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Résumé

De nombreux efforts, et d'immenses progrès ont été réalisés ces dernières années par les pays à revenu faible et intermédiaire vers la couverture universelle de santé. Celle-ci est atteinte lorsque tous les individus ont accès à des soins de santé de qualité lorsqu'ils en expriment le besoin, et sans encourir de difficultés financières. Cette thèse s'efforce de mesurer les progrès réalisés par les pays à revenu faible et intermédiaire en matière de couverture universelle de santé, d'en déduire les déterminants et de mettre en évidence les effets que peut avoir la couverture universelle de santé sur l'état de santé. La thèse s'organise autour de trois chapitres. Le premier chapitre montre l'effet des paiements directs sur la pauvreté. L'analyse vise à décrire la nécessité de progresser vers la couverture universelle de santé en mettant en exergue l'effet des paiements directs sur la pauvreté. Le deuxième chapitre vise à exposer les facteurs qui ont expliqué les progrès réalisés par certains pays en matière de couverture universelle de santé, en analysant l'effet spécifique des recettes du gouvernement. En outre, à la différence d'autres études, ce chapitre estime le niveau minimal de recettes du gouvernement (en pourcentage du PIB) que les pays à revenu faible et intermédiaire devraient mobiliser pour progresser significativement vers la couverture universelle de santé. Enfin, le chapitre trois étudie l'effet du progrès vers la couverture universelle de santé sur l'état de santé.

Mots clés : couverture universelle de santé; paiements directs, pauvreté ; recettes du gouvernement ; instabilité des recettes du gouvernement ; instabilité des dépenses publiques ; mortalité maternelle ; mortalité infanto- juvenile ; qualité de la régulation ; pays à revenu faible et intermédiaire.

Abstract

Many efforts and tremendous progress have been made in recent years by low-and middle-income countries towards universal health coverage. It is achieved when all individuals have access to quality health care when they need it, without incurring financial hardship. This thesis aims to measure the progress made by low- and middle-income countries in universal health coverage, deduce their determinants, and highlight the effects of universal health coverage on health outcomes. The thesis is organized around three chapters. The first chapter documents the effect of out-of-pocket expenditures on poverty. The analysis aims to show the necessity to move towards universal health coverage by highlighting the effect of out-of-pocket expenditures on poverty. The objective of the second chapter is to show the factors that have explained the progress made by some countries in universal health coverage by analyzing the specific effect of government revenue. In addition, this chapter, unlike other studies, estimates the minimum level of government revenue (in percent of GDP) that low and middle-income countries should mobilize to make significant progress towards universal health coverage. Finally, chapter three examines the effect of progress towards universal health coverage on health status.

Keywords: Universal health coverage; poverty; out-of-pocket expenditures; government revenue; government revenue instability; government expenditures instability; low-and- middle income countries; under-five mortality; maternal mortality; quality of regulation.

Introduction Générale

Malgré les importants progrès enregistrés dans les pays à revenu faible et intermédiaire (PRFI) dans le domaine du financement de la santé, on y observe toujours les plus forts taux de paiements directs en proportion des dépenses totales de santé. Les paiements directs ont souvent pour conséquence de limiter l'accès aux soins de santé des personnes les plus pauvres et augmenter leur risque d'encourir des dépenses de santé catastrophiques et voir les enfoncer davantage dans la pauvreté (Bayati and al, 2019).

En moyenne, dans les PRFI, les paiements directs représentent la principale source de financement de la santé (WHO, 2018). Cela est principalement dû à la place marginale qu'occupe les dispositifs de prépaiement dans le financement de la santé qui est la conséquence à la fois d'une faible mobilisation des recettes fiscales, d'une inusffisante allocation des ressources publiques au financement de la santé et des défaillances que rencontrent les systèmes de santé. Tout cela dans un contexte où les défis liés à la santé se posent avec acuité. Ces pays ont les taux de mortalités maternelles et infantiles parmi les plus élevés au monde, les difficultés d'accès à des soins de qualité, une transition épidémiologique intense, un contexte épidémiologique lié notamment à la Pandémie de Covid -19 qui accentue une pression déjà forte sur les systèmes de santé, et des taux de pauvreté parmi les plus élevés au monde.

La figure 1 ci-dessous, montre que dans les pays à faible revenu, les paiements directs représentent la principale source de financement de la santé et sont de l'odre de 41%, alors que les dépenses publiques en 2018 ne représentaient que 21 % des dépenses totales de santé, et l'aide extérieure à la santé occupe le tiers des dépenses de santé.

Parmi les pays à revenu intermédiaire de tranche inférieure, les paiements directs ont contribué à hauteur de 42 % aux dépenses de santé, et représentent la part la plus importante de l'ensemble des dépenses de santé. En moyenne, les transferts publics représentaient plus d'un tiers des dépenses totales de santé, et les cotisations sociales d'assurance maladie pour 7 % supplémentaires. L'aide extérieure représentait 10 % du financement de la santé.

Dans les pays à revenu intermédiaire de tranche supérieure, les dépenses publiques ont été la principale source de financement de la santé, les transferts gouvernementaux représentant 38 % du total dépenses de santé et les contributions à l'assurance maladie représentent 17%.

En définitive, il est intéressant de noter que plus les niveaux de revenu des pays augmentent, plus la part des transferts publics au financement de la santé augmente, de même que les dépenses prépayées issues des systèmes contributifs obligatoires ou volontaires. Dans le même temps, on note que la part des paiements directs dans les dépenses de santé a tendance à regresser.

Figure 1: Dépenses de santé par source de financement et par groupe de revenus en 2018
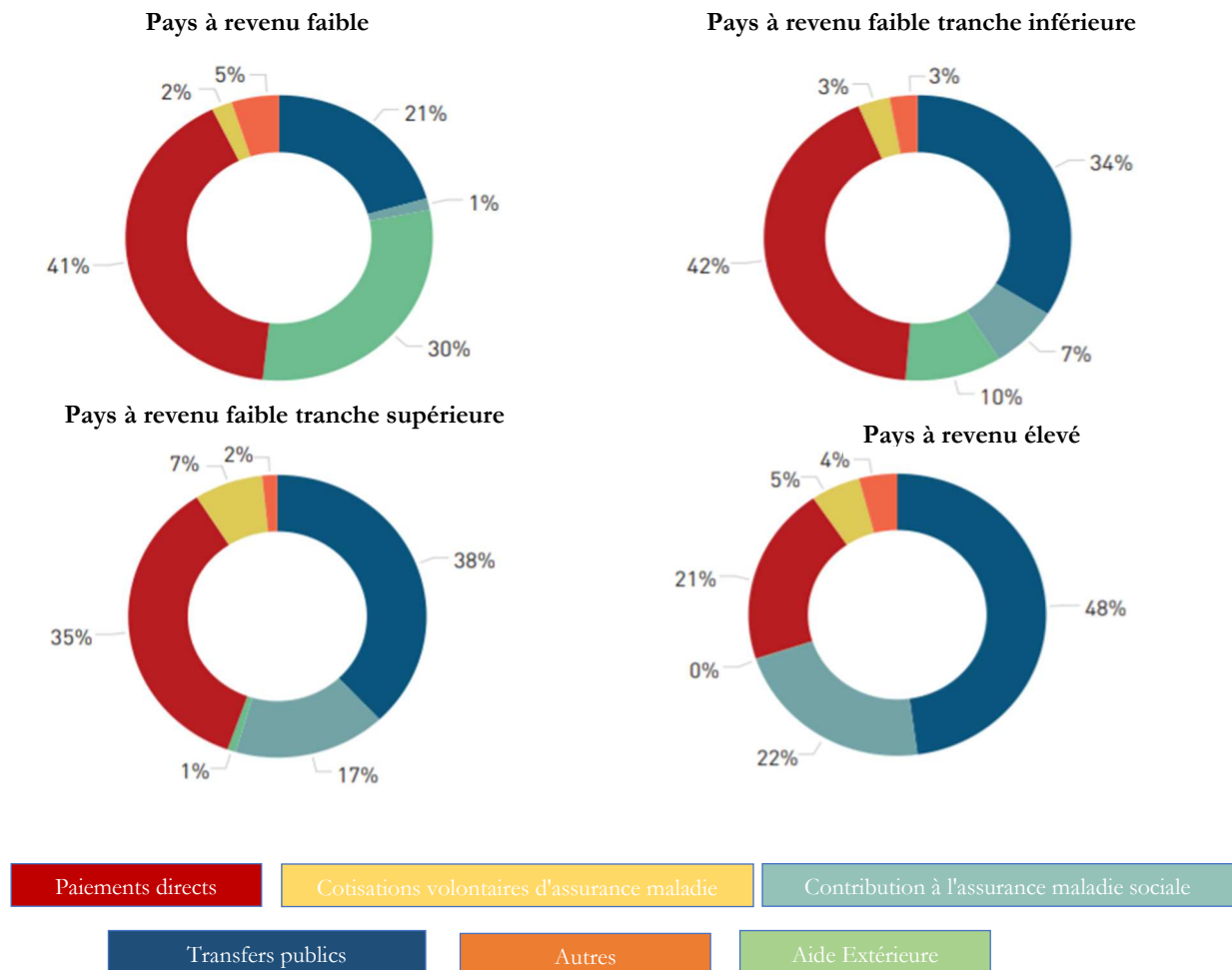
Source : Dépenses de santé par source de financement et par groupe de revenus, 2018.
OMS, Les dépenses mondiales de santé: Faire face à la tempête (P 07), 2018

L'objectif de la présente thèse, qui s'inscrit dans la perspective de l'intérêt global en faveur de la couverture universelle de santé est triple. Premièrement, il s'agit d'abord d'analyser les enjeux que représentent les paiements directs dans les pays à revenu faible et intermédiaire, notamment leurs conséquences sur la pauvreté. Cela, dans le but d'exposer davantage la nécessité de mettre en place un mécanisme de prépaiement fondé sur la couverture universelle de santé. Deuxiemement, il s'agit d'étudier l'effet des recettes du gouvernement sur la probabilité d'atteindre cet objectif. La mobilisation des recettes publiques est indispensable pour assurer un système de prépaiement fondé sur un financement équitable de la santé. Enfin, cette thèse s'efforce de montrer les effets que peuvent avoir le progrès vers la couverture universelle de santé en faveur de l'amélioration de l'état de santé dans les pays à revenu faible et intermédiaire.

Contributions de la thèse

Les contributions de cette thèse sont exposées dans les lignes qui suivent.

Premier Essai : La littérature montre que les paiements directs ont un effet négatif sur les conditions de vie des ménages, en particulier les ménages pauvres. Ils augmentent le risque pour eux de faire face à des dépenses de santé catastrophiques (wagstaff and al, 2020 ; Sirag and Mohamed Nor, 2021 ; Xu and al, 2003). Dans ce chapitre, nous testons l'effet des paiements directs sur la pauvreté dans 66 pays à revenu faible et intermédiaire entre 1996 et 2012.
Pour ce faire, nous avons utilisé la méthode des variables instrumentales à effets fixes en données de panel. Cette méthode nous a permis de corriger les problèmes d'endogeneïté qui surviennent à la suite d'un biais de simultaneïté entre les paiements directs en pourcentage des dépenses de consommation finale et nos variables de pauvreté.
En effet, les paiements directs peuvent entraîner une augmentation de la pauvreté de la population et, dans le même temps, la pauvreté peut entraîner un risque financier accru et des

paiements directs élevés en raison de la proportion importante qu'ils peuvent représenter dans les dépenses de consommation des ménages. Ce qui les emmènera à faire des arbitrages susceptibles de réduire leur bien être (Sirag et Mohamed Nor, 2021). D'autres méthodes de regression telles que la méthode de regression à effets de seuil statiques et à variables explicatives exogènes de Hansen (1999), ou de Kremer et al. (2013) qui proposent un modèle à effets de seuil et à variables explicatives qui peuvent être potentiellement endogènes. Ces méthodes suggèrenent une exogeneïté des regresseurs, alors que la littérature considère une endogeneïté de nos variables de pauvreté. Afin de réaliser leur analyse sur les effets des paiements directs sur la pauvreté, Sirag et Mohamed Nor(2021) ont utilisé une méthode suggérée par Seo et Shin (2016) qui proposent un modèle à effets de seuil dynamique avec variables explicatives qui peuvent être potentiellement endogènes. Leur approche methodologique consiste à utiliser un modèle de panel à effets de seuil et de corriger l'endogeinté avec la méthode des moments généralisée. Comparé à ces méthodes, notre modèle a l'avantage de trouver des instruments pour corriger le biais d'endogeneïté. La validité de ces instruments est expliquée dans la suite de cette thèse.

Nos contributions sont les suivantes:

- La contribution majeure dans l'analyse de l'effet des paiements directs sur la pauvreté est le type d'indicateur utilisé pour mesurer les paiements directs. A date, plusieurs indicateurs sont utilisés dans la littérature pour mesurer les paiements directs. La première est de demander combien les ménages dépensent pour leurs soins de santé, et de les exprimer en dépenses de santé par habitant. Cela est souvent l'appanage des études à l'échelle microéconomique pour un seul pays. C'est le cas notamment des études de Banthin, Cunningham, et Bernard (2008) et Gruber and Levy (2009). Le deuxième indicateur est la mesure de la progressivité des paiements directs en utilisant par exemple l'indice de Kakwani (1977) qui indique si les paiements directs représentent une proportion plus élevée du revenu des pauvres (regressif) ou plus faible

(progressif). Le troisième indicateur permet de rapporter les paiements directs aux dépenses totales de santé. Toutefois, cela ne nous indique pas si la part des paiements directs varie en fonction du revenu ou de la consommation du ménage. Le quatrième indicateur permet de prendre en compte les dépenses de santé catastrophiques et établit un rapport entre les paiements directs et les ressources totales dont dispose un ménage. Si le ratio est supérieur à un certain seuil (par exemple, 10 %), les paiements directs sont considérés comme catastrophiques. Le cinquième indicateur est l'indice de concentration des dépenses de santé catastrophiques. Il vise à déterminer si la probabilité d'encourir ces dépenses diffère entre les ménages les plus pauvres et les plus riches. Le septième indicateur mesure l'appauvrissement. Il indique si les paiements directs font la différence entre un ménage qui se trouve au dessus ou en dessous du seuil de pauvreté. Dans notre cas, nous rapportons les paiements directs à la consommation finale des ménages, ce qui à date, de toutes les études consultées, n'a pas encore été utlisé dans la littérature. L'avantage de cet indicateur est qu'il nous fournit la part qu'occupe les paiements directs dans les dépenses de consommation des ménages.

- La correction du biais d'endogeneïté entre les paiements directs et les indicateurs de pauvreté ;

- L'Inclusion dans les analyses de l'effet des facteurs socio-économiques, démographiques et institutionnels qui affectent potentiellement la pauvreté;

- Contrairement à la plupart des études abordant l'effet des paiements directs sur la pauvreté à l'échelle microéconomique, notre analyse s'effectue au niveau agrégé.

Nos résultats montrent que les paiements directs augmentent la pauvreté, plus particulierement la sévérité de la pauvreté. Aussi, ils suggèrent que les paiements directs affectent plus amplement les ménages les plus pauvres et ainsi, aggravent la pauvreté. Par conséquent, une forte réduction des paiements directs s'accompagne d'une réduction substantielle de la pauvreté. En plus de la

réduction des paiements directs, une amélioration du revenu conduit à une réduction de la pauvreté. Pour capter cet effet revenu, nous utilisons une variable considérée comme *proxy*. Il s'agit du transfert des migrants. L'intérêt de l'utilisation de cette variable est de capter des transferts spécifiquement destinés aux ménages qui pourraient être utilisés pour assurer des dépenses de consommation, notamment les dépenses de santé. Sirag et Mohamed Nor (2021) trouvent des résultats qui vont dans le même sens que les nôtres. En plus de trouver que les paiements directs augmentent la pauvreté, particulièrement pour les plus pauvres, les auteurs constatent qu'une hausse du revenu, mesurée par le PIB par habitant, réduit la pauvreté.

Deuxième Essai : La mobilisation des recettes publiques est l'un des principaux défis des pays à revenu faible et intermédiaire dans la perspective de leur progression vers la couverture universelle de santé. L'objectif de ce chapitre est d'étudier l'effet des recettes du gouvernement (provenant de diverses sources) en pourcentage du PIB sur la probabilité de progrès vers la couverture universelle de santé. La littérature a très peu exploré cet effet, il n'existe donc pas suffisamment de recul. Nous apportons notre contribution à travers une étude empirique, en faisant l'hypothèse qu'une plus grande capacité de mobilisation des ressources, une priorité accordée à la santé dans les dépenses totales du gouvernement, une meilleure qualité de régulation et un contrôle de la corruption, représentent des facteurs contribuant à l'atteite de l'objectif attendu.

Les contributions de ce chapitre sont les suivantes :

- Nous utilisons des données de panel avec des modèles probit, logit, complementary log log et probit avec variables instrumentales entre 1995 et 2015. L'avantage de l'utilisation de cet ensemble de modèle est de s'assurer de la robustesse de nos résultats, en les confrontant à une battérie de tests. Nos résultats sont consistant et ne varient pas, quelque soit le modèle utilisé.

- Nous identifions les principaux facteurs expliquant la probabilité de progresser vers la couverture universelle de santé, et nous déduisons un seuil minimum de recettes du

gouvernement en pourcentage du PIB que les pays à revenu faible et intermédiaire devront mobiliser. Ce résultat est une contribution majeure à la littérature et a une implication en termes de politique économique, d'autant plus qu'il nous indique le seuil à atteindre en termes de recettes publiques pour s'assurer de progresser efficacement vers la CSU. A date, pour autant que nous sachions, il n'y a aucune étude dans la littérature qui determine ce seuil.

- Contrairement aux études précédentes, nous examinons l'effet de la volatilité des recettes et des dépenses publiques en pourcentage du PIB;

- Contrairement aux autres études, nous testons l'effet différencié des recettes du gouvernement (exclusivement composées de taxes en pourcentage du PIB) sur la probabilité de progresser vers la couverture universelle de santé, et l'effet des recettes totales du gouvernement, y compris les contributions sociales.

Nos résultats indiquent que les recettes du gouvernement augmentent substantiellement la probabilité pour un pays de progresser vers la couverture universelle de santé. Ainsi, lorsque les recettes du gouvernement augmentent de 100, la probabilité de progresser vers la couverture universelle de santé augmente de 66.5%. Aussi, nous constatons que le niveau minimal de recettes du gouvernement permettant à un pays de progresser significativement vers la couverture universelle de santé est de 23.58% du PIB. Enfin, nous constatons que la volatilité des recettes et des dépenses publiques affecte négativement la probabilité de progresser vers la couverture universelle de santé.

Troisième Essai : L'objectif fondamental de ce chapitre est de contribuer au débat sur la couverture universelle de santé en produisant une analyse empirique documentant les effets du progrès vers la couverture universelle de santé sur l'état de santé dans les pays à revenu faible et intermédiaire. Dans ce chapitre, nous mesurons les progrès vers la couverture universelle de santé par les trois principaux mécanismes utilisés pour y parvenir. Il s'agit notamment des programmes gouvernementaux de couverture santé, les programmes d'assurance privée à

adhésion obligatoire, et les programmes d'assurance privée à adhésion volontaire. Toutes exprimées en dépenses de santé par habitant et parité de pouvoir d'achat. Pour faire nos estimations, nous utilisons la méthode des variables instrumentales en données de panel entre 2000 et 2015. Dans ce chapitre, nos contributions sont les suivantes :

- Nous testons l'effet différencié des différents programmes concourant à la couverture universelle de santé sur l'état de santé ;

- Nous utilisons la méthode des variables instrumentales pour corriger le potentiel biais d'endogeneité entre la couverture universelle de santé et l'état de santé ;

- Nous testons l'effet de l'existence d'un potentiel effet de seuil pour vérifier la validité de l'hypothèse de non - linéarité que nous avons faite ;

- Nous montrons l'effet significatif des installations sanitaires améliorées sur l'état de santé.

Nos résultats indiquent que les programmes gouvernementaux et les programmes d'assurance volontaire réduisent substantiellement la mortalité infanto-juvénile et le ratio de mortalité maternelle. En revanche, l'assurance privée obligatoire n'a pas d'effet sur la mortalité maternelle et infantile.

Lorsque les dépenses de santé par habitant des programmes gouvernementaux de couverture santé augmentent de 100$, la mortalité infanto-juvénile baisse de 21.10 pour 1000 naissances vivantes, dans le même temps, le ratio de mortalité maternelle baisse de 21.1 pour 100.000 naissances vivantes. Lorsque les dépenses de santé par habitant de l'assurance volontaire augmentent dans la même proportion, le taux de mortalité infanto-juvénile baisse de 203 pour 1000 naissances vivantes, tandis que le ratio de mortalité maternelle baisse de 964 pour 100000 naissances vivantes. Nous trouvons également que l'accès à des installations sanitaires améliorées a plus d'effet sur l'état de santé que les programmes gouvernementaux de couverture santé. Une hausse du taux de croissance économique, l'accouchement en présence d'un personnel médical qualifié et la vaccination au DTP diminuent les taux de mortalité maternelle et infanto-juvénile.

Essay 1

Effect of Out-of-Pocket Payments on poverty in Low- and middle-income countries

Abstract

Evidence has shown that out-of-pocket payments remain health financing sources, which jeopardizes the enhancement of living conditions of households and consequently leads them to poverty. We propose to test the effect of out-of-pocket payments on poverty on 66 low- and middle-income countries between 1996-2012. We use variables approximating the level, the intensity and the severity of poverty such as respectively, poverty headcount, poverty gap and the squared poverty gap. Compared to other studies, we control this estimated effect for demographic, socioeconomic and institutional, public and health financing factors.

The results highlight that the out-of-pocket payments lead to increase poverty. The effect remains greater in the case where poverty severity is used as dependent variable. Accordingly, the positive effect of out-of-pocket payments further affect the poorest. Our findings suggest that reduction of out-of-pocket expenditures allow a considerable reduction of poverty in low and middle-income countries.

Keywords: Out-of-pocket payments, poverty, panel data instrumental variables

JEL codes: I11, I13, I18, I32

1   Introduction

Out-of-pocket payments[1] remain one of the main sources of health financing in most low-and middle-income countries. WHO (2014) estimates that the total health expenditures per capita, public fund was in 2011 Int$623 worldwide, Int$ 361 in middle-income countries and Int$ 27 in low-income countries. The percentage of health expenditures covered by out-of-pocket payments varied from 47% in low-income countries to 34% in middle -income countries. However, there are many disparities between these countries. While in Cuba and Rwanda, out-of-pocket expenditures on total health expenditures represent respectively 4.4% and 28.1% in 2014, in Nigeria, out-of-pocket spending cover 71.7% of total health expenditures (WDI, 2014). These expenditures could have many consequences for households, particularly for the poor. One of them is to jeopardize access to and the use of healthcare (Falkingham and *al.*, 2004). They have also increased poverty through catastrophic health expenditures (Aryeetey and *al.*, 2016; Kumar and *al.*, 2015a; Xu and *al.*, 2003).

Evidence shows that in a country where a major party of health expenditures is financed by out-of-pocket, effects on catastrophic health spending and poverty are more significant (Ghosh, 2011). They result in poverty in the vulnerable people and further increase poverty incidence in the poorest. For vulnerable populations, increase in out-of-pocket payments leads to reduce the saving and disposal income of households, which must be allocated to other expenses items such as the purchase of essential goods. For the poorest, out-of-pocket payments induce households to sell their assets and to borrow to finance the use of healthcare (Mugisha and *al.*, 2002; Van Damme and *al.*, 2004; Russel, 2004). In South-Eastern Nigeria, Onah and Govender (2014) showed that an average, households spent $33 monthly on health care.

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[1] Out-of-pocket payments refer to any direct outlay by households, including gratuities and in-kind payments, to health practitioners and suppliers of pharmaceuticals, therapeutic appliances and other goods and services for which the primary intent is to contribute to the restoration or the enhancement of the individual's health status

That represents 12.1% of household monthly expenditures. When data is disaggregated by socioeconomic groups, authors showed that poorest households are subject to highest cost of burdens (14.8% of household expenditures on health). In this way the progressive reduction of out-of-pocket payments in health financing will not only increase the use of healthcare but also further reduce poverty which has decreased over the recent years. Evidence on the issue related to the consequences of out-of-pocket payments remains unanimous on the fact that an increase in health expenditures financed by households results in the occurring of financial catastrophe[2] and the increase of poverty in low-and middle-income countries (Wagstaff and Van Doorslaer, 2003; Ghosh, 2011; O'Donnel, 2005; Ambari and *al.*, 2014; Van Doorslaer and *al.*, 2006; Lim Wattananon and *al.*, 2007; Garg and Karan, 2008; Gustafsson and Shi, 2008). Furthermore, the most used techniques to estimate the effect of out-of-pocket payments on poverty could be improved.

The contributions of this paper are: Firstly, we focus on a large dataset of low- and middle-income countries. Secondly, we use econometric tools to deal with the potential endogeneity bias of out-of-pocket payments for which the sources will be presented in detail in the follow of paper. Thirdly, we control the model for the effect of socioeconomic, demographic and institutional factors that are likely to affect poverty.

The rest of the paper is organized as follows. Section 2 highlights a literature review on the effect of out-of-pocket payments on the impoverishment of households in low-and middle-income countries; section 3 outlines our model specification, data, and empirical strategy; section 4 discusses the results; and section 5 concludes and draws up some policy recommendations.

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[2] The financial catastrophe caused by out-of-pocket payments occurs in the case where they exceed a given proportion of household's income (Wagstaff and Van Doorslaer (2003) who's the level depends on the study

2   Background

The effects of out-of-pocket payments on households' impoverishment in low-and middle-income countries have been well documented in the literature. However, the relationship between the two factors is complex and due to the multidimensionality of poverty. On this matter, the studies have shown that out-of-pocket payments result in a financial catastrophe constituting an important additional source of poverty, particularly in the poorest (Baeza and Packard, 2006; Van Doorslaer and *al.*, 2006; Wagstaff and Van Doorslaer, 2003).

The major part of empirical studies exploring the effects of out-of-pocket payments on poverty has focused on specific countries. Firstly, Garg and Karan (2008) worked on India and showed that out-of-pocket payments have led 32.5 million persons below the poverty line between 1999 and 2000. Furthermore, they found that the overall poverty increases by 3.2% after accounting for the out-of-pocket payments.

In addition, Kumar and *al.* (2015b) investigated the socioeconomic differentials in impoverishment effects of out-of-pocket payments in China and India. They found that annually about 7% and 8% respectively of Chinese and Indian populations falls in poverty due to out-of-pocket payments. Moreover, in this study, the gap percentage between household income and poverty line dues to out-of-pocket payments, have been estimated to 2% and 1.3%, respectively in China and India.

