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Faiz Ur Rehman
Muhammad Nasir

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Faiz Ur Rehman
School of Economics, Quaid-i-Azam University, Islamabad

and

Muhammad Nasir
Pakistan Institute of Development Economics, Islamabad

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Pakistan Institute of Development Economics
Islamabad, Pakistan

E-mail: publications@pide.org.pk
Website: http://www.pide.org.pk
Fax: +92-51-9248065

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C O N T E N T S

List of Tables

List of Figures

ABSTRACT

The 2011 National Nutrition Survey of Pakistan revealed that 51 percent of the country's population was consuming less than 2,100 calories a day. In the backdrop of rising food insecurity, hunger and malnutrition in Pakistan, this study aims to measure the effects of indirect taxation on health outcomes of children (<5 years). More specifically, the impact of *incidence* of General Sales Tax *(GST)* in the province of Punjab has been estimated on a child's height and weight. The proponents of the uniform GST argue that the tax would not affect children because most food items consume by children are exempted from the GST. However, the opponents believe that household, especially those belonging to the lower income group, would reallocate resources away from children in the face of higher GST. To study these effects, we utilised three different waves (2007-08, 2011, and 2014) of Multiple Indicators Cluster Surveys (MICS). The results show that the tax incidence, and not the GST rate, has a significantly negative impact on children's height-for-age Z-score (HAZ). No effect was found on weight-for-age-z-score (WAZ). These results are robust to different specifications and exhibit considerable heterogeneity across different income groups. These findings suggest that the exemption of certain food items for children from the GST may not eliminate the negative effects of this tax on a child's health. Thus, our study raises concerns on the long term welfare consequences of GST.

JEL Classification: H2, I12, I22, J18
Keywords: Taxes, Tax Incidence, Health, Public Policy

1. INTRODUCTION

Taxation has primarily been used as a major public policy instrument for the redistribution of resources in the economy. Nonetheless, this policy tool has also been utilised to achieve other objectives including, but not limited to, protection of local industry, promotion of investment and employment generation, environmental protection, and prevention of unhealthy and undesirable behaviour. For the last two decades, taxation in general and indirect taxation (taxes on goods and services) in particular has been implemented extensively to promote healthy behaviour and diet.[1]

Nevertheless, there is a dearth of studies that explore the income effect of consumption taxes on health outcomes of the lower-income households who spend a significant portion of their earnings on consumer goods. Consequently, these taxes could also have a negative impact on health outcomes by reducing the real income of the poor households. Hence, the objective of this paper is to examine the impact of indirect taxes (GST) on children's anthropometric health indicators.

The Sustainable Development Goals (SDGs) place great emphasis on the mobilisation of domestic resources to achieve Universal Health Care (UHC). Recently, the Lancet's Commission[2] recommended raising revenue through taxation (mainly on tobacco and other unhealthy products) to generate sufficient resources for financing UHC. However, the report fails to mention how sufficient revenues could be generated in the developing countries (including South Asia); where taxes on goods and services (indirect taxes) already contribute a significant share to the resource pool [Martinez (2011)].

A major fiscal problem in all South Asian countries is the low and stagnant revenue productivity of their tax systems. All the countries in the region have a Tax-to-GDP ratio of about 10 percent with the exception of India where it is approximately 16.5 percent [Martinez (2011)]. It is, however, still

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[1]Fletcher, *et al.* (2010) provides a detailed literature on taxes and health behaviour in their study.

[2]http://www.globalhealth2035.org/sites/default/files/report/global-health-2035.pdf

below the levels seen in countries with comparable level of development. The low and static revenues have seriously constrained the ability of South Asian countries to finance the much needed UHC. As a result, the fiscal authorities rely on indirect taxation in order to meet their expenditures, which in turn have disproportionate and unobservable effects on different segments of the population. In Pakistan, for instance, the share of indirect taxes in total tax revenue is roughly 72 percent; the remaining revenues are generated through direct taxation [Pakistan (2014)].[3]

The tax base in Pakistan continues to be low as income from agriculture receives generous tax exemptions. Despite the fact that the contribution of agriculture sector to GDP is about 21 percent, its share in tax revenues is merely around 1 percent [Ahmad (2008)]. Similarly, the service sector also falls short of its proportion of the tax revenue (i.e., 20 percent) compared to its share in the GDP. Burki, *et al*. (2015) claims that the country's elite has consolidated their bargain with the state and powerful lobbies to negotiate their tax rates with the government bilaterally. This is clearly reflected in the gap between different sectors' contributions to GDP against their shares in the tax revenues. This weak and complicated tax structure has greatly reduced the potential tax revenues that could have been generated if the tax evasion and avoidance were checked. If exemptions for agriculture, for instance, were withdrawn and taxes were imposed at the rates specified in the 2012 Finance Bill, the additional tax revenue would have amounted to PKR 80-115 billion [Nasim (2012)]. Numerous other studies have also approximated the tax gaps albeit for other sectors of the economy such as manufacturing, wholesale and retail (Ahmed and Mark, 2008). These studies concurred that the main tax laws—including the Customs Act 1969, Sales Tax Act 1990, Income Tax Ordinance 2001, and the Federal Excise Duty Act 2005—allow the government to waive taxes legally. These aforementioned laws provide different sectors with bargaining powers whereby they negotiate their effective tax rates with the government. It is this bargaining power that is reflected in the contributions of different sectors to the revenue system.

This preferential tax treatment makes the tax system regressive, which ultimately leads to the increasing gap between the rich and poor [Wahid (2005)]. Heavy reliance on indirect taxation is not only widening inequality in Pakistan but also fuelling poverty which, among other things, could also affect the mother-child health. It is widely documented that taxes on consumption goods

[3]The distribution of direct/indirect taxes is quite different in developed countries. The US federal government receives about 60 percent of its tax revenues from income and payroll taxes with a very moderate share coming from consumption (15 percent) and other taxes. For OECD countries, the share of consumption taxes in tax revenues is twice as large as that of United States where as the share from payroll taxes, individual income taxes, corporate income taxes, and property taxes are about the same (http://www.oecd.org/).

severely affect the poorer segment of society [Nazli and Meilke (2008)]. Chaudhry and Chaudhry (2008) estimates that approximately 20 percent increase in food inflation is due to indirect taxation causing an increase in the poverty headcount by 7 percent.

