Sovereign wealth funds and economic growth

Ermanno Affuso1 · Khandokar M. Istiak2 · Alex Sharland3

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Abstract
A synthetic control method in a comparative case study evaluates the potential effect of a sovereign wealth fund on the economic growth of a country. Trinidad and Tobago (T&T) is the focus of the case study. This is the first empirical research in the economic literature that attempts to evaluate the impact of a sovereign wealth fund on economic growth of an emerging economy. The results provide evidence that the fund contributed to a higher real per capita GDP of T&T by an estimate of $5104.57 (2010 US$) per year. The cumulative 30 years’ welfare impact of the fund is approximately $107,196 (2010 US$) per capita. Small island economies should consider implementing similar programs to foster economic growth.

Keywords Economic development · Sovereign wealth funds · Synthetic control method · Small island developing states · Trinidad and Tobago

JEL Classification C54 · E21 · O11

Introduction
A sovereign wealth fund (SWF) is a state-owned investment fund usually derived from a country’s surplus reserves. It acts as a stabilizer by investing a country’s surplus money in other countries (Butt et al. 2008). The main purpose of SWFs is to enhance sustainable growth and preserve the welfare of future generations (Aizenman and Glick 2007; Beck and Fidora 2008; Urban 2011). The Permanent School Fund of 1854, followed by the Permanent University Fund of 1876, established by the State of Texas, was the first SWF designed to use excess oil revenues to fund educational institutions in an attempt to promote human capital formation (Dewenter et al. 2010). Along the same lines, almost a century later, Kuwait started the Kuwait Investment Authority, a modern SWF that aims to invest excess oil revenues and promote economic growth (Kuwait Investment Authority, 2021). A more comprehensive literature review on the history of Sovereign Wealth Funds is available in Alhashel (2015).

The size and number of SWFs have increased dramatically in recent times. According to the SWF Institute1, there are 89 SWFs with accumulated assets of nearly $8.2 trillion dollars in 2020. In the literature of SWFs, it is possible to identify three main streams of research. The first stream focuses on the overview and growth of SWFs (Bahoo et al. 2019; Clarke 2016; Eldredge 2019; Monk 2011; Bagger 2010). There is another interesting study from Bagattini (2011) who uses the data of 12 countries over the period of 1992–2007 and investigates whether SWFs have improved the fiscal position and success of the countries.

The second stream of research focuses on the governance and political bias of SWFs particularly in emerging democracies (Cohen 2009; Gilson and Milhaupt 2007; Paltrinieri et al. 2014). Finally, the last and largest stream of research addresses investment strategies of SWFs. In this area, it is possible to identify studies that analyze the association

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1 Economics and Finance, 314 Mitchell College of Business, University of South Alabama, Mobile, USA
2 Economics and Finance, 308 Mitchell College of Business, University of South Alabama, Mobile, USA
3 Marketing and Quantitative Methods, 359 Mitchell College of Business, University of South Alabama, Mobile, USA

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1 https://www.swfinstitute.org/fund-rankings/sovereign-wealth-fund (accessed on 11/20/20).
between SWFs and target firm value, risk, and performance (Bertoni and Lugo 2014; Bortolotti et al. 2015; Urban 2016; Gangi et al. 2019) and other studies that use innovative empirical methods to analyze the investment strategies effectiveness (Miceli 2013; Boubakri et al. 2017 Debarsy et al. 2017).

Bahoo et al. (2020) conducted an extensive literature review based on 184 manuscripts of the current state of research on SWFs. The authors identified literature gaps and future research questions, including the role of an SWF in the economic stability and growth of a country that implemented it. Garg and Shukla (2021) conducted a systematic literature review of SWF based on 102 studies even more recently. Garg and Shukla’s review attempts to understand the implication of SWF on investors, host economies, and the world economy. The authors argue that less than a third of the reviewed studies are related to the impact of SWF on its hosting economy focusing mainly on global perspectives or commodity-rich countries. Interestingly, the authors point out that even though SWF have been implemented since the 1950s, they did not spark interest in academic research until 2008–2011. The authors conclude that most of the literature on SWF comprises qualitative studies, suggesting the need for more rigorous empirical research. Based on the premises of Bahoo et al. (2020) and Garg and Shukla (2021), the current empirical study explores whether the existence of a SWF can influence the economic growth of its host economy.

The research uses Trinidad and Tobago (T&T), a small developing economy in the Caribbean region, as a case study to explore the impact of the SWF on its economy. There is a specific reason for choosing T&T as a case study. Small Island Developing States (SIDS) have been a priority for United Nations policy since the 1990s (UN Millennium Goals 2005; Ghina, 2003). The latest development in this effort is the Samoa Pathway adopted in the Third International Conference on Small Island Developing States held in Apia, Samoa, on September 1–4, 2014, with a view to achieving sustainable development for the SIDS. Among the SIDS, the Caribbean countries have some unique characteristics. These developing countries are known as the “blue economy” with a focus on sustainable use of ocean resources (Silver et al. 2015). They have access to major markets in North and South America and most of them have made the transition from agriculture or mining to a service-driven economy. They are also extremely vulnerable to climate change and natural disasters.

