

# **CHAPTER 3 : THE PROMISE OF GROWTH: A “DIFFERENCE-IN-DIFFERENCES” ANALYSIS OF THE ECONOMIC IMPACT OF SWITCHING DIPLOMATIC RELATIONS BETWEEN TAIWAN AND CHINA**

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*This chapter is the quantitative component for the research project on the economic impact of diplomatic engagement with Taiwan and China. We apply the Difference-in-Differences (DID) approach to investigate whether an event that occurred in a certain year leads to better or worse economic performance – be it the severance of diplomatic ties with Taiwan in exchange for the recognition of China, or the launch of significant Chinese investment programs in the region. According to our empirical results, South Africa's economy did not improve after it cut ties with Taiwan in 1998. Croatia, the Czech Republic, Hungary, Montenegro and Slovenia also did not perform better economically, relative to Turkey, after the launch of China's 16+1 initiative, which excluded Ankara. Results from Latin America and the Caribbean also cast doubt on Beijing's assertions that the Belt and Road Initiative (BRI) brings great economic benefits to its partners. In Oceania, Tonga, which switched recognition to China in 1998, has still not shown stronger economic performance than neighboring countries, while Taiwan's partner, Tuvalu, has enjoyed positive economic growth relative to its control country.*

## **3.1 Introduction**

Taiwan's diplomatic isolation began when it lost its right to the "China seat" at the United Nations in 1971 and was replaced by the People's Republic of China (PRC). It lost the recognition of over four dozen countries, including the US, in the years that followed, and has more recently suffered further setbacks. Seven countries cut diplomatic ties in the period from 2016 to 2019: Sao Tome and Principe, Panama, Dominica, Burkina Faso, El Salvador, the Solomon Islands, and Kiribati. In December 2021, Nicaragua also cut diplomatic ties and switched recognition to Beijing. The rapid rise of China's political and economic strength has been a decisive factor in these losses. But Taiwan is still working hard to participate in international organizations, such as the World Health Organization (WHO). It aims through trade, investment, tourism and technological exchanges to send a message to the world that “Taiwan can help”.

This chapter aims to provide the empirical foundation to assess the impact of having diplomatic relations with Taiwan or China and provide results for further analytical examination. It is aided by additional data and observations in the region-based chapters

that follow. We apply the Difference-in-Differences (DID) approach, an econometric technique developed by Card and Krueger (Card & Krueger, 1994), to implement data-driven comparative case studies. Under the DID framework, we investigate whether an event that occurred in a certain year – be it a severance of diplomatic ties with Taiwan in exchange for recognition of China, or the launch of Chinese investment programs in the region – leads to better or worse economic performance. The variable, GDP per capita in log form, was sourced from the United Nations (UN) Data for Oceanian countries and the World Bank’s World Development Indicators (WDI) for Africa, Latin America and the Caribbean (LAC), and Central and Eastern Europe (CEE). The data are complete until 2019. The global outbreak of *COVID-19* in early 2020 had such a global economic impact that data from 2020 are more volatile.

## 3.2 Methodology

DID is our econometric model of choice to observe the variation in economic performance between two countries. A detailed description of the development and advantages of this methodology is included in ANNEX 3.1 along with the equations used in the regression model, while a simplified example of its application is outlined below followed by an explanation of how it was utilized in this chapter.

### 3.2.1 DID example

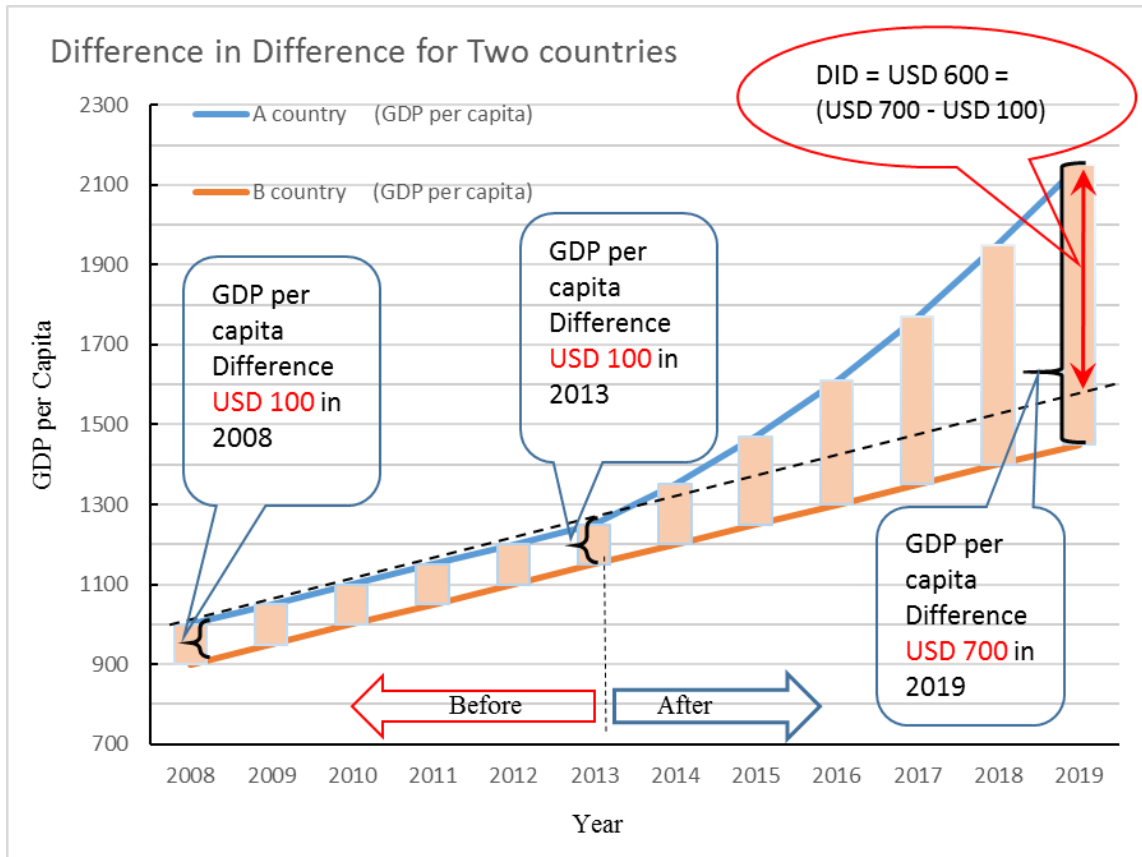
When observing the impact in 2019 of a certain economic event or change of policy that occurred in 2013 in country A, now termed the treated country, the year 2013 is hereafter referred to as the “interruption year”.

To conduct such an examination, we first select a “control country”, referred to as country B, which ideally is located in the same region and has a similar culture, language, education level, and political and economic policies as country A. We then set an empirical period to observe, which in this example is from 2008 until 2019, in other words beginning well before the interruption year.

Figure 3.1 illustrates the trend of GDP per capita of both countries in the selected period from 2008 to 2019. The difference in GDP per capita between the two countries was US\$100 in 2008, as shown in Table 3.1. This \$100 gap remained fixed until the interruption year, when the treated country adopted the economic policy in question and started feeling its impact. By 2019, the difference in GDP per capita between country A and B has widened to \$700. The dotted line in Figure 3.1 is the *assumed parallel* – the expected GDP per capita trend for country A if it had not adopted the policy, keeping the fixed \$100 difference to country B. A Difference-in-Differences calculation is then carried out by comparing the average change over time in the outcome variable for the treated country to the average change over time for the control country – subtracting the

differences between the two countries before and after the implementation of the new policy: \$700 – \$100. Therefore, the DID result is \$600, which illustrates the impact of the change on country A and shows that its economic performance was better than that of the control country after the interruption year.

**FIGURE 3.1 DIFFERENCE IN DIFFERENCES METHOD**



**TABLE 3.1 DIFFERENCE IN DIFFERENCES METHOD**

Year	2013	2019
Country A (GDP per capita in USD)	1,250	2,150
Country B (GDP per capita in USD)	1,150	1,450
Difference	100	700
<b><i>Difference-in-Differences = (700 – 100) = 600</i></b>		

### ***3.2.2 DID application in this chapter***

In this chapter, we aim to apply the DID method to estimate the effect of an event, for example the establishment or severance of relations with Taiwan or China, on the economic performance of our treated countries. Our variable, GDP per capita in log form, was sourced from the UN Data for the Oceanian countries and the WDI for the three remaining regions.

As a chief objective of this chapter is to supply empirical results for the regional-based discussions, our selection of the treated countries is mainly informed by the contributors to those chapters. Two key considerations are relevant: whether these countries have switched their diplomatic relations from Taipei to Beijing or vice versa, or in the case of no formal diplomatic shift, whether bilateral relations have been strengthened; and the scale of trade and investment relations these countries maintain with Taiwan and China. The control countries, on the other hand, are chosen based on region, GDP per capita, income level, size of population and cultural affinity. We made our best efforts to choose a control country in the same region, if available.

