A Success of Economic Policy: An Analysis of the Impact of Western Development on Life Expectancy in Chinese Western Regions

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Abstract: *In 2000, China enacted the Western Development Project, which has helped undeveloped areas in the west and is still continuing. In order to test whether the impact of the Western Development is significant this paper uses data analysis of life expectancy using Difference in Difference regressions that compares the life expectancy increase in the western regions, before and after this policy, to the life expectancy increases, across the same time periods, in the non-western regions. The results indicate that the life expectancy in the western regions increased faster during the period when the Western Development was established compared to other regions. This suggests that the Western Development made positive changes in social development and impacted the lives of millions of people.*

Key Word*: Western Development; Difference in difference; Life expectancy; Social development; Macroeconomics.*

I.   Introduction

1.1.   Background

In the late nineteenth and early twentieth centuries, China set up many policies to boost regional development, such as China's Special Economic Zone, China's open coastal cities, and the Pearl River Delta. However, most of the economic policies pushed the already developing cities to continue advancing, rather than offering the opportunity to undeveloped cities. This aggravated the leaders of these cities, who demanded help. Finally, in the year 2000, the Western Development was established to help the "backward" cities in the west to develop.

1.2.   Topic

With the establishment of this program, the western regions had more opportunities for economic and social development. However, the actual effects of this policy have not been tested. To ensure that the policy has had impact, an analysis from the perspective of overall social development is essential. The success of a policy should be judged by the extent to which it has contributed to the development of society. To assess this, it is appropriate to use life expectancy as an indicator can measure the level of economic development of a society and the level of health care services. Life expectancy as a social indicator can measure the level of economic development of a society and the level of health care services (Kabir, 2008).)Therefore, this project uses life expectancy to evaluate the impact of the establishment of the Western Development on the social development of the western region.

Existing papers that have examined the impact of Western Development on economic development and people's lives only state the increasing growth after the implementation of the policy without comparing it with the data before the implementation of the policy and, more importantly, without comparison to the other regions. For example, as shown in "Major Achievements in Economic Development of Ethnic Regions since the Western Development, income levels, urbanization levels, and GDP in the western region increased from 2000 to 2020 (Ma, 2020). However, the data after 2000 are not compared to those before 2000. And, more importantly, they are not compared to data in other regions, that were not part of this policy. Therefore, the effectiveness of the Western Development cannot be truly proven. Past studies do not prove that any change in life expectancy is indeed caused by Western development and would not have occurred even without its implementation.

1.3. Hypothesis

The Western Development had a positive impact on life expectancy, so the life expectancy of western zones after the establishment of Western Development should firstly grow faster than before the implementation and secondly grow faster than other zones after implementation.

1.4. Method

The method for testing the impact on life expectancy over time will be difference in difference. Difference in difference is a statistical technique used in quantitative research by using observational research data to study the differences of effect on the "experimental group" versus the "control group". It calculates the effect on the outcome by comparing the average change in the outcome variable over time in the experimental group to the average change in the control group. Dference-in-difference is a simple panel-data approach that applies to group averages in cases where some groups are exposed to effects and others are not. This approach is well suited for estimating the effects of sharp changes in the economic environment or changes in government policies (Angrist, 1999). As for this study, it will examine the average change of life expectancy of western zones, as the experimental group which experienced the policy, and non-western zones, as the control group which didn't experience the policy.

II. Literature Review

1.5. Western Development

China embarked on the development plan so-called Western Development plan in 2000 for western regions, which include eight western zones, namely Gansu, Guizhou, Qinghai, Shaanxi, Sichuan, Hunan, Hebei and five autonomous regions, specifically Yunnan, Guangxi, Inner Mongolia, Ningxia, and Xinjiang and one municipality, Chongqing. These regions cover an area of 6.57 million square kilometers, or 68% of China's territory, and have a population of 357 million, or nearly 27% of China's total population. The western region, home to most of China's poor, shares borders with 14 countries and 12,747 kilometers of borders (Saeed, 2011).