Among all the Caribbean countries, T&T has accomplished sustainable growth in recent years (Elias-Roberts 2021). This country has consistently achieved economic progress as measured across a range of metrics. According to one source2, the country had the highest annual GDP of US $23.81 billion, fourth-highest per capita GDP of US $17,130, and the second lowest debt-GDP ratio among the Caribbean countries. It is also the only country among the Caribbean countries (or other SIDS countries) may start building a fund to improve economic growth and mitigate business-cycle fluctuations. Thus, the T&T case study may be a solid research platform to test whether or not this government policy is consistent with the objectives of the Samoa Pathway for the development of the SIDS.

According to PwC3, there are three macroeconomic objectives of a SWF. The first is creating a capital base for the preservation and growth of national wealth by investing excess reserves into diversified assets. The second objective is to stabilize the macroeconomic environment by using the SWF to decrease the volatility of government spending during crisis periods. The last objective is to promote economic development by investing in capital assets (energy, transport, water management, communication, etc.) and social infrastructure (e.g., education, health, human capital).

The SWF in T&T has contributed substantially to the economy and helped to mitigate the detrimental effects of the 2015 crash of energy prices. According to the 2016 annual report (Ministry of Finance of T&T4), the government of T&T withdrew $375.05 million during the budget crisis to contribute to its annual budget. According to Labadie and Thompson (2016, pp. 16),

“The fund uses excess revenue from petroleum operations to cushion the impact on or sustain public expenditure capacity during periods of revenue downturn caused by a fall in prices of crude oil or natural gas.”

The government also used US$251 million from the fund to finance the budget of 2017; in particular, the Development Programme, also known as the Public Sector Investment Programme (PSIP). According to Trinidad and Tobago Newsday5, because of the COVID-19 pandemic, the government of T&T has taken steps to allow for emergency

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2 https://countryeconomy.com/countries/groups/caribbean-community (accessed on 11/30/20).
3 https://www.pwc.com/gx/en/sovereign-wealth-investment-funds/publications/assets/pwc-the-taxonomy-of-sovereign-investment-funds.pdf (accessed on 11/20/20).
4 https://www.ifswf.org/sites/default/files/annual-reports/HSF%20Trinidad%202016%20Annual%20Report%202016.pdf (accessed on 11/20/20).
5 https://newsday.co.tt/2020/04/17/put-some-hsf-towards-retraining/ (accessed on 11/20/20).
drawdowns of at most US$1.5 billion from the fund that will be used for salary relief grants and food cards, trade payables, VAT refunds, and income tax refunds.

Although the SWF has played a major role in the development of the economy of T&T in the past (and possibly will continue to do so in the post-COVID period), surprisingly, there is no empirical study exploring the contribution of a SWF to economic growth. In fact, to the best of our knowledge, this is the first empirical study investigating the impact of any SWF on the economic performance of any single country. The current study extends the literature by investigating the impact of a SWF on one small developing country, which may provide clues to similar countries considering this pathway (e.g., Guyana).

This study poses a counterfactual research question; that is, “Would Trinidad and Tobago’s economic performance have been different without the SWF?” The answer to this question is important because, if the SWF had a significant positive economic impact on the economy of T&T, other Caribbean or SIDS countries may consider replicating this strategy and reap the benefit enjoyed by T&T.

This study is unique in the literature of SWFs for two main reasons. It is the first study that assesses the impact of a SWF on the economic growth of a SIDS. Second, whereas other studies use a simple panel OLS methodology (Bagattini 2011) or institutional and factual analyses (El-Kharouf et al. 2010) to examine the impact of a SWF, this research uses a more sophisticated technique by using the synthetic control method to conduct a counterfactual analysis. The superiority of this method over traditional regression models is discussed in Abadie et al. (2010: pp 494). Specifically, "Relative to traditional regression methods, transparency and safeguard against extrapolation are two attractive features of the synthetic control method."

The superiority of the synthetic control method (SCM) over the difference-in-difference (DiD) regression method is discussed in Bouttell et al. (2018: pp.2), "Unlike DiD approaches, SCM does not rely on parallel pre-implementation trends. Given that it is sometimes difficult to establish whether the parallel trends assumption is met, this method provides a useful supplementary method to DiD. Finally, SCM allows for unmeasured time-varying confounders, whereas DiD only allows for measured time-varying confounders."

Recently, the synthetic control method has been used by Berardi et al. (2016) to estimate the tax incidence of a “soda tax” on French consumers. Chung et al. (2016) used this method to analyze the impact of the Alaska Permanent Fund Dividend on newborns’ health outcomes. Quast and Gonzalez (2017) also used this technique to examine the impact of sex-work regulations on sexually transmitted diseases in Mexico.

