What Are the Causal Effects of the Average Wage Increase on Regional GDP, Specifically During the Covid-19 Crisis? Empirical Evidence from New Zealand.

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Abstract. This paper uses empirical evidence and the difference in difference estimation (DID) to examine the causal effect of the average wage on GDP before and after the Covid-19 crisis. The research is conducted by regions, including New Zealand as a whole, the Auckland region and the Wellington region separately. The results show before the pandemic, an increase in wage leads to a rise in GDP in all three areas. After the pandemic, although average wage and GDP still have a positive relationship in New Zealand, for Auckland and Wellington, this relationship is negative. This is likely due to the fact that Auckland and Wellington's tertiary industries based economy type is more affected by the Covid-19 crisis.

Keywords-Average Wage Increase; Covid-19 Crisis; New Zealand

1. INTRODUCTION

New Zealand enacted the world's first minimum wage regulation in 1894. It was conceived as a way to reduce inequality and poverty. After years of raising, the current minimum wage is 18.9 NZD (approximately 13.6 USD), the second-highest in the world. Meanwhile, the government announced from April 1st, 2021, the minimum wage will be increased to 20.0 NZD (approximately 14.4 USD). However, during the last two decades, New Zealand had developed the world's biggest increase in income inequality. The richest 1% of people control 38% of the nation's income [1]. Polling shows inequality has been rated as the biggest issue in the country by New Zealanders since 2014. Besides, New Zealand is a typical small and medium business-based economy; SMEs made up 99% of the country's firms [2]. However, the firms face significant negative impacts caused by covid-19, the increase of minimum wage is likely to increase the burden on firms.

Existing research on minimum wage mainly focuses on its consequences on labour level and unemployment rate. The majority of the research argued that a higher minimum wage would increase labour costs and decrease labour demand [3]. A large number of empirical research has backed it up. However, several studies since the 1990s do not find a significant negative relationship between unemployment and minimum wage, sometimes even positive [4]. It is even valid for youth who are considered less skilful and are more likely to earn minimum wage [5]. In both New Zealand and overseas, the research has not reached consistent results. Also, it is

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surprising that there is only minimal research on the impact of minimum wage on firms' profitability, especially under the pandemic circumstance.

This paper aims to identify the effects of the minimum wage on regional GDP. It also extends previous research on the impact of the Covid-19 crisis on the firms. The research outcome shows that, for New Zealand, the increase in average wage will increase GDP, regardless of before or after the Covid-19 crisis. However, for Auckland and Wellington, the increase in average wage will only play a positive contribution to GDP before the covid. After the Covid-19 crisis, a higher average wage leads to a lower GDP. This is highly likely due to the fact that Auckland faced multiple lockdowns. Also, both Auckland and Wellington are outward-oriented economies with high proportions of tertiary sector industries. Thus, Auckland and Wellington face more challenges than the rest of the country. This paper evaluates the link between minimum wage and GDP. The research result can then be used to inform relevant government policy and business decision-makers in New Zealand.

1.1 Literature Review

The study of minimum wage and inequality has a long history in both New Zealand and overseas. Before the 1990s, researchers generally believed that increasing the minimum wage causes a higher unemployment rate. Johnston conducted a survey in New Zealand, and he surprisingly found even the minimum wage in New Zealand was one of the highest in the world with high social fare ware, its society was not equal [6]. His research used money income as an indicator of inequality and analysed outcomes in a spatial pattern. However, at that time, New Zealand's population was not evenly distributed, and the cost of living varied, so some differences were expected. Meanwhile, most economists believed that the minimum wage increase would decrease the employment rate and increase businesses' burden, such as Brown and Coleman [7, 8]. In Coleman's research, 72% of the New Zealand economists agreed with the theory above, and the percentage was even higher in the US and Australia. However, the limitation here was that the theory assumed a perfectly competitive or monopoly economy, whereas maybe not practical in the real world.