Hike in food prices due to taxation are also linked to malnutrition [Grimard (1996)]. Based on the household data from Pakistan, Grimard (1996) estimated that calorie intake response to income of poor households is greater than the entire sample. Malnutrition is thus reflective of poverty; people who do not have sufficient income for food are also malnourished.[4]Furthermore, exposure to adverse nutritional shocks can have unfavourable effects on early life anthropometric indicators like birth weight and childhood stunting [Beaton (1993); Martorell, *et al.* (1994); Martorell (1999); Hoddinott and Kinsey (2001); Skoufias (2003)].

While there may be a plethora of factors responsible for the prevailing food insecurity, hunger and malnutrition in Pakistan, this research aims to investigate the effects of the incidence of indirect taxation on a child's height-for-age-z-score (HAZ) and weight-for-age-z-score (WAZ). For this purpose, we utilise three waves (2007-08, 2011 and 2014) of Multiple Indicator Cluster Surveys (MICS) for the province of Punjab, Pakistan. The results reveal that the burden of indirect taxes has a statistically negative impact on children's HAZ. These results are robust to different specifications and exhibit considerable heterogeneity across different income groups. The plausible channel for this outcome is the income effect; that is, the victims of indirect taxes are mainly the low income households. The incidence of indirect taxes decreases their real income thereby forcing them to reallocate resource away from children which in turn could adversely affect their health. However, no effect on WAZ was found.

Until recently, no scientific study was conducted to explore even the raw correlations between consumption taxes and health outcomes. Reeves, *et al*. (2015) and Carter and Cobham (2016) are the two exceptions. The study by

[4]In fact, food insecurity is a major national challenge for Pakistan. According to a 2008 assessment by the United Nations, 51 percent of Pakistan's population were faced with food insecurity and the calorie intake was less than the daily requirement of 2,100 calories. It presents an alarming situation for the severely food insecure people whose proportion rose to 28 percent from a mere 6 percent between 2005 and 2008. Two thirds of the rise in food insecurity over the years are attributed to the food insecurity in rural areas. These findings were consolidated by the data collected by the National Nutrition Survey of 2011 (http://ghdx.healthdata.org/record/pakistan-national-nutrition-survey-2011). Moreover, Food and Agriculture Organisation (FAO) also brought to attention a very bleak picture of child malnutrition in 2010-12 and found that about 35 million people in Pakistan were undernourished [Officer (2016)]. Again, there are wide discrepancies between urban and rural populations and across different income groups in terms of malnourishment and stunted growth (NIPS, 2012). Moreover, the women's nutritional status has also worsened over the previous decade in terms of height and weight measurements, haemoglobin deficiency and vitamin-A deficiency (National Nutrition Surveys, 2001 and 2011; http://phrc.org.pk/downloads.html).

Reeves, *et al*. (2015) explores the relationship between different types of tax regimes (capital gains, profits, income and indirect taxes) and health spending for 89 low-income and middle-income countries. The study concludes a negative association between indirect taxes and certain types of health outcomes, which could possibly arise from the negative effects of these taxes on the real incomes of the poor. On the other hand, Carter and Cobham (2016) claim to have exploited better data on tax types and health outcomes. They observe no association between indirect taxation and health outcomes. The study concludes that the evidence on the relationship between taxes and health spending is mixed. Hence, in this context, our study makes several noteworthy contributions to the literature. First, this study contributes to the rare literature linking tax regimes and health in general and child health outcomes in particular. Second, the previous studies have merely focused on the correlation between a country level tax structure and the aggregate level health outcomes/spending. Such aggregation of behaviours could result in loss of important information at the individual level. Moreover, these studies do not control for individual and household level characteristics. Consequently, the estimated coefficient of interest could be biased (under or overestimated) due to omitted variables. Our study fills this gap by exploring the relation between indirect taxes and health outcomes at the micro level. Third, this research concentrates on a specific region, i.e., the province of Punjab, which would minimise selection bias arising due to unobserved heterogeneities. Lastly, the study tries to explore the income channel by also focusing on the burden of taxes (or tax incidence) instead of using only the raw measure of indirect taxes.

The study proceeds as follow: Section 2 discusses the relevant literature, while Section 3 sheds light on the evolution of Pakistan's GST. We explain the empirical framework, relevant variables and data in Section 4. Section 5 discusses results and Section 6 concludes the study.

2. BACKGROUND LITERATURE

A comprehensive and multidisciplinary literature has been developed to study the impact of food insecurity and the subsequent malnutrition on child anthropometric markers such as birth weight and height trajectory. It has been well documented that pre- and early post-natal exposure to malnutrition shocks result in stunting [Beaton (1993); Martorell, *et al.* (1994); Martorell (1999); Hoddinott and Kinsey (2001); Skoufias (2003)]. Furthermore, the negative effects of undernourishment are not limited to immediate health outcomes (child height and weight). It affects long-term socioeconomic indicators like educational performance, wages, productivity and overall wellbeing. It has been studied that poor nutrition and health of children under the age 5 years increase their dropout rates and reduce their learning in the school [Haddad and Bouis (1991); Thomas and Strauss (1997); Glewwe and Miguel (2007); Victora, *et al.*

(2008)]. Similarly, children who stand tall and are born heavier perform better in different socioeconomic and cognitive indicators [Case and Paxson (2008); Steckel (2008); Currie (2009); Lundborg, *et al.* (2009)]. Likewise, the height of child in earlier stages is reflected in cognitive scores in the later ages [Maurer (2010); Huang, *et al.* (2013); Vogl (2014)], whereas, height and muscular strength are also positively related to working capacity [Lundborg, *et al.* (2009); Schick and Steckel (2010)] and taller individual are observed to earn higher wages [Haddad and Bouis (1991); Strauss and Thomas (1998); Schultz (2002); Persico, *et al.* (2004); Case and Paxson (2008); Lundborg, *et al.* (2009); Vogl (2014)].