The manuscript is organized in five sections. The second section describes the history and structure of the SWF in T&T. The third section discusses the theoretical motivation, the fourth section discusses the data. The subsequent sections disclose the empirical model, findings, and results discussion. The last section concludes the study.

The history and structure of sovereign wealth fund of Trinidad and Tobago

The Interim Revenue Stabilisation Fund (IRSF), the SWF of T&T, was first announced in 1997. According to the T&T Guardian6, the IRSF was created as a “rainy day” fund in T&T on September 29, 2000. The IRSF started its journey with a balance of US$415 million. Later on, the Heritage and Stabilisation Fund (HSF) was founded in March 2007 by the Parliamentary Act 6 of 2007. The HSF started with a balance of US$1.4 billion which was transferred from the IRSF.

The HSF long-term fund has two elements; a stabilization component to protect fiscal policy from large fluctuations in energy sector revenues, and a savings component for the benefit of future generations. The government keeps the fund (HSF) separate from the overall foreign exchange reserves. The government owns the fund and it is managed by an independent board comprising of the representatives from the Ministry of Finance, the Central Bank of T&T, and three representatives from the private sector. The fund is controlled in a transparent way. The Central Bank reports the latest status of the fund to the Board quarterly, and the Board reports it to the Minister of Finance annually. The Minister of Finance reports the status of the HSF to Parliament annually.

The HSF has three objectives with respect to the economy of T&T. First, it provides support continuing public expenditures during periods of revenue downturns. Second, the HSF generates an alternate source of income to support public expenditure during a revenue downturn caused by the depletion of non-renewal petroleum resources. Finally, it provides a heritage source of funds for future generations; income derived from today’s excess petroleum revenues.

The HSF invests in medium to long-term foreign currency denominated assets, fixed income securities, and equities. The Board makes decisions about the strategic asset allocations. The fund is operated with a view to achieving a target rate of return. According to the International Forum

6 (https://www.guardian.co.tt/news/govts-worldwide-drawdown-on-their-sovereign-wealth-funds-6.2.1114107.0636893706 (accessed on 11/21/20).
of Sovereign Wealth Funds\(^7\), 60% of the difference between the actual tax revenue and the estimated tax revenue from oil and gas are accumulated in the HSF annually.

According to the Heritage and Stabilisation Fund Quarterly Investment Report\(^8\), the portfolio valuation of HSF was approximately US$6.48 billion on December 31, 2019. Out of the US$6.48 billion of net assets, US$1.29 billion was US core domestic equity and US$4.03 billion was US dollar denominated fixed income instruments. So, 82.10% of the HSF assets were invested in the US financial market on December 31, 2019. The portfolio quarterly return was 1.05% in the last quarter of 2019.

**Theoretical consideration**

When a SWF is initiated by a government, it can affect different components of the economy. According to the theory of Classical dichotomy, the nominal and real variables of a country are different and the economy may respond differently to policy changes in the short and long run. According to the sticky prices assumption (under the Keynesian hypothesis), short-run aggregate supply is horizontal. According to the flexible prices assumption (under the neoclassical view), long-run aggregate supply is vertical. So, to get a complete picture, it is essential to explore the impact of a SWF on both nominal and real variables in the short and long run. Therefore, the “aggregate demand–aggregate supply” framework (Fig. 1) has been used to investigate the growth impact of a SWF in a country.

Before the introduction of the SWF, the long-run equilibrium of the country is \( E_1 \), with aggregate demand (\( AD_1 \)), short-run aggregate supply (\( SRAS_1 \)), and long-run aggregate supply (\( LRAS_1 \)) cross at \( E_1 \). The introduction of the SWF may have three possible effects on the economy.

First, policymakers may use the fund to boost both physical capital (by investing in natural resources and infrastructure) and human capital (by investing in education and health sectors). This course shifts the long-run aggregate supply curve from \( LRAS_1 \) to \( LRAS_2 \).

Second, as capital and labor are complementary, more labor is required when the SWF is used to increase the physical capital stock. This increases demand for labor (mostly blue-collar workers) and increases their wages. Moreover, when the SWF is used to increase the human capital stock, the marginal product of skilled labor (mostly white-collar workers) and their wages go up. Overall, wages may go up when the SWF is used to increase the capital stock of a country. This course shifts the short-run aggregate supply curve from \( SRAS_1 \) to \( SRAS_2 \).

Third, besides investment, a SWF is also used by many countries to operate different programs like salary relief grants, food cards, VAT refunds, and income tax refunds. These programs increase consumption. Higher investment and consumption increase aggregate demand from \( AD_1 \) to \( AD_2 \).