After the 1990s, some research found that minimum wages do not hurt unemployment. For example, in Wellington's research, he identified that the minimum wage and unemployment do not have a negative relationship, even for youth who are considered less skilful and are more likely to earn minimum wage [9]. Addison and Blackburn (1999) have also shown the same result. The authors used the "reduced-form" approach, which linked the minimum wage and poverty rate for teenagers from 1983 to 1996.Recent research also evaluated the link between minimum wage from firms' profits perspective. In New Zealand, Pacheco's research (2007) showed that the rising minimum wage plays an insignificant role in its profit expectation. However, Pacheco indicated the employers' profitability by analysing important minimum wage news's impact on the firm's stock market value. Many other variables can affect the market value, so that the result can be biased. [4].

Before the 1990s, the majority of the study used the time-series approach. The advantage of the time series approach is that this approach can distinguish long-run and short-run effects. However, studies (e.g., Brown,1982) during this time typically have many assumptions, such as employers can accurately value the marginal product of labour, and the minimum wage act has full compliance over the country. Since the 1990s, more studies have used the cross-sectional

method, which describes the outcomes at each moment and allows more variables to be included in the research. The natural experiment is another popular method,(e.g. Johnston, 1975). It is done by comparing regional difference, such as city to city. However, it is difficult to identify the treatment or control group, so the experiment can not be fully controlled.

Event study is another helpful approach. This is done by analysing important minimum wage news on the firm's stock market value and used in Pacheco's research (2007) [4], and Bell and Machin's research (2018) [10]. However, the basic assumption here is that all the investors will view news of a minimum wage increase negatively, which may be biased. According to the investigation, given that covid-19 is a new crisis, there is no research on the potential effects of the minimum wage increase on the New Zealand firm's profits, specifically during the Covid-19 crisis.

2. DATA

This paper relies on the data provided by Statistics New Zealand and the reserve bank of New Zealand. This paper will use the weekly panel data of New Zealand as a whole and two regions, the Auckland region, and the Wellington region. The data type is panel data, and the data period is from January 2015 to December 2020. Every April 1st, the New Zealand government implements a minimum wage increase. In 2015, the minimum wage was 14.75 NZD, whereas from April 1st, the minimum wage in New Zealand is 20 NZD. The minimum wage is the same across the whole country. Additionally, the unit of observation is the region.

In this paper, GDP is used instead of firms' profits because firms' profits for each region are not public data, and there is no sound way of estimation. This paper uses yearly GDP data from 2015 to the first quarter of 2020. Due to the lack of data access, it is assumed that every year, the GDP is the same in each quarter and each week during this period. For 2020 quarter two, 2020 quarter three and 2020 quarter four, this paper uses quarterly GDP data for each region and assumes the GDP is the same for every week within the quarter. Another assumption is there are thirteen weeks each quarter. For the weekly average wage, it is assumed that the wage is the same for each week within the quarter.

3. METHOD

This paper adopts the difference in difference (DID) estimation approach to carry out a quasi-experiment. The difference in difference estimation is also called controlled before and after study. It uses longitudinal data from the treatment and control groups to estimate the causal effect. This approach estimates the impact of specific intervention by comparing the changes in outcomes over time before and after the intervention. The DID estimation is chosen in this paper because it can examine the causal effect by using observational data of both individual and group levels. Because DID focuses on the change rather than the absolute level, each region's GDP can start at different levels. This is important in this study because New Zealand's firm and population concentration are unevenly distributed. GDP in the Auckland region is beginning at a much higher level than in other regions. Therefore, comparing the change instead of the absolute GDP level is more statistical significant in this situation.

In order to examine the causal effect of wage on GDP, specifically during the covid-19 crisis, this paper divides the time into two periods. The first quarter in 2020 is chosen as the demarcation because New Zealand entered the first round of nationwide lockdown on 25th March 2020. Also, the minimum wage increase act was enacted on 1st April 2020. Thus, from 2015 to the first quarter of 2020 is the "before" Covid-19 crisis period, whereas the second, third and fourth quarters in 2020 are considered as the "after" Covid-19 crisis period.

To ensure the validity of the difference in difference model, it is assumed here that without the intervention of minimum wage increase, the effect of the Covid-19 lockdown is constant over time. In New Zealand, the Auckland region faced two rounds of lockdown in 2020, and the rest of the country faced one round. The assumption means, without the minimum wage increase in April, all the firms in all the regions, regardless of the industries and alert level, faces precisely the same effect caused by Covid-19.

