort to various mechanisms to smoothen consumption. Households that are not insured against such shocks

This work has been completed thanks to the support of the A*MIDEX project (no. ANR-11-IDEX-0001-02) funded by the "Investissements d'Avenir" French Government program, managed by the French National Research Agency (ANR). The authors would like to thank Mohammad Abu-Zaineh, Martine Audibert, Emmanuelle Augeraud-Veron, Stephen Bazen, Jean-Paul Moatti, Carine Nourry, Nicholas James Sheard, and Bruno Ventelou for helpful comments and suggestions. The authors are solely responsible for any remaining errors. Address correspondence to: Raouf Boucekkine, Aix-Marseille University (Aix-Marseille School of Economics), CNRS & EHESS, 2 rue de la Charité, 13002 Marseille, France; e-mail: raouf.boucekkine@univ-amu.fr

often rely on savings, sale of assets, labor substitution, or borrowing (Morduch, 1995; Flores et al., 2008). Labor substitution often involves children engaging in the labor market to varying degrees [Sauerborn et al. (1996)]. Morbidity shocks, depending on severity and duration, may affect the income of the household in two main ways: (1) through a reduction in productivity and hence income generated for the same number of hours worked, and (2) through medical costs leading to a possible reduction in disposable income [Gertler and Gruber (2002)]. This paper proposes to study the impact of parental health shocks on child work and the role of health insurance in this relationship. With health insurance, individuals may be more likely to seek care when needed and will be less likely to pay large out-of-pocket sums to settle the bills incurred as a result of their seeking care [Flores et al. (2008); Saksena et al. (2011)].

Child work in and of itself might not necessarily be a bad thing as it can help with the development of children, providing them with the skills and experiences needed to succeed in the future [ILO-IPEC (2013)]. However, types of work that are dangerous or that keep children away from school are detrimental to their health and welfare [ILO-IPEC (2014)]. The International Labour Organization estimates that roughly 58.6% of children between the ages of 5 to 17 are engaged in agricultural work, with 25.4% being engaged in non-domestic services work (ILO-IPEC, 2013). The number of children defined as being in child labor has decreased from 245.5 million in 2002 to 167.25 million by 2012. Of this, roughly 85 million are classified as doing hazardous work, that is, work that threatens their health and development. Sub-saharan Africa remains the region with the highest incidence of child labor with one in every five children engaged in the activity [ILO-IPEC (2013)].

Figure 1 shows the trends in child work across regions and time. The region of Sub-Saharan Africa had the highest percentage of its children estimated to be engaged in child work in 2012, with as many as 11% engaged in hazardous child work compared to about 5% in the other regions. In terms of trends between the year 2008 and 2012, it is interesting to note that the largest fall in hazardous child work occurred in Sub-saharan Africa with a fall of about 5%.

Studies on the relationship between child labor and health has generally focused on the negative effect of child labor on the health of the child, with a shift in focus on the health impact of the worst forms of child labor. However, while a direct link can be made on the effect of child labor on child health, other health variables have the potential to influence child labor. It is well known that parental variables influence the child's time, it therefore stands to reason that the health of the parent would affect child labor in one way or another.

In this respect, the focus has generally been on parental mortality and its effect on child labor. Several studies have investigated both the impact of parental death (due to ill health or otherwise) and of income shocks on child labor and household consumption. For example, in their study of the impact of parental death caused by the Indian Ocean tsunami, Cas et al. (2014) find that, depending on the age of the child, he/she takes on some of the responsibilities of the deceased parent.

https://doi.org/10.1017/dem.2016.28 Published online by Cambridge University Press

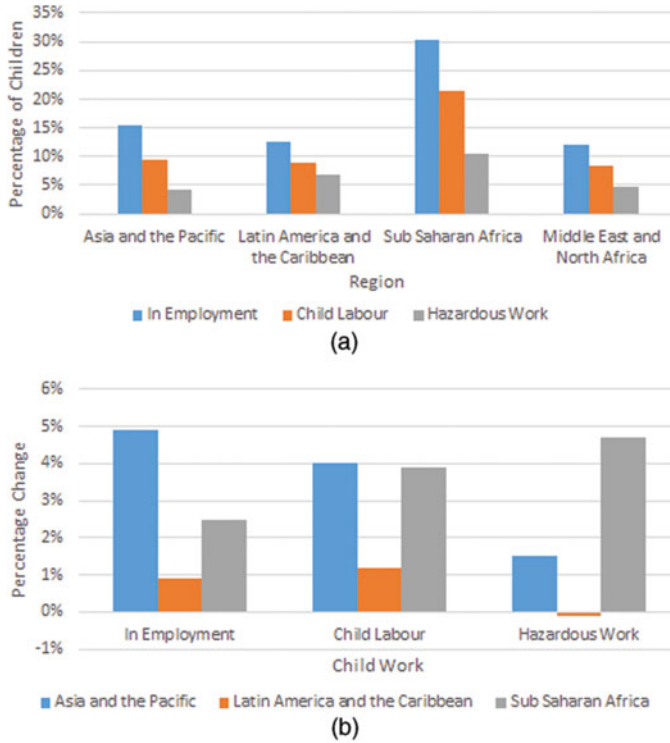

FIGURE 1. (Colour online) Child work trends. (a) Child work across regions in 2012. (b) Trends in child work (2008–2012).
Source: ILO-IPEC (2013).