After the introduction of a SWF, the above-mentioned three effects may shift the long-run equilibrium of the country from \( E_1 \) to \( E_2 \). The growth path of the economy with a SWF can be shown by the arrows from \( E_1 \) to \( E_2 \), which increases real GDP from \( Y_1 \) to \( Y_2 \).

The impact of a SWF on economic growth can also be explained by the growth model of Harrod (1939) and Domar (1946). According to their model, the economy incurs a fixed coefficient production function indicating that the capital-output ratio is constant, i.e., \( \frac{K}{Y} = \alpha \), with \( K \) being capital, \( Y \) is output, and \( \alpha \) is the constant ratio. Since \( \alpha \) is constant, the previous relationship can also be written as \( \frac{dK}{dY} = \alpha \). The GDP growth rate \( g_Y = \frac{dY}{Y} = \frac{dK/\alpha}{K/\alpha} \) is also the capital growth rate. At the equilibrium, \( I = S \), where \( S \) is the stock of savings. Now, \( S = sY + u(SWF) \) with \( s \) being the savings rate from \( Y \) and \( u \) is the SWF utilization rate. Hence, we can rewrite the change in capital stock as: \( dK = sY + u(SWF) - \delta K \). The GDP growth rate can be expressed as \( g_Y = \frac{sY + u(SWF) - \delta K}{K} \).
Furthermore, per capita GDP can be expressed as $\frac{Y}{L}$ where $L$ is the population. Therefore, $y = \frac{Y}{L}$ in per capita terms. By taking the logarithm on both sides of the previous relationship, we obtain $\log(y) = \log(Y) - \log(L)$. Differentiation of the latter relationship with respect to time $t$ leads to

$$\frac{d \log(y)}{dt} = \frac{d \log(Y)}{dt} - \frac{d \log(L)}{dt} \quad \text{or} \quad \frac{dy}{dt} = \frac{dY}{dt} - \frac{dL}{dt} \frac{L}{Y}.$$

Finally, the growth rate of per capita GDP, $g_y = g_Y - g_L$, encapsulates the SWF ($u$) utilization rate which has a positive impact on both real GDP and real per capita GDP as shown by the following relationship

$$g_Y = sY + u(SWF) - \frac{\partial K}{K} - \eta \quad (2)$$

where $\eta$ is the labor growth rate.

### Data

In order to evaluate the impact of the SWF on the T&T economy, we conduct a counterfactual analysis and create a synthetic control version of T&T. The controlled synthetic version represents T&T without the existence of the SWF. To do that, we need to use a set of small island countries that have similar social and economic structures to that of T&T. In this respect, we use the other CARICOM countries to represent the synthetic T&T. According to the website of the CARICOM Caribbean Community\(^9\), all CARICOM countries are developing economies with many similar characteristics. Their land size and population are small, they have access to major markets in North and South America, and most of them made the transition from agriculture or mining to a service-driven economy. Consequently, we believe that the other CARICOM countries represent the best comparators to create a synthetic T&T. In this paper, we use 13 CARICOM countries which were the original co-founders of CARICOM with T&T, to construct the synthetic control T&T and conduct the counterfactual analysis.

We use a sample of 812 observations from 14 economies (the founding members of CARICOM) from 1960 to 2017. These countries are; Antigua and Barbuda, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and The Grenadines, Suriname, and Trinidad and Tobago. The panel data draws information from annual real per capita GDP (expressed in constant 2010 US$), annual energy use (Kg of oil equivalent per capita), annual per capita gross capital formation (expressed in constant 2010 US$), the labor force participation rate (as a proxy for annual labor), and annual per capita agricultural land expressed as hectare/person. These data are publicly available at the World Development Indicators internet repository of The World Bank. Some of the missing observations have been imputed using the multiple imputation procedure based on chained equations developed by van Buuren and Groothuis-Oudshoorn (2010). The descriptive statistics are reported in Table 1 and shown in Fig. 2.

The six panels in Fig. 2 illustrate the countries average variation of the stochastic economic processes within the time-series dimension. A clear positive trend in the

\(^{9}\) https://caricom.org (accessed on 11/23/20).
CARICOM average per capita real GDP is visible in the top-left panel, in spite of two major recessions: 1974–1976 and 2008–2009. It is also interesting to notice a sharp rise in the average per capita gross capital formation by the end of the 1990’s. A pronounced positive trend is noticeable in the labor force participation rate, while a less pronounced positive trend is detectable in average per capita use of energy. The average per capita agricultural land use has been almost constant between 1960 and 2017. The population shows a very small positive trend for the CARICOM countries between 1960 and 2017.

