ECONOMIC WELL-BEING AND PHYSICAL ILL-BEING
(THREE ISSUES IN ONE DECADE: CASE OF SRI LANKA)

By

Nirosha Wijesekara Dissanayaka

Dissertation

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

IN DEVELOPMENT POLICY

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ABSTRACT

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NIROSHA WIJESEKARA DISSANAYAKA

In the development literature, income and expense-based indicators are often used to measure household well-being. However, later researchers pointed out that it is not appropriate to use economic indicators alone to measure domestic well-being, but it should be studied with a broader concept (Phipps 2002; Alkire and Sarwar 2009; Edward N. Wolff and Ajit Zacharias 2006; Sen 1985). They highlighted the importance of multidimensional factors and indicators in investigating household well-being (Di Tommaso 2007; Krishnakumar 2007; Krishnakumar and Ballon 2008; Mabsout 2011). Accordingly, this study investigates household well-being in Sri Lanka in terms of economic, social, and physical well-being.

The first chapter examines the impact of a large-scale development program on household well-being in the Hambantota District in the Southern Province of Sri Lanka. The name of the program is the Greater Hambantota Development Program (GHDP), which includes international level constructions such as a port, an airport, a stadium, and a massive administrative complex. The government obtained a huge amount of money from China for the construction of the project. Introducing such a massive development program to Hambantota was one of the biggest promises one candidate made during the presidential election in 2005. Project outcomes and the political motivation of the program are still debatable. However,

whether the project is successful or not, the job creation and the cash flow circulating in the area can directly and indirectly impact domestic well-being, which is the focus of this study. The findings show that the income (earnings from wages, agricultural activities, and non-agricultural activities) of the people living in the Hambantota districts is lower than the income of the people who live in the non-treated district after the program was implemented, relative to the before intervention. Simultaneously, people's spending on food and non-food items has also been lower in the households of the Hambantota district compared to their counterparts. The time it needs to spend by people who live in the Hambantota district to reach the public places is higher than the people who live in the non-treated district after the new city plan and road network introduced, vis-a-vis the before period. Furthermore, irregular development projects carried out have increased the vulnerability of the people of the area to natural disasters and disasters due to wild animals.

Chapter two examines the impact of war on the physical well-being of children under five by using two critical indicators of stunting and wasting. The study finds that children under five exposed to the war are more likely to be stunted and wasted than the same age cohort who lived in the non-war areas. When considering single age groups, the stunting results show the larger effects for younger cohorts. When under five cohorts are separated into two based on children born during the ceasefire and non-Ceasefire, results indicate that children born during the battle are more likely to be severely stunted and wasted than those born during the ceasefire. The study also provides evidence that antenatal care and postnatal care in the war area are lower than the non-war areas in the war period, relative to the non-war period. In addition, the iron and parasite drugs intakes of children and mothers exposed to war are significantly lower than that of their counterparts during the war period relative to the non-war periods.

Chapter three investigates the impact of Ride-Sharing Service (RSS) on the taxi/trishaw industry in Sri Lanka. According to the findings, the RSS increases the income of both full-time and part-time taxi drivers. However, the income of part-time taxi drivers increases at a higher rate compared to full-time taxi drivers. The study also reveals that the working hours of full-time employees have fallen, while those of part-time workers have increased. Moreover, both full-time and part-time taxi drivers desire to work longer hours if the opportunity arises. Compared to the full-time workers, more part-time taxi drivers desire to continue the same occupation if they get an opportunity to work more hours. Considering the entire workforce, the demand for taxi driving jobs has increased after the RSS intervened in the taxi industry in Sri Lanka.

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CHAPTER ONE

POLITICAL FAVOR, DEVELOPMENT PROJECTS, AND HOUSEHOLD WELL-BEING (THE CASE OF THE GREATER HAMBANTOTA DEVELOPMENT PROGRAM, SRI LANKA)

1.1 Introduction

Often, the main objectives of government-implemented projects are to uplift the economic and social well-being of the country. Many projects, therefore, work as building blocks to achieve the socio-economic goals of citizens. Whatever the purpose, when implemented, projects are not always successful and sometimes bring opposite results to the goal (Matthew et al., 2019; Damoah, 2015; Fabian and Amir, 2011; Ackah, 2020). Projects failures are common in many Asian and African countries but not so common in European countries. Many failed projects initiated by governments in developing countries are hampering the economic growth of those countries (Nweze, 2016). Some examples of such failed projects are power generation projects introduced to African countries, construction projects in Asian countries, and IT projects in the United Kingdom (Shahhossein et al., 2018; Fabian and Amir, 2011; Heeks, 2006, Okereke, 2017).

However, there is no clear criterion for identifying the failure of a project. Various researchers have come up with different definitions to identify the failures of projects (Turner, 1993; Belout & Gauvrean, 2004; Atkinson, 1999; Amachree, 1998; NZekwe et al., 2015; Cousillas et al., 2010). We can see some commonalities used to measure the failure of a project when considering these different definitions. Those are quality, time overrun, cost overrun, need fulfillment, poor project planning and variations of scope & design, etc. However, some words that are used to define the failure of projects themselves have no definition. For example, poor planning, quality, variation of scope can be stated.

Sri Lanka also implemented a large-scale development program in the Hambantota district. The project is called GHDP and includes several large-scale sub-projects such as an international airport, an international port and, an international stadium. It also consists of an extension of highways, railways, and a massive administrative complex. The government received large sums of money from China for these constructions. Furthermore, some water supply projects have also been implemented to fulfill the water needs of the people living in the Hambantota district. In the end, however, the port, airport, and stadium were not as commercially successful as hoped.

As mentioned earlier, due to the lack of direct criteria for measuring the success of a project, different people began to argue about the success or failure of the GHDP from different angles based on their political ideology. Some argue that large-scale international market-oriented investments in the district, directly and indirectly, impact local well-being due to the cash flow and job opportunities generated in the area (Rangajeewa, 2013). Others argue that the locals did not get the job opportunities they had hoped for, and that people have become more difficult and anxious due to informal planning and construction (Mariyathas et al., 2016). Instead of trying to identify problems and fix them, people in many developing countries are trying to point out that all actions taken by the political party to which they belong are correct, and all actions taken by the opposition party are wrong. No exception for Sri Lanka. By Considering both the optimistic and pessimistic arguments, the study investigates whether the GHDP program would significantly impact households' well-being in the Hambantota district.

1.1.1 Background

Mr. Mahinda Rajapaksha, who was the President of Sri Lanka from 2005 to 2015, is a resident of the Hambantota district, which was one of the poor districts in Sri Lanka. The total land area of the Hambantota district is 2563 square kilometers and is located 240 kilometers away from the capital. The Hambantota district belongs to the dry zone, where about 95 percent of

the total population lives in the rural. 97.04 percent of the total population is Sinhalese, and the rest of the 2.96 percent represents all the other communities, including Muslims and Hindus.

Until 2005, Hambantota was just 'one of the other districts' in Sri Lanka that received no local or foreign attention. However, the victory of President Mahinda Rajapaksha on November 17, 2005, presidential election, and the emergence of the leader who ended the LTTE war in 2009 brought the Hambantota district to the forefront of local and international attention. Mr. Mahinda Rajapaksha had promised at the presidential elections in 2005 that he would bring about massive development in the Southern Province and especially to the Hambantota District. As promised, during his tenure, he introduced a massive development project to revive the Hambantota district, the area where he was born and raised. The first phase commenced in the first quarter of 2006 after the president was sworn on November 19, 2005. The vision of the project was to make Sri Lanka the gateway to Asia. No other city in the country has changed so significantly since independence. This massive development upheaval is the result of political decisions.

However, the government of Sri Lanka had not had enough funds to do such a large construction. Therefore, the government borrowed a large amount of money from the Export-Import (Exim) Bank of China since the government had no funds to carry out such a large project. For example, the cost of the first phase of the international port was US$ 361 million, of which the government obtained 85 percent from the Exim Bank of China. The estimated cost of the international airport was US$ 209 million, which increased later up to US$243.7 million. Of which the US$210 million was obtained from China Exim Bank. Estimate costs for the extension of the highways and the railway lines were US$ 180 million and US$ 278.2 million, respectively. That money also was obtained from Exim Bank of China. The estimated cost of the Hambantota Water Supply Project is Rs.2200 million. It was jointly implemented by the China Geological Engineering Corporation and Salcon in collaboration with the

National Water Supply and Drainage Board of Sri Lanka. Compared to other multilateral development banks, interest rates on Chinese loans are often higher. Sri Lanka borrowed US$ 307 million for the first phase of the Hambantota Port at an interest rate of 6.3 percent. However, interest rates of multilateral development banks are mostly 2-3 percent, sometimes even lower than 2 percent (Jonathan Hillman, 2017). The reason why Sri Lanka borrows at high-interest rates may be that low-interest lenders are reluctant to take the risk of investing in such massive projects.

The objectives of the project were not only limited to the international market or international trade. It is also expected to uplift the rural and service sector economy with a sustainable design by opening job opportunities for people living in the area. At the same time, inspiring the tourism industry and generating direct and indirect sources of income are among the objectives of this massive program. The project moved with the vision of creating a golden future for the people living in the Hambantota district.

However, it is questionable whether the above investments provide benefits to the people living in this area. Some argue that these investments are not truly beneficial to the majority living in the Hambantota district. They point out that projects aimed at the rich (such as international ports, airports, stadiums, etc.) do not benefit the poor (Mariyathas et al., 2016). There are several points to consider in this regard.

First, the total population living in the Hambantota district is 599,903. Among them, the urban population is 31,709, representing 5.28 percent of the people belonging to the Hambantota district. The percentage of poor households based on the official poverty line in the Hambanthota district in the year 2006 is 10.5 that is high compared to most other districts. Furthermore, 43.7 percent of the total population in the Hambantota district is engaged in the agriculture sector. Are international airports, stadiums, or ports beneficial to the inhabitants of such a city where more than 40 percent of the population depends on agriculture who are

relatively poor? Second, when borrowing from China, a large portion of the borrowed money goes back. One of the reasons is that the country that applies for a loan has to agree unofficially to different loan terms to obtain the loan. For example, if the country applies a loan for construction, the construction should be outsourced to a Chinese company. Then, they import consultants, technicians, workers, and machinery from China. Therefore, some point out that most of the people engaged in the non-agricultural sector will not benefit much from these massive development projects. Third, some point out that the population's income has worsened after the GHDP was implemented (Mariyathas et al., 2016). For example, Hambantota is located between the capital and Kataragama. Kataragama is a place of worship for Sinhala and Hindu devotees who represent more than 90% of the country's population. Another important place near Kataragama is a wildlife sanctuary which names Yala. Thousands of people from many parts of the country visit the Kataragama Sacred city almost every year. Yala Wildlife Sanctuary is also a major tourist attraction. While passing through Hambantota city, many pilgrims and tourists stop at small shops run by locals along the old road to buy buffalo milk (locally named milk) and local sweets (local name kaludodol). Selling those to visitors was the livelihood of many families who lived near the old road. As the new highway and the road systems became operational, the small shops beside the old road closed due to a lack of customers, and many locals lost their livelihoods. Also, most of the residents displaced due to the new construction have been forcibly resettled in the new city (Mariyathas, 2016). As a result, the livelihoods of inhabitants were disrupted. On the other hand, the new employment opportunities were taken by skilled and educated outsiders. Some researchers state that the GHDP was an ambitious plan but unrealistic (Rathnayaka, 2017). They show that the GHDP was not a strategic project to generate economic growth.

> "*The biggest caveat to Sri Lanka's ambitions in Hambantota is that it is in an extremely rural region that's better known as the domain of migrating elephants.*

Literally, Sri Lanka and China aimed to build a new city in the middle of the jungle (Shepard, 2016)".

Feasibility studies have repeatedly pointed out the risks involved in the construction of international ports and airports. However, all those warnings were ignored by the egocentric political agenda. Finally, negative growths were reported by the Hambantota port in 2015 and 2016[1].

On the other hand, natural drainage canals in many areas were blocked due to irregular constructions carried out by ignoring the feasibility study reports. Some people point out that natural disasters such as floods in the Hambantota district have increased since the implementation of the project. Moreover, according to the locals, wildlife disasters have increased (Robertson, 2018). Thousands of acres of forest lands have been used for development, resulting in the loss of habitat for wild elephants and other animals. As a result, homeless wild elephants began to roam the villages. Therefore, in parallel with the development activities, the human-elephant conflict in the Hambantota district also intensified. On the other hand, the area is a bird sanctuary, which has disrupted flights (Vishvajith, 2019; Robertson, 2018). Therefore, the second objective of this study is to examine the impact of GHDP on disasters in the region.

However, some other researchers point to the positive aspects of the project. According to them, there is no doubt that the Hambantota district is one of the fastest-growing regions in Sri Lanka with unique features. Some point out that the project will improve the living standards of the people in the Hambantota district. They also point out that even adjoining backward areas will become developed districts (Rangajeewa et al., 2013). Others argue that large-scale investment activism will increase cash flow and create jobs. For example, quoting government

[1] source: Statistics published by the Central Bank of Sri Lanka

estimates, Rangajeewa et al. (2013) point out that the international port alone will create 50,000 jobs. Therefore, they believe that this project will increase the income of the people in the area and improve the living standards of the people. However, all the massive construction was done by Chinese companies and employed Chinese workers. Therefore, the area residents say that they did not get employment opportunities through this project (Routledge, 2012; Robertson, 2018). Thus, the third objective of this study is to identify whether the employment opportunities of the people living in the Hambantota District are different from their counterparts. Accordingly, there are both positive and negative views on the outcome of this massive development process in the Hambantota District. However, those criticisms often take on a political face. I expect that there are significant impacts from the project on household well-being in the Hambantota District. Accordingly, the main objective of this study is to investigate the effects of GHDP on household well-being without looking at it from a political angle.

According to my knowledge, existing studies on the GHDP are descriptive. Criticisms based on those descriptive studies against, and favor of the project do not provide the magnitude of the extent to which it is negative or positive. I hope this empirical study will fill this gap of existing literature on the GHDP.

Moreover, most developing countries face similar issues when they implement development projects since project failure is common in most developing countries. Even though, they implement projects to uplift the household's well-being, sometimes outcomes that expect from the project give reverse effects. The biggest issue occurs when the money spent on the projects is borrowed at high-interest rates. It is better to understand that investing large sums of money alone cannot improve the well-being of the people. This study will provide a good example for policymakers to make better decisions before investing a large amount of borrowed money in a luxury-type development project in rural and poor areas.

Household Well-being

The term 'well-being' mainly includes physical well-being, economic well-being, and socio-economic well-being. Recent studies have shown that household well-being cannot be measured using only wealth-based indicators such as household income or per capita income (Alkire and Sarwar 2009; Edward and Zacharias, 2006). Instead, researchers suggested investigating well-being in the broader sense (Brown et al. (, 2005). For example, the Human Development Index (HDI) was developed by Pakistani economist Mahbub ul Haq in 1990 to measure well-being by putting three indicators into a composite index. Three indicators used to prepare the HDI index are income, educational attainment, and life expectancy.

Various researchers have shown that it is essential to use non-income indicators to measure well-being (Phipps 2002; Di Tommaso 2007; Krishnakumar 2007; Krishnakumar and Ballon 2008; Mabsout 2011, Sarah Brown and Daniel Gray, 2016). The OECD also was developed an OECD well-being framework which includes a key dimension of current well-being. It includes income & wealth, work & job quality, housing, health, knowledge & skills, environmental quality, subjective well-being, safety, work-life balance, social connections, and civic engagements. Some researchers argue that variables such as asset ownership, debt burden, access to public services also reflect well-being (Zacharias and Thomas, 2009). To find a better solution, Yograj Gautam and Peter Andersen, 2016, assessed the role of livelihood diversification in household well-being in west Nepal. They have developed a composite household well-being index by putting four components with 15 related indicators. The four elements used were food consumption, housing, storage and ownership, and large-scale real estate. Taking all the above into account, this study investigates household well-being using income, access to basic amenities, time that it takes to access public services, the risk to disasters, household expenses, housing conditions, housing ownership, access to water, and sanitary facilities. Although education and health services play an essential role in measuring

the well-being of households, this study does not investigate the impacts of the project on those services because the government provides free health and education services to all the people of Sri Lanka.

1.2 Data Description and model specification

The study uses the Household Income and Expenditure Survey (HIES) data from 2002 to 2016 collected by the Department of Census and Statistics (DCS), Sri Lanka. The survey years are 2002, 2006/07, 2009/10, 2012/13, and 2016. The two-stage stratified random sampling methods were used to conduct the surveys. To verify the findings, I have used two data sets (The Demographic and Health Survey Data (DHS) for 2006 & 2016 and The Labor Force Survey (LFS) data from 2002 to 2016).

After checking balance tests considering the Hambantota as treated district and each of the other different districts as control districts separately, I found that the best suitable district to select as control district is Anuradhapura. The balance test presented in Table 1.1 is the equilibrium test of all the variables in this study. It tests whether there is a balance between the observed and non-observed covariates in treatment and control groups. Once the Anuradhapura district is considered as the control group, all covariates except three were balanced in mean different value of treatment and control groups. Those variables are Adhoc-Income, type of walls, and expenditure on health. Of which two coefficients show 5 percent significant levels, and the variable of Adhoc Income shows a 10 percent significance level. However, the Adhoc-income variable does not provide statistically significant findings in the main results. The second variable is household wall type which I used to prepare a wealth index for the household by using principal component analysis. Therefore, the wall-type variable also does not significantly influence the main results. Only the remain is health expenditure variable which is significant at 5 percent level in our main findings. Since all the other covariates are balanced, I assumed that both treatment and control groups are matched. Another motivation to select the

Anuradhapura district is that it is far from the Hambantota district, and no spillover effect can be expected between the two districts. On the other hand, Income and expenditure-related indicators of treatment and control districts (obtained from the Annual Central Bank Report of Sri Lanka) at the baseline are very close (See appendix I), increasing my motivation to select Anuradhapura as the control district.

1.2.1. Data Description

Variable Description: The variable income is used to measure household well-being, and it consists of six income categories. They are salaries and wages, agricultural activities, non-agriculture activities, other agriculture activities, other income, and Adhoc-income. Income from salaries and wages refers to the income received by working as an employee during the last calendar month. Income from agricultural activities refers to the income received through cultivating paddy and other seasonal crops as an employer or own-account worker. The value-added is derived by deducting input values from the output values. Income from other agricultural activities refer to the income earned through non-seasonal crops and livestock activities. Other income refers to the other payments. The Adhoc-income refers to income received by household members by chance or Adhoc gains during the last calendar year. All income variables are reported in log form. Household total food expenditure and its different categories were tested using expense in log forms. Food categories tested were cereals, fish, non-alcohol beverages, short-eats, vegetables, liquor, and other food types. The total non-food expenditure composes of different expenditure categories. Those are health, fuel & light, personal care, clothing, housing, transport, and other expenditures. questions are, ‘Do you have electricity supply (mainline) nearby your area?’, ‘Do you have telephone facilities in your area?’, ‘Do you have pipe born line (mainline) nearby your area? Answers were given in yes/no forms. Access to basic facilities was measured using the answers provided for those questions.

Table 1.1: Balance Test

Variables	Mean Control	Mean Treated	Difference	t-stat	Pr(|T|>|t|)
sex	0.50	0.49	0.01	0.29	0.7684
age	31.21	31.91	-0.69	-1.38	0.1692
Log level of education	0.86	0.87	-0.01	-0.98	0.3245
Income- Salaries and Wages	2,180.43	2309.65	-129.22	-0.69	0.4880
Income- Agriculture	34,809.58	41,221.70	-6,412.12	-1.08	0.2800
Income- Non Agriculture	1,025.64	1,252.90	-227.26	-1.16	0.2474
Income- Ad hoc Income	9,680.13	6,815.63	2,864.49	1.75	0.0802*
Income- Ad hoc loans	4,271.23	4,171.17	100.05	0.08	0.9349
Debt - financial institution	11,863.31	11,434.82	431.48	0.19	0.8498
Debt_ money lenders	3,063.59	2,023.58	1,040.01	1.46	0.1431
Food expenditure	65,278.01	46,767.76	18,510.25	1.58	0.1213
Time to Bus halt	10.14	9.80	0.33	0.79	0.4291
Time to District Medical Office	32.43	31.37	1.06	1.04	0.2971
Time to District Secretariat office	36.14	35.58	0.55	0.55	0.5776
Time to Maternity clinic	26.03	26.98	-0.95	-1.20	0.2280
Time to M.C. / U.C. / P.C.	34.73	35.30	-0.57	-0.55	0.5790
Time to School	21.74	20.08	1.36	2.01	0.0443
HH-ownership	0.94	0.94	-0.00	-0.39	0.6919
HH-Walls	0.94	0.95	-0.01	-2.14	0.0322**
HH-Cooking fuel	0.13	0.14	-0.01	-1.644	0.1001
Disaster - Wild animal	0.03	0.02	-0.00	-0.292	0.7701
Disaster - Natural	0.06	0.06	-0.01	-0.975	0.3295
Non-Food Expenditure - Health	570.53	704.62	-134.09	2.260	0.0240**
Non-Food Expenditure - Personal care	286.75	310.14	-23.38	-2.092	0.0360
Non-Food Expenditure – Fuel &Light	904.13	927.04	-22.91	-0.512	0.6081
Non-Food Expenditure - Clothing	5,196.02	5,052.42	143.60	0.569	0.5693
Non-Food Expenditure-Transport	1,751.06	1,605.51	145.55	0.876	0.3806
Non-Food Expenditure - Other	34,969.13	23,618.43	11,350.70	1.065	0.2870

*Notes: *p<0.10, **p<0.05, ***p<0.01. M.C stands for Municipal council, U.C. stands for Urban Council, P.C. stands for provincial council, HH stands for households*

During the survey, three questions were asked from respondents, based on the respondent's ability to access electricity, water, and telephone connections from their location. Those Proximity to water, electricity and telephone facilities from home has been used for this

purpose. They are binary variables and were considered as 1 if the facility was available near the house. Otherwise, those variables are considered as 0. Three variables have been used to examine the availability of water. First, it considered whether households use safe drinking water[2] or not. The variable of safe drinking water equals 1 if the household consumes water from a safe water source and 0 if they consume water from an unsafe water source. The name of the second variable related to the water facility is within the premises. It is a binary variable, which equals 1 if the household has access to water within their premises, and 0 otherwise. Water sufficiency is the third variable used to access water facilities. It is also a binary variable, which equals 1 if the household has more than 2-bed rooms, Cooking Fuel, Toilet facility, Floor material, Roof material, Wall materials, and Household Ownership are binary variables that I used in this study to examine household well-being through housing conditions. The variable if Houses with more than 2-bed rooms equal 1 if the household has more than two bedrooms and 'o' otherwise. The variable of Cooking Fuel equals '1' if the household uses gas or electricity for cooking and '0' if they use kerosene firewood, sawdust, paddy husk, or other material for cooking. The variable of Toilet facility equals '1' if the household uses a water seal toilet (which can be connected to pit/ tank/ drainage system/ piped sewer) and '0' if the toilet is not a water seal/ direct pit/ other unsafe toilets.

The variable of 'floor material' equals '1' if the floor material of the household is cement, teraso, tile, or concrete and 0 for mud, wood, sand, or other material. The variable of 'Roof material' in this study equals '1' if the roof material of the household is tile, asbestos, or concrete, and '0' if metal sheet, takaram, cadjan, Palmyra, straw, other material used by a household to cover their roof. The variable of Wall materials equals '1' if the household use

[2] Protected well, tap lines, tube wells and bottled water are considered as safe water sources. Water comes through Village water projects were also considered safe water sources. Water from unsafe wells, bowsers, rivers, tanks, rain, and other unprotected water sources can be considered 'unsafe water sources'

bricks, cabook, cement block, pressed solid block to build the walls and '0' if walls are made by mud, plank, metal sheet, cadjan, Palmyra, other material. Household ownership is another variable that I used to investigate the well-being of the household. The variable equals '1' if the household has constructed/ purchased by an occupant, inherited, freely received/ received as a gift, or compensated and '0' if they rent, lease, encroached the house which they are living at the moment of the survey.