Van Doorslaer and *al.* (2006) explored the effect of out-of-pocket payments on poverty in eleven Asian countries. They found that in some countries such as Vietnam and Bangladesh, in which health system is majorly financed by out-of-pocket expenditures, the estimated poverty is higher than in the other countries, ranging from an additional 1.2% of the population in Vietnam and 3.8% in Bangladesh. On this subject, Van Minh and *al.* (2013) found that between

2002 and 2010, 3% to 4% of Vietnamese households have been putted in poverty because of private expenditures.

Furthermore, in a recent study, Rashad and Sharaf (2015) focused on the catastrophic and economic consequences of healthcare payments on poverty estimates in Egypt, Jordan, and Palestine, they concluded that out-of-pocket payments push more than 20% of the population into a financial catastrophe and 3% into extreme poverty in 2011. However, in Jordan and Palestine, the study notes limited effects of incidence of out-of pocket payments on poverty. This is because catastrophic health expenditures are not so high in these two countries. In Jordan, OOP expenditures do not cause disruption to many households, as only 2.7% of the households are encountering catastrophic health expenditures at the 10% threshold, and 0.7% at the 40% of the non-food-expenditure threshold. In Palestine, 6.7% of the population is facing catastrophic health expenditures at the 10% threshold and approximately 2% at the 40% of the non-food-expenditure threshold (Rashad and Sharaf, 2015)

3   Methodology

The effect of out-of-pocket payments on poverty is empirically investigated by focusing on an unbalanced panel-data model covering 66 low-and middle-income countries over the period 1996-2012. Generally, the analyses on a long period could result in stationary problems. However, Hurlin and Marion (2006) found that this problematic occurs in the case where the time dimension of panel data exceeds 20 years. In our case the time dimension (17 years) is less than the suggested threshold. Hence, we think acceptable to work on this studied period.

We depart from a fixed effects model instead a random effect one to account for unobserved heterogeneity across the countries. The use of random effects model would not be relevant because poverty situation is not determined in a random way.

There are factors that are important drivers of poverty. There are for example, democracy, financial development, population structure, etc. The use of fixed effects model sets the goal to account for the disparities in the methods of poverty assessment. Poverty indicators are generally computed on the base of survey data. The frame of reference used to calculate these indicators can vary from a country to another.

4   Model specification

The econometric model is specified as follows:

$$Y_{it} = \alpha + \beta X_{it} + \sum_{k=1}^{n} \delta_k Z_{kit} + V_i + \varepsilon_{it}$$

(1)

Y_{it} refers to poverty variables for the country i at the year t. X_{it} refers to the variable of interest such as the out-of-pocket payments and ε_{it} is the idiosyncratic disturbance whereas α is the intercept. Z_{kit} represents the k (k ranging from 1 to n) used control variables. β; δ_k are the parameters which must be estimated. V_i is the country fixed effects which account for the heterogeneity between countries.

The advantage of the panel data instrumental variable approach compared to the OLS regressions, is that first it takes into account the unobservable heterogeneity which if not controlled for, makes the estimation endogenous. Second, the method of panel data instrumental variables technique, by using excluded instruments, allows us to test the causality impact of out of pocket expenditures on the poverty rates. That is because we are using valid excluded instruments, we can safely say that the causality goes from the out-of-pocket variable to the poverty rates and not the reverse.

5   Data

The variables used in the paper come from three databases. The major part of them is retrieved from the World Bank Indicator database (WDI, World Bank, 2014). These are: the density of population, the mean duration in secondary education, the international remittances as share of GDP, the unemployment rate, poverty headcount, poverty gap, the grants excluding technical cooperation, the net transfers on external debt public and publicly guaranteed, households' final consumption expenditures and the size of total population.

Out-of-pocket payments and central government health expenditures, all expressed in per capita, come from the Global Health Expenditures (GHE) database (NHA, WHO, 2008a). The civil liberties index comes from the freedom house database. Table 1 presents the variables descriptions and sources, and the Table 2 shows the descriptive statistics of used variables. In the regressions, we choose to transform the variable of out-of-pocket payments and poverty indicators in logarithms to estimate out-of-pocket payments elasticity against poverty. We also use the logarithm of greenhouse gases emissions because the relationship between the greenhouse gases emissions and the logarithm of out-of-pocket payments variable is less adjusted than the logarithm of greenhouse gases emissions and the logarithm of out-of-pocket payments variable (Figure 3 in Appendix).

Furthermore, we do not include the GDP per capita that appears a key determinant of poverty because the out-of-pocket payments and the final consumption of households constitute a non-negligible part of this last one. The including of GDP per capita would have resulted in a collinearity bias.

Table 1 : Variables description and source

Variables	Description	Source
gap190	Poverty gap at $1.90 a day (2011 PPP) (%)	World Development
gap310	Poverty gap at $3.10 a day (2011 PPP) (%)	Indicators Database
gap1	Poverty gap at national poverty lines (%)	
povrat190	Poverty headcount ratio at $1.90 a day (2011 PPP) (% of population)	
povrat310	Poverty headcount ratio at $3.10 a day (2011 PPP) (% of population)	
povrat1	Poverty headcount ratio at national poverty lines (% of population)	
grgdp	GDP growth (annual %)	
gdpc	GDP per capita, PPP (current international $)	
gdp	GDP, PPP (constant 2011 international $)	
density	Population density (people per sq. km of land area)	
fdi_inf	Foreign direct investment, net inflows (% of GDP)	
fdi_out	Foreign direct investment, net outflows (% of GDP)	
remittance	Personal remittances, received (% of GDP)	
unemp_model	Unemployment, total (% of total labor force) (modeled ILO estimate)	
grants	Grants, excluding technical cooperation (BoP, current US$)	
transf	Net transfers on external debt, public and publicly guaranteed (PPG) (NTR, current US$)	
dura_secon	Secondary education, duration (years)	
press	press freedom index	Freedom house
CL	Civil liberties index	database
PR	Political right index	
cpi	Corruption perception indes	Transparency International database
polity2	Quality of political system	POLITYIV database
oop_the	Out-of-pocket as percentage of private health expenditures	Global Health
oop_pvt	Out-of-pocket as percentage of total health expenditures	expenditures database
oop_house	Out-of-pocket payments as a share of the household's, final consumption expenditures	Authors calculation
corup_wgi	Control of corruption	Wordlwide
gov_ef	Government effectiveness	governance indicators
pol_sta	Political Stability, Absence of Violence/Terrorism	database
regu_qual	Regulatory Quality	
law_wgi	Rule of law	
voice_wgi	Voice and Accountability	

Source : Author

Table 2: Descriptive statistics

Variables	Definitions	Mean	Std.Dev.	Min	Max	Observations
Log. GAP190	Logarithm of poverty gap using 1.90 PPP $ as threshold (%)	0.687	1.839	-4.605	3.697	356
Log. Headcount190	Logarithm of poverty headcount using 1.90 PPP $ as threshold (%)	1.944	1.566	-4.605	4.404	357
Log. GAP_squared190	Squared poverty gap using 1.90 PPP $ as threshold	1.374	3.679	-9.21	7.394	356
Log. GAP310	Logarithm of poverty gap using 3.10 PPP $ as threshold (%)	1.931	1.264	-3.219	4.077	356
Log. Headcount310	Logarithm of poverty headcount using 3.10 PPP $ as threshold (%)	3.034	1.001	-0.916	4.532	356
Log. GAP_squared310	Logarithm of Squared poverty gap using 3.10 PPP $ as threshold	3.861	2.529	-6.438	8.154	356
Log. OOP	Out-of-pocket payments as share of final consumption of households Total population per km2	1.27	0.495	-0.957	2.438	357
Density	Population density (people per sq. km of land area)	103.497	126.337	1.573	1164.76	357
Education	The mean duration in secondary education (years)	6.146	0.815	4	8	357
Remittances	Personal remittances received (% of GDP)	6.027	6.684	0.001	30.754	356
Unemployment rate	Unemployment, total (% of total labor force)	7.954	5.566	0.1	35.9	357
Civil Liberties Index	Press freedom index	3.431	1.109	1	7	357
Total public net flows per capita	Grants including cooperation per capita+transfers on external debt public and publicly guaranteed per	27.61	89.099	-274.256	606.778	357
MINIHEXP	Central government health expenditures per capita	84.784	90.597	1.383	602.287	351
Log. Greenhouse gases	Logarithm of total greenhouse gas emissions (kilotons of CO_2 equivalent)	24.744	1.653	21.315	28.726	357

Source: Authors' calculation using the WDI, the GHE and the Freedom House database

Before estimating the effect of out of pocket expenditures on poverty, , we run unit root test on our variables. Table 9 (in appendix) gives the results of the unit root test for the variables expressed in level. We use the The Levin, Lin and Chu test wich make the simplifying assumption that the panels are homogenous. The null hypothesis is that the panels contain unit roots3, and the alternative is that the panels are stationary4. We find that all the variables used in our models are stationary, except for the education variables (Secondary education, duration) ; and the unemployment rate (Unemployment, total (% of total labor force)). For these two variables we did not get response because they are many missing data.

Dependant variable: Poverty

Poverty could be understood in two different forms such as the monetary and non-monetary poverty. The monetary poverty measures the deprivation of people in terms of income and the non-monetary poverty accounts for the other aspects except the income that could lead the population to a deprivation and a worsening well- being. Among these other aspects, there are for example the access to healthcare, education, improved water and sanitation, etc.

This paper focuses on the monetary poverty. We use monetary approach to capture the effect of out-of-pocket payments on households' capacity to purchase goods and services.

Even monetary approach contains some shortcomings, especially because it does not consider all other aspect of well-being. Monetary approach does not consider the goods and services needed for well-being that are outside the market (World bank 2018).

At country level, the monetary poverty is generally approximated by three main variables. The first one is poverty headcount. It measures the level of poverty and refers to the percentage of population living below a certain threshold defined at national or international level. The

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[3] Or all panels contain unit roots depending on the nature of the test.
[4] Or some/at least one panels are/is stationary depending on the nature of the test.

second one is poverty gap index which assesses the intensity of poverty. Based on the World Bank definition, it refers to the mean shortfall in income or consumption of population from the poverty line a day. This index is calculated through the difference between the average expenditure (income) of the poor and poverty line defined as national or international level. Then, this difference is expressed as a percentage of the poverty line. The third poverty variable is the squared poverty gap index. It is generally used to approximate the severity of poverty (Adams and Page, 2005). This measure is sensitive to change in distribution among the poor. In other words, while a variation of a number of the poorest among the poor people does not change poverty headcount and gap, it would affect the squared poverty gap (Adams and Page, 2005). The cited poverty variables are estimated at national poverty line or by regarding a harmonized threshold generally defined around $(Purchasing power parity, PPP) 1.90 or $(Purchasing power parity) 3.10 a day.

However, in the studies focusing on many countries, the use of poverty variables estimated at national poverty line would be biased given the defined poverty thresholds can differ from a country to another. Hence, it would be more rigorous here to use poverty variables assessed by using conventional thresholds. To this end, we focus on both the standardized thresholds. Those are $1.90 PPP or $ 3.10 PPP a day.

The explanatory variables

The variable of interest is out-of-pocket payments. They are likely to affect poverty by jeopardizing the financial resources of households. In this way, we suggest focusing on the out-of-pocket payments as a share of the household's, final consumption expenditures (OOP). This variable is calculated by dividing the out-of-pocket payments by household's final consumption expenditures, all expressed in PPP dollars per capita.

We also include other socioeconomic, demographic and institutional factors commonly used in the literature as main determinants of poverty. These are: the density of population, the mean duration in secondary education, the international remittances as a percentage of GDP, the unemployment rate, the press freedom, and the GDP per capita growth.

Density of population (Density): refers to the size of population per square kilometer of land areas. It is included in the econometric model to control for the effect of population growth on poverty incidence. The area surface of any country remains generally constant. Accordingly, any variation of population density would be caused by the variation of the population including residents and migrants. The population density is likely to have a mixed effect on poverty. Based on Malthusian theory, the population rapidly grows compared to the agricultural production. This observation comes from the decreasing returns in the agricultural sector. In this way, the increase in population growth would result in an increase in numbers of landless individuals. In low-and middle-income countries, a major part of population works in the agricultural sector. Accordingly, with the increase in landless people, some households would not access to rewarding activities and would experience a decrease in their income which is likely to put them below the poverty line. In this case, the increase in population density approximating the population growth would increase poverty.

However, companies are generally induced to install their activities in the densely populated areas. The new activities produced by these companies would create employment and allow the people to get salaries and consequently additional incomes. Moreover, the establishment of companies in a zone has generally the consequence to result in a creation of small accessory activities such as for example activities of real property leas and catering services. In this way, the increase in population density would increase household income and would consequently reduce poverty.

Educational variable (Education): the duration of secondary education refers to the average number of years in secondary school. It is introduced into the model because it appears to be an important determinant enhancing poverty (Mihai and *al.*, 2015). The most educated people are likely to get a best employment and consequently benefit to greater incomes (salaries) compared to less educated persons. These educated people are more likely to be less poor than the others.

Moreover, the improvement of the population's education would reduce poverty through the channel of the enhancement of health status. A better education would allow the people to adopt preventive behaviors to avoid some diseases. Accordingly, an improvement of education would reduce the morbidity of people resulting in invalidity and would consequently allow individuals to work and to perceive incomes; a fact will reduce poverty.

International remittances as share of GDP (Remittances): the international remittances include personal transfers and compensation of employees. The personal transfers comprise all current transfers in cash or in kind made or received by resident households to or from nonresident households and all current transfers between resident and nonresident individuals. The compensation of employees integrates the income of the border, seasonal, and other short-term workers who are employed in an economy where they are not resident and of residents employed by nonresident entities.

The international remittances constitute support funds to households. They allow the populations to create business. Accordingly, they would reduce poverty in low-and middle-income countries (Adams and Page, 2005).

Unemployment rate (Unemployment): refers to the share of the labor force that is working but available for and seeking employment. It is a factor jeopardizing the reduction of poverty incidence in low-and middle-income countries (Zhong and Xiue, 2003). The persons without employment cannot perceive a permanent income, particularly in low-and middle-

income countries in which the social aids are weakly allocated. In this way, the increase in the unemployment rate would result in an increase of poverty incidence.

Index of civil liberties (Press): refers to the propensity of a government to ensure the freedom of expression and belief, the associational and organizational rights, the rules of law and the autonomy of individuals and organizations without inference to the state. The values of this index vary from 1 (most free) to 7 (least free). It controls for the negative relationship between democracy and poverty (Boix, 2001; Lake and Baum, 2001; Ghobarah and *al.*, 2004; Bueno De Mesquita and *al.*, 2000). In democratic countries, the election process promotes the participation of the poorest. Accordingly, in these countries, the governments will tend to implement policies in favor of poor people. In this way, the democracy would contribute to the eradication of poverty in low-and middle-income countries. Given the way through which the civil liberties index has been assessed, a positive coefficient associated to this last one will mean that it reduces poverty and vice-versa.

Total net public flows per capita: controls of the effect of official development assistance to poverty. In low-and middle-income countries, the goal of foreign aid is to support the governments in the course towards the improvement of social standards including poverty. In this way, the foreign aid is a key determinant likely to reduce poverty. However, the official development assistance includes some components which must be repaid by the recipient countries. These are the external debt services including the principal repayments on external debt, and the interests on external debt.

Accordingly, the estimation of real effect of external aid on poverty requires retrieving repaid resources from the total funds allocated by foreign sponsors to the countries. To this end, we calculate the total net public flows per capita by firstly adding the received grants in current dollars excluding technical cooperation and the net transfers on external debt public and publicly

guaranteed. The net transfers include the total disbursements retrieving from the external debt service. Then, the added variables are divided by the size of total population.

Central government health expenditures per capita (MINIHEXP): expressed in PPP dollars and financed by health ministry and other ones, central government health expenditures, could play an important role in the reduction of poverty. Healthcare financed by central government generally benefits to the poorest. Hence, the increase in central government health expenditures would increase health care access particularly for the poor.

They would consequently reduce the risks of financial catastrophe and poverty. Furthermore, the increase in access to healthcare would also enhance health status of populations, in particular the poorest (Anand and Ravaillion, 1993; Bidani and Ravaillon, 1997; Mehrotra and Delamonica, 2002; Gupta and *al.*, 2003) which are the sickest.

Identification Issues

The estimation of out-of-pocket payments effect on poverty is lead to a potential endogeneity bias. The first potential endogenous variable is the out-of-pocket payments. This endogeneity can arise from the reverse causality bias. An increase in poverty would result in a reduction of a household's income. It would consequently decrease the amount of budget allocated by households to health financing. In this way the increase in poverty would adversely affect the volume and the share of out-of-pockets in the final consumption of households.

The second source of endogeneity may also due to the omitted variables bias. In addition to the direct and discretionary payments made by the patients, there are other fees which frequently occur, but which are not included in the calculation of out-of-pocket payments given the lack of information related to them. The main supplementary fees come from the transportation costs between the place of residence and health facilities. They are substantial in low-and middle-income countries (Nahar and Costello, 1998; Attanayake and *al.*, 2000, Silal,

2012). They are likely to limit the use of healthcare and to increase the occurrence of poverty in households.

In addition to the variable of out-of-pocket payments, all the other explanatory variables are also endogenous in the model. This endogeneity is mostly caused by the simultaneity bias between these variables and the proxy variables of poverty. The control variables may be affected by poverty.

Firstly, the duration of education is generally lower in poor individuals comparatively to the others. In this way, the increase in poverty would reduce the mean duration of secondary education.
Furthermore, the poorest people cannot access to a better quality of education. Accordingly, the increase in numbers of the poor would reduce the size of educated populations which will result in an increase in the unemployment rate.

Secondly, the increase in poverty induces populations to migrate towards the less poor countries to improve their living standards. It consequently increases the flows of emigration likely to reduce the size and the density of the population. Therefore, the density and the remittances would be affected by poverty. Regarding the variable of democracy, it would also be influenced by poverty. Poor countries experience a low-level democracy (Ross, 2006).

Thirdly, the increase in poverty in a country would lead to reduce the tax revenue mobilization used in part to finance central government health expenditures. Moreover, it generally appears that the poor countries receive more foreign aid compared to the others. In this way, the total public net flows and central government health expenditures would be affected by poverty.

Instrumentation Strategy

The endogeneity of out-of-pocket payments is addressed by using the heteroskedastic-efficient two-step generalized method of moment (IV/GMM) estimator performed by Baum and *al.* (2007). The benefit of this estimator is to produce efficient coefficients and consistent standard error estimates.

It is closer to the traditional two least squares IV/2SLS estimator. The only difference is that the efficient GMM estimator controls for the potential heteroskedasticity and serial correlation in the sample. It comes for the use of the optimal weighting matrix, the over identifying restriction of the model and the relaxation of the independently and identically distributed (iid) assumption. For just-identified model, the homoscedasticity and serial independence, the efficient GMM estimator is a commonly IV/2SLS estimator. The use of this estimator requires findings external instrumental variables that affect the suspected endogenous variable without directly influence the dependent variable. To this end, we depart from two instruments. The first instrument measures the emissions of greenhouse gases including CO_2 totals excluding short-cycle biomass burning (such as agricultural waste burning and Savannah burning) but including other biomass burning (such as forest fires, post-burn decay, peat fires and decay of drained peatlands), all anthropogenic CH_4 sources, N_2O sources and F-gases including Hydro fluorocarbons (HFCs), Perfluoinated (PFCs) and Sulfur hexafluoride (SF_6). Expressed in kilo tones of CO_2 equivalent, these gases lead to air pollution and are likely to result in non-communicable and chronic diseases such as for example, the cardiovascular, the respiratory and the mental illnesses (Chen and *al.*, 2008; Beatty and Shimshack, 2013; Block and Calderon-Garciduenas, 2009). The treatment costs of these diseases are generally costly and would accordingly increase the level of health expenditure, particularly of out-of-pocket payments. The effect of this instrument on the out-of-pocket payments as share of final consumption of households could be negative or positive. In the case where the greenhouse

gases increase more the volume of out-of-pocket payments than the one of household's final consumption, they will increase the variable of interest. The reversed effect is expected in the contrary case. In general, the urban populations are more concerned by air pollution; it would have been interesting to couple the greenhouse gases emissions with the percentage of persons living in urban zones. However, the urbanization variable would be correlated to poverty indicators.

The urban people are generally less poor than the rural individuals. In this way, the increase in the percentage of urban populations would be associated with less poverty. On this subject, we find negative coefficients of correlation between urbanization and poverty indicators varying from 0.3602 to 0.4945 (Table 3). Even if these correlations are not very high, they are not sufficient to attest the exogeneity of urbanization variable.

In addition to the emissions of greenhouse gases, we have not found another external instrument that could be valid. Indeed, the out-of-pocket payments are one component of a household's income which is used to calculate poverty indicators.

Accordingly, it is hard to find an external instrument which would affect the out-of-pocket payments without directly influencing poverty. On this matter, we propose to use as a second instrument, the lag of out-of-pocket payments. The hypothesis of this strategy is that the lag of out-of-pocket payment variable is likely to affect poverty indicators at the year t by only influencing the out-of-pocket payments variable at the year t. However, the lag of out-of-pocket payments variable could also affect poverty indicators at the year t by affecting their lag. The second assumption would be valid in the case where there is a memory effect in the distribution of poverty indicators. This memory effect means that the lag of a variable influence its level at the year t. Hence, it is important to identify the good lag of poverty indicators for which there is not a memory effect. To this end, we use a fixed effects model to regress poverty indicators on their one year, two-year and three-year lags (Table 4 in Appendix). We find that the two-year

lag of poverty indicators does not significantly affect their level at the year t. Hence, we use the two-year lag of out-of-pocket payments variable as the second instrument. This two-year lag will affect poverty indicators at the year t by only influencing the variable of out-of-pocket payments at the same year t.

In the follow of paper, the relevance and the exogeneity of both used instruments will be tested respectively through the weak identification and the over-identification test of Sargan. The weak identification provides the Cragg-Donald Wald F statistic which must be compared to critical values of Stock and Yogo (Stock and Yogo, 2004). A Cragg-Donald Wald F statistic greater than the critical value of Stock and Yogo induces to reject the weakness of used instruments. Reciprocally, a Cragg-Donald Wald F statistic lower than the critical value of Stock and Yogo, induces to no reject the null hypothesis of the weakness of used instrument. However, an instrument which is not weak is relevance, but a relevant instrument can be weak. Hence the first stage of instrumentation will be presented in the baseline results. Concerning the Sargan test of over identification, it provides a J statistic for which the p-value must be greater than the most acceptable threshold (10%) in the case where the used instrument is over identified. A p-value which is lower than the acceptable threshold means that the null hypothesis of exogeneity of used instruments can be rejected. Regarding the other control variables, we directly include their one-year lag into the model to address their potential endogeneity.

6   Results

6.1   Statistical analysis of poverty and out-of-pocket payments

To analyze the time trend of out-of-pocket payments and poverty indicators by region, we divided the sample into six regions and three-income groups based on the World Bank ranking. The regions are: East Asia and Pacific (EAP), Europe and Central Asia (ECA), Middle

East and North Africa (MENA), Latin America and Caribbean (LCA), South Asia (SA) and Sub-Saharan Africa (SSA). The income groups are low-income, lower middle income and upper middle-income countries.

Firstly, we find that low variations of out-of-pocket payments as share of households, final consumption over time, in all regions and income groups. They have slightly diminished in Sub-Saharan African (Figure 1) and low-income (Figure 2) countries.

Poverty indicators have decreased in all regions. The greatest decrease has been recorded in South Asia countries. In low-income countries, the severity of poverty measured by the squared poverty gap has more increased comparatively to the others. In middle- income countries, poverty headcount assessing the level of poverty has experienced the most decreasing trends compared to the others. The results on poverty indicators remain similar when the other poverty threshold ($ 3.10 a day) is regarded (Figures 4 and 5 in Appendix).

The findings reveal that efforts are been made by low-and middle-income countries to reduce poverty. However, the countries need to reduce the share of the household's final consumption allocated to health financing.

6.2 Findings on econometric regression

Before the the regressions, we firstly remove the observations for which the values of poverty indicators are zero (Mexico in 2004 and Ukraine in 2008) because they could bias the findings. The baseline results are reported in (Table 8 in Appendix). The statistical diagnostics show that the used instruments are relevant and are not weak based on the comparison between the Cragg-Donald F Wald statistics and the critical values of Stock and Yogo. Both the instruments increase the out-of-pocket payments as share of final consumption of households (Table 5 in Appendix). The positive effect of the total greenhouse gases emissions shows that they increase more the out-of-pocket payments compared to the final consumption of

households. Furthermore, the Sargan test reveals that the instrumental variables are over identified. Thereby, the used instruments are valid.

In addition, we find that the out-of-pocket payment as share of the household's final consumption leads to increase the level, the intensity, and the severity of poverty. On the base of the poverty threshold of $ 1.90 a day, it appears that a 1% increase in share of out-of-pocket payments in the final consumption of household results in an increase in poverty headcount, poverty gap and squared the poverty gap respectively by 0.808%, 0.846 and 1.692%.

The effect of out-of-pocket payments on poverty headcount and poverty gap increases whereas that the one on squared poverty gap decreases when the second poverty threshold, $ 3.10 a day, is considered. For 1% increase in out-of-pocket payments as a percentage of households' final consumption, poverty headcount, poverty gap and squared the poverty gap respectively increase by 0.453%, 0.597% and 1.193%. In view of this finding, it seems that the out-of-pocket payments more affect the severity of poverty. They further affect the poorest and accordingly exacerbate poverty of the last ones. Regarding the control variables, we find that the international remittances, the civil liberties, and central government health expenditures contribute to decreasing poverty indicators. The density of population majorly enters with negative and significant coefficients. The unemployment leads to increase poverty indicators. The educational variable is majorly associated with non-significant coefficients. However, in the case where these coefficients are significant, they remain negative. This indicates that an increase in the level of education leads to a decrease in corruption levels. The total public net flows only reduce poverty indicators when the threshold of $ 3.10 a day is considered. The non-significant effect coefficients associated with educational variable and to total public net flows could come from the presence of atypical countries. In this way, we use box-plot analysis to identify these countries (Figure 6 in Appendix). We do not find anomalies in the distribution of educational variable, but we identify potential outliers in the one of total public net flows.

Hence, we re-estimate the regressions in which the total public net flows are associated with non-significant coefficients and we find that the results remain unchanged (Table 6 in Appendix). To avoid the regression being pulled by outliers. All observations below the first quartile and above the third quartile were considered as outliers. There is no method developed in panel data with instrumental variables that allows automatic identification of outliers. Therefore, we have opted for a visual method that consists in eliminating all countries that are below the first quartile and above the third quartile. Of course, the method is not perfect, but it is the only alternative we have at this stage.