**Empirical model**

To assess the potential impact of the SWF on economic growth, we use a nonparametric synthetic control method for comparative studies as formulated by Abadie and Gardeazabal (2003) and Abadie et al. (2010). The rationale behind the synthetic control method is to find a convex combination of control CARICOM economies that resembles the economy of Trinidad and Tobago. Such a convex combination is found through optimal weights that minimize the distance between the data characteristics of T&T and those of the CARICOM control units. More formally, we observe the CARICOM units $j = 1, 2, \ldots, 13 +$ Trinidad and Tobago\footnote{Trinidad and Tobago is assumed to be the fourteenth observed unit.} from $t = 1960, 1961, \ldots, 2017$. The SWF of T&T was established in 2000. The 13 CARICOM control economies constitute the donor pool.
and we consider the intervention, i.e., the T&T Interim Revenue Stabilisation Fund (IRSF), occurring in the year 2000, therefore, we observed the pre-intervention periods $t = 1960, 1961, \ldots, 2000$ and the post-intervention periods $\tau = 2001, 2002, \ldots, 2017$. We define two possible GDP outcomes for unit $i$ in year $t$: $Y_{it}^0$, i.e., GDP of unit $i$ in year $t$ if the economy was not exposed to the intervention, and $Y_{it}^1$, i.e., GDP of unit $i$ in year $t$ if the economy was exposed to the intervention.

The aim of our study is to measure the impact of the T&T’s SWF on the Gross Domestic Product of this country in the post-intervention period. Therefore, we measure the impact as the post-intervention difference of the observed outcome $Y_{it}^1$, and the counterfactual GDP, i.e., $Y_{0t}^\tau$ in the counterfactual instance that T&T did not implement the SWF. Such an impact would be $\delta_t = Y_{it}^1 - Y_{0t}^\tau$, which is essentially a generalization of the difference-in-differences panel estimator with fixed-effects varying over time. Since we do not observe the counterfactual outcome $Y_{0t}^\tau$, we use the synthetic control method to recover the unobserved outcome as a convex combination of the outcomes observed in the donor pool. Hence, the outcome will be $\delta_t = Y_{it}^1 - \sum_{j=1}^{13} w_{ij} Y_{jt}^0$, where the optimal weights are estimated as

$$\arg \min_{w_{ij}} \sqrt{(\Gamma^1 - \Gamma^0 W)^\top \Lambda (\Gamma^1 - \Gamma^0 W)}$$

with $w_{ij} \geq 0$ and $\sum w_{ij} = 1$ \hspace{1cm} (3)

where $\Gamma^1 = (X_{14}', Y_{14}^0, \ldots, Y_{14}^3)'$ is a $9 \times 1$ vector of pre-intervention characteristics for T&T which comprises: (i) A 4 \times 1 vectors of covariates $X_{14} = [(\text{Capital}_{14}/\text{POP}_{14})', \text{Labor}_{14}', \text{Energy}_{14}', (\text{Land}_{14}/\text{POP}_{14})']'$, and (ii) A 5 \times 1 vector of special predictors obtained as linear combinations of pre-intervention outcomes which includes per capita GDP and the predictors $X = [(\text{Capital}/\text{POP})', \text{Labor}', \text{Energy}', (\text{Land}/\text{POP})']'$ each year prior to $\tau$ in order to ensure that $Y_{14} = \sum_{j=1}^{13} w_{ij} Y_{jt}^0$ and $X_{14} = \sum_{j=1}^{13} w_{ij} X_{jt}^0$ do not have to hold exactly if they are outside the convex hull of the control units; $\Gamma^0$ is a $9 \times 13$ matrix with the $j$th row ($X_{14}', Y_{14}^0, \ldots, Y_{14}^3)'$ with elements previously defined. The $9 \times 9$ positive semidefinite matrix $\Lambda$ allows the optimal weights $w_i$ that minimize the distance $||\Gamma^1 - W \Gamma^0||$ to be a function of the variables predicting power. The objective function (3) can be minimized with any modern algorithm of nonlinear optimization.

Abadie and Gardeazabal (2003) proposed a placebo or falsification test as an inferential technique that is similar to the refutability test by Angrist and Krueger (1999).

This test is based on a random permutation of the intervention assignment to any unit of the treated and control groups. In other words, the test consists of applying the synthetic control method to any CARICOM economy of the donor pool. This process generates a sample of 14 synthetic control CARICOM economies (13 from the donor pool if they had counterfactually implemented a SWF and the synthetic T&T). Subsequently, for each synthetic control unit in the sample, we determine the gap in economic growth due to the intervention after $\tau$ and compute the mean squared prediction errors of these gaps between pre- and post-intervention. If the treated unit has the largest (in magnitude) post- to pre-intervention mean squared prediction error (MSPE) ratio within the sample, there is statistical evidence of impact of the intervention. In our case, if one would randomly assign the intervention to any CARICOM economy from the donor pool, the probability of having a post-/pre-intervention MSPE ratio of the same magnitude of T&T would be $1/14 = 7.14\%$ (Abadie et al. 2010: 502–503).