The study also used the time to access government agencies to test domestic well-being. Variables represent the time taken from home to the closest facility. The time is taken to reach the nearest public places from home was considered in this study. Public places are banks, bus halts, District Medical office (DMO), DS office, government dispensary, private dispensary, hospital, maternity clinic, Municipal Council/Urban Council/ Provincial Council (MC/UC/PC), post office, and pre-schools.

As explained earlier, some people living in the Hambantota district claim more prone to disasters after implementing the project. Two binary variables were used to test the authenticity here. The first variable relates to natural disaster, which equals 1 if the household unit was affected by any natural disaster during the last 12 months, and 0 otherwise. The next variable is wild animal disasters, which equals 1 if the household unit was attacked by wild animals during the year prior to the survey and 0 otherwise.

1.2.2 Model specification

The study used the difference in differences approach to identify the impact of GHDP on household well-being. The standard DID model used is as follows.

$$Y_{hdt} = \pi_0 + \pi_1 Post_t + \pi_2 Hamb_{hd} + \pi_3 (Post_t * Hamb_{hd}) + X'_{hdt}\alpha + \mathcal{E}_{hdt} \ldots (1)$$

Where, 'h' stands for households; 'd' stands for district and 't' stands for years. Y_{hdt} represents the outcome variables of household 'h' in district 'd' at time 't'. 'post' is a year

dummy that equals one for 2016 and equals zero for 2006. '*Hamb*' represents a binary variable which is one for Hambantota District, and zero for Anuradhapura district. X'_{hdt} represents a set of other variables that can affect outcome variables, such as sector, sex, age, religion, ethnicity, marital status, level of education, etc. $\mathcal{E}_{hdt}$ is the error term. π0, π1, π2, π3, α, are parameters supposed to be estimated.

1.3. Empirical Results

This section discusses empirical findings of the impacts of the GHDP program on household well-being in the Hambantota district.

1.3.1 Impact of the GHDP on Income, and expenditure on food & non-food items

A widely used indicator to measure the well-being of households is income (Luttmer 2005; Senik 2008; Clark and Oswald 1996; Frijters, and Shields 2008). One may expect, on the other hand, to be an increased income of the household in the area after implementing such a massive development project. Table 1.2, therefore, is used to examine the project's impact on the income of the people in the area, which provides the income of households in six different categories. Columns (1) to (6) refer to income received through salaries and wages, agriculture activities, non-agriculture activities, other agriculture activities, Adhoc-income, and other income, respectively. All income categories show negative signs relative to the control group after the intervention of the program. Out of those coefficients, three income categories show statistically significant results. They are salaries and wages, agricultural activities, and non-agricultural activities. According to some researchers and government reports, the project aimed to create many jobs. If that happened, the income from the salaries and wages of households in the Hambantota district would be higher after the program was implemented. However, column (1) of Table 1.2 shows that the income from salaries and wages of the people living in the Hambantota district is 16.5 percent lower in the Hambantota district than the non-treated district after the program was implemented. It can be affected by several factors. As

mentioned earlier, the people in the area may not have found employment opportunities as workers were brought in from China for almost all construction projects. Second, the people of the area had to move out of their usual residence

Table 1.2: Impact of GHDP on Income of the households

Description	(1)	(2)	(3)	(4)	(5)	(6)
	Log Income by different categories					
	Salaries and wages	Income from Seasonal Crops	Non-Agri. activities	Income from Non-Seasonal Crops	Other Income	Adhoc Income
Treated	-0.085	-0.070	-0.068	-0.038***	-0.041**	-0.146**
	(0.075)	(0.061)	(0.073)	(0.007)	(0.020)	(0.060)
Post	0.075***	0.071*	0.163*	0.072***	0.081	0.061
	(0.014)	(0.041)	(0.091)	(0.018)	(0.063)	(0.061)
Treated x Post	-0.165***	-0.158**	-0.185**	-0.033	-0.038	-0.080
	(0.035)	(0.068)	(0.077)	(0.230)	(0.079)	(0.087)
Controls	YES	YES	YES	YES	YES	YES
R2	0.41	0.27	0.27	0.23	0.30	0.23
Observations	3317	3317	3317	3317	3317	3317

***Note**: Dependent Variables are income in log forms by different categories. Columns (1) to (6) represent income from salaries and wages, agricultural activities, non-agriculture activities, other agriculture income, and Adhoc income.*

The variable of salaries & wages refers to the income received through salaries and wages during the last 4 weeks prior to the survey. Income received through agriculture activities refers to the period of cultivation year prior to the survey. The reference period of income through non-agriculture activities refers to the last calendar month prior to the survey. The periods of income received through other agriculture activities, Adhoc income, and other income refer to the last 12 months prior to the survey. Salaries and wages refer to the income received by working as an employee during the last calendar month. (Note: This includes tips, commissions, overtime payments received during the last calendar month, and bonus and/or arrears payments received within the last 12). Agricultural activities refer to the income received through cultivating paddy and other seasonal crops (Seasonal crops include paddy, cereals, vegetables, potatoes, chilies, onions, tobacco, and other seasonal crops) as an

employer or own account worker during the last cultivation year. The study refers to the value-added of the output derived by deducting input values from the output values.

Other agricultural activities refer to the income earned through non-seasonal crops (non-seasonal crops include tea, rubber, coconut, coffee, pepper, betel banana, fruits, etc.) and livestock activities (livestock activities include meat, fish, eggs, milk, other food items related to livestock, horticulture, etc.). Other income refers to the other payments (other income includes pensions, samurai (welfare payments to the poor), old age payments, tuberculosis/kidney disease payments, education and scholarships, dividends/interest, property rent, boarding fees, remittances receipts, etc.). Adhoc income refers to loans taken from banks or money lenders, sales/ pawning of assets, withdrawals from saving/ bank deposits/ gratuity fund / provident fund, income receives from associations, welfare societies, health and medical aids, compensation/ insurance, other (lottery & Adhoc gains), other commendations, disaster relief payments, etc. Basically, it refers to income received by household members by chance or Adhoc gains during the last calendar year.

*All regressions included household controls. Coefficients with robust standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

to provide land for the development project, which may have resulted in the loss of even their previous jobs. This situation is likely to have a negative impact on the income earned from wages. Although more than 40 percent of the area's population is dependent on agriculture, the GHDP project does not include any component related to the development of agriculture. Still, one can expect a positive indirect impact on the agricultural sector from the program. Table, however, shows that there has been a significant negative impact on the income from seasonal crops after implementing the program. (Column 2 of Table 1.2). The main expectation of the project is to enhance the non-agriculture sector in the district. However, after the introduction of the project, the income of households received through non-agricultural activities has also decreased significantly (Column 3 of Table 1.2).

One of the other important components that many researchers used to measure household and individual well-being is expenditure (Heinz-Herbert and Weick, 2015). When incomes fall, households often not only cut down on non-essential living expenses but also reduce the cost of some essential items, such as food. Among other expenditures, expenditure on food is one of the important factors that can be used to measure household well-being (McGregor and Borooah, 2009). According to Engels' law, as household incomes increase, the proportion of money they spend on food out of their total income decrease (Engel, 1857). However, it further states that an increase in income of the household increases the total expenditure on foods. Accordingly, we can expect a negative impact on food expenditure since the income of households from three categories were decreased after the intervention of the project. For example, the Great Depression in the United Kingdom has reduced actual food spending in its households (Rachel et al. (2015)). They further point out how their shopping basket's home-based shopping efforts and characteristics in responding to economic shocks. By using weekly household expenditures for various food items, this study shows how people in the Hambantota district respond to their income reduction (Table 1.3). The total money spent on food items by households of Hambantota district has decreased statistically significantly by 5.5 percent compared to the households in the treated district after the GHDP was implemented. When total food expenditure differentiates by essential foods and non-essential foods, those items are lower by 6.1 percent and 5.1 percent in the treated district after the GHDP implementation than before the intervention.

Table 1.3: Impact of GHDP on Food Expenditure of households

Description	(1)	(2)	(3)
		Food Expenditure on	
	Total Food Expenditure	Essential food for living	Non-essential foods for living
Treated	-0.039***	-0.037**	-0.046***
	(0.009)	(0.011)	(0.012)
Post	0.029***	0.039***	0.098
	(0.002)	(0.001)	(0.037)
Treated x Post	-0.055***	-0.061**	-0.051**
	(0.014)	(0.031)	(0.025)
Controls	YES	YES	YES
R2	0.51	0.36	0.28
Observations	3317	3317	3317

***Notes**: Dependent Variables are log variables that indicate food expenditure by types of food. Column (1) shows the total food expenditure of households. Columns (2) & (3) represent expenditure on essential food for living and non-essential foods for living respectively.*

*All regressions included household controls. Coefficients with robust standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

Household expenditure on non-food items can also change as incomes fall, which is examined in Table 1.4. It does not show a significant impact on total non-food expenditure. However, when total non-food expenditure differentiates between essential non-foods and non-essential non-foods, expenditure on essential non-food items is lower by 2.5 percent in the treated district after the GHDP implementation than before the intervention. According to Tables 1.3 & 1.4, the food expenditures of the households are significantly lower than the non-food expenditures. Such an outcome can be expected as poor people spend more of their income on food than non-food (Obisesan et al., 2016).

Table 1.4: Impacts of GHDP on Non-Food Expenditure of households

Description	(1) Total Non-Food Expenditure	(2) Essential Non-Food Expenditure	(3) Non-Essential Non-Food expenditure
Treated	-0.063**	-0.100*	-0.060*
	(0.029)	(0.054)	(0.035)
Post	0.058	0.076**	0.084**
	(0.063)	(0.031)	(0.035)
Treated x Post	-0.014	-0.025**	-0.096
	(0.041)	(0.012)	(0.081)
Controls	YES	YES	YES
R2	0.27	0.23	0.21
Observations	3317	3317	3317

***Notes**: Dependent Variables are log variables that indicate non-food expenditure by types of non-foods. Column (1) shows the total non-food expenditure of households. Columns (2) & (3) represent expenditure on expenditure on essential non-foods and non-essential non-foods, respectively.*

*All regressions included household controls. Coefficients with robust standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

1.3.2 Impact of the GHDP on Housing conditions

Housing status also threatens the health and well-being of humans (Goldstein et al. 1990). Some researchers point out that the qualities of properties are significantly linked to the health and well-being of residents (Rolfe et al., 2020; Li-Li Ma, 2018; Evans, Well & Moch, 2003). This section examines the impacts of housing conditions in the Hambantota district after the GHDP was implemented. Although large-scale development constructions have been carried out in the Hambantota district during the development period, it is clear from the table that the housing conditions in that area have not been improved (table 1.5). Houses with more than 2-bed rooms, use gas or electricity for cooking, use water seal toilets, use permanent materials for floors, roofs, and walls, in the Hambantota district are 15.6, 5.8, 3, 3.5, 9.2, 8.7 percentage points lower than the non-treated district, after the GHDP introduced. Mariyathas et al. (2016) point out that some people had to move to makeshift homes because they had to leave their

Table 1.5: Impacts of GHDP on Household conditions

Description	(1) Houses with more than 2 bedrooms.	(2) Cooking Fuel	(3) Toilet facility	(4) Floor material	(5) Roof material	(6) Wall materials	(7) Household Ownership
Treated	0.106***	0.053***	0.045***	0.33***	0.065***	0.048***	0.006
	(0.026)	(0.015)	(0.015)	(0.006)	(0.015)	(0.014)	(0.013)
Post	0.095*	0.061*	0.033*	0.011**	0.022*	0.027*	0.080**
	(0.054)	(0.033)	(0.018)	(0.004)	(0.012)	(0.014)	(0.037)
Treated x Post	-0.156***	-0.058**	-0.030*	-0.035***	-0.092***	-0.087***	-0.021
	(0.036)	(0.024)	(0.018)	(0.013)	(0.019)	(0.017)	(0.016)
Controls	YES	YES	YES	YES	YES	YES	YES
R2	0.15	0.10	0.08	0.09	0.13	0.12	0.05
Observations	3317	3317	3317	3317	3317	3317	3317

***Notes**: Dependent Variables are binary variables. Column (1) represents a binary variable which equals 1 if the household has more than 2-bed rooms and zero otherwise. Column (2) represents the variable of cooking fuel which equals 1 if the household uses either gas or electricity for cooking and zero otherwise. Column (3) represents the household's toilet types, which equals 1 if the household uses a water seal toilet and zero otherwise. Column (4) shows the floor material which equals 1 if the household uses permanent material and zero otherwise. Column (5) represents the roof material, which equals 1 if the household has permanent material for the roof and zero otherwise. Column (6) represents wall material which equals 1 if the household has permanent material for the roof and zero otherwise. Column (7) shows the ownership of the house which equals 1 if the house owns by a member of the household and zero otherwise. All regressions included household controls. Coefficients with robust standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

usual habitats quickly to build new projects. It is possible that it influenced the deterioration of the condition of the houses.

1.3.3 Impact of the GHDP on access to basic facilities and access to public services.

Another complaint from locals is the misleading road network built in the new city. According to them, the new road network is worse for the inhabitants as well as visitors. The city is no longer directly accessible via the main road. The access road to the city is rerouted around the port (Mariyathas et al., 2016). The project should also take into consideration the facilities of the people living beside the highways during construction. For example, once highways are constructed, fly-over-bridges must be built to allow people to cross from one side to the other. Due to budget constraints, such bridges have been built with a large gap. This can cause inconvenience to the public and can also affect the well-being of the home. This situation also may increase the time takes for people to access public places.

Table 1.6 shows the time taken by households to reach selected public places after GHDP intervention in Hambantota District. The variables used are the time taken from home to the bank, bus stop, District Medical Center (DMO), Secretariat (DS), Government Dispensary, Private Dispensary, Hospital, Maternity Clinic, Post Office, and Preschool. It is visible that the time is taken to reach public places from households have increased after the intervention of the program. In other words, people living in the Hambantota district need to spend more time to reach public places for their needs now than before.

Table 1.6: Impacts of the GHDP on time take to access public services

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Description	Bank	Bus halt	DMO office	DS office	Gov. Dispensary	Private dispensary	Hospital	Maternity clinic	MC/UC /PC	Post office	Pre school
Treated	0.102***	0.002	-0.004	0.013	0.061***	0.020	0.002	0.029**	0.015	0.112***	0.087**
	(0.007)	(0.016)	(0.014)	(0.013)	(0.014)	(0.015)	(0.014)	(0.013)	(0.012)	(0.013)	(0.013)
Post	-0.049	-0.031	-0.004	0.006	-0.030	0.027	0.003	0.010	0.023	-0.061	-0.083***
	(0.065)	(0.064)	(0.040)	(0.038)	(0.029)	(0.041)	(0.038)	(0.038)	(0.041)	(0.064)	(0.029)
Treated x Post	0.164***	0.091***	0.034*	0.084***	0.063***	0.073***	0.088***	0.090***	0.052***	0.052***	0.070***
	(0.011)	(0.024)	(0.020)	(0.018)	(0.019)	(0.021)	(0.020)	(0.019)	(0.019)	(0.019)	(0.019)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R2	0.08	0.07	0.11	0.12	0.13	0.14	0.12	0.12	0.16	0.11	0.10
Observations	3317	3317	3317	3317	3317	3317	3317	3317	3317	3317	3317

***Notes**: Dependent Variables indicate the time taken to access public services from home. Those are in natural log forms. Accordingly, columns (1) – (11) represent the time taken from home to bank, bus halt, DMO office, DS office, government dispensary, private dispensary, hospital, maternity clinic, MC/UC.PC, post office, pre-school respectively. DMO stands for District Medical Office, DS stands for Divisional Secretariat office, MC stands for Municipal council, UC stands for Urban Council, PC stands for Provincial Council.*

*All regressions included household controls. Coefficients with robust standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

Another commonly used indicator for measuring domestic well-being is access to basic facilities such as water, electricity, and telephone connections. For example, a 'composite household well-being index' was prepared by Yograj & Peter (2016) by incorporating access to basic facilities. Sohail et al. (2014) also estimated the effects on achieving education and health those are two attributes of human well-being, by access to electricity. They found a significant positive link between electricity availability and well-being in rural and urban households.

Table 1.7: Impacts of GHDP on access to the basic facilities: electricity and telephone lines

Description	(1)	(2)
	Near to the basic facilities	
	Power supply	Telephone line
Treated	-0.039**	-0.021
	(0.014)	(0.022)
Post	0.014	0.012
	(0.017)	(0.013)
Treated x Post	-0.037**	-0.041
	(0.015)	(0.032)
Controls	YES	YES
R2	0.07	0.06
Observations	3317	3317

Notes: Dependent Variables are binary variables. Column (1) represents 'the availability of electricity supply (mainline) nearby the household area'. Column (2) represents 'the availability of telephone facility nearby the household area'. All regressions included 'household controls', and 'district-fixed effects.

*All regressions included household controls. Coefficients with robust standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

Table 1.7 investigates the impact of the GHDP on the accessibility to electricity and telephone services from home. The proximity of the power supply to the households of the Hambantota

district is 3.7 percentage points lower than the control district after the implementation of the project. As mentioned earlier, this may have been since new temporary sites had to be used as housing, since development projects needed to be expedited. However, the table does not provide a significant impact on access to the telephone facilities. During this digital era, most people use wireless telephone connections provided through telephone towers. Therefore, telephone lines are not mandatory to obtain telephone connections.

As mentioned in the introduction section, water supply projects were implemented to meet the water needs of the Hambantota district. The people of the Hambantota district have been suffering from water scarcity for a long time as it belongs to a geographical region with an arid climate. Groundwater sources are also very scarce, and well water is also not available throughout the year. Due to this, the need for a water project was acute. On the other hand, it is necessary to provide proper water supply facilities to implement large-scale projects. However, compared to the large-scale projects implemented in the Hambantota district, the water supply project does not belong to that category of large-scale projects. Water projects have directly targeted the households and were conducted by the National Water Supply and Drainage Board of Sri Lanka. The study next examines the impact of GHDP on the water availability of households. Three variables were used in this regard: Safe drinking water, Water within premises, and Water sufficiency. The results show that after the intervention of GHDP, the supply of drinking water to households in the Hambantota district is 27 percentage points higher than that of the controlled group. Availability of water supply to households in the Hambantota district is 9 percentage points higher than treated district after the GHDP was implemented. The results are consistent with Jonathan C. et al. (2016), who assessed water consumption and household well-being in the United Kingdom. However, it cannot be said that there is an adequate water supply for households in the Hambantota district throughout the year to meet their daily water needs.

Table 1.8: Impacts of the GHDP on access to water facilities

Description	(1)	(2)	(3)
	Water availability		
	Safe drinking water	Water within premises	Water sufficiency
Treated	0.063*** (0.013)	0.093*** (0.022)	0.039** (0.016)
Post	0.042*** (0.013)	0.051** (0.019)	-0.041 (0.027)
Treated x Post	0.170*** (0.022)	0.090*** (0.030)	0.017 (0.021)
Controls	YES	YES	YES
R2	0.16	0.18	0.026
Observations	3317	3317	3317

***Notes**: Dependent Variables are binary variables. Column (1) represents 'te availability of safe drinking water to use. Column (2) represents the availability of water within the household. Column (3) indicates whether the household has sufficient water to use. The variable of Safe drinking water equals 1 if the household consumes safe water and 0 otherwise. The variable of water within premises equals 1 if the water is available within their households. Water sufficiency is equals 1 if the household has enough water to drink, bath & wash during the year, and 0 otherwise.*

*All regressions included household controls. Coefficients with robust standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

This section compares access to basic facilities such as water, electricity, and telephone. Compared to the controlled district, access to water facilities in this area has been increased considerably while access to power supply has been decreased slightly. What can be the reason? Since all the GHDP are massive constructions, a special power supply provides to those sites. That power lines did not target the electricity supply of households. Therefore, the power supply to households does not show an increase. However, as mentioned before, the water supply project directly targeted households in the area. Therefore, it has a direct impact to access to the water facilities of the area.

1.3.4 Impacts of the GHDP on safety from disasters

This section examines household well-being in terms of vulnerability to disasters. Table 1.9 was obtained to identify the impact of GHDP on household disaster risk. The results indicate that the households in the Hambantota district's vulnerability to natural disasters and wildlife disasters is 6.2 and 3.8 percentage points higher than the controlled districts after the project was introduced.

Table 1.9: Impacts of the GHDP on safety from disasters

Description	(1)	(2)
	Disaster	
	Natural Disasters	Disasters due to wild animal
Treated	0.069	0.015*
	(0.064)	(0.008)
Post	0.022	0.001
	(0.016)	(0.007)
Treated x Post	0.062***	0.038***
	(0.016)	(0.010)
Controls	YES	YES
R2	0.016	0.012
Observations	3317	3317

***Notes**: Dependent Variables are binary variables. Column (1) represents natural disasters. Column (2) represents 'disasters due to wild animals. The dependent variable of the first regression is Natural disaster, which equals 1 if the housing unit was affected by any natural disaster during the last 12 months, and 0 otherwise. The dependent variable in the second column is Wildlife Disasters, which is equal to 1 if there has been a wildlife attack on the housing unit in the last 12 months, and 0 otherwise.*

*All regressions included household controls. Coefficients with robust standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

However, the survey only collects disaster information from respondents if disasters affect their houses or lives, not croplands. If we add damages to croplands by natural and wild animal attacks, the impact would be higher.

1.4 Robustness Check:

1.4.1 Robustness Check: Income

The results of the major findings on income can also be verified by tables 1.10 and 1.11. I have used the HIES data set and equation 2 of this study to obtain table 1.10. The table shows the impact of the project on household income in considering Hambantota as the treatment district and all other districts as controlled districts. As the main findings, results reported in Table 1.10 also show negative signs for all income variables, and among them, income received through salaries & wages, highly statistically significant. Apart from that, two different data sources have been used to check the robustness of the results. Then, Labor Force Survey data was used to check the validity of the findings of the household income. However, the Labor Force Survey does not collect information on income from detailed categories such as income from wages and income from non-agricultural activities. Instead, it gathers the total income of households. The accuracy of the key income findings was re-checked using equation (1) with the Labor Force Survey data. Results are reported in Table 1.11. On average, both data sources report closely similar results, confirming the validity of the findings of this study.

Table 1.10: Robustness Check: Impact of GHDP on household Income (The Control group: Other districts except for Hambantota)

The Control group is rest of the whole districts			
Description	(1)	(2)	(3)
	Log Income from		
	Salaries and wages	Agriculture activities	Non-Agriculture activities
Treated	-0.069*	-0.055***	-0.041
	(0.046)	(0.046)	(0.210)
Post	0.060***	0.071***	0.053***
	(0.010)	(0.018)	(0.016)
Treated x Post	-0.089***	-0.026	-0.028
	(0.024)	(0.059)	(0.050)
Controls	YES	YES	YES
R2	0.43	0.20	0.29
Observations	41,047	41,047	41,047

***Notes**: Dependent Variables are income in log forms, by different categories. Columns (1) to (3) represent income from salaries and wages, income from agricultural activities, income from non-agriculture activities.*

The variable of salaries & wages refers to the income received through salaries and wages during the last 4 weeks prior to the survey. Income received through agriculture activities refers to the period of cultivation year prior to the survey. The reference period of income through Non-agriculture activities refers to the last calendar month prior to the survey.

*All regressions included household controls. Coefficients with robust standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

Table 1.11: Robustness Check: Impact of GHDP on household Income (Using LFS data)

Description	(1) Total Income
Treated	-0.093
	(0.069)
Post	0.115**
	(0.048)
Treated x Post	-0.145 **
	(0.057)
Controls	YES
District fixed effects	YES
Year Fixed effects	YES
R2	0.22
Observations	1,389

***Notes**: The dependent variable is in log form. Column (1) represents total Income(in log form) considering Anuradhapura district as the control group.*

*All regressions included household controls. Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

1.4.2 Robustness check: Water supply results

The impact of the water project on the well-being of households in the Hambantota District was studied under Table 1.8 of the previous section. In this section, the DHS data was used to verify those findings by employing the same equation. The DHS survey collects data on the water availability of households in detail. However, it does not collect data on water sufficiency. Therefore, I have used the rest of the two variables reported in Table 1.8 to investigate the validity of the estimates. Results are reported in Table 1.12. Findings are consistent with the estimates of main findings, both in signs and significant levels that confirm the validity of the results.