To ensure food security and adequate nutrition, different public policy intervention programs have been initiated especially in the developing world. The basic purpose of such interventions is to break the intergenerational transmission of poverty which arises from the trap of low levels of income-health-education-income nexuses. One such policy is the public cash transfer programs—the Conditional Cash Transfers (CCTs)—to supplement and increase nutritional level and thus the human capital of poor children. However, earlier studies on cash transfer programs were skeptical about the effectiveness of CCTs. Behrman and Deolalikar (1987) have observed near to zero elasticity between income and nutrition. However, the follow-up studies have documented positive income-nutrition elasticities which then led to the development of a comprehensive literature on the relationship between public health policies and maternal-child health outcomes [Bouis and Haddad (1992); Behrman, Foster, and Rosenzweig (1997); Subramanian and Deaton (1996); Haddad, *et al.* (2003)]. To make the transfer effective and efficient, different conditions were imposed on parents before they receive the transfer. For instance, Mexico's *Progresa* program, the best known of these cash transfer interventions, had two key features that mediated its nutritional impacts. Firstly, it was compulsory for older children to attend school. Secondly, younger children of the household were to visit clinics for regular medical checkups and nutritional monitoring (where, among other things, they were given supplements) [Aguero, *et al.* (2006)]. Empirical evidence confirmed that *Progresa* significantly raised the nutritional status of the targeted children [Behrman and Hoddinott (2005)].

The conditional cash transfer programs were initiated in Latin America and were then expanded to Asia, Africa and Middle East. The main targets of the transfer are maternal health together with child health and education. In this context, a meta-analysis has been provided by Saavedra and García (2012) on the impact of CCT on different indicators of child education in 42 CCT programs in 15 developing counties. They concluded that CCT is an effective policy tool to break intergenerational poverty traps. Bastagli, *et al.* (2016) also provided a comprehensive review on the CCT and its effects on different economic indicators. It shows that CCT has a significant impacts on education,

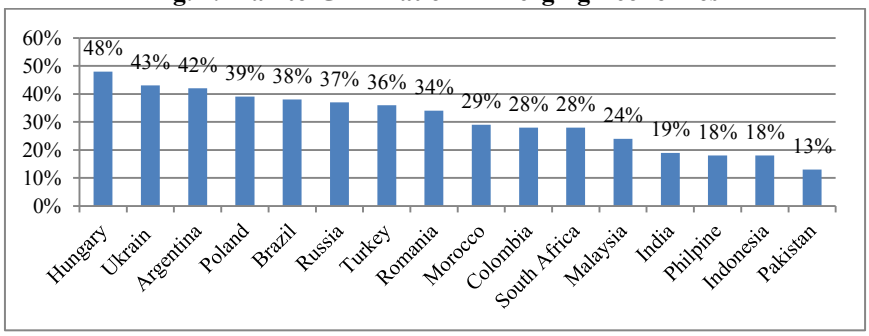
health and nutrition, empowerment, employment, and saving and investment behaviours.

Taxes (direct and indirect) have also been used as a policy instrument to change health behaviour of the population. Specifically, taxes on cigarette, soft drinks, sodas and other food items have been used to combat the rapidly growing obesity in the United States and other developed countries. Studies have revealed that taxes as a policy instrument have insignificant impact on smoking and resultant health behaviours due to different types of substitution effects. For instance, Adda and Cornaglia (2010) asserts that the ban on smoking in one place increases the exposure of non-smokers to cigarette smoke in other spaces where the ban is not applied. Higher taxes on smoking also lead to unintended rise in weight and obesity [Chou, *et al.* (2004); Gruber and Frakes (2006); Baum (2009)]. Whereas, other studies observed that cigarette significantly reduces obesity [Courtemanche (2009)]. Furthermore, Evans and Farrelly (1998) studied that smokers respond to higher cigarette taxes with higher tar and nicotine content in the additional cigarette they smoke. Similarly, Adda and Cornaglia (2006) observed that smokers quickly adjust their behaviour to smoking in response to higher taxes on cigarette products. Finally, recent theoretical and empirical research by Schroeter, *et al.* (2008) showed that there are plausible situations where taxes on certain types of food (e.g., junk food and food away from home) could increase body weight due to substitution effects among the same types of foods. Likewise, taxes on beverages including soda could cause a substitution to other high-calorie beverages and may have higher or no effect on calorie intake. In the extreme case, these possible substitution patterns could result in a situation where individuals may avoid drinking soda, but may offset this behaviour by taking high-energy and high-calorie beverages, such as fruit juice, juice drinks, or whole milk. The net effect of these behavioural responses could hence result in less revenues from taxes as well as no loss in weight; causing a failure of the policy.

3. GENERAL SALES TAX (GST) IN PAKISTAN

Pakistan's tax-to-GDP ratio is one of the lowest amongst the developing countries as can be seen from figure 1. The ratio is merely 13 percent for the fiscal year 2012-13 (IMF, 2013). Figure 2, on the other hand, shows that Pakistan's tax-to-GDP ratio is continuously decreasing since the late 1990s. However, despite the low tax-to-GDP ratio, its tax rate is one of the highest in the developing world. For instance, the corporate tax rate was 34 percent during the fiscal year 2013-14; higher than India, Sri Lanka and Bangladesh. Similarly, the rate of indirect taxes also remains higher than most of the developing countries [SDPI (2013)].

