The University of Sydney
Faculty of Arts and Social Sciences

Master Of Economics

'Does wealth affect health?
Insights through Instrumental analysis'

Submitted by:

Anitya Prabhudas Umare

(510256562)

Supervisor: **Prof. Chandana Maitra**

A thesis submitted in fulfilment of
the requirements for the degree of
Masters of Economics

12th November, 2022

Acknowledgement

I would like to extend my sincere gratitude to *professor* **Chandana Maitra** for all the support and guidance. I am very much grateful for the special topic: “Health-wealth Nexus on women”, and especially to work on developing countries, with rich datasets such as demographic and health surveys. I would also like to thank all the *tutors* especially **Alex Berger** and **Ning Xu** who helped me with research through the semester, without whom this project would not have been possible.

Abstract

The world is progressing in terms of innovation and research in all areas, including health, education, and a more modern approach to reducing gender and social inequality. However, many nations are still on the verge of providing adequate healthcare facilities, quality education, and assistance during difficult times (Akin, J.S., Birdsall, Ferranti, D.M. 1987). In Pakistan, where the socioeconomic gradient of health appears to be dependent on multiple factors, recent surveys by demographic and health surveys reveal a decline in women's access to basic needs compared to men at home or in general (Mustafa et al., 2015). This factor worsens further when demographic and wealth indexes are considered. This paper attempts to determine the causal inference of women based on the socioeconomic gradient by health using the Instrumental variable. Discerning regarding the effect of wealth on women's health when based on variables such as wealth, status, educational attainment, household control, healthcare, and number of children. To evaluate the concerns of endogeneity and reverse causality, this paper employs an Instrumental approach and 2sls robust estimation method. The paper utilises Pakistan's (2017-18) demographic and health survey data, with body mass index serving as a health indicator and overall wealth score as an endogenous parameter. Strong evidence indicates that controlled results have a significant impact on health; however, additional evidence is required to quantify model results by identifying the influence of precise control variables. The paper demonstrates a strong correlation between health and wealth using an empirical approach.

Introduction

The advancement of a nation is proportional to the health of its citizens (World Health Organization, 2015); consequently, health is regarded as a fundamental right worldwide. Numerous models, such as endogenous growth (Zon & Muysken, 2001), Grossman, and literature (National Institute of Child Health and Human Development (US), 2000), emphasise the importance of health linking to human development growth by closing social, cultural, inequity, and environmental gaps. Significant findings from (Gilthorpe et al., 2003) demonstrate that deprivation may have lasting effects on wealth, education, low IQ, and mortality rate. Whereas the impact is greater in the case of women, (Cabaillot et al., 2022) the results are associated with poor child development and lifelong progress. In addition, the socioeconomic gradient reveals significant variations in health-related behaviours, risks, and expenses (Dupas 2011). In addition, there have been significant differences in health outcomes between developing and developed nations; much of this can be attributed to the advancement of women and the rise of gender inequality. Based on decision-making, learning opportunities, income distribution, and wealth accumulation, women have a low social status, which keeps them apart from mainstream social status, as suggested by Cohen (2006).

This paper examines the health-wealth nexus among women in order to reduce causal inferences and validate the effect. Given the socioeconomic gradient, it would be difficult to justify the direction of impact and associated factors. The direction of causality could be from health to wealth, or vice versa (Meer, Miller, Rosen, 2003). In a separate argument, (Dutta et al., 2020) assert that caste in a social hierarchy has a significant impact on health and wealth. On the basis of Pakistan's demographic and health survey data, a measure of wealth-health can

be derived from questions on health activities, living region, number of resources, inheritance, education, and wealth factor score. This paper uses data on body mass index (v445) and total wealth score (v190) approached via Instrumental Variables to validate endogeneity and estimate reverse causality. The article includes all significant factors, such as healthcare facility, education, BMI, early marriage, number of children carrying and pregnant, and employment status, that are directly or indirectly related to the nexus. Moreover, the paper establishes not only the effect on health, but also the effect on the financial situation under various living conditions. In light of impending issues, the purpose of this research is to establish the causal relationship between health and wealth gradient, particularly in developing nations such as Pakistan, by taking into account numerous pervasive and influential controlling factors.