Table 1.12: Robustness Check: Impact of GHDP on household facilities (Using DHS data)

Description	(1)	(2)
	Water availability	
	Safe drinking water	Water within premises
Treated	0.059*	0.113***
	(0.010)	(0.026)
Post	0.044**	0.097***
	(0.014)	(0.023)
Treated x Post	0.085***	0.132**
	(0.021)	(0.038)
Controls	YES	YES
R2	0.015	0.16
Observations	3250	3250

***Notes**: Dependent Variables are binary variables. Columns (1) and (2) represent the availability of safe drinking water and within the premises at the household, respectively.*

*All regressions included household controls. Coefficients with robust standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

1.4.3 Robustness check: Household conditions

DHS data have been used to test the feasibility of key findings on housing conditions. After considering the questions and definitions of both surveys, I have selected variables of toilet facility, floor materials, roof materials, and housing ownership to verify the results of household conditions. Results are reported in Table 1.13. Again, results derived by using DHS data are consistent with the estimates of main findings, both in signs and significant levels that confirm the validity of the results.

Table 1.13: Robustness Check: Impact of GHDP on household conditions (Using DHS data)

Description	(3)	(4)	(5)	(6)
	Household conditions			
	Toilet facility	Floor material	Roof material	Housing Ownership
Treated	0.039*** (0.006)	0.077*** (0.008)	0.067*** (0.006)	0.008 (0.008)
Post	0.036*** (0.006)	0.024*** (0.007)	0.030*** (0.005)	0.070*** (0.006)
Treated x Post	-0.054*** (0.009)	-0.062*** (0.010)	-0.085*** (0.008)	-0.006 (0.010)
Controls	YES	YES	YES	YES
R2	0.023	0.039	0.024	0.043
Observations	3,250	3,250	3,250	3,250

Notes: *Dependent Variables are binary variables. Column (1)represents the toilet types of the household which equals 1 if the household uses a water seal toilet and zero otherwise. Column (2) shows the floor material which equals 1 if the household uses permanent material for the floor and zero otherwise. Column (3) represents the roof material, which equals 1 if the household has permanent material for the roof and zero otherwise. Column (4) shows the ownership of the house which equals 1 if the house owns by a member of the household and zero otherwise.*

*All regressions included household controls. Coefficients with robust standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

1.4.4 Heterogeneous effects

Although the GHDP project has affected all households and individuals in the Hambantota area, it can have different impacts on urban and non-urban households. I have, therefore, investigated the heterogeneous effects of the GHDP by sector employing equation (2).

$$Y_{hsdt} = \beta_0 + \beta_1 post + \beta_2 Hamb_{hd} + \beta_3 Urban\_Sector_{hs} + \beta_4 (post_{ht} * Urban\_Sector_{hs}) + \beta_5 (Hamb_{hd} * Urban\_Sector_{hs}) + \beta_6 (Hamb_{hd} * post_{ht}) + \beta_7 (Hamb_{hd} * post_{ht} * Urban\_Sector_{hs}) + X'_{hdt}\theta + \mathcal{E}_{hjt} \ldots\ldots (2)$$

Where '*h*' stands for households; '*d*' stands for districts; '*s*' stands for the sector and '*t*' stands for years. '*Y*' represents the outcome variable. '*post*' is a year dummy that equals one 2016 and equals zero for the period 2006. '*Hamb*' represents a binary variable which is one for Hambantota District, and zero for Anuradhapura District. The '*Urban_Sector'* is a dummy variable which equals 1 if the household belongs to an urban area and 0 if the household belongs to the rural area. X'_{hdt} represents a set of other variables that can affect child health, the wealth of the family, Sex, religion, ethnicity, marital status, education levels, etc. ε_{hjt} is the error term. β0, β1, β2, β3, β4, β5, β6, β7, and θ, are parameters.

Since the project is mainly on construction, one can expect more jobs for males than females. Therefore, the gender of the household headship can be a matter of income of the household. Equation (3) has been used to investigate the impact of GHDP on the gender of the household headship.

$$Y_{hsdt} = \pi_0 + \pi_1 post + \pi_2 Hamb_{hd} + \pi_3 Headship_{hs} + \pi_4 (post_{ht} * Headship_{hs}) + \pi_5 (Hamb_{hd} * Headship_{hs}) + \pi_6 (Hamb_{hd} * post_{ht}) + \pi_7 (Hamb_{hd} * post_{ht} * Headship_{hs}) + X'_{hdt}\Omega + \mathcal{E}_{hjt} \ldots\ldots\ldots (3)$$

'*Headship*' is a binary variable that equals 1 if the head of the household is male and equals 0 otherwise. $X'_{hdt}\Omega$ represents a set of other variables that can affect outcome, the wealth of the family, religion, ethnicity, marital status, education levels, etc. ε_{hjt} is the error term. π_0, π_1, π_2, π_3, π_4, π_5, π_6, π_7, and Ω are parameters supposed to be estimated.

The estimates from equation (2) & (3) are reported in table 1.14. It shows the heterogeneous impacts of the GHDP project on income by sector and the sex of the household head. According to the results, no heterogeneous impact on income by the gender of the household headship. However, income received through salaries and wages and through non-agriculture activities of households in the urban sector is more affected. The findings show that the

Table 1.14: Triple DID – Heterogeneity by sector and household headship

Description	(1)	(2)	(3)	(4)	(5)	(6)
	Household Income from					
	Salaries and wages		Seasonal crops		Other Income	
Panel A : Heterogeneity by Sector						
Treated	0.099***		0.105**		-0.051***	
	(0.031)		(0.050)		(0.013)	
Post	0.074**		0.057***		0.081**	
	(0.029)		(0.004)		(0.037)	
Urban	0.027***		0.091*		0.056***	
	(0.004)		(0.050)		(0.008)	
Treated x Post	-0.165***		-0.158**		-0.039	
	(0.035)		(0.053)		(0.081)	
Treatment x Urban	-0.116*		-0.101		-0.185	
	(0.059)		(0.117)		(0.152)	
Post x Urban	0.046		0.049*		0.059	
	(0.069)		(0.0.029)		(0.224)	
Treatment x post x Urban	-0.115***		-0.132**		-0.052	
	(0.039)		(0.042)		(0.305)	
Panel B : Heterogeneity by household headship						
Treated		-0.086		-0.105		-0.058*
		(0.110)		(0.146)		(0.0.032)
Post		0.077**		0.091**		0.093***
		(0.038)		(0.045)		(0.014)
Male_Headed_HH		0.046**		0.081**		0.048***
		(0.021)		(0.040)		(0.005)
Treated x Post		-0.164***		-0.153***		-0.068
		(0.034)		(0.050)		(0.139)
Treatment x Male_Headed_HH		0.112		0.102		0.074
		(0.113)		(0.095)		(0.123)
Post x Male_Headed_HH		0.036***		0.120**		0.090*
		(0.005)		(0.060)		(0.050)
Treatment x post x Male_Headed_HH		-0.127		-0.163		0.255
		(0.146)		(0.215)		(0.168)
Controls	YES	YES	YES	YES	YES	YES
R2	0.29	0.38	0.26	0.27	0.19	0.28
Observations	3,317	3,317	3,317	3,317	3,317	3,317

***Notes**: Dependent Variables are income in log forms. Columns (1) - (2) represent income from salaries and wages. Columns (3) & (4) represent income from agricultural activities, and columns (5) & (6) represent income from non-agriculture activities. The variable of salaries & wages refers to the last 4 weeks prior to the survey. Income received through agriculture activities refers to the cultivation year prior to the survey. Income through Non-agriculture activities refers to the previous calendar month. Odd columns of the table show heterogeneity by sector and even columns show heterogeneity by sex of the head of the household. All regressions included household controls. Coefficients with robust standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

probability of income receives through salaries and through non-agriculture activities are 11.5 percent and 13.2 percent lower on households in the urban sector in the Hambantota district relative to the control group after the GHDP was implemented, respectively.

Natural disasters and disasters due to wild animals may affect urban and rural sectors differently. The heterogeneous impacts of the GHDP project on disasters by sector were tested by employing equation (2).

Table 1.15: Triple DID – Heterogeneity by sector on disasters

Description	(1) Natural disaster	(2) Disaster due to wild animal
Treated	-0.036**	-0.019**
	(0.014)	(0.010)
Post	-0.023	-0.003
	(0.022)	(0.008)
Urban	-0.105***	-0.049***
	(0.011)	(0.007)
Treated x Post	0.062***	0.038***
	(0.016)	(0.010)
Treatment x Urban	-0.088	-0.025
	(0.081)	(0.023)
Post x Urban	0.081	0.043
	(0.082)	(0.058)
Treatment x post x Urban	-0.136***	-0.051***
	(0.024)	(0.013)
R2	0.012	0.018
Observations	3317	3317

***Notes**: Dependent Variables are binary variables. Column (1) represents natural disasters. Column (2) represents disasters due to wild animals. Urban is a binary variable which equals 1 if the household belongs to the urban sector and 0 for the non-urban sector.*

*All regressions included household controls. Coefficients with robust standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

Table 1.15 shows the results. Findings suggest that the urban areas were less affected by both types of disasters compared to the rural. One possible reason is that the GHDP used thousands of acres of forest lands for construction, and those forest lands mostly belonged to rural areas. Therefore, wild animals, wildly, wild elephants may roam, and attack villagers compared to the urban people. Another possible reason may be that the urban sector has a better drainage system that may help to flush away rainwater. Therefore, flood issues may be less in urban compared to the rural.

1.5. Discussion and Conclusion

The study focuses on the consequences of large-scale investments based on political decisions by using the diff-in-diff approach. It also examines the impact on the domestic well-being of medium or small-scale projects such as water supply targeted at the general population in the area. Results show that the income earned from the salaries, agricultural and non-agricultural activities of the people of the Hambantota district has decreased after implementing the GHDP. However, income received through those economic activities by urban sector households is more affected than the non-urban sector.

As household incomes fall, so do their expenses. Spending on foods and non-food items by households in the Hambantota district has been decreased after the program implemented relative to their counterparts. More negative impacts shown on non-food items are personal care, fuel & lighting, and health care expenditures. Moreover, expenditures on food items have been declined more than the expenditures on non-food items.

According to the new city plan and the road network introduced to the Hambantota district, the time required for people to reach from their homes to public places has increased. Irregular development projects carried out in disregard of the feasibility study reports have increased the vulnerability of the people in the area to natural and wildlife disasters. However, the water

projects implemented targeting the people of the area have had a significant positive impact on the drinking water needs of the people.

Introducing large-scale projects suitable for a luxurious lifestyle sometimes may not meet the needs of the poor. The GHDP would be a good example of such a situation. Therefore, care should be taken when planning projects to uplift the living standards of the people living in such areas where more than 40% of the population depends on agriculture for their livelihood. Today, Sri Lanka is experiencing the consequences of politicians not listening to the views and advice of experts in the field when making their decisions. It is important to have an accurate estimate of the expected returns on loans before investing. Developing large-scale infrastructure by borrowing at high-interest rates without proper planning or study is very risky. Therefore, policymakers need to prepare policies that are required to prevent such situations in the future.

However, as short-term solutions, it needs to identify households severely affected by the GHDP. A program should be implemented to increase their income and should provide subsidies to the households who were severely affected till they recover. Since natural disasters and disasters due to wild animals have increased significantly after implementing the project, the government needs to take actions to reduce it. For example, construction of more sophisticated and stronger elephant fence, construction of drainage system to drain rainwater can be suggested. It will also be important to educate the public on disaster risk reduction programs. An institution or association can be set up to public awareness programs to make them aware of how to deal with a disaster and manage disaster better. As the time is taken to access essential public services has increased after the new road network is implemented, the city's public transportation needs to be improved. Although safe drinking water and on-premises water supply have significantly increased in the Hambantota district; there is no sufficient water for their daily needs throughout the year. After looking into the reasons for the

inability to provide water throughout the year, steps should be taken to provide a regular water supply.

Project failure is common in most developing countries. Many projects they implement to uplift the household's well-being. Unfortunately, a considerable number of projects fail. The biggest issue occurs when the money spent on the projects is borrowed at high-interest rates. The case of Sri Lanka would be a good example for them to think more before investing in massive projects after borrowing a large amount of money.

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APPENDICES

Appendix 1:

Income and expenditure related indicators of Treatment and Control districts, 2006/07

Description	Hambantota	Anuradhapura
Richest 20%	50.3	49.0
Poorest 20%	5.2	5.4
Middle 60%	44.4	45.7
Poorest 40%	14.9	15.3
Mean income	0.45	0.43
Per capita income	0.44	0.42
Income receivers' income	0.50	0.50
Per capita income	5,789	5,913
No. of income receivers	1.8	1.6
Household size	4.2	3.7
Income receivers mean income	13,474	13,662
Mean household income	24,076	21,995
Agriculture income	4,250	3,869
Non-agriculture income	3,957	3,607
Total monetary income	20,878	19,103
Salaries and wages	7,595	6,061
Other cash income	2,628	3,275
Income by chance/Adhoc	2,448	2,291
Non-monetary income	3,198	2,891
Total Expenditure	20,568	20,290
Food Expenditure	8,293	7,254
Food ratio	40.3	35.8
Non-food Expenditure	12,275	13,036
Non-food ratio	59.7	64.2
Mean household Expenditure	0.36	0.41
Per capita Expenditure	0.34	0.40

Source: Household Income and Expenditure Survey Final Report 2006/07

Appendix 2:

References for Income categories

Salaries and wages	Salaries and wages refer to the income received by working as an employee during the last calendar month. (Note: This includes tips, commissions, overtime payments received during the last calendar month, and bonus and/or arrears payments received within the last 12)
Agricultural activities	Agricultural activities refer to the income received through cultivating paddy and 'other seasonal crops ('Seasonal crops' refers to paddy, cereals, vegetables, potatoes, chilies, onions, tobacco, and other seasonal crops) as an employer or own account worker during the last cultivation year. The study refers to the value-added of the output derived by deducting input values from the output values**.**
Other agricultural activities	Other agricultural activities refer to the income earned through non-seasonal crops ('non-seasonal crops' refers to tea, rubber, coconut, coffee, pepper, betel banana, fruits, etc.) and livestock activities ('livestock activities' refers to meat, fish, eggs, milk, other food items related to livestock, horticulture, etc.).
Other income	Other income refers to the other payments (other income refers to pensions, samurai (welfare payments to the poor), old age payments, tuberculosis/kidney disease payments, education, and scholarships, dividends/interest, property rent, boarding fees, remittances Receipts, etc.).
Adhoc income	Adhoc income refers to loans taken from banks or money lenders, sales/ pawning of assets, withdrawals from saving/ bank deposits/

	grativity / provident fund, income receives from associations, welfare societies, health, and medical aids, compensation/ insurance, other (lottery & Adhoc gains), other commendations, disaster relief payments, etc. The reference period for the Adhoc gains during the last calendar year.

Source: HIES – questionnaire, Department of Census and Statistics

Appendix 3:

References for Non-Food categories

fuel & light	includes electricity, solar power, Kerosene oil, firewood, LP Gas, bulbs, candles, batteries, matches, other
personal care	Toilet soap, toothpaste, toothbrush, cosmetics, perfumes, face cream, Hair oil, cream, dye, Haircut, dressing, other
Health expenditure	Fees to private medical practitioners, Ayurvedic consultation fees, consultation fees to specialist, payment for private hospitals and nursing homes, purchase of medical and pharmaceutical products, spectacles, other
Clothing	Clothing & textiles, tailoring charges, Footwear & other personal effects
Housing	Housing rent, taxes, water bills
Transport	Train/bus/van/taxi/ship/airlines fees, maintenance of private vehicles (petrol & other fuel, oil, tire, spare parts, repair of vehicles, license & insurance fees, other

Source: HIES – questionnaire, Department of Census and Statistics

Appendix 4 :

References for Housing conditions

Variable	Description
Houses with more than 2 bedrooms.	The number of bedrooms is greater than 2 bedrooms.
Cooking Fuel	Firewood, Gas, Kerosene, electricity, sawdust, paddy husk, other
Toilet facility	Water seal, pour-flush, pit, other
Floor material	Cement, Terrazzo, tiles, mud, other
Roof material	Tile, Asbestos, concrete, metal sheet, cadjan, Palmyra, straw, other
Wall materials	Bricks, cabook, cement blocks, pressed soil blocks, mud, plank, metal sheet, cadjan, Palmyra, other
Household Ownership	The house own by a person living in that house

Source: HIES – questionnaire, Department of Census and Statistics

CHAPTER TWO

UNIDENTIFIED VICTIMS OF THE LTTE WAR: (THE EFFECTS OF WAR ON THE PHYSICAL WELL-BEING OF CHILDREN UNDER THE AGE OF FIVE)

2.1 Introduction

Victims of war are those who suffer the devastating effects of armed conflict between two or more parties. Among them, those who have died, been injured, or maimed due to war are known as direct victims. Many studies are available on direct victims since incidences of deaths, injuries, and disabilities are visible and available. (Mendelsohn & Straker, 1998; Petrig, 2009; Pfanner, 2009). However, women and children, who are not involved in a war, often become victims of war. (Joanna Barbara 2006; McKay, 1998; Machel 1996; Ashford & Huet-Vaughn 1997; Ferris, 1993; Levy & Sidel, 1997). Unfortunately, most of them are not visible directly, and no proper data sources are available on such indirect victims.

This paper, therefore, attempts to investigate the impacts of war on children and women who did not involve but were indirectly affected by war. Living in a war zone can expose people to various influences (Barbara 2006; Judith, 2004). They can be affected physically, economically, or psychologically. According to the WHO estimates, due to armed conflicts globally, 10 percent of the people exposed to traumatic events suffer severe mental health issues. Another 10% of them will develop behavior that disrupts their productivity. On the other hand, children, especially those who experience war through the media, also suffer from war mentality of viewing hostile images (Judith, 2004). However, out of different influences, this study has focused on the children under five who were not undisclosed as victims of Sri Lanka Elam War IV but were victims of war due to poor health.

I mainly use stunting and wasting indicators to measure child health conditions. These two indicators represent histories of a child's health and nutrition. That can use to measure the nutritional imbalance caused by malnutrition.[3]. The overall health of society is widely determined by wasting. It refers to low weight-for-height and is associated with illness and loss of weight. Weight responds more to current conditions; height is more of a 'stock' variable. This indicator mainly indicates poor caloric intake, poor nutrition, and other infectious diseases. Stunting of children less than five years of age is one of the World Health Assembly's targets indicators. Stunting is a medical condition that reflects impaired growth and development and results from chronic or poor nutrition status. It refers to the low height concerning age. According to the World Health Organization (WHO), stunted children are unable to achieve their physical and cognitive potentials compared to normal children. Further, the WHO states that stunted children tend to have a higher risk of illness and death. The report on "Nutrition Landscape Information System (NLIS) Interpretation guide of WHO" also points out that stunting represents the cumulative effects of malnutrition and infections. This situation reflects the conditions that existed at birth and even before.

The above indicators I used to measure childhood malnutrition are widely used in many studies (Edward et al., 1997; Reynaldo et al., 2012; Emily et al., 2004; Wolde et al., 2015; Cesar, 1992; Nandini et al., 1997; Ricci and Becker, 1996; Yacob et al., 2016; Melina et al., 2017; Yaghmaei and Guha-Sapir, 2019; Wolde & Chala 2015). For example, Melina et al. (2017) investigated children's underweight, stunting, and wasting in Tanzania. They mainly assessed risk factors associated with the above three indicators among children under one year of age in six districts in northern Tanzania. They assessed programs that aimed to reduce child undernutrition, such as sanitation, child feeding, deworming, supplements of vitamin A and health educations. They employed multivariate logistic regression, found that child undernutrition is still a challenge in

[3] Nutrition Landscape Information System (NLIS) Interpretation guide of World Health Organization

Tanzania despite these programs. Gizelle et al. (2014) also examined the prevalence of stunting, wasting, and underweight in grade one learners in the Northwestern Province of South Africa. They made a comparison of three indicators comprising boys versus girls and black versus whites for school beginners. They found that black learners are more wasted and stunted compared to whites. Even though plenty of literature is related to stunting, wasting, and underweight indicators, very little is related to war or conflicts. Ayesha et al. (2019) have conducted a systematic review summarizing current and past knowledge of the impact of armed conflict on child health and development. They have screened 17679 publications (published from 1 January 1945 to 25 April 2017) and selected 155 as eligible to include. According to them, One-third of quantitative studies were cross-sectional and around half of the 131 quantitative studies were case reports. It had six mixed-use studies and 18 qualitative studies that examined injuries, disease, death, environmental exposure, health, education, torture, and sexual assault. However, they point out an absence of data on the impact of conflict on child development.

However, many of those studies have focused on other areas of child health and its impacts. Pearn (2003), for example, investigated damage to children's high-energy tissues and massive burns injuries that directly impact war. Cohn (1981) investigated the torture of children and discussed Chilean children who immigrated to Denmark. Among limited literature on war and its impact on child health, Yaghmaei & Guha-Sapir, (2019) have used acute stunting and severe acute stunting as indicators to measure the nutrition of children and women (whose age between 15-49 years) in Yemen civil war. They mainly focused on the conflicts and disasters that caused the humanitarian crisis and its impact on the health system. Although we can find some literature on the effects of war on children's health in other countries, no proper study exists to examine the impact of the 30 years of war on children's health in Sri Lanka. The reason for that may be data availability. The government or any reputed other agency could not

conduct surveys for nearly 30 decades covering Northern and Eastern provinces. The population and housing census conducted by the Department of Census and Statistics (DCS) of Sri Lanka (during 1981 to 2012) also was unable to cover the northern and eastern provinces due to the conflict situation in the country. Therefore, it would be crucial to conduct a study to find out if the war has affected the health of children living in the war zone and, if so, how policies should implement to help them.

On the other hand, as far as I know, none of the literature compared the child health statuses between war and ceasefire periods, which I address in this study. I further investigate the effect on antenatal care and postnatal care of the mother, such as the service of midwives during and after the pregnancy associated with the child's health.

Furthermore, this study also investigates the use of iron and parasitic drugs by children and mothers (during pregnancy), as those are essential for maintaining good health in children. Accordingly, the main objective of this study is to identify the impact of war on some indirect victims. In this regard, I tried to answer the question 'Are the health status of under-five children who lived in the war zone different from children of similar age in non-war areas? The study reveals that children under five exposed to the war are more likely to be stunted and wasted than their counterparts. However, under-five children born during the battle period were more likely to be stunted and wasted than those born during the war.

2.1.1 The war Background

Sri Lanka is an island in South Asia, surrounded by the Indian Ocean. The country is being home to over 21.8 million citizens and rich in natural resources. The economy composes of agriculture, manufacturing, fishing, mining, and tourism. The Sinhalese are the majority ethnic group in Sri Lanka, representing 74.9 percent of the total population. The other ethnic groups are Sri Lankan Tamils, Indian Tamils, and Moors, who constitute 11.2 percent, 4.3 percent,

and 9.3 percent of the total population. There are nine provinces in Sri Lanka. Sinhala people represent the majority in all regions except Northern and Eastern. The second-largest ethnic group, Tamils, are mostly confined to a handful of geographical areas in the northern and eastern provinces. Tamils predominate in the Northern Province, and the Eastern province mixed with Tamils, Muslims, and Sinhalese. Due to various reasons, in late 1970, a group of Tamils organized themselves into armed groups named Tamil-Tigers[4] to fight against the government. They started their first activities against the government on 23 July 1983. The LTTE members fought to acquire Northern and Eastern two provinces of Sri Lanka, which cover nearly 28.1 percent of the island's total land with a population of 2.8 million (approximately 14 percent of the national population). The Northern Province consists of five districts: Jaffna, Kilinochchi, Mannar, Mullaitivu, and Vavuniya. The Eastern Province consists of three districts, Trincomalee, Batticaloa, and Ampara.