They find that over a longer term, a male child who lost at least one parent is more likely to be engaged in an economic activity than one whose parents survived. A similar effect is found for older female children though they are more likely to be engaged in household work if at least one parent died. Younger children are on the other hand protected from the negative impacts of the death of a parent. It is important to not only deal with the effects of parental death but also the effects of health shocks. Such health shocks do not necessarily imply the death of an adult and, for this reason, might have different consequences.

One of the first studies on this subject was by Bazen and Salmon (2010) in Bangladesh, which shows that a father being chronically ill has no effect on the child's participation in income-generating activities, while a sudden health shock to the father has a positive effect. A study by Dillon (2013) in northern Mali, finds that health shocks to adult men increases children's participation in child care and the hours they spend on household enterprises, both of which are activities that keep the adults close to home. A more recent work by Alam (2015) in rural

https://doi.org/10.1017/dem.2016.28 Published online by Cambridge University Press

Tanzania provides evidence of an effect of mother's illness on child work through an increase in household work. These studies generally do not assess the impact of health insurance affiliation on the relationship between parental health shocks and child labor. Two recent works have attempted to fill this gap. Landmann and Frölich (2015) analyze the expansion of a health and accident insurance scheme in Pakistan and find a negative effect of health insurance affiliation on child labor outcomes. Liu (2016) investigates the impact of a health insurance reform in rural China and shows that a severe health shock to either the head of the household or the spouse increases child work (defined as child employment).

In this paper, we conduct an empirical analysis – using data from Rwanda – to investigate the role played by health insurance in determining child work decisions following parental health shocks. We implement a propensity score matching technique combined with hurdle models. We distinguish between (1) a health shock to the mother and to the father, (2) sudden health problems and chronic illnesses, (3) three different forms of child work (market work, family business, and domestic work), (4) the affiliation or non-affiliation to health insurance. Our work differs from the studies described above in that it investigates how the effects of the health shock will vary based on the gender of the parent facing the shock and also on the type of work activity under consideration. Though our data is cross-sectional, its main advantage is on the ability to jointly estimate the child work participation decisions and, for children who work, the decisions on the time devoted to each work activity. Previous results point to a potential substitution effect not only between education and child work but also between the different types of child work. We seek to analyze how health insurance affiliation affects these latter types of substitution effects. Our empirical results show that health insurance does protect children against child work in the presence of parental health shocks. In addition, there is a substitution effect not only between the parent and the child on the labor market, but also between the time the child spends on the different work activities. We also show that this effect depends on the gender of the sick parent.

2. ECONOMETRIC ANALYSIS: THE CASE OF RWANDA

In Rwanda, while health insurance for the formal sector and private health insurance existed in the early 2000s, workers in the informal sector were often excluded from these protection schemes [Chuhan-Pole and Angwafo (2011)]. In response to this, the mutual health insurance (MHI) scheme was expanded. The goal of the expansion was to create access to quality health services, especially for those who were underserved, including the poor and vulnerable.

2.1. Data

We use data from the *Third Integrated Household Living Conditions Survey* (EICV3), a cross-sectional survey representative of the Rwandan population

https://doi.org/10.1017/dem.2016.28 Published online by Cambridge University Press

conducted in 2010/2011 [NSIR (2011)]. The study is conducted on 3,001 adolescents aged 13–18 years, i.e. of secondary school age. As we are interested in studying the effect of parental health shocks, we only keep data on children of monogamous household heads, for which both parents are in the household and are not disabled. The analysis does not include the children for which both parents reported a health problem during the past two weeks of the survey in order to fully disentangle the effect of a health shock to the mother from that of a health shock to the father. The outcomes of interest are whether a child engages in any of the three activities (namely, market work, family business, and domestic work) and for how many hours per week. As child work takes different forms, three dependent variables are used in the different model specifications: (1) the number of hours worked on market work, (2) the number of hours worked in the family business, and (3) the number of hours spent on domestic work. In all the analyses, children are divided into two groups based on whether both parents are affiliated to the MHI scheme. The explanatory variables include the determinants of child work as found in the literature [see for instance Basu (1999) or ILO (2004)]. These include characteristics of the children (age, proportion of siblings, gender, children's own health problems), of the parents (age, formal education, health problems), and of the household (size, rurality, living conditions, health problems of other members).