The estimated effects of out-of-pocket payments on poverty could be biased in presence of atypical countries in the distribution of out-of-pocket payments and of poverty indicators. Hence, we identify these countries through box-plot analysis (Figure 7 in Appendix) and remove them from the regressions. Then, we re-estimate the model and check whether the results will change. The baseline of new estimations is reported in Table 3.

We observe that the used instruments remain valid based on the Sargan test and on the comparison between the Craag-Donald Wald F statistics and the critical values of Stock and Yogo. These instrumental variables contribute to increasing the effect of out-of-pocket payments (Table 7 in Appendix). We also find that the effect associated to out-of-pocket payments remains positive and significant. Compared to the other poverty indicators, the positive effect of out-of-pocket payments on the squared poverty gap remains high.

Furthermore, the magnitude of coefficients associated to the out-of-pocket payments variable does not drastically change. In addition, the coefficient associated to the control variables also remains stable. In view of evidence the removing of atypical countries does not considerably affect the findings.

Compared with Van Doorslaer and *al.* (2006) who studied the effect out- of- pocket expenditures on poverty in eleven Asian countries and used $1.08 and $2.15 per capita per day

PPP as poverty thresholds. We find that the poverty threshold we use ($1.90 and $ 3.10), leads to a lower effect of out of pocket expenditures on poverty than the effect found by (Van Doorslaer and *al.*, 2006). For instance, using $1.08 per capita per day PPP, Authors find that for 1% increase in out of pocket expenditures, poverty headcount increase by 2.7%. For using $2.15 threshold, if out of pocket expenditures increase by 1%, poverty headcount increase by 1.99%. While in our study we find that for 1% increase of out of pocket expenditures results in an increase in poverty headcount by 0.80%($1.90 per capita PPP) and $0.45 ($3.10 per capita PPP). Unlike Van Doorslaer and *al.*, 2006, we have chosen a poverty threshold that integrates health care needs. Which implies that our results correspond more to reality. Aregbeshola and khan, 2018 who studied the effect of out of pocket payments among households in Nigeria found that when out of pocket payments increase by 1%, poverty headcount increase by 0.8% using the $1.25 a day poverty line and express out-of-pocket payments as a share of households' consumption expenditures. Despite a slight difference, our results are more in line with those obtained by Aregbeshola and khan, 2018 compared to (Van Doorslaer and *al.*, 2006).

7   Conclusion

On the time where low-and middle-income countries have committed to ensure a sustainable financing of health systems since the 58th session of the world health assembly in 2005, it is important to identify the fairest sources of health financing. Among these sources of health financing, it appears based on the literature that the out-of-pocket payments remains a factor impeding the living standards of populations and exacerbating their level of poverty. However, for instance, a major part of evidence found in the literature is based on microeconomic data. To the best of our knowledge, there are no studies which have specifically explored the effect out-of-pocket payments on poverty at cross-country level. To this end, we propose to fill this gap by econometrically testing this effect.

Based on data availability, this paper focuses on 66 low-and-middle income countries over the period 1996-2012. It tests the effect of out-of-pocket payments on three poverty indicators such as poverty headcount, poverty gap and the squared poverty gap respectively approximating the level, the intensity, and the severity of poverty. Two poverty thresholds such as $1.90 and $ 3.10 a day are considered. The out-of-pocket payments are expressed as share of final consumption of households to account for the burden of out-of-pocket payment on the financial resources of households. The model has been controlled for other aspects likely to affect poverty. There are based on demographic, socioeconomic, institutional, public and health financing factors. Furthermore, in our investigations, the endogeneity issues related to the variable of out-of-pocket payments are dealt by using the method of instrumental variables. The findings reveal that the out-of-pocket payments lead to increase the level, the intensity, and the severity of poverty. We also find that out-of-pocket payments more affect poverty severity. It accordingly appears that the burdens of out-of-pocket payments are higher for the poorest. The raised evidence remains robust with the removing of atypical countries.

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Appendix

List of countries: Albania, Armenia, Bangladesh, Benin, Bhutan, Bolivia, Botswana, Brazil, Burkina Faso, Burundi, Cambodia, Colombia, Congo Republic, Costa Rica, Cote d'Ivoire, Dominican Republic, Ecuador, El Salvador, Fiji, Georgia, Guatemala, Guinea-Bissau, Haiti, Honduras, India, Indonesia, Iran Islamic Republic, Jamaica, Jordan, Kazakhstan, Kenya, Kyrgyz Republic, Lao PDR, Liberia, Madagascar, Malawi, Malaysia, Mali, Mexico, Moldova, Mongolia, Morocco, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Panama, Paraguay, Peru, Philippines, Rwanda, Senegal, Sierra Leone, Solomon Islands, South Africa, Sri Lanka, Sudan, Swaziland, Tanzania, Thailand, Tunisia, Turkey, Uganda, Ukraine, Vietnam

Table 3: Testing for the effect of out-of-pocket payments as a percentage of final consumption of households on poverty, excluding atypical countries

Dependant variables	Poverty headcount		Log poverty Gap		Log. Squared Poverty Gap	
Specifications	(1)		(2)		(3)	
Poverty threshold	$ 1.90/day	$ 3.10/day	$ 1.90/day	$ 3.10/day	$ 1.90/day	$ 3.10/day
Log.OOP	0.765***	0.455**	0.886***	0.604***	1.771***	1.207***
	(2.966)	(2.495)	(2.967)	2.694)	(2.967)	(2.694)
Density−1	0.013**	-0.003	-0.010**	-0.008**	-0.020**	-0.017**
	(-2.352)	(-1.203)	(-2.380)	(-1.997)	(-2.380)	(-1.997)
Educationt−1	-0.25	-0.078	-0.376**	-0.117	-0.752**	-0.234
	(-1.471)	(-0.675)	(-1.978)	(-0.830)	(-1.978)	(-0.830)
Remittancest−1	-0.067***	-0.033***	-0.084***	-0.051***	-0.168***	-0.103***
	(-6.071)	(-4.473)	(-6.814)	(-5.629)	(-6.814)	(-5.629)
Unemploymentt−1	0.071***	0.042***	0.077***	0.051***	0.154***	0.101***
	(3.699)	(3.259)	(3.592)	(3.199)	(3.592)	(3.199)
Civil_Libertiest−1	0.290***	0.190***	0.330***	0.250***	0.661***	0.499***
	(3.306)	(3.248)	(3.364)	(3.433)	(3.364)	(3.433)
Total net public flows per capitat−1	-0.001	-0.001*	-0.001	-0.001*	-0.001	-0.002*
	(-1.564)	(-1.870)	(-0.962)	(-1.797)	(-0.962)	
MINIHEXPt−1	-0.004***	-0.003***	-0.005***	-0.004***	-0.011***	-0.008***
	(-3.490)	(-4.427)	(-4.346)	(-4.480)	(-4.346)	(-4.480)
Constant	5.280**	3.303***	3.563*	3.358**	7.126*	6.717**
	(2.436)	(2.722)	(1.781)	(1.975)	(1.781)	(1.975)
Observations	331	357	337	341	337	341
F-statistics	23.408***	23.908***	25.888***	26.261***	25.888***	26.261***
Cragg-Donald Wald F statistics	109.109	92.179	90.464	92.179	90.464	92.179
Critical values of Stock and Yogo (10%)	19.93	19.93	19.93	19.93	19.93	19.93
Sargan tests: p-values	0.12	0.142	0.143	0.126	0.143	0.126
R2	0.837	0.855	0.855	0.855	0.855	0.855

Notes: t statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 4a: Matrix of partial correlations

	Log. Headcount ($1.90)	Log. Gap ($1.90)	Log (Gap2) ($1.90)	Log. Headcount ($3.10)	Log. Gap ($3.10)	Log (Gap2) ($3.10)	Density	Urbanization
Log. Headcount ($1.90)	1							
Log. Gap ($1.90)	0.9791***	1						
Log (Gap2)($1.90)	0.9791***	1	1					
Log. Headcount ($3.10)	0.9552***	0.8876***	0.8876***	1				
Log. Gap ($3.10)	0.9919***	0.9590***	0.9590***	0.9796***	1			
Log (Gap2)($3.10)	0.9919***	0.9590***	0.9590***	0.9796***	1	1		
Density	0.1094**	0.0646	0.0646	0.1511***	0.1167**	0.1167**	1	
Urbanization	-0.3602***	-0.2684***		-0.4945***	-0.4154***	-0.4154***	-0.2871***	1
Education	-0.1851***	-0.2406***	-0.2406***	-0.0585	-0.1412***	-0.1412***	0.0927*	-0.1901***
Remittances	-0.0269	-0.0536	-0.0536	0.0582	-0.0007	-0.0007	0.2287***	-0.0872
Unemployment	-0.0479	-0.07	-0.07	-0.0088	-0.0427	-0.0427	-0.0433	0.2944***
Civil liberties	0.0976*	-0.0105	-0.0105	0.2612***	0.1542***	0.1542***	0.0489	-0.4883***
Total net public- flows per capita	-0.0254	-0.0425	-0.0425	0.0251	-0.0056	-0.0056	-0.0016	-0.1617***
MINIHEXP	-0.2715***	-0.2298***	-0.2298***	-0.3538***	-0.3021***	-0.3021***	-0.1489***	0.4103***
Log. Greenhouse gases	-0.1925***	-0.2044***	-0.2044***	-0.1827***	-0.1945***	-0.1945***	-0.0032	0.1440***
Log. OOP	0.1614***	0.2016***	0.2016***	0.1345***	0.1468***	0.1468***	-0.1260**	0.0499

	Education	Remittances	Unemployment	Civil Liberties	Total net public flows per capita	MINIHEXP	Log.Greenhouse gases	Log. OOP
Education	1							
Remittances	0.0569	1						
Unemployment	0.0835	0.1983***	1					
Civil liberties	0.3375***	0.1018*	-0.0815	1				
Total net public-flows per capita	0.0537	0.2280***	0.055	0.1521***	1			
MINIHEXP	-0.0001	-0.0947*	0.1330**	-0.3104***	-0.0731	1		
Log. Greenhouse gases	0.1618***	-0.4647***	-0.2857***	0.0472	-0.1803***	-0.0887	1	
Log. OOP	0.106	0.1240**	-0.0184	0.0816	-0.0858	-0.1309**	0.0275	1

Notes: t statistics in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 4b: Testing for the memory effect in the distribution of poverty indicators, by using a robust fixed effects model

	Poverty threshold: $ 1.90 a day				
Dependent variable	Log. Headcount	dependent variable	Log. GAP	Dependent variable	Log. GAP_squared
Log. Headacount t-1	0.619***	Log. GAPt−1	0.623***	Log. GAP_squaredt−1	0.623***
	(5.495)		(6.445)		(6.445)
Log. Headcountt−2	0.095	Log. GAPt−2	0.071	Log. GAP_squaredt-2	0.071
	(1.133)		(1.246)		(1.246)
Log. Headcountt−3	0.172**	Log. GAPt−3	0.202***	Log. GAP_squaredt-3	0.202***
	(2.21)		(2.913)		(2.913)
Constant	-0.072	Constant	-0.237***	Constant	-0.473***
	(-0.897)		(-8.929)		(-8.929)
Observations	234	Observations	231	Observations	231
R2	0.683	R2	0.671	R2	0.671
F-statistics	123.403***	F-statistics	76.755***	F-statistics	76.755***

	Poverty threshold: $ 3.10 a day				
Dependent variable	Log. Headcount	dependent variable	Log. GAP	Dependent variable	Log. GAP_squared
Log. Headcount t-1	0.844***	Log. GAPt−1	0.847***	Log. GAP_squaredt-1	0.847*** (5.366)
	(9.764)		(5.366)		
Log. Headcountt−2	-0.03	Log. GAPt−2	-0.042	Log. GAP_squaredt-2	-0.042
	(-0.254)		(-0.232)		(-0.232)
Log. Headcountt−3	0.151	Log. GAPt−3	0.110*	Log. GAP_squaredt-3	0.110*
	(1.304)		(1.706)		(1.706)
Constant	-0.074	Constant	-0.061	Constant	-0.123
	(-0.536)		(-0.627)		(-0.627)
Observations	247	Observations	245	Observations	245
R2	0.808	R2	0.733	R2	0.733
F-statistics	348.580***	F-statistics	93.791***	F-statistics	93.791***

Notes: t statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Figure 1: Time trend of out-of-pocket payments as share of final consumption, poverty headcount, poverty gap and squared poverty gap at $1.90 by world bank income.
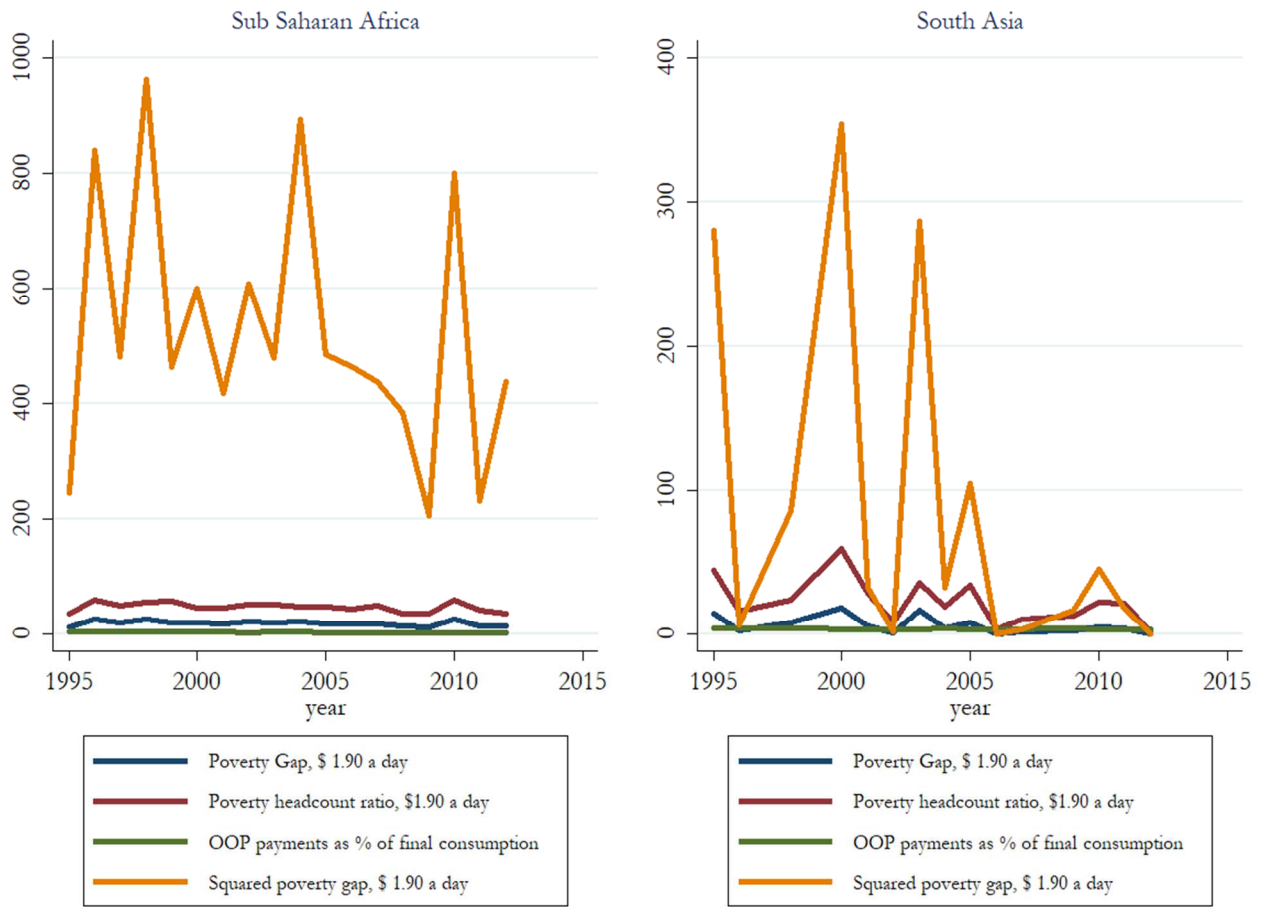
Source: Author using the WDI, and the GHE databases.

Figure 2: Time trend of out-of-pocket payments as a share of the household's, final consumption expenditures and of poverty indicators ($ 1.90 a day) by income groups over 1996-2012
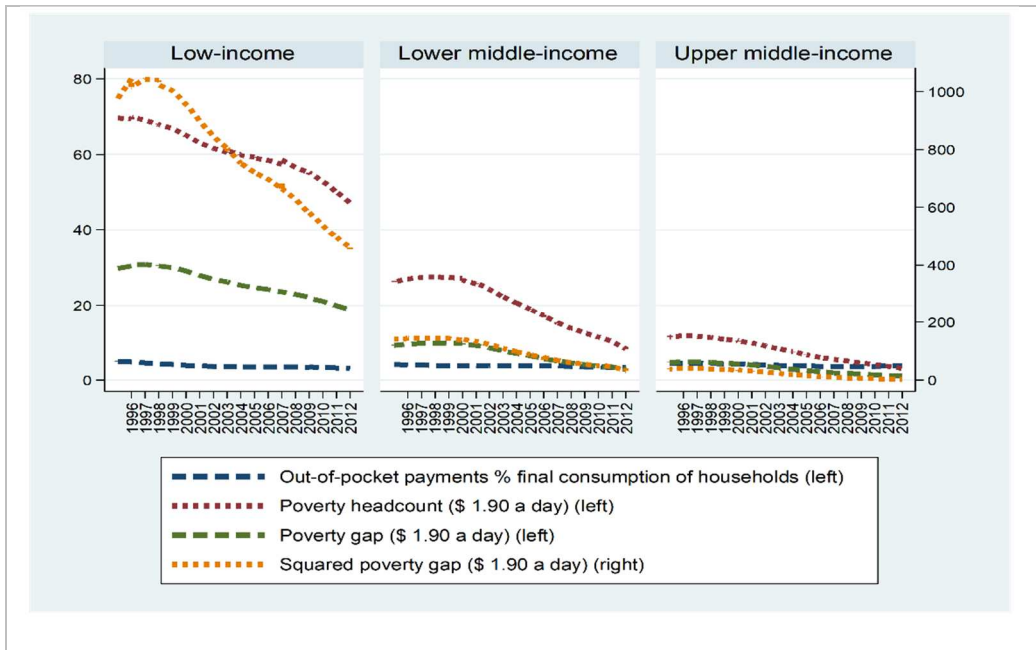
Source: Author using the WDI, and the GHE databases.

Figure 3: Scatter plots between greenhouse gases emissions and out-of-pocket payments as share of final consumption of households
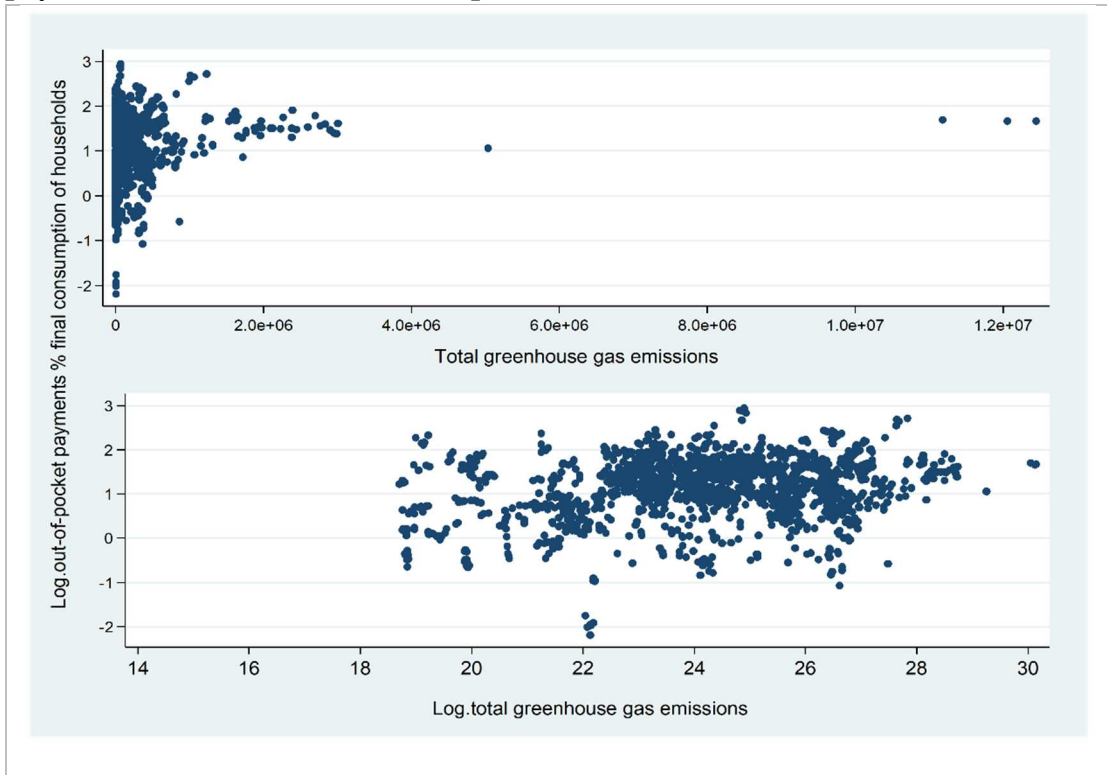
Source: Author using the WDI, and the GHE databases.

Figure 4: Time trend of poverty indicators ($ 3.10 a day) by region over 1996-2012
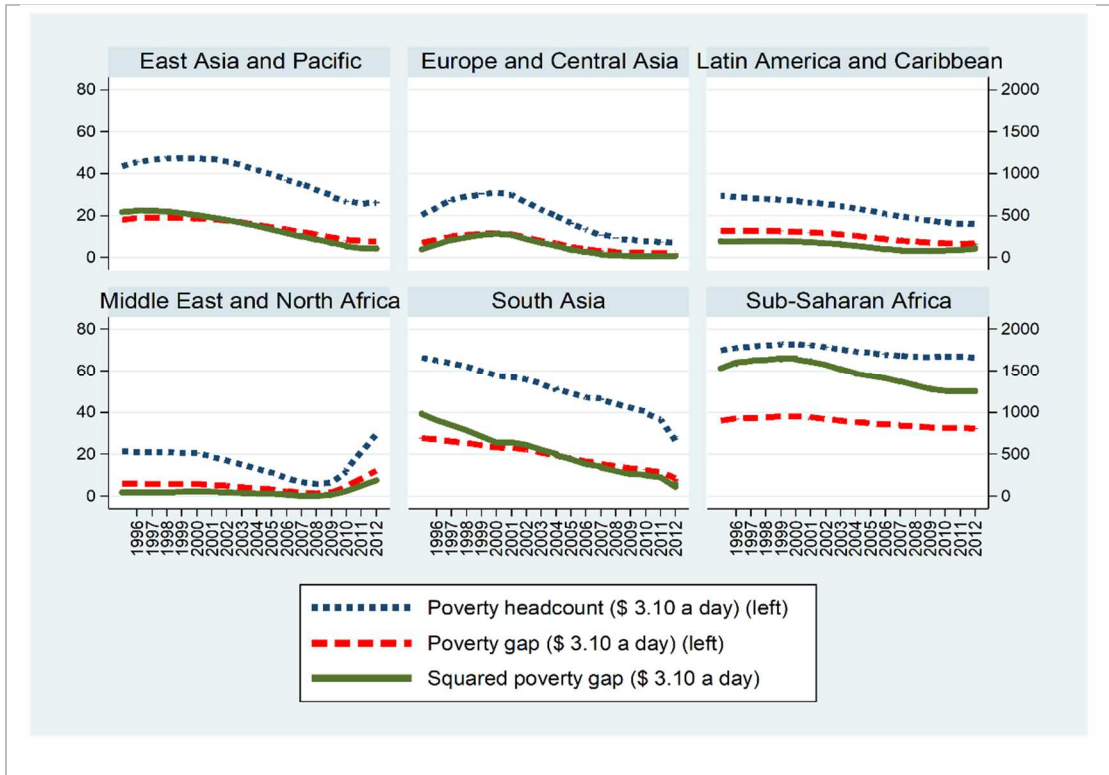
Source: Author using the WDI.

Figure 5: Time trend of poverty indicators ($ 3.10 a day) by income groups over 1996-2012
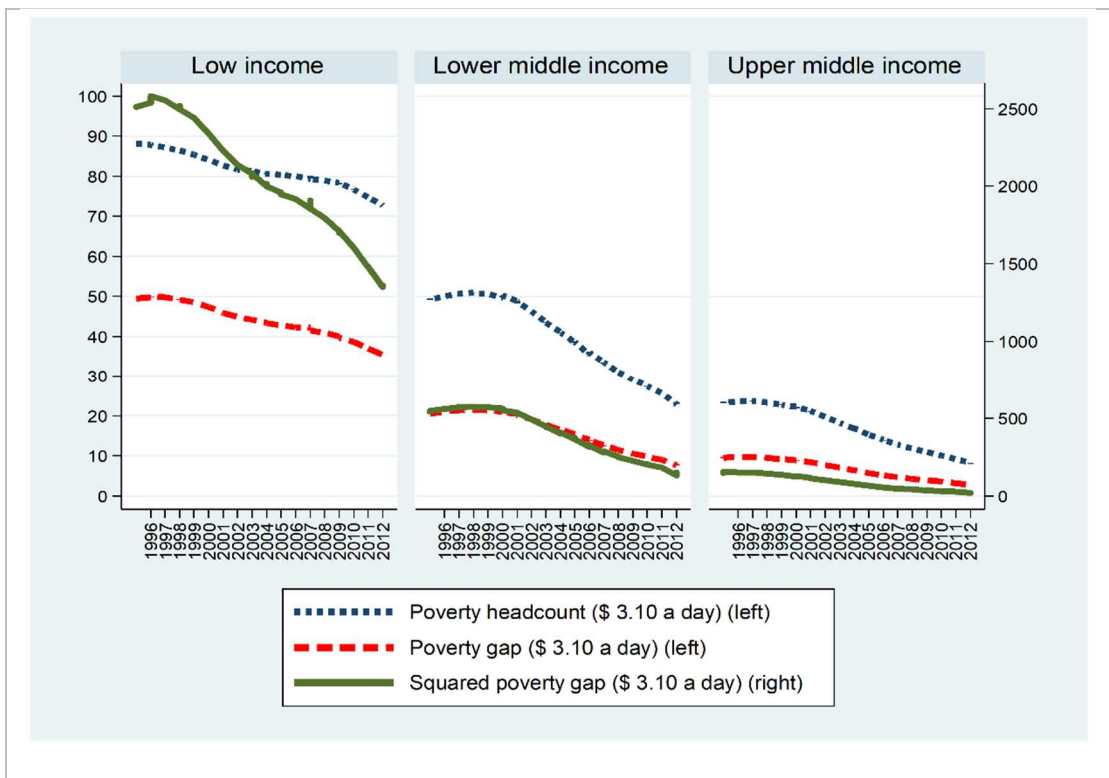
Source: Authors using the WDI.