3.1 Model

Based on the difference in difference model (DID), the result is expected to be specified as a fixed-effect linear regression model [11]. The regression model is parallel to Card and Krueger's studies in 1994.

$$GDP = \beta_0 + \beta_1 X_1 + \varepsilon \quad (1)$$

where X1 represents the average wage, and ε shows the error term.

4. RESULT

Firstly, this paper runs the regression for New Zealand as a whole; secondly, this paper considers two significant regions individually, the Auckland region and Wellington region, which are the largest and the second-largest economy within New Zealand. Also, their economies are more complex and outward-oriented. Auckland is known as New Zealand's financial centre with over one-third of the nation's population. Also, Wellington is the capital and political centre of New Zealand, it is the third-largest city in New Zealand. Thus, Auckland and Wellington are more likely to be impacted by the Covid-19 crisis and they worth to be considered individually.

TABLE 1. THE RELATIONSHIP OF WEEKLY AVERAGE WAGE AND GDP IN NEW ZEALAND

Variables	Before Covid-19 crisis	After Cord-19 crisis
Constant	-5384.479***	-10768.56***
	(130.0836)	(1432.626)
Average wage	9.005361***	13.22447***
	(0.109485)	(1.115861)
Number of observation	273	39
R-Square within	0.9615	0.7915

Notes: ***p=0.000. Standard errors are reported in parentheses.

Based on the result from Table 1, considering the whole country, the average weekly wage has a positive impact on GDP for both before and after the Covid-19 crisis. This means when the wage increases, the GDP will increase with it. However, the coefficient is more significant (13.22>9.00) after the Covid-19 crisis, which means the wage plays a more substantial role in GDP than before.

TABLE 2. THE RELATIONSHIP OF WEEKLY AVERAGE WAGE AND GDP IN AUCKLAND

Variables	Before Covid-19 crisis	After Cord-19 crisis
Constant	-2729.816***	6984.958***
	(69.49094)	(190.5038)
Average wage	3.80061***	-0.191382***
	(0.0559315)	(0.0064502)
Number of observation	273	39
R-Square within	0.9444	0.7915

Notes: ***p=0.000. Standard errors are reported in parentheses.

Based on the result from Table 2, in Auckland, the average weekly wage has a positive impact on GDP before the Covid-19 crisis. This means before the Covid-19 crisis, when the average wage increases, the GDP will increase with it. However, the coefficient is negative after the Covid-19 crisis. This represents after the Covid-19 crisis, a higher wage in Auckland leads to a lower GDP.

TABLE 3. THE RELATIONSHIP OF WEEKLY AVERAGE WAGE AND GDP IN WELLINGTON

Variables	Before Covid-19 crisis	After Cord-19 crisis
Constant	-336.26***	685.2461***
	(13.75369)	(0 .0066045)
Average wage	0.7821889***	-0.0449582***
	(0 .0105471)	(0 .0066045)
Number of observation	273	39
R-Square within	0.9496	0.5560

Notes: ***p=0.000. Standard errors are reported in parentheses.

Based on the result from Table 3, the average weekly wage has a positive impact on GDP before the Covid-19 crisis. This means before the Covid-19 crisis, when the wage increases, the GDP

will increase with it. However, the coefficient is negative after the Covid crisis. This represents after the Covid-19 crisis, a higher wage in Wellington leads to a lower GDP.

In summary, there is a casual relationship between average wage and GDP in New Zealand, including the Auckland region and the Wellington region. Before the pandemic, in New Zealand, Auckland and Wellington, the average wage and GDP are positively correlated. However, with the intervention of the Covid-19 crisis, the increase in average wage leads to decreases in GDP in Auckland and Wellington. This paper gives two significant reasons here. Firstly, due to the unevenly distributed population and city size in New Zealand, Covid-19 cases were unevenly distributed as well. With over one-third of New Zealand's population, Auckland had the most Covid-19 cases in the nation. The nationwide lockdown lasted seven weeks, from March 21st to May 13th. However, Auckland faced the second round of lockdown from August 12th to August 30th. The second round of lockdown definitely affected Auckland's regional GDP negatively.