Figure 1: Different regions in China (Map from UNICEF)

The Western Development focuses on burgeoning natural resources, human resources development, market environment, industry, agriculture, and tourism resource. The Chinese government has accordingly developed a 50-year plan, divided into three phases. The first phase of the plan lasted from 2000 to 2010. During this phase, the main focus was on restructuring construction (roads, railroad tracks, and dams), environmental protection (reforestation), education, creating a friendly environment for foreign and international investment, establishing industrial zones to create jobs, and access to government jobs and services for the local population. The second phase refers to the current strategy that the government will support through 2030. In this phase, it is planned to build on the achievements of Phase One to accelerate development and strive to maintain stable and relatively fast economic growth. Phase Two will also strengthen social construction and establish mechanisms to raise the level of education covering both urban and rural residents while attempting to accelerate the growth of cultural industries. Phase Three, which will last from 2031 to 2050, will be based on the

promotion of modernization, with a corresponding effort to increase ongoing projects in rural areas. Fast and secure communication links will also be promoted in the region to bring prosperity to the people (Lai, 2002).

1.6. History of Western Development Program

In the 1980s, discontent in the interior provinces over the widening economic gap grew as the coastal provinces sold products for export to the interior, driving local businesses to bankruptcy.

Moreover, the coastal provinces lightly processed raw materials purchased from the west at low state-regulated prices and exported them to world markets in exchange for valuable hard currency. In response to this perceived inequity, the inland provinces refused to sell raw materials to the coastal regions. In the 1990s, a group of analysts and scholars argued that during the first two decades of reform, the coastal regions accumulated wealth by "exploiting" the western regions, while the western regions demanded compensation from the central government in the form of policies that were even more favorable in the interior than in the coastal regions.

In the 1990s, such demands intensified. Between 1995 to 1997, legislators from the interior asked the central government to translate its commitment to supporting the interior region into concrete policies, laws, projects, and investments that would address the staggering disparities during different conferences and meetings. Finally, Jiang Zemin proposed the Western Development Strategy during the Ninth National People's Congress in March 1999 and formally elaborated on the strategy in two speeches in June 1999. At the June 9 meeting of the CPC Central Committee on poverty alleviation, he declared, "The conditions for accelerating the development of the central and western regions are basically in place and now is time .... While we continue to accelerate the development of the eastern coastal regions, we should also accelerate the development of the central and western regions. From now on, this should become a major strategic task for the Party and the state and should be placed in a more visible position.

On June 17, 1999, Jiang Zemin used the term Western Development for the first time at a conference on the reform and development of state-owned enterprises in five northwestern provinces in Xi'an. In elaborating the rationale and purpose of this policy, he quoted Deng Xiaoping's 1992 speech on overcoming regional inequalities at the turn of the century. on June 19, the People's Daily, reported on the speech, known as the "Xi'an speech," as a front-page headline, which marked the birth of the Western Development Policy (Lai, 2002).

1.7. Different Regions in the Western Development Program

All of the western regions have massive natural resources, which indicates their high potential. For example, Gansu province, located in the upper reaches of the Yellow River is one of the western regions. It is an agricultural region, producing raw cotton, corn, wheat, and wild medicinal herbs. However, its economy is based on mining and the extraction of minerals such as chromium, coal, copper, cobalt, gypsum, iron, lead, nickel, mercury, and zinc. It has the largest nickel mine in the country, accounting for 90% of China's nickel reserves, which could be developed.

As another example, Guizhou province, a poor and economically underdeveloped province, is rich in natural resources, such as coal. It has experienced poor economic growth, but agricultural production has improved and poverty has reduced. The main marketable crops are cured tobacco, rapeseed, vegetables, pigs, cattle, sheep, and timber. It is considered the third-largest tobacco producer in the country and home to the famous brand Guizhou tobacco. Its coal reserves are the highest among the southern provinces of China, ranking fifth in the country. Guizhou also has abundant natural resources for hydroelectric power generation (Saeed, 2011).

1.8. The economic growth brought by Western Development

Since the implementation of Western Development, the overall economy of western regions has continued to grow, the quality of life of people has improved and the level of urbanization has increased significantly. At the same time, poverty eradication has also achieved remarkable results. GDP per capita of the eight western zones increased significantly from 2000 to 2018. In 2000, the regional GDP of the eight western zones and regions was 7328.1 billion yuan, reaching 78605.7 billion yuan in 2020 (Appendix 1). Over the past 40 years of reform and opening up, the economy, society, and people's life in western zones have undergone great changes. Although some areas in ethnic areas have not been lifted out of poverty, the income level and consumption level of urban and rural residents in most areas have increased significantly. Since the implementation of the Western Development Strategy, the state has increased the financial investment in the western regions,and the institutional changes and innovations have accelerated the social and economic development of the western regions, and at the same time, the urban development of the western regions has entered a new stage, with the functions of cities gradually improved, the number of cities rapidly increased, the

area of urban built-up areas continuously expanded, the quality of urbanization gradually improved, and the proportion of the urban population to the total population continuously increased (Ma, 2020).