2.2. Econometric Methodology

Matching. The aim of this study is to investigate the role played by health insurance in the relationship between parental health shocks and child work. Hence, we need to run our analyses on two different samples of children based on whether both parents are MHI affiliated or not insured. Prior to the exploratory analysis, we propose to implement a propensity score matching method to adjust for pre-treatment observable differences between the group of treated (insured) and the group of untreated (uninsured). In a first step, we estimate the propensity score of the treatment (whether both parents have health insurance) on the set of explanatory variables described in the data section, without the variables related to parental health shocks. This is done using a probit model. The analysis of the balancing property is restricted to all treated plus those controls in the region of common support. Second, we implement a kernel matching procedure using the propensity scores (the conditional treatment probability) estimated in the first step. Three outcome variables are specified: (1) the number of hours spent on market work, (2) the number of hours spent on the family business, and (3) the number of hours spent on domestic work. Hence, the matching technique reduces to the minimum common number of observations with non-missing values on all outcomes.

Regression model. Once the children are matched based on whether both parents are MHI affiliated, we implement a hurdle model in which the count dependent

https://doi.org/10.1017/dem.2016.28 Published online by Cambridge University Press

TABLE 1. Results: Average treatment effect on treated

	Treated	Controls	Difference	S. E.	T-Stat
Market work	1.659	2.835	− 1.176	0.461	− 2.55
Family business	1.814	1.774	0.040	0.275	0.15
Domestic work	18.642	18.063	0.578	0.633	0.91

variables – the number of hours worked in the three activities – are assumed to be bounded. We then compare the results for insured and uninsured households. Note that all specifications include the same set of explanatory variables, and use the weights given to the matched observation from the propensity score matching scheme described above. The Cragg linear hurdle regression [Cragg (1971)] implemented here examines separately the determinants of the decision on whether to engage in child work and that on the time spent working. More precisely, for each dependent variable, two equations are estimated jointly: A probit equation determining the likelihood to engage in child work, and a linear regression determining the number of hours worked. Note that hurdle models assume that the residuals of the hurdle equation and the outcome equation are uncorrelated.

2.3. Results

The results of the matching are shown in Table 1 and in Table A1 of the appendix. The latter table presents the balancing diagnostics of the matching model. It shows that most of the biases that exist before matching are controlled for and therefore no longer significant after matching. Weighting the regressions with the propensity scores will address possible imbalances in the estimates due to selection bias. Results from the average treatment effects show a significant effect of parental MHI affiliation on the hours the child spends on market work (Table 1). There is no average significant difference when it comes to family business and domestic work however. Thus, the hours a child spends on market work are on average higher for children with uninsured parents compared to those with MHI affiliated parents.

A summary of the results for the hurdle regressions is displayed in Table 2. The full tables of results can be found in the appendix (Table A2 to A4). In summary, we analyze the effects of parental health shocks on child work, disentangling between (1) a health shock to the mother and to the father, (2) sudden health problems and chronic illnesses, (3) three different forms of child work (market work, family business, and domestic work), (4) households being affiliated to the MHI and those not having any insurance.

The main goal of health insurance is to guarantee a better coverage and access to healthcare services. This paper shows that health insurance has an additional desirable but indirect effect of preventing child work that often results from the

https://doi.org/10.1017/dem.2016.28 Published online by Cambridge University Press

TABLE 2. Summary of results of the Hurdle model

	Participation		Hours worked	
	Insured	Uninsured	Insured	Uninsured
Market work				
Father chronically ill	−0.133	−0.723**	−47.852	9.921
	(0.249)	(0.289)	(43.366)	(28.711)
Mother chronically ill	0.218	0.349***	−8.282	6.846
	(0.134)	(0.114)	(15.430)	(13.704)
Father suddenly ill	−0.161	−0.157	24.815	−68.930**
	(0.160)	(0.156)	(18.401)	(29.561)
Mother suddenly ill	0.269*	−0.191	9.625	−65.327**
	(0.147)	(0.161)	(16.032)	(27.268)
Family business				
Father chronically ill	−0.269	−0.344	8.296	12.404*
	(0.220)	(0.286)	(8.473)	(7.120)
Mother chronically ill	0.128	0.601***	−0.797	−2.334
	(0.116)	(0.117)	(4.599)	(3.387)
Father suddenly ill	0.035	0.588***	2.586	0.500
	(0.122)	(0.137)	(4.972)	(3.880)
Mother suddenly ill	−0.055	0.193	−2.156	−3.600
	(0.142)	(0.154)	(5.668)	(4.943)
Domestic work				
Father chronically ill	−0.134	−0.169	−4.518	0.706
	(0.202)	(0.236)	(5.366)	(3.359)
Mother chronically ill	0.197	−0.125	−3.565	0.239
	(0.141)	(0.130)	(3.209)	(1.847)
Father suddenly ill	−0.146	−0.166	3.917	2.766
	(0.125)	(0.146)	(3.109)	(2.104)
Mother suddenly ill	0.064	−0.076	−1.472	9.891***
	(0.153)	(0.152)	(3.539)	(1.960)
No. Observations	2,241	761	2,241	761