Meanwhile, Auckland and the capital Wellington are the most and the second most international cities in New Zealand. New Zealand is a pillar industry of agriculture and animal husbandry, but it is not for Auckland and Wellington. This means that the pandemic's reduction in international exchanges has more significant negative impacts on Auckland and Wellington. Unlike other places in New Zealand, tertiary industries such as services are vital to Auckland and Wellington. These are precisely the industries that have been most negatively affected by the pandemic. Therefore, even though New Zealand's overall GDP is still increasing with the average wages after the Covid-19 crisis, Auckland and Wellington's situation is the opposite.

5. CONCLUSION

In conclusion, this paper evaluates the link between average wage and GDP, specifically during the covid-19 crisis. Based on the result, for New Zealand as a whole, regardless of the Covid-19 crisis, a higher wage results in a higher GDP. However, for Auckland and Wellington, the wage tends to decrease after the Covid-19 crisis. This is likely because the Auckland and Wellington economy heavily relies on rental, services, tourism, exports and imports industries. These two regions highly rely on tertiary industries, such as services and rental. Another reason is that Auckland faced multiple rounds of lockdowns compared with the rest of the country, so Auckland faced longer negative impacts caused by the pandemic. Therefore, the Covid-19 crisis has more significant impacts on these two regions.

The result is helpful for relevant policymakers and business decision-makers. The government might want to consider special subsidies for Auckland and Wellington or specific industries impacted by the Covid-19 crisis more than others. Business decision-makers might want to consider where to operate their business or which industry to invest in to be less impacted by the Covid-19 Crisis. The limitation of this paper is that due to the lack of more regional data on New Zealand's GDP and wage, it is only possible to study Auckland and Wellington at this stage. However, there are some other regions that are worth exploring, such as the Canterbury region (the second-largest city by population) and Queenstown, which is a tourism-based economy. It will be also helpful to find some relatively small regions to examine if the results are accurate. If more data are published in the future, then a more detailed study of each New Zealand region will be possible with higher accuracy. Additionally, with more data on each industry being

published, it is possible to examine the impact of the average wage increase on regional GDP by industries.

REFERENCES

[1] Understand Inequality - Inequality: A New Zealand Conversation. Inequality: A New Zealand Conversation. (2021). Retrieved 28 January 2021, from http://www.inequality.org.nz/understand/.

[2] Alinaghi, N., Creedy, J., & Gemmell, N. (2019). *The redistributive effects of a minimum wage increase in New Zealand*. Victoria Business School.

[3] Brown, C. (1999). "Minimum Wages, Employment, and the Distribution of Income." Handbook of Labor Economics, Vol. 3B, ed. Orley Ashenfelter and David Card, 2101–63. Amsterdam: Elsevier Science, North-Holland.

[4] Pacheco, G. (2007). The Changing Role of Minimum Wage in New Zealand. New Zealand Journal Of Employment Relations, 32(03), 2-17.

[5] Addison, J., & Blackburn, M. (1999). Minimum Wages and Poverty. Industrial and Labor Relations Review, 52(3), 393-409. doi:10.2307/2525141

[6] Johnston, R. (1975). But Some Are More Equal ... Who Gets What Where, and How, in New Zealand. Geography, 60(4), 255-268. Retrieved February 18, 2021, from http://www.jstor.org/stable/41415046

[7] Brown, C., C. Gilrow, and A. Kohen. (1982). "The effect of the minimum wage on employment and unemployment." Journal of Economic Literature, 20: June, pp. 487-528.

[8] Coleman, W.(1992). "Concord and Discord Amongst New Zealand Economists: the Results of an Opinion Survey." New Zealand Economic Papers, 26:1, pp. 47-82

[9] Wellington, A. J. (1991). "Effects of the minimum wage on the employment status of youths: an update." Journal of Human Resources, 26:1, pp. 27-46

[10] Bell, B., Machin. S. (2018) "Minimum Wages and Firm Value". Journal of Labor Economics. 36(1), pp.159-195

[11] Card, D., & Krueger, A. (1994). "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania. "The American Economic Review, 84(4), 772-793.