The interruption years for different treated countries were either the years when they broke diplomatic ties with Taiwan in favor of China, or vice versa (also referred to as “breaking year” in these cases), or the date when China launched major investment drives in the region.

2006 was selected for the ten African countries examined, the year of the third Forum on China-Africa Cooperation (FOCAC). The importance of this event is reflected by a sharp increase in trade and investment between China and African countries in the years that followed (See Chapter 5). FOCAC was first held in 2000 and 2003 as ministerial meetings, but the 2006 event was held in Beijing as a full summit, with 41 heads of state from Africa attending. China's first policy white paper on Africa was presented in the same year, along with specific financial commitments. They included \$5 billion in financing, a pledge to double aid by 2009, the establishment of a China-Africa Development Fund with \$5 billion in capital, and expanded infrastructure commitments. The forum also set the pattern for the subsequent triannual forums.

2012 was chosen as the interruption year for the 16 CEE countries examined because it was the year the 16+1 framework was launched under the title: Cooperation between China and Central and Eastern European Countries. China’s goal was to introduce the Belt and Road Initiative (BRI) into the region through the framework (see Chapter 7). China’s drive for investment in the CEE countries can be seen as part of an effort to open up the European market and connect it to China through new links across Central Asia (see Chapter 7).

2013 was picked for the 33 Latin American countries examined, the year when China launched the BRI along with its branches in Latin America. Since then, China has been increasingly able to use economic statecraft, including infrastructure investment, to pursue its strategic goals (see Chapter 4). Some studies suggest that the BRI could help Chinese partners achieve stronger economic performance. Therefore, we examine whether GDP in the treated countries slowed down after 2013 compared to that of a long-term Chinese partner (also see Chapter 4).

2006 was selected for the eleven Oceanian countries, the year of the first China-Pacific Island Countries Economic Development and Cooperation Forum (hereafter referred to as “China Pacific Forum”) and the visit of the then Chinese premier, Wen Jiabao. China significantly increased its economic presence and aid engagement in the Pacific after 2006 (see Chapter 6).

The interruption and breaking years divide the empirical period into the pre-breaking and post-breaking periods. By comparing the GDP per capita differences between two countries in both periods, a DID value is obtained. In addition, a DID trend graph is produced for treated countries that warrant further discussion. The DID trend is produced by treating each year in the empirical period as an interruption to yield multiple DID results, before plotting these resulting values into a curve that can better explain the economic development before and after the interruption. That is, it dynamically maps out the GDP per capita differences between the treated and control countries throughout the observed period.

### 3.3 Empirical Results

The four regions examined by this empirical study are Africa, CEE, LAC, and Oceania. A comprehensive result of the DID analyses is provided in the ANNEX while we focus on selected countries for detailed DID regression and trend analysis. For Africa, two out of the ten treated countries were chosen: Malawi and South Africa. In the CEE, two out of the 16 were selected: The Czech Republic and Hungary. In LAC, five out of 33: Costa Rica, Dominica, Grenada, Guatemala, and Saint Lucia. In Oceania, two out of ten: Tonga and Tuvalu. Most of these countries either switched diplomatic relations or are diplomatic or trade partners of Taiwan.

For each treated country discussed, two graphs are presented: a GDP per capita trend of both the treated and control countries on the left, and one for the DID trend on the right. The GDP trend graph outlines the paths of economic performance measured by (the log of) GDP per capita over the entire study period, with the solid line representing the GDP per capita of the treated country, and the dashed line denoting its counterpart drawn from the control country. A vertical dotted line denotes the year of the interruption.

The DID trend graph, on the other hand, shows the DID result values plotted on a curve for each year of the empirical period. That is to say, the DID trend graph dynamically maps out the GDP per capita differences between the treated and control countries throughout the observed period of time. When the DID trend goes up, the economic growth rate of the treated country is higher than that of the control, indicating stronger economic growth than the other country. When the DID trend goes down, the economic growth rate of the treated country is slower than that of the control.

#### 3.3.1 *Africa*

A total of ten African countries – Angola, Burkina Faso, the Central African Republic, Chad, Eswatini, Malawi, Sao Tome and Principe, Senegal, South Africa, and the Gambia – were selected to undergo DID analysis (see ANNEX 3.2). Control countries were assigned to treated countries on the basis of similarities in GDP per capita and other relevant factors noted above. The interruption year of 2006 was applied - the year of the third FOCAC, while additional breaking years were employed for countries that had broken off ties with Taiwan: 1998 for South Africa, 2008 for Malawi, and 2016 for Sao Tome and Principe.

The default empirical period for African countries is from 1998 to 2019. However, the WDI database lacks data for Sao Tome and Principe before 2001, thus the empirical period 2001 to 2019 was selected for it. South Africa broke ties with Taiwan in 1998, but as 1990 was the year that saw the release of Nelson Mandela, which was swiftly followed by the

end of apartheid in 1991 and subsequent revocation of sanctions, the period of 1990 to 2019 was adopted.

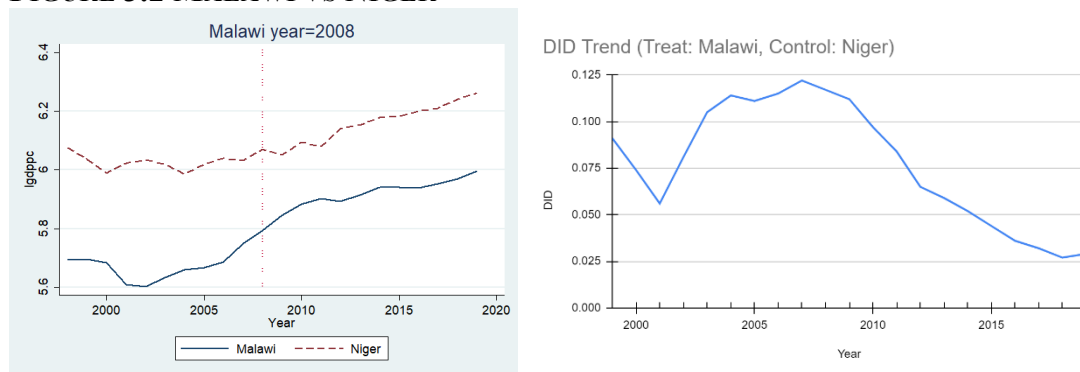
In the ten observed countries presented in ANNEX 3.2, Burkina Faso, Sao Tome and Principe, Senegal, South Africa and the Gambia experienced economic downturns that were statistically significant after the third FOCAC took place in 2006. On the other hand, Chad and Malawi are observed to have experienced economic growth after 2006. Angola, the Central Africa Republic and Eswatini did not produce results that are statistically significant. In this treated pool, two countries that switched diplomatic allegiance between Taiwan and China – Malawi and South Africa – yielded statistically significant results thus warranting additional DID trend analysis and further discussion. A table showing the DID trends for African countries is included in ANNEX 3.3.

### 3.3.1.1 Malawi

Figure 3.2 shows the treated country, Malawi, alongside its control country, Niger, during the period 1998 to 2019. The DID illustrates the (log of) GDP per capita trend and the breaking year, 2008, when Malawi cut diplomatic ties with Taiwan. The right graph illustrates the DID trend from 1998 to 2019 and displays all positive DID values in this period. Compared with the control country, the DID trend for GDP per capita in Malawi went down from 1999 to 2001.

The DID trend from 2002 to 2007 increased and was statistically significant, meaning that Malawi's economic growth rate was greater than Niger's in this period. By contrast, in the period from 2008 to 2014, the DID trend decreased and was statistically significant throughout this interval, suggesting that the magnitude of its growth rate was less than that of Niger, and the economic performance of Malawi began to slow during the six years following the establishment of ties with China. From 2015 to 2019, DID results are statistically insignificant; therefore, we cannot say whether Malawi had a better or worse economic performance in this period.

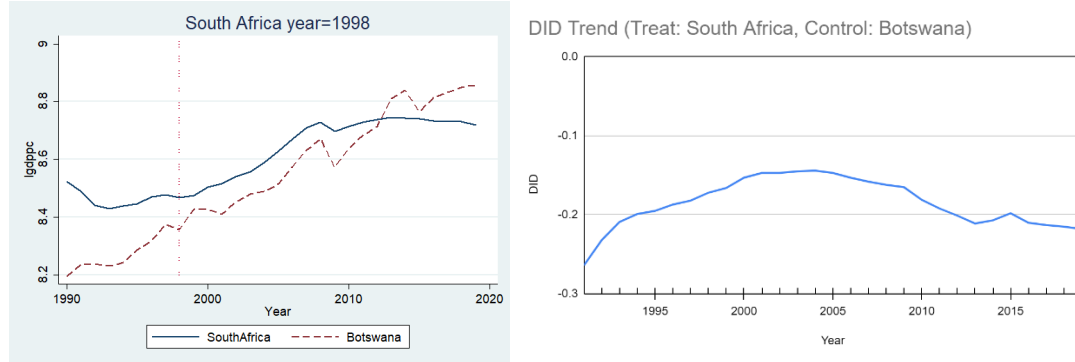
**FIGURE 3.2 MALAWI VS NIGER**



### 3.3.1.2 South Africa

Figure 3.3 compares the treated country, South Africa, and its control country, Botswana. The breaking year on the left graph is 1998, when South Africa cut ties with Taiwan, and the observation period is 1990 to 2019. The right graph exhibits the DID trend, showing negative and statistically significant DID values throughout the empirical period. The DID trend also starts falling from 2004, showing that South Africa's economy did not improve compared to Botswana's. Its economy remained stagnant after 2004.