However, although Western Development has brought further development, this by itself cannot count this policy as a success. Examining its impact on people's living conditions should be the standard of success for a policy. Therefore, my paper will explore whether this policy impacts people's life and social development positively.
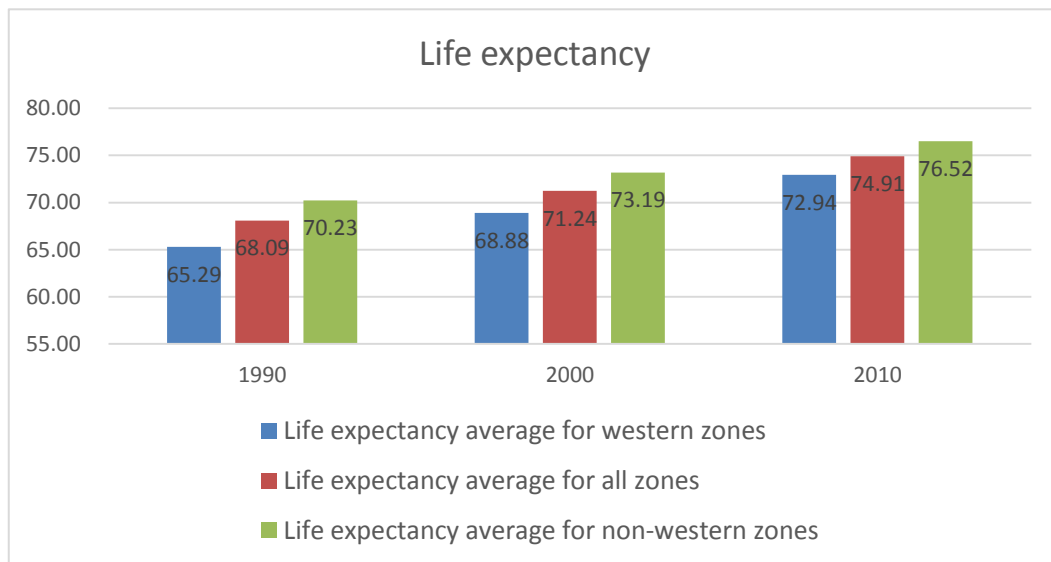
1.9. Life Expectancy

Life expectancy at birth is widely used as an indicator of a country's overall level of development. Several determinants affect life expectancy. First, one of the major determinants of life expectancy is income. It has been observed that there is a strong relationship between absolute income levels, as measured by GDP per capita, and life expectancy in poor countries ⁃the lower the GDP per capita, the lower the life expectancy.

In addition, education is considered another determinant that has an impact on life expectancy. Education has both direct and indirect effects on health outcomes. It increases labor market productivity and income growth, and educating women has a beneficial impact on child health and social well-being. Intuitively, education also raises awareness of health and thus action to improve it, which in itself has a significant impact on increasing life expectancy. Third, urbanization also plays a key role in determining life expectancy. Urban dwellers in developing countries typically enjoy better access to health services and means of livelihood, better education and other better socioeconomic facilities, which have a positive impact on health outcomes. Finally, total health care spending is considered to have a significant impact on life expectancy because it contributes directly to mortality reduction. Because it directly contributes to lower mortality and morbidity (Kabir, 2008). A cross-sectional study within Canada showed that lower health care expenditures had a significant negative impact on life expectancy. This study showed that lower health care expenditures were associated with a statistically significant increase in infant mortality

Due to the availability of data, only GDP per capita could be is included in this study as a determinant of life expectancy (Kabir, 2008).

III.   Empirical Work

To examine the effect of Western Development policies on life expectancy, we use data on GDP per capita and life expectancy from all the regions in China in 1990, 2000 and 2010. All data is from the National Bureau of Statistics of China.