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.
Estimator: Cragg hurdle regression.

occurrence of parental health shocks. Here, the difference between insured and uninsured households is striking. There is no significant effect of parental health shocks on child work for insured households. The only significant effect for the insured is an increase in the participation in market work when the mother is suddenly ill.

We now present the results for chronic illness. An uninsured father being chronically ill appears to reduce the probability that the child will be engaged in market work while having no significant effect on their participation in the other activities. In terms of hours worked, we find that it increases the number of hours

https://doi.org/10.1017/dem.2016.28 Published online by Cambridge University Press

spent on the family business for those who are engaged in this activity. Hence, a father being chronically ill leads to a substitution effect by reducing the child's participation in market work, while increasing the number of hours the child spends on the family business. Turning to the mother, results suggest that having a chronically ill mother increases the child's participation in market work and family business, without impacting the number of hours worked for those already engaged in these activities. Again, no effects are found if the mother is MHI affiliated.

When we focus on sudden health shocks, results show that a sudden health shock to the father does not impact the child's participation in market work, but highly reduces the number of hours worked for the children who are already engaged in such activities. Another important feature is that a sudden health shock to the father increases the child's participation in family business. We find no significant effect on either participation or hours spent on domestic work irrespective of the father's insurance status. The father facing a sudden health shock appears to lead to a substitution between market work and family business for the uninsured while not having an effect on the insured. When we focus on the sudden maternal health shocks we find no effect on the participation of the child in any of the work activities. It however leads to a decrease in the number of hours the child spends on market work while increasing the number of hours the child spends on domestic work.

To summarize, we generally find insignificant effects of parental health shocks on child work, when the parents are insured. For the case where they are uninsured, we find evidence of different substitution effects depending on the gender of the sick parent and on the duration of illness:

(i) A father being chronically ill lowers the child's participation in market work, while increasing the number of hours the child spends in the family business.
(ii) A mother being chronically ill increases the child's participation in market work and in the family business.
(iii) A sudden health shock to the father lowers the number of hours the child devotes to market work, while increasing the family business participation.
(iv) A sudden health shock to the mother lowers the number of hours the child devotes to market work, while increasing the number of hours devoted to domestic work.

3. PATHWAYS OF IMPACT

We now discuss our results for uninsured parents in light of related empirical studies. To this effect, we run several hurdle regressions to study the effect of a parent's health shock on their labor market decisions and those of their spouse. Table 3 displays the results for the main variables of interest.[1] Note that there are no results concerning the father's participation in family business because they appeared less likely to be engaged in these activities.

Regarding the father, we found that his being chronically ill lowers the child's participation in market work, while increasing the number of hours the children

https://doi.org/10.1017/dem.2016.28 Published online by Cambridge University Press

TABLE 3. Pathways of impact

	Mothers				Fathers			
	Participation		Hours worked		Participation		Hours worked	
	Insured	Uninsured	Insured	Uninsured	Insured	Uninsured	Insured	Uninsured
Market work								
Father chronically ill	0.075	0.261	− 25.872	1.254	− 0.513**	− 0.974***	− 4.843	− 0.785
	(0.174)	(0.188)	(16.646)	(6.064)	(0.200)	(0.211)	(5.142)	(3.929)
Mother chronically ill	− 0.053	− 0.003	0.311	− 3.096	0.042	− 0.057	1.358	2.615
	(0.112)	(0.106)	(8.605)	(3.839)	(0.157)	(0.144)	(2.923)	(1.997)
Father suddenly ill	0.074	− 0.308***	− 0.287	− 4.443	− 0.486***	− 0.749***	− 7.955**	− 7.085***
	(0.113)	(0.117)	(8.002)	(4.778)	(0.133)	(0.133)	(3.342)	(2.563)
Mother suddenly ill	0.045	− 0.082	− 4.278	1.137	0.275	− 0.369**	− 2.198	2.267
	(0.125)	(0.129)	(9.182)	(4.614)	(0.205)	(0.157)	(3.240)	(2.502)
Family business								
Father chronically ill	0.120	0.039	0.621	18.166***				
	(0.195)	(0.228)	(2.605)	(3.057)				
Mother chronically ill	− 0.297***	− 0.359***	− 3.617**	5.388**				
	(0.113)	(0.111)	(1.841)	(2.221)				