**FIGURE 3.3 SOUTH AFRICA VS BOTSWANA**



### 3.3.2 Central Eastern and Europe (CEE)

A total of 16 CEE countries – Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Montenegro, North Macedonia, Poland, Romania, Serbia, Slovakia, and Slovenia – were selected to undergo DID analysis (see ANNEX 3.4 DID results of Central and Eastern Europe). Turkey was selected as the control country for the area due to its geographic proximity, its candidacy for European Union (EU) membership and its exclusion from China's 16+1 initiative, making it an ideal point of reference when exploring the economic impact of the initiative on CEE countries.

The interruption year 2012 was applied, as we wanted to examine the economic impact of the initiative against initial hope in the CEE that the 16+1 format would boost Chinese trade and investment and stimulate growth. (see Chapter 7). The empirical period for the region is 1999 to 2019.

In the 16 observed countries displayed in the ANNEX 3.4, eleven presented negative DID result values, while five showed positive values. More significantly, Croatia, the Czech Republic, Hungary, Montenegro and Slovenia all presented statistically significant, and negative, DID result values, showing that they did not perform better than Turkey after the launch of the 2012 initiative.

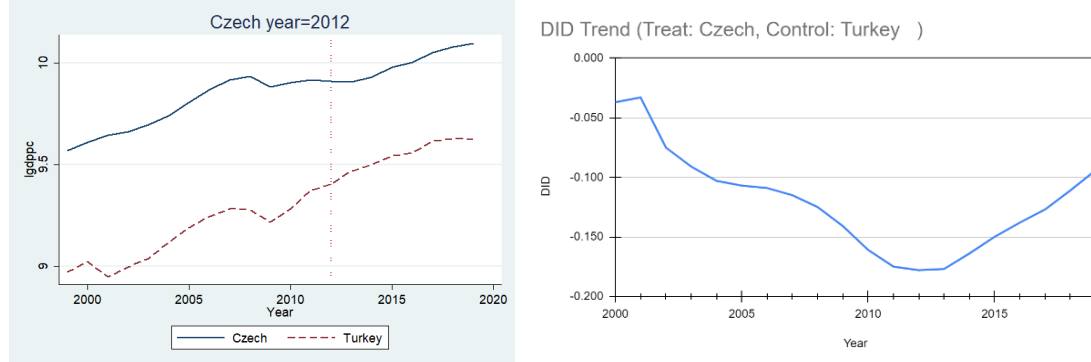


In the countries that yielded statistically significant result, the Czech Republic and Hungary were chosen to undergo additional DID trend analysis and further discussion. A table showing the DID trend for CEE countries is included in ANNEX 3.5.

### 3.3.2.1 *The Czech Republic*

Figure 3.4 shows the Czech Republic as the treated country and Turkey as the control. The left graph is the (log of) GDP per capita trend with an observation period from 1999 to 2019, with 2012 as the interruption year. The right graph shows the DID result trend from 2000 to 2019, with negative DID result values presenting throughout the entire empirical period within two intervals: 2004 to 2006, and 2008 to 2018. The DID value began to drop from 2001 and stopped at 2012, showing that the magnitude of economic growth was less than that of Turkey during this period. From 2013 to 2018, the DID trend rose but still presented negative and significant DID results, meaning that while the degree of Czech economic growth was stronger than Turkey’s in the period, it still experienced a slump after 2012.

**FIGURE 3.4 THE CZECH REPUBLIC VS TURKEY**

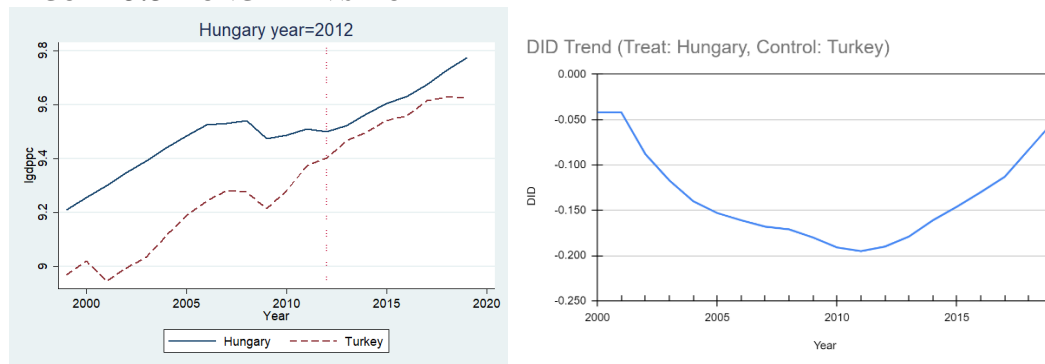


### 3.3.2.2 *Hungary*

Figure 3.5 shows Hungary as the treated country and Turkey as the control. The empirical period is 1999 to 2019 and the interruption year is 2012.

On the right, Hungary’s DID trend is shown to have decreased after 2001, reaching its lowest point in 2011, denoting economic shrinkage in the period. However, the DID trend experiences an uptick from 2012 to 2019, illustrating stronger growth than Turkey.

**FIGURE 3.5 HUNGARY VS TURKEY**



### 3.3.3 Latin America and the Caribbean

A total of 33 countries in the LAC were tested (see **ANNEX 3.6 DID Results of Latin American and the Caribbean**), with the default empirical period set from 2000 through 2019. In 2000, Taiwan welcomed its first transition of power after Chen Shui-bian of the Democratic Progressive Party (DPP) was elected president ending over half a century of rule by the Chinese Nationalist Party (KMT) and opening the door to a new diplomatic onslaught from China. For countries that switched ties to China recently, such as Panama (2017) or El Salvador (2018), not enough time has passed for an assessment on economic development to be conducted. Therefore, they are still treated in the model as Taiwanese partners, and alternative end years for the empirical period are used.

The interruption years for the individual countries are either the year of their diplomatic switch, or 2013, the year when the BRI was extended to the LAC. Control countries were chosen on the basis of two criteria: Similarity in the level of economic development (in this case GDP per capita), and consistency in their recognition of Taiwan or China. For further discussion of these selections, and how the empirical DID results applied to the testing of the “Switching Helps” and “BRI Attracts” hypotheses, please refer to Chapter 4: *The Political Economy of Diplomatic Competition: Taiwan and China in Latin America and the Caribbean*.

In the following section, Costa Rica, Dominica, Grenada, Guatemala, and Saint Lucia receive some further DID regression and trend analysis. A table showing the DID trend for LAC countries is included in **ANNEX 3.7**.

#### 3.3.3.1 Costa Rica

Figure 3.6 illustrates Costa Rica as the treated country and Panama as the control country. Costa Rica cut ties with Taiwan after 63 years in 2007, while Panama remained Taiwan’s diplomatic partner until a switch to China in 2017. The empirical period is from 2000 to 2017. The graph on the upper left shows the (log of) GDP per capita trends of both

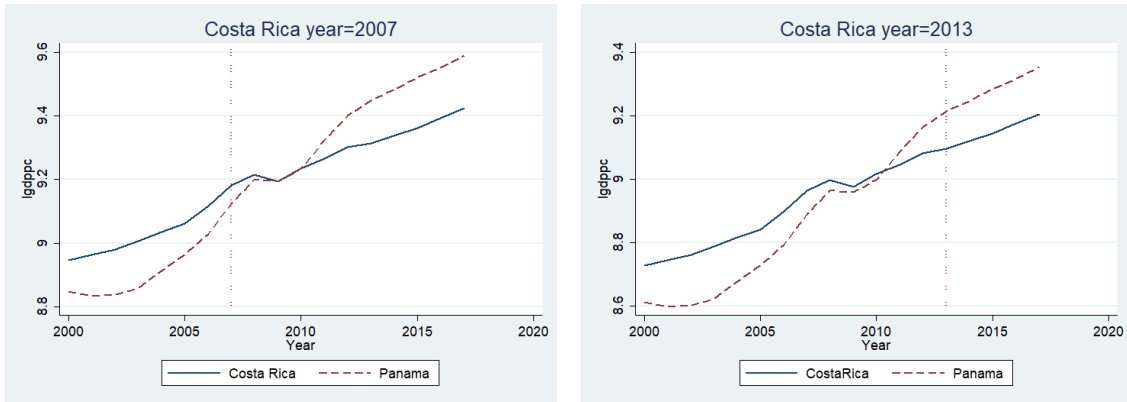
countries with the break year of 2007, and the one at the upper right shows the (log of) GDP per capita trends of both, with the interruption year of 2013.