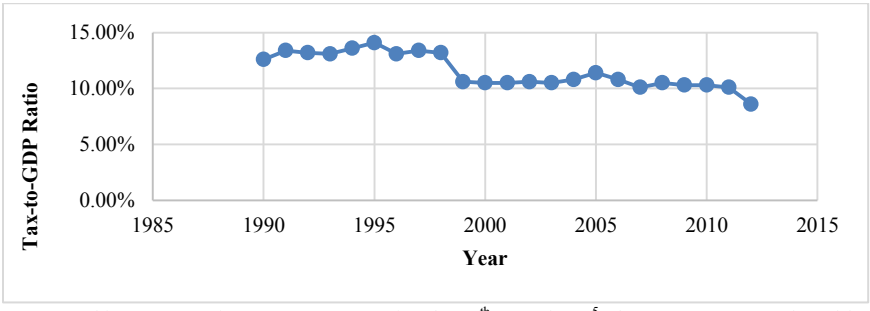
Fig. 1. Tax-to-GDP Ratio in Emerging Economies



Source: IMF (2013).

Due to high dependency on indirect taxes for revenue generation, the period 1960-1980 is be considered an era of excise duties. Currently, the contribution of indirect taxes in total tax revenue is roughly 72 percent with GST being the most significant indirect tax in Pakistan [Pakistan (2014)]. The standard rate of GST in Pakistan was 12.5 percent in 1992, which was then increased to 18 percent in 1995 in order to narrow down the budget deficit. In the year 2004, the GST was levied at five different rates: 12 percent, 15 percent, 18 percent, 20 percent and 23 percent respectively. However, the anomalies of different rates were removed in the coming years and a uniform rate of 15 percent was set in July, 2004. In 2007, the GST was levied at 16 percent, which was further increased to 17 percent in 2009 but eventually decreased afterwards. However, the Finance Bill of 2013-14 again raised the GST rate to 17 percent.

Fig. 2. Trend of Tax-to-GDP Ratio in Pakistan



Source: Pakistan Economic Survey, 2012-13After the 18th amendment[5], the rates were promulgated by both federal and provincial governments. The detailed federal and provincial GST and STS rates are given in Table 1. It shows that GST on goods is 17 percent, whereas it ranges between 13-16 percent on services levy by provinces. Currently, GST is contributing 60 percent of the total revenue from indirect taxes in Pakistan [Ahmed (2010); SDPI (2013); Jamal and Javed (2013)].

[5]The 18th amendment is a landmark amendment to the constitution of Pakistan which is promulgated in 2010. One of its features is the transfer of tax collection on services constitutional powers to provincial governments. The GST on services was also part of the transferring powers [Shah (2012)].

Table 1

Sales Tax Rates of Federal and Provincial Levels after 18th Amendment

Pakistan	2015	2014	2013	2012	2011
Federal GST	17%	17%	16%	16%	16%
Punjab STS	16%	16%	16%	16%	16%
Sindh STS	14%	14%	16%	16%	16%
KPK STS	15%	15%	15%	17%	17%
Baluchistan STS	15%	15%	15%	15%	15%

Source: Federal Board of Revenue (FBR) of Pakistan; GST= General Sales Tax on both goods and services; STS=Sales Tax on Services by provincial governments

4. DATA AND METHODOLOGY

4.1. Data and Variables

In this section, we discuss descriptive statistics of General Sales Tax (GST) and the resultant burden/incidence of taxes which are followed by the basic statistics on mother and child health indicators. To calculate the impact of GST on child health outcomes (HAZ and WAZ), we merge provincial level tax incidence with the child socioeconomic and health outcomes recorded in Multiple Indicator Cluster Surveys (MICS). For this purpose, three rounds of Punjab's MICS (2007-08, 2011 and 2014) have been utilised along with the Punjab's incidence of taxes which are derived from four different studies on the GST burden in Pakistan [Rafaqat (2003); Wahid and Wallace (2008); Jamal and Javed (2013); Asghar (2017)].

4.2. General Sales Tax and Incidence of Taxes

It is important to shed some light on the variable of tax incidence/burden. The pattern of tax burden can be analysed by comparing the shares of taxable expenditures by income groups with their respective shares of income. If the tax is proportional, the shares of tax payable will equal the income shares for all groups; if the tax is regressive (progressive), the tax burden of the lower income groups will be larger (smaller) than their respective income shares [Ruggeri (1978)]. Furthermore, incidence of tax depends on the price elasticities of demand and supply. As mentioned above, we have borrowed the construction of tax burdens over the years from four different studies [Rafaqat (2003); Wahid and Wallace (2008); Jamal and Javed (2013); Asghar (2017)].

Table 2 presents the descriptive statistics of GST and tax incidence by income quintiles. It shows that GST has increased from 14 percent to 17 percent in the last one-and-a-half decade. An interesting observation in Table 2 is that the tax incidence decreases as the households enter in the highest quintiles, that is, the richest income group. Thus, the regressive behaviour of the burden of

GST demands its analysis on different socioeconomic and health indicators. This makes the examination of the impact of tax incidence on child health outcomes across households and over time imperative.

Table 2

Descriptive Statistics of GST and Tax Incidence

Variable	Mean	Std. Dev.	Min	Max
GST	15.37	1.18	14	17
Tax Incidence (%)	3.91	1.21	1.4	5.4
Tax Incidence (%) by Quintiles				
Lowest (Poorest)	4.34	1.33	1.6	5.4
Second	3.94	1.23	1.4	5.0
Middle	3.88	1.14	1.6	4.9
Fourth	3.74	1.10	1.5	4.7
Highest (Richest)	3.57	1.07	1.4	4.5

4.3. Multiple Indicator Cluster Surveys (MICS)

The Multiple Indicator Cluster Surveys (MICS) are surveys implemented by countries especially developing nations under the programme developed by the United Nations Children's Fund to provide internationally comparable, statistically rigorous data on the health conditions of women and children. For this purpose, five rounds have been completed and two are under process across different provinces and regions of Pakistan.[6]

4.3.1. *Sampling framework of the Punjab's MICS*

MICS has a representative survey of households, women and children. In the province of Punjab, four rounds of MICS have been completed. This project utilises the last three completed rounds of Punjab's MICS (2007-08, 2011 and 2014). In the round of 2007-08, 91,280 households have been surveyed in the 35 districts. The interviewed households include 86,148 women (age 15–49) and 70,226 under 5 years' children. In the round of 2011, 95,238 households were