TABLE 3. Continued

	Mothers				Fathers			
	Participation		Hours worked		Participation		Hours worked	
	Insured	Uninsured	Insured	Uninsured	Insured	Uninsured	Insured	Uninsured
Father suddenly ill	0.026	0.293**	-3.754**	− 0.055				
	(0.123)	(0.142)	(1.784)	(2.247)				
Mother suddenly ill	− 0.225*	− 0.304**	− 5.650***	− 3.747				
	(0.128)	(0.137)	(2.099)	(2.900)				
Domestic work								
Father chronically ill	− 0.174	4.237	4.796	7.764***	0.338	− 0.208	− 5.107	23.134***
	(0.407)	(508.444)	(3.669)	(2.434)	(0.206)	(0.193)	(8.400)	(5.669)
Mother chronically ill	− 0.509**	3.994	− 7.660***	− 7.000***	0.053	0.002	− 11.861*	− 2.917
	(0.204)	(225.372)	(2.677)	(1.579)	(0.120)	(0.110)	(6.082)	(3.913)
Father suddenly ill	0.027	4.077	1.535	1.761	− 0.002	− 0.014	5.292	4.977
	(0.286)	(261.026)	(2.445)	(1.543)	(0.119)	(0.119)	(5.216)	(3.878)
Mother suddenly ill	− 0.598***	4.447	− 2.703	4.350**	0.136	− 0.214	2.914	3.444
	(0.217)	(278.310)	(2.817)	(1.717)	(0.136)	(0.131)	(5.622)	(4.747)
No. Observations	1,454	509	1,454	509	1,454	509	1454	509

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. Estimator: Cragg hurdle regression.

engaged in family business spend in this activity. This seems to suggest that there is a substitution effect between market work and family business. Now, if we look at Table 3, we notice that when the father is chronically ill, his market participation decreases, while the hours of those engaged in domestic work seem to increase. On the other hand, the mothers' hours spent on both family business and domestic work increase. Hence, both the child and the mother appear to focus their work on family related activities. One explanation could be that, as the father is chronically ill, there is a need to have someone at home to take care of him, so children drop out of activities that take them away from home. To compensate for the double income loss, the mother devotes more of her time to business activities that generate income while keeping her close to home. These activities may allow her to be flexible in terms of her time use.

Shifting attention to sudden illness, we have found that a health shock to the father lowers the number of hours children devote to market work, while increasing their family business participation. Table 3 shows that in such a case the father reduces his participation in market work, and for those who keep working, the number of hours also reduces. Likewise, the mother reduces her participation in market work, while increasing her participation in family business. Here, the substitution effect we previously observed in the case of a chronic health problem of the father seems to also be at work. However, the mechanism is different. While in the first case, the chronic illness prevents the child from engaging in market work, the short-term nature of the sudden illness implies that the child does not have to completely drop out of the market. A reduction in their time spent on market work appears to be sufficient. Their presence in the household is however still needed, and so is the income that they generate. Therefore, it is not surprising that we observe an increase in their participation in family business. It is also not surprising that we observe a similar trend for the mother, who completely drops out of the market to take up family business which is often close to home and flexible time-wise.

Recall that, using data from Bangladesh, Bazen and Salmon (2010) find that a father being chronically ill has no effect on the child's participation in income generating activities, while a sudden health shock to the father has an increasing effect. Although they combine all income generating activities, we differentiate between market work and family business. This differentiation brings to fore a trade-off between these two income generating activities. Note that the work of Bazen and Salmon (2010) focused on children between the ages of 5 to 14. Our results are in line with with those of Dillon (2013), who finds that in northern Mali, health shocks to adult men increases children's participation in child care and the hours they spend on household enterprises, both of which are activities that keep them close to home. Altogether, these results are not found when the parents have a MHI. In fact, we find that health shocks to the father has no significant effect on the child's participation in any of the work activities under consideration. No effects are also found for the number hours of the children who are already engaged in such activities.

https://doi.org/10.1017/dem.2016.28 Published online by Cambridge University Press

Turning our attention to the mother, we showed that when she is chronically ill, the child's participation in both market work and family business increase. From Table 3, there appears to be no effect on the father's work activities. However, there is a decrease in the mother's participation in family business. For those who remain in these activities, the number of hours worked increases. In addition, there is a decrease in the number of hours the mother spends on domestic work. Here, there seems to be no substitution effect.

Finally, we have shown that in the case where the mother faces a sudden health shock, it lowers the number of hours children devote to market work, while increasing the number of hours they devote to domestic work. The mother reduces her participation in family business while increasing her number of hours spent on domestic work, as shown in Table 3. The father's participation in market work appear to decrease, but unfortunately we are not able to study what happens in the case of his participation in family business, as fathers appear less likely to be engaged in such activities.