The DID trend graph at the bottom applies to both analyses using the break year 2007 and the interruption year 2013. It shows a downward sloping curve from 2001 to 2012, when it reaches the lowest point with a negative DID value. The results are statistically significant, showing that Costa Rica's economic growth rate is observed to be weaker than Panama's during that period.

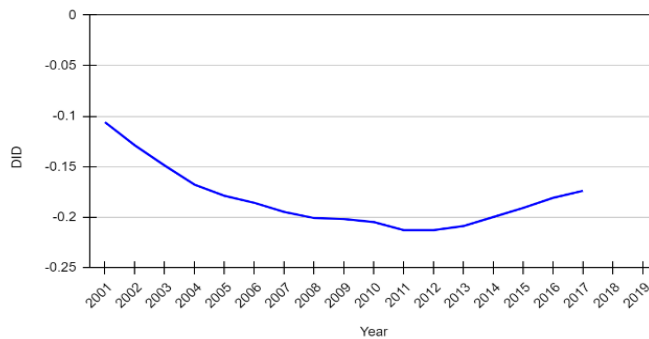
The DID trend continues its decline after 2007, showing that the gap between Costa Rica and Panama keeps on shrinking. The negative DID value is statistically significant within the 2007 to 2012 interval, indicating that Costa Rica's economic performance was worse after cutting diplomatic ties with Taiwan.

After 2013, the DID trend appears to increase from the lowest point, and the results are statistically significant during the period from 2013 to 2017. The DID trend shows that Costa Rica's economic growth was a little stronger than that of the control country after the adoption of the BRI.

**FIGURE 3.6 COSTA RICA VS PANAMA**



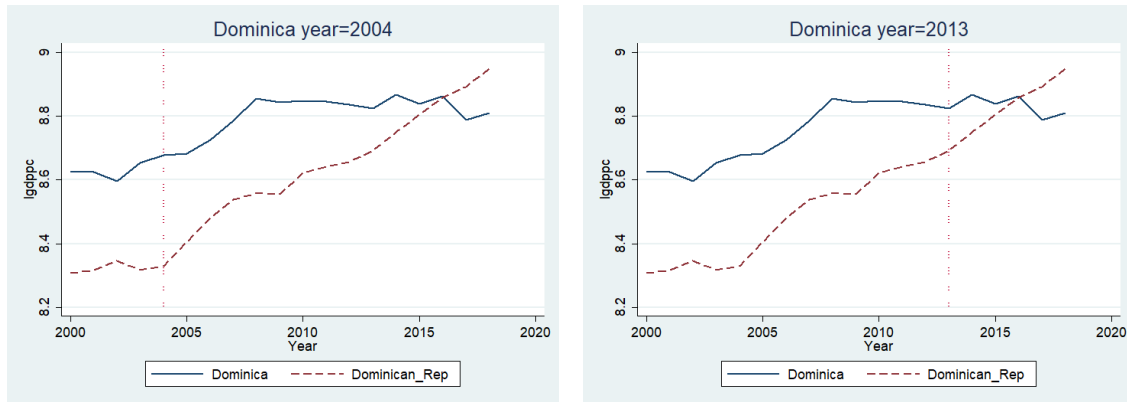
DID Trend (Treat: Costa Rica, Control: Panama)



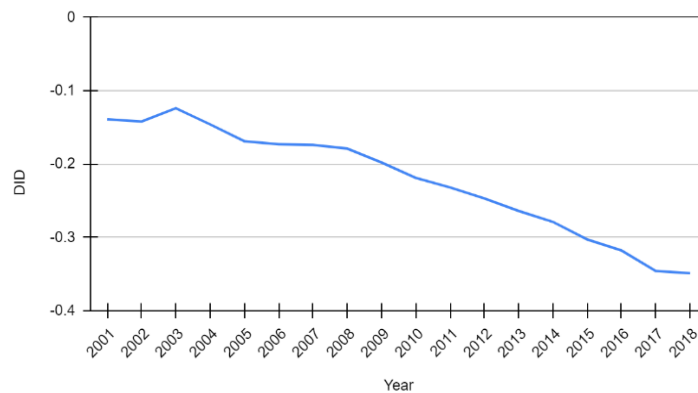
### 3.3.3.2 *Dominica*

Dominica, which broke away from Taiwan in 2004, is compared with the control country, the Dominican Republic, in Figure 3.7 with an assessed interval from 2000 to 2018. In line with the same consideration, the Dominican Republic was chosen as it remained a Taiwanese diplomatic partner until it switched to China in 2018. We find that although the GDP per capita of Dominica is greater than that of the Dominican Republic, its economic growth was weaker with a statistically significant, negative DID value for the empirical period. According to the DID trend, the value began to decrease mildly in 2003, and there was a decline between 2008 and 2017, when it reached its lowest value. From these results we can conclude that after Dominica switched its diplomatic recognition to China in 2004, its economic performance worsened. Moreover, Dominica did not enjoy positive economic performance after China extended its BRI to the region in 2013.

**FIGURE 3.7 DOMINICA VS THE DOMINICAN REPUBLIC**



DID Trend (Treat: Dominica, Control: Dominican Rep)

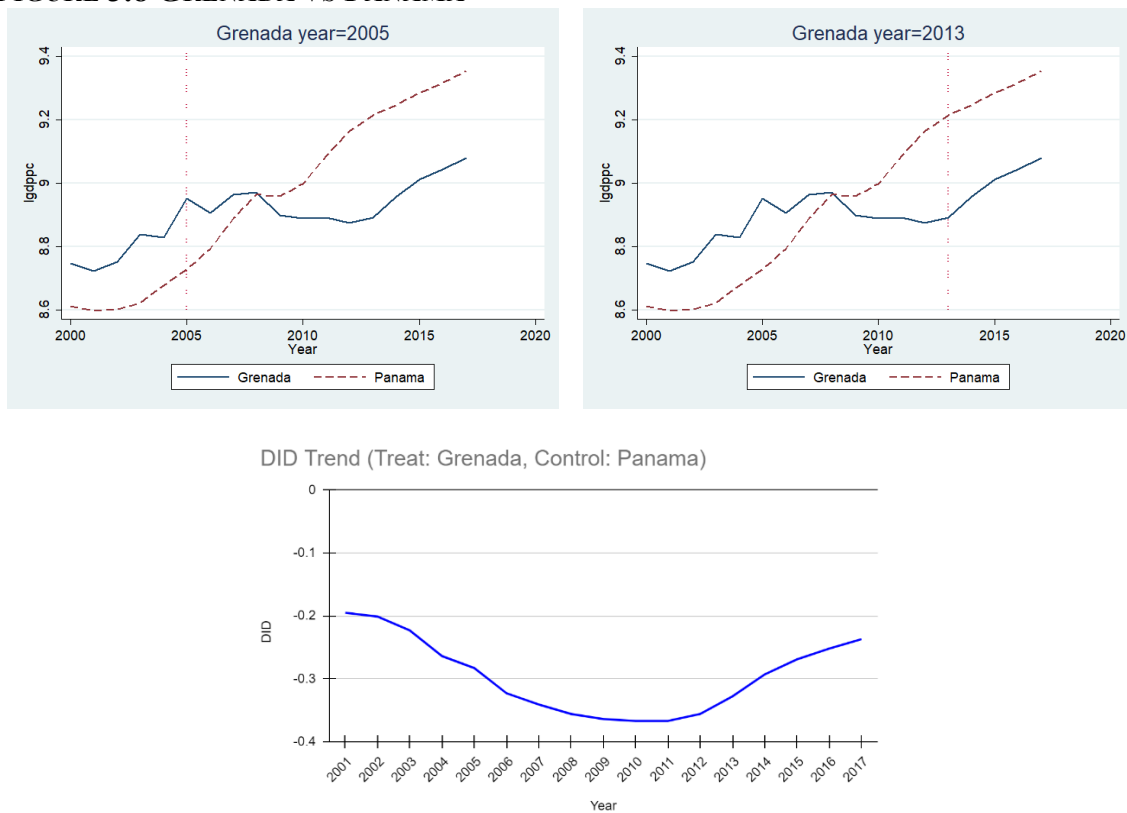


### 3.3.3.3 Grenada

Figure 3.8 presents the treated country Grenada, which broke away from Taiwan in 2005, and its control, Panama. The upper graphs show the (log of) GDP per capita trend of Grenada and Panama with both the break year of 2005 and interruption year of 2013. After 2008, Grenada had a lower GDP per capita than Panama. Again, Panama was chosen as it remained Taiwan’s diplomatic partner until it switched to China in 2017.