The Northern and the Eastern provinces of Sri Lanka were at the center of the Elam war for nearly three decades. Four phases of conflict can identify between government and LTTE during that three decades: 1983-1987, 1990-1994, 1995-2001, and 2006-2009. And also, government tried to talk and find solutions three times, 1987-1990, 1994-1995, 2001-2005, and all attempts were failed (De Mel and Venugopal, 2016).

Meanwhile, the LTTE gradually expanded its control over the northern and eastern provinces of Sri Lanka, capturing about 75 percent of its territory. However, throughout the war (except heavy fighting periods), the government of Sri Lanka provided health, education, and other essential services to the citizens who were living in the areas controlled by the LTTE (Mampily 2011). The LTTE used guerrilla attacks and suicide bomb attacks from time to time in different places for approximately over 30 years. However, the heavy and face-to-face battle began on

[4] later known as LTTE (Liberation Tigers of Tamil Elam)

21 July 2006, after closing the 'Mawil Aru' sluice gates by the LTTE. The closure of the sluice blocked the supply of water to more than 15,000 farmers (for drinking and other day-to-day activities) and their 30,000 acres of farmland (Waduge, 2006). The government ordered to open the gate, but the LTTE continued to refuse.

Table 2.1: Phases of the civil war in Sri Lanka

Duration	Description	Affected districts
1983-1987	Elam War I	Jaffna, Colombo(Black July), Mullativu, Anuradapura
1987-1990	Indian Peacekeeping Force	Jaffna, Trincomalee
1990-1994	Elam War II	Jaffna, Kilinochchi, Mullaitivu, Mannar, Batticaloa, Trincomalee (Partially)
1995-2001	Elam War III	Kilinochchi, Mullative, Mannar, Batticaloa, Trincomalee
2001-2005	Ceasefire	
2006-2009	Elam War IV	Kilinochchi, Mullative, Mannar
2007 July	End of war in Eastern province	Batticaloa, Trincomalee
2009 May	Defeat of LTTE	Kilinochchi, Mullaitivu

Source: World Bank Group Publication on Shadows of conflict in Northern and Eastern Sri Lanka

After a series of failed negotiations, the government of Sri Lanka started the fight against LTTE, which was named Eelam-War IV, on 26 July 2006. Sri Lankan government defeated the LTTE terrorism from Eastern province in July 2007 and from the Northern Province in May 2009, ending 30 years war, which started on 23 July 1983. The death toll due to the LTTE war is still debatable. However, the number of displaced people in the Eastern province in 2006 was 468,000 (O'Donnell et al., 2018).

Table 2.2: Internally displaced people in Sri Lanka, 1987-2009

District	Year	No. of IDP
Jaffna	1987	250,000
Jaffna, Mannar, Vavuniya, Mullaitivu, parts of Kilinochchi	1990	377,000
Vanni and Jaffna districts	1991	460,000
Border villages of North and East	1992	595,000
Vanni Area	1998	612,518
Vanni and part of Eastern districts	2000	731,000
Jaffna	2001	788,000
Resettlements in the North	2002	462,000
Resettlements in the North and East	2003	386,000
Resettlements in the North and East	2004	352,000
Batticaloa, Ampara and Trincomalee (East)	2006	468,000
Vanni, Jaffna, and East districts	2007	714,000
Vanni area (esp. Mullaithivu and Kilinochchi)	2008	824,000
. Mullaithivu and Kilinochchi	2009 Dec.	876,000

Source: World Bank Group Publication on Shadows of conflict in Northern and Eastern Sri Lanka

During the war, the LTTE did not allow the government officials to enter both Eastern and Northern provinces to conduct any survey or census. Therefore, the lack of annual surveys or census data for these areas poses a problematic study situation. However, the government conducted a DHS survey of Sri Lanka in 2006/2007, which covered the Eastern Province too, right after the war's end. Although the LTTE was defeated militarily, several socio-economic problems arose in the country. One of them is the health problems of children, which are the focus of this study. Specifically, I focused on hidden or unknown victims of the LTTE war by using the difference in differences method.

In this regard, I investigated two birth cohorts. Children who were born during the Elam war-IV are considered the first cohort. The second cohort refers to the children who were born

during the ceasefire period. Both cohorts are under five years of age. Both birth cohorts tested for war & non-war regions and war & non-war periods.

Further, I investigated channels of antenatal care, postnatal care, and receiving health facilities (including drugs) for mothers and children that can affect child health statuses. Since the government of Sri Lanka provides universal, free access to health care services to its population, all have an equal chance and right to use government-provided health services. It is also important to mention the free health system of Sri Lanka since it has a significant impact on the health of children.

2.1.2 Health service of Sri Lanka

Since 1930, universal free health facilities provided by the government have been accessible to all Sri Lankans. However, in 1951, the government of Sri Lanka enacted the free health policy that provided rights to access free health care services to its citizens. The state government funded the health system, which covers nearly 50 percent of outpatients and 90 percent of inpatient services. All preventative services, maternal care services (post and prenatal care), childcare services, and immunizations are provided free of charge for whole citizens. The private sector is also involved in health care services for people who are willing to pay out-of-pocket.

Preventive health services of Sri Lanka deliver through a well-organized health care network that comprises health care teams. Each team consists of medical officers, nurses, public health inspectors, and midwives. Each team needs to cover a specific geographical area with a population between 50,000 to 100,000. It is the responsibility of medical officers to coordinate the curative care institutions and the other local bodies in their respective areas. Public health midwives are appointed, covering a population ranging from 2000 to 4000. They need to provide home-based and clinic care for all pregnant mothers and under-five children of that specific geographical area they work for (Smith, 2018).

2.2. Data

The secondary data obtained from the Sri Lanka Demographic and Health Survey (SLDHS), conducted by the Department of Census and Statistics (DCS) for 2016 and 2006/07 used to perform the study. The DHS-2006/07 has used a stratified two-stage cluster sample design. There were 2500 clusters selected at the first stage. The second stage involved the systematic sampling of 10 households from every 2500 clusters. However, in the end, data was gathered from 2106 clusters due to security matters. Accordingly, DHS 2006/07 collected data from 19,872 households out of 21,600 and interviewed over 14,692 women aged 15-49.

All the districts were included at the sample design stage and later dropped five districts belonging to Northern Province due to security issues. However, Eastern Province was covered in this survey since the war ended in Eastern Province 2007 July.

The DHS 2016 used the same sampling method. However, at the first stage, there were 2500 census blocks selected. Those are called primary sampling units (PSU). At the second stage, there were 12 housing units selected from each PSU. Those are called secondary sampling units (SSU). Accordingly, during the DHS-2016, 27,210 households were enumerated, and there were 18,510 eligible women interviewed successfully.

2.2.1. Identification Strategy

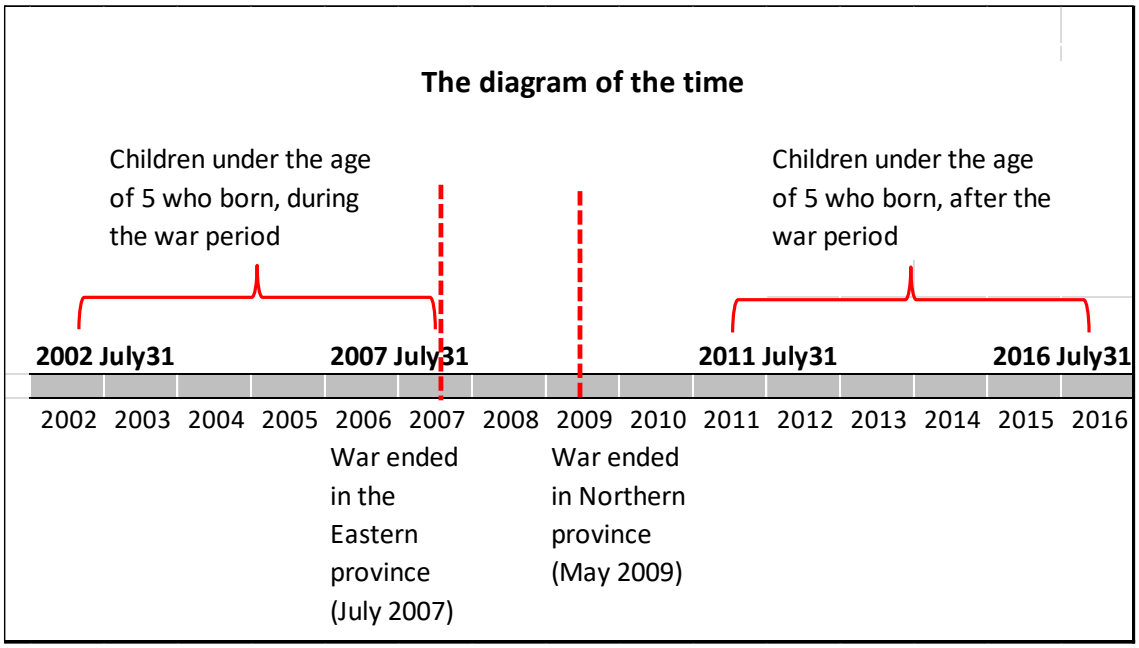
To find the causal impact of conflict situations on children and women in Sri Lanka, I employed the difference-in-differences (DID) model. The DID allows us to compare the changes of outcome variables of the treatment group before and after the policy intervention.

Treatment and control groups: The treatment group of this study is children (less than five years old) and women (age 15-49) who are living in the Eastern province where war prevailed. The Eastern Province has an area of 2854 square kilometers and is composed of three districts. They are Batticaloa, Trincomalee, and Ampara. The war did not affect those three districts

equally. It is hard to find which district was affected more or less by the war since the death tolls from the war, the number of casualties, the number of displaced persons, and the amount of property lost are debatable. Due to this, the whole Eastern Province considers as a treatment group. In addition, as the impact of the war on each district may vary, the three districts were considered separate treatment groups to identify them. The control group is children (less than five years old) and women (age 15-49) living in all other provinces except for the Eastern province.

Before and after periods: The birth cohort born during 31st July 2002-31st July 2007 was treated as Before-period. Furthermore, the birth cohort born during 31st July 2011- 31st July 2016 considers as After-period. The diagram below further illustrates how the two birth cohorts select for the before and after periods.

Diagram 1: Time bar diagram on selecting birth cohorts



Variables used: As mentioned earlier, stunting and wasting of children under five were used as two key indicators in this study to measure the health status of children. Regardless of ethnicity, well-fed children ten years of age or younger have similar height and weight distribution and growth rates worldwide (Kogil, 2003). This permits the development of a

reference population that can use to facilitate human psychological comparisons. This is done by preparing a standardized Z-score for each child.

The z-score, Z_{kn}, of the n^{th} child for the k^{th} indicator can be estimated by using the following formula:

$$Z_{nk} = \frac{(Obs_{kn} - M_{pop})}{\sigma_{pop}} \quad \text{..... (1)}$$

Where, Z_{kn} is the Z-score for n^{th} child for k^{th} indicator, obs_{kn} is the observed value of the k^{th} indicator for n^{th} child, M_{pop} is the median of the k^{th} indicator in the reference population, and $\boldsymbol{\sigma}_{pop}$ is the standard deviation of the reference population.

Height for age Z-scores can measure stunting status. When the height for age z-score is below -3 standard deviations, it refers to severely stunted. It is below the mean of WHO child growth standards (hc70<-300). Moderately or severely stunted refers to height for age Z-scores that are below -2 standard deviations. It is below the mean on the WHO child growth standards (hc70<-200). The two variables that I used to measure stunting were binary variables named severely stunted and severely or moderately stunted. The variable of severely stunted equals 1, if the height for age Z-score of the child is below -3 standard deviations, and '0' otherwise. The variable of severely or moderately stunted equals 1 if the height for age z-score of the child is below -2 standard deviations, and '0' otherwise.

The wasting indicator refers to the low weight with respect to the height of the under-five children. Wasting in children is the life-threatening result of poor nutrient intake and/or disease[5]. According to UNICEF, children suffering from severe wasting have a high risk of

[5] Levels and trends in child malnutrition- UNICEF/WHO/World Bank joint publication on Malnutrition estimates, 2018 edition

death since wasted children have a weakened immune system and are prone to long-term developmental delays.

Severe wastage means that the weight Z-value for height is less than the standard deviation of -3. Moderately or severely wasted refers to the weight-for-height -score below -2 standard deviations. I have used two binary variables in this model to measure waste. They are severely wasted and severely or moderately wasted. The variable of severely wasted equals 1 if the weight-for-height z-score of the child is below -3 standard deviations, and 0 otherwise. The variable of severely or moderately wasted equals 1 if the weight-for-height z-score of the child is below -2 standard deviations, and 0 otherwise.

According to UNICEF, antenatal care is vital for protecting the health of the mother and the unborn child. Pregnant women can learn about healthy behaviors, warning signals, and pregnancy symptoms through skilled health personnel under antenatal care services. It also helps mothers receive social and emotional support, access to micronutrient supplementation, immunization during pregnancy. Since it is crucial for mothers to attend the clinical examinations of a specialist during their pregnancy to maintain the health of the baby and the mother, this paper examines the attendance of mothers to clinics. It is a binary variable, equals 1 if the woman attended a clinic at a government hospital where a specialized doctor is available during the pregnancy, and 0 otherwise. The study also used variables on iron consumption and parasitic drug use by mothers and under-five children. Those are also binary variables, equal to 1 if they received treatments and 0 otherwise. Receiving tetanus injections during the pregnancy period is also considered in this study since it helps for healthy and safe delivery. Furthermore, variables of visits by midwives during the pregnancy, visits by midwives after the delivery, registration of mother at the Public Health Midwife Office during the antenatal care period were also used as binary variables to see their impacts.

Table 2.3: Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Stunting (Z_scores)	13,894	-0.88	1.23	-3.99	3.96
Wasting (Z_scores)	13,894	-0.98	1.24	-3.99	3.57
Severly stunting	13,894	0.04	0.19	0	1
Severly wasting	13,894	0.05	0.22	0	1
Severly or Moderatly stunting	13,894	0.16	0.37	0	1
Severly or Moderatly wasting	13,894	0.19	0.39	0	1
BH_multiple or single birth	13,894	0.02	0.13	0	1
BH_Sex of the child	13,894	0.51	0.50	0	1
Iron syrup given to child(within 14 days)	13,894	0.08	0.27	0	1
Parasite drugs given to child (within six months)	13,894	0.58	0.49	0	1
Mother age	6,601	35.53	8.13	15	49
Mother ethnicity	6,601	0.72	0.45	0	1
Mother literacy	6,601	0.01	0.09	0	1
Mother religion	6,601	0.32	0.47	0	1
ANC_Register the pregnancy at PHMO	6,601	6.97	3.22	0	1
ANC_Midwife visit home during pregnancy	6,601	1.14	0.35	0	1
ANC_received iron spills/capsules during pregnancy	6,601	0.99	0.12	0	1
ANC_received parasite drugs during pregnancy	6,601	0.95	0.22	0	1
ANC_Checked blood samples	6,601	0.95	0.21	0	1
ANC_Checked height	6,601	0.99	0.10	0	1
ANC_Checked VDRL	6,601	0.88	0.32	0	1
ANC_Checked urine	6,601	0.99	0.10	0	1
ANC_Checked weight	6,601	0.99	0.09	0	1
PNC_Midwife visit home after the delivery	6,601	0.94	0.24	0	1
Father ever attend school?	13,894	0.98	0.15	0	1
Father_occupation	13,894	0.97	0.17	0	1
Father_age	13,894	39.61	9.26	15	70
Wealth Index	43,844	2,182.17	1,262,223	-12,800,000	6,254,612
Qsector	43,844	0.19	0.39	0	1

Note: ANC stands for Antenatal Care, PHMO stands for Public Health Midwife Office, PNC stands for Postnatal care, BMI stands for Body Mass Index.

Table 2.4: Summary statistics of the variables used to compile the "Wealth Index"

Variable	Obs.	Mean	Std. Dev.	Min	Max
HH has a Land phone	43,844	1.66	0.47	1	2
HH has a Motor bicycle	43,844	1.66	0.47	1	2
HH has a Mobile phone	43,844	1.31	0.46	1	2
HH has a bicycle	43,844	1.60	0.49	1	2
HH has a boat	43,844	2.00	0.06	1	2
HH has a car	43,844	1.89	0.31	1	2
HH has a safe drinkWater	43,844	1.63	0.48	1	2
HH has electrity	43,844	1.10	0.30	1	2
HH floor condition[1]	43,844	1.16	0.61	1	2
HH has a fridge	43,844	1.52	0.50	1	2
HH fuel use[2]	43,844	1.25	0.85	1	2
HH own to a family member	43,844	1.12	0.46	1	2
HH has a ownland	43,844	1.65	0.48	1	2
HH has a radio	43,844	1.25	0.43	1	2
HH roof condition[3]	43,844	1.61	0.05	1	2
HH use solar power	43,844	1.98	0.14	1	2
HH toilet condition[4]	43,844	1.20	0.40	1	2
HH has a tractor	43,844	1.96	0.19	1	2
HH has a trishaw	43,844	1.87	0.33	1	2
HH has a tv	43,844	1.15	0.36	1	2
HH has a wall	43,844	1.41	0.61	1	2
HH has a watch	43,844	1.05	0.21	1	2

(1). 1, If the main material of the floor: cement, terrazzo, tiles/ granite, or concrete, and 0 otherwise,

(2). 1, if the main source of fuel: electricity or gas and 0 otherwise,

(3). 1, if the main material of roof: tiles, asbestos, concrete and 0 otherwise,

(4). 1, if household use flush or pour-flush toilet and 0 otherwise,

HH stands for households

Household and individual controls include sector, wealth, ethnicity, religion, father's occupation, father's age, mother's age, the literacy of mother and father, and the sex of the child, multiple or single births, etc. The sector is a binary variable, which equals 1 if the household

belongs to an urban area and 0 if the household belongs to a rural area. The wealth of the household was measured by preparing a wealth index using the principal component analysis. Variables used to prepare the wealth index has mentioned in table 2.4. The sex of the child, the sex of the mother, and the sex of the father variables are binary variables equal to 1 for males and 0 for females. Ethnicity is a dummy variable that equals 1 if the ethnicity of the mother is Sinhala and 0 if the ethnicity of the mother is non-Sinhala. Religion is a binary variable which equals 1 if the mother's religion is Buddhism and 0 if the mother's religion is non-Buddhist. The father's occupation is a binary variable, which equals 1 if the father has an occupation, and 0 otherwise. The age of the mother and the age of the father variables were used as natural logs. Literacy of the mother is a binary variable which equals 1 if the mother can read and understand the small paragraph shown by the enumerator during the survey, and 0 if the mother cannot either read and/or understand it.

Descriptive statistics: Table 2.3 provides descriptive statistics of outcome and control variables such as mean, standard deviation, and minimum and maximum values for each variable used in the study. Table 2.4 offers descriptive statistics used to prepare the wealth Index for households. Using principal component analysis, I prepared a wealth index for each household as a control variable in this study.

2.2.2 The DID model:

The standard DID model is;

$$CE_{idt} = \beta_0 + \beta_1 War\_period_t + \beta_2 War\_Area_{id} + \beta_3 (War\_period_t * War\_Area_{id}) + X'_{idt}\alpha + \delta_d + \mathcal{E}_{idt}, \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where, *i* stands for individuals, d stands for district/province, *t* stands for years. CE_{idt} represents outcome variables of individual i in district d (or province) at time t. *War period* is a year dummy that equals 1 for 31st July 2002 to 30th July 2007 and equals 0 for the period 31st July

2011 to 30th July 2016. *War area* represent an area dummy which is 1 for war areas (Eastern Province), and 0 for non-war areas (All other Provinces). X'_{idt} represents a set of other variables that can affect child health, such as the wealth of the family, Sex of the child, multiple births or a single birth, father's education level, father's occupation, mother's age, mother's literacy, etc., etc. δ_d is district fixed-effects, $\mathcal{E}_{id}$ is the error term. β0, β1, β2, β3, α, are parameters supposed to be estimated.

2.3. Empirical Results

2.3.1 Main Findings

2.3.1.1 The impact of the LTTE war on wasting and stunting of children under-five

According to the WHO, stunting is the poor growth and development experienced by children due to poor nutrition, recurrent infections, and lack of adequate psychosocial stimulation. During the first 1000 days from conception to two years of age - poor growth has adverse consequences for the baby. These include low productivity, low adult wages, poor educational performance, high risk for chronic diseases in adulthood, and later overweight in childhood. Table 2.5 of this section shows the results of stunting of children under five. The table revealed that children under five living in the Eastern Province during the war were 7 percentage points more stunted than their counterparts (Panel A, column 1).

Table 2.5: The impact of the LTTE war on severely stunted and severely or moderately stunted children under five.

Description	Stunted –Children Under five			
	(1)	(2)	(3)	(4)
	All Sample	Batticaloa District	Trincomalee District	Ampara District
Panel A: Severely Stunted				
War Area x War Period				
Age <5	**0.069*** (0.009)**	**0.062*** (0.005)**	**0.088*** (0.006)**	**0.061*** (0.004)**
0<Age <1	0.175*** (0.023)	0.195*** (0.019)	0.177*** (0.018)	0.143*** (0.019)
1<Age<2	0.073*** (0.008)	0.065*** (0.007)	0.068*** (0.007)	0.080*** (0.006)
2<Age<3	0.053*** (0.015)	0.021*** (0.007)	0.079*** (0.006)	0.060*** (0.007)
3<Age<4	0.041* (0.021)	0.017*** (0.006)	0.088*** (0.005)	0.019* (0.010)
4<Age<5	0.029** (0.011)	0.046*** (0.009)	0.023** (0.010)	0.020** (0.010)
Panel B: Severely or Moderately Stunted				
War Area x War Period				
Age <5	**0.131*** (0.024)**	**0.096*** (0.009)**	**0.196*** (0.009)**	**0.118*** (0.026)**
0<Age <1	0.239*** (0.026)	0.249*** (0.025)	0.248*** (0.024)	0.215*** (0.026)
1<Age<2	0.126*** (0.033)	0.094*** (0.028)	0.213*** (0.021)	0.104*** (0.020)
2<Age<3	0.128*** (0.037)	0.103*** (0.014)	0.232*** (0.015)	0.084*** (0.014)
3<Age<4	0.132*** (0.041)	0.064** (0.022)	0.127*** (0.021)	0.091*** (0.020)
4<Age<5	0.044* (0.023)	0.019*** (0.007)	0.089*** (0.005)	0.020* (0.011)
Controls	YES	YES	YES	YES
District fixed effects	YES	YES	YES	YES

Note: *Dependent Variables are severely stunted and severely or moderately stunted children under five. Column 1 has reported the results of stunting of children under five, by considering the Eastern province as the war area, and all the other provinces as the non-war areas. Column (2) shows the results obtained by considering the Batticaloa district as the treatment group and the other non-war districts as the control*

group. Similarly, columns (3) and (4) show the results obtained by considering the Trincomalee and Ampara districts as treatment groups and the other non-war districts as control groups, respectively.

Panels A and B show the results of severely stunted and severely or moderately stunted children under five, respectively. The first row of each panel refers to the children under five, and the rest of the rows refer to different age groups (age between 1-2, 2-3, 3-4, and 4-5).

Severely stunted is a binary variable which equals 1 if the height-for-age z-score is below -3 standard deviations, and 0 otherwise. Severely or moderately stunted is a binary variable which equals 1 if the height for age z-score is below -2 standard deviations, and 0 otherwise.