[6]For further details on MICS in Pakistan, visit http://mics.unicef.org/surveys.

successfully interviewed. In these households, 137,938 women (age 15-49) were also interviewed. Furthermore, 66,666 child questionnaires were answered by the mothers. Whereas, in the latest Punjab's MICS round, which was completed in 2014, 38,405 households were successfully interviewed which include 53,668 women (age 15–49). From the data on mothers, a record of about 27,495 children was obtained. It should be noted that the response rates for the identified households, women and children were above 90 percent in all the three rounds which is one of the essential requirements for the credibility and validity of any survey.[7]

4.3.2. *Child Health Indicators and Control Variables*

The main anthropometric indicators of a child include height and weight. Linear growth, physical strength and health are measured through height-for-age-z-score (HAZ) which is calculated by utilising the multicentre growth reference developed by the World Health Organisation (WHO). The HAZ is standardised with age and gender of a child. According to this criterion, a stunted child is the one who has HAZ below –2 standard deviations below the median of the reference population. For a severely stunted child, this score is below –3 standard deviations. It is considered an appropriate indicator to measure a child's long-term nutritional condition and health [Martorell and Habicht (1986)]. Similarly, to measure the short-term nutritional condition and the health of a child, weight-for-age-z-score (WAZ) is calculated and compared with a reference population of the WHO. The WAZ is also standardised for age and gender of a child. On this criterion, a wasted child is the one who has WAZ below –2 standard deviations. For a severely wasted child, this score is below –3 standard deviations.

In addition to the variables of interest (GST and Tax Incidence), we have also controlled for various child, mother, and household characteristics. These include child age in months, gender; mother's age and education; and the household region of residence and the wealth index. The wealth index is an indicator of the household's socioeconomic status. It is constructed using the household ownership of assets by employing the principal component analysis. The index does take into account the rural-urban difference in wealth of the households.[8] Table 3 provides a comparison between the mean values of the HAZ, WAZ and other socioeconomic and health indicators of children, mothers and households both for the full sample and separately for three rounds of MICS.

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[7]For further details, visit http://www.bos.gop.pk/mics.

[8]The details about the construction of wealth index are available in Pakistan Demographic and Health Survey (2012-13).

Table 3

Descriptive Statistics of Child and Mother Health Indicators

	Full Sample	Round 2007- 08	Round 2011	Round 2014
Child Health Outcomes				
Height-for-age Z-score (HAZ)	-1.52	-1.63	-1.46	-1.44
	[1.64]	[1.81]	[1.53]	[1.46]
Weight-for-age Z-score (WAZ)	-1.48	-1.43	-1.50	-1.55
	[1.29]	[1.38]	[1.22]	[1.21]
Child Characteristics				
Male	0.51	0.51	0.51	0.51
	[0.50]	[0.50]	[0.50]	[0.50]
Age in Months	29.90	29.56	29.52	30.16
	[17.25]	[17.47]	[17.10]	[17.03]
Mothers' Characteristics				
Age in Years	29.90	29.85	29.90	30.03
	[6.03]	[6.11]	[5.99]	[5.92]
Years of Education	2.10	1.92	2.21	2.26
	[1.40]	[1.34]	[1.42]	[1.45]
Living in Urban Areas	0.35	0.31	0.38	0.34
	[0.48]	[0.46]	[0.49]	[0.47]
Children Per Mother	3.72	3.85	3.66	3.54
	[2.15]	[2.26]	[2.10]	[1.99]
Household Characteristics				
Wealth Score	-0.07	-0.09	-0.05	-0.07
	[0.96]	[0.98]	[0.94]	[0.93]
Wealth Quintile	2.93	2.84	3.04	2.87
	[1.39]	[1.40]	[1.38]	[1.40]
Observations	174261	70447	72924	30890

Note: Standard deviations are in parentheses.

4.4. Empirical Methodology

Since the general sales tax is imposed at the federal level which is exogenous to the children's health, a candid way for identifying the causal impact of GST on children's HAZ and WAZ is to compare children exposed to higher GST rates with the ones exposed to lower rates. Using such an approach is beneficial as the changes in the variable of interest (tax rates) are arising only from temporal variation. In order to control for any time trends in variables that are correlated with the tax rate and outcome variable, we also incorporate the year and month of birth fixed effects. There can be substantial unobserved heterogeneity in various district level characteristics (e.g., culture, backwardness, etc.) which may be correlated with the two variables.[9] Hence, in order to control for any spatial heterogeneity across regions, we also control for district fixed effects in our preferred specification.

[9]Here time-invariant variable also include those variables that changes very slowly over time, such as, poverty.

Subsequently, the causal impact of tax (GST) rates on children's health outcomes is examined by using the following equation:

$$HO_{idt} = \alpha + \delta_t + \lambda_d + \varphi_1 tax\_rate_t + \beta X_{idt} + e_{idt} \quad \ldots \quad \ldots \quad (1)$$

Here HO_{idt} shows the health outcome of child *i*, living in district *d*, born in time *t*. The tax_rate_t is an indicator of the GST rate in year t; δ_t and λ_d represent the year and month of birth fixed effects and the district fixed effects, respectively; and X_{idt} is a vector of the child, mother and household characteristics as discussed in the previous sub-section.

Next, we also want to examine the impact of tax incidence. For this purpose, the variation across different income groups also comes into play to identify the impact of tax on children's health outcomes. The equation for this empirical specification is written as follows:

$$HO_{ijdt} = \alpha + \delta_t + \lambda_d + \varphi_1 tax\_incidence_{jt} + \beta X_{ijdt} + e_{ijdt} \quad \ldots \quad (2)$$

Here HO_{ijdt} indicates the health outcomes of child *i* from income group *j*, living in district *d* and born in year *t*. The subscript *j* represents the income groups. We estimate both these specifications in our empirical analysis in the next section.