According to the DID result, we see a statistically significant and negative DID value during the period from 2001 to 2017, meaning that Grenada’s economy did not perform well in this period. The bottom graph of the DID trend shows a downward curve from 2000 to 2010 which turns upwards from 2011 to 2016, meaning that while Grenada’s economy was recovering after 2011, it was still worse than Panama’s, as is apparent in the negative DID value. Therefore, we find that although economic growth was slightly better than Panama’s after the launch of the BRI, Grenada’s economy did not do well. The DID trend also indicates that Grenada’s economic performance suffered after it cut ties with Taiwan in 2005.

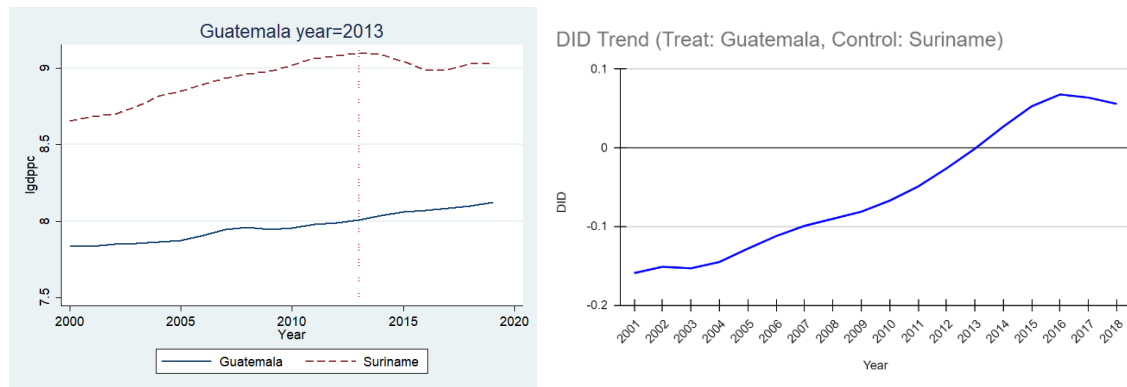
**FIGURE 3.8 GRENADA VS PANAMA**



### 3.3.3.4 Guatemala

Figure 3.9 shows Guatemala as the treated country and Suriname as the control. Suriname was chosen as it is a long-term diplomatic partner of China whereas Guatemala has long recognized Taiwan. The assessed period is from 2000 to 2018. The DID trend rises from its lowest value in 2001 but remains negative until 2013. The result is statistically significant only in the period 2001 to 2009, with a negative DID value that shows Guatemala's economy struggling. After 2014, the DID value turns positive but is statistically insignificant, so we cannot verify that Guatemala's economy outperformed that of Suriname.

**FIGURE 3.9 GUATEMALA VS SURINAME**

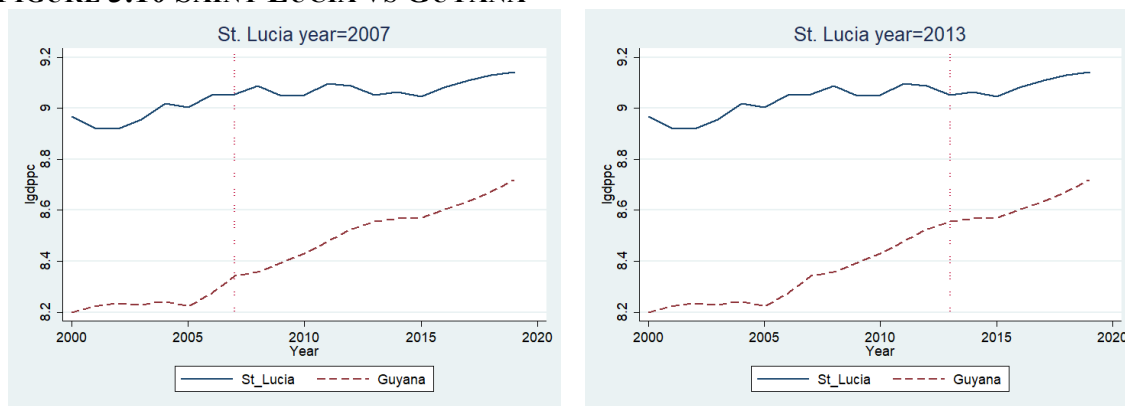


### 3.3.3.5 Saint Lucia

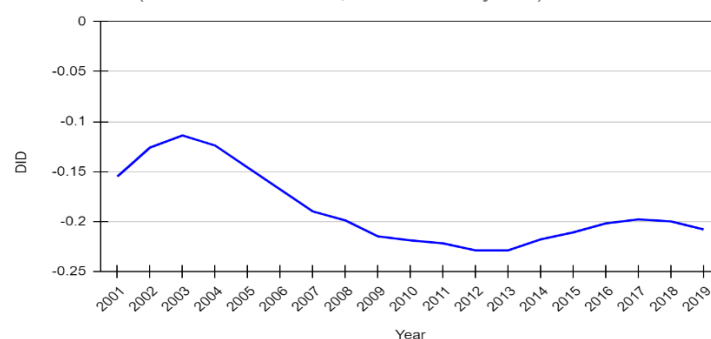
The (log of) GDP per capita trend of Saint Lucia compared with the control country, Guyana, is shown in Figure 3.10. One interruption year is 2007, when Saint Lucia re-established ties with Taiwan in 2007, while the other is 2013, when the BRI was adopted in the region. The observed period is from 2000 to 2019.

The DID trend displays a negative value and is statistically significant within the entire period, which can be interpreted as showing that Saint Lucia's economic performance lags behind that of Guyana. After establishing diplomatic ties with Taiwan in 2007, Saint Lucia presented a negative and statistically significant DID value, showing that it did not enjoy economic improvement after switching to Taiwan. In general, the DID trend value began a more pronounced decline after 2003 and a return to growth in 2013. During the period of 2003 to 2013, Saint Lucia's economy did not experience stronger growth than the control country.

**FIGURE 3.10 SAINT LUCIA VS GUYANA**



**DID Trend (Treat: Saint Lucia, Control: Guyana)**



### 3.3.4 Oceania

A total of 10 Oceanic countries – Fiji, the Marshall Islands, the Federated States of Micronesia (FSM), Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu – were selected to undergo DID analysis (see ANNEX 3.8).

As island nations in this region are generally small economies that are vulnerable to exogenous shocks, a longer empirical period was adopted to better illustrate their economic development. The empirical period is therefore set from 1970, when decolonialization started in the region, to 2019.

The control countries were selected based on their similarities to individual treated countries in three criteria: the level of GDP per capita, size of population and the country's key economic sectors. 1998 was selected as the breaking year for the Marshall Islands and Tonga, the year both countries cut ties with Taiwan. For the remaining eight states, the interruption year was set as 2006, when China initiated the first China Pacific Forum.

In the six Oceanic countries that yielded statistically significant results, three – the FSM, Palau, and Solomon Islands – presented negative DID values. That is, their

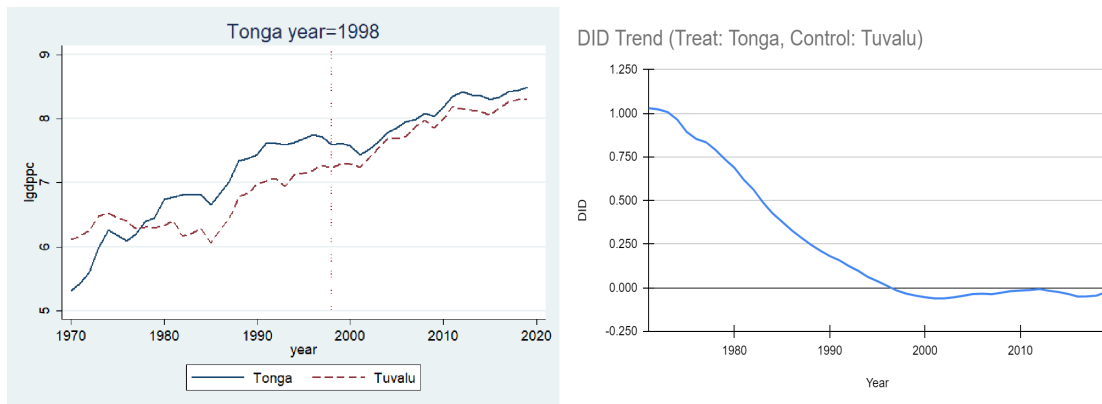
economies did not perform well relative to their control countries after 2006. Tonga also presented a negative and statistically significant DID value, meaning that it did not perform well economically compared to its control country after cutting ties with Taiwan in 1998. Samoa and Tuvalu, on the other hand, presented positive and statistically significant DID result values, illustrating a better economic performance compared to their control countries after 2006.