*The coefficients are derived using different regressions. All the regressions included household controls, individual controls, and district fixed effects. Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

When considering districts separately, children under five in each war district were above 6 percentage points more severely stunted than their counterparts (Panel A, column 2-4). The rest of the rows in panel A refer to stunting of different age groups; 0-1, 1-2, 2- 3, 3-4, 4-5. The highest affected birth cohort is age 0-1, born from 2006 July to 2007 July. Children under five living in the Eastern Province during the war were above 13 percentage points more severely or moderately stunted than their counterparts (Panel B, column 1). When considering districts separately, the magnitude varies from 10 to 20 percentage points. One out of every four children under the age of one exposed to war is more severely or moderately stunted than their counterparts (panel 2 row 2). Both panels in this table show that stunting decreases as age increases. For example, severely stunting of children whose age between 0-1, 1-2, 2-3, 3-4, 4-5 in the eastern province during the war period is 17.5, 7.3, 5.3, 4.1, 2.9 higher than their counterparts, respectively. In general, a similar pattern can be seen when considering districts separately. Severely or moderately stunting also follows a similar pattern. One possible reason for low stunting for children above age three is they were born during the ceasefire period when the government provided food, necessary drugs, and medicine to the war zones. Mothers'

education level and attention can also affect the stunting of children whose age is 1 or 2 years since mothers need to feed them. If the kid has more siblings, the mother's attention on the infant can be less. However, when their age goes up three or above, they can feed themselves if foods are available. That can be one of the other reasons for lower stunting as age goes up. On the other hand, some existing literature also supports the stunting pattern across age groups shown in the table (Donald M. 2015; Shaikh S. R. 2014). For example, Donald M. (2015) investigates whether the threshold level of maternal education is sufficient to reduce child undernutrition by using Zimbabwe, Tanzania, and Malawi. As age increases, the stunting of children of those countries also decreases.

The following section focuses on the wasting of children under five. When a person's food is not adequate & of good quality and suffers chronic illnesses, they are more likely to develop wasting. Basically, wasting is a short-term health issue. As mentioned before, data were collected right after the war ended in the eastern province. Therefore, table 2.6 represents the wasting of children by age by the time of data collection. It shows that wasting of children living in Batticaloa and Trincomalee were highly affected regardless of their age. However, the Ampara district does not show a significant impact of war on the wasting of children under the age of five (except the 4-5 age group in panel B). What can be the reason? Compared to the other two districts, the Ampara district was slightly less affected by the war.

One reason for this may be the change in the ethnic composition of the Ampara district relative to the other two. As explained earlier, the LTTE war was waged by the Tamil community against the Sinhala government. Therefore, the conflict escalated as more pro-war groups lived in the Tamil-majority areas.

Table 2.6: The impact of the LTTE war on severe wasted and severely or moderately wasted of children under five

Description	Wasted – Under five children			
	(1) All Sample	(2) Batticaloa District	(3) Trincomalee District	(4) Ampara District
Panel A: Severely Wasted				
War Area x War Period				
Age <5	**0.029**	**0.065*** **	**0.094*** **	**-0.036**
	(0.036)	**(0.007)**	**(0.009)**	**(0.073)**
0<Age <1	0.046	0.108***	0.084***	-0.043
	(0.044)	(0.015)	(0.016)	(0.041)
1<Age<2	0.007	0.084***	0.108***	-0.039
	(0.034)	(0.013)	(0.014)	(0.022)
2<Age<3	0.009	0.074***	0.076***	-0.084
	(0.050)	(0.011)	(0.012)	(0.052)
3<Age<4	0.028	0.018	0.113***	-0.029
	(0.036)	(0.010)	(0.011)	(0.019)
4<Age<5	0.064*	0.133***	0.079***	0.003
	(0.036)	(0.007)	(0.008)	(0.008)
Panel B: Severely or Moderately Wasted				
War Area x War Period				
Age <5	**0.039**	**0.065*** **	**0.0142*** **	**-0.091**
	(0.061)	**(0.015)**	**(0.017)**	**(0.075)**
0<Age <1	0.049	0.109*	0.088***	-0.045
	(0.061)	(0.056)	(0.021)	(0.041)
1<Age<2	0.011	0.112***	0.113***	-0.100
	(0.07)	(0.027)	(0.030)	(0.65)
2<Age<3	0.010	0.106***	0.094***	-0.015
	(0.081)	(0.019)	(0.022)	(0.022)
3<Age<4	0.029	0.021	0.062***	-0.038
	(0.101)	(0.023)	(0.020)	(0.031)
4<Age<5	0.078***	0.092***	0.125***	0.043**
	(0.022)	(0.014)	(0.010)	(0.014)
Controls	YES	YES	YES	YES
District fixed effects	YES	YES	YES	YES

Note: *Dependent Variables are severely wasted and severely or moderately wasted in children under five. Column 1 has reported the results of wasting of children under five, by considering the Eastern province as the war area, and all the other provinces as the non-war areas. Column (2) shows the results obtained by considering the Batticaloa district as the treatment group and the other non-war districts as the control group. Similarly, columns (3) and (4) show the results obtained by considering*

the Trincomalee and Ampara districts as treatment groups and the other non-war districts as control groups, respectively.

Panels A and B show the results of severely wasted and severely or moderately wasted children under five, respectively. The first row of each panel refers to the children under five, and the rest of the rows refer to different age groups (age between 1-2, 2-3, 3-4, and 4-5).

Severely wasted is a binary variable which equals 1 if the weight-for-height z-score is below -3 standard deviations, and 0 otherwise. Severely or moderately stunted is a binary variable which equals 1 if the weight-for-height z-score is below -2 standard deviations, and 0 otherwise.

*The coefficients are derived using different regressions. All the regressions included household controls, individual controls, and district fixed effects. Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

For example, the Sinhala population in the Batticaloa district is 1.3 percent, and in the Ampara district, it is 39 percent. Similarly, the Tamil people living in the Batticaloa district is 72 percent, and in the Ampara district, it is 17 percent. The Trincomalee district is composed of 26.7 percent Sinhala people and 31.0 percent Tamil people. However, the Moor population who also speak Tami in Trincomalee district is 41.8 percent. Therefore, the whole Tamil-speaking community in the Trincomalee district is 72.8 percent.

2.3.1.2 The impact of the LTTE war on wasting and stunting of children under-five during the non-ceasefire period and the ceasefire period

In 2001, a ceasefire agreement was signed between the government and the LTTE. The LTTE breached the agreement in the last quarter of 2005. Therefore, to identify whether the non-ceasefire period and the ceasefire period had a different effect on the stunting and wasting of the children, I investigated the children belonging to these two periods separately.

The ceasefire period is between 2002 July to 2005 December (42 months), while the non-ceasefire period refers to the period between 2006 January to 2007 July (18 months). Table 2.7

Table 2.7: The impact of the LTTE war on stunting of children born during the ceasefire and the non- ceasefire periods

Description	Stunting			
	(1)	(2)	(3)	(4)
	All Provinces	Batticaloa District	Trincomalee District	Ampara District
Panel A	**Severely Stunting: Children born during the non- ceasefire period**			
War Period	-0.023**	-0.033**	-0.032**	-0.033**
	(0.014)	(0.014)	(0.013)	(0.015)
War Area x War Period	0.147***	0.183***	0.132***	0.126***
	(0.020)	(0.015)	(0.013)	(0.015)
R^2	0.46	0.039	0.036	0.040
Observations	4,049	3,718	3,697	3,756
Panel B	**Severely Stunting: Children born during the ceasefire**			
War Period	-0.004	-0.003	-0.004	-0.003
	(0.003)	(0.004)	(0.004)	(0.005)
War Area x War Period	0.036**	0.014***	0.072***	0.030***
	(0.012)	(0.004)	(0.005)	(0.001)
R^2	0.005	0.003	0.006	0.003
Observations	9,845	9,004	8,924	9,123
Panel C	**Severely or Moderately Stunting: Children born during the non- ceasefire period**			
War Period	-0.055**	-0.055**	-0.054**	-0.56**
	(0.021)	(0.022)	(0.026)	(0.022)
War Area x War Period	0.204***	0.196***	0.0235***	0.183***
	(0.025)	(0.022)	(0.023)	(0.022)
R^2	0.037	0.030	0.031	0.032
Observations	4,049	3,718	3,697	3,756
Panel D	**Severely or Moderately Stunting: Children born during the ceasefire**			
War Period	-0.007	-0.006	-0.007	-0.006
	(0.008)	(0.007)	(0.008)	(0.006)
War Area x War Period	0.100***	0.054***	0.180***	0.090***
	(0.027)	(0.009)	(0.008)	(0.007)
R^2	0.013	0.010	0.012	0.011
Observations	9,845	9,004	8,924	9,123
Controls	YES	YES	YES	YES
District Fixed effects	YES	YES	YES	YES

Notes: *Dependent Variables are severely stunted and severely or moderately stunted of children under 18 months. Column 1 has reported the results of stunting of children under the age of 18 months, by considering the Eastern province as the war-area, and all the other provinces as the non-war areas. Column (2) shows the results obtained by considering the Batticaloa district as the treatment group and the other non-war districts as the control group.*

Similarly, columns (3) and (4) show the results obtained by considering the Trincomalee and Ampara districts as treatment groups and the other non-war districts as control groups, respectively.

Panels A and B show the results of severely stunted children who were born during the war and the ceasefire periods, respectively. Severely stunted is a binary variable which equals 1 if the height-for-age z-score is below -3 standard deviations, and 0 otherwise. Severely or moderately stunted is a binary variable which equals 1 if the height for age z-score is below -2 standard deviations, and 0 otherwise.

*All the regressions included household controls and individual controls. Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

and 2.8 report results. These table is closely similar to the previous table 2.5 and 2.6. However, the previous section investigates war's impact on children by single age groups. It does not differentiate between the ceasefire and the non-ceasefire periods. For example, in table 2.5, the age group 0-1 refers to the births between 2006 August 01 to 2007 July 31. The age group, 1-2, refers to the births between 2005 August 01 to 2006 July 31. Since the ceasefire ended in December 2005, age group 1-2 includes births that refer to the ceasefire and non-ceasefire periods. In other words, births from 2005 August 01 to 2005 December 31 (ceasefire period) and births from 2006 January 01 to 2006 July 31 (non-ceasefire period) belong to 1-2 age group. Therefore, Tables 2.7 and 2.8 in this section provide a better picture of ceasefire and non-ceasefire impacts on children under age five.

Table 2.7 shows four panels. Panel A and B refer to severely stunted children born during non-ceasefire and ceasefire periods, respectively. Panel C and D refer to severely or moderately stunted children born during non-ceasefire and ceasefire periods, respectively.

Table 2.8: The impact of the LTTE war on the wasting of children born during the non-ceasefire period and ceasefire periods

Description	Wasting			
	(1)	(2)	(3)	(4)
	All Provinces	Batticaloa District	Trincomalee District	Ampara District
Panel A: Severely Wasting: Children born during the non- ceasefire period				
War Period	-0.011	-0.12	-0.014	-0.011
	(0.014)	(0.015)	(0.014)	(0.012)
War Area x War Period	0.034	0.076***	0.084***	-0.030
	(0.036)	(0.015)	(0.016)	(0.034)
R^2	0.025	0.026	0.027	0.024
Observations	4,049	3,718	3,697	3,756
Panel B: Severely Wasting: Children born during the ceasefire				
War Period	-0.007	-0.005	-0.007	-0.006
	(0.006)	(0.006)	0.007)	(0.005)
War Area x War Period	0.029	0.063***	0.097***	-0.041
	(0.037)	(0.007)	(0.005)	(0.043)
R^2	0.029	0.032	0.034	0.030)
Controls	YES	YES	YES	YES
District Fixed effects	YES	YES	YES	YES
Observations	9,845	9,004	8,924	9,123
Panel C: Severely or Moderately Wasting: Children born during the non- ceasefire period				
War Period	-0.017	-0.018	-0.017	-0.016
	(0.022)	(0.021)	(0.023)	(0.020)
War Area x War Period	0.020	0.079***	0.103***	-0.127
	(0.061)	(0.020)	(0.024)	(0.216)
R^2	0.041	0.042	0.041	0.040
Observations	4,049	3,718	3,697	3,756
Panel D: Severely or Moderately Wasting: Children born during the Ceasefire				
War Period	0.007	0.003	0.007	0.008
	(0.013)	(0.014)	(0.013)	(0.019
War Area x War Period	0.043*	0.089***	0.155***	0.033*
	(0.024)	(0.013)	(0.015)	(0.019)
R^2	0.047	0.053	0.056	0.051
Controls	YES	YES	YES	YES
District Fixed effects	YES	YES	YES	YES
Observations	9,845	9,004	8,924	9,123

Notes: *Dependent Variables are severely wasted and severely or moderately wasted of children under the age of 18 months. Column 1 has reported the results of wasting of children, by considering the Eastern province as the war-area, and all the other provinces as the non-war area. Column (2) shows the results obtained by considering the Batticaloa district as the treatment group and the other non-war districts as*

the control group. Similarly, columns (3) and (4) show the results obtained by considering the Trincomalee and Ampara districts as treatment groups and the other non-war districts as control groups, respectively.

Panels A and B show the results of severely wasted children who were born during the war and ceasefire periods, respectively. Severely wasted is a binary variable which equals 1 if the weight-for-height z-score is below -3 standard deviations, and 0 otherwise. Severely or moderately wasted is a binary variable which equals 1 if the weight-for-height z-score is below -2 standard deviations, and 0 otherwise.

*All the regressions included household controls and individual controls. Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

The table clearly shows that severely stunted and severely or moderately stunted children born during the non-ceasefire period are considerably higher than the same age cohort born during the ceasefire period. A similar pattern cannot be seen in table 2.6, which refers to the wasting of children born during the ceasefire and non-ceasefire periods. Instead, it shows that the wasting of children belonging to both cohorts in Batticaloa and Trincomalee districts are high regardless of the period (ceasefire or non-ceasefire).

2.4 Identifying Channels that can be affected on child health in war areas:

Different factors can cause children's stunting and wasting. Some of them are fetal factors, maternal factors, childhood nutrition and infection, environmental factors, etc. This section focuses on child and maternal nutrition & infections, antenatal care, postnatal care, etc.

2.4.1 Iron & parasitic drug use of children (under 5 years of age) and its impact on children's health.

Table 2.9: The impact of war on Iron and Parasite drug intake of children under five

Description	Iron and Parasite drug intake by children			
	(1)	(2)	(3)	(4)
	All Sample	Batticaloa	Trincomalee	Ampara
Panel A: Drug use for intestine worms				
War Area x War Period				
Age < 5	-0.092* (0.62)	-0.245*** (0.018)	-0.130*** (0.020)	0.054 (0.071)
0<Age <1	0.007 (0.032)	0.012 (0.010)	0.003 (0.011)	0.021 (0.012)
1<Age<2	-0.030 (0.111)	-0.148*** (0.032)	0.101*** (0.025)	0.015 (0.036)
2<Age<3	-0.084 (0.122)	-0.329*** (0.025)	-0.239*** (0.032)	0.122 (0.125)
3<Age<4	-0.188** (0.065)	-0.299*** (0.029)	-0.209*** (0.021)	0.056* (0.030)
4<Age<5	-0.194*** (0.016)	-0.524*** (0.030)	-0.181*** (0.033)	*-0.074** (0.027)
Panel B: Iron Syrup/tablet intake				
War Area x War Period				
Age < 5	-0.082* (0.046)	-0.189*** (0.006)	-0.152*** (0.008)	0.046 (0.049)
0<Age <1	-0.059 (0.043)	-0.083*** (0.014)	-0.134 (0.013)	0.029 (0.011)
1<Age<2	-0.069* (0.049)	-0.108*** (0.012)	-0.169*** (0.014)	0.049 (0.043)
2<Age<3	-0.093** (0.035)	-0.181*** (0.011)	-0.154*** (0.012)	0.011 (0.011)
3<Age<4	-0.117* (0.059)	-0.259*** (0.009)	-0.175*** (0.011)	0.042 (0.091)
4<Age<5	-0.117 (0.082)	-0.259*** (0.010)	-0.174*** (0.011)	0.042* (0.025)
R2				
Controls	YES	YES	YES	YES
District Fixed- effects	YES	YES	YES	YES

Notes: *Dependent Variables are Drug use for intestine worms and iron intake of children. Variables of Worm treatments and Iron Syrup/tablet of children are binary variables. Panel A and B show Worm treatments and Iron intake, received by children, respectively. The variable of Worm treatments equals 1 if parasite drugs*

were given to the child during the past six months, and 0 otherwise. The variable of the Iron Syrup/tablet also a binary variable, equals 1 if the iron syrup was given to the child during the last 14 days, and 0 otherwise. The first row of each panel refers to the children under five, and the rest of the rows refer to different age groups (age between 1-2, 2-3, 3-4, and 4-5).

Column 1 has reported the results by considering the Eastern province as the war-area, and all the other provinces as the non-war areas. Column (2) shows the results obtained by considering the Batticaloa district as the treatment group and the other non-war districts as the control group. Similarly, columns (3) and (4) show the results obtained by considering the Trincomalee and Ampara districts as treatment groups and the other non-war districts as control groups, respectively.

*The coefficients are derived using different regressions. All the regressions included household and individual controls and district fixed effects. Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

First, the study investigates Iron consumption and parasitic drug use of children and pregnant mothers. Results are reported in table 2.9. Panel A shows the drug use for intestine worms of children, while panel B shows the iron intake. Both iron intake and parasite drugs intake of children in the war province are lower during the war period when compared with their counterparts. Among the three districts, Batticaloa reports the lowest iron intake and parasite drug intake of children. The second highest affected district is Trincomalee. The Ampara, again, does not show a significant impact in both cases. One of the highlights of this table is that as children get older, the iron syrup and parasites drugs given to the child by their mothers gradually decrease. In other words, in contrast to the stunning results, this table shows larger effects for the oldest kids. Several factors can affect this. One of the other common factors is that as the baby gets older, the mother may lose attention to the baby's health. If the child has more siblings, the situation may worsen. Infants less than one-year-old get more attention from midwives and free medical health centers too. The child needs to bring to the MOH office for free immunization. During the visit, children are given iron and drugs for worms too. However,

when the child grows up mother seldom visits the MOH office. For example, vaccines for diphtheria, tetanus, and whooping cough (pertussis; DTaP), to the children needs five doses of DTaP vaccine. The first, second, third, fourth, and fifth doses are given when the child is at two months, four months, six months, fifteen-eighteen months, four-six years, respectively. Another example is that for Haemophilus influenzae type b (Hib), the child needs 3–4 doses of the Hib vaccine (it depends on the brand). The first, second, third, and fourth doses are given at two, four, six, and twelve-fifteen months, respectively. It shows that the visits of the child to MOH office goes down as their age increases. Therefore, getting free iron and parasite drugs may lower as the age of the child go up. Second, essential drug transportation was carried out by the government to the war-torn areas during the war situation too. However, it was impossible to follow up on whether they adequately distributed those drugs among the people. There were allegations that the drugs provided by the government were being used by LTTE members for their purposes and not being distributed to the public. If so, it could be due to a shortage of drugs. Since infants are at more risk than older kids, parents may give younger kids the available iron syrup and parasite drugs.

2.4.2 Iron & parasitic drug use of mothers and its impact on children's health.

The WHO recommends that mothers need to take 30 mg - 60 mg of elemental iron daily during pregnancy to prevent maternal anemia, low birth weight, and premature birth. Among the leading causes of stunting and wasting in children, low birth weight and premature birth, and maternal anemia are prominent. On the other hand, deworming is recommended by the WHO for pregnant women after the first trimester, to reduce the worm burden of roundworms, whipworms, and hookworms. Since both iron and parasite drug intake by the mother during the pregnancy directly affects the health of children under the age of five, I use this section to investigate it.

Table 2.10: The impact of war on Iron and parasite drug intake of mothers when they were pregnant by the child's age.

Description	Iron and parasite drug intake of mothers when they were pregnant			
	(1)	(2)	(3)	(4)
	All Sample	Batticaloa	Trincomalee	Ampara
Panel A: Drug use for intestine worms				
Child's age	-0.183***	-0.299***	-0.255***	-0.044*
Age < 5	(0.022)	(0.042)	(0.046)	(0.023)
0<Age <1	-0.19***	-0.224**	-0.343***	-0.023
	(0.050)	(0.099)	(0.099)	(0.040)
1<Age<2	-0.105**	-0.244**	-0.164*	-0.005
	(0.041)	(0.101)	(0.089)	(0.030)
2<Age<3	-0.187***	-0.197**	-0.289***	-0.109*
	(0.046)	(0.078)	(0.096)	(0.061)
3<Age<4	-0.225***	-0.316***	-0.312**	-0.032*
	(0.065)	(0.113)	(0.136)	(0.005)
4<Age<5	-0.192***	-0.404***	0.134	-0.101
	(0.066)	(0.123)	(0.145)	(0.074)
Panel B: Iron Syrup/tablet				
Child's age	-0.028***	-0.053***	-0.015**	-0.033**
Age < 5	(0.004)	(0.019)	(0.007)	(0.014)
0<Age <1	-0.029**	-0.081**	-0.015**	-0.004
	(0.014)	(0.040)	(0.006)	(0.007)
1<Age<2	-0.041*	-0.050	-0.002	-0.058**
	(0.022)	(0.046)	(0.007)	(0.028)
2<Age<3	-0.011	-0.034	0.004	0.008
	(0.014)	(0.037)	(0.006)	(0.006)
3<Age<4	-0.051	-0.065	0.003	-0.069
	(0.036)	(0.052)	(0.085)	(0.057)
4<Age<5	-0.019	0.024*	0.015	-0.057
	(0.030)	(0.013)	0.011)	(0.055)
Controls	YES	YES	YES	YES
District fixed effects	YES	YES	YES	YES

Notes: Dependent Variables are Drug use for intestine worms and iron intake of mothers who have under-five children. Variables of Worm treatments and Iron Syrup/tablet of mothers are binary variables. Panel A and B show Worm treatments and Iron intake, received by the mothers, respectively. The variable of Worm treatments equals 1 if parasite drugs were received by the mother during her pregnancy period, and 0 otherwise. The variable of Iron Syrup/tablet also a binary variable, equals 1 if the iron syrup was received by the mother during the last 14 days, and 0 otherwise.

Column 1 has reported the results by considering the Eastern province as the war-area, and all the other provinces as the non-war areas. Column (2) shows the results obtained by considering the Batticaloa

district as the treatment group and the other non-war districts as the control group. Similarly, columns (3) and (4) show the results obtained by considering the Trincomalee and Ampara districts as treatment groups and the other non-war districts as control groups, respectively.

*The coefficients are derived using different regressions. All the regressions included household and individual controls and district fixed effects. Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

Information gathered through the DHS survey on the use of drugs for intestinal worms and iron tablets or syrups by mothers (who have children under five) during their pregnancy has been used in this regard. Accordingly, iron and parasite drug intake of mothers when they were pregnant by the age of the child is shown in table 2.10. Panel A of column 1 shows that the drug use for intestine worms by mothers who lived in the Eastern province is 18.3 percentage points lower relative to their counterparts. The Batticaloa district shows the lowest iron and parasite drug consumption compared to the other war-torn communities. Regardless of the child's age, mothers consumed fewer parasite drugs in the eastern province than in the other provinces. On average, iron consumption of mothers who has a child or children above one year old does not show significant impacts in the eastern province compared to other provinces in the war period. However, the less iron consumption can be seen for mothers who gave birth to a child during the heavy fighting period in the eastern province compared to other non-war provinces.

2.4.3 Antenatal care: - Visit of Midwife during ANC

It is also essential to investigate the access and facilities of free health services for mothers during antenatal and postnatal care periods. In Sri Lanka, public health midwives (PHM) are the front-line health workers providing care to children, mothers, and pregnant women. They are well trained for child and mother care services. The midwife should maintain a formal register of women of childbearing age and all children under the age of five in the community

for which she is responsible. PHMs are advised to systematically visit homes that belong to their area to provide assistance and instructions on antenatal care, postnatal care, childcare, breastfeeding counseling, and family planning. She needs to encourage the community to attend Public Health Midwife Office (PHMO).