Figure 6: Box-plot analysis of educational variable and of total public net flows per capita
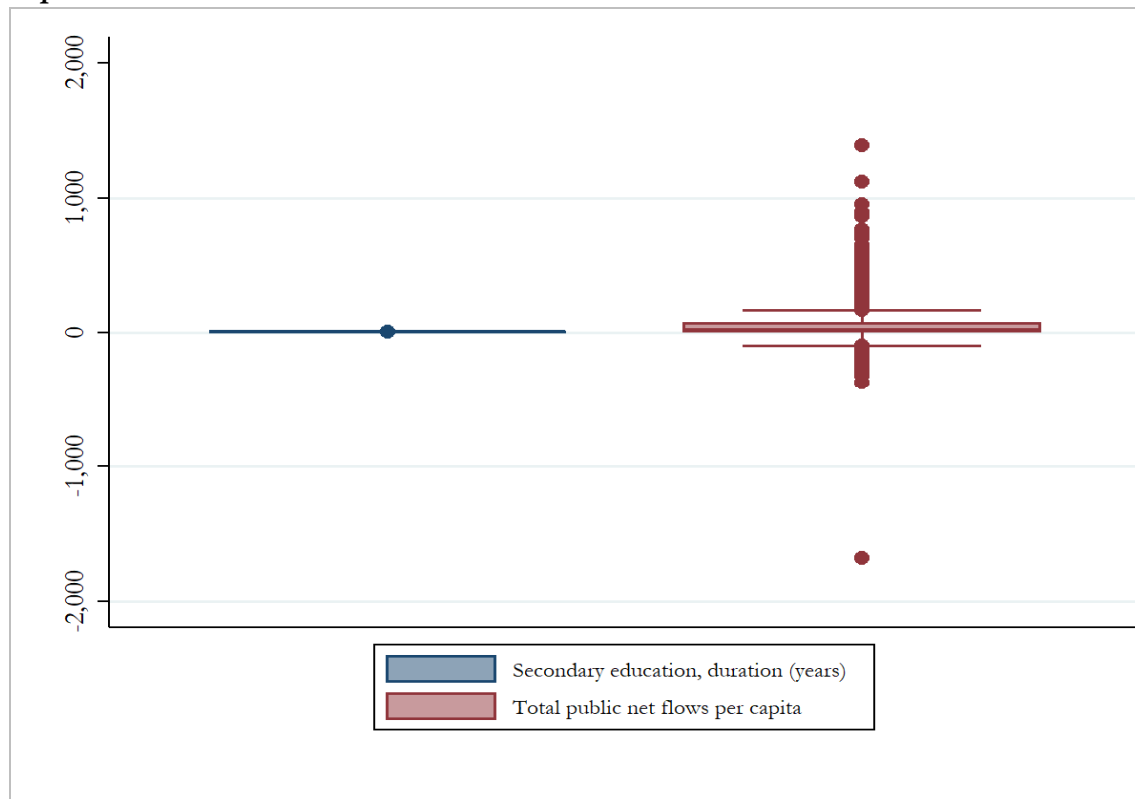
Source: Authors using the WDI.

Table 5: First stage of instrumentation regressions, including the atypical countries

Dependant variables	Out-of-pocket payments as share of final consumption of households					
Specifications	$1.90 a day			$3.90 a day		
Poverty threshold	1	2	3	1	2	3
Log.OOP t-2	0.603***	0.608***	0.608***	0.605***	0.605***	0.605***
	(12.904)	(13.024)	(13.024)	(13.012)	(13.012)	(13.012)
Log. Greenhouse gases	-0.084**	-0.083**	-0.083**	-0.081**	-0.081**	-0.081**
	(-2.043)	(-2.025)	(-2.025)	(-1.993)	(-1.993)	(-1.993)
Density−1	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
	(0.313)	(0.339)	(0.339)	(0.318)	(0.318)	(0.318)
Educationt−1	0.014	0.015	0.015	0.014	0.014	0.014
	(0.313)	(0.316)	(0.316)	(0.304)	(0.304)	(0.304)
Remittancest−1	-0.005*	-0.005*	-0.005*	-0.005*	-0.005*	-0.005*
	(-1.707)	(-1.733)	(-1.733)	(-1.779)	(-1.779)	(-1.779)
Unemploymentt−1	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
	0.823)	(-0.797)	(-0.797)	(-0.826)	(-0.826)	(-0.826)
Civil_Libertiest−1	-0.01	-0.007	-0.007	-0.009	-0.009	-0.009
	(-0.423)	(-0.283)	(-0.283)	(-0.385)	(-0.385)	(-0.385)
Total net public flows per capitat−1	-0.00001	-0.00001	-0.00001	-0.00001	-0.00001	-0.00001
	(-0.025)	(-0.099)	(-0.099)	(-0.094)	(-0.094)	(-0.094)
MINIHEXPt−1	-0.0004	-0.0004	-0.0004	-0.0004	-0.0004	-0.0004
	(-1.361)	(-1.332)	(-1.332)	(-1.332)	(-1.332)	(-1.332)
Constant	2.741**	2.681**	2.681**	2.667**	2.667**	2.667**
	(2.359)	(2.359)	(2.354)	(2.354)	(2.354)	(2.405)
Observations	357	356	356	361	361	361

Notes: t statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Testing for the effect of out-of-pocket payments as a percentage of final consumption of households on poverty, excluding atypical countries for total public net flows per capita

Dependant variables	Log. Poverty headcount	Log poverty Gap	Log. Squared Poverty Gap
Specifications	(1)	(2)	(3)
Poverty threshold	$ 1.90/day	$ 1.90/day	$ 1.90/day
Log.OOP	0.831***	0.845***	1.690***
	(2.969)	(2.682)	(2.682)
Density−1	-0.006	-0.009**	-0.018**
	(-1.614)	(-2.128)	(-2.128)
Educationt−1	-0.231	0.380*	-0.759
	(-1.310)	(-1.899)	(-1.899)
Remittancest−1	-0.074***	-0.090***	-0.180***
	(-6.445)	(-6.946)	(-6.946)
Unemploymentt−1	0.074***	0.079***	0.158***
	(3.545)	(3.35)	(3.35)
Civil_Libertiest−1	0.289***	0.315***	0.630***
	(3.218)	(3.089)	(3.089)
Total net public flows per capitat−1	-0.001	-0.001	-0.001
	(-1.359)	(-0.907)	(-0.907)
MINIHEXPt−1	-0.004***	-0.005***	-0.010
	(-3.092)	(-3.670)	(-3.670)
Constant	3.166*	3.472*	6.944*
	(1.744)	(1.691)	(1.691)
Observations	317	316	316
F-statistics	19.573***	21.225***	21.225***
Cragg-Donald Wald F statistics	80.134	81.77	81.77
Critical values of Stock and Yogo (10%)	19.93	19.93	19.93
Sargan tests: p-values	0.342	0.359	0.359
R2	0.853	0.864	0.864

Notes: t statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Figure 7: Box-plot analysis of poverty indicators
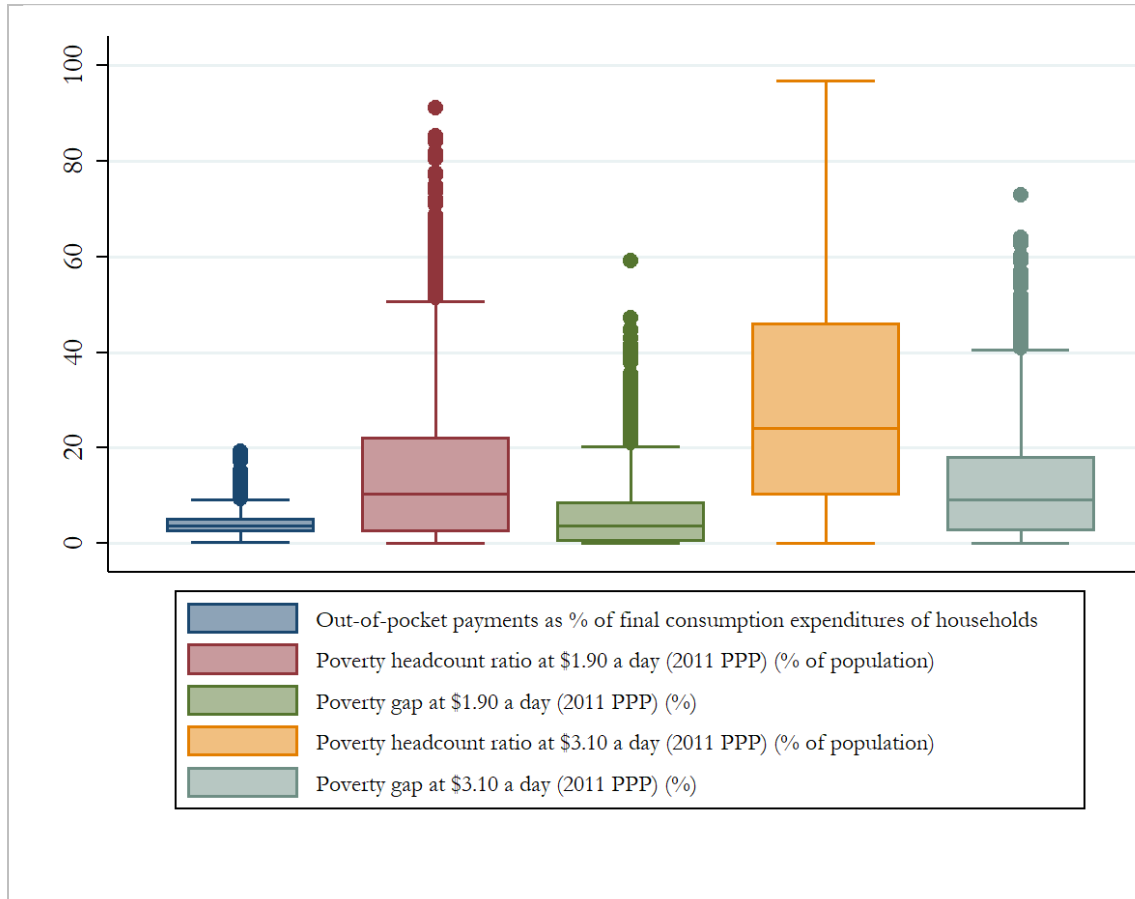
Source: Author using the WDI.

Table 7: First stage of instrumentation regressions, excluding the atypical countries

Dependant variables	Out-of-pocket payments as share of final consumption of households					
Poverty threshold	$1.90 a day			$3.10 a day		
Specifications	(1)	(2)	(3)	(1)	(2)	(3)
Log.OOP t-2	0.638***	0.638***	0.638***	0.605***	0.601***	0.601***
	(14.093)	(12.855)	(12.855)	(12.986)	(12.718)	(13.012)
Log. Greenhouse gases	-0.105**	-0.090**	-0.090**	-0.081**	-0.088**	-0.088**
	(-2.588)	(-2.098)	(-2.098)	(-1.991)	(-2.059)	(-2.059)
Density−1	-0.001	0.0002	0.0002	0.0003	-0.001	-0.001
	(-0.447)	(0.197)	(0.197)	(0.306)	(-0.628)	(-0.628)
Education−1	0.026	0.021	0.021	0.019	0.02	0.02
	(0.583)	(0.437)	(0.437)	(0.411)	(0.412)	(0.412)
Remittances−1	-0.005*	-0.005*	-0.005*	-0.005*	-0.005*	-0.005*
	(-1.806)	(-1.680)	(-1.680)	(-1.761)	(-1.675)	(-1.675)
Unemployment−1	-0.004	-0.004	-0.004	-0.004	-0.005	-0.005
	(-0.828)	(-0.826)	(-0.826)	(-0.808)	(-0.875)	(-0.875)
Civil_Liberties−1	-0.006	-0.005	-0.005	-0.01	-0.009	-0.009
	(-0.260)	(-0.215)	(-0.215)	(-0.413)	(-0.384)	(-0.384)
Total net public flows per capita−1	-0.00001	-0.00001	-0.00001	-0.00001	-0.00001	-0.00001
	(0.369)	(-0.058)	(-0.058)	(-0.053)	(-0.072)	(-0.072)
MINIHEXP−1	-0.0003	-0.0004	-0.0004	-0.0004	-0.0003	-0.0003
	(-0.968)	(-1.293)	(-1.293)	(-1.344)	(-1.125)	(-1.125)
Constant	3.391***	2.848**	2.848**	2.637**	3.126**	3.126**
	-2.941	-2.405	-2.405	-2.321	-2.593	-2.593
Observations	331	337	337	357	341	341

Notes: t statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Testing for the effect of out-of-pocket payments as a percentage of final consumption of households on poverty

| Dependant variables	Poverty headcount		Log poverty Gap		Log. Squared Poverty Gap	
Specifications	(1)		(2)		(3)	
Poverty threshold	$ 1.90/day	$ 3.10/day	$ 1.90/day	$ 3.10/day	$ 1.90/day	$ 3.10/day
Log.OOP	0.808***	0.453**	0.846***	0.597***	1.692***	1.193***
	(3.103)	(2.497)	(2.897)	(2.754)	(2.897)	(2.754)
Density−1	-0.007**	-0.003	-0.010**	-0.006*	-0.020**	-0.011*
	(-1.983)	(-1.226)	(-2.478)	(-1.819)	(-2.478)	(-1.819)
Educationt−1	-0.207	-0.058	-0.331*	-0.088	-0.661*	-0.177
	(-1.287)	(-0.514)	(-1.823)	(-0.659)	(-1.823)	(-0.659)
Remittancest−1	-0.067***	-0.033***	-0.083***	-0.051***	-0.166***	-0.102***
	(-6.241)	(-4.474)	(-6.894)	(-5.749)	(-6.894)	(-5.749)
Unemploymentt−1	0.074***	0.043***	0.079***	0.052***	0.158***	0.105***
	(3.968)	(3.301)	(3.779)	(3.392)	(3.779)	(3.392)
Civil_Libertiest−1	0.284***	0.188***	0.311***	0.240***	0.622***	0.480***
	(3.408)	(3.225)	(3.302)	(3.456)	(3.302)	(3.456)
Total net public flows per capitat−1	-0.001	-0.001*	-0.001	-0.001*	-0.001	-0.002
	(-1.414)	(-1.822)	(-0.872)	(-1.722)	(-0.872)	(-1.722)
MINIHEXPt−1	-0.004***	-0.003***	-0.005***	-0.004***	-0.011***	-0.008***
	(-3.908)	(-4.475)	(-4.522)	(-4.827)	(-4.522)	(-4.827)
Constant	3.334*	3.188***	3.412*	2.476*	6.824*	4.951*
	(1.937)	(2.655)	(1.761)	(1.727)	(1.761)	(1.727)
Observations	357	361	356	361	356	361
F-statistics	23.259***	23.259***	25.478***	26.115***	25.479***	26.115***
Cragg-Donald Wald F statistics	109.109	92.179	92.516	92.179	92.516	92.179
Critical values of Stock and Yogo (10%)	19.93	19.93	19.93	19.93	19.93	19.93
Sargan tests: p-values	0.159	0.139	0.195	0.173	0.195	0.173
R2	0.858	0.856	0.869	0.87	0.869	0.87

Notes: t statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 9 : Panel Unit Root Test of the Variables in Level

Variables	Levin-Lin-Chu
Out of pocket payments as a share of the household's, final consumption expenditures	-3.0620 (0.0011)
Poverty headcount ratio at national poverty lines (% of population)	-2.0182 (0.0018)
Poverty gap at $ 1.90 a day (2011 PPP) (%)	-3.6318 (0.0001)
Poverty headcount ratio at $ 1.90 a day national poverty lines (% of population)	-3.0206 (0.0013)
Personal remittances, received (% of GDP)	-19.0608 (0.0000)
Population density (people per sq.km of land area)	-15.9709 (0.0000)
Unemployment, total (% of total labor force) (modeled ILO estimate)	No response
Secondary education, duration (years)	No response

The p-values are in parenthesis

Essay 2

Government revenue and progress towards universal health coverage in low and middle income countries

Abstract

Universal health coverage has been classified as one of the health-related sustainable development Goals. Mobilizing more financial resources is one of the main challenges of progress towards universal health coverage in low- and middle-income countries. For that reason, government need to expand revenue mobilization. There are a few analyses on the relationship between government revenue and progress towards universal health coverage. In our study, we investigate the causal effect of Government revenue and progress towards universal health coverage. We argue that the higher government revenue mobilization, priority given to the health sector, quality of regulation and the control of corruption are important factors for progress towards universal health coverage. Using a panel data with Probit, logit, Complementary log-log regression, and Probit model with instrumental variables for 138 low and middle-income countries, we find that government revenue significantly increases the probability of progress towards universal health coverage between 1995 to 2012. Going further, we estimate the marginal effect of government revenue and the probability to progress towards UHC, and we find that a 100 increase of country government revenue is leading to increase 66.5% the probability to progress towards UHC.

Keywords: Government revenue, universal health coverage, institutions, public health expenditures.

JEL codes: H51, I18, I13, H52

1   Introduction

One of the main challenges of low- and middle-income countries progressing in universal health coverage is the capacity of government to raise revenues. Low revenue mobilization has two main implications. Firstly, countries rely on external funding to finance their health systems, and the major issue of relying on external assistance is the instability and the unpredictability of these funds. Secondly, low revenue mobilization tends to increase out of pocket expenditures and dependence of health care facilities on user fees and unofficial payments (World Bank, 2014). Public health spending of 5% of GDP is needed to move towards universal health coverage, while $86 per capita to provide primary health care in low and middle-income countries (Macintyre and *al.*, 2017).

Health financing policies for progress towards UHC seek to address the challenges of raising revenues and reducing out-of-pocket expenditures. The reliance of out-of-pocket expenditures for health financing is still very important in developing countries. In sub-Saharan Africa where most of the poor live, it accounts for about 36% of total health expenditure, compared to 22% for the rest of the world (McIntyre, 2018). Social health insurance scheme (financed by wage-based contributions) and national health insurance scheme (financed by tax revenue) are in practice the two major approaches to health system financing in developed countries. However, due to large informal sectors and a high unemployment rate in developing countries (Schneider, 2002), national health insurance scheme is the best way to ensure effective coverage and equity for progress towards universal health coverage. For example, in Thailand, UHC scheme financed by government revenue since 2002 has led to the most effective coverage and the reduction of out-of-pocket expenditures (Huang and Yoshio, 2016).

Government revenue in 2015 ranged from an average 30% of GDP in high-income countries, to 25.65% in middle-income countries and 18.38% in low-income countries. UHC index[5] is greater than 72 in high-income countries, 60 and 25 respectively in middle-income and low-income countries. In our sample, we find that the lowest level of government revenue as a share of GDP and universal health coverage index are located in Sub-Saharan Africa and South Asia.

Overall, there are a compelling evidence of the positive effect of government revenue, especially tax revenue, on economic performance, welfare, state capacity and development (Besley and Persson, 2010; Dincecco and Katz, 2016; Dincecco and Prado, 2010). There is also a strong correlation between tax revenue and public health spending. Stuckler and *al.* (2010) found that an additional increase of $1USD in tax revenues is associated with an increase in public health spending of $0.11 USD. More specifically, Murshed and *al.* (2017) find that fiscal capacity, measured by government revenue, improve significantly social protection expenditures in low and middle-income countries. The authors found that for 1% increase of government expenditures as a share of GDP, social protection expenditure increases by 0.125 percentage points. Reeves and *al.* (2015) also find that tax revenue is positively and significantly associated with progress towards universal health coverage, particularly for countries with low level of tax revenues[6]. For these countries, an additional $100 increase in tax revenue per year improve the proportion of births attended by skilled health professional by 6.74 percentage point and extend protection against financial risks by 11.4 percentage point.

Studies that focus on health financing for universal health coverage are more interested in mobilizing domestic resources through tax revenues. In our study, we are more interested in the entire composition of public resources. We will also show the minimum level of public resources

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[5] UHC index range from 0 to100
[6] Reeves et *al.* (2015) defined low tax revenues countries as countries where tax revenues is less than $1000USD

as a% of GDP that would enable low- and middle-income countries to move towards universal health coverage.

The objective of this paper is to investigate the causal relationship between government revenue on progress towards UHC.

This paper makes three contributions to the literature: firstly, we analyze the main determinants of progress towards universal health coverage in LMIcs. Secondly, we explain progress made by some low and middle-income countries on universal health coverage compared to countries that not made significant progress towards UHC. Finally, we find the minimum rate of government revenue as a share of GDP that would allow the country to make significant progress towards UHC.

The rest of the paper organized as follow. Section 2 presents the stylized facts on the determinants of progress towards UHC. Section 3 describes data, section 4 presents econometric specification and section 5 discusses the results. The section 6 concludes with policy implications for LMIcs progressing towards UHC and perspectives for future research.

Dependant variable: Universal health coverage index

In our study, we use universal health coverage index (UHC index) constructed by Leegwater et al, 2015 as dependant variable. The UHC index include 16 variables covering these dimensions.

- Infrastructure and human resources ;

- Provision of services, and the

- financial resources for health.

The index of universal health coverage thus constructed is between 0 and 100. The higher the index values for a country, the more it is considered that the country is approaching universal health coverage. Further information about the transformation of our dependent variable is available in the methodology section.

2   Stylized facts on the determinants of progress towards UHC

Government Revenue

The government collects public resources for two main purposes: to finance the production of public goods, and to fulfill its redistributive role. Government revenue consists of taxes, social contributions, grants and other revenues. Tax revenues are the main sources of government revenue for health financing in most developing countries (Moore, 2004). In low- and middle-income countries, tax revenues represent around 65% of total government revenue (IMF, 2011). The government revenue in % of GDP is a good indicator of the size of the public sector into the economy. The interest of this variable is twofold. It gives an indication of, first the level of development of a country's tax system and second, the government's ability to mobilize social contributions.

As we show in Figure 1, government revenue varies respectively from 18.38 % of GDP in low-income countries to 30.13% of GDP in high-income countries. Compared to the other region countries (WHO classification), this percentage is the second worst, 21.62%, for sub-Saharan Africa countries (Figure 2).

Figure 1: Government revenue as a share of GDP by income group
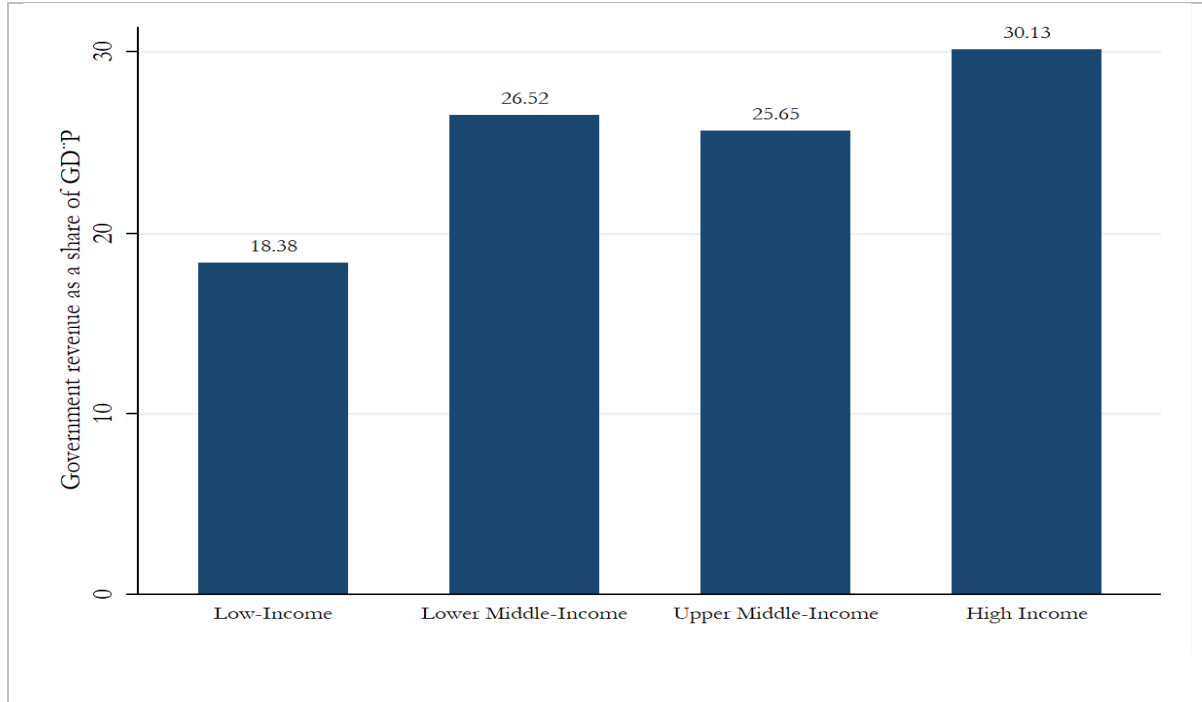
Source: Author using World Bank data, 2015

Figure 2: Government revenue as a share of GDP by region
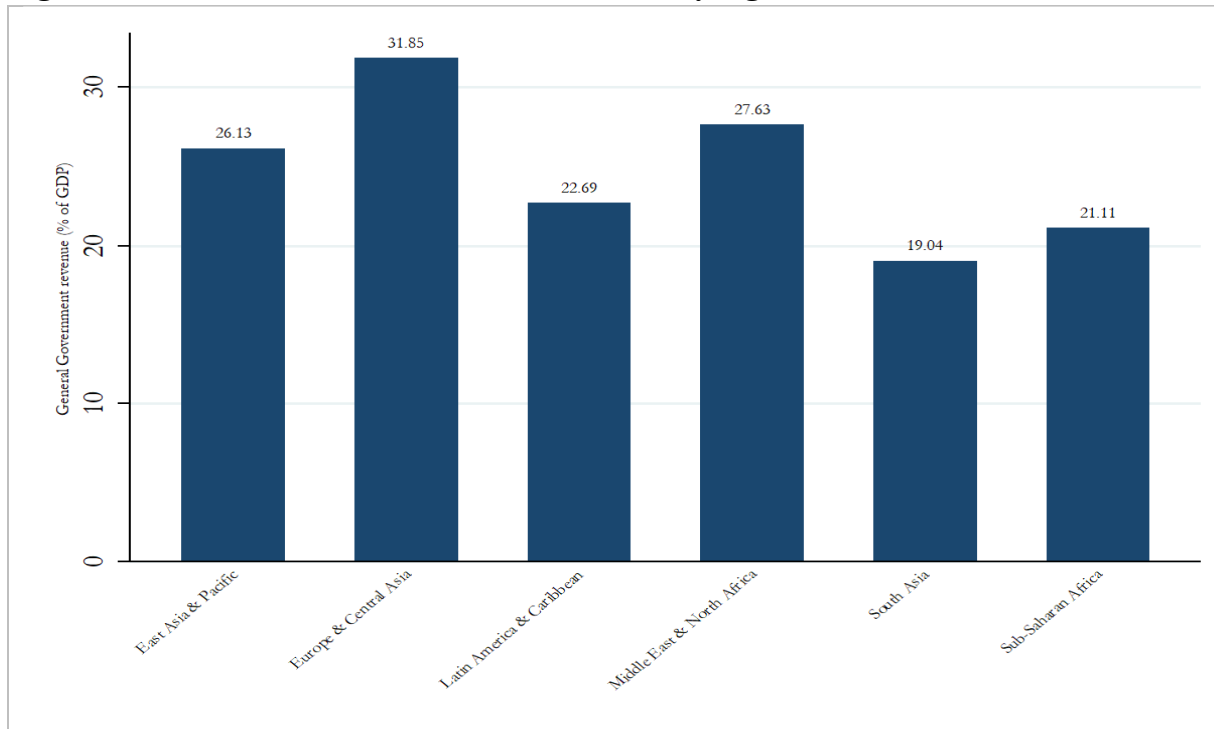
Source: Author using World Bank data, 2015

Table 1 shows the average of government revenue composition in LMIcs by quartile index. It shows the typical profile of composition of government revenue of countries that made a great progress towards UHC. In upper middle-income countries, 34.76% of government revenue is generated from taxes on good and services, 27, 56% from taxes on income, profits and capital gains,17,57% from grants, and other revenue and, 7.55% from social contributions. For all income group countries, social contributions as a share of government revenue are quite weak. It represents respectively 0.56% in low-income countries, 1.57% in lower middle-income countries and 7.55% in upper-middle-income countries and 13.73% in high income countries. Revenue mobilization through social contributions is partly a function of the size of the informal sector (Meheus and Mcintyre, 2017). Through a large database, Charmes (2012) shows that the share of employment in the informal economy in total non-agricultural employment represents 58.4% in Northern Africa, 65.9% in sub-Saharan Africa, 57.7% in Latin America, 69.7% in Southern and South-eastern Asia and 43.2% in West Asia. In these conditions, it's difficult to finance progress towards UHC through social contributions. Table 1 also shows that countries which are made a great progress towards UHC has a government revenue composition as follows: 37.13% of taxes on goods and services; 22.39 % of taxes on income, profits and capital gains; 15.65% of grants and other revenue and 10.47 % of social contributions. This low level of social contributions on government revenue indicates that countries should focus more on taxes to progress towards UHC.