### Table 2: Difference-in-differences Models for different intervention starting periods

| $\tau$ | $\Delta$ | AIC | BIC | RMSE $\sigma_c$ |
|--------|---------|-----|-----|----------------|
| 1995   | 2578 (1789) | 16,549 | 16,573 | 6407 | 6411 |
| 1996   | 2877 (1803) | 16,549 | 16,572 | 6406 | 6410 |
| 1997+  | 3176+ (1821) | 16,549 | 16,572 | 6405 | 6409 |
| 1998   | 3469+ (1841) | 16,549 | 16,572 | 6407 | 6411 |
| 1999   | 3753+ (1866) | 16,550 | 16,573 | 6409 | 6413 |
| 2000b  | 4027+ (1864) | 16,551 | 16,574 | 6414 | 6418 |
| 2001   | 4303+ (1927) | 16,553 | 16,576 | 6422 | 6426 |
| 2002   | 4577+ (1965) | 16,554 | 16,578 | 6429 | 6411 |
| 2003   | 4826+ (2008) | 16,555 | 16,580 | 6436 | 6409 |
| 2004   | 4980+ (2058) | 16,559 | 16,582 | 6447 | 6410 |
| 2005   | 5091+ (2116) | 16,562 | 16,585 | 6459 | 6411 |

Standard errors in parentheses; *90%, **95% confidence; $\tau(0/1)$ is a dummy variable that picks value 1 on and after each intervention starting time and zero otherwise; $\delta = \text{change in annual Trinidad and Tobago per capita GDP due to intervention}; \text{AIC Akaike information criterion}; \text{BIC Bayesian information criterion}; \text{RMSE root mean square error}; \sigma_c = \text{residuals standard deviation (808 degrees of freedom)}; \text{Year when the Heritage fund was started}.

### Empirical findings

In comparative studies, it is a good practice to allow the starting time of the intervention to be in the neighborhood of $\{\tau - 5, \tau - 4, \ldots, \tau - 1, \tau, \tau + 1, \ldots, \tau + 4, \tau + 5\}$, i.e., 5 years before and after the intervention. To test the sensitivity of the data to the different start time of the intervention, we use ordinary least squares to estimate a simple difference-in-differences model such as $Y_{it} = \alpha_i + \tau_t + \delta D_{it} + \epsilon_{it}$. We estimate...
Table 3: Optimal weights for the Synthetic Trinidad and Tobago

| Economy                        | Weights (w_j) |
|--------------------------------|---------------|
| Antigua and Barbuda            | 0.000         |
| The Bahamas                    | 0.102         |
| Barbados                       | 0.000         |
| Belize                         | 0.000         |
| Dominica                       | 0.000         |
| Grenada                        | 0.000         |
| Guyana                         | 0.001         |
| Haiti                          | 0.000         |
| Jamaica                        | 0.278         |
| Saint Kitts and Nevis          | 0.000         |
| Saint Lucia                    | 0.000         |
| Saint Vincent and The Grenadines| 0.000         |
| Suriname                       | 0.619         |

w_i = 0 suggests that the information from the economy data did not contribute to constructing the synthetic control economy; w_i ≠ 0 suggests that the economy shares similar economic characteristics with the treated unit, thereby working as an information donor to construct the synthetic control economy.

11 different models based on different starting time and use the Akaike and Bayesian information criteria, root mean square error, and residuals’ standard error as a comparative tool to select r that minimize the predictive information loss based on available data. In Table 2, we report a comparison of 11 different values of the impact of the intervention based on different starting periods using a simple difference-in-differences model.

The model that better represents the reality with minimum information loss (AIC = 16,549; BIC = 16,572), the lowest root mean square (RMSE = 6405), and the lowest regression standard errors (σ_ε = 6409). This result is consistent with the hypothesis that circulating information about the future possibility of establishing the SWF could have created positive expectations that may have triggered economic growth prior to 2000. In fact, based on the difference-in-differences estimator, the increase in real per capita GDP after 1997 could have been approximately $3,176/year (expressed in constant 2010 US$) in T&T.

Based on the premise that expectations could have triggered economic growth prior to 2000, we set the calibration time interval for the synthetic control method optimizer of (3) between 1960 and 1997. In Table 3, we report the optimal weights (w) that minimize the distance between the treated unit and its synthetic counterpart.

The table shows that the GDP of T&T prior to 1997 is best represented by a convex combination of The Bahamas, Guyana, Jamaica, and Suriname. In Table 4, we compare the descriptive statistics for T&T, Synthetic T&T, and the other economies in the donor pool. In the same table, we also report the optimal weights A that minimize the mean squared prediction error of the real per capita GDP in Trinidad and Tobago prior to 1997.

Table 4 depicts how well the economic variables match in observed (actual) T&T and synthetic T&T. As in Table 1, it can be discerned that the range of per capita use of energy between observed and synthetic T&T (1081.16, 3712.80) falls outside the convex hull of the donor pool data (755.80).