In this chapter, we focus on Tuvalu and Tonga for our DID regression and trend analysis. An account of other countries will be provided in Chapter 6. A table showing the DID trend for Oceanic countries is included in **ANNEX 3.9**.

### 3.3.4.1 Tonga

Figure 3.11 illustrates the DID result for GDP per capita of the treated country, Tonga, and the control, Tuvalu, for the period 1970 to 2019. Tonga cut ties with Taiwan to establish diplomatic relations with China in 1998, while Tuvalu has been a long-term partner of Taiwan. In the right graph of Figure 3.11, Tonga's DID trend is shown to have decreased during the years 1971 to 1987, and the DID result is statistically significant. That is, Tonga's economic growth compared to Tuvalu shrank significantly during this period. From 1988 to 2002, the DID trend for Tonga was still gradually decreasing, but it was not statistically significant and so we cannot confidently conclude how the economy was performing during this period. The DID trend fluctuated slightly from 2002 to 2019, and we can see that Tonga's comparative growth was largely stagnant during this period.

**FIGURE 3.11 TONGA VS TUVALU**



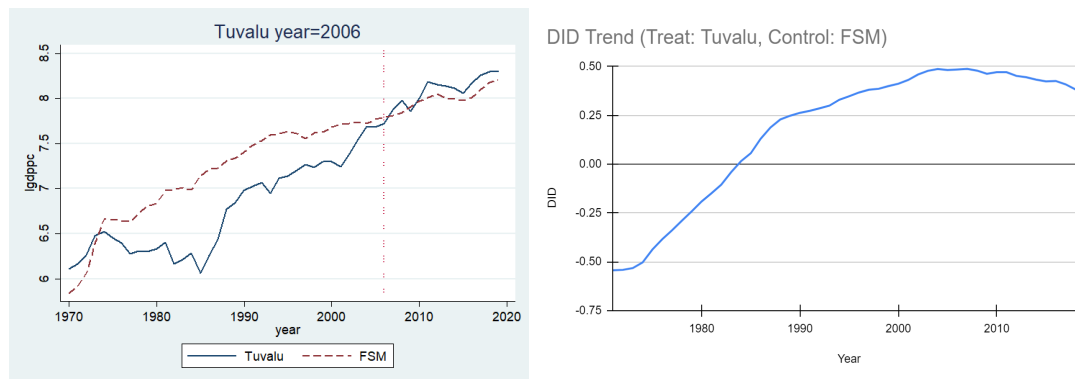


### 3.3.4.2 Tuvalu

Tuvalu's (log of) GDP per capita trend appears in the left graph of Figure 3.12, and the DID trend in the right. The treated country is Tuvalu, a long-term Taiwanese diplomatic partner in the Oceanic region, with the control country chosen as the FSM, which has long recognized Beijing. Both Micronesian countries rely heavily on fishing license fees and fisheries. The examined period is 1970 to 2019. According to the DID trend, the results are statistically insignificant in the decade from 1978 to 1988, and during this period we cannot assert whether or not Tuvalu's economy performed better. In 1989 it gives us a statistically significant empirical result and positive DID value. This indicates that Tuvalu's economy grew faster than the FSM.

According to the right graph, the DID trend reaches its highest point in 2007 with a positive DID value. In the period from 2004 to 2007, the DID trend does not fluctuate much and presents a flat curve with positive DID values for four years. This indicates that the economy performed at a high level. After 2007, the DID values began to ease off. Therefore, we find that Tuvalu enjoyed positive economic performance before 2006 and fluctuated somewhat afterwards.

**FIGURE 3.12 TUVALU VS FEDERATED STATES OF MICRONESIA**



## 3.4 Conclusion

Our empirical results show that countries switching diplomatic recognition from Taiwan to China do not necessarily enjoy a significant boost to their economic performance. The DID results indicate that of the ten African countries observed, five - Burkina Faso, Sao Tome and Principe, Senegal, South Africa, and the Gambia - experienced economic downturns after the third FOCAC took place in 2006. The meeting was followed by a sharp increase in Chinese trade and investment on the continent. (See Chapter 5). On the other hand, Chad and Malawi are observed to have experienced economic growth after 2006. However, Malawi's economic performance began to slow from 2008 to 2014 compared to

the control country, Niger. Similarly, South Africa's economy did not improve after it cut ties with Taiwan in 1998 relative to its control country, Botswana. It stagnated further after 2004.

The empirical results also show that the economy of Eswatini, Taiwan's only remaining partner in the African region, began to slow after 2015. Taiwan's main projects in the country involve agriculture, animal husbandry and medical technology. It sent a technical training team to Eswatini and selected trainees to go to Taiwan for further instruction. Internet technology remains a high priority across the continent and further high-tech assistance for Eswatini can be expected to boost economic performance.

Of the 16 CEE countries tested, five - Croatia, the Czech Republic, Hungary, Montenegro, and Slovenia - did not perform better economically than their control country, Turkey, after the launch of the 16+1 initiative. This contributed to some of the frustration heard within the CEE that the format had not delivered on its promise of growth (see Chapter 7).

Of the 33 LAC countries that were considered, 21 were aligned with Beijing and 13 of these presented negative DID values, including statistically significant and insignificant ones. The results demonstrate that these countries did not see stronger economic growth after 2013, the year when China launched the BRI. This casts doubt on China's assertions that the BRI brings great economic benefits to its partner countries. It was also observed that Costa Rica, Dominica and Grenada did not perform better than their control countries after switching recognition to China.

Of the ten Oceanic countries examined six - Fiji, the Federated States of Micronesia, Palau, Papua New Guinea, Solomon Islands, and Vanuatu - did not see a relative economic improvement compared with their control countries after 2006 when the first China Pacific Forum took place. We also see that Tonga, which switched recognition to China in 1998, still has comparatively weak economic growth, while the Taiwanese partner, Tuvalu, has enjoyed positive economic growth relative to its control country.

## **REFERENCES**

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World Bank, World Development Indicators. GDP per capita (constant 2010 US\$).

United Nations Data. GDP, Per Capita GDP - US Dollars.

### ANNEX 3.1 The Difference-in-Differences Methodology

The Difference-in-Differences model, developed by Card and Krueger (1994), was first used to analyze the impact of an increase in the minimum wage in New Jersey in 1980 on the employment of fast-food store employees. It used Pennsylvania as a control group to compare the results before and after 1980. According to Card and Krueger, “On April 1, 1992, New Jersey increased its minimum wage to \$5.05 per hour, the highest minimum wage in the United States, but the neighboring state of Pennsylvania did not follow suit and kept its minimum wage at \$4.25. The New Jersey–Pennsylvania comparison can be used to assess the employment impact of (changes in the) minimum wage.”

<b>Employment in Fast-Food Restaurant (in full-time equivalents)</b>			
	<b>Before NJ increased the minimum wage</b>	<b>After NJ increased the minimum wage</b>	<b>Difference</b>
<b>New Jersey</b>	20.4	21	0.6
<b>Pennsylvania</b>	23.3	21.2	-2.1
Difference	2.9	0.2	<b><i>DID=2.7</i></b>
<i>Difference-in-Differences</i>	<b>2.7</b>		

Source: David Card and Krueger, "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania," *American Economic Review* (September 1994), Table 3.

The above table summarizes the main results of their study. The finding is that employment in New Jersey fast-food restaurants grew rather than declined compared to Pennsylvania's. Fast food restaurants in New Jersey hired 0.6 more workers after the minimum wage increase than they had before. On the other hand, employment in Pennsylvania outlets declined by 2.1 workers. The Difference-in-Differences method concludes that a rise in the minimum wage led to an increase of 2.7 workers in the average fast-food outlet.

This methodology was well received and is now widely used in various fields where researchers wish to evaluate performance before and after an event. There are several reasons for using this measurement methodology: (1) Endogeneity problems can be avoided to a large extent. For instance, some policies or events are generally exogenous relative to economic entities. (2) The traditional method of evaluating the effect of a policy or event is typically to set a dummy variable for the occurrence of an event and then run the regression. In contrast to the simple “before and after” method, in which all change in the outcome is ascribed to the policy, the DID model nets out changes in the outcome in a control group. Thus, the DID model is more scientific because it allows separation of the policy’s impact from co-occurring general trends, leading to a more accurate estimation of the effects of the event. (3) The principles and models of DID are straight forward and easy

to understand and use. (4) It is a suitable method for our subject countries. In the initial stage of this study, we explored the possibility of using the synthetic control method (SCM), another approach for estimating the impact of a treatment on a single unit. However, counterfactual countries could not be successfully built under the SCM approach.

The main purpose of DID is to deal with the possible impact of unobservable factors on the overall economy. If we simply use the traditional regression model to explore the changes in the overall economy before and after the severance of diplomatic relations, without comparison with a control group, it is impossible to determine if the overall economy of the country we are observing was changed by other factors. The DID model solves the above-mentioned problems.