Table 1: Government revenue composition and progress towards UHC in low- and middle-income countries

	Q1	Q2	Q3	Q4	Total
	Quartiles of UHC index				
Low income					
Taxes on income, profits and capital gains (% of revenue)	17.40	13.74	9.88		15.88
Taxes on goods and services (% of revenue)	17.92	28.04	17.05		20.84
Social contributions (% of revenue)	0.39	1.10	0		0.56
Grants and other revenue (% of revenue)	33.69	37.29	69.58		36.86
Lower Middle-Income					
Taxes on income, profits and capital gains (% of revenue)	20	19.51	18.89	22.69	19.90
Taxes on goods and services (% of revenue)	24.26	36.25	36.26	22.24	30.52
Social contributions (% of revenue)	0.36	2.45	1.57	2.29	1.57
Grants and other revenue (% of revenue)	26.80	25.87	25.85	42.85	28.14
Upper Middle-Income					
Taxes on income, profits and capital gains (% of revenue)	24.94	34.19	25.03	22.39	25.56
Taxes on goods and services (% of revenue)	33.71	29.80	34.68	37.13	34.76
Social contributions (% of revenue)	2.88	2.73	8.36	10.47	7.55
Grants and other revenue (% of revenue)	22.48	18.25	17.45	15.65	17.57
High Income					
Taxes on income, profits and capital gains (% of revenue)	31.90	31.68	29.70	29.49	29.77
Taxes on goods and services (% of revenue)	20.16	29.53	30.66	32.77	31.62
Social contributions (% of revenue)	5.66	7.68	8.79	11.90	10.69
Grants and other revenue (% of revenue)	-0.50	-0.552	-0.215	-0.02	-0.12
Total					
Taxes on income, profits and capital gains (% of revenue)	21.54	26.47	23.76	23.71	23.85
Taxes on goods and services (% of revenue)	26.95	33.07	35.87	33.60	33.05
Social contributions (% of revenue)	1.40	2.83	6.40	11.25	6.65
Grants and other revenue (% of revenue)	25.92	22.90	20.17	20.25	21.76

Source : Author's calculation using world economic outlock data, 2015

Priority given to the health sector: In general, the share of public expenditures on health on total government expenditures indicates the priority given to the health sector (Tandon et *al.*, 2014). Priority in the government expenditures for health budget has been an important factor for population coverage and the protection of catastrophic health expenditures. For example, in Thailand, between 2001 and 2011, when the share of health expenditure in total public expenditure increased from 10.4% to 14.5%, and the share of public health expenditure in total health expenditure increased from 70.7% to 74.9%, the covered population went from 63% to 93 % (World Bank, 2014). In Mexico, when public health expenditures as a share of GDP increased from 9.90% in 1995 to 13.28% in 2001, Mexico reach UHC and cover 98% of population by one of the three health insurance schemes.

Economic Growth

Economic growth has an essential role in progress towards UHC. For Beveridge-type systems (mainly tax-financed), the higher the economic growth is, the higher the government revenue to finance the system. Similarly, for Bismarck-type systems (mainly financed by wage contributions), the ability to pay social contributions will be greater in a situation of strong and stable economic growth (Ensor1999). In Belgium, Germany and Austria, during periods when progress towards UHC was greatest, GDP per capita increased more than five times in Belgium and Germany in 1970 and quadrupled in Austria, similarly for Costa Rica where economic growth had reached 7% during the expansion of UHC (Carrin and James 2004). Miranda (1994) attribute the expansion of UHC to this period of strong growth.

Inflation Rate

Even though the inflation rate in low and middle-income countries is among the highest in the world, it has dropped considerably in recent decades, from 24.2% in 1994 to a median of 5% in 2017 (World Bank 2019). A high inflation rate can lead to several implications. Firstly, a high inflation rate may compromise public spending in particular public health expenditure which is necessary to progress towards UHC. Secondly, a high rate of inflation could slow down the economic activity due to policies aimed at reducing the rate of inflation, including a restrictive monetary policy (Mishkin 2008; Camba-Mendez, Garcia, and Rodriguez-Palenzuela 2003; and Briault 1995). The interest of choosing this variable is to control the effect of the inflation rate on progress towards universal health coverage.

Institutional factors

We use four institutional factors. The first three measure the quality of political and institutional environment (political stability and absence of violence, the voice accountability).

The quality of the regulation: This variable measures a government's ability to design and implement efficient and effective public policies. A weak index supposes a weak regulatory quality. The average value of this variable in our sample is - 0.49, with values ranging from -2.54 (Somalia in 1995) to 1.48 (Bermuda in 2000). The quality of regulation seems to have deteriorated in some countries like Libya (-1.81 in 1995 to - 2.24 in 2015) and in Guinea-Bissau (-0.82 in 1995 to -1.2 in 2015). It remained almost constant in Bermuda throughout the period. Nevertheless, some countries made slight progress. This is the case in Liberia (-1.98 in 1995 to - 0.88 in 2015), and in Rwanda where the quality of regulation has improved considerably (-1.47 in 1995 to 0.25 in 2015).

Political stability and the absence of violence: this variable measures the probability of political instability and threats against the government, including terrorism. The average value of this indicator is - 0.41, with values ranging from - 3.1 (Somalia, 2010) to 1.92 (Greenland in 2015). Political stability has deteriorated considerably in countries such as Yemen (- 1.39 in 1995 to -2.63 in 2015) or Venezuela (- 0.62 in 1995 to -2.63 in 2015).

Control of corruption: The control of corruption measures the fact that public power is used to satisfied private interest. A form of corruption that is materialized by collusion between public authorities and private interests. The higher the index, the less the corruption is indicated. In our sample, the average value of this variable is -0.51, with values between - 1.91 when the control of corruption is very low (Afghanistan in 2000) and 1.38 when the level of control is high (Bermuda in 2000).

The rule of law: This variable measures the perception of the extent to which agents trust and respect the rules of the society and in particular the quality of contract performance. The average value of this indicator is - 0.52, with values ranging from - 2.45 (Somalia in 2010) to 1.74 (Greenland in 2015). The rule of law is essential for progress towards UHC. It ensures contracts compliance and make sure that beneficiaries have access to the benefits they are entitled to.

Figure 3. Correlation between universal health coverage index and institutional factors
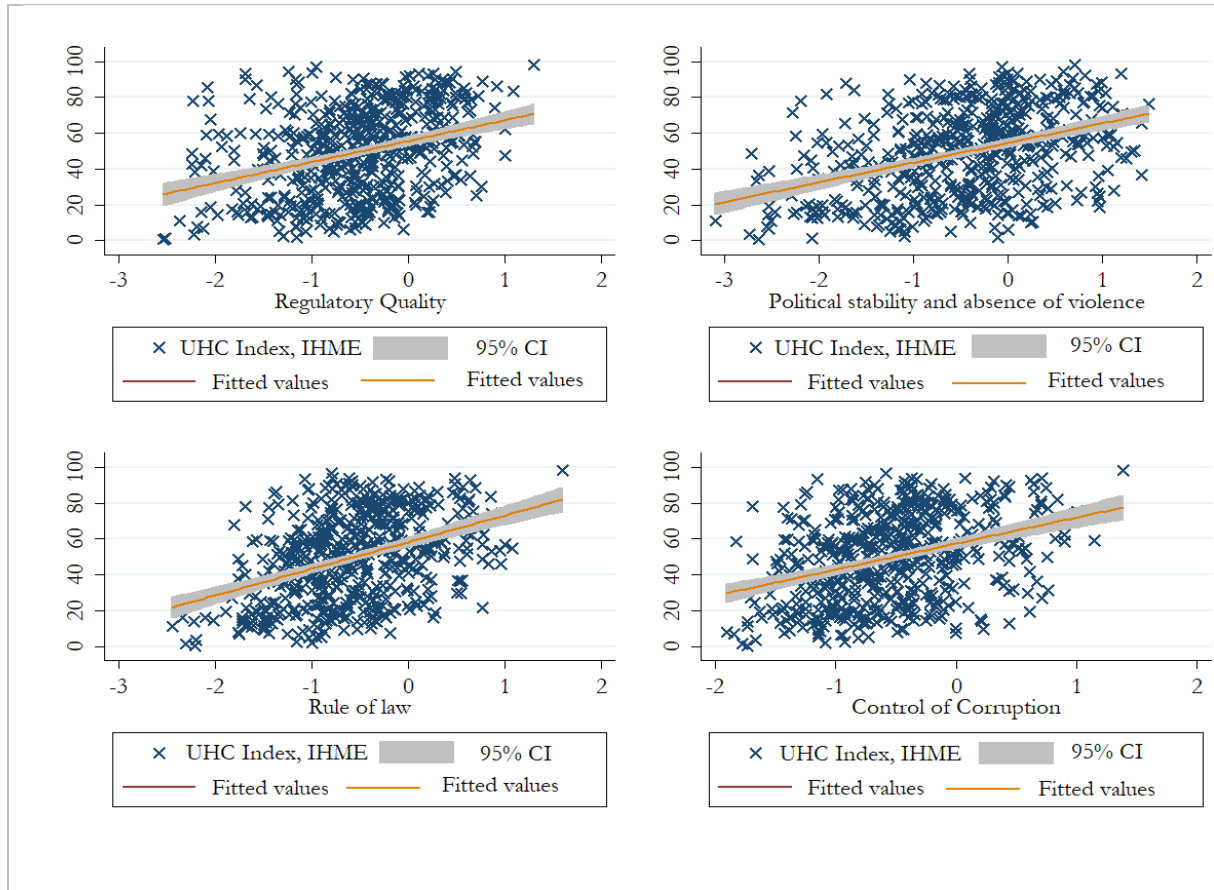
Source: Author using World Bank data

Key variables for progress towards universal health coverage

By dividing the progress index towards UHC in quartiles, we analyze in Table 2 the characteristics of countries that have progressed towards UHC compared to other countries. First, we find that there is no low-income country is in quartile 4 (UHC index 75-100). Then, it turns out that the countries that have made strong progress towards UHC (Q4) are the countries that have greater capacity to mobilize domestic resources, high public spending. These countries give a higher priority on health spending. For example, countries of Q4 and classified as lower middle-income have an average percentage of GDP of 41% for government revenue, 45.96% for public expenditure and 12.23% for public health expenditure. We note that the countries that have given higher priority to health are the countries that have progressed more towards UHC. Thus, for lower-middle-income countries, public health expenditure as a % of total public expenditure was

8.52% when in the first quartile (UHC index 25-100), and 12.23% when considered very advanced in the progress towards UHC (UHC index 75-100).

Table 2: Key variables for progress towards universal health coverage

	Quartiles of UHC index				
	Q1	Q2	Q3	Q4	Total
Low-Income					
General Government revenue (% of GDP)	16.16	23.05	30.20		19.20
General Government expenditures (% of GDP)	18.94	26.10	35.34		22.27
Public expenditures on health (% of Government expenditures)	10.36	12.06	12.83		10.93
Regulatory Quality		-0.88	-0.89		-0.97
Lower Middle-income					
General Government revenue (% of GDP)	19.40	24.63	30.44	41.07	25.03
General Government expenditures (% of GDP)	22.78	25.13	33.66	45.96	27.47
Public expenditures on health (% of Government expenditures)	8.52	10.95	10.31	12.23	9.96
Regulatory Quality	-0.76	-0.76	-0.69	-0.73	-0.74
Upper Middle-income					
General Government revenue (% of GDP)	19.66	23.64	25.58	27.18	25.39
General Government expenditures (% of GDP)	20.80	25.37	27.52	30.18	27.62
Public expenditures on health (% of Government expenditures)	9.34	10.22	11.20	11.79	11.06
Regulatory Quality	0.18	-0.28	-0.26	-0.20	-0.24
High Income					
General Government revenue (% of GDP)	14.67	21.57	27.44	38.60	30.13
General Government expenditures (% of GDP)	17.95	25.69	27.83	38.89	31.73
Public expenditures on health (% of Government expenditures)	17.73	10.68	10.20	9.86	10.69
Regulatory Quality	-0.36	-0.017	-0.17	-0.39	-0.23
Total					
General Government revenue (% of GDP)	19.15	27.71	27.71	29.32	25.51
General Government expenditures (% of GDP)	21.73	25.41	29.96	32.61	27.82
Public expenditures on health (% of Government expenditures)	8.92	10.66	10.68	11.84	10.55
Regulatory Quality	0.74	-0.60	-0.40	-0.18	-0.47

Source : Author's calculation using WDI, IMF and WGI data

3   Data

We use a panel dataset comprised of 138 low and middle income countries over five distinct years (1995, 2000, 2005, 2010 and 2015). Table 3 presents the description of our variables and Table 4 gives descriptive statistics of the main variables used. The UHC index represents the variable explained. It includes a tracer variable for prevention and treatment services. Those are antenatal care[7]; skilled birth attendance coverage; in-facility delivery rates; vaccination coverage (three doses of diphtheria–pertussis–tetanus, measles vaccine, and three doses of oral polio vaccine or inactivated polio vaccine); tuberculosis cases detection rates; coverage of antiretroviral therapy for populations living with HIV, and coverage of insecticide-treated nets for malaria-endemic countries. The normalized index value ranging from 0-100. It comes from the Institute of health metrics and evaluation database. The control variables (General government total expenditure of GDP, GDP per capita and the inflation rate) come from World Development indicators database. The institutional variables (regulatory quality, political stability and absence of violence and the Rule of law; the control of corruption), which is also the control variables come from international country risk guide database. The variable of interest, Government revenue as a percentage of GDP is from the IMF World Economic Outlook database.

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[7] WHO define antenatal care as care provided by skilled health-care professionals to pregnant women and adolescent girls in order to ensure the best health conditions for both mother and baby during pregnancy

Table 3 : Variable description and source

Variables	Description	Source
depvaretude	Dependant variable =1 if UHC index >76.7; 0 if not	Author calculation
depvaretude2	Robustness variable = 1 if UHC index >71.3; 0 if not	
varquart	UHC index divided into quartile	
UHC_Index	Universal health coverage index	IHME
GovExpend	General government total expenditures % of GDP	WDI
PubHExpGovExp	Public health expenditures as % of government expenditures	
inflation	Inflation rate	
AgValueAdd	Agriculture, value added (% of GDP)	
ManValueAdd	Manufacture, value added (% of GDP)	
GDPpercapita	GDP per capita, PPP	
GDP_growth	GDP growth	
GovRevGDP	Government revenue as % GDP	ICRG
RegulatoryQuality	Regulatory Quality	
PoliticalStab	Political stability and absence of violence	
RuleofLaw	Rule of Law	
ControlofCorruption	Control of Corruption	
TradeasGDP	Trade (% of GDP)	IMF data
Socialcontributions	Social contribution (% of revenue)	
Grants	Grants and other revenue (% of revenue)	
totnatresour	Total natural ressources rent (% of GDP)	
Tax_revenue_Gdp	Tax revenue (% of GDP)	
Unemployment	Unemployment, total (% of total labor force) (national estimate)	ILOSTAT database

Source : Author

Table 4: Descriptive statistics

Variables	Source	Std. Dev.	Min	Max
Universal health coverage index	IHME	24.18	0.5	98.2
Government revenue as % GDP	IMF	12.83	0.63	112.28
General government total expenditures % of GDP	WDI	13.59	0	76.77
Public health expenditures as % of government expenditures	WDI	4.431	1.132	28.99
Inflation rate	WDI	123.80	-8.11	2671.79 [1]
Regulatory Quality	ICRG	0.70	-2.54	1.48
Political stability and absence of violence	ICRG	0.91	-3.1	1.92
Rule of Law	ICRG	0.70	-2.45	1.74
Control of Corruption	ICRG	0.61	-1.91	1.38
Agriculture, value added (% of GDP)	WDI	13.71	1.06	81.82
Trade (% of GDP)	WDI	38.59	0.02	354.97

[1] Angola inflation rate in 1995

Source: Author calculation using panel dataset

4   Methodology

Three estimation methods were chosen. This is to consider the specific nature of the dependent variable, and to ensure the strength of our results. To make our estimate, we made a binary transformation of progress towards universal health coverage. The interest of this transformation is to classify countries into two categories. Countries that have reached universal health coverage, and countries that have not reached it. To define a threshold, we used Rwanda as a reference country. The chosen threshold is 76.7, corresponding to the value of the UHC index in 2015. The variable is coded as follows: 0 if the UHC index is < 76.7, in this case the country is considered not to have reached UHC, and 1 if the UHC index is >= 76.7, and the country is considered to have reached UHC. The choice of Rwanda is justified by the fact that this country has made considerable progress in recent years towards UHC.

Justification of Rwanda as a reference country

With a compulsory membership system based on community insurance, Rwanda has reached an 80% coverage rate (2015-2016) of the population. This rate, among the highest in Africa, has been achieved, thanks in particular to the "Ubudehe" program which has a very effective stratification mechanism to identify and integrate the poor and the vulnerable (orphans, widows and elderly) to all social programs (Kunda, 2014). Figure 4 show the proportion of pregnant women aged 15 to 49 years given birth in the presence of qualified medical staff. Although Rwanda has the highest prenatal coverage rate, it also remains a reference in terms of equity. More than 80% (84.2%) of pregnant women in the poorest quintile give birth in presence of qualified health professional, against 97.2 % for highest quintile. In Ethiopia and Kenya for example, the differences are more pronounced between the lowest and the highest quintiles (Figure 4).

Figure 4: Proportion of pregnant women between the ages of 15 and 49 giving birth in the presence of qualified medical professional in five African countries.
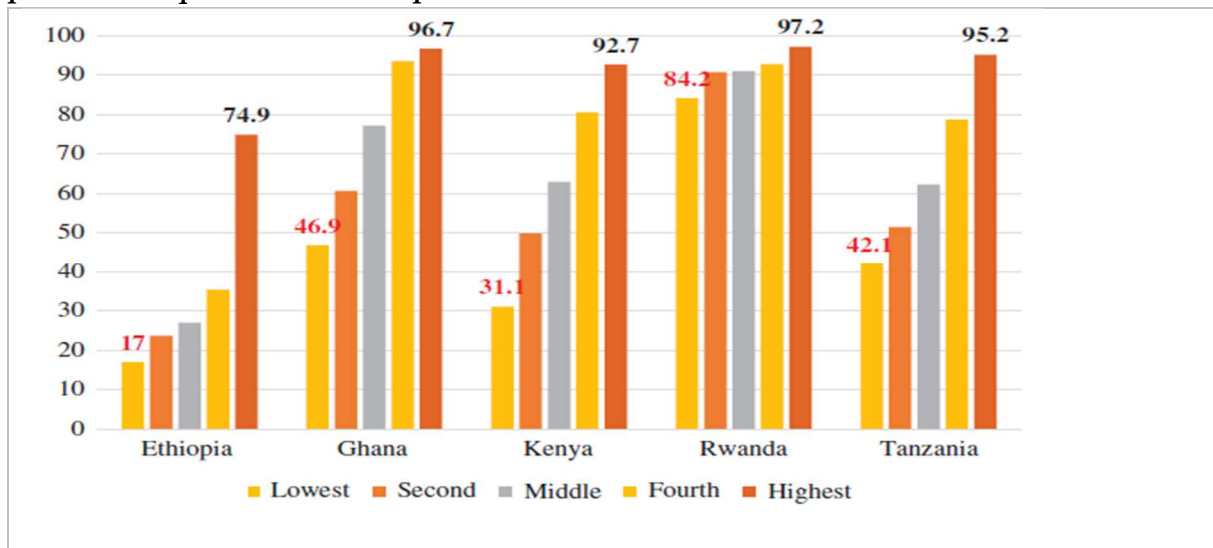
Source: Ghana (DHS 2014), Kenya (DHS 2014), Rwanda (DHS 2014), Ethiopia (DHS 2011) and Tanzania (DHS 2015).

Figure 5 and Table 5 shows respectively Rwanda health outcomes indicators and its health finance profile. Between 2000 to 2015 infant mortality rate, under-5 mortality rate and maternal mortality ratio fall considerably (Figure 5). At the same time, government health expenditure as percentage of current health expenditures has gone from 25% in 2000 to 30.88% in 2014. At the same time, the priority given to health system has increased significantly. Domestic general government health expenditure increased from 5.33% of general government expenditures in 2000 to 9.17% in 2014 (Table 4).

Figure 5 : Rwanda health outcomes indicators
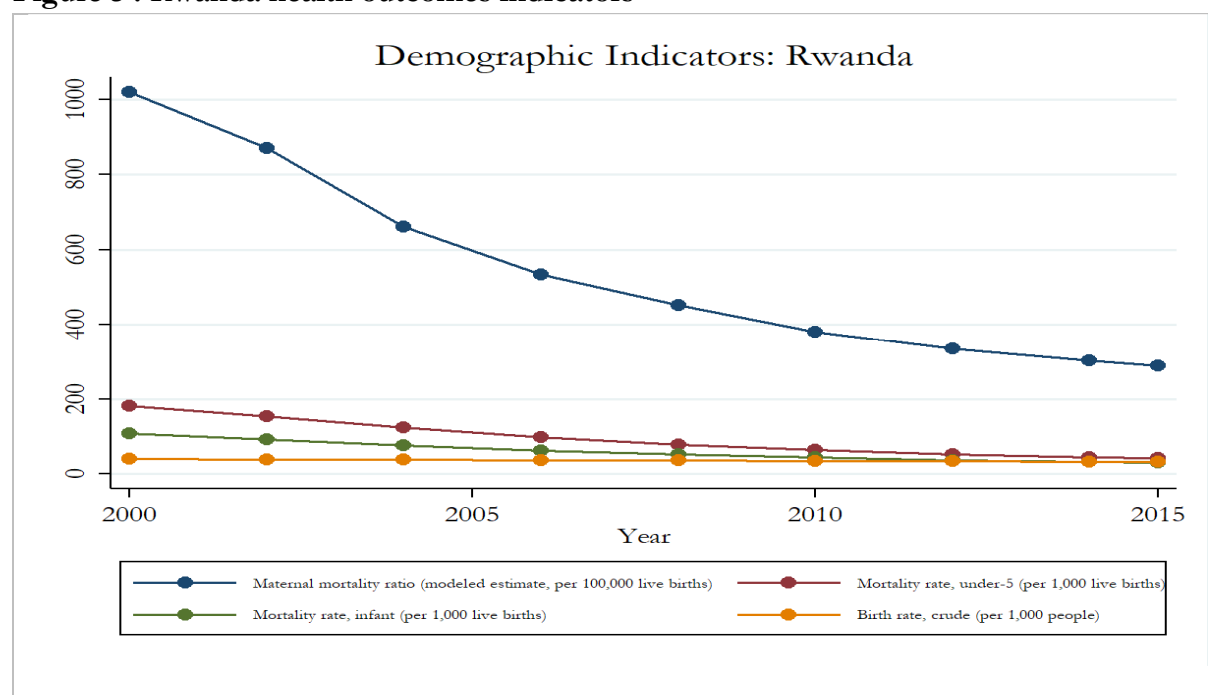
Source: Author using world development indicators, 2015

Table 5: Rwanda health finance indicators

	2000	2002	2006	2008	2010	2012	2014
External health expenditure as % of CHE	47,33	36,16	50,39	48,96	49,52	43,09	36,57
Dom. gen gov. health expend as of % CHE	24,99	29,97	17,21	18,24	18,08	22,82	30,88
Dom. gen gov health expend as % of GDP	1,15	1,31	1,43	1,59	1,69	1,94	2,54
Dom.gen gov health expend as % of gen. gov. Expend	5,33	5,49	7,2	7,2	6,98	7,86	9,17
Dom gen gov health expend per capita	7,34	10,04	15,81	20,73	23,38	31,02	43,83
Out-of-pocket expenditure as % of CHE	24,46	23,77	24,28	23,36	22,3	23,68	24,6

Source: Author's presentation from panel dataset

Figure 6 shows Rwanda's total health expenditure per capita by type of expenditure. Although direct payments still account for 24% of total health expenditure, and their share per capita is growing steadily, the share of public health expenditure per capita has also increased significantly from $ 7.3 per capita in 2000 to 30.6 $ per capita in 2015. The graph shown that in Rwanda there are an increasing part of total health expenditures financed by domestic general government health expenditures.