Previous Literature

As a result of the creation of new technologies, the expansion of economies, and globalization, the world is advancing at an accelerated rate. Several nations are establishing new benchmarks in the fields of health care, education, and research. As a result, many nations are developing, but when men and women, educational attainment, and employability are compared, it is clear that there are significant differences between nations. Many developing nations continue to address issues such as the advancement of women, the reduction of fertility and mortality rates, the provision of adequate nutrition, and the reduction of inequality. However, wealthy households appear to have a higher standard of living due to affordability and early illness diagnosis as a result of easy access to splitting healthcare services. According to (Mirowsky, 2017), there are a number of additional variables that vary by region, social status, and educational level.

Numerous studies, such as (Semyonov, Epstein, Maskileyson, 2013), have examined the relationship between wealth and health, arguing that wealthy individuals have easier access to resources, whereas the health of the poor declines. In addition, despite the fact that this study was conducted in a developed nation, many developing nations tend to rely on subpar healthcare systems and poor technological advancements, allowing wealthy individuals to seek support from outside sources while forcing others to rely poorly due to insufficient resources and income. According to (Dey, Nambiar, Sheikh et al., 2012), there has been a significant increase in infant mortality, a decline in mortality, and widespread morbidity. Which has a variety of societal repercussions, including a diminished labour force, deteriorating mental health, and increased medical resource consumption.

Multiple studies, such as (Deaton 2002) and (Wilkinson & Pickett 2008), have investigated the wealth and health gradient in relation to income, education, and healthcare using various methodologies. Similar to the literature (Adams, Hurd, and Macfadden, 2003), the inference was made under socioeconomic status, inventions, and mortality. A paper such as (Hanandita & Tampubolon, 2014) attempted to establish a connection between mental health and poverty, deducing a strong negative relationship by demonstrating the casual influence of health knowledge and behaviour on mental health. In addition, (Hartog and Hessel, 1997) contend that IQ influences health but not wealth or happiness, whereas family background increases wealth but not health or happiness. Few studies have been conducted on developing nations due to a lack of reliable data, and the studies that have been conducted have primarily

focused on a few underlying factors. Numerous studies (Hargreaves, Morison, Gear, Kim, Makhubele, Porter, Watts, and Pronyk, 2007) have been conducted to determine the most effective methods of data collection in developing countries; however, they have largely failed to get to the root of the problem.

In the context of the health-wealth gradient, (Husain, Dutta, and Chowdhary, 2014) reports that there is causation on both sides. Wealth deprivation leads to ignorance of healthcare access, which tends to foster the development of chronic diseases and raises the mortality rate. While underdeveloped nations lack a healthy physical and mental development of their children, which keeps them impoverished for a lifetime. In addition, numerous studies assert that external proxy variables, such as culture, social hierarchy, and racial outcomes, exert substantial causal influence on both health and wealth (Barr 2014).

Data

The literature is based on Demographic and Housing Data collected every few years from around the world using various questionnaires. The data obtained based on demographic areas, direct and indirect fertility, major components of health factors, employability, and educational level contains 5,333 variables and 15,068 observations on topics ranging from women's health to child care. This data, however, is from an individual record and excludes other datasets that are irrelevant to this study, such as household, men's, fieldwork, survey, and community data. This cross-sectional data was collected in 2017-18 by surveying all genders, with a particular focus on children under five and women aged 15 to 49.

The paper utilises cross-sectional data on Pakistan (2017-18) obtained from demographic and health surveys, which includes information on health behavior, healthcare access, previous co-morbidities, living standards, region affiliation, and wealth status. Taking into account the breadth of health indicators across datasets, the paper selects body mass index (BMI) as a response variable where the data is long-linearised. Due to the anomalies in the dataset, data about pregnant women with less than two months gestation were omitted. Substantial missing data can be seen all across variables i.e. 9, 740 for BMI. (Roy et al., 2019) and (Nuttall, 2015) indicate that obesity and malnutrition are strongly correlated with the weight-height ratio. In addition, BMI provides a basic understanding of the causes of obesity and undernourished households, which are indirectly related to living standards and wealth status. In addition, the dataset includes the wealth all factor index as an explanatory variable, where factor index refers to the normalised scores based on all combined wealth indicators. The wealth indicator illustrates the economic success of a nation based on the amount of utilities used by households, inheritance received, government transfers, and wealth accumulated.