5. RESULTS AND DISCUSSION

5.1. Impact of GST on HAZ

Since GST is imposed at the federal level, there is no spatial variation in the tax rate across different geographic regions (e.g., districts). The variation here in the tax rate is coming only from different GST rates imposed in different survey years. Hence, the results in Table 4 present the impact of temporal variations in the GST rate on children's health.

In Model 1, we explore the impact of tax rates on HAZ without controlling for child, mother or household characteristics. Surprisingly, the coefficient is positive and statistically significant; suggesting that the increase in GST rates over time improves children's long-term health. Specifically, it indicates that a one percentage point increase in the GST rate increases the HAZ by 0.375 standard deviations (SD). However, this result may have been driven by the omitted variables bias. Therefore, in the second model, we control for various child, mother and household characteristics as discussed in the previous section. The findings in Model 2 are unchanged. The coefficient of GST rate is positive and highly significant and the magnitude has increased slightly. This highlights the fact that the results in previous model are robust to the inclusion of observed characteristics of children and household.

Another concern could be that there are time invariant differences across the year and month of birth as well as the region of residence. For example, if there is a shock that affects the entire province, the years fixed effects will

control for it. Similarly, month of birth fixed effect would control for any seasonal variations that might have driven the results. In order to incorporate the temporal heterogeneity, we control for the year and month of birth fixed effect in the third model. The results in Table 4 changed dramatically. The coefficient for GST rate becomes negative as was theoretically expected. Nonetheless, it is now statistically insignificant suggesting that there is not a causal relationship between GST rates and children's health. This means that the previous results may have been driven by the time trends in other variables which were correlated with the tax rates.

Table 4

Impact of GST on HAZ

Variables	Model 1	Model 2	Model 3	Model 4
GST Rates	0.375***	0.403***	-0.463	-0.313
	(0.106)	(0.110)	(0.517)	(0.483)
Constant	-7.809***	-8.219***	2.113	0.454
	(1.800)	(1.883)	(6.021)	(5.636)
Observations	143,230	137,291	125,465	125,465
R-squared	0.013	0.057	0.073	0.088
Child & HH Characteristics	No	Yes	Yes	Yes
YOB & MOB FE	No	No	Yes	Yes
District FE	No	No	No	Yes

Note: Robust standard errors, clustered at the district level, are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1. YOB and MOB FE show the year and moth of birth fixed effects, respectively.

Similar to the temporal differences, the spatial heterogeneity can also affect the results. For example, districts in Punjab are very different in certain characteristics. These could include unobserved time-invariant (e.g., culture, norms and values, etc.) as well as observed but slow-changing characteristics (e.g. poverty, backwardness, etc.). That is, the HAZ would be smaller for children in poor districts even in the absence of higher GST rates. In order to get a cleaner identification of the effect of GST rates on HAZ, we control for district fixed effects in Model 4. The results are qualitatively similar to those in Model 3. The findings in the last two models (in Table 4) provide no evidence of the detrimental effects of increase in GST rates on children's health. This is a surprising result for a developing country with per capita income of around $1,600. One possible explanation could be that, although the GST rate is fixed across products and regions, its impact could vary across income groups. In other words, households with lower socioeconomic status would have to bear a higher burden (w.r.t their budgets) compared to households from the higher income group even if the tax rate is same for all the households. It is, therefore, imperative to examine the impact of tax incidence instead of the tax rate.

5.2. Impact of Tax Incidence on HAZ

In the light of discussion in the previous section, we now examine the impact of tax incidence on children's HAZ. As shown in the section on data and variables, the tax incidence of the general sales tax has been higher for lower income groups. In other words, the impact or burden of a similar GST rate is higher for households who have lower socioeconomic status. Hence, using tax incidence gives us variations across two dimensions: (i) temporal variation by using different rounds and (ii) variation across income groups. The results of these analyses are presented in Table 5. In the first model, where we do not control for any child or household characteristics, tax incidence adversely affects a child's HAZ. The coefficient is negative and statistically significant. It suggests that a one percentage point increase in tax incidence reduces HAZ by 0.97 SD. The magnitude of this impact is very high which may have been the result of omitted variable bias. Consequently, we control for covariates related to child, mother, and household. The result of this specification, shown in Model 2, is qualitatively similar to the one in the first model. Nonetheless, the magnitude of the coefficient has decreased by more than a quarter, thereby confirming the fact that the effect was overestimated in the first model.

Table 5

Impact of Tax Incidence on HAZ

Variables	Model 1	Model 2	Model 3	Model 4
Tax Incidence	-0.976***	-0.649***	-0.649***	-0.572***
	(0.064)	(0.069)	(0.064)	(0.047)
Constant	1.100**	-0.238	-1.920	-1.997
	(0.421)	(0.422)	(1.394)	(1.323)
Observations	142,812	137,274	125,450	125,450
R-squared	0.043	0.065	0.081	0.094
Child & HH Characteristics	No	Yes	Yes	Yes
YOB & MOB FE	No	No	Yes	Yes
District FE	No	No	No	Yes

Note: Robust standard errors, clustered at the district level, are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1. YOB and MOB FE show the year and moth of birth fixed effects, respectively.

In Model 3, the temporal heterogeneity is dealt with by controlling for year and month of birth fixed effects. Interestingly, the results remain the same, suggesting that these findings are not caused by some time trends in other variables which could have been correlated with both tax incidence and the outcome variable. Lastly, we incorporate the district fixed effects in order to remove the effects of unobserved spatial heterogeneity. In other words, children who belong to different income groups, but are living in the same districts are compared. This significantly improves our identification

strategy and is, therefore, our preferred specification. The findings, presented in Model 4, are similar to the previous models with a slight decrease in the magnitude. The coefficient for tax incidence is negative and statistically significant at the 1 percent level. It indicates that a percentage point increase in the tax incidence across time and households leads to a reduction of 0.57 SD in HAZ. This shows a very strong causal impact of tax incidence and raises concerns about the unobserved, and may be unintended, long-term welfare consequences of the indirect taxes such as the General Sales Tax (GST). These findings provide additional evidence against the use of indirect taxes, and that too with very high rates, for increasing tax revenues to improve the Tax-to-GDP ratio.