11 This is represented by the value of δ associated with the year of 1997 in Table 2.
However, the inclusion of $\Lambda$ should mitigate this problem by providing more predictive power (weight) to real per capita GDP (0.334) and labor (0.383) prior to 1997.

A graphical representation of the synthetic control method is provided in Fig. 3 that shows a sharp increase in real per capita GDP growth for T&T, after the year 1997, compared to the synthetic control counterpart. Table 5 reports the numerical gap in per capita real GDP between observed and counterfactuals. Fig. 4 represents the gap in per capita real GDP between observed and counterfactuals around a zero line.

The last column of Table 5 measures, on an annual basis, a strictly positive gap in per capita real GDP due to the SWF of T&T after 1997. Based on this measure, the average increase in real per capita GDP, between 1997 and 2017, due to the existence of the SWF, is estimated at $5104.57^{12}$ (expressed in constant 2010 US$) with 99% statistical confidence (The $t$ test involves the null, $H_0$: $5105 = 0$, $t$-value = 8.9, with 20 degrees of freedom). The cumulative welfare change due to the existence of the SWF is $107,196^{13}$ (expressed in constant 2010 US$) per capita between 1997 and 2017.

Finally, we perform the placebo test to measure the post-/pre-Heritage Fund mean squared prediction error as described earlier. The test consists of re-running the analysis by applying the synthetic control method to any CARICOM economy of the donor pool. Consequently, we will have a sample of 14 synthetic control CARICOM economies including a synthetic T&T. Subsequently, for each synthetic economy we determine the mean squared prediction error (MSPE) ratio of the gap in economic growth due to the intervention before and after 1997. If T&T, which is the treated unit, has the largest MSPE ratio calculated from the post- to pre-intervention periods, there is empirical evidence of the Heritage Fund causing economic growth in T&T.

We extend the placebo test of Abadie et al. (2010) by taking an additional safety measure. We conduct a nonparametric bootstrap of post-/pre-Heritage Fund MSPE ratio

### Table 5: Gap in per capita real GDP (US$ 2010) of Trinidad and Tobago due to the Heritage & Stabilisation Fund

| Year | Actual Trinidad and Tobago | Synthetic Trinidad and Tobago | Gap |
|------|-----------------------------|--------------------------------|-----|
| 1997 | 7877                        | 7752                           | 125 |
| 1998 | 8505                        | 7850                           | 655 |
| 1999 | 9171                        | 7934                           | 1237|
| 2000 | 9779                        | 8050                           | 1729|
| 2001 | 10,152                      | 8192                           | 1960|
| 2002 | 10,911                      | 8293                           | 2618|
| 2003 | 12,426                      | 8414                           | 4012|
| 2004 | 13,346                      | 8671                           | 4675|
| 2005 | 14,105                      | 8857                           | 5248|
| 2006 | 15,892                      | 9107                           | 6785|
| 2007 | 16,570                      | 9284                           | 7286|
| 2008 | 17,052                      | 9279                           | 7773|
| 2009 | 16,226                      | 9129                           | 7097|
| 2010 | 16,683                      | 9300                           | 7383|
| 2011 | 16,551                      | 9535                           | 7016|
| 2012 | 16,680                      | 9654                           | 7026|
| 2013 | 16,761                      | 9708                           | 7053|
| 2014 | 16,641                      | 9632                           | 7009|
| 2015 | 16,824                      | 9394                           | 7430|
| 2016 | 15,765                      | 8989                           | 6776|
| 2017 | 15,350                      | 9047                           | 6303|

12 This is the average of the 21 values of the last column of Table 5.
13 This is the sum of the 21 values of the last column of Table 5.
based on 999 replicates as outlined by Efron and Tibshirani (1994:45–49) and derive bootstrap standard errors of the MSPE ratio as reported in Table 6.

The distribution of the pre-intervention MSPE in our sample of synthetic economies spans from a minimum value of 71,953 to the maximum value of 283,676,522 with a mean value of 22,168,897. The sample median pre-intervention MSPE is 765,931,14 which indicates that the synthetic control method provides a good fit for real per capita GDP prior to 1997.

Table 6 indicates that the MSPE ratio of T&T is the highest (35.656) demonstrating that the ratio is over 35 times higher after 1997 (when the plan of adopting a SWF was introduced) compared to before 1997 (when the SWF did not exist). As T&T has the largest MSPE ratio (among the Caribbean economies) calculated from the post-1997 to pre-1997 periods, there is empirical evidence of the fund causing economic growth in T&T after 1997. The placebo test is graphically illustrated in Fig. 5.

The solid black line in Fig. 5 shows the gap for T&T while the gray solid line on the top of T&T represents the gap for The Bahamas. Post-intervention, the synthetic Bahamas responded to the placebo test with the largest gap among the synthetic CARICOM economies. The reader should notice that the pre-intervention gap for the synthetic Bahamas is quite large as well (poor fit) with a pre-/post-intervention MSPE ratio of 0.655.