Graph 1: Life expectancy average for all the zones, western zones and non-western zones
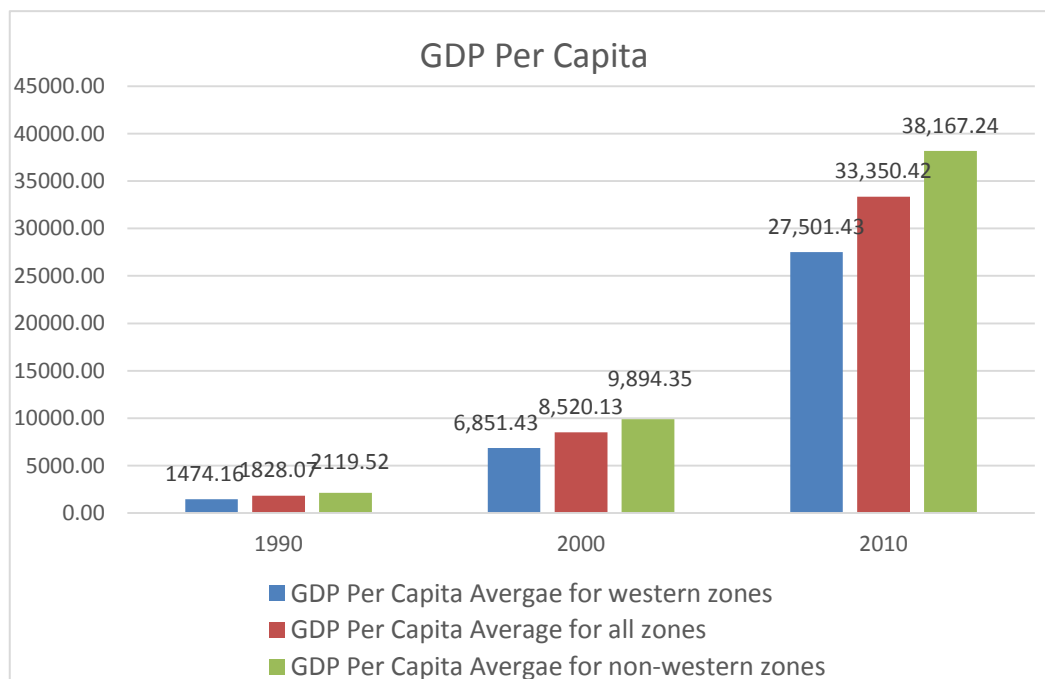
Graph 2: GDP Per Capita average for all the zones, western zones and non-western zones

To examine the impact of Western Development on life expectancy, identifying the growth of life expectancy before and after the implementation is essential. The results of growth of life expectancy before and after the implementation could directly link to whether the null hypothesis would be approved, then prove the effectiveness of "Western Development." Graph 1 shows the data of life expectancy for life expectancy average for western zones, life expectancy average for all zones and life expectancy average for non-western zones are shown in three time periods, namely 1990, 2000 and 2010. Since the Western Development was implemented in 2000, the year 1990 can reflect the original situation in the western region. The year 2010 could show the changes in the western region after the implementation of the policy.

Graph 2 The average table below shows the data of GDP Per Capita for GDP Per Capita average for western zones, GDP Per Capita average for all zones GDP Per Capita for non-western zones in three time periods, namely 1990, 2000 and 2010.

From these two graphs, a message could be interpreted that the life expectancy growth in the western region after implementation is higher than the growth in the western region before implementation. Before implementation (1990-2000), the average life expectancy growth in the western region was 3.6. after implementation (2000-2010), the average life expectancy in the western region increased to 4.06. This could indicate that life expectancy in the western region did increase at a higher rate because of these policies. In addition, life expectancy growth was higher in the western region than in the non-western region, especially after the implementation. Between 1990 and 2000, the average life expectancy growth was 3.6 in the western region and 3.0 in the non-western region. The difference in growth is 0.6 year. However, between 2000 and 2010, average life expectancy increased by 4.06 for western zones and by 3.33 for the non-western zones. The growth difference here is 0.73 years. Thus, the growth differential widened, with higher life expectancy growth in the western regions than in the non-western regions. By having the result above, difference in difference could be a method to prove the average change of life expectancy over time.