Figure 6: Total health expenditures per capita by type of expenditure
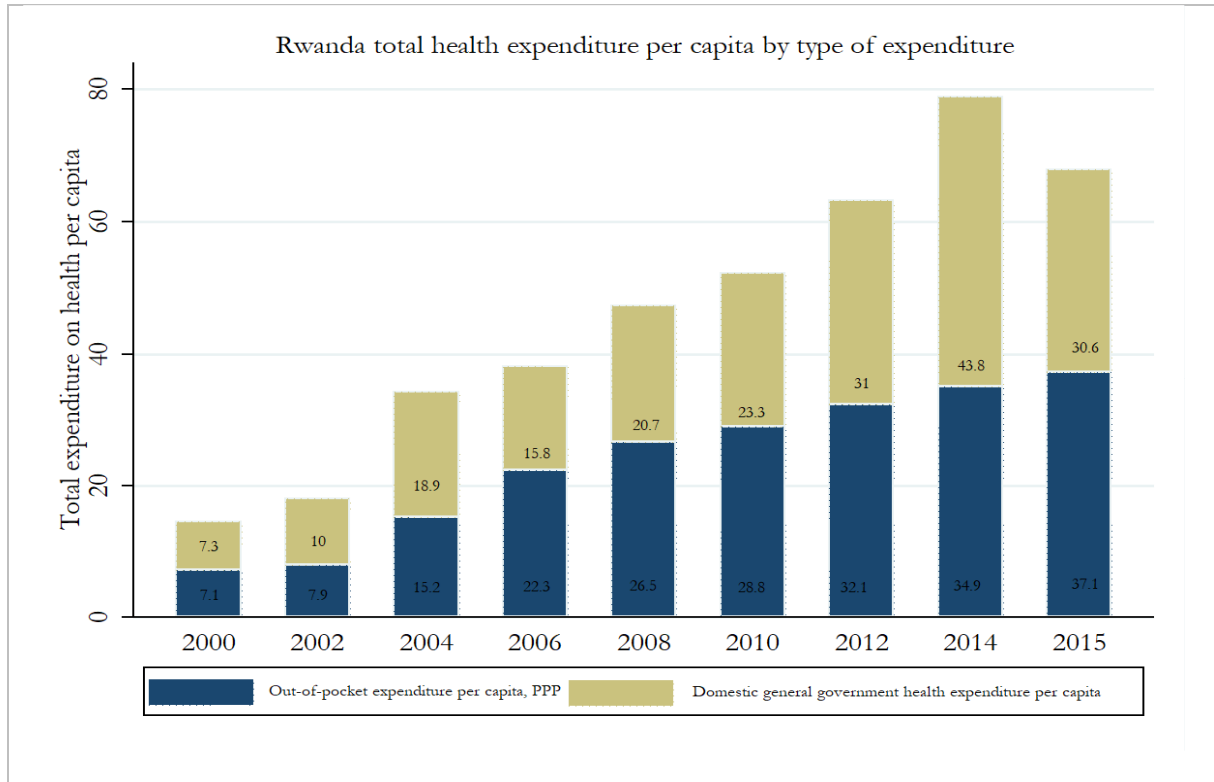
Source: Author using World Bank indicator

Table 6 shows international comparison of health indicators. Rwanda's choice as a country of reference can also be explained by the fact that between 2000 and 2015, infant mortality rate fell by 70%, under-5 mortality rate by 76.8% and maternal mortality rate by 83.7%. Whereas the fall was less important in Sub-Saharan Africa and LMIcs in general. During this period, antenatal service coverage increased by 189.77% and the Nurses and midwives (per 1,000 people) increased by 102.04% compared to an increase of 62.97 in prenatal services in sub-Saharan Africa and only 19.09% in LMIcs.

Table 6: International comparisons of health indicators between 2000-2015

	Rwanda	% Variation	SSA	% Variation	LMIcs	% Variation
GDP per capita, PPP USD constant $	1274.08	118.31	4324.99	43.89	6950.46	49.17
Physicians (per 1,000 people)	1.7	0.23	0.22		1.21	10.37
Prenatal service coverage	60.775	189.77	62.97	36.5	83.07	19.09
Mortality rate, infant (per 1,000 live births)	59.51	-70	64.11	-40	39.83	-40.45
Mortality rate, under-5 (per 1,000 live births)	92.71	-76.8	100.02	-46.73	56.62	-45.58
Maternal mortality ratio	759.6	-83.7	567.93	-34.42	226.21	-67.24
Life expectancy at birth, total (years)	59.33	37.77	57.14	17.99	65.66	9
Hospital beds (per 1,000 people)	1.7		1.27		2.72	
Domestic general government health expenditure (% of GDP)	1.77	46.08	1.81	5.94	2.57	7.8
Community health workers (per 1,000 people)	1.35		0.44		0.44	
Current health expenditure (% of GDP)	7.38	70.4	5.63	20.15	5.87	14.78
Immunization, DPT (% of children ages 12-23 months)	94.37	8.8	73.83	25.89	82.61	11.2
Immunization, HepB3 (% of one-year-old children)	95	11.36	78.96	-8.32	83.68	10.8
Immunization, measles (% of children ages 12-23 months)	88	29.7	72.45	24.01	82.19	10.30
Newborns protected against tetanus (%)	84	11.11	77.90	28.17	79.50	25.01
Nurses and midwives (per 1,000 people)	0.64	102.4	1.33	17	2.51	48.95
Out-of-pocket expenditure (% of current health expenditure)	24.08	6.17	40.51	-21.09	39.51	-13.53

Source: Author using World Bank data

5 Econometric specification

5.1 Probit Model

As a first step, the estimates are made with a probit model with a random effect. The choice of this model is explained by the fact that our dependent variable is categorical, and the hypotheses of our study. Indeed, we want to capture the characteristics that explain the progress made by the countries that achieved UHC, compared to other countries. Then, we carry out robustness tests by varying the thresholds, in order to verify the validity of our results.

The estimated model is as follows:

$$\Pr ob(UHCindex_{it}=1|x_{it},\alpha_i)=\Phi(\alpha_i+\beta_1 G_{it}+\gamma' x_{it}+v_{it}) \tag{1}$$

with $\Phi(x'_{it}\beta)=\int_{-\infty}^{x'_{it}\beta}\phi(z_{it})dz_{it}$ is the cumulative distribution of a normal random variable.

In equation (1), i and t are respectively country and the year, G_{it} is our variable of interest, it represents government revenue (taxes, social contributions, subsidies received and other income) of a country i in the year t, and the vector x_{it} represents all of our control variables. Those are: general government total expenditures % of GDP; GDP per capita; Regulatory quality; political stability and absence of violence; the Rule of law; the control of corruption; the public health expenditures as % of government expenditures, and the inflation rate, and v_{it} which represents the error term; α_i are the specific individual effects. We also use the panel data logit regression model which use, instead of the normal distribution, the logistic distribution.

5.2 Complementary log-log regression

Always in order to consider the specificity of our dependent variable, we use Complementary log-log regression. This model used with a binary variable, allows considering the rare events because there are 78.76% of the countries of our sample which are considered not to have reached the UHC, against 21.24% considered to have reached the UHC. This model is therefore adapted to consider the fact that the achievement of UHC is considered as a rare event.

5.3 Probit model with instrumental variables

The interest of the choice of this model is to correct the possible endogeneity that can remain in our model. Government revenue as a share of GDP is likely to be endogenous for the probable simultaneity bias between government revenue as a percentage of GDP and progress towards UHC. The simultaneity bias is explained by the fact that government revenue is a determinant of progress towards universal health coverage in LMIcs. It represents an important source of health financing. However, when countries are faced with declining of population coverage, or a lower level of financial protection, they will seek to increase the level of government revenue. Without correction, this endogeneity could lead to inconsistent estimators. To address the problem of endogeneity, we use two instrumental variables z_{1it} and z_{2it}. These instrumental variables need to be correlated with G_{it} without been uncorrelated with the error term $E(u_{it} | z_{it}) = 0$. The assumptions we make in choosing our instrumental variables are as follows:

Our first instrument is agriculture, value added (% of GDP). Agricultural sector in developing countries is hardly taxable especially when it is largely composed of subsistence. In our sample, we find a negative and significant correlation between agriculture, value added (% of GDP) and government revenue as a percent of GDP. Rajaraman (2004) also find that if the share of agriculture in GDP increase in one percent, tax revenue as percent of GDP decrease by a little over a third of

one percent. The second instrument we use is the trade openness, Trade (% of GDP). There is a relationship between international trade and government revenue, but not with UHC. Shubati and Warrad (2018) find that a 1% increase in international trade leads to decrease government revenue about 0.22%. We employ nonlinear discrete choice methods to perform the econometric estimations, because first our dependent variable is dichotomous (0 or 1). The advantages of these methods are that they capture the true probabilistic nature of our dependent variable. Second, compared to linear probability models, the predictions obtained from the discrete choice models are exactly bounded between 0 and 1 contrarily to linear probability models for which the predictions might exceed 0 and 1. Third, the standard errors obtained from linear probability models are by construction heteroskedastic which might not be necessarily the case for discrete choice models.

6   Results

The results of our principal regression are summarized in Table 7 in appendix. We estimate the effect of government revenue on the probability to progress towards UHC. Our first finding is that the coefficient of government revenue is positive and significant across all models. It's means that government revenue is an important factor explaining the probability that a country will move to UHC (table 6). By estimating the marginal effect of government revenue on the probability to progress towards UHC, we find that a 100 increase of country government revenue is leading to increase 66.5% the probability to progress towards UHC in column (1) Table 8. The magnitude of the coefficient remains relatively the same, except in the instrumental variable probit model wich corrects the endogeneity problem (column 4, table 7).

The coefficient of quality of regulation is positive and significant for all models. It means that the quality of regulation is an important factor that explains the probability of a country's progress towards UHC, and we found that if quality of regulation increases by 1, the probability of

a country's progress towards UHC increases by 0.16 (Table 8). The magnitude of the coefficient remains the same in logit and complementary log-log models except for instrumental variable probit model.

The inflation rate is negative, but significant only for logit and complementary log-log models.

Our results show that an increase in inflation rate of 100 is accompanied by a reduction in the probability of progress towards the UHC of 91.2% for complementary log-log model and 84.3% for logit model. However, the results are only significant at 10% level.

The priority given to health sector measured by the ratio of public health expenditures on total government expenditures is positively and significantly explaining the probability of country's progress towards UHC. For example, a 100 increase on the share of public health expenditures on total government expenditures could increase the probability to progress towards UHC by 80%. Compared to Murshed and *al.*, 2017 who studied the effect of fiscal capacity on social protection expenditures, we also find that government is a main determinant for progress towards UHC.

6.1 Robustness analysis

To test the robustness of our result, we make further estimations. In these estimations, we measure the effect of component of government revenue. For instance, we exclude natural resources rent on government revenue to control the effect of raw materials price variation for countries rich in natural resources. We found that government revenue still has a positive and significant effect on the probability to progress towards UHC. The magnitude of coefficient increases for our entire models (table 9). We found that a 100 increase of country government revenue is leading to increase 89.6% the probability to progress towards UHC on the panel data probit model (column 1, table 10). The coefficient remains relatively the same in a complementary log-log model. In a logit model (column 2, table 8), we found that a 100 increase of government

revenue is leading to increase 91.5% the probability to progress towards UHC. We also measure government revenue by tax revenue as percent of GDP, we find that the magnitude of our coefficient is too higher than when the government revenue includes social contributions, grants, and other revenue. In a probit model, we find that a 100 increase of government revenue leading to increase 101% the probability to progress towards UHC (table 11 in the appendix). For logit and complementary log-log models, the magnitude of the coefficient still relatively the same as our principal model. To measure the sensitivity of our results, we vary the threshold from wich we estimate that a country has made sufficient progress towards UHC. We choose a lower threshold and Kenya as country reference wich UHC index in 2015 is 71.3. Choosing Kenya as country reference for robustness is motivated by the fact that that in Kenya there is a high rate of tracers' variables for universal health coverage. For instance, in Kenya, 92.7% of pregnant women giving birth in the presence of qualified medical professional. The value of Kenya UHC index in 2015 is 71.3. For this estimation, we find that government revenue is still having a positive and significant effect on the probability for countries progress towards UHC. The same applies for the quality of regulation, inflation rate and priority given to health sector which also has a positive and significant effect of the probability for countries progress towards UHC (Table 11 in appendix). In addition to the robustness check, we find a minimum rate of government revenue to progress towards UHC. For that, we divided our government revenue variable in a quartile, and we included it in our baseline regression (table 12 in appendix), we found that government revenue still has a positive and significant effect of the probability to progress towards UHC except for countries wich government revenue is in the first quartile (government revenue as a share of GDP under 18.18%). As we have shown in column (1), (2), (3), to progress towards universal coverage countries need to have a government revenue greater or equal to the median which is 23.58%. This result is the same for logit and complementary log-log models.

Effect of government revenue and expenditures instability

To perform our analysis, we test the effect of government revenue and government expenditures instability on the probability of progress towards UHC. To measure government revenue instability, we use the method perform by Ebeke and Ehrhart., 2010 which consist to take the standard-deviation of the growth rates of government revenue and government expenditures in % of GDP over 5-year overlapping sub-periods. The variables are in logarithmic terms. Table 13 provides the results of the effect of government revenue on progress towards UHC. We find that when government revenue instability increase by 1%, the probability to progress towards UHC decrease by 6% using probit model. The effect of government expenditures in table 14 is the same. When government expenditures instability increase by 1%, the probability of progress towards UHC decrease by 5%. This indicates that developing countries should be very careful about the instability of gouvernment revenue and instability because its affect their public investment capacity.

Testing the threshold effect of government revenue on progress towards UHC

To test if there is the threshold effect of government revenue on progress towards UHC, we generate the squared of government revenue and include it the same regression of government revenue variable. Table 15a, 15b and 15c show that the effect of government revenue on progress towards UHC remain the same, and the coefficient of the variable squared government revenue is not significant. This indicate that there is no threshold effect of government revenue on progress towards UHC. This confirm the assumption we make that the effect is linear.

7   Conclusion

Our results suggest several conclusions: Firstly, there is a positive and statistically significant causality between government revenue and progress towards UHC. Countries that have made greater progress towards UHC are those with higher government revenues. Secondly, our results show that countries that give higher priority to public health spending, have a greater probability of progressing towards UHC. It also appears that the fact that some countries are rich in natural resources does not improve their probability of progress towards UHC. Thirdly, the quality of regulation is an important determinant of progress towards UHC. The probability of progressing towards UHC is greater for countries with strong regulatory quality. Finally, countries with high inflation rates have made less progress towards UHC than others.

Despite these strong results, our paper has some limits. Firstly, the universal health index covers only the dimension of access to health services. The other dimensions have not been included because of unavailability of data. Secondly, we did not include the analysis of equity in the mobilization of government revenue. Future research is needed to disaggregated government revenue and study separately the effect of tax revenue (tax on income, profits, and capital gains; taxes on goods and services), social contributions and grants on progress towards UHC.

As far as the economic policies implications, low- and middle-income countries should improve their government revenue as a share of GDP beyond 23% to progress towards UHC and to give greater priority to health spending on budget. The inflation rate also must be controlled. On the institutional side, the quality of regulation appears to be essential for any countries engaged on progress towards UHC.

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Appendix

Table: 7 Effect of government revenue on the probability of progress towards UHC

VARIABLES	(1) Probit	(2) Cloglog	(3) Logit	(4) Ivprobit
Government revenue	0.00665***	0.00622***	0.00637***	0.108***
	(0.00209)	(0.00196)	(0.00206)	(0.0126)
Control of Corruption				-0.350*
				(0.184)
Regulatory Quality	0.169***	0.166***	0.169***	0.744***
	(0.0380)	(0.0401)	(0.0395)	(0.178)
Inflation	-0.00711	-0.00912*	-0.00843*	-0.0178
	(0.00437)	(0.00496)	(0.00503)	(0.0112)
Public expenditures on health	0.00809*	0.00807*	0.00827*	0.0231
	(0.00444)	(0.00435)	(0.00440)	(0.0164)
Observations	458	458	458	390

Robust standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 8: Marginal effect of government revenue on the probability of progress towards UHC

VARIABLES	(1) Probit	(2) Cloglog	(3) Logit	(4) Ivprobit
Government revenue	0.665***	0.622***	0.637***	10.81***
	(0.209)	(0.196)	(0.206)	(1.257)
Control of Corruption				-0.350*
				(0.184)
Regulatory Quality	0.169***	0.166***	0.169***	0.744***
	(0.0380)	(0.0401)	(0.0395)	(0.178)
Inflation rate	-0.711	-0.912*	-0.843*	-1.776
	(0.437)	(0.496)	(0.503)	(1.117)
Public expenditures on health	0.809*	0.807*	0.827*	2.312
	(0.444)	(0.435)	(0.440)	(1.643)
Observations	458	458	458	390

Robust standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Robustness analysis

Table 9: Marginal effect of government revenue on the probability of progress towards UHC

VARIABLES	(1) Probit	(2) Logit	(3) Cloglog	(4) Ivprobit
Government revenue [1]	0.896***	0.915***	0.895***	10.41***
	(0.248)	(0.234)	(0.242)	(3.869)
Control of Corruption				-0.331
				(0.314)
Regulatory Quality	0.105***	0.0971***	0.106***	0.441
	(0.0379)	(0.0366)	(0.0373)	(0.428)
Inflation rate	-0.0140***	-1.479***	-1.419***	-6.976*
	(0.00434)	(0.462)	(0.437)	(3.617)
Public expenditures on health		0.745	0.856	-2.969
		(0.633)	(0.672)	(6.231)
Observations	195	195	195	154

[1] Government revenue is measured by Total non-resource revenue including social contributions
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 10: Marginal effect of government revenue on the probability of progress towards UHC

VARIABLES	(1) Probit	(2) Logit	(3) Cloglog	(4) Ivprobit
Government revenue [1]	1.010**	0.969**	0.984**	20.62***
	(0.450)	(0.463)	(0.458)	(7.128)
Public expenditures on health	1.043*	1.060*	1.046*	4.429
	(0.586)	(0.551)	(0.576)	(2.826)
Regulatory Quality	0.248***	0.249***	0.246***	1.269***
	(0.0458)	(0.0473)	(0.0458)	(0.323)
Inflation rate		-0.564	-0.440	-1.708
		(0.524)	(0.477)	(1.326)
Control of Corruption				-0.942**
				(0.380)
Observations	273	273	273	244

[1] Government revenue is measured by tax revenue wich refers to compulsory transfers to the central government for public purposes. Certain compulsory transfers such as fines, penalties, and most social security contributions are excluded. Refunds and corrections of erroneously collected tax revenue are treated as negative revenue.
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 11: Effect of government revenue on the probability of progress towards UHC [1]

VARIABLES	(1) Probit	(2) Logit	(3) Cloglog	(4) Ivprobit
Government revenue	0.0346***	0.0591***	0.0466***	0.120***
	(0.0129)	(0.0226)	(0.0172)	(0.0241)
Inflation rate	-0.0408**	-0.0778**	-0.0687**	
	(0.0191)	(0.0364)	(0.0289)	
Control of Corruption	0.195	0.303	0.156	-0.673**
	(0.246)	(0.442)	(0.369)	(0.265)
Regulatory Quality	0.734**	1.288**	1.059**	1.159***
	(0.288)	(0.524)	(0.453)	(0.229)
Constant	-1.156***	-1.936***	-1.958***	-3.547***
	(0.378)	(0.675)	(0.525)	(0.660)
Observations	459	459	459	423
Number of countries	109	109	109	109

[1] Kenya threshold. "UHCindex=0 if UHCindex<71.3 and UHCindex=1 if UHCindex>=71.3
Robust standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 12: Effect of government revenue (divided in quartile) on the probability of progress towards UHC

VARIABLES	(1) Probit	(2) Logit	(3) Cloglog
2.varquart	0.0264	0.0255	0.0270
	(0.0423)	(0.0452)	(0.0434)
3.varquart	0.209***	0.193***	0.205***
	(0.0560)	(0.0597)	(0.0572)
4.varquart	0.203***	0.204***	0.201***
	(0.0633)	(0.0678)	(0.0643)
Inflation rate	-0.00631	-0.00884*	-0.00788
	(0.00415)	(0.00473)	(0.00480)
Public expenditures on health	0.00860*	0.00858**	0.00879**
	(0.00439)	(0.00431)	(0.00442)
Regulatory Quality	0.157***	0.145***	0.154***
	(0.0383)	(0.0413)	(0.0400)
Observations	458	458	458

Robust standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 13: Effect of government revenue instability on progress towards UHC

VARIABLES	UHC Index
Government revenue instability	-6.143***
	(2.206)
Public health expenditures	0.0455**
	(0.0230)
Inflation	-0.0252
	(0.0295)
Control of Corruption	0.510**
	(0.253)
GDP per capita	0.000156***
	(4.78e-05)
Government Expenditures	
Constant	-1.987***
	(0.658)
Observations	425
Number of id	104

Robust standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 14: Effect of government expenditures instability on progress towards UHC

VARIABLES	UHC Index
Government expenditures instability	-5.330**
	(2.298)
Public health expenditures	0.0583**
	(0.0292)
Control of Corruption	
GDP per capita	0.000174***
	(5.56e-05)
Government Expenditures	0.0262*
	(0.0153)
Constant	-3.466***
	(0.945)
Observations	426
Number of id	106

Robust standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 15a: Testing the threshold effect of government revenue on progress towards UHC

VARIABLES	depvaretude
GovRevGDP	0.0484*
	(0.0288)
c.GovRevGDP#c.GovRevGDP	-0.000391
	(0.000333)
ControlofCorruption	0.590***
	(0.176)
Constant	-1.735***
	(0.538)
Observations	502
Number of id	115

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 15b: Testing the threshold effect of government revenue on progress towards UHC

VARIABLES	depvaretude
GovRevGDP	0.0543*
	(0.0316)
c.GovRevGDP#c.GovRevGDP	-0.000406
	(0.000390)
PubHExpGovExp	0.0459*
	(0.0243)
Constant	-2.703***
	(0.602)
Observations	512
Number of id	116

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 15c: Testing the threshold effect of government revenue on progress towards UHC

VARIABLES	depvaretude
GovRevGDP	0.0510*
	(0.0280)
c.GovRevGDP#c.GovRevGDP	-0.000348
	(0.000326)
RegulatoryQuality	0.605**
	(0.279)
RuleofLaw	0.0993
	(0.245)
Constant	-1.819***
	(0.531)
Observations	502
Number of id	115

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Essay 3

Does progress towards Universal Health Coverage improve health outcomes?

Abstract

The fundamental goal of this paper is to contribute to the universal health coverage debate, by producing an empirical evidence of the effects of progress towards universal health coverage in improving health outcomes in low and middle-income countries. We measure progress towards universal health coverage by Government schemes, voluntary health insurance schemes and compulsory health insurance schemes expenditures per capita. We used fixed effects with instrumental variables in panel data for the period 2000 - 2015 to identify the effects of progress towards universal health coverage on under-five mortality rate and maternal mortality ratio. Our results indicate that government schemes and voluntary health insurance schemes strongly reduce under-five mortality rate and maternal mortality ratio. Compulsory health insurance schemes have no effects on health outcomes. A \$100 increase of government schemes health expenditures per capita leads to a reduction in the under-five mortality rate of 21.10 per 1000 as well as decrease of around 27.1 per 100000 the maternal mortality ratio. If voluntary health insurance schemes expenditures per capita increase by \$100, under-five mortality rate decreases by about 203 per 1000 as well as maternal mortality ratio decrease by 964 per 100000. We also find that access to sanitation seems more effective in improving health outcomes than government schemes. Higher GDP growth, birth attended by skilled health professionals and Immunization DTP are also found to decrease mortality rates.

Keywords: Universal health coverage; Maternal mortality ratio; Under-five mortality rate; Fixed-Effect IV.

JEL codes: I13; I18; I15

1   Introduction

According to World Health Organization, Universal Health Coverage (UHC) means that all people and communities can use the promotive, preventive, curative, rehabilitative and palliative health services they need, of sufficient quality, while also ensuring that the use of these services does not expose the users to financial hardship. Through this definition, universal health coverage is clearly a goal to be achieved. Thus, 100% coverage both in terms of health services and protection from financial hardship, is equivalent to achieving UHC. To measure progress towards UHC, three points should be considered: the proportion of the population covered, the proportion of packages of services covered and the proportion of costs covered by prepaid and pooled funds. To a large extent, there is a rapid and steady progress towards UHC, especially in the emerging countries (Mexico, Thailand, Brazil, and Chile), and some low income countries (Ghana, and in Rwanda). To date, some countries in Sub-Saharan Africa are increasingly committed to UHC, particularly in Ivory Coast and Gabon where reforms are being undertaken in this direction. Beyond progress towards UHC, it is important to question the achievement of these objectives (access to high-quality health services; protection from financial hardship and improvement of health outcomes). While we note that there is a consensus on the progress made in the first two objectives (Gruber and *al.*, 2014; Fink and *al.,* 2013; Gosh 2010; Wagstaff 2010; Ekman and *al.*, 2008; Wagstaff and Lindelow 2008; SU and *al.*,2006).

There are three main contributions of this paper. Firstly, we analyze at the aggregate level for the first time the effects of government schemes, voluntary health insurance schemes and compulsory health insurance schemes on health outcomes. This analysis allows us to suggest the most appropriate type of program to improve health outcomes in the context of progress towards UHC and to consider the heterogeneity of each country. Secondly, we use instrumental variables to deal with the endogeneity bias of the variables used to measure

progress towards UHC. Finally, we show in our analysis the impact of sanitation and birth attended by skilled health professional in the context of progress towards universal health coverage.

The rest of the paper is organized as follows. The following section present a literature review of effects of progress towards UHC. In a section 3, we present a dataset we use. Section 4 outlines our econometric methodologies. Section 5 presents results of main estimations and in a section 6 we conclude.