5.2.1. *Heterogeneous Effects of Tax Incidence*

We next explore whether there is any heterogeneity in the effects of tax incidence. This is done across three dimensions: region of residence, gender of the child and socioeconomic status of the household. The findings are presented in Table 6. The first two columns show the heterogeneity across the rural/urban residence. Although, the coefficients are similar in terms of sign and significance, the magnitude is slightly higher in the urban region. The tax incidence adversely affects both rural and urban children, but the former are relatively less exposed to its detrimental effects. One possible justification for the result is that households in the rural region have better access to necessary food items because of lower prices. Moreover, they may grow their own food which is also relatively healthier compared to the food available in the market.

The third and fourth columns provide the heterogeneity analysis across gender of the child. Once again, the effect is homogeneous in terms of sign and statistical significance. However, females are relatively more affected. This highlights the important issue of gender bias against the female in the intra-household resource allocation in the event of a fall in household income. In other words, the female child bears the brunt. In this sense, the indirect taxes can also become a source of gender discrimination and thereby reinvigorating the biases of social and cultural norms. Lastly, we want to investigate that who across the different income groups are most affected. Columns 5 and 6 present the evidence for heterogeneity across socioeconomic status. It is evident from the table that increase in tax incidence has no impact on the children in rich families and understandably so. The entire impact is coming from the middle and lower income groups. In the event of a tax increase which reduces their overall in-hand income, these households are forced to reduce the allocation of resources for children in the household budget even when the children's food items are exempted from the tax.

Table 6

Impact of Tax Incidence on HAZ–Heterogeneous Effects

	Region of Residence		Gender of Child		Socioeconomic Status	
	Urban	Rural	Male	Female	High	Lower
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Tax Incidence	-0.698***	-0.586***	-0.515***	-0.627***	0.518	-0.554***
	(0.121)	(0.055)	(0.050)	(0.056)	(1.082)	(0.051)
Constant	-2.544	-0.958	-2.003	-2.103	-7.018	-1.548
	(1.950)	(1.501)	(1.333)	(1.382)	(5.853)	(1.327)
Observations	43,858	81,592	64,011	61,439	22,610	102,840
R-squared	0.084	0.097	0.089	0.101	0.074	0.083
Child & HH Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
YOB & MOB FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors, clustered at the district level, are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1. YOB and MOB FE show the year and moth of birth fixed effects, respectively. The lower socioeconomic status includes households from middle and lower income groups. High includes only the highest (richest) income group.

5.2.2. *Robustness Using Round-wise Analysis*

In the analysis on tax incidence and child health, so far, the variation in tax incidence was coming from two dimensions: temporal and across income groups. In order to get the pure impact of tax incidence in a particular year, it is important to disentangle the two variations. Hence, in Table 7, we examine the effect of tax incidence of the GST rates for each round separately. The effects are separated because it informs about the relative severity of tax incidence of GST rates in different periods. The table shows that tax incidence has had an adverse impact on children's HAZ in all the three rounds. Hence, it is not just the temporal increase in the tax rates that has detrimental consequences for children's health. The tax incidence resulting from the imposition of the GST rate in a particular year also negatively affects the households across different income groups at a given point of time. Nonetheless, the impact is more severe in the last two rounds (i.e., 2011 and 2014). The difference between the magnitude between 2007 and 2011 is 0.19 SD. On the other hand, this difference is only 0.6 SD between the last two rounds and it is not statistically significant. The big jump in the magnitudes between 2007 and 2011 could be explained by the difference in the GST rates. In 2007, it was 15 percent and it remained 16 percent for the period 2009-2013. Hence, this increase might have transmitted its detrimental effects on children's health. The GST then further increased to 17 percent in 2014. Since the MICS survey was also conducted in the same year, the households may not have changed their budgetary decisions immediately.

Table 7

Impact of Tax Incidence on HAZ – Robustness

Variables	2007 Model 1	2011 Model 2	2014 Model 3
Tax Incidence	-0.574***	-0.759***	-0.703***
	(0.052)	(0.054)	(0.167)
Constant	-13.677***	3.680***	4.532*
	(3.471)	(0.945)	(2.357)
Observations	49,616	53,027	22,807
R-squared	0.095	0.131	0.129
Child & HH Characteristics	Yes	Yes	Yes
YOB & MOB FE	Yes	Yes	Yes
District FE	Yes	Yes	Yes

Note: Robust standard errors, clustered at the district level, are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1. YOB and MOB FE show the year and moth of birth fixed effects, respectively.

5.3. Impact of GST on WAZ

We have so far focused on the impact of tax rate and tax incidence on the HAZ score, which is a measure of long-run nutritional status of children. We would also like to explore if the increase in indirect taxes has any effect on the weight-for-age Z-score (WAZ) – a measure of short-term nutritional status. The results for the impact of GST rates on WAZ are reported in Table 8. Similar to the earlier tables, the specification in Model 1 examines the impact of GST without controlling for child, mother or household characteristics. The coefficient is negative and statistically significant; suggesting that a one percentage point increase in tax rate reduces the WAZ score by 0.245 SD. This result holds when control for the various covariates in the second model. The findings in the first two models indicate that an increase in GST rates does have an adverse impact on the children's health in the short-run. However, when we control for the temporal and spatial heterogeneity in the next two specifications (Models 3 and 4), the significance vanishes. As Model 4 is our preferred specification, we conclude that GST rates do not causally affect WAZ, as was the case with HAZ.