Our latter results are in line with those of Alam (2015), who, in a study on rural Tanzania, finds that a mother's illness has no significant effect on the number of hours children spend on market work, but leads to an increase in their hours spent on domestic work. This latter effect is also found by Dillon (2013) for child care activities. Alam's (2015)) lack of effect for market work is most likely related to the fact that he does not take the duration of illness into consideration and he combines market and family business activities. In the later case, should the health shocks lead to opposing effects, they may cancel out, leading to an insignificant effect, as observed in Alam (2015).

Finally, recall that, in a study on rural China, Liu (2016) finds that a severe health shock to either the head of the household or the spouse increases child work (defined as child employment). Because we carry out a more refined analysis, Liu's (2016)) results are not in line with ours. Indeed, we consider three types of child work activities. In addition, while he focuses on the share of employed children within the household, we focus on the probability of a given child working in the three different activities and the number of hours worked in each.

4. CONCLUSION

This paper investigates the effect of health insurance on the relationship between parental morbidity and child work decisions. Using data from Rwanda, we implement a propensity score matching technique combined with hurdle models, allowing to estimate both the child work participation and, for children who work, the time devoted to work. We distinguish between: (1) a health shock to the mother and to the father, (2) sudden health problems and chronic illnesses, (3) three different forms of child work (market work, family business, and domestic work), and (4) the affiliation or non-affiliation to health insurance. Empirical results reveal that the difference between insured and uninsured households is striking. There is (almost) no significant effect of parental health shocks on child work for insured

https://doi.org/10.1017/dem.2016.28 Published online by Cambridge University Press

households. On the other hand, parental health shocks have a substantial influence on child work when households do not have health insurance. Parental health shocks result in substitution effects not only between the parent and the child on the labor market, but also between the time the child spends on the three different types of work. In addition, these substitution effects depend heavily on the gender of the sick parent.

Altogether, our paper provides novel insights about the mitigating effect of health insurance on the relationship between parental health shocks and child work. Measuring direct and indirect effects of extending health insurance coverage is a key issue, especially in the current debate on reforms seeking to achieve Universal Health Coverage (UHC). The main goal of health insurance is to guarantee better coverage and access to healthcare services. This paper shows that health insurance has an additional desirable but indirect effect of preventing child work that often results from the occurrence of parental health shocks.

APPENDIX

TABLE A1. Descriptive statistics

	Unmatched			Matched			
Variable	Treated	control	%bias	Treated	control	%bias	%reduct $\|bias\|$
Age	15.257	15.177	4.8	15.257	15.232	1.5	68.7
Male	0.502	0.515	− 2.7	0.502	0.503	− 0.2	93.6
Illness	0.076	0.080	− 1.6	0.076	0.074	0.8	52.3
Proportion of siblings	0.445	0.462	− 10.4**	0.445	0.450	− 2.9	71.9
Rural	0.895	0.903	− 2.7	0.895	0.901	− 2.2	16.8
Extremely poor	0.240	0.376	− 29.7***	0.240	0.234	1.4	95.4
Father's age	48.902	48.259	8.0*	48.902	48.728	2.2	72.9
Mother's age	44.426	43.846	8.1*	44.426	44.365	0.8	89.5
Father formally educated	0.778	0.744	8.0*	0.778	0.767	2.6	67.3
Mother formally educated	0.678	0.669	2.0	0.678	0.668	2.2	− 12.8
Illness (other members of the household)	0.301	0.342	− 8.6**	0.301	0.301	0.1	98.9

https://doi.org/10.1017/dem.2016.28 Published online by Cambridge University Press