Accordingly, the study was focused on the visit of midwives to the homes of pregnant women during the pregnancy period. Table 2.11 shows the visits of the midwife in charge of the area during the mother's pregnancy. Column (1) shows the results by considering the war and the non-war-provinces. It indicates that households (where pregnant mothers live) visited by midwives in the war province are 15.9 percent lower than non-war provinces during the war period relative to the peace period.

Table 2.11: Effect of the visit of the midwife in charge of the area during the mother's pregnancy

Description	ANC			
	(1)	(2)	(3)	(4)
	Dependent variable: Log number of visits by midwife during the mother's pregnancy			
	All Sample	Batticaloa	Trincomalee	Ampara
War Period	0.036**	0.035	0.037**	0.036**
	(0.013)	(0.012)	(0.013)	(0.011)
War Area x War Period	-0.159***	-0.083***	-0.166***	-0.214***
	(0.036)	(0.013)	(0.014)	(0.021)
R2	0.087	0.068	0.072	0.068
Controls	YES	YES	YES	YES
District Fixed effects	YES	YES	YES	YES
Observations	6,601	6,043	5,995	6,119

Notes: *The Dependent Variable is the Visit of the Midwife during the Antenatal care (ANC) period in log form).*

Column (1) shows the estimates obtained by considering the Eastern Province as the treatment group and all other provinces as the control group. The estimates obtained separately by considering Batticaloa, Trincomalee, and Ampara districts as treatment groups and all other non-war districts as controlled groups are shown in columns (2), (3), and (4) respectively.

*All the regressions included household and individual controls and district fixed effects. Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01*

Columns (2) to (4) show that households visited by midwives in Batticaloa, Trincomalee, and Ampara districts are 8.3, 16. 6 and 21.4 percent lower than their counterparts in the war period relative to the non-war period. However, the 'attendance of the midwife in charge of the area during the mother's pregnancy' of Ampara district is considerably lower than the other two districts. The reason for this may be the population composition of the Ampara district. About 40 percent of the population is Sinhalese. Tamils make up 17 percent, while the rests are Muslims and other ethnic groups. Therefore, it is common practice to attach midwives to represent the Sinhala and Muslim majority. During the war and the ceasefire period, Sinhala government officials were unable to carry out their duties freely in the Northern and Eastern Provinces due to LTTE threats. It may have been the cause of this situation.

2.4.4 Antenatal care: - Mother register pregnancy at PHMO

The PHMO office of Sri Lanka plays a vital role in child and maternal care. All mothers are advised to register their pregnancy at the PHMO to provide all necessary guidance that important for the child and maternal carefree of charge. Once a mother registers at the PHMO, the government provides much assistance to her prenatal care and postnatal care, including free nutrition supplements, free immunization, free clinical check-ups, and treatments, etc. In addition to that, free delivery facilities, child immunizations, nutrition supplements for the child, and other health guidance provide by the PHMOs. Therefore, being registered at the PHMO is essential for child health.

However, mothers may face difficulties participating in PHMO due to war situations that may affect child health. The study examined the registration of pregnancy at the PHMO office to investigate this channel. Table 2.12 has reported the results. The results show that the

'registration of pregnancy at the PHMO office' of the affected cohort exposed to the war is 6.5 percentage points lower than those who were not exposed to the war in the war period, compared to the non-war period. Columns (2), (3) & (4) show that the registration of pregnancies in PHMOs of Batticaloa, Trincomalee, and Ampara districts are 7.5, 6.2, and 5.7 percentage points lower than non-war districts in the war period relative to the peace period, respectively.

Table 2.12: Effect of Mothers' participation in pregnancy clinic at the PHMO

	Dependent variable: Registration of pregnancy at the PHMO			
	(1)	(2)	(3)	(4)
	All Sample	Batticaloa	Trincomalee	Ampara
War Period	-0.017	-0.018	-0.014	-0.018
	(0.021)	(0.024)	(0.019)	(0.025)
War Area x War Period	-0.065**	-0.075***	-0.062**	-0.057**
	(0.026)	(0.024)	(0.021)	(0.025)
R2	0.051	0.048	0.050	0.049
Controls	YES	YES	YES	YES
District fixed effects	YES	YES	YES	YES
Observations	6,601	6,043	5,995	6,119

Notes: *Dependent Variable is registration of pregnancy at PHMO. The variable of registration of pregnancy at PHMO is a binary variable, equals 1 if the pregnancy registered at the PHMO and 0 otherwise.*

Column (1) shows the estimates obtained by considering the Eastern Province as the treatment group and all other provinces as the control group. The estimates obtained separately by considering Batticaloa, Trincomalee, and Ampara districts as treatment groups and all other non-war districts as controlled groups are shown in columns (2), (3), and (4) respectively. PHMO stands for Public Health Midwife Office.

*All the regressions included household and individual controls and district fixed effects. Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01*

2.4.5 Antenatal care: Attending a clinic at a government hospital where a specialized doctor is available

Mothers need to attend the clinical examinations during their pregnancy to maintain the baby's health and the mother's. However, Brigg Reilley et al. (2002) show that many medical

professionals in the Northern and Eastern Provinces have fled the war zone due to the war. Although there should be 27 government doctors in the war zone, 21 of them are vacant. They further point out that the government has not provided proper training to medical officers in the war zone since its beginning.

Table 2.13: Attending a clinic at a government hospital where a specialized doctor is available

Description	ANC			
	Dependent variable: Attending a clinic at a government hospital where a specialized doctor is available			
	(1)	(2)	(3)	(4)
	All Sample	Batticaloa	Trincomalee	Ampara
War Period	0.035***	0.031***	0.048***	0.084***
	(0.003)	(0.004)	(0.005)	(0.015)
War Area x War Period	-0.288**	-0.297***	-0.558***	-0.111
	(0.117)	(0.052)	(0.051)	(0.050)
R2	0.153	0.151	0.150	0.161
Controls	YES	YES	YES	YES
District Fixed effects	YES	YES	YES	YES
Observations	6,601	6,043	5,995	6,119

Notes: *Dependent Variable is a binary variable. It equals 1 if the woman attended a clinic at a government hospital where a specialized doctor is available and 0 otherwise.*

Column (1) shows the estimates obtained by considering the Eastern Province as the treatment group and all other provinces as the control group. The estimates obtained separately by considering Batticaloa, Trincomalee, and Ampara districts as treatment groups and all other non-war districts as controlled groups are shown in columns (2), (3), and (4) respectively.

*All the regressions included household and individual controls and district fixed effects. Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01*

Table 2.13 was derived from investigating this situation, which may directly impact the health of the child. The table shows that pregnant mothers living in the Eastern province are nearly 30 percentage points less likely to attend clinics at government hospitals where specialized doctors are available when compared to their counterparts. Columns (2) and (3) of the same

table show that these adverse effects for Batticaloa, Trincomalee districts are 29.7 and 55.8 percentage points during the war compared to their counterparts. Again Ampara district does not show significant impacts.

2.4.6 Postnatal care: - Visit of Midwife after the delivery

Postnatal care is crucial to maintaining the health of both mother and baby. Therefore, after the baby is born, the midwives are advised to visit the home to examine the mother and baby. They provide advice and guidance on how to maintain the health of the baby and the mother. However, war areas can suffer a lack of midwives.

Table 2.14: Effect of the visit of the midwife in charge of the area after the delivery

	PNC visit of the midwife after the delivery			
	(1)	(2)	(3)	(4)
	All Sample	**Batticaloa**	**Trincomalee**	**Ampara**
War Period	-0.102*** (0.022)	-0.100*** (0.011)	-0.103*** (0.021)	-0.097*** (0.018)
War Area x War Period	-0.443*** (0.044)	-0.509*** (0.022)	-0.325*** (0.023)	-0.458*** (0.021)
R2	0.131	0.095	0.066	0.093
Controls	YES	YES	YES	YES
District Fixed effects	YES	YES	YES	YES
Observations	6,601	6,043	5,995	6,119

Notes: *The Dependent Variables are visits of the midwife after the delivery, which is a binary variable. It equals 1 if the midwife visited the woman who gave the birth at least five times, and 0 otherwise.*

Column (1) shows the estimates obtained by considering the Eastern Province as the treatment group and all other provinces as the control group. The estimates obtained separately by considering Batticaloa, Trincomalee, and Ampara districts as treatment groups and all other non-war districts as controlled groups are shown in columns (2), (3), and (4) respectively

PNC stands for postnatal care.

*All the regressions included household and individual controls and district fixed effects. Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01*

As an example, Brigg Reilley (2002) points out that out of the 108 vacancies for midwives in the Northern and Eastern provinces of Sri Lanka, only 34 have been filled by that time. Since the visit of a midwife after childbirth can affect child health, I have investigated whether there is an impact of living in the war area on midwives' visits during the postnatal care period. Results are reported in table 2.14. The magnitudes of percentage points are relatively very high in this table. It indicates that care about the child and mother form the responsible organizations go down after the delivery that may lead to stunting and wasting. Column (1) shows that the examination of midwives for postpartum women and children during the postpartum care period of Eastern province was 44.3 percentage points lower than non-war provinces in the war period, relatively to the peace period. Columns (2) to (4), which examine the districts of the Eastern Province separately, also show that these negative impacts for Batticaloa, Trincomalee, and Ampara districts as 50.9, 32.5, and 45.8 percentage points, respectively. During the postnatal care period, midwives should guide mothers for any health issues of mother and child, eating pattern of mother, the way of correct breastfeeding, information on postnatal care and danger signs of the mother or the newborn baby, etc. However, the table shows that postnatal care is much lower in the war zones compared to the no-war zones during the war period. It can directly affect the stunting and wasting of children who were exposed to the war.

2.5.3 Heterogeneous effect

War affects people living in the war area regardless of their ethnicity, religion, age, status or gender, etc. However, there can be some heterogeneous effects of war on people based on the urban/rural sector that they live. Why might there be differences in urbanicity? The LTTE is a guerrilla force that has a small military capacity. Their strategy and tactics involved small units and often operated in rural areas. Because after a sudden attack, they need small jungle areas to hide and protect themselves. Therefore, we can expect them to be mainly operating in rural areas compared to the urban. Second, once they hid among civilians in urban areas after the guerilla

attack, the government's army could not attack back them since it might damage other innocent civilians. Therefore, I expected different impacts of war on urban and rural areas. Accordingly, a test was performed to investigate the heterogeneous impact of the war on the urban/rural sector. The triple DID method was used to estimate the heterogeneous effect of war on the 'sector' using the following equation.

$$Y_{ijst} = \beta_0 + \beta_1 War\_Period_{it} + \beta_2 War\_Area_{ij} + \beta_3 Urban\_Sector_{is} + \beta_4 (War\_Period_{it} * Urban\_Sector_{is}) + \beta_5 (War\_Area_{ij} * Urban\_Sector_{is}) + \beta_6 (War\_Area_{ij} * War\_Period_{it}) + \beta_7 (War\_Area_{ij} * War\_Period_{it} * Urban\_Sector_{is}) X'_{ijt}\alpha + + \delta_d + \mathcal{E}_{ijt}, \text{ ---------(3)}$$

Where, *i* stands for individuals; j stands for districts; *s* stands for the sector and *t* stands for years. *Y* represents the outcome variable. *War-period* is a year dummy that equals one for Aug 2002 to Aug 2007 and equals zero for the period July 2011 to July 2016. *War area* represents a binary variable which is one for war areas (Eastern Province) and the zero for non-war areas (All other Provinces[6]). *The Urban_Sector* is a dummy variable which equals 1 if the household belongs to the urban area and 0 if it belongs to the rural area. X'_{ijt} represents a set of other variables that can affect child health, the wealth of the family, Sex of the child, multiple births or a single birth, father's education level, father's occupation, mother's age, mother's literacy, etc. $\mathcal{E}_{ij}$ is the error term. β_0 to β_7 and α, are parameters.

Results are reported in Table 2.15, which indicates that under five child cohort born in war areas during the war period were affected by the war regardless of the urban or rural sector.

[6] The Northern Province has excluded due to unavailability of data.

Table 2.15: Heterogeneous effect of Sector (Urban/Rural) on Stunting, wasting and of children in war and non-war regions in Sri Lanka

	Panel A: severely affected		**Panel B: Moderately or severely affected**	
	(1)	(2)	(3)	(4)
	Stunting	Wasting	Stunting	Wasting
War period	-0.014**	-0.005	-0.015	0.004
	(0.005)	(0.008)	(0.012)	(0.016)
Urban	-0.015	-0.001	-0.004	-0.010
	(0.019)	(0.009)	(0.014)	(0.023)
War Area * Urban	0.033**	-0.019*	-0.011	-0.044
	(0.017)	(0.009)	(0.013)	(0.027)
War Area * War period	0.069***	0.029	0.130***	0.039
	(0.011)	(0.036)	(0.022)	(0.036)
Urban* War period	0.015	-0.014	0.022	-0.019
	(0.013)	(0.011)	(0.020)	(0.023)
War Area * War period * Urban	0.014	0.045	-0.006	0.018
	(0.034)	(0.032)	(0.061)	(0.060)
R^2	0.009	0.012	0.012	0.021
Observations	13,894	14,634	13,894	14,634
Controls	YES	YES	YES	YES
District Fixed Effects	YES	YES	YES	YES

Notes: Dependent Variables are stunting and wasting. Panel A shows results of stunting and wasting of children who are severely affected. Panel B shows results of stunting and wasting of children who are either severely or moderately affected.

Severely stunted is a binary variable which equals 1 if the height for age z-score of the child is below -3 standard deviations and zero otherwise. Severely wasted is a binary variable which equals 1 if the weight for height z-score is below -3 standard deviations and zeroes otherwise. The sector is also a binary variable, equals 1 if the household belongs to the urban sector and equals 0 if the household belongs to the rural sector.

*All the regressions included household and individual controls and district fixed effects. Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01*

2.6 Discussion and Conclusion

The paper investigates the impact of war on under-five children who are not visible as victims but affected by conflict in poor health. Although they did not receive much attention from researchers as victims of war, this study sought to show that they were severely affected by war in terms of poor health conditions.

The main results indicate that under-five children exposed to the war are more severely stunted than their counterparts. Among them, infants whose ages are between 0-1 are highly stunted than the other groups. One-fourth of children exposed to war are either severely or moderately stunted compared to the same age cohort who live in non-war areas. Results also show that severely stunting decreases as the age increases from age 0 to 5. Severely or moderately stunting also follows a similar pattern. Wasting does not offer a significant impact on children whose age is below 4 when it considers the Eastern Province as a whole. However, when districts consider separately, children who belong to all age groups under the five in Batticaloa and Trincomalee districts suffer from wasting relative to their counterparts. The results on stunting are consistent with most of the previous findings. However, the numbers of stunting and wasting are higher in those studies than in Sri Lanka. For example, Bcheraoul et al. (2018) show an increase in the likelihood of being stunted of under-five children exposed to the Yemen war, but a higher rate (22 percentage points) than this study. In 2019, about 44.4 percentage points of children under five in Pakistan were stunted, and 10.7 percentage points were wasted (Khan et al., 2019). Those studies have been conducted absolutely without comparison with any other region or period. However, since this study has studied stunting and wasting concerning non-war areas and non-war periods, the values here may be relatively small compared to previous studies.

Considering the 2007 DHS survey period, some of the children under-fives were born during the non-ceasefire period, and the rest were born during the ceasefire period. The ceasefire, of

course, does not bring sustainable peace. However, it is an excellent comfort to ordinary people who are terrified by the war. The study tried to determine whether ceasefire indirectly matters to children and those not involved in combat. The results show that children born during the non-ceasefire period are more likely to be wasting and stunting than children born during the period, which indicates that ceasefire matters child health. I hope this study will help formulate appropriate policies to provide the health and other facilities required by the relevant team to bring the health of the affected community back to normal.

Children under five do not contribute to the war. If so, how did the war affect the health of these children? What are the channels that can affect poor child health in war areas compared to non-war areas? The study has investigated the impacts of antenatal care, postnatal care, clinical check-up during the pregnancy, and iron and parasite drugs intake by the mother and the child to answer those questions. Results provided evidence that antenatal care, postnatal care, clinical check-up, iron & parasite drugs intake are lower in those war areas during the war period than in non-war areas. Lastly, everyone must understand that the consequences of war are not limited to its warring fighters but also the oppression of unborn children. Countries that experience war now or in the future need to think about healthy unborn or just born humans. Even if a government wins a battle, if the next generation is not healthy, the consequences of such victories are questionable.

2.6.1 Policy implications and limitations

According to the WHO, stunting and wasting have long-term effects on individuals and societies. It includes diminished cognitive and physical development, reduced productive capacity and poor health, and an increased risk of degenerative diseases such as diabetes. The under-five child cohort that was considered is now in the teenage group. Children who have been severely affected by the war for less than 18 months are now in the 14/15 age group.

Therefore, regular screening of children exposed to the war for identification of health issues can be recommended. Social workers and field health staff should work with the families of affected cohorts to help them recover. Reduction of productive capacity may affect child education. Therefore, policymakers should carefully pay attention to the birth cohort's education who are exposed to the war. Thus, the current health status of children of that age group exposed to war should be re-examined and should be provided free nutrition supplements and necessary treatments to recover them from poor health conditions.

Even though the study finds reliable results, it still has limitations. Under the Difference in Differences approach, it is better to have historical data sets to see the parallel trend assumption. However, due to the conflict situation, it could not conduct surveys or censuses in areas where civil war prevailed. All surveys and censuses conducted during the war period were just limited to the non-war areas. Even though the war existed in two provinces, the DHS survey in 2006/07 was conducted in the Eastern province only. Therefore, the study excluded the Northern Province.

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CHAPTER THREE

IMPACT OF RIDE-SHARING SERVICES ON TAXI INDUSTRY IN SRI LANKA

1.3 Introduction

Information Technology (IT) has changed the world in different ways. Almost every industry in the world faces a highly competitive environment with this IT revolution (Fujun Lai et al., 2006; Bruque Camara, 2003; Inmyung Choi, 2017). Simultaneously, the Ride-Sharing Service (RSS) was introduced to the taxi industry, which brought about rapid changes to the sector and increased the attraction of policymakers, researchers, and the urban and middle-class population to the taxi industry. However, only a few empirical studies can be found so far in the field of RSS, mostly due to a lack of sufficient data.

The ride-sharing platforms constitute the so-called sharing economy. Turning underused, unused, and/or inefficient services or assets into productive resources or services refers to the so-called sharing economy. Service providers should have proper links with service receivers to provide their service efficiently. In the taxi hiring services field, websites such as Uber, Lift, etc., have been developed to facilitate the efficient meeting of taxi drivers with their clients. It is also important to know how the RSS works. Ride-sharing companies primarily provide on-demand services through digital applications based on the Internet platform. The ride-sharing applications should be installed on the smartphone or tablet of taxi drivers. Then, a taxi driver connects to the passenger who requests a trip across the RSS application. With these digital apps, anyone can book a taxi online for a very reasonable price. The platform of RSS provides information on the fee of the trip to passengers in advance. Therefore, the trip fee should be accepted by both parties before starting the journey. The passenger must make payment upon arrival at the destination. A percentage of the total fare goes to the ride-sharing company as its commission fee and the rest of the money transfer to the taxi driver. In that way, RSS provides

the service of matchmaker rather than transport provider. It may satisfy the needs of passengers at a higher level, compared to the traditional mobility services.

The digital revolution can have either positive or negative impacts on the existing markets. Some research findings show that ride-sharing companies disrupt the traditional taxi industry. Hung-Hao Chang (2017) shows that the Uber service of Taiwan has reduced the revenue of regular taxi drivers in the initial year by 12% and increased this negative effect more for the consequent years. The author further shows that by the third year of entry, Uber has reduced the revenue of regular taxi drivers by 18%. Judd Cramer and Alan B. Krueger (2016) show that the rate of 'capacity utilization of Uber taxi drivers' was 30% higher than that of traditional taxi drivers in the United States. Abel Brodeur and Kerry Nield (2016) show that 'taxi rides per hour' by regular taxi drivers reduced around 8% after Uber service entered New York City. On the other hand, there may be a potential impact from the RSS on the labor market (Tirachini 2019; Jin et al., 2018). Keith Chen and Michael Sheldon (2015) studied the labor supply elasticity of Uber taxi drivers. The authors show that the attractive pricing scheme of Uber considerably increases the supply of Uber rides in the United States. Another study done by Abel Brodeur and Kerry Nield (2016) to investigate Uber's labor supply shows that the labor supply in Uber increases during rainy seasons compared to the dry season. Keith Chen and Michael Sheldon (2015) also studied the labor supply elasticity of Uber drivers. To conduct this study, they used 25 million trips made through five major cities in the United States between September 2014 and July 2015. The authors revealed that with the high price, Uber could increase its supply of Uber rides. Judd Cramer and Alan Krueger (2016) studied the impacts of the Uber taxi service on the traditional taxi industry in the USA. They have done their study to compare the capacity utilization among taxicabs and the Uber-X considering five cities of the USA performing trip-level data of Uber-X. The study shows that the utility rate of 'Uber-X' drivers is 30% higher than that of other taxi drivers. They further point out that Uber-

X drivers have a high utility capacity, which will help speed up the customer needs adjustment process and provide a flexible labor supply to the taxi industry. According to a study done by Abel Brodeur and Kerry Nield (2016), after the Uber intervention in the traditional taxi market, it has become easier for passengers to take a taxi, especially on rainy days. They used data on Uber rides from April to September 2014 and January to June 2015 to do the analysis. They found that number of taxi rides per hour decreased 8% after entering Uber into the market.

To answer the question of how Uber is changing taxis, Scott Wallsten (2015) studied the competitive effects of the sharing economy. His study shows that the increase in the so-called sharing economy causes for creating new competition among industries and the traditional taxi industry finds it difficult to compete with Uber because Uber provides a unique customer-friendly service. The uber facilitates payment through credit card service and is more affordable than traditional taxis. It also provides a very kind, reliable and respectable service to the clients. The results of his study show that this competition also encourages traditional taxi drivers to improve their service.

Accordingly, many research findings show that the RSS causes negative impacts on the available taxi industry and a positive impact on the labor market. However, I expected different results from the Sri Lankan taxi industry due to several reasons.

First, the taxi industry in Sri Lanka shows some similar characteristics to a perfectly competitive market. Anyone over 18 with a driver's license can enter this market with a small investment. Finance companies are looking to help them. The finance company's premium can be paid from the monthly income earned using the three-wheeler or car in the taxi service. Ultimately, he will own the vehicle in a few years. All taxi service providers contribute insignificantly to the market, and their services do not change the supply curve. Also, they are price takers, and they cannot significantly influence the market. Furthermore, their services do

not vary substantially, and taxi drivers can freely enter and exit the market. Buyers and sellers cannot incur costs in making an exchange of the service. In this situation, taxi drivers may be unable to compete with the RSS service. The alternative for them may be to join the RSS as well. Previous studies have focused on taxi drivers working under traditional and RSS services in the same area. However, due to the competitive nature of the taxi industry in Sri Lanka, almost every taxi driver joined it after the introduction of RSS. Therefore, we can expect different results.

Second, before introducing the RSS to the country, taxi/trishaw drivers needed to park their vehicles beside the roads and sit for a long time until customers came to ask for the service. In Sri Lanka, most of the taxi/trishaw drivers are young people. They wasted their time ineffectively in queues to find customers. In that way, taxi drivers' working hours were largely wasted in queues to find passengers. The RSS provides the facility to identify the place of demand and the person who needs the service online instead of waiting to meet a passenger. With the introduction of the RSS, almost every taxi driver had to adapt to the RSS service soon to face the market's competitive nature. Most of them use both Uber and PickMe applications to find passengers instead of wasting their time. That may have positive impacts on taxi drivers.

Finally, there are no taxi regulations in Sri Lanka. Taxi drivers mostly charge their fees arbitrarily. Even for the same distance, some taxi drivers charge different fares depending on the situation. For example, taxi fares were higher during the day than at night, during rainy seasons compared to the dry season, and higher in the mountains than in the plains. Due to all these reasons, I expected different results from existing literature.