Regression Statistics	
Multiple R	0.836338287
R Square	0.69946173
Adjusted R Square	0.682189416
Standard Error	2.374992274
Observations	93

ANOVA

	df	SS	MS	F	Significance F
Regression	5	1142.109727	228.421945	40.4961208	2.5977E-21
Residual	87	490.7311823	5.6405883		
Total	92	1632.84091			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Life expectancy	70.22764706	0.576020236	121.918715	5.045E-99	69.0827445	71.3725496	69.0827445	71.3725496
West Dummy	-4.78407563	0.85714554	-5.5814041	2.6643E-07	-6.4877452	-3.0804061	-6.4877452	-3.0804061
Period 1	2.959411765	0.81461563	3.63289343	0.00047325	1.34027499	4.57854854	1.34027499	4.57854854
Period 2	6.293211765	0.81461563	7.72537567	1.7829E-11	4.67407499	7.91234854	4.67407499	7.91234854
Period 1 West	0.481302521	1.212186847	0.39705308	0.6923007	-1.9280501	2.89065514	-1.9280501	2.89065514

Figure 2: Regression without GDP per capita

The variables included in the regression are life expectancy, West dummy, Period 1, Period 2, Period 1 West and Period 2 West. Life expectancy refers to the life expectancy data of all the provinces in China in 1990, 2000 and 2010. West dummy is the variable that identifies whether a province is a western zone or not. Period 1 refers to 1990 to 2000, which is the period before implementation. This variable utilizes 1 for the year 2000 and 0 for the year 2010, which means the year 2000 exists inside this variable and the year 2010 does not exist since Period 1 refers to the period before implementation. Period 2 means 2000 to 2010, which is the period after implementation. This variable utilizes 1 for the year 2010 and 0 for the year 2000, which means the year 2010 exists inside this variable and the year 2000 does not exist since Period 2 refers to the period after implementation. Period 1 West is the variable that identifies western zones between 1990 to 2000, so it utilizes Period 1 time West dummy. and Period 2 West is the variable that recognizes western zones between 2000 to 2010, so it utilizes Period 2 time West dummy.

Period 1 West and Period 2 West are the most important variables since they reflect the growth in western zones compared to other zones before and after implementation. These two variables could reflect whether the growth of life expectancy in western zones after implementation exceeds the growth of life expectancy before implementation, which can directly prove the effectiveness of Western Development. These two variables can be interpreted as the shrinking rate of the gap in life expectancy between western zones and other zones.

Looking at the results, first of all, the adjusted R-square for this regression is 0.68, which indicates that 68% of the variation in life expectancy can be explained by the other variables. Taking a closer look at the different variables, the coefficient of life expectancy is 70, which means that the average life expectancy for all regions is 70. The coefficient for the western dummy is -4.78, which indicates that the average life expectancy in the western region is almost 5 years less than in all provinces. The p-value for the western dummy is small, which means it is statistically significant and the confidence interval says that there is a 95% probability that the life expectancy in the western region is between 3.1 and 6.5 years lower than other regions. In addition, the coefficient for Period 1 is 2.95, which reflects an increase in life expectancy of about 3 years for all provinces between 1990 and 2000. The p-value is very low, which means that it is statistically significant and the confidence interval says that there is a 95% probability that life expectancy increased in Period 1 is between 1.3 and 4.5 years. For Period 2, the coefficient is 6.3, which demonstrates that the increase in life expectancy between 2000 and 2010 is about 6.3 years. The p-value is very small, proving the statistical significance. The confidence interval is between 4.7 and 8 years, which indicates that there is a 95% probability that the life expectancy increased in Period 2 is between 4.7 and 8 years.

In addition, the coefficient for Period 1 West is 0.48, which implies that the gap in life expectancy between the West and the rest of the region narrowed by 0.48 years between 1990 and 2000. However, this is not statistically significant and the confidence interval ranges from -1.9 to 2.9, which includes zero. Most importantly, the coefficient of 1.2 for Period 2 West suggests that the gap in life expectancy between the West

Zone and the other zones narrowed by 1.2 years between 2000 and 2010. The gap is indeed closing at an accelerated rate, but this is also not statistically significant. Zero is also within this confidence interval. Therefore, this regression does not prove the original null hypothesis, which is the plan of Western Development did not have a positive impact on life expectancy in western zones.

Regression Statistics	
Multiple R	0.87612289
R Square	0.76759132
Adjusted R Square	0.75137676
Standard Error	2.10062673
Observations	93