To apply the DID method, the two countries —the treated country and the control country — must be independent of each other, such that in the aftermath of the event in question one will not affect the other. That is to say, the occurrence of the event is an exogenous matter. In such cases the DID method can be used to assess the magnitude of the impact. In addition, the chosen control group must be similar in relevant ways to the experimental country. For example, region, income level, population, and culture all fall within our consideration to avoid introducing differences due to other factors.

The DID regression model is as follows:

$$Y_{it} = \alpha + \gamma D_t + \beta X_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

where  $D_t$  is a dummy variable for the observation period. The year of the event is the interruption year ( $T_0$ ). The period before the interruption year is denoted as  $P_0$ , and after the interruption year denoted  $P_1$ . After the interruption year ( $P_1$ ) is denoted  $D_t=1$ . Before the interruption year ( $P_0$ ) is denoted  $D_t=0$ .  $X_{it}$  is for the countries in our modeling pool. The treated country has dummy variable  $X_{it}=1$ , and the control country is assigned the dummy  $X_{it}=0$ . Herein  $\mu_i$  is an unobservable country characteristic. Therefore, before breaking off diplomatic relations ( $P_0$ ), the treated country and the control country do not differ, so  $X_{it}=0$ . After breaking off diplomatic relations ( $P_1$ ), the treated country is denoted  $X_{it}=1$ , while the control country keeps the designation  $X_{it}=0$ . Since equation (1) can be differenced when panel data are available (that is, the post-period minus the pre-period),  $\mu_i$  can be eliminated and the following equation is obtained:

$$\Delta Y_i = \gamma + \beta X_{ip1} + \Delta \varepsilon_i \quad (2)$$

where  $\Delta Y_i$  is the DID result, and  $\beta$ , namely the degree of economic impact on the country after the severance of diplomatic relations, which we get after differencing  $\Delta Y_i$  over the countries, is the DID estimate that we want to observe.

In addition, we also illustrate the DID trend, which adopts each DID value ( $\Delta Y_i$ ) per year and draw the curve to realize the changes of the DID result in our empirical period.

### ANNEX 3.2 DID Results for Africa

Treated country	Year	Control countries		
			DID	P>   t
Angola	2006	Nigeria	-0.016	<b>0.808</b>
Burkina Faso	2006	Mozambique	-0.171	0.014**
Central African Republic	2006	Madagascar	-0.057	<b>0.238</b>
Chad	2006	Guinea-Bissau	0.358	0.000***
Eswatini	2006	Tunisia	0.013	<b>0.767</b>
Malawi	2006	Niger	0.115	0.002***
	2008	Niger	0.117	0.000***
Sao Tome and Principe	2006	Ghana	-0.104	0.094*
	2016	Ghana	-0.121	0.076*
Senegal	2006	Zambia	-0.306	0.000***
South Africa	1998	Botswana	-0.108	0.009***
	2006	Botswana	-0.099	0.015**
The Gambia	2006	Guinea-Bissau	-0.109	0.000***

Inference: \*\*\* p<0.01; \*\* p<0.05; \* p<0.1

### ANNEX 3.3 DID Trend in Africa

Malawi vs Niger		
Year	DID	P>   t
1999	0.091	0.015**
2000	0.074	0.070*
2001	0.056	0.206
2002	0.081	0.080*
2003	0.105	0.022**
2004	0.114	0.009***
2005	0.111	0.007***
2006	0.115	0.002***
2007	0.122	0.001***
2008	0.117	0.000***
2009	0.112	0.001***
2010	0.097	0.003***
2011	0.084	0.016**
2012	0.065	0.059*
2013	0.059	0.086*
2014	0.052	0.135
2015	0.044	0.227
2016	0.036	0.336
2017	0.032	0.388
2018	0.027	0.461
2019	0.029	0.401

S. Africa vs. Botswana		
Year	DID	P>   t
1991	-0.264	0.000***
1992	-0.232	0.000***
1993	-0.209	0.000***
1994	-0.199	0.000***
1995	-0.195	0.000***
1996	-0.187	0.000***
1997	-0.182	0.000***
1998	-0.172	0.001***
1999	-0.166	0.001***
2000	-0.153	0.002***
2001	-0.147	0.003***
2002	-0.147	0.002***
2003	-0.145	0.002***
2004	-0.144	0.002***
2005	-0.147	0.001***
2006	-0.153	0.000***
2007	-0.158	0.000***
2008	-0.162	0.001***
2009	-0.165	0.001***
2010	-0.181	0.000***
2011	-0.192	0.000***
2012	-0.201	0.000***
2013	-0.211	0.000***
2014	-0.207	0.000***
2015	-0.198	0.000***
2016	-0.21	0.000***
2017	-0.213	0.000***
2018	-0.215	0.000***
2019	-0.218	0.000***

Inference: \*\*\* p<0.01; \*\* p<0.05; \* p<0.1

### ANNEX 3.4 DID results for Central and Eastern Europe

Treated country	Year	Control country		
			DID	P>   t
Albania	2012	Turkey	0.028	<b>0.744</b>
Bosnia and Herzegovina	2012	Turkey	-0.035	<b>0.663</b>
Bulgaria	2012	Turkey	-0.019	<b>0.824</b>
Croatia	2012	Turkey	-0.262	0.000***
Czechia.	2012	Turkey	-0.178	0.011**
Estonia	2012	Turkey	-0.086	<b>0.297</b>
Hungary	2012	Turkey	-0.190	0.007***
Latvia	2012	Turkey	-0.005	<b>0.959</b>
Lithuania	2012	Turkey	0.078	<b>0.405</b>
Montenegro	2012	Turkey	-0.129	0.071*
North Macedonia	2012	Turkey	-0.107	<b>0.110</b>
Poland	2012	Turkey	-0.008	<b>0.914</b>
Romania	2012	Turkey	0.020	<b>0.826</b>
Serbia	2012	Turkey	-0.080	<b>0.319</b>
Slovakia	2012	Turkey	-0.036	<b>0.646</b>
Slovenia	2012	Turkey	-0.261	0.000***

Inference: \*\*\* p<0.01; \*\* p<0.05; \* p<0.1



### ANNEX 3.5 DID Trend for Central and Eastern Europe

Czech Rep. vs. Turkey			Hungary vs. Turkey		
Year	DID	P>   t	Year	DID	P>   t
2000	-0.037	0.547	2000	-0.042	0.478
2001	-0.033	0.609	2001	-0.042	0.518
2002	-0.075	0.236	2002	-0.088	0.166
2003	-0.091	0.124	2003	-0.117	0.061*
2004	-0.103	0.072*	2004	-0.14	0.025**
2005	-0.107	0.072*	2005	-0.153	0.020**
2006	-0.109	0.090*	2006	-0.161	0.023**
2007	-0.115	0.102	2007	-0.168	0.027**
2008	-0.125	0.098*	2008	-0.171	0.030**
2009	-0.141	0.071*	2009	-0.18	0.025**
2010	-0.161	0.029**	2010	-0.191	0.011**
2011	-0.175	0.013**	2011	-0.195	0.006***
2012	-0.178	0.011**	2012	-0.19	0.007***
2013	-0.177	0.010***	2013	-0.179	0.009***
2014	-0.164	0.015**	2014	-0.161	0.016**
2015	-0.15	0.022**	2015	-0.146	0.026**
2016	-0.138	0.033**	2016	-0.13	0.049**
2017	-0.127	0.039**	2017	-0.113	0.073*
2018	-0.111	0.073*	2018	-0.083	0.174
2019	-0.094	0.134	2019	-0.053	0.377

Inference: \*\*\* p<0.01; \*\* p<0.05; \* p<0.1

### ANNEX 3.6 DID Results for Latin America and the Caribbean

Treated Country	Break Year	Control_1		
		Control Country	DID	P>   t
Antigua and Barbuda	2013	Panama	-0.488	0.000***
Argentina	2013	Saint Vincent and the Grenadines	0.014	<b>0.803</b>
Bahamas	2013	St. Kitts and Nevis	-0.180	0.000***
Barbados	2013	St. Kitts and Nevis	-0.110	0.000***
Belize	2013	Bolivia	-0.296	0.000***
Bolivia	2013	Belize	0.296	0.000***
Brazil	2013	Saint Vincent and the Grenadines	0.003	<b>0.953</b>
Chile	2013	Panama	-0.213	0.005***
Colombia	2013	Paraguay	0.007	<b>0.886</b>
Costa Rica	2007	Panama	-0.195	0.006***
	2013	Panama	-0.209	0.007***
Cuba	2013	Dominican Republic	-0.023	<b>0.781</b>
Dominica	2004	Dominican Republic	-0.146	0.008***
	2013	Dominican Republic	-0.264	0.000***
Dominican Republic	2013	Mexico	0.277	0.000***
Ecuador	2013	Paraguay	-0.082	0.075*
El Salvador	2013	Suriname	-0.007	<b>0.893</b>
Grenada	2005	Panama	-0.283	0.000***