In addition, the paper considers a number of control variables that affect health based on educational attainment in relation to basic healthcare access, marriage to first birth interval, employability, place of residence, number of visits to a health facility in the previous year, and number of surviving children. Taking into account the endogeneity of the model and the fact that these control variables explain women's health, they were selected.

Finally, some proxy variables relating to basic needs of life were included, such as water source, toilet facility, electricity use, and fuel use. To validate the reverse causality, the 'exposure to media' instrument is utilized, which measures only the exposure to information consumed while watching television and not consumption. Due to the lack of data, the model disregards newspaper reading and radio listening, as well as media consumption as a whole due to the possibility of causality with health. Instrument was recoded from a categorical variable to a dummy variable in which 'Watching once per week' is considered positive (1) and none (0) otherwise.

Table 1: variables Summary statistics of the variables

Variable	***Description***	***Mean***	***Standard deviation***	***Min***	***Max***
Health (v445)	Body mass index	2585.143	582.574	1293	9998
Wealth (v190)	Wealth index combined	3.004115	1.412329	1	5
v106	Highest educational level	0.9944916	1.140043	0	3
v714	Respondent currently working	0.1374618	0.3443457	0	1
v102	Type of place of residence	1.518582	0.4996712	1	2
v221	Marriage to first birth interval (months)	34.10428	93.11956	0	996
v394	Visited health facility last 12 months	0 .736891	0.4403357	0	1
v219	Living children + current pregnancy	3.211641	2.256354	0	14
v113	Source of drinking water	25.84889	19.12635	11	97
v116	Type of toilet facility	17.8236	15.72755	11	97
v119	Household has: electricity	1.09392	1.030826	0	7
v161	Type of cooking fuel	8.162905	15.28657	1	97
s1107a	Currently use any type of drugs	0.0321274	0.1763444	0	1
(Instrument) TV	RECODE of v159 (frequency of watching television)	0.4861618	0.4998251	0	1

Empirical Strategy

As presented in Table (1), the paper employs 'TV,' i.e. the recoded dummy variable of the categorical variable 'frequency of watching television,' as an instrumental variable (IV) to account for the endogeneity problem and validate the two major issues with wealth as an endogenous variable. First, examine the confounding effect, in which the error term largely explains the model or zero conditional mean. The second possibility is that health explains wealth, creating a reverse causality. Consequently, in order to account for endogeneity, the exogenous variable 'TV' is included in equation (2). In addition, an IV is an exogenous variable that strongly correlates with the endogenous variable to produce effects on the response variable.

$$\text{Health} = \beta_0 + \beta_1 \text{Wealth} + \beta_2 x_1 + u_i \quad (1)$$

$$\text{Wealth} = \mu_0 + \mu_1 \text{TV} + \mu_2 x_1 + e_i \quad (2)$$

x_1 – Exogenous Variables

Wealth – Endogenous Variable

Health – Response variable

The paper estimates the model using the robust 2sls method after calculating the causal inference with equation (1) using the ordinary least squares method to measure the health change. To specify the potency of an intravenous solution, which is subsequently evaluated using F-stat.

Results

Estimates based on the simple OLS method, as shown in equation (1), indicate that a unit change in wealth correlates to a substantial improvement in health. In addition, when a 5% significance level is applied to the p estimator, the results demonstrate a massively negative causal relationship between the number of drugs used in the past and current employability and health. In addition, highlighting the strong positive correlation between the number of living children, electricity consumption, and healthcare expenditures. However, the model fails to explain thoroughly and with sufficient precision. This may be the result of the omitted variable bias and the absence of essential variables.