TABLE A2. Results of the Hurdle model: Market work

	Participation		Hours worked	
	Insured	Uninsured	Insured	Uninsured
Age	0.293***	0.339***	13.687**	15.943***
	(0.030)	(0.026)	(5.668)	(4.533)
Male	0.197**	0.617***	39.223***	− 3.354
	(0.090)	(0.085)	(15.013)	(11.930)
Ill	− 0.112	0.132	− 7.354	− 80.449***
	(0.173)	(0.148)	(21.692)	(27.804)
Proportion of siblings	0.896**	0.335	6.472	− 203.065***
	(0.411)	(0.404)	(53.119)	(56.727)
Household size	− 0.114***	− 0.020	1.683	4.822
	(0.032)	(0.029)	(3.628)	(3.100)
Rural	0.244	0.546***	− 20.294	− 1.202
	(0.180)	(0.170)	(21.120)	(21.684)
Extremely poor	0.250**	− 0.097	19.622	− 10.718
	(0.101)	(0.096)	(12.180)	(11.054)
Father's age	0.001	− 0.008	− 0.418	1.711
	(0.008)	(0.009)	(1.022)	(1.104)
Mother's age	0.001	0.010	0.850	− 4.414***
	(0.011)	(0.011)	(1.353)	(1.470)
Father formally educated	− 0.194*	− 0.008	14.896	− 0.480
	(0.101)	(0.093)	(13.265)	(10.582)
Mother formally educated	− 0.025	− 0.167**	2.903	32.219***
	(0.097)	(0.084)	(12.686)	(11.995)
Ill (other members of the household)	− 0.128	0.105	− 3.163	− 4.164
	(0.104)	(0.089)	(12.610)	(10.585)
Father chronically ill	− 0.133	− 0.723**	− 47.852	9.921
	(0.249)	(0.289)	(43.366)	(28.711)
Mother chronically ill	0.218	0.349***	− 8.282	6.846
	(0.134)	(0.114)	(15.430)	(13.704)
Father suddenly ill	− 0.161	− 0.157	24.815	− 68.930**
	(0.160)	(0.156)	(18.401)	(29.561)
Mother suddenly ill	0.269*	− 0.191	9.625	− 65.327**
	(0.147)	(0.161)	(16.032)	(27.268)
Constant	− 6.008***	− 7.454***	− 297.884**	− 111.009
	(0.641)	(0.620)	(125.731)	(87.715)
No. of observations	2,241	761	2,241	761

Notes: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in parentheses. Estimator: Cragg hurdle regression.

https://doi.org/10.1017/dem.2016.28 Published online by Cambridge University Press

TABLE A3. Results of the Hurdle model: Family business

	Participation		Hours worked	
	Insured	Uninsured	Insured	Uninsured
Age	0.302***	0.376***	3.271***	1.724**
	(0.025)	(0.028)	(1.262)	(0.870)
Male	− 0.037	− 0.148*	− 3.190	6.261**
	(0.075)	(0.083)	(3.113)	(2.540)
Ill	− 0.109	− 0.276	− 10.972	10.360**
	(0.147)	(0.171)	(7.058)	(4.711)
Proportion of siblings	1.062***	0.960**	− 5.050	− 8.354
	(0.349)	(0.438)	(15.283)	(12.186)
Household size	− 0.105***	− 0.042	1.918	1.995**
	(0.027)	(0.033)	(1.246)	(0.912)
Rural	0.580***	0.257	8.667	2.167
	(0.172)	(0.161)	(9.084)	(4.700)
Extremely poor	0.050	0.012	− 6.004*	1.711
	(0.088)	(0.097)	(3.621)	(2.773)
Father's age	− 0.002	− 0.012	− 0.268	0.252
	(0.007)	(0.009)	(0.317)	(0.272)
Mother's age	0.001	− 0.0004	0.255	− 0.178
	(0.009)	(0.011)	(0.406)	(0.375)
Father formally educated	− 0.207**	− 0.046	3.974	2.016
	(0.086)	(0.096)	(3.385)	(2.588)
Mother formally educated	− 0.120	− 0.264***	− 0.597	− 4.045
	(0.081)	(0.087)	(3.191)	(2.574)
Ill (other members of the household)	− 0.179**	− 0.268***	− 2.997	− 3.976
	(0.088)	(0.097)	(3.741)	(2.741)
Father chronically ill	− 0.269	− 0.344	8.296	12.404*
	(0.220)	(0.286)	(8.473)	(7.120)
Mother chronically ill	0.128	0.601***	− 0.797	− 2.334
	(0.116)	(0.117)	(4.599)	(3.387)
Father suddenly ill	0.035	0.588***	2.586	0.500
	(0.122)	(0.137)	(4.972)	(3.880)
Mother suddenly ill	− 0.055	0.193	− 2.156	− 3.600
	(0.142)	(0.154)	(5.668)	(4.943)
Constant	− 5.834***	− 6.793***	− 64.446**	− 34.244*
	(0.543)	(0.616)	(27.476)	(19.686)
No. of observations	2241	761	2241	761

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. Estimator: Cragg hurdle regression.

https://doi.org/10.1017/dem.2016.28 Published online by Cambridge University Press