	2013	Panama	-0.328	0.000***
Guatemala	2013	Suriname	-0.001	<b>0.984</b>
Guyana	2013	Dominican Republic	-0.076	<b>0.244</b>
Haiti	2013	Bolivia	-0.223	0.000***
Honduras	2013	Bolivia	-0.140	0.003***
Jamaica	2013	Paraguay	-0.298	0.000***
Mexico	2013	Dominican Republic	-0.277	0.000***
Nicaragua	2013	Bolivia	-0.061	<b>0.180</b>
Panama	2013	Antigua and Barbuda	0.488	0.000***
Paraguay	2013	Colombia	-0.007	<b>0.886</b>
Peru	2013	Saint Vincent and the Grenadines	0.282	0.000***
Saint Kitts and Nevis	2013	Uruguay	-0.254	0.000***
Saint Lucia	2007	Guyana	-0.190	0.000***
	2013	Guyana	-0.229	0.000***
Saint Vincent and the Grenadines	2013	Brazil	-0.003	<b>0.953</b>
Suriname	2013	Guatemala	0.001	<b>0.984</b>
Trinidad and Tobago	2013	St. Kitts and Nevis	0.022	<b>0.733</b>
Uruguay	2013	St. Kitts and Nevis	0.254	0.000***
Venezuela	2013	Panama	-0.295	0.000***

Inference: \*\*\* p<0.01; \*\* p<0.05; \* p<0.1

### ANNEX 3.7 DID Trend for Latin America and the Caribbean

Costa Rica vs Panama			Dominica vs Dominican Republic		
Year	DID	P>   t	Year	DID	P>   t
2001	-0.106	0.174	2001	-0.139	0.015**
2002	-0.129	0.097*	2002	-0.142	0.012**
2003	-0.149	0.050**	2003	-0.124	0.028**
2004	-0.168	0.023**	2004	-0.146	0.008***
2005	-0.179	0.014**	2005	-0.169	0.001***
2006	-0.186	0.008***	2006	-0.173	0.001***
2007	-0.195	0.006***	2007	-0.174	0.002***
2008	-0.201	0.008***	2008	-0.179	0.003***
2009	-0.202	0.013**	2009	-0.198	0.002***
2010	-0.205	0.010***	2010	-0.219	0.001***
2011	-0.213	0.005***	2011	-0.232	0.001***
2012	-0.213	0.005***	2012	-0.247	0.000***
2013	-0.209	0.007***	2013	-0.264	0.000***
2014	-0.2	0.011**	2014	-0.279	0.000***
2015	-0.191	0.016**	2015	-0.303	0.000***
2016	-0.181	0.023**	2016	-0.318	0.000***
2017	-0.174	0.027**	2017	-0.346	0.000***
			2018	-0.349	0.000***

Grenada vs Panama			Guatemala vs Suriname		
Year	DID	P>   t	Year	DID	P>   t
2001	-0.195	0.009***	2001	-0.159	0.000***
2002	-0.201	0.007***	2002	-0.151	0.000***
2003	-0.223	0.002***	2003	-0.153	0.000***
2004	-0.264	0.001***	2004	-0.145	0.000***
2005	-0.283	0.000***	2005	-0.128	0.002***
2006	-0.323	0.000***	2006	-0.112	0.008***
2007	-0.341	0.000***	2007	-0.099	0.023**
2008	-0.356	0.000***	2008	-0.09	0.050*
2009	-0.364	0.000***	2009	-0.081	0.090*
2010	-0.367	0.000***	2010	-0.067	<b>0.158</b>

2011	-0.367	0.000***	2011	-0.049	<b>0.308</b>
2012	-0.356	0.000***	2012	-0.026	<b>0.596</b>
2013	-0.328	0.000***	2013	-0.001	<b>0.984</b>
2014	-0.293	0.000***	2014	0.027	<b>0.578</b>
2015	-0.269	0.001***	2015	0.053	<b>0.266</b>
2016	-0.252	0.001***	2016	0.068	<b>0.152</b>
2017	-0.237	0.002***	2017	0.064	<b>0.161</b>
			2018	0.056	<b>0.187</b>

<b>St. Lucia vs Guyana</b>		
<b>Year</b>	<b>DID</b>	<b>P&gt;   t  </b>
2001	-0.155	0.001***
2002	-0.126	0.010**
2003	-0.114	0.016**
2004	-0.124	0.007***
2005	-0.146	0.002***
2006	-0.168	0.000***
2007	-0.190	0.000***
2008	-0.199	0.000***
2009	-0.215	0.000***
2010	-0.219	0.000***
2011	-0.222	0.000***
2012	-0.229	0.000***
2013	-0.229	0.000***
2014	-0.218	0.000***
2015	-0.211	0.000***
2016	-0.202	0.000***
2017	-0.198	0.000***
2018	-0.208	0.000***
2019	-0.200	0.000***

Inference: \*\*\* p<0.01; \*\* p<0.05; \* p<0.1

### ANNEX 3.8 DID Results for Oceania

Treated Country	Break Year	Control_1		
		Control Country	DID	P>   t
Fiji	2006	NCL	-0.019	<b>0.837</b>
Marshall	1998	FSM	0.013	<b>0.869</b>
Micronesia	2006	Tuvalu	-0.465	0.000***
Palau	2006	Cook ISL	-0.320	0.026**
Papua New Guinea	2006	El Salvador	-0.03	<b>0.823</b>
Samoa	2006	Tuvalu	0.293	0.026**
Solomon	2006	Samoa	-0.482	0.000***
Tonga	1998	Tuvalu	-0.327	0.067*
Tuvalu	2006	FSM	0.458	0.000***
Vanuatu	2006	New Caledonia	-0.047	<b>0.485</b>

Inference: \*\*\* p<0.01; \*\* p<0.05; \* p<0.1

### ANNEX 3.9 DID Trend for Oceania

Tuvalu vs. FSM		
Year	DID	P>   t
1971	-0.543	0.000***
1972	-0.541	0.000***
1973	-0.532	0.000***
1974	-0.503	0.007***
1975	-0.437	0.035**
1976	-0.384	0.059*
1977	-0.338	0.081*
1978	-0.289	0.117
1979	-0.241	0.174
1980	-0.191	0.269
1981	-0.149	0.375
1982	-0.105	0.528
1983	-0.041	0.803
1984	0.015	0.926
1985	0.056	0.715
1986	0.13	0.386
1987	0.188	0.198
1988	0.229	0.108
1989	0.248	0.084*
1990	0.263	0.067*
1991	0.273	0.061*
1992	0.286	0.053*
1993	0.3	0.046**
1994	0.33	0.028**
1995	0.348	0.022**
1996	0.367	0.016**
1997	0.381	0.013**
1998	0.386	0.011**
1999	0.4	0.008***
2000	0.412	0.006***
2001	0.431	0.004***
2002	0.459	0.002***

Tonga vs. Tuvalu		
Year	DID	P>   t
1971	1.03	0.000***
1972	1.023	0.000***
1973	1.007	0.000***
1974	0.964	0.000***
1975	0.893	0.000***
1976	0.853	0.000***
1977	0.835	0.000***
1978	0.791	0.000***
1979	0.737	0.000***
1980	0.688	0.001***
1981	0.618	0.002***
1982	0.563	0.005***
1983	0.489	0.014**
1984	0.427	0.028**
1985	0.379	0.045**
1986	0.33	0.065*
1987	0.288	0.094*
1988	0.248	0.138
1989	0.213	0.213
1990	0.182	0.296
1991	0.158	0.372
1992	0.125	0.494
1993	0.097	0.6
1994	0.062	0.739
1995	0.038	0.838
1996	0.012	0.95
1997	-0.015	0.938
1998	-0.033	0.861
1999	-0.045	0.812
2000	-0.054	0.772
2001	-0.061	0.74
2002	-0.061	0.731

2003	0.478	0.001***
2004	0.487	0.001***
2005	0.482	0.001***
2006	0.485	0.001***
2007	0.488	0.000***
2008	0.479	0.001***
2009	0.463	0.001***
2010	0.471	0.001***
2011	0.471	0.001***
2012	0.452	0.001***
2013	0.445	0.002***
2014	0.433	0.003***
2015	0.424	0.005***
2016	0.426	0.003***
2017	0.409	0.004***
2018	0.383	0.006***
2019	0.369	0.008***

2003	-0.055	0.749
2004	-0.046	0.783
2005	-0.036	0.83
2006	-0.034	0.837
2007	-0.037	0.817
2008	-0.028	0.86
2009	-0.019	0.908
2010	-0.016	0.92
2011	-0.013	0.935
2012	-0.007	0.964
2013	-0.017	0.918
2014	-0.024	0.885
2015	-0.035	0.835
2016	-0.05	0.763
2017	-0.049	0.761
2018	-0.045	0.783
2019	-0.025	0.877

Inference: \*\*\* p<0.01; \*\* p<0.05; \* p<0.1