2   Background

The Effects of progress towards UHC on financial protection

The review of the literature on the effects of progress towards UHC on financial risk protection reveals mixed and weak results. By analyzing the effects of community health insurance in the Nouna district of Burkina Faso, Fink and *al.* (2013) found limited effects on out-of-pocket expenditures. Nevertheless, authors have noticed a considerable reduction of catastrophic health expenditures. Another study in the Nouna district found that between 6-15% of households were suffering from catastrophic health expenditures (Su and *al.*,2006). One of the reasons given for this is that some illnesses with a relatively high cost of care were not covered by a package of health services and that households were only aware of this reality, after making out-of-pocket payments (Fink and *al.*, 2013).

Conversely, we note that some health insurance programs have improved the financial protection of households. For example, in Vietnam, the Health Care Fund for the Poor (HCFP) has led to a substantial reduction of out-of-pocket expenditures (Wagstaff 2010; Ekman and *al.*, 2008). However, it should be noted that there are also limited health insurance effects on reducing catastrophic health spending in countries such as China and India (Gosh,

2010; Wagstaff and Lindelow, 2008). These differences in results are due to the structural differences between these programs and the national context in which they operate (Budi and *al.*, 2013).

The Effects of Progress towards UHC on health care access

There is a broad consensus on the positive effects of progress towards UHC on access and use of health services. This is particularly the case of Thailand. The 30 Bath program introduced in 2001, increased access and use of ambulatory services for the poor by 8-12% between 2001 and 2005 (Gruber and *al.*, 2015). This trend continued after the generalization of UHC (combination of social health insurance for private sector employees, civil servant medical benefit schemes for government employees, retirees and dependent and publicly subsidized voluntary health insurance for the informal sector) in the country. There was a significant increase in ambulatory visits of 55.98%, and hospitalizations increased by 41.34% (Panpiemras and *al.*, 2011).

The Effects of progress towards UHC on the quality of care

There is no consensus in the literature on the effects of progress towards UHC on quality of healthcare, although theoretically it can be assumed that health coverage schemes are likely to have positive effects on quality of care. As a stable and potentially sustainable source of funds for hospitals, health coverage schemes can select healthcare providers through competitive tendering on various criteria, including quality of care, long waiting times. The fact that insured persons have a channel for expressing their possible complaints and feelings about benefits in healthcare facilities can be an additional means of pressure which can lead to changes in the organization of the services and eventually have a positive effect on the quality of care. This was drawn from a survey of the partnership between voluntary health insurance and health professionals in Guinea. This survey revealed that insured patients are more

demanding than uninsured patients on the quality of care they receive. The waiting time has also been reduced for insured patients. The establishment of a partnership with a voluntary health insurance schemes has also contributed to change the behavior of health providers. In spite of the positive effects of voluntary health insurance schemes, it appears that the membership rates were very low. One of the reasons is linked to the lack of medicines in the health facilities (Diallo and *al.*,2005). However, studies of voluntary health insurance schemes in Kenya, Uganda and the United Republic of Tanzania have found positive effects on the quality of care in health facilities, increasing the availability of essential medicines in hospitals, and reducing waiting times, despite the increase in attendance in hospital structures (Span and *al.*,2012).

The effect of progress towards UHC on equity

Latin American countries have made progress towards UHC[8]. Even though the death of a poor child is between 1.5 and 6 times higher than that of a rich child. The gap has narrowed in recent years (World Bank 2015). Fitzpatrick and *al.* (2018) by studying equity in progress towards UHC, compared coverage of health service and neglected tropical diseases. The authors found that the coverage of neglected tropical diseases was lower in 77 of 113 countries studied. This indicates that a pro-poor coverage is too lower than coverage of health services for the rest of the population.

The effects of progress towards UHC on improving health outcomes

The improvement of health outcomes is a common goal of all the stakeholders involved in progress towards UHC. As for the effects of progress towards UHC on health outcomes, the review of the literature reveals a heterogeneous result depending on the group of countries studied and methodologies used. To examine the effects of progress towards

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[8] For example: Colombia, Dominican Republic, Mexico, Brazil

UHC on population outcomes, Moreno-Serra and Smith (2012) used instrumental variables on longitudinal data covering 153 developing and developed countries. Authors found that a 10 % increase in public health spending per capita reduce under-five mortality rate of 7.9 deaths per 1000 children. Wagstaff and Cleason (2004) showed important beneficial effect of increasing public health expenditures on under-five mortality rate and maternal mortality ratio.

In another study, Wagstaff and Pradham (2005) used panel data with a double difference estimator to assess the impact of health insurance on health outcomes, health care utilization and non-medical household consumption in Vietnam. Authors found that Vietnam's health insurance program has reduced chronic malnutrition, underweight and body mass index for children and increase use of primary care facilities. Furthermore, Chen and *al.* (2017) using panel data and double-difference method showed that Taiwan National Health Insurance has allowed an increase in the use of both outpatients and inpatients services. However, authors found that the program does not reduce mortality; even less improves self-perceived health status. They also conclude that stronger measures of health outcomes could be used to better discern the effects of Taiwan National Health Insurance on health status. In another study, Giedeon and Uribe (2009) found that the Colombian health insurance program has improved the use of preventive and curative services for the poor. However, there are no strong evidence on the impact of the program on infant mortality, low birth weight or self-perceived health outcomes.

3   Data

In our estimations, we use four period data (2000, 2005, 2010 and 2015) covering 139 low and middle-income countries and 550 observations. Our dataset is from four principal databases: Global health observatory (World Health Organization 2018); World development indicators (World Bank 2018); World governance indicators and Unicef database. Table 1

presents the summary statistics of the variables used in our estimations. The value 0 for the voluntary health payment schemes and for compulsory health insurance schemes and indicate the countries where these programs are not existent. The list of these countries and the corresponding years are in the appendix (Table 12 and Table 13). The definition and the source of all variables are in the Table 14 in the appendix.

Table 1 : Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
UHC index	464	54.06	23.26	1.4	98.2
Under-5 mortality rate	290	79.13	50.63	4.8	233.1
Maternal mortality rate	461	299.51	332.72	4	2650
Sanitation access	298	45.85	28.85	4.58	100
Water source access	297	68.93	20.36	16.82	100
Voluntary health payment schemes	377	22.40	53.97	0	355.42
Compulsory health insurance schemes	380	58.59	134.37	0	936.30
Household Out-of-pocket payment	437	137.10	138.63	0.19	862.28
Government schemes compulsory	437	217.90	259.65	3.85	2480.57
Tax revenue as GDP	279	15.56	5.91	0.77	37.3762
Government revenue as GDP	507	26.69	13	.637	112.28
Regulatory quality	406	-0.21	0.49	-1	1.48
GDP per capita	512	7297.96	7109.64	529.20	56395.01

Source: Author using WDI; GHO; WGI; UNICEF; WHO and IMF data

Dependent variable

We measure health status by two mortality indicators:

- ***Maternal mortality ratio (maternal deaths for 100.000 live births):*** measures the risk of dying that women faces during pregnancy or within 42 days after a pregnancy per 100.000 births (WHO, 2004).

- ***Under-five mortality ratio***: indicates the number of deaths between birth and five years per 1000 each year. It measures the probability that a newborn baby will die before reaching age five.

The choice of these two variables is motivated by the fact that child and maternal mortalities respond quickly to improvements in access to health care and quality of health care.

Our variable of interest is Universal health coverage (UHC).

We use three variables as proxy of progress towards UHC. We measure progress towards UHC through the health financing schemes. These are: Government schemes, voluntary health insurance schemes and compulsory health insurance schemes. The interest of using these three variables is to capture the different types of health financing schemes using to progress towards UHC on health outcomes in low and middle income countries. Table 2 presents the main characteristics of Governments schemes, voluntary health insurance schemes and compulsory health insurance schemes. The variables are measured in health expenditures per capita, PPP.

Government schemes

This variable indicates the role of public health schemes in funding health system, relative to private prepaid fund. The descriptive statistics show an average government schemes health expenditure per capita of $132.02 in the whole sample. It is around four times larger than the average of voluntary health schemes $35.59 and two times larger than an average of compulsory health insurance schemes $69.95. Extending government schemes is essential for financial protection, wich is one of the most important dimensions of progress towards UHC. The more government schemes expenditures per capita is high, the less the reliance on out-of-pocket payments for health care. Xu and *al.* (2007) show a highly positive correlation between out-of pocket payments with poorer financial protection, as measured by the incidence of catastrophic health expenditure. When out-of-pocket payments are the main source of funding for health systems, they have several drawbacks. The most important is that people delay giving up treatment when they need it or face serious difficulties when they must pay for health services. Table 2 shows the percentage change in government schemes and health outcomes by region and income groups. Government schemes expenditures per capita

increased considerably from 2000 to 2015, and at the same period, there was a significant reduction in maternal mortality ratio and under-five mortality rate. For example, from 2000 to 2015, government schemes expenditures per capita increased by about 75% in low-income countries, under-five mortality rate declined by 50%, and maternal mortality ratio by 511%.

Voluntary health insurance schemes

The interest of choosing this variable is to consider the role of private[9] prepaid fund for health system in each country. The voluntary health insurance schemes expenditures per capita is relatively low and represent respectively $10.45, $14.89 and 41.87 in low income, lower income, and upper middle-income countries. Figure 1 shows a value for mean Government schemes, compulsory health insurance schemes and voluntary health insurance schemes health expenditures per capita for each world bank income group. The compulsory health insurance schemes have the lowest value for all world bank income group. The lowest values are in low income countries. These countries are also those for which the health outcomes are the lowest.

Compulsory health insurance schemes

This indicator illustrates the role of prepaid social contributions through payroll deductions. The compulsory health insurance schemes expenditures per capita is too low in developing countries, in part because of the importance the informal sector. The compulsory health expenditures per capita represent $0.87 in low income countries, $5.59 in lower income countries and $64.75 in upper middle-income countries. Table 4 shows the percentage change in compulsory health insurance schemes. We note that compulsory health insurance schemes have less increased than government schemes. For example, from 2000 to 2015, compulsory

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[9] WHO indicates that private sector funds are from households, corporations and non-profit organizations.

health insurance schemes increased by about 17.98% in low income countries. In contrast, government health schemes and voluntary health insurance schemes increased respectively by about 75% and 121%. In Sub-Saharan Africa, the increase of compulsory health insurance schemes was particularly low. It was only about 3% between 2000 to 2015.

Table 2: Characteristics of health financing schemes

Health care financing schemes	Composition	Funding	Characteristics
Government schemes	Central government schemes ;	International transferts and grants ;	Participation is automatic for all citizens or residents ;
	State/regional/local government schemes	Transferts by government on behalf of specific groups ;	The benefit entitlement is non- contributory, typically universal or available for a specific population group or disease category defined by law
		Subsidies ; Other transfers from government domestic revenue	
Compulsory contributory health insurance schemes	Social health insurance schemes ;	Compulsory prepayment from individuals/households ;	Participation is mandatory for all citizens or resident ;
	Compulsory private insurance schemes	Compulsory prepayment from employers ;	The Benefit entitlement is contributory, based upon the purchase of an insurance policy from a selected health insurance company
		Other compulsory prepaid revenues	
Voluntary health insurance schemes	Private/substitutory health insurance schemes ;	Voluntary prepayment from individuals/households	Participation is voluntary ;
	Employer-Based insurance (other than enterprises schemes) ;	Voluntary prepayment from employers	Benefit entitlement: contributory: based upon the purchase of the voluntary health insurance policy
	Government – based voluntary insurance ; Other primary coverage schemes ; Complementary/Supplementary insurance schemes ; Community based insurance ; Other complementary/Supplementary insurance	Other voluntary prepaid revenue	

Source: Author using information from health accounts 2011

Figure 1: Government schemes, compulsory health insurance schemes and voluntary health insurance expenditures per capita by the World Bank income group
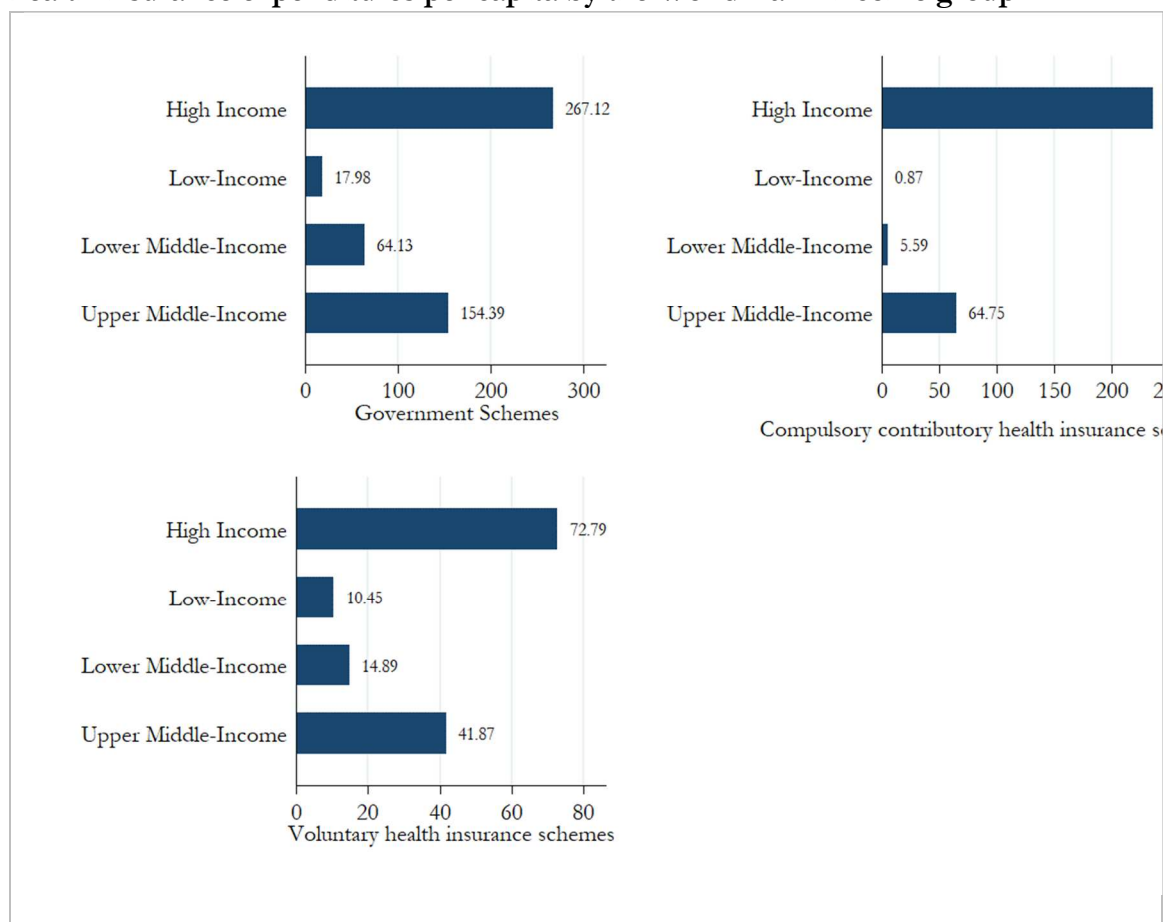
Source: Author's calculations using global health observatory data

Table 3: Health financing schemes by world bank revenue classification

Revenue Classification	Government schemes	CHI Schemes	VHI schemes	MMR	UMR
High Income	267.12	236.40	72.79	79.12	18.45
Low-Income	17.98	0.87	10.45	950.62	144.09
Lower Middle-Income	64.13	5.59	14.89	465.21	88.01
Upper Middle-Income	154.39	64.75	41.87	134.25	39.72
Total	132.23	66.92	35.44	293.75	78.44

Source : Author calculation

Table 4: Health financing schemes by region

Region	Government schemes	CHI Schemes	VHI schemes	MMR	UMR
East Asia & Pacific	157.34	20	20.03	147.57	46.12
Europe & Central Asia	153.88	280.21	17.36	30.51	31.19
Latin America & Caribbean	210.02	110.64	52.52	119.98	41.6
Middle East & North Africa	234.72	99.23	44.74	76.5	25.72
South Asia	99.34	18.55	15.24	290.31	63.70
Sub-Saharan Africa	83.39	4.02	42.29	592.77	111.05
Total	141	65.90	35.06	300.71	79.33

Source: Author calculation

Table 3 shows that health financing schemes, particularly government schemes is two important in high income countries than any other income groups. We observe that compulsory health insurance scheme expenditures per capita is too low in lower and upper middle income countries, while voluntary health insurance schemes health expenditures per capita is more important. Table 4 meanwhile shows that the compulsory health insurance schemes expenditures per capita is too low in sub-Saharan Africa, while the voluntary health insurance expenditures per capita is too important.

The others explanatory variables

Physicians (per 1000 people): This variable characterizes human resources for health in each country in the sample. The existence of a better trained and reasonably distributed network of healthcare providers within the territory is an essential factor in improving health outcomes. Overall, there is a strong inequity in the distribution of health professionals in developing countries. Globally, about half of the population lives in rural areas, while there only have 25% of the total number of health professionals (WHO 2006). In Senegal, for example, less than 40% of doctors work in rural areas, while their population accounts for 77% of the total Senegalese population (Zurn and *al.*, 2010). In our sample, density of physicians[10] is very important in Cuba (6.76 per 1000 in 2010), Georgia (4.28 per 1000 in 2010).

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[10] WHO defined density of physicians as the total number per 1000 population, latest available year

It is obviously very low in Sub-Saharan Africa as in Zimbabwe (0.066 per 1000 in 2010) or in Niger (0.019 per 1000 in 2010). This is well below the standard proposed by the World Health Organization. The WHO has estimated that to ensure 80% of birth attended by skilled health staff, countries need a minimum of 2.28 health professionals (Physicians, nurses and midwives) per 1000 population (Zurn and *al.*, 2010). A correlation between availability of human resources for health care access is well documented. For example, Brnighausen and Anand (2007) found a strong correlation of physicians' density and coverage of MCV, diphtheria, tetanus, and pertussis (DTP3) and poliomyelitis (polio3). Also, Hu and *al.* (2014) found that publicly health workers significantly improved vaccination. In another study, Farahani and *al.* (2009) used instrumental variables method to analyze the causal effect of physicians on health. Authors found that increasing the number of physicians by one per 1,000 population decreases infant mortality rate by 15% within five years and by 45% in the long-run. In our study, we expected a negative and significant correlation between the number of physicians per 1000 people and health outcomes.

GDP per capita, PPP (constant 2011 international $): Higher per capita income can increase the ability of businesses and citizens to make prepayment and finance the schemes to progress towards UHC and may have effect on health outcomes. Asiedu and *al.* (2015) by using GMM estimator to analyze the causal effect of income on health outcomes, find a positive and significant impact of GDP per capita on infant mortality rate and maternal mortality ratio. Clark (2011) also find a positive effect of GDP per capita on health outcomes.

People using at least basic sanitation services: Access to improved sanitations facilities has a fundamental effect on health outcomes. An insufficiency of sanitation contributes to about 10% of the global disease burden, causing mainly diarrhea diseases (Mara and *al.*, 2010). In 2000, diarrhea accounts for 22% of all deaths among under five mortalities in Sub-Saharan Africa (SSA) and 23% in South Asia (Morris and *al.*, 2003). Access to improved

sanitation is lower in Sub-Saharan Africa than in any other region. In 2015, only 25% of people living in SSA use at least basic sanitation services. We expect a positive impact of sanitation on health outcomes.

Birth attended by skilled health professional: Sub-Saharan Africa and South Asia have the lowest rate of birth attended by skilled health professional. The figures are respectively 59% and 40% in those regions. In Africa, health survey has shown a high prevalence of home delivery (Berhan and Berhan, 2014). We use this variable to capture access to health care for pregnant women, as well as the conditions in which they deliver. We expect a positive impact of birth attended by skilled health professional on health outcomes.

GDP growth: Economic growth is an important determinant of health outcomes. Pritchett and Summers (1996) using fixed effects-panel data models, find that economic growth reduce infant and child mortality. While mortality rates increase during recession (Rhum 2000 ; Rhum 2005 ; Rhum 2015).

4 Methodology

In this study, we employ the fixed effects panel instrumental variable method firstly because our dataset is of longitudinal type. Secondly, we control for the fixed effects since we are dealing with country level panel data which might have non-varying unobserved heterogeneity. Thirdly, we suspect that our variables of interest (government schemes health expenditures per capita; compulsory health insurance expenditures per capita and voluntary health insurance expenditures per capita) are endogenous. The reasons for the endogeneity are explained further below. Our estimation technique allows us to solve all the issues presented above. This is why it is appropriate to use it in this work.

The advantage of the panel data instrumental variable approach compared to the OLS regressions is that first it takes into account the unobservable heterogeneity which if not controlled for, makes the estimation endogenous. Second, the method of panel data instrumental variables technique, by using excluded instruments, allows us to test the causality impact of the health financing schemes (proxy for progress towards UHC) on health outcomes. That is because we are using valid excluded instruments, we can safely say that the causality goes from the health financing schemes on health outcomes and not the reverse.

It is difficult to capture the effects of progress towards UHC on health outcomes without considering a potential endogeneity bias. The endogeneity bias is explain by the fact that there may be unobservable variables that are correlated with a UHC and the health outcomes. These variables can affect both health outcomes and UHC in a given country, such as the Ebola epidemic in West Africa, which has had severe economic and health consequences for the countries affected. In our study, the potential endogeneity is may be due to a simultaneity bias; It can be explained by a looped relationship between progress towards UHC and health outcomes. As some countries have poor health indicators such as high under-five mortality, may decide to increase either the level of coverage in health services, or levels of financial protection, or both in order to address them. These potential endogeneities, if it is not considered in the regressions, could lead to biased estimated coefficients. To tackle the problem, we use a fixed effect with instrumental variables in panel data.

5   Econometric specification

We consider the following model where the dependent variable is health outcomes, $HealthOutcomes_{it}$ which depends on UHC_{it} considered potentially endogenous, and K_1 exogenous variables denoted by x_{1it} .

This model is our structural equation.

$$HealthOutcomes_{it} = \beta_1 UHC_{it} + x_{1it}\beta_2 + u_{it} \tag{1}$$

$$i = 1,....,N; \quad t = 1,...,T$$

The equation errors uit are presumed to be uncorrelated with $x_{1it}\beta_2$, and it is assumed to be correlated with UHC_{it} and then, our OLS estimator is inconsistent for β_1.

To get a consistent estimator we presume the existence of at least two instrumental variables denoted z_{1it} and z_{2it}. These instrumental variables need to be correlated with the UHC_{it} variable without being correlated with the error term u_{it}, and then we have $E(u_{it} \mid z_{it}) = 0$.

The instrumental variables we have, must be both correlated with UHC_{it}. In the first step, an auxiliary equation is estimated in which the variable UHC_{it} is regressed on all the exogenous variables.

$$UHC_{it} = x_{1it}\pi_1 + x_{2it}\pi_2 + v_{it} \tag{1.1}$$

In the first-step equation, we only have exogenous variables on the right-hand side. The exogenous variable x_{1it} used in equation 1.1 can be used as instruments for itself.

The equation 1 can be simplified and rewritten as follows:

$$HealthOutcomes_{it} = x_{it}\beta + \mu_{it} \tag{1.2}$$

Where the regressor vector $x_{it} = [UHC_{it} \ x_{1it}]$ associate endogenous and exogenous variables. And then, the vector of instrumental variables is $z_{it} = [x_{1it} \ x_{2it}]$.

The underlying idea behind the use of these two instrumental variables is that they do not directly explain the health outcomes, but they are the directs determinants of progress towards UHC. We use two variables as instruments for each of our three dependent variables. For government schemes health expenditures per capita, we use two variables as instruments. Those are: the share of tax revenue on GDP and the quality of regulation. The assumptions we make are as follow.

The share of tax revenue on GDP is an indicator of a country's ability to mobilize tax revenues. It is the total tax revenue excluding social security contributions and income from natural resources. The assumption we make is that the higher the level of tax revenue in a country, the more the country will have enough resources to finance progress towards UHC.

The quality of regulation is an essential determinant of progress towards universal health coverage. In most developing countries, there is a plurality of health care providers. The expansion of a private sector and in some cases an unreported sector of health care providers requires the establishment of an appropriate regulatory system. The regulation is necessary to ensure quality of care, control costs by the incentives mechanisms and to manage the equitable distribution of health professionals (Howard and *al.*, 2016).

For voluntary health insurance schemes health expenditures per capita, we use two instruments. Those are: the rule of law and the agriculture value added as a share of GDP. The assumptions we make are as follow.

The rule of law as instrument is a proxy of the ability of system and actors to respect the contracts wich is an important factor of progress towards UHC. Health coverage program usually works based on a care package that insureds have access to. This package of care is formalized in a contract. This contract lists the rights of the insured and an obligation to pay a contribution. This is also true when it comes to buying care from healthcare providers. The assumption we make is that when the rule of law is well established, people have greater confidence in the system, and in the case of voluntary membership, they have a greater

incentive to join the program. This increased of coverage will allow greater access to health care, needed to improve health outcomes.

Agriculture value added as a share of GDP is use as instrument to capture the instability of income. When the agriculture value added as a share of GDP is high, it is too hard to collect contributions because of the instability of income. As agriculture is practiced in rural areas where maternal and under-five mortality rates are higher. Income instability could compromise people's ability to join the health coverage program. This will reduce access to health care and lead to even higher mortality rates.

For compulsory health insurance schemes health expenditures per capita, we use two instruments. Those are: ***Unemployment rate*** as a share of total labor force, and the ***value added of manufacture***. When unemployment rate is high, it is difficult to collect contributions, and this has effect of increasing the uninsured people, thus reducing the level of access to care with the risk of rising maternal and under-five mortality rates. Value added of manufacture as a share of GDP is used as instrument to capture the proportion of private sector in GDP. We assume that the higher the value added of the private sector, the greater the ability of the economy to mobilize prepaid fund.

6   Results

In all the tables of results, we see that in our models, the validity of our instruments is assured. The same applies for the overidentifying restrictions, as demonstrated by the Hansen-Sargan test. This test allows us to not reject the null hypothesis and conclude that the overidentifying restriction is valid. For the weak identification test, the Stock and Yogo (2005) statistic allow us to reject the null hypothesis of weak instruments. In our models the instruments we use appears strong and fulfil the conditions of instruments validity. Finally, all standard errors are corrected for heteroskedasticity. The standard errors are therefore robust.

Government schemes: We present in Table 8 the results for the effect of government schemes on health outcomes. The IV-2SLS estimations results shows that the effect of government schemes on under-five mortality rate and maternal mortality ratio are statistically significant at 1% level. The results indicate that a higher government schemes health expenditure per capita has a sizable effect on health outcomes: a $100 increase of government schemes health expenditures per capita is leading to reduce the under-five mortality rate of 21.10 per 1000 (Table 8) as well as decreases of around 27.1 per 100 000 the maternal mortality ratio (Table 8).