ANOVA

	df	SS	MS	F	Significance F
Regression	6	1253.3545	208.892417	47.3396345	3.3168E-25
Residual	86	379.486408	4.41263265		
Total	92	1632.84091			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Life expectancy	69.9487349	0.51249617	136.486357	2.595E-102	68.9299262	70.9675436	68.9299262	70.9675436
West dummy	-4.6657668	0.75849184	-6.1513737	2.3486E-08	-6.1735987	-3.1579349	-6.1735987	-3.1579349
Period 1	1.85364922	0.75341441	2.46033152	0.01588122	0.35591094	3.35138749	0.35591094	3.35138749
Period 2	1.48893702	1.19777539	1.24308534	0.21721477	-0.8921616	3.87003569	-0.8921616	3.87003569
Period 1 West	1.10203824	1.07925583	1.02110936	0.31006651	-1.0434514	3.24752783	-1.0434514	3.24752783
Period 2 West	3.2353284	1.14575301	2.82375729	0.00589718	0.95764681	5.51301	0.95764681	5.51301
1000 GDP Per Capita	0.12334469	0.02456572	5.0210081	2.7504E-06	0.07450965	0.17217972	0.07450965	0.17217972

Figure 3: Regression with GDP per capita

However, another regression with GDP per capita has been run since it is one of the determinants of life expectancy, and it implies different results. Firstly, the adjusted R-square for this regression is 0.75, which indicates that 75% of the variation in life expectancy can be explained by the other variables. Compared to the previous regression, the adjusted R-square rises from 0.68 to 0.75. Therefore, this could outline that this regression has a stronger relationship between life expectancy and GDP per capita.

The result showing of life expectancy, West dummy, Period 1 and Period 2 in this regression is similar to the first regression. The coefficient of life expectancy is about 70. The coefficient for Period 1 is 1.9, which reflects an increase in life expectancy of 1.9 years for all provinces between 1990 and 2000. For Period 2, the coefficient is 1.5, which demonstrates that the increase in life expectancy between 2000 and 2010 is about 1.5 years. However, it is not statistically significant since the confidence interval ranges from -0.9 to 3.9, which includes zero.

For the two important variables: Period 1 West and Period 2 West, the coefficient for the Period 1 West is 1.1, which means that the gap in life expectancy between western zones and the rest of the country shrank by 1.1 years between 1990 and 2000. However, this is not statistically significant because the confidence interval is -1 to 3.2, which includes zero. However, for Period 2 West, the coefficient is 3.2, which indicates that the gap in life expectancy between western zones and the other districts narrowed by 3.2 years between 2000 and 2010. The gap narrowed much faster, and it is statistically significant because the confidence interval does not contain 0. Period 1 West and Period 2 West are not statistically significant in the previous regression, so it can not prove the null hypothesis. However, this regression can prove the null hypothesis since Period 2 West is statistically significant. Therefore, life expectancy of western zones after the establishment of Western Development did grow faster than before the implementation, and did grow faster than other zones after implementation.

IV. Conclusion

The regression with GDP per capita results supports the original hypothesis, which means the Western Development had a positive impact on life expectancy, so the life expectancy gap between the western region and the rest of China shrink faster after implementation than before implementation. In the second regression, the coefficient of the Period 1 West variable is much smaller than the coefficient of the Period 2 West variable, which reflects that life expectancy grew faster in the west compared to other regions between 2000 and 2010

than it did in the west compared to other regions between 1990 and 2000. In addition, Period 1 West is insignificant inside the second regression, so it does not prove certain things as if Period 2 West is significant, so it can prove the original null hypothesis. Therefore, the Western Development had a positive effect on life expectancy, so life expectancy in the western regions increased faster than before during the period when the Western Development was established and faster than other regions after the implementation.

1.10. Limitation

The limitation of this paper can be reflected due to the availability of the data. First of all, the data on life expectancy could only be found in 1990, 2000, and 2010. The data is separated by a decade, so the presenting result will not be as rigorous as it would with the annual data. In addition, there is still no data on life expectancy in 2020, so continuous growth or impact cannot be reflected in the current study. The comparison of life expectancy in western zones before implementation and after implementation could only show the impact from 1990 to 2010. However, from 2010 to 2020, the growth of life expectancy in western zones cannot be studied. This cannot prove the continuous impact of "Western Development". Therefore, this is another limitation based on the availability of data .

Lastly, the only determinant of life expectancy that was available was the data of GDP per capita could be found as the determinant of life expectancy. A full study would benefit from the inclusion of information on income, education, urbanization and total health care spending. Then, the overall study could be more comprehensive and accurate. This can affect the objectivity of the overall data and the presenting result. Therefore, these are the two main limitations of this study.

A closing thought is that these findings do not rule out that increased life expectancy is itself an important determinant of the take-off of economic growth (Hansen, 2015). This does not contradict the findings of the paper, but illustrates the complexity of evaluating economic policy. In conclusion, this study adds significantly to our understanding of the positive impact of Western Development policy in the last 30 years.

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