Table 8

Impact of GST on WAZ

Variables	Model 1	Model 2	Model 3	Model 4
GST Rates	-0.245***	-0.236***	0.349	0.324
	(0.034)	(0.034)	(0.368)	(0.348)
Constant	3.147***	2.923***	-4.164	-3.926
	(0.572)	(0.577)	(4.335)	(4.118)
Observations	140,778	134,935	123,291	123,291
R-squared	0.038	0.045	0.053	0.062
Child & HH Characteristics	No	Yes	Yes	Yes
YOB & MOB FE	No	No	Yes	Yes
District FE	No	No	No	Yes

Note: Robust standard errors, clustered at the district level, are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1. YOB and MOB FE show the year and moth of birth fixed effects, respectively.

5.4. Impact of Tax Incidence on WAZ

Similar to what we did in case of the HAZ, we now examine whether tax incidence would have any effect on the short-run measure of health. The findings of the impact of tax incidence on WAZ are presented in Table 9. The first column does indicate that the tax incidence has a significant negative effect on weight-for-age Z-score of children in Punjab. Nonetheless, when we control for various covariates in the second model, the significance disappears, although the sign remains the same. The results in columns 3, where year and month of birth fixed effects are included, are similar to the ones in column 2. Similar story emerges when the district fixed effects are controlled for in column 4. Since the last three specifications are progressively more robust, and since all of them report a statistically insignificant effect on tax incidence on WAZ, we conclude that the former does not have a causal effect on the latter.

Table 9

Impact of Tax Incidence on WAZ

Variables	Model 1	Model 2	Model 3	Model 4
Tax Incidence	-0.226***	-0.071	-0.077	-0.053
	(0.048)	(0.052)	(0.052)	(0.041)
Constant	0.572***	-0.124	1.013	0.791
	(0.208)	(0.201)	(0.806)	(0.771)
Observations	140,363	134,920	123,278	123,278
R-squared	0.041	0.046	0.053	0.062
Child & HH Characteristics	No	Yes	Yes	Yes
YOB & MOB FE	No	No	Yes	Yes
District FE	No	No	No	Yes

Note: Robust standard errors, clustered at the district level, are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1. YOB and MOB FE show the year and moth of birth fixed effects, respectively.

Looking at the results and discussion in this section, we see that only the tax incidence (and not the tax rates) has a causal negative impact on children's long-run nutritional status. The reason for the insignificant effect in the short-run could be that people may not immediately change the composition of their food consumption. In the event of negative effect on overall income, they may initially try to smooth consumption for a short period of time through, for instance, borrowing. This, however, may not be sustainable and that is why we observe the negative impact on HAZ–the longer term measure of nutritional status.

6. CONCLUDING REMARKS

Pakistan's Tax-to-GDP ratio has remained gloomy for several years. In addition to the low collection of revenues, the reliance has been heavily on the indirect taxes such as the General Sales Tax (GST). Due to weak and outdated tax structure together with inefficiency and ineptness of the institutions responsible for revenue collection, the major share of revenue collects is through indirect taxes. One of the major pitfalls of reliance on indirect taxes is that it affects individuals irrespective of their incomes. The tax incidence of GST has been found to be higher for lower income groups. In addition to the immediate, observable and direct effects of higher GST, there can also be some indirect and unobservable effects that can have long-term welfare consequences. One of these is the impact on children's health which has not been explored in Pakistan. The current study is an attempt to fill this gap by examining the impact of increase in GST on children's short-term and long-term health statuses. For this purpose, the province of Punjab is considered for analysis due to data availability for multiple periods.

Using the last three rounds of Punjab's Multiple Indicators Cluster Surveys (MICS), the results show that increase in GST rates do not have any effect on the children's health. However, the increase in tax incidence adversely affects children's height-for-age-z-score (HAZ). A one percentage point increase in the tax incidence reduces a child's HAZ by 0.57 SD. This is a very high number. Moreover, the effect is robust across different specifications and has been found for each round in the disaggregated analysis. However, the impact is found only for middle and lower income groups. Children in the higher income group are not affected by the rise in tax incidence. No significant heterogeneity was found across region of residence and gender of the child in terms of sign and significance, although the magnitudes were slightly higher for rural residents and female children. On the other hand, neither GST rates nor tax incidence was found to have any effect on weight-for-age-z-score (WAZ). Hence, we may conclude that increase in tax incidence have a causal adverse effect only on the long-term nutritional situation of the children in Punjab.

The possible channel for this detrimental effect of higher tax incidence on children's health could be the reduction in households' overall purchasing power due to increase in the tax rates. The finding that the impact is observed only for middle and lower income groups suggest that the exemption of certain food items for children from the GST may not eliminate the negative impact of this tax on children's health, especially if these exemptions are positively associated with increase in the rates of sales taxes [Stratmann (2017)]. This is because the poor households' overall income is reduced due to high GST on other necessary items and they are forced to reallocate the household resources which could reduce the budgetary share specified for children. This raises an important concern about the fairness of the uniform but high rates of GST as it can have long-term welfare consequences. From an economic point of view, we are always interested in understanding the influence on the labour market outcomes such as occupational choices and wages. Hence, following Vogl (2014) study on the impact on Mexican children's HAZ, the back of an envelope calculations suggest that these Pakistani children are likely to experience a reduction of approximately 15 percent in future wages due to the unfavourable effect of increase in tax rates. This calls for attention on the part of policy makers. This analysis provides an additional reason for reducing the reliance on indirect taxes and shifting it to direct taxation by broadening coverage (and not increasing the rates for those who are already being taxed heavily). Subsequently, this will require overhauling and restructuring of the entire taxation system in the country. As a starting point, however, the GST should be reduced significantly, ideally bringing it down to a single digit. The potentially decrease in revenue could be recovered by broadening the tax base and by bringing the three million households identified by the Federal Bureau of Revenue to be potential tax payers in the tax net.

Future research could extend this work in several directions. First, given the availability of data, the channel that has been suggested should be empirically verified. Second, once the data from the latest rounds of MICS is available for other provinces, it should be included in the analysis to incorporate regional heterogeneities and generalise the results for the entire country. Lastly, the impact of tax incidence form other taxes, especially the direct taxes, may also be explored for comparison purposes.

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