Voluntary health insurance schemes: Table 9 shows estimated effect of voluntary health insurance schemes expenditures per capita on health outcomes. Both estimates are statistically significant at 1% level. The panel data IV-2SLS estimation indicate that an increase in voluntary health insurance schemes per capita strongly reduces the under-five mortality rate and maternal mortality ratio: a $100 increase in voluntary health schemes expenditures per capita reduce under -five mortality rate of 203 per 1000 as well of 964 per 100000 maternal mortality ratio. These effects are substantially important than the effect of government schemes expenditures per capita on health outcomes.

Compulsory health insurance schemes: Table 10 shows that compulsory health insurance schemes have no effect on health outcomes. This is likely due to the very low level of wage-indexed social contributions in low and middle-income countries.

Table 3 presents a descriptive statistics of the health financing schemes by world bank income group and region. Data shows that for low and middle income countries, government schemes health expenditures per capita is quite important than compulsory health insurance schemes and voluntary health insurance schemes. We also notice that for both world bank income group and region, compulsory health insurance schemes expenditures per capita are too lower that the two other health financing schemes. This is not surprising because in low

and middle income countries, particularly in Sub Saharan Africa, the proportion of prepaid health expenditures covered by voluntary health insurance like community based insurance and complementary or supplementary insurance schemes is quite important. These elements also explain the facts that the effects of voluntary health insurance on health outcomes is too significant.

Other covariates: The results for our covariates are in line with our expectations and are statistically significant. The access of sanitation appears to be strongly reducing under five-mortality rate and maternal mortality ratio. For our first model using government schemes as variable of interest, a 1% increase of sanitation access lead to reduce under-five mortality rate for 3 per 1000 as well as decrease of 8 per 100000 of maternal mortality ratio. Higher immunization coverage and birth attended by skilled health professional are found to be associated with lower health outcomes. But these effect on health outcomes is limited. Higher economic growth is found to be associate to better health outcomes. The magnitude of the coefficient is more important than other covariates except for sanitation access. A 1% increase of economic growth reduces the under- five mortality rate by 2.6 per 1000 and maternal mortality ratio by 5.31 per 100000. We present in Table 11 in Appendix the summary of our results for the effect of the three health financing schemes for comparative needed. Our results show that government schemes and voluntary health insurance schemes leads to better health, while compulsory health insurance schemes have no effect on health outcomes.

Our findings match with the results found by Moreno-Serra and Smith (2012) who's also studied the effect of progress towards universal health coverage on population health. Using panel data with instrumental variables, Moreno-Serra and Smith found that government spending improve health outcomes. For instance, a $100 increase in government health spending per capita reduce under-five mortality rate by 13.2 per 1000. Our study indicates that a $100 increase of government schemes health expenditures per capita reduce under-five

mortality rate of 21.10 per 1000. However, unlike Moreno- Serra and Smith (2012) who's no found effect of voluntary health insurance on health outcomes, our results indicate that VHI strongly reduce under-five mortality rate. For instance, a $100 increase in voluntary health schemes expenditures per capita lead to reduce under -five mortality rate of 203 per 1000. This difference is probably due to our instrumentation strategy and the relevance of our instruments. More generally, OECD (2016) also indicate that health spending (used as proxy for universal health coverage) contributed to increase life expectancy to about 1 year in OECD countries between 1990 to 2013.

Effect of inequality

The literature shows that voluntary health insurance schemes could exclude individuals who do not have a great ability to pay. We therefore choose the model with voluntary health schemes as variable of interest to understand the effect of income inequalities on health outcomes. For this, we choose three variables: income share held by lowest 10%, income share held by highest 10% and the interdecile ratio11 to measure the effect of income inequality between the rich and the poor. Table 12 shows the effect of voluntary health insurance on health outcomes using the income share held by lowest 10%. When income share held by lowest 10% increased by 1%, under-five mortality rate decreased by about 256 per 1000 as well as maternal mortality ratio decreased by 816 per 100000. At the same time, we found that the effect of voluntary health schemes (VHS) on under-five mortality rate divided by 2 and by 3 for maternal mortality ratio. In a second regression, we include the income share held by highest 10% variable. The results are summarized in Table 10. We found that when the income share held by highest 10% increased by 1%, under-five mortality rate decreased by 429 per 1000 as well as maternal mortality ratio decreased by 142 per 100000. Finally, when we include

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[11] The interdecile ratio was obtained by dividing the decile of the richest 10% by the poorest 10%

the interdecile ratio, we found that a 1% increased in inequality lead to increased under-five mortality rate by 12 per 1000 as well as increased maternal mortality ratio by 60 per 100000 (Table 11 in Appendix).

Testing the threshold effect of progress towards UHC on health outcomes

To test if there is the threshold effect of progress towards UHC on health outcomes, we generate the squared of variable used as proxy for UHC. In this case we take the government schemes health expenditures per capita as proxy for UHC. We include it the same regression the squared of government schemes health expenditures per capita and the government schemes health expenditures per capita variable. Table 18a, 18b show that the effect of government schemes health expenditures per capita on health outcome remain the same, and the coefficient of the variable squared of government schemes health expenditures per capita is not significant. This indicate that there is no threshold effect of government schemes health expenditures per capita on health outcome. This confirm the assumption we make that the effect is linear.

7   Conclusion

The aim of this study was study the causal effect of progress towards universal health coverage on improving health outcomes.

We use a large panel dataset available at country level for 139 low and middle-income countries between 2000 – 2015. In order to adress our research question, we use IV-2SLS to estimates the effect of progress towards UHC on under-five mortality rate and maternal mortality ratio. Our results strongly indicate that progress towards UHC is lead to better health outcomes, except for compulsory health insurance schemes for wich the effect is not significant. This is probably due to the low level of compulsory health insurance schemes expenditures per capita in low and middle income countries, because of the importance of informal sector.

The effect of voluntary health insurance schemes on health outcomes is ten time higher than the effect of government schemes. This is due to multiple reasons: voluntary health insurance members have access to a larger package of health services than the public system. They are more demanding to a better quality of care than members of a public system. They receive preferential treatment, receive more attention, and eventually receive better quality of care and shorter waiting times. Because of pregnant women and children are sensitive to better quality of care, more effective antenatal care, voluntary health insurance schemes have a strong effect on under-five mortality rate and maternal mortality ratio. People who join voluntary health insurance plans are those who have a strong ability to pay. We can therefore consider that these people, given their income level, have better health. In these conditions, the risk of maternal and under-five mortality rates is already quite low.

Our study has several policy implications: Although voluntary insurance schemes lead to better health, we are not suggesting that this path be taken to move towards universal health

coverage. This is because they exclude people who do not have a strong ability to pay and use regressive funding mechanisms. The most appropriate ways for low and middle- income countries to improve health with equity through universal health coverage are to prefer government schemes. It is the best way to reduce inequalities.

We also shown that access of sanitation lead to better health outcomes. Its effect on under-five mortality and maternal mortality ratio is too high than the effect of government schemes. When government schemes expenditures per capita increased by 10%, under-five mortality rate decreased by about 2.1 per 1000 as well as maternal mortality ratio decreased by 2.1 per 100000. In contrast, when access of sanitation increased by the same proportion under-five mortality rate decreased by about 33 per 1000 and maternal mortality ratio by 81 per 100000. Even though 68% of the world's population uses improved sanitation, WHO estimated that 892 millions of people still defecate in the open air, for example in street gutters, or in water courses. In the context of progress towards UHC, low and middle-income countries need to invest more to improved access of sanitation that have a significant impact in reducing under-five mortality rate and maternal mortality ratio. Effect of birth attended by skilled health professional and physicians are also important in the context of progress towards UHC. The periods when the best health outcomes were achieved in developed countries in the context of universal health coverage, were periods of strong economic growth. We find that the rate of economic growth has the same positive effect on health outcomes in low and middle-income countries. This implies that economic policies leading to a strong, stable and inclusive economic growth rate must be adopted.

Finally, future research is needed to explore mixed effect of government schemes and voluntary health insurance schemes, government schemes and compulsory health insurance schemes and the mixed effect voluntary health insurance schemes and compulsory health insurance in low and middle-income countries. Future research also should deal with the effect

of unobservable factors like the cost of transport necessary for access to health services, and we need to explore the effect of these programs on inequalities.

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Appendix

Table 5: Percentage change in Government schemes on health outcomes, by region and income group, 2000 – 2015

Region/ Income	Government schemes	UMR	MMR
Region			
East Asia & Pacific	75	-43	-50
Europe & Central Asia	149	-58	-45
Latin America & Caribbean	194	-42	-26
Middle East & North Africa	40	-46	-30
South Asia	88	-47	-57
Sub-Saharan Africa	107	-47	-36
Income			
Low-Income	75	-50	-511
Lower Middle-Income	58	-36	-74
Upper Middle-Income	56	-17	-8

Source: Author

Table 6:   Percentage change in voluntary health insurance schemes on health outcomes, by region and income group, 2000 – 2015.

Region/ Income	Voluntary health insurance schemes	UMR	MMR
Region			
East Asia & Pacific	153	-43	-36
Europe & Central Asia	62	-58	-46
Latin America & Caribbean	121	-42	-26
Middle East & North Africa	13	-46	-30
South Asia	224	-47	-58
Sub-Saharan Africa	153	-47	-36
Income			
Low-Income	121	-50	-415
Lower Middle-Income	139	-36	-20
Upper Middle-Income	18	-17	6

Source: Author

Table 7: Percentage change in contributory compulsory health insurance schemes on health outcomes, by region and income group, 2000 – 2015

Region/ Income	Compulsory hea	UMR	MMR
Region			
East Asia & Pacific	169	-43	-36
Europe & Central Asia	464	-58	-46
Latin America & Caribbean	183	-42	-26
Middle East & North Africa	195	-46	-30
South Asia	105	-47	-58
Sub-Saharan Africa	3	-47	-36
Income			
Low-Income	17.98	-50	-415
Lower Middle-Income	64.13	-36	-20
Upper Middle-Income	154.39	-17	6

Source: Author

Table 8: Direct effect of Government schemes on health outcomes

VARIABLES	UMR	MMR
Government schemes	-0.211***	-0.277***
	(0.0307)	(0.0936)
Sanitation access	-3.333***	-8.175***
	(0.479)	(1.541)
Births attended skilled	-0.330 **	-1.834***
	(0.158)	(0.605)
Immunization DTP	-0.664***	-1.167***
	(0.145)	(0.376)
GDP growth	-2.680***	-5.316***
	(0.514)	(1.648)
Observations	528	528
R-squared	0.828	0.888
Number of id country	139	139
UnderidtestPV	0.0849	0.0849
Weakidenttest	7.675	7.675
HansenJstat	0.0601	0.276

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 9: Direct effect of voluntary health insurance schemes on health outcomes

VARIABLES	UMR	MMR
Voluntary health schemes	-2.031***	-9.648**
	(0.637)	(3.787)
Sanitation access	-1.798**	-3.294
	(0.769)	(2.352)
Births attended skilled	-0.266*	
	(0.147)	
Immunization DTP	-0.561***	-3.722***
	(0.183)	(1.256)
GDP growth	-2.452***	-5.756*
	(0.705)	(3.419)
Observations	512	485
R-squared	0.775	0.419
Number of id country	139	139
UnderidtestPV	0.0606	0.0481
Weakidenttest	4.328	5.895
HansenJstat	0.574	0.241

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 10: Direct effect of compulsory health insurance on health outcomes

VARIABLES	UMR	MMR
Compulsory contributory health insurance schemes	-0.137	-0.240
	(0.196)	(0.850)
Sanitation access	-1.136***	
	(0.358)	
Immunization DTP	-0.929***	
	(0.350)	
GDP growth	-0.176	-19.04***
	(0.474)	(3.779)
Nurses and midwives	2.578	
	(1.897)	
Physicians		-51.84**
		(24.20)
GDP per capita		46.34
		(82.58)
Births attended skilled		-8.284***
		(1.710)
Observations	453	429
R-squared	0.786	0.802
Number of id country	121	115
UnderidtestPV	0.281	0.628
Weakidenttest	2.217	0.262
HansenJstat	0.484	0.347

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 11 : Summary of results

Health Financing schemes	Under-five mortality rate	Maternal mortality ratio
Government schemes	(-) 21.10 per 1000	(-) 27.10 per 100.000
Compulsory health insurance schemes	No effect	No effect
Voluntary health insurance schemes	(-) 203 per 1000	(-) 964 per 100.000

Notes : The table presents the results of the effect of each health financing schemes on health outcomes, for $100 increase for the corresponding health financing schemes expenditures per capita. No effect = no statistically significant effect is found in the baseline model.

Table 12: Effect of VHS on health outcomes: income held by lowest 10% use as covariates

VARIABLES	UMR	MMR
Voluntary health schemes	-1.041***	-2.795**
	(0.221)	(1.224)
Sanitation access	-1.491***	-6.383***
	(0.313)	(1.220)
Births attended skilled	-1.426***	-5.079***
	(0.124)	(1.013)
Immunization DTP	-0.280***	
	(0.0936)	
lowest 10	-25.68***	-81.60**
	(7.607)	(37.71)
Observations	453	347
R-squared	0.970	0.907
Number of id country	124	111
UnderidtestPV	0.148	0.212
Weakidenttest	340.8	4.082
HansenJstat	1.480	0.146

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 13: Effect of VHS on health outcomes: income held by richest 10% use as covariates

VARIABLES	UMR	MMR
Voluntary health schemes	-0.526***	-1.407
	(0.153)	(0.917)
Sanitation access	-1.067***	-5.346***
	(0.310)	(1.379)
Births attended skilled	-1.704***	-5.913***
	(0.250)	(1.388)
Immunization DTP	-0.169*	
	(0.0866)	
highest 10	-4.295**	-14.21*
	(1.721)	(8.307)
Observations	456	402
R-squared	0.962	0.907
Number of id country	129	107
UnderidtestPV	0.167	0.199
Weakidenttest	252.3	3.749
HansenJstat	2.067	0.460

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 14: Effect of VHS on health outcomes: using interdecile ratio as covariate

VARIABLES	UMR	MMR
Voluntary health schemes	-0.411***	-0.926**
	(0.143)	(0.427)
Sanitation access	-1.180***	-3.960***
	(0.143)	(0.517)
Births attended skilled	-1.439***	-6.757***
	(0.0903)	(0.283)
GDP growth	1.188	
	(0.832)	
Inequality	1.294***	6.066***
	(0.150)	(0.750)
Immunization DTP		0.108
		(0.0710)
Observations	482	347
R-squared	0.993	0.983
Number of id country	127	109
UnderidtestPV	0.257	0.156
Weakidenttest	32.38	181.9
HansenJstat	0.218	1.146

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 15: List of country where VHI schemes is 0

Country	Corresponding year
Libya	2000; 2005
Myanmar	2000
Samoa	2000
Solomon Island	2000 to 2015

Source: Author

Table 16: List of country where contributory compulsory health insurance schemes is 0

Country	Corresponding year	Country	Corresponding year
Afghanistan	2005; 2010; 2015	Madagascar	2000 - 2015
Angola	2000 - 2015	Malawi	2000 - 2015
Bangladesh	2000 - 2015	Maldives	2000; 2005
Belize	2000; 2005	Mauritius	2000 - 2015
Bhutan	2000 - 2015	Morocco	2000; 2005
Botswana	2000 - 2015	Namibia	2000 - 2015
Brazil	2000 - 2015	Nepal	2000; 2005; 2010
Cambodia	2000; 2005	Papua New Guinea	2000 - 2015
Central Afrian Republic	2000 - 2015	Samoa	2000 - 2015
Chad	2000 - 2015	Sao Tome and Principe	2000; 2005; 2010
Cuba	2000 - 2015	Solomon Island	2000 - 2015
Dominica	2000 - 2015	South Africa	2000 - 2015
Equatorial Guinea	2000 - 2015	Swaziland	2000 - 2015
Egypt	2000 - 2015	Tadjikistan	2000 - 2015
El Salvador	2000 - 2015	Timor Leste	2005; 2010; 2015
Eritrea	2000 - 2015	Togo	2000; 2005; 2010
Fiji	2000 - 2015	Tonga	2000 - 2015
Georgia	2000 - 2015	Tuvalu	2000 - 2015
Ghana	2005	Uganda	2000 - 2015
Grenada	2000 - 2015	Ukraine	2000 - 2015
Iraq	2005; 2010	Vanuatu	2000 - 2015
Jamaïca	2000	Zambia	2000 - 2015
Kiribati	2000 - 2015	Zimbabwa	2010; 2015
Liberia	2000 - 2015		

Source: Author

Table 17: variables, description and source

Variables	Description	Source
Outcomes		
Under-5 mortality rate	Mortality rate, under-5 (per 1,000 live births)	WDI(World Bank 2015)
Maternal mortality ratio	Maternal mortality ratio (national estimate, per 100,000 live births)	Unicef (Unicef, 2018)
Regressors		
Gvschemes compulsory	Government schemes expenditures per capita, PPP	GHO data , WHO(2018)
Voluntary health insurance schemes	Voluntary health insurance schemes expenditures per capita, PPP	GHO data , WHO(2018)
Compulsory health insurance schemes	Compulsory contributory health insurance schemes expend per capita,PPP	GHO data , WHO(2018)
Water Access	People using at least basic drinking water services (% of population)	WDI(World Bank 2015)
Sanitation access	People using at least basic sanitation services (% of population)	WDI(World Bank 2015)
Tax revenue as GDP	Tax revenue as a share of GDP	IMF data (2018)
Nurse and midwives	Nurses and midwives (per 1,000 people)	WDI(World Bank 2015)
Physicians	Physicians (per 1,000 people)	WDI(World Bank 2015)
Regulatory Quality	Quality of regulation	WGI (2016)
GDP per capita	GDP per capita, PPP	WDI(World Bank 2015
GDP growth	GDP growth (annual %)	WDI(World Bank 2015
Birth attended by skilled	Births attended by skilled health staff (% of total)	Unicef (2018)
Immunization, DTP	Immunization, DPT (% of children ages 12-23 months)	WHO, Unicef (2018)
Lowest 10%	Income share held by lowest 10%	WDI(World Bank 2015)
Highest 10%	Income share held by highest 10%	WDI(World Bank 2015)
Inequalities	Interdecile ration D9/D1	Author calculation

Source: Author

Table 18a: Testing the threshold effect of government schemes health expenditures per capita on health outcomes

VARIABLES	UMR
Government_schemes	-0.584**
	(3.186)
Government_schemessq	0.00496
	(0.0214)
sanitation_access	-1.866
	(1.804)
Immun_DTP	-3.388
	(11.93)
GDP_growth	0.685
	(14.61)
GDPpercapita	0.0152
	(0.0606)
Physicians	35.18
	(164.1)
Observations	32
R-squared	-0.253
Number of id_country	13

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 18b: Testing the threshold effect of government schemes health expenditures per capita on health outcomes

VARIABLES	UMR
Government_schemes	-0.279**
	(0.374)
Government_schemessq	0.00103
	(0.00101)
sanitation_access	-3.286***
	(1.003)
Births_attended_skilled	0.444
	(0.300)
Immun_DTP	-0.234
	(0.533)
GDP_growth	-0.521
	(3.348)
GDPpercapita	-0.00960
	(0.0155)
Observations	23
Number of id_country	9
R-squared	0.795

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Conclusion Générale

Dans cette section, nous présentons les conclusions détaillées de cette thèse consacrée au progrès vers la couverture universelle de santé dans les pays à revenu faible et intermédiaire.

Réduire les paiements directs ne demeure pas seulement une priorité pour les Etats uniquement dans le but de protéger les individus et les ménages contre les conséquences financières liées à l'accès aux soins, mais s'inscrit dans un mouvement d'ensemble de réduction de la pauvreté. Le chapitre 1 de cette thèse permet de déterminer l'effet des paiements directs sur la pauvreté dans soixante six (66) pays à revenu faible et intermédiaire, et met en exergue l'effet négatif que les paiements directs peuvent avoir sur la pauvreté.

L'effet des paiements directs sur la pauvreté est largement abordé par la littérature. Cependant, celle-ci ne s'intéresse qu'aux effets micro-économiques. Certes, la mesure de la pauvreté s'avère complexe, du fait de sa multidimentionnalité. Dans notre étude, nous avons choisi d'aborder la pauvreté par sa dimension monétaire. Ce chapitre vise deux principaux objectifs :

- D'une part, il s'agit avant tout de mettre en exergue la nécessité de progresser vers la couverture universelle de santé en raison des conséquences négatives que peuvent avoir les paiements directs sur la pauvreté. Pour cela, nous utilisons trois indicateurs de pauvreté (la profondeur de la pauvreté, la sévérité de la pauvreté, et l'intensité de la pauvreté), et deux seuils de pauvreté (\$1.90 et \$3.10).

- D'autre part, il s'agit de mettre en evidence l'effet des facteurs socioéconomiques, démographiques et institutionnels sur la pauvreté.

Deux seuils de pauvreté sont considérés, à savoir 1,90 \$ et 3,10 \$ par jour. Les paiements directs sont exprimés en tant que part de la consommation finale des ménages afin de tenir compte de la charge que peuvent représenter les paiements directs sur les ressources financières des ménages. Le modèle a été contrôlé pour d'autres facteurs susceptibles d'affecter la pauvreté. Il s'agit des facteurs démographiques, socio-économiques, institutionnels, publics et de financement de la santé.

En outre, dans nos estimations, les problèmes d'endogénéité liés à la variable des paiements directs sont traités en utilisant la méthode des variables instrumentales.

Nos résultats suggèrent que les paiements directs augmentent considérablement la profondeur, la sévérité et l'intensité de la pauvreté dans les pays à revenu faible et intermédiaire, avec un impact négatif plus significatif sur la sévérité de la pauvreté, en affectant plus amplement les personnes les plus pauvres. Il apparaît donc que la charge des paiements directs est plus élevée pour les plus pauvres. Ces résultats ont été soumis à une multitude de tests qui ont confirmé leur robustesse.

Le deuxième essai analyse l'effet des recettes du gouvernement en pourcentage du PIB sur la probabilité pour les pays à revenu faible et intermédiaire de progresser vers la couverture universelle de santé. Au terme de cette étude, nous constatons que plus la capacité de mobilisation des ressources est élevée, plus la probabilité de progresser vers la couverture universelle de santé est grande. Aussi, nous constatons que les pays qui ont davantage progresser vers la couverture universelle de santé accordent une plus grande priorité à la santé dans la définition de leur budget. Ainsi, plus les dépenses publiques de santé en pourcentage des dépenses totales du gouvernement sont importantes, plus la probabilité de progresser vers la couverture universelle de santé est grande. Fait notable, l'analyse menée pour cerner la spécificité des pays riches en ressources naturelles met en évidence que ces pays ont tendance à mobiliser davantage de recettes du gouvernement que les autres pays. Néanmoins, nous constatons que bien que le fait d'être un pays riche en ressources naturelles engendre des recettes plus importantes, ce n'est pas pour autant que ces pays progressent plus amplement vers la couverture universelle de santé, comparé aux pays moins dotés en ressources naturelles pour lesquels les revenus sont plus volatiles. En toutre certains pays bien que riches en ressources naturelles, ne mobilisent que très peu de recettes. Ce qui implique que pour atteindre cet objectif, les PRFI devraient mettre l'accent sur des réformes améliorant leur mécanisme de gestion et les insitutitons qui les encadrent. En effet, la qualité de la régulation apparait comme un déterminant incontournable à la progression vers la couverture universelle de

santé. Plus la qualité de la régulation est forte, plus la probabilité de progresser vers la couverture universelle de santé est élevée. Pour tester la robustesse de ces résultats, plusieurs modèles économétriques ont été utilisés, et nous arrivons à la conclusion que la mobilisation des recettes du gouvernement (en pourcentage du PIB) est indispensable pour progresser vers la couverture universelle de santé.

Le résultat emblématique de ce chapitre est de déterminer le seuil minimum de recettes du gouvernement en pourcentage du PIB que les pays devraient mobiliser pour amplement progresser vers la couverture universelle de santé. Ce seuil est de l'ordre de 23%.

Dans notre échantillon, nous observons qu'en moyenne, les dépenses publiques de santé représentent 10.48% des dépenses totales. Pourtant, nos résultats indiquent que les pays qui ont davantage progressé vers la couverture universelle de santé accordent une plus grande priorité aux dépenses de santé dans les dépenses totales du gouvernement. Il en est de même pour la qualité de la régulation. Cette dernière est fondamentale pour assurer un progrès vers la couverture universelle de santé. Enfin, les pays à revenu faible et intermédiaire devraient davantage porter attention à la volatilité des ressources et des dépenses publiques. En effet, il apparait qu'une hausse de la volatilité des recettes du gouvernement réduit la probabilité de progresser vers la couverture universelle de santé dans ces pays. Ce résultat est aussi valable pour l'instabilité des dépenses publiques.

Le troisième essai porte sur les effets du progrès vers la couverture universelle de santé sur l'état de santé dans les pays à revenu faible et intermédiaire. Pour mieux appréhender ces effets dans le contexte des pays à revenu faible et intermédiaire, nous utilisons comme proxy du progrès vers la couverture universelle de santé, les différents mécanismes utilisés par ces pays pour progresser vers la couverture universelle de santé. Il s'agit notamment des dépenses de santé par habitant des programmes gouvernementaux, les dépenses de santé par habitant des systèmes d'assurance obligatoire, et les dépenses de santé par habitant des systèmes d'assurance volontaire. Nos résultats indiquent que le progrès vers la couverture universelle de santé conduit à une amélioration substantielle de l'état de santé, excepté les systèmes d'assurance obligatoire. L'absence

d'effet des systèmes d'assurance obligatoire sur l'état de santé peut paraître surprenante dans la mesure où on peut estimer qu'une assurance à adhésion obligatoire inclut tous les types de profils, sains ou malades, riches ou pauvres. Il apparait néanmoins que ces systèmes sont très marginaux dans les pays à revenu faible et intermédiaire. Le moyen le plus approprié que nous suggérons pour progresser vers la couverture universelle de santé est les systèmes gouvernementaux d'assurance santé. Cela pour plusieurs raisons. Ce sont des systèmes non contributifs, où le droit aux soins ne dépend pas de la contribution ou non des individus. Dans la mesure où les financements sont prépayés, financés par les impôts, il n'y a pas de lien entre le revenu des individus et leur accès aux soins. Ce système permet en outre des subventions croisées. Enfin, il est le plus équitable des trois systèmes étudiés. D'autres facteurs sont des déterminants de l'état de santé et dans le contexte du progrès vers la couverture universelle de santé, les pays à revenu faible et intermédiaire doivent porter une grande attention sur les accouchements en présence de personnel médical qualifié. Ces deux éléments sont indispensables pour assurer un meilleur suivi prénatal et un accouchement dans les meilleures conditions.