TABLE A4. Results of the Hurdle model: Domestic work

	Participation		Hours worked	
	Insured	Uninsured	Insured	Uninsured
Age	−0.167***	−0.119***	0.133	−0.678*
	(0.026)	(0.027)	(0.617)	(0.356)
Male	−0.129	−0.407***	−18.363***	−13.062***
	(0.082)	(0.088)	(2.262)	(1.246)
Ill	−0.080	−0.293**	−0.875	−1.210
	(0.147)	(0.142)	(3.698)	(2.280)
Proportion of siblings	1.042***	1.820***	27.390***	15.491***
	(0.337)	(0.402)	(9.244)	(5.844)
Household size	−0.088***	−0.069**	−3.839***	−2.623***
	(0.024)	(0.029)	(0.729)	(0.464)
Rural	0.869***	0.668***	9.194**	1.110
	(0.108)	(0.119)	(3.868)	(2.094)
Extremely poor	0.018	−0.027	−3.643	−3.051**
	(0.106)	(0.106)	(2.355)	(1.375)
Father's age	−0.009	−0.026***	−0.186	−0.418***
	(0.008)	(0.009)	(0.190)	(0.124)
Mother's age	0.018*	0.034***	0.342	0.541***
	(0.010)	(0.011)	(0.246)	(0.146)
Father formally educated	−0.042	0.091	−0.115	−0.743
	(0.104)	(0.106)	(2.378)	(1.372)
Mother formally educated	−0.058	−0.471***	1.074	0.375
	(0.095)	(0.104)	(2.177)	(1.253)
Ill (other members of the household)	0.062	−0.069	−1.846	−1.347
	(0.092)	(0.095)	(2.229)	(1.323)
Father chronically ill	−0.134	−0.169	−4.518	0.706
	(0.202)	(0.236)	(5.366)	(3.359)
Mother chronically ill	0.197	−0.125	−3.565	0.239
	(0.141)	(0.130)	(3.209)	(1.847)
Father suddenly ill	−0.146	−0.166	3.917	2.766
	(0.125)	(0.146)	(3.109)	(2.104)
Mother suddenly ill	0.064	−0.076	−1.472	9.891***
	(0.153)	(0.152)	(3.539)	(1.960)
Constant	3.254***	2.793***	7.183	34.786***
	(0.541)	(0.586)	(13.401)	(7.712)
No. of observations	2,241	761	2,241	761

Notes: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in parentheses. Estimator: Cragg hurdle regression.

https://doi.org/10.1017/dem.2016.28 Published online by Cambridge University Press

NOTE

1 The full table of results are available from the authors upon request.

REFERENCES

Alam, Shamma Adeeb (2015) Parental health shocks, child labor and educational outcomes: Evidence from Tanzania. *Journal of Health Economics* 44, 161–175.

Basu, Kaushik (1999) Child labor: Cause, consequence, and cure, with remarks on international labor standards. *Journal of Economic Literature* 37(3), 1083–1119.

Bazen, Stephen and Claire Salmon (2010) The impact of parental health on child labor. *Economics Bulletin* 30(4), 2549–2557.

Cas, Ava, Elisabeth Frankenberg, Wayan Suriastini, and Duncan Thomas (2014) The impact of parental death on child well-being: Evidence from the Indian Ocean Tsunami. *Demography* 51(2), 437–457.

Chuhan-Pole, Punam and Manka Angwafo (2011) *Yes Africa Can: Success Stories from a Dynamic Continent*. Washington, DC: World Bank.

Cragg, John G. (1971) Some statistical models for limited dependent variables with application to the demand for durable goods. *Econometrica* 39(5), 829–844.

Dillon, Amrita (2013) Child labour and schooling responses to production and health shocks in northern Mali. *Journal of African Economies* 22(2), 276–299.

Flores, Gabriela, Jaya Krishnakumar, Owen O'Donnell, and Eddy van Doorslaer (2008) Coping with health costs: Implications for the measurement of catastrophic expenditures and poverty. *Health Economics* 17(12), 1393–1412.

Gertler, Paul and Jonathan Gruber (2002) Insuring consumption against illness. *American Economic Review* 92(1), 51–70.

ILO (2004) *Child Labour: A Textbook for University Students*. Geneva: International Labour Office.

ILO-IPEC (2013) *Making Progress Against Child Labour - Global Estimates and Trends 2000–2012*. Geneva: International Labour Office.

ILO-IPEC (2014) *A Health Approach to Child Labour - Synthesis Report of Four Country Studies on Child Labour in the Brick Industry*. Geneva: International Labour Office.

Landmann, Andreas and Markus Frölich (2015) Can health insurance help prevent child labor? An impact evaluation from Pakistan. *Journal of Health Economics* 39, 51–59.

Liu, Kai (2016) Insuring against health shocks: Health insurance and household choices. *Journal of Health Economics* 46, 16–32.

Morduch, Jonathan (1995) Income smoothing and consumption smoothing. *Journal of Economic Perspectives* 9(3), 103–114.

NSIR (2011) *The Third Integrated Household Living Conditions Survey (EICV3), Main Indicators Report*. Kigali: National Institute of Statistics of Rwanda.

Saksena, Priyanka, Adélio F. Antunes, Ke Xu, Laurent Musango, and Guy Carrin (2011) Mutual health insurance in Rwanda: Evidence on access to care and financial risk protection. *Health Policy* 99(3), 203–209.

Sauerborn, Rainer, Alayne M. Adams and M. Hien (1996) Household strategies to cope with the economic costs of illness. *Social Science & Medicine* 43(3), 291–301.