Table 2: OLS Results

Source	SS	df	MS	Number of obs	= 4,665
				F(12, 4652)	56.57
Model	207326055	12	17277171.3	Prob > F	0
Residual	1.42E+09	4,652	305409.803	R-squared	0.1273
				Adj R-squared	0.1251
Total	1.63E+09	4,664		Root MSE	552.64

v445	Coefficient	Std. err.	t	P>|t	[95% conf.	interval]
v190	105.0188	8.946582	11.74	0	87.47923	122.5583
v102	-24.55242	18.97278	-1.29	0.196	-61.74806	12.64322
v106	2.601171	9.1653	0.28	0.777	-15.36716	20.5695
v113	1.021916	0.5564926	1.84	0.066	-0.0690737	2.112905
v116	-2.845423	1.091421	-2.61	0.009	-4.985126	-0.70572
v119	104.4565	30.93039	3.38	0.001	43.81832	165.0948
v161	-6.692981	2.354415	-2.84	0.004	-11.30875	-2.07721
v219	47.4365	4.08123	11.62	0	39.43536	55.43764
v221	0.1505778	0.0876454	1.72	0.086	-0.0212488	0.322404
v394	25.83625	19.50892	1.32	0.185	-12.41048	64.08297
v714	-67.27525	23.83563	-2.82	0.005	-114.0044	-20.5461
s1107a	-178.5486	48.17963	-3.71	0	-273.0035	-84.0937
_cons	2105.99	53.94558	39.04	0	2000.231	2211.749

The IV estimation shows no impact of media exposure on health, but affects directly on wealth.

Table 3: 2sls Regression Results

v445	Coefficient	Robust std. err.	Z	P>|z|	[95% conf.	interval]
v190	131.6881	47.20281	2.79	0.005	39.17232	224.2039
v102	-7.788481	34.87299	-0.22	0.823	-76.13828	60.56132
v106	-8.504577	22.04168	-0.39	0.7	-51.70548	34.69632
v113	0.9407963	0.5864372	1.6	0.109	-0.2085995	2.090192
v116	-2.126321	1.548693	-1.37	0.17	-5.161704	0.909061
v119	64.60585	77.32407	0.84	0.403	-86.94654	216.1582
v161	-4.543796	4.638713	-0.98	0.327	-13.63551	4.547915
v219	47.84021	3.717522	12.87	0	40.554	55.12642
v221	0.1537659	0.0980128	1.57	0.117	-0.0383357	0.3458676
v394	26.44481	20.49867	1.29	0.197	-13.73184	66.62147
v714	-61.86243	24.2679	-2.55	0.011	-109.4266	-14.29822
s1107a	-174.3241	38.91359	-4.48	0	-250.5933	-98.05488
_cons	2023.711	150.8073	13.42	0	1728.134	2319.288

First-stage regression summary statistics

Variable	R-sq.	Adjusted R-sq.	Partial R-sq.	Robust F(1,4651)	Prob > F
v190	0.6057	0.6047	0.0374	158.446	0

Number of obs =	4,664
Wald chi2(12) =	657.44
Prob > chi2 =	0
R-squared =	0.1256
Root MSE =	552.38

Moreover, the paper estimation for two-stage least squares (2sls) demonstrates a significantly stronger positive correlation between wealth and health than the OLS method. And, testing the significance of IV reveals an F-stat of 180, which, according to the rule of thumb, is strong evidence for the validation of strong IV as presented in table.

Table 4: First-stage regression summary statistics

Variable	R-sq.	Adjusted R-sq.	Partial R-sq.	F(1,4651)	Prob > F
v190	0.6057	0.6047	0.0374	180.888	0

Minimum eigenvalue statistic = **180.888**

Critical Values	# of endogenous regressors: 1
H0: Instruments are weak	# of excluded instruments: 1

2SLS relative bias	5%	10%	20% (Not available)	30%
	10%	15%	20%	25%
2SLS size of nominal 5% Wald test	**16.38**	**8.96**	**6.66**	**5.53**
LIML size of nominal 5% Wald test	**16.38**	**8.96**	**6.66**	**5.53**

Specifically, a massive change in employability indicates poor overall health, which, depending on the region, could be a result of a large population serving low-paying jobs or a possibility of less unemployment.