**Discussion**

Based on several empirical analyses, the current study reports a statistically significant positive impact of the SWF on the economic performance of T&T. The synthetic control

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14 The pre-intervention MSPE for T&T is 931,308 which is close to the median value.
method finds that the average increase in real per capita GDP, between 1997 and 2017, due to the existence of the SWF is approximately $5104.57 (expressed in constant 2010 US$). The cumulative welfare change due to the existence of the SWF is estimated at $107,196 (expressed in constant 2010 US$) per capita between 1997 and 2017.

As discussed in the third section, the aggregate demand–aggregate supply model and the Harrod–Domar growth model can explain how a SWF can contribute to the economic growth of a country. The mechanism behind the growth prospect can be explained through a few channels.

First, on several occasions, the government of T&T used money from the SWF to finance public expenditure and the Public Sector Investment Programme (PSIP). The PSIP is a strategic investment plan for T&T to formulate the National Budget that reflects public investment in national priority areas. According to the website of the Ministry of Finance of T&T\(^\text{15}\), the PSIP comprises programs and projects of Ministries, Departments and Agencies aimed at attaining national strategic objectives. These programs and projects are intended to realize the goals of the Government’s National Development Strategy (NDS) 2016–2030 (Vision 2030). So, the SWF has contributed to an improved quality of life, economic development, sound infrastructure, employment generation, and stronger institutional systems for the economy of T&T. Moreover, the government of T&T has decided to use part of the fund to facilitate economic recovery during the post-COVID period through different programs such as salary relief grants, food cards, trade payables, VAT refunds, and income tax refunds. Investing in infrastructure development, employment generation, and income tax refunds, has a long-run impact on the economy through the government spending multiplier effect and tax multiplier effect. Generally, the poorest have a higher marginal propensity to consume than the rich. According to economic theory, the higher the marginal propensity to consume, the greater the multiplier should be. Hence, any VAT refund or income tax refund will substantially increase the consumption of those who belong to the lowest income sectors, and will have a larger impact on the economy through the multiplier effect.

Second, as mentioned previously, the T&T government used some of the SWF to finance government spending. In the absence of the fund, the government would have had to borrow the funds at a high interest rate from domestic banks or from other external sources. This is the opportunity cost of not having a SWF in the economy. In that case, the government would need to pay with compounded interest rates. Borrowing from its own money (from the SWF) reduced the cost of financing government expenditure in crisis periods. So, financing from its own SWF is useful from the perspective of the opportunity cost approach.

Third, the fund may have reduced the possibility of uneven growth and economic volatility in the T&T economy. T&T’s exports are heavily energy related. According to the website of the World’s Top Exports\(^\text{16}\), the export value of T&T mineral fuels including oil was US$5.1 billion (55.7% of total exports) in 2019. When energy prices rise, export income for T&T rises rapidly. The government can save and invest the additional revenue (in excess of budgetary projections) into the SWF. If the extra energy revenues were not invested in the fund, the money would probably be invested in the booming energy sector. This would attract more factors of production from agriculture, fishing, and tourism sectors to the energy sector. Thus, other sectors would suffer because of the factor reallocation. As the natural resource-based export sector is usually

\(^{15}\) www.finance.gov.tt (accessed on 11/20/20).

\(^{16}\) www.worldstopexports.com (accessed on 11/24/20).
capital-intensive, the growth of this sector is not sufficient to absorb the lost jobs in other labor-intensive sectors (Bagattini 2011). The introduction of the SWF may have reduced the possibility of overheated growth in the energy sector, and low growth in the other sectors, by investing the surplus export earnings in foreign financial markets via the SWF portfolio.

Fourth, there could be potential positive externalities associated with the fund. The externalities may include greater market confidence and lower public pressure to spend windfall gains earned from higher energy prices in T&T. Usually, governments use SWF under critical crisis moments. So, the marginal utility (incremental benefit) of using a SWF is very high because the money is used in urgent situations.

We suggest that T&T use a portion of the HSF for diversification of the economy. As export earnings of T&T are heavily energy oriented, and energy demand may decline during the post-COVID years, diversifying the economy will be helpful for future growth. The European Union Council on Tourism and Trade (EUCTT) announced T&T as the “The Best Tourist Destination for 2012.” We suggest using funds from the SWF for the improvement of the tourism sector as it is one of the best potential growth sectors in T&T.

We also suggest that T&T follows the Santiago Principles that are a set of 24 voluntary guidelines to operate the SWF. The International Working Group of Sovereign Wealth Funds (IWG), which is composed of 26 IMF member countries with SWFs, drafted 24 Santiago Principles in Santiago (Chile) in 2008 to operate their SWFs effectively. The Santiago Principles aim “(i) To help maintain a stable