On the other hand, in addition to the full-time workers, many taxi drivers in Sri Lanka are engaged in taxi driving as their second occupation. The impact of RSS can vary among full-time and part-time workers. Therefore, this study is expected to contribute to the literature to fill the gap of different impacts generated by RSS on full-time and part-time taxi drivers. In

addition, this study addresses taxi drivers' work desires and their expectation to work longer hours if the opportunity is raised. It will be a new addition to the existing research studies. Another significant contribution from this paper to the literature is identifying the future demand for taxi driving jobs generated by the total workforce.

The present study also will be beneficial to Sri Lanka policymakers. Although the taxi industry can significantly impact the economy, proper and in-depth attention has not been paid to investigating this sector in Sri Lanka. At least, no proper survey has been conducted on the industry by any reputed government or other agency. Thus, there is no clear picture of the impact of the RSS on the taxi industry in Sri Lanka. Considering all those information gaps and problems the industry is facing, it incited my curiosity and imagination to study all the aspects of the industry to have a clear picture of the taxi industry in Sri Lanka.

Considering all those things, I wanted to answer the following research questions. 'Does RSS intervention affect the economic well-being of taxi drivers in Sri Lanka?', 'If so what extent?', 'Does the intervention of the RSS affect full-time and part-time taxi drivers differently?', 'Has the desire of the people to become a taxi driver increased after the intervention of the RSS service?'.

3.1.1 Background

The taxi industry is the largest transportation industry in Sri Lanka in terms of the number of people engaged. It provides a great service to the upper, middle, and lower-income groups. As a paratransit mode, it mainly offers a low-cost feeder connection between main bus routes/railway stations and door-steps/other destinations of the commuters.

The public bus transportation system in the Country does not adequately meet the mobility demand of the general public. Therefore, the taxi industry has emerged to fulfill that mobility

gap of the general public. Although the taxi industry generates direct and indirect employment opportunities for people, this study focuses only on those who work directly as taxi drivers.

3.1.2 Background of the Taxi/Trishaw Industry

Auto trishaws mainly dominate taxi services in Sri Lanka. It is a short-distance mode of passenger transport in Sri Lanka and developing countries such as India, the Philippines, Thailand, and Bangladesh. The Auto trishaw evolved from the rickshaw. In April 1914, the first time, trishaws were introduced to Singapore as pedal rickshaws that were consisted of chairs bolted with tricycle frames. The first batch consisted of 15 trishaws. The initial batch of rickshaws was crudely constructed. Therefore, they were unable to survive for a long period of time on the streets of Singapore. The British colonial authorities rejected an American company's request to import 500 trishaws later that year due to considerations for road safety (Lim J., 1995, pp. 6–7). Three-wheelers first entered Sri Lanka in the early 1980s (Kumarage, Bandara, & Munasinghe, 2010). It means the trishaws entered the country soon after the Neoliberal economic policy was introduced in 1977. At that time, it became trendy among low and middle-income short-distance commuters due to the availability of three-wheelers at lower prices than taxis operating in the country's major cities. As a result, the industry started to grow very fast, surpassing all the country's other informal sector economic activities. Many people began to embrace the trishaw industry as their livelihoods, considering its profitability due to its inherent characteristics, such as high fuel efficiency, low price, and higher adaptability to the Sri Lankan roads, even on narrow rocky streets, etc.

The taxi industry in Sri Lanka was growing so fast after1980s. What can be the reasons for that? One of the main reasons can be the neo-liberal policy introduced to Sri Lanka In 1977, which expanded the circle of opportunities in the manufacturing and services sectors of the economy (Ronald J. H. , 1987; Kanishka G., 2020; Abdul A. M. N. 2012; Mick Moore, 1990). As a result, economic zones were constructed for new industries, which led to a high level of

labor migration to Colombo and other major cities (Korale R.B.M., 1987). The growing urban population put severe pressure on the existing transport industry. Public transportation could not meet the demand that increased quickly, which allowed the taxi industry to grow faster.

Understanding those trends in the mobility market, the taxi operators introduced low-cost auto trishaws imported from India, deriving a new market for the trishaw industry. Subsequently, the three-wheeler industry adversely affected the taxi service and the bullock cart passenger industry (Thirikkal). As a result, the traditional taxi service and the manual Thirikkal Service disappeared from the market due to their un-competitiveness against the trishaw industry. This created a 'perfectly competitive market environment' for the taxi driver industry.

In addition to the typical features of taxis, such as fuel efficiency, low maintenance costs, low spare parts costs, and low start-up capital, it also makes everyday life easier. The convenience here means that taxi drivers can do their job without interrupting their daily domestic routine. While working as a taxi driver, one can also do other household chores such as taking kids to school, shopping, going to the market, etc. Also, compared to jobs in other sectors such as agriculture or construction, working as a taxi driver does not require a lot of physical exertion.

3.1.3. Background of the Ridesharing Services in Sri Lanka

There have been two major RSS feeds in Sri Lanka since 2015, namely PickMe and Uber. PickMe is a local start-up company introduced to Sri Lanka in June 2015. Uber is one of the most prominent RSS globally, which was introduced to Sri Lanka in October 2015. Both services offer the same services using slightly different business models. Uber Technologies is an American Multinational ride-hailing company that provides peer-to-peer ridesharing. Garret Camp and Travis Kalanick built its startup in 2009. As it attracts customers and caters to the needs of travelers, Uber has expanded in many parts of the world. Uber is based in San

Francisco and currently operates in more than 785 major cities in over 60 countries. Drivers of Uber service are mostly independent.

Figure 3.1: Taxi drivers work in the Colombo District and other provinces, 2008-2017

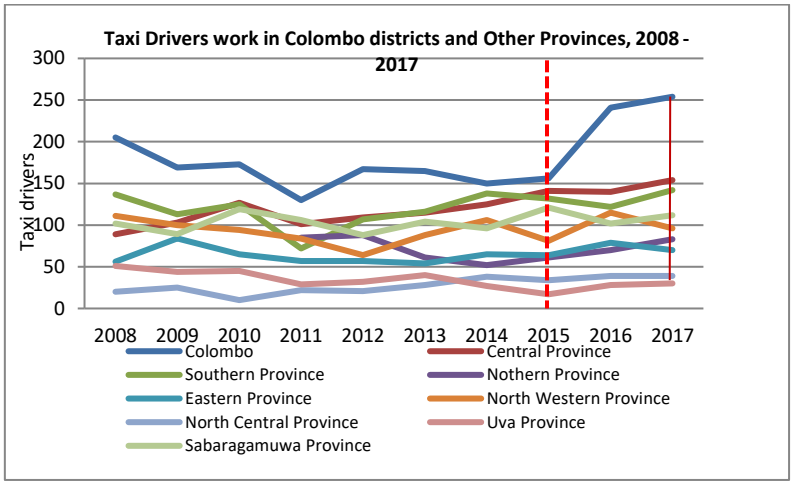
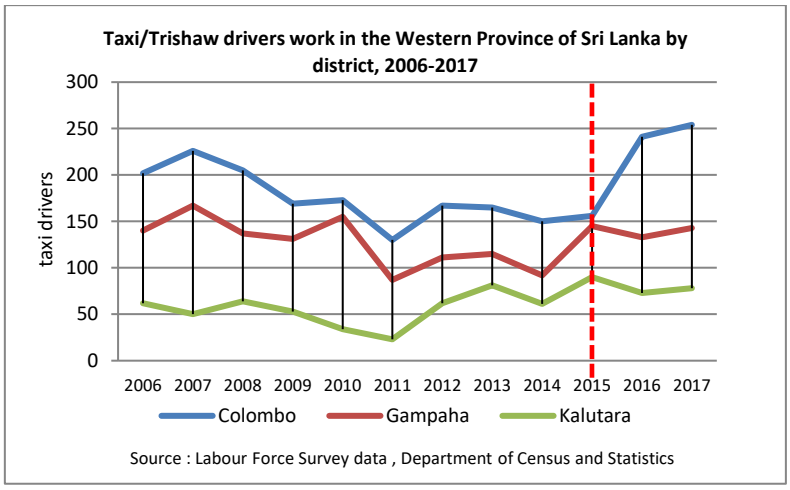


Figure 3.2: Taxi drivers work in the Western province by district, 2008- 2017



They use their car to meet customer needs through the Uber service or rent or lease their vehicle to Uber with the driver. Both companies gained customer attraction in a very short period. The PickMe company states that they received one million ride requests within six months (June 2015-January 2016) after introducing the PickMe service to the Colombo District of Sri Lanka. The number of ride requests of that company increased up to 10 million by September 2016.

On the other hand, the Uber service providers in Sri Lanka states that they completed 53 million trips and provided livelihood opportunities for 110,000 drivers by January 2021. Those numbers show us how fast this service spread to the community.

Labor Force Surveys are conducted annually by the Department of Census and Statistics to collect data on the labor market. The survey uses the Two-Stage Stratified Random Sampling method and represents all the country and its economic activities. Figures 3.1 and 3.2 were prepared using annual LFS data from the year 2006 to 2017. Figure 3.1 compares the number of taxi drivers working in the Colombo district from 2008 to 2017 with other provinces. It shows that after 2015, the number of taxi drivers employed in the Colombo District has increased significantly compared to other provinces. Figure 3.2 further illustrates the increase in the number of taxi drivers in the Colombo District compared to the other two districts in the same province. Since the introduction of RSS in 2015, there has been a significant increase in taxi drivers in the Colombo District compared to the other two districts.

3.2. Data & Methodology

Sri Lanka Labor Force Survey (LFS) data, from 2005 to 2017 and Sri Lanka Household Income & Expenditure Survey (HIES) data for years 2002, 2006, 2009, 2012, and 2016 collected by the Department of Census and Statistics (DCS) were used to perform the study. To find the causal effect of RSS on the trishaw industry in Sri Lanka, I employed the difference-in-differences (DID) model since it allows comparing the changes of outcome variables of the treatment group before and after the policy.

3.2.1 Data Description

As mentioned in chapter one, at the initial stage, both PickMe and Uber were introduced to the Colombo district in 2015. Hence, the treatment group of this study is taxi/trishaw drivers living within the area of Colombo district, who were directly affected by RSS. Taxi/trishaw drivers living in the rest of all other 23 districts are considered as the control group. Years from 2006

to 2014 are considered the before-intervention period, whereas years from 2016 to 2017 are considered the after-intervention period. One of the main assumptions of the DID is that there will be no other significant effect on the outcome variables during the period under consideration. To the best of my knowledge, there have been no such interventions on the 'well-being' of taxi drivers, other than the RSS in this area during the considered period.

Variable description: To measure the economic performance of taxi drivers, their monthly income, expenses for food and non-food items, and indebtedness was used. Cramer and Krueger (2016) used operating miles of taxi drivers as average running miles of the taxi per day with and without passengers in the cab for their study. In addition to the economic performance, I used the number of hours they worked last month to identify the work effectiveness. The study also focused on their work willingness if allowed to work longer than usual. This study also focused on 'whether people would be willing to work the extra hours also as a taxi driver' or 'whether they would prefer to use that time for another job' if they had the opportunity to work longer hours.

To investigate the impact of RSS on the labor market, the study has used an individual's willingness to join the taxi industry as a taxi driver. The LFS survey collects data from whole individuals, whose age is 15 and above, on whether they were trying to find a job and which occupation they expect to do during the reference period of the survey. I used that data to find the willingness of people to join the labor market as taxi drivers. The LFS also collects data from respondents on whether they are ready to accept the job if offered it within the next two weeks. I used it to investigate the work readiness of the labor force to join the taxi industry as a taxi driver. There are two types of taxi drivers working in Sri Lanka. Some of them work as full-time taxi drivers, and their main occupation is taxi driving. Some people do other occupations and work as part-time taxi drivers. Their secondary occupation is taxi driving. I investigated them separately since the ride-sharing applications can be affected differently in

these two categories. Other demographic characteristics such as age, sex, ethnicity, education levels, and religion also were considered.

Table 3.0: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
sector (urban/rural)	13,939	0.234	0.423	0	1
Sex	13,939	0.987	0.115	0	1
Age	13,939	39.028	11.818	15	91
Race	13,939	0.756	0.429	0	1
Religion	13,939	0.605	0.489	0	1
Marital Status	13,939	0.793	0.405	0	1
Literacy Sinhala	13,939	0.820	0.384	0	1
Literacy Tamil	13,939	0.221	0.415	0	1
Literacy English	13,939	0.142	0.349	0	1
For the main occupation					
Total Monthly income (Rs.)	13,939	17,023.660	7,453.631	1,000	80,000
Main_economic activity	13,939	8,322.438	0.496	8,322	8,323
Usual_working hours	13,939	55.178	15.949	0	90
Actual working hours	13,939	25.717	28.296	0	70
Like_to work longer period	13,939	0.139	0.345	0	1
Like to work longer (in the same occupation)	13,939	0.515	0.501	0	1
For Second occupation					
Total Monthly Income (Rs.)	1,108	21,656.570	28,872.520	500	53,000
Type of secondary activity	1,108	8,322.498	0.500	8,322	8,323
Actual working hours	1,108	7.249	3.696	1	19
Usual_working hours	1,108	13.985	9.770	1	25
Like_to work longer period	1,108	0.517	0.500	0	1
Like to work longer (in same occupation)	1,108	0.157	0.364	0	1

Note: *I used two occupation codes: 8322 and 8323, to filter individuals who engaged in the taxi/trishaw industry by using two variables, main economic activity and type of secondary occupation that was collected during the survey. The occupations were classified under Sri Lanka Standard Classification of Occupation (SLSCO-2008) prepared based on the International Standard Classification of Occupations (ISCO), one of the main international classifications for which ILO is responsible. S.D. stands for Standard Deviation.*

3.3 Empirical Framework

This study estimates the effects of RSS on the 'economic well-being' of taxi drivers using the difference-in-differences strategy (DID). It also compares the impacts of RSS on full-time and part-time workers separately.

Two occupation codes that were used to filter taxi drivers are 8322 and 8323. The occupations were classified under Sri Lanka Standard Classification of Occupation (SLSCO-2008), prepared based on the International Standard Classification of Occupations (ISCO), one of the main international classifications prepared to identify occupations. If a person's main occupation is a taxi driver, they are considered a full-time taxi driver. A person employed in another job is regarded as a part-time taxi driver if he works as a taxi driver in addition to his main job to earn an extra income.

I have used the following equation to estimate the impact of RSS on the economic well-being of taxi drivers:

$$Y_{ijt} = \beta_0 + \beta_1 Post_t + \beta_2 Treatment_{ij} + \beta_3 (Post_t * Treatment_{ij}) + X'_{ijt}\alpha + \delta_t + \theta_j + \mathcal{E}_{ijt}, \text{---(1)}$$

Where; 'i' for individuals; 'j' for district, and 't' for time, 'Y' represents the outcome variables, '*Post*' is a binary variable, assigned to *0* for the pre-intervention period (before 2015), and 1 for the year 2016 which is the post-intervention period. '*Treatment*' equals *1* if a taxi/trishaw driver living within the area of Colombo district, who directly affected by the RSS, and '*0*' if he/she was living outside of Colombo district. X'_{ijt} is a set of other control variables such as education, income levels, age, gender, etc., β0, β1, β2, β3, α, are parameters supposed to be estimated, ε_{ijt} is the error term. δ_t indicates year fixed effect, and θ_j indicates district fixed effect. The output variables represented by Y_{ijt} are; monthly income, expenditure on food

and non-food items, indebtedness, actual working hours, willingness to work long period, willingness to work extra hours as a taxi driver, willingness to work the extra hours in other work (occupation), of individuals who work as full-time/part-time as a taxi driver. Monthly income, working hours, expenses for food and non-food items are used in natural log forms. Taxi drivers' indebtedness was identified using the two variables loans and pawning. Both loans and pawning are binary variables. If a taxi driver has borrowed money through a loan during the period under consideration, the loan variable is considered as 1, otherwise, it is treated as 0. If a taxi driver received money from a pawning during the period under consideration, the pawning variable is considered as 1, otherwise, it is treated as 0. The outcome variable of willingness to work long period is a binary variable, which equals 1 if an individual is willing to work longer hours than usual and 0 otherwise. The variable of willingness to work extra hours as a taxi driver is also a binary variable. If a taxi driver is willing to spend his or her extra hours also as a taxi driver, the variable of willingness to work extra hours in the taxi industry equals 1, and 0 otherwise.

3.4 Empirical Results

This section discusses empirical findings of the impact of RSS on the taxi industry. The results of the study are composed of three subsections. The first sub-section discusses the economic impact of RSS (monthly income, expenditures, and indebtedness). The second section includes working hours and work willingness of taxi drivers. The third subsection focuses on the effects of RSS on demand for taxi driver jobs in the future. The last part of this section verifies the validity of the results.

3.4.1 Main Results

3.4.1.1. Impacts of RSS on Income of Taxi drivers

One of the main components in household well-being is income. Therefore, the first attempt is to investigate the impact of RSS on the income of taxi drivers**.** Before starting to discuss the income impacts, it is better to identify the nature of the job. Because the working behavior of the taxi industry is quite different from other industries. As explained earlier, there are two types of taxi drivers available (full-time and part-time). After the main job, part-time workers work as taxi drivers, at night, on weekends, and other holidays. The ride-sharing service can affect them in different ways. Therefore, I attempted to examine whether full-time and part-time workers were affected differently by the RSS. Table 3.1 shows the impacts of RSS on the monthly income of Taxi drivers. Columns (1) and (2) indicate that after introducing the RSS, the monthly income of full-time and part-time taxi drivers in the Colombo district is 8.1 and 11.3 percent higher than their counterparts who live in the non-treated districts. The results are consistent with previous findings (Judd Cramer and Alan B. Krueger, (2016); Abel Brodeur and Kerry Nield, (2016); Keith Chen and Michael Sheldon (2015)). In addition to previous findings, this study shows the different impacts of income on the type of taxi driver. Although the monthly income of full-time and part-time taxi drivers has increased the rate of increase in the income of part-time taxi drivers has a higher magnitude than that of full-time employees. It indicates that RSS is more beneficial for part-time taxi drivers in terms of income. The most important thing is that RSS does not reduce the income of full-time taxi drivers either. In other words, RSS has positively affected all taxi drivers in the treated district in terms of income earned, regardless of the type of taxi driver.

Table 3.1: Impact of RSS on the monthly income

Description	Dependent Variable: Log Monthly Income	
	Full-time taxi drivers	Part-time taxi drivers
	(1)	(2)
Treated District x Post	0.081**	0.113**
	(0.032)	(0.050)
Controls	YES	YES
Year Fixed effect	YES	YES
District Fixed Effect	YES	YES
Observations	13,929	1,107
R2	0.204	0.087

Notes: *The dependent Variable is Log Monthly Income in Sri Lankan Rupees. Column (1) represents full-time taxi drivers, while column (2) represents part-time taxi drivers in the taxi industry.*

Taxi drivers working in the Colombo district belong to the treatment group, while taxi drivers in the other 23 districts belong to the control group. The Before period is from 2006 to 2015 and the Post period is 2016 and 2017.

*Both regressions included household controls, year-fixed effects, and district-fixed effects. (LFS data was used). Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

3.4.1.2 Impacts of RSS on Expenditure of Taxi drivers

Expenditure also reflects the household's well-being. Therefore, this section examines the expenditure of people who work as taxi drivers as their main livelihood. Engel's Law, an economic theory introduced by a German economist and statistician in 1857, describes the relationship between household income and expenditures on goods or services. It states that as the income of a household increases, the proportion of expenditure on food decreases. However, it further showed that the absolute expenditures of the household on are still increasing. We already found that, after the intervention of the RSS, the income of taxi drivers

in the Colombo District has increased compared to the control group. According to Engel's Law, the expenses of taxi drivers in the Colombo district should also be higher than their counterparts. The costs incurred by taxi drivers in purchasing food and non - food items were used to test the compliance of the results with Engel's law. I used equation 1 to obtain estimates. Different types of food and non-food expenditure were tested for full-time and part-time taxi drivers separately. Results are presented in 3.2 and 3.3. Table 3.2 shows the consumption of food expenditure of households who receive income by working as taxi drivers. Column (1) shows the total food expenditure, and columns (2) & (3) of the same table show two categories of food expenditure, such as essential foods and non-essential foods. Results in column (1) indicate that the total household expenditure of the treatment group is 12.2 percent

Table 3.2: Impact of RSS on Food Expenditure

	Expenditure on Food		
	(1)	(2)	(3)
	Total	Essential foods	Non-Essential
Treated District x post	0.122***	0.124***	0.106**
	(0.008)	(0.039)	(0.053)
Controls	YES	YES	YES
District Fixed Effect	YES	YES	YES
Observations	3948	3948	3948
R2	0.289	0.17	0.196

***Notes**: Dependent Variables are log household food-expenditure by different categories. Column (1) shows the natural log of household expenditure, and columns (2) & (3) represent essential foods and non-essential food.*

Taxi drivers working in the Colombo district belong to the treatment group, while taxi drivers in the other 23 districts belong to the control group. The Before-period is 2006, and the Post period is 2016.

*Regressions included household controls and district-fixed effects. (HIES data was used). Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

higher than the non-treated district after the RSS application was introduced, relative to the before period. The expenditure on food items for essential and non-essential foods of taxi drivers who were exposed to the RSS available areas are 12.4 and 10.6 percent higher than the non-treated districts, in the after-period, relative to the before-period, respectively. Once the income of taxi drivers in Colombo District increased after RSS intervention, their expenditure on non-food items also may be higher. Therefore, the study also investigated expenditure on non-food items. Accordingly, Table 3.3 shows that the results for non-food items of taxi drivers exposed to the war are higher than the non-treatment group after the intervention of the RSS, relative to the before period.

Table 3.3.: Impact of RSS on Non-Food Expenditure

Description	Non-Food Expenditure		
	(1)	(2)	(3)
	Total	Essential non-food items	Non- essential non-food items
Treated District x Post	0.056** (0.023)	0.074** (0.035)	0.037** (0.014)
Controls	YES	YES	YES
Year Fixed effect	YES	YES	YES
District Fixed Effect	YES	YES	YES
Observations	3948	3948	3948
R2	0.108	0.106	0.073

Notes: Dependent Variables are log household non-food expenditure by different categories. Column (1) shows the natural log of household non-food expenditure, and columns (2) & (3) represent different non-food categories such as, essential non-food items and non-essential non-food items. Taxi drivers working in the Colombo district belong to the treatment group, while taxi drivers in the other 23 districts belong to the control group. The Before-period is 2006, and the Post period is 2016.

*Regressions included household controls and district-fixed effects. (HIES data was used). Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

The total non-food expenditure of taxi drivers in the Colombo district is 5.6 percent higher than the non-treated districts after implementing the RSS, relative to the before intervention. Essential non-food items and non-essential non-food items are 7.4 percent and 3.7 percent higher than the untreated districts after the RSS was implemented. Taxi drivers, on average, belong to low-income households. In fact, low-income households spend less on non-food items and more on food items. This is what the results of this section exactly show. The findings also support the results of previous literature (Aimable N et al. 2020; Patricia M. A. and Kristin F. B., 2016; Obisesan O.O. 2016).

3.4.1.3. Impacts of RSS on indebtedness of Taxi drivers

According to the OECD definition, indebtedness also plays a vital role in determining domestic well-being. On the one hand, it is important to consider whether other factors have contributed to this increased income and spending potential discussed in the previous section. For example, 'borrowing' or 'pawning' may sometimes reflect increasing people's income and expenses. Moreover, as incomes increase, pawning can be expected to decline. Therefore, the paper investigates the impact of RSS on the indebtedness of taxi drivers. I applied equation 1 to derive the results that are given in Table 3.4. Columns (1) and (2) show the impact of RSS on 'loans' and 'pawning' of households of taxi drivers, respectively. Column (1) shows that borrowing of the treatment group is 7.1 percentage points lower than their counterparts after the RSS intervened in the taxi industry, relative to the before intervention. The pawning of the treatment group is 6.2 percentage points lower than the control group after RSS was implemented. The results provide evidence that households whose main income from taxi driving increased their income and expenditure relative to their counterparts did not increase due to their borrowings

or pawning. It is common for middle- and low-income households to decline borrowings and pawning as their incomes rise. However, the rise in business loans is a good sign for the economy.