Discussion

Despite the fact that wealth has a significant impact on health, many nations fail to recognise and implement effective policies to address the issue. In developing nations, the causal effect of health and wealth can be observed interchangeably (Pollack et al 2007). Particularly, a low per capita income reduces purchasing power, causing the working population to consume less food. Studies (Moghalu, 2014) and endogenous growth models explain the wealth, savings, and importance of investment, innovation, and capital per worker that lead nations to prosperity. In addition, exposure to multiple media sources provides a boost to human capital (Thomas, Strauss, and Henriques, 1991) through improved health behaviour and early reporting of health problems. On the other hand, it reveals that the wealthy possessing a variety of media sources does not actually improve health (Milovanska-Farrington & Farrington, 2021) and can have a significant impact on overconsumption, causing the health to deteriorate over time.

Moreover, basic needs of living have been fundamentally regarded as a vital and minimum source of survival (Bilchitz, 2007); consequently, many organisations and governments have redoubled their efforts to improve basic needs by implementing effective policies. Despite the fact that malnutrition, poor hygiene, and the lowest per-capita income could be attributed to the nation's worst performance in terms of basic needs, (Wiesmann, 2006) suggests that more can be seen as a result. (Aslam, Kingdon, 2012) demonstrates that a mother's education has a negative effect on her child's height when combined with media exposure, regardless of living conditions. In addition, a sharp increase in the use of private hospitals by the affluent and their ability to purchase and consume drugs for chronic diseases, whereby a marginal use of healthcare significantly improves the health of the poor, has occurred.

As a result of missing data across the dataset, atypical responses to the questionnaire can also be observed, which is indicative of a lack of model precision and data quality. The literature describes the problem of data collection in developing nations in terms of digital and physical means.

Conclusion

According to the research, there is a strong correlation between wealth and health, and even a moderately positive effect of wealth can significantly improve health. This is especially evident in developing nations where inadequate healthcare systems and policies are pervasive (Starfield, Shi, Macinko 2005.). This has a significant long-term impact, resulting in a general decline in the child's progress and mental capacity. This paper also demonstrates the strong causal inference for the deprivation of basic needs, indicating a significant decline in health as a result of chronic drug use and lower levels of education. In addition, we find that having access to electricity and using healthcare facilities more frequently are indicators of a high health capital.

In contrast, the paper has some limitations, including the fact that the model explains the results inadequately and that there is a need for extensive research into the variables that influence both health and wealth. The casual inference of working predicts a decline in health, which could be a result of strenuous manual labour or a lower income, as well as an association

between a large population and low-paying jobs. Model predicts a strong association between an individual's employability and a high level of inference. The differences in population employability based on regions and gender require substantial evidence. Future research could also investigate the occurrence of multicollinearity between present employability and wealth. Exposure to media has a strong relationship with wealth and a neutral relationship with health, indicating that media exposure is a strong instrument for predicting wealth.

Lastly, this research is conducted in a limited amount of time with variable and time constraints, where the evaluation of data variables and robust estimation may yield different numerical results. While the model makes accurate predictions, substantial evidence is required to justify the absence of data and the occurrence of bias; consequently, the results may remain inconclusive.

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Stata Do-File

descriptive Statistics

Desc

Summary statistics

Sum

keeping the required variables

keep v102 v106 v113 v116 v119 v159 v161 v190 v221 v219 v394 v445 v714 s924a s1107a

desc

sum

regression OLS

reg v445 v190 v102 v106 v113 v116 v119 v161 v219 v221 v394 v714 s1107a

categorical variable information

tab v159

Changing it into Dummy variable (Instrumental variable)

recode v159 (0/1=0) (2=1), gen(TV)

2sls robust

ivregress 2sls v445 v102 v106 v113 v116 v119 v161 v219 v221 v394 v714 s1107a (v190 = TV)

Robustness Check

estat firststage

estat endogenous

2sls robust

ivregress 2sls v445 v102 v106 v113 v116 v119 v161 v219 v221 v394 v714 s1107a (v190 = TV), robust