Table 3.4: Impact of RSS on Loan and Pawning of households

	All sample	
	(1)	(2)
	Loans	Pawning
Treated District x Post	-0.071*** (0.021)	-0.062*** (0.017)
Controls	YES	YES
Year Fixed effect	YES	YES
District Fixed Effect	YES	YES
Observations	3948	3948
R2	0.634	0.078

***Notes**: The two dependent Variables (loans and pawning) reported in the table are binary. Loans equal '1' if the taxi driver borrowed a loan during the considered period; otherwise, it is '0'. Pawning is also a binary variable considered '1' if the household member earned money from a pawning during the period under consideration, and '0' otherwise. Taxi drivers working in the Colombo district belong to the treatment group, while taxi drivers in the other 23 districts belong to the control group. The Before period is from 2006 to 2015 and the subsequent period is 2016 and 2017.*

*Both regressions included household controls, year-fixed effects, and district-fixed effects. (LFS data was used). Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

But in a country like Sri Lanka, getting a business loan from a bank is not an easy task for a taxi driver since they cannot prove a steady income source. Therefore, they often get loans from informal money lenders. Because of the high-interest rates they charge, low-income

earners borrow money from money lenders only if they have no other choice. It would be important if I could check the savings of taxi drivers in the formal bank account. Unfortunately, the Labor Force survey does not collect bank account information, or at least no question in the questionnaire to check whether they have a formal bank account. The second option is pawning. Most of the daily income earners in Sri Lanka get money through these two methods. But both methods are very disadvantageous to the borrower as they charge high-interest rates. Therefore, daily earners do not try to get a loan except when they are in a very difficult financial situation. Therefore, the daily income earners are more likely to reduce borrowings and pawning as their income increases. Therefore, this table, on the other hand, also supports the previous findings on income.

3.4.1.4. Impacts of RSS on working hours of Taxi drivers

One would think that the working hours would also increase in parallel with the increase in income for both full-time and part-time workers. To test it, I obtained table 3.5, which shows the Impacts of RSS on the working hours of Taxi drivers. The impact of the RSS on the working hours of full-time and part-time taxi drivers takes a different form. The effect of RSS on working hours is negative for full-time taxi drivers and positive for part-time taxi drivers. For example, the working hours of full-time taxi drivers working at the Colombo district are approximately 6 percent lower, while the working hours of part-time taxi drivers are 5.4 percent higher compared to their counterparts. One possible reason for that is that part of the ride-demand filled by full-time taxi drivers shift to part-time drivers after RSS intervention. Another possible reason for that is before the introduction of RSS, there were many trust-based clients around the full-time taxi drivers. It was common in Sri Lanka for clients to continue to seek the services of their regular service provider. Part-time taxi drivers found it difficult to contact trust-based clients because they could not provide services to their clients whenever they

needed the service since they had to wait until they did the main job. That situation was a disadvantage for part-time drivers.

Table 3.5: Impact of RSS on working hours of taxi drivers

Description	Dependent variable: Natural log of working hours	
	(1)	(2)
	Full-time workers	Part-time workers
Treated District x Post	-0.059*** (0.006)	0.054*** (0.017)
Controls	YES	YES
Year Fixed effect	YES	YES
District Fixed Effect	YES	YES
Observations	13,929	1108
R2	0.949	0.310

Notes1*: The dependent variable is the actual working hours of taxi drivers. Columns (1) & (2) represent the impacts of RSS on working hours of full-time and part-time workers, respectively. Taxi drivers working in the Colombo district belong to the treatment group, while taxi drivers in the other 23 districts belong to the control group. The Before period is from 2006 to 2015, and the post-period is from 2016 and 2017.*

*Both regressions included household controls, year-fixed effects, and district-fixed effects. (LFS data was used). Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

However, with the introduction of RSS, the service providing companies track the routes of taxies by using GPS technology and inform customers regarding the exact taxi fees. Also, since all taxi drivers are registered with the relevant company, the chances of fraudulent activities are minimal. As a result, there is no need to get the services of a regular taxi driver as before, as there are no reliability issues. This situation may have led to an increase in the working hours of part-time taxi drivers. Another possible reason may be that part-time taxi drivers can better manage the time left over for their part-time jobs.

3.4.1.5. Impacts of RSS on willingness to working longer hours

This study also investigated the willingness to work longer hours and the desire to work those additional hours in the same occupation as taxi drivers. The study used two questions in the questionnaire in this regard. The first question is, “would you like to work if you are allowed to work for a longer period (than you usually work)?”. The second question is, “if so, would you like to work in the present occupation or another occupation?”. Table 3.6, which shows the willingness to work, was obtained by using the answers given by respondents to those two questions. Accordingly, Table 3.6 compares the desire to work for full-time and part-time taxi drivers. Columns (1) & (3) refer to the willingness to work longer than regular working hours. Columns (2) & (4) refer to whether respondents like spending extra hours in their current job. The 'preference to work longer than the usual' of full-time taxi drivers in the Colombo district is 12 percentage points higher than the non-treated districts after introducing the RSS application to the taxi industry. Of them, working those additional hours in the current occupation of the treated group is 3.7 percentage points higher than the full-time workers in the non-treated group in the after-period, relative to the before the intervention of RSS. Work preference of part-time taxi drivers in the Colombo district is 17.4 percentage points higher than the non-treated districts after introducing the RSS application, relative to the before intervened RSS. Of them, the desire to work those additional hours on the same occupation of the treated group is 12.1 percentage points higher than their counterparts. The results can be expected. Because the study already shows that the income and expenditure of both taxi drivers increased while borrowings and pawning decreased. From the individuals' side, the situation is better for them. On the other hand, full-time workers earn more now by working fewer hours than before. Therefore, full-time workers still can increase their working hours up to the maximum level. Since part-time workers' income increase at a higher rate than full-time workers, they are better off than before, which may encourage them to work more.

Table 3.6 Impact of RSS on Willingness to work longer by taxi drivers

	Full-time workers		Part-time workers	
	(1)	(2)	(3)	(4)
	Willingness to work longer period	Willingness to continue the same occupation	Willingness to work longer period	Willingness to continue the same occupation
Treated District x Post	0.120*** (0.017)	0.037*** (0.006)	0.174*** (0.027)	0.121*** (0.024)
Controls	YES	YES	YES	YES
Year Fixed effect	YES	YES	YES	YES
District Fixed Effect	YES	YES	YES	YES
Observations	13,929	13,929	1108	1108
R2	0.015	0.008	0.022	0.048

***Notes**: Dependent Variables are dummy variables that represent Willingness to work long periods and Willingness to continue the same occupation as taxi drivers. Column (1) & (2) represent full-time workers and columns (3) & (4) represent part-time workers. Taxi drivers working in the Colombo district belong to the treatment group, while taxi drivers in the other 23 districts belong to the control group. The Before period is from 2006 to 2015 and the subsequent period is 2016 and 2017.*

Willingness to work a long period is a binary variable that equals 1 if a taxi driver is willing to work longer and zero otherwise. The variable of Willingness to continue the same occupation is also a binary variable. It equals '1' if the taxi driver is willing to work additional hours as a taxi driver and '0' otherwise.

*Regressions included household controls, year-fixed effects, and district-fixed effects. (LFS data was used). Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

3.4.1.6. Impact of RSS on Demand for taxi driver job

As explained earlier, full-time taxi drivers spend fewer working hours to earn more income than before RSS intervention. If so, the demand for taxi driving jobs of the workforce can also be expected to increase.

Table 3.7: Impact of RSS on Willingness to join as a taxi driver and work readiness (Includes all who are seeking a job-above 15 years old)

	(1)	(2)
	Willingness to join the taxi industry as a taxi driver	Readiness to accept a job as a taxi driver
Treated District x Post	0.024*** (0.003)	0.046*** (0.012)
Controls	YES	YES
Year Fixed effect	YES	YES
District Fixed Effect	YES	YES
Observations	56,923	56,923
R2	0.031	0.0211

***Notes**: Dependent variables are dummy variables representing Willingness to join the taxi industry as a taxi driver and their work readiness.*

Taxi drivers working in the Colombo district belong to the treatment group, while taxi drivers in the other 23 districts belong to the control group. The Before period is from 2006 to 2015 and the subsequent period is 2016 and 2017.

*Both regressions included household controls, year-fixed effects, and district-fixed effects. (LFS data was used). Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

To investigate that, I used two survey questions from all individuals above age 15 who were selected to the labor force survey. The first survey question is 'Describe the nature of the occupation/ economic activity/ self-employment that you like to be engaged in'. Their responses were coded under the Sri Lanka Standard Classification of Occupation (SLSCO-2008). Two occupation codes: 8322 and 8323, were used to filter individuals engaged in the taxi/trishaw industry. The second question is, 'Are you ready to accept the job if offered it within the next two weeks?'. Using those two questions, I could filter respondents who desire

to join the taxi industry and whether they are ready to accept the job if it offers within two weeks. Table 3.7 shows the results. Column (1) of Table 3.7 shows the individuals' expectation of being a taxi driver, and column (2) shows their work readiness. The willingness to join as a taxi driver of job seekers (individuals above 15 years old) in the treated district is 2.4 percentage points higher than their counterparts after RSS intervened in the taxi industry in Sri Lanka. Among them, the work readiness of the treated group is 4.6 percentage points higher than their counterparts. The results would be beneficial for policymakers. One reason is that developing countries need more labor on the production side than services such as taxi driving since they need to encourage exports and other productions. As taxi services are consumed by the time they produce, such services cannot be exported. More young labor attraction to the taxi service may cause labor shortage in other production sectors. Therefore, policymakers should make decisions carefully whether they encourage or discourage young labors to the taxi industry.

3.4.2. Falsification test

A falsification test was performed to make sure the results were valid. The main objective of performing this test is to identify whether the effects of RSS on the income, working hours and willingness to work of taxi drivers reflect different trends between treated and control at the baseline. As explained earlier, RSS was introduced to the taxi industry in Sri Lanka in 2015. Therefore, I conducted a falsification test by introducing RSS intervention as 2014 instead of 2015. I expected that this test would yield results that are not statistically significant. Suppose there is a difference between treated and untreated groups before the RSS intervention. In that case, the pseudo test results should capture the difference and provide statistically significant coefficients for the interaction terms. However, as expected, the test results reported in Tables 3.8, 3.9, and 3.10 show statistically insignificant results for the interaction terms. It indicates no different trends in the income, working hours, and willingness to work of taxi drivers before intervention the RSS into the taxi industry.

Table 3.8: Falsification test of the monthly income of taxi drivers

Dependent Variable: Log Monthly Income		
	(1)	(2)
	Full-Time taxi drivers	Part-time taxi drivers
Treated District x Post	0.005 (0.005)	0.013 (0.042)
Controls	YES	YES
Year Fixed effect	YES	YES
District Fixed Effect	YES	YES
Observations	5,540	403
R2	0.089	0.116

***Notes**: The Dependent Variable is Log Monthly Income. Column (1) represents taxi drivers who work full-time in the taxi industry. Column (2) represents taxi drivers who work part-time in the taxi industry as a taxi driver.*

Taxi drivers working in the Colombo district belong to the treatment group, while taxi drivers in the other 23 districts belong to the control group. The Before period is from 2005 to 2013, and the post-period is 2015-2017.

*Both regressions included 'household controls, year-fixed effects, and district-fixed effects (LFS data was used). Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

Table 3.9: Falsification test of working hours of taxi drivers

Description	Dependent variable: Natural log of working hours	
	(1)	(2)
	Full-time workers	Part-time workers
Treated District x Post	0.001 (0.006)	0.064 (0.038)
Controls	YES	YES
Year Fixed effect	YES	YES
District Fixed Effect	YES	YES
Observations	5,540	403
R2	0.055	0.148

***Notes**: The dependent variable is the actual working hours of taxi drivers. Columns (1) & (2) represent the impacts of RSS on the 'working hours' of full-time and part-time workers, respectively.*

*Taxi drivers working in the Colombo district belong to the treatment group, while taxi drivers in the other 23 districts belong to the control group. The Before period is from 2005 to 2013, and the post-period is 2015-2017. Both regressions included 'household controls, year-fixed effects, and district-fixed effects (LFS data was used). Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

Table 3.10: Falsification test of 'Willingness to work longer' of taxi drivers

	Full-time workers		Part-time workers	
	(1)	(2)	(3)	(4)
	Willingness to work longer period	Willingness to continue the same occupation	Willingness to work longer period	Willingness to continue the same occupation
Treated District x Post	0.023	0.007	0.126	-0.025
	(0.016)	(0.008)	(0.450)	(0.036)
Controls	YES	YES	YES	YES
Year Fixed effect	YES	YES	YES	YES
District Fixed Effect	YES	YES	YES	YES
Observations	5,540	5,540	403	403
R2	0.027	0.008	0.045	0.052

***Notes**: Dependent variables are dummy variables representing Willingness to work long and Willingness to continue the same occupation' as taxi drivers. Columns (1) & (2) represent full-time workers and Column (3) & (4) represent part-time workers.*

Taxi drivers working in the Colombo district belong to the treatment group, while taxi drivers in the other 23 districts belong to the control group. The Before period is from 2005 to 2013, and the post-period is 2015-2017.

*Both regressions included household controls, year-fixed effects, and district-fixed effects (LFS data was used). Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

3.4.3. Robustness Check

To verify the findings of this study, I checked the robustness by using a different sample. The Colombo District, which was the focus of this study, belongs to the Western province of Sri Lanka and is the capital of the country. Compared to other provinces, the Western province is a densely populated area with three economically advanced districts. The three districts are Colombo, Kalutara, and Gampaha. I restricted the sample to the western province and selected the Colombo district as the treatment group and Kalutara and Gampaha districts as the control group to check the robustness. The same equation applied to obtain the main results were used

in this section too. Results are reported in tables 3.11, 3.12, 3.13, 3.14, and 3.15. The signs and significant levels of the results obtained to test the robustness of this study are consistent with the basic estimates, verifying the results of the study.

Table 3.11 examines the robustness of the monthly income of taxi drivers using a small sample confined to the Western Province. Table 3.1 of the previous chapter has revealed the increase in the income of full-time and part-time taxi drivers after the RSS intervened in the taxi industry. The results have been further showing that the increase in the income of part-time taxi drivers is higher than the increase in the income of full-time taxi drivers. Table 3.11 also confirms those results presented previously in Table 3.1. Table 3.12 examines the validity of the impact of the RSS on the food expenditure of taxi drivers. Except for pulses and meat, the significant levels and magnitudes of the coefficients reported in table 3.2 are closely similar to table 3.12. It indicates that even with different samples, the findings of taxi drivers' food expenditures reported in the main results section are valid. Table 3.13 examined the validity of the findings presented in Table 3.3 regarding the expenditures incurred on non-food items. The signals, significant levels, and magnitude of the coefficients listed in Table 3.3, excluding transportation and recreational costs, are closely related to Table 3.13. It also confirms the main findings.

Table 3.11: Robustness check of the monthly income of taxi drivers (With respect to the small sample confined to the Western Province)

	Dependent Variable: Log Monthly Income	
	(1)	(2)
	Full-time workers	Part-time workers
Treated District x Post	0.017*	0.201**
	(0.009)	(0.086)
Controls	YES	YES
Year Fixed effect	YES	YES
District Fixed Effect	YES	YES
Observations	5299	328
R2	0.310	0.61

***Notes**: The Dependent variable is the log monthly income of taxi drivers. Column (1) represents the impact of full-time workers, and column (2) represents part-time workers.*

Regressions represent the western province where the treatment group is taxi drivers working in the Colombo District. The control group is taxi drivers working in Gampaha and Kalutara Districts who belong to the Western Province but are not RSS available. The Before period is from 2006 to 2015 and the subsequent period is 2016 and 2017.

*Both regressions included household controls, year-fixed effect, and district-fixed effects. (LFS data was used). Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

Table 3.12: Robustness check of RSS on Food Expenditure
(With respect to the small sample confined to the Western Province)

Description	Western Province		
	(1)	(2)	(3)
	Total	Essential food items	Non-essential food items
Treated District x Post	0.128*** (0.0199)	0.109*** (0.035)	0.091** (0.035)
Controls	*YES*	*YES*	*YES*
Year Fixed effect	*YES*	*YES*	*YES*
District Fixed Effect	*YES*	*YES*	*YES*
Observations	*1592*	*1592*	*1592*
R2	*0.285*	*0.18*	*0.140*

***Notes**: Dependent Variables are log household food-expenditure by different categories. Column (1) shows the natural log of household expenditure, and columns (2) & (3) represent different food categories such as essential food items and non-essential food items.*

The table represents the small sample where the treatment group is taxi drivers working in the Colombo District. The control group is taxi drivers working in Gampaha and Kalutara districts. The Before-period is 2006, and the Post period is 2016.

*Regressions included household controls and district-fixed effects. (HIES data was used). Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

Table 3.13: Robustness check of RSS on Non-Food Expenditure
(With respect to the small sample confined to the Western Province)

Description	Non-Food Expenditure		
	(1)	(2)	(3)
	Total	Essential non-food items	Non-essential non-food items
Treated District x Post	0.053**	0.201*	0.082*
	(0.020)	(0.051)	(0.025)
Controls	YES	YES	YES
Year Fixed effect	YES	YES	YES
District Fixed Effect	YES	YES	YES
Observations	1592	1592	1592
R2	0.084	0.118	0.042

***Notes**: Dependent Variables are log household non-food expenditure by different categories. Column (1) shows the natural log of household non-food expenditure, and columns (2) & (3) represent different non-food categories, such as essential non-food items and non-essential non-food items.*

The table represents the whole sample where the treatment group is taxi drivers working in the Colombo District, and the control group is taxi drivers working in all other 24 districts. The Before-period is 2006, and the Post period is 2016.

*Regressions included household controls and district-fixed effects. (HIES data was used). Coefficients with robust cluster errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

Next, I have examined the validity of key findings on loans and pawning by restricting the observations to the western province. Results reported in table 3.14 of the main finding section are closely similar to the results reported in table 3.4 in terms of signs and magnitudes. Accordingly, Table 3.4 further confirms the key findings.

Table 3.14: Robustness check: Impact of RSS on Loan and Pawning of households

	All sample	
	(1)	(2)
	Loans	Pawning
Treated District x Post	-0.049* (0.030)	-0.059** (0.026)
Controls	YES	YES
Year Fixed effect	YES	YES
District Fixed Effect	YES	YES
Observations	1585	1585
R2	0.0288	0.048

***Notes**: The two dependent Variables reported in the table are binary variables of loans and pawning. The loan is a binary variable. It equals '1' if the taxi driver borrowed a loan during the considered period; otherwise, '0' Pawning is also a binary variable equals 1 if the household member received money from a mortgage during the period, and '0' otherwise. Taxi drivers working in the Colombo district belong to the treatment group, while taxi drivers in Gampaha and Kalutara districts belong to the control group. The Before-period is 2006, and the Post period is 2016.*

*Regressions include household controls and district-fixed effects. (LFS data was used). Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

Table 3.15: Robustness check of working hours of taxi drivers
(With respect to the small sample confined to the Western Province)

Description	working hours	
	(3)	(4)
	Full-time workers	Part-time workers
Treated District x Post	-0.089***	0.099**
	(0.024)	(0.047)
Controls	YES	YES
Year Fixed effect	YES	YES
District Fixed Effect	YES	YES
Observations	5299	328
R2	0.45	0.399

***Notes**: The dependent variable is the working hours of taxi drivers who work full-time as taxi drivers in natural log.*

Regressions represent the western province where the treatment group is taxi drivers working in the Colombo District. The control group is taxi drivers working in Gampaha and Kalutara Districts who belong to the Western Province but are not RSS available. The Before period is from 2006 to 2015 and the subsequent period is 2016 and 2017.

*Both regressions included household controls, year-fixed effect, and district-fixed effects. (LFS data was used). Coefficients with cluster standard errors are reported in parenthesis. *p<0.10, **p<0.05, ***p<0.01.*

Table 3.15 shows the robustness of the working hours of taxi drivers. The effects of RSS on the working hours of taxi drivers have shown in Table 3.5 of the main findings section. According to Table 3.5, the working hours of full-time taxi drivers decreased, and the working hours of part-time taxi drivers increased in the treated group compared to the control group after the intervention of the RSS. The findings in Table 3.5 can be further corroborated by Table 3.15, taken from a small sample confined to the Western Province. The coefficients, signs, and significant levels and magnitudes are closely related in both tables 3.5 and 3.15,

which confirm the main findings of working hours. However, it would be important to see the effect of RSS on actual occupations. The RSS in Colombo may not affect the probability someone in the sample is in the taxi driving industry. When the sample of taxi drivers changes, this may affect other variables, as well. Therefore, it would be important to investigate the situation using different samples for full-time and part-time taxi drivers. However, with limitations of data availability and the sample size, I leave this for future research.

3.5 Conclusion and discussion

The paper investigates the impact of the intervention of RSS on the traditional taxi/trishaw industry in Sri Lanka. According to the study, the RSS increased the income of both full-time and part-time taxi drivers who belong to the treated areas. However, the increase in the income of part-time taxi drivers is higher than that of full-time taxi drivers. Meanwhile, the working hours of full-time taxi drivers in the treated district have decreased than their counterparts after RSS intervention. In contrast, the working hours of part-time taxi drivers in the treated district have increased. Moreover, the results show that both borrowings and pawning of taxi drivers exposed to the RSS available area have decreased relative to their counterparts after RSS intervention into the taxi industry. Therefore, it can conclude that the RSS had a positive impact on the 'economic well-being' of taxi drivers due to the increase in the income and expenditure and the decrease in loans and mortgages of the treatment group relative to the control group. However, RSS gives a higher positive impact on part-time taxi drivers than on full-time taxi drivers. On the other hand, both full-time and part-time taxi drivers are willing to work longer hours if they have an opportunity. Among them, the willingness to work for part-time taxi drivers is much higher than that of full-time taxi drivers.

The study also revealed that the labor force's demand for taxi driving jobs is likely to increase in the future. The desire to work as taxi drivers in the future of the individuals exposed to the RSS has 2.4 percentage points higher than their counterparts. In the future, these RSS services

will inevitably spread across the country. It will make structural changes in the workforce. Therefore, recognizing the impacts of RSS would help plan for the future labor policies of the country.

The demand for three-wheelers and other taxis is likely to increase in the future because the desire to work as a taxi driver has increased. Therefore, appropriate measures should be taken to control their price rise. On the other hand, a developing country like Sri Lanka wants to increase productivity by employing the country's young labor for productive purposes rather than as taxi drivers. If the government's policy is to reduce the employment of young people in the taxi industry, appropriate actions should be taken to discourage them.

Although the study yielded reliable results, it still has limitations. Taxi drivers who were registered with the RSS service offer their services efficiently for a relatively lower price. Since the taxi service in Sri Lanka has the features of a fully competitive market, the other drivers who did not register in the RSS cannot offer their service at a high price. It is hard for them to survive or compete with taxi drivers registered with the RSS service. So, the best option left for them is to register with the RSS since they do not need to pay unless they find a ride through the RSS. On the other hand, any customer wishing to avail the service can search the taxi fee online, which is relatively lower than taxies that have not registered to the RSS. Demand theory states that the higher the price of a service or product, the lower the demand when all else is equal. Therefore, I assumed that all taxies that are in the treatment group have registered in the RSS.

The study is limited to the supply side of the taxi industry. It would be great if it possible to address the demand side of the taxi industry after intervention of RSS. For example, Uber states that they have completed above 53 million trips and generated livelihood opportunities for above 110,000 taxi drivers since 2015. The Pickme company, on the other hand, states that one million Pickme ride requests as of 2016 January were increased up to 10 million ride requests

by September 2016 (within 9 months). Therefore, studying the demand side of the RSS would also be essential. Unfortunately, no proper survey or census data is available now to examine the demand side. Therefore, it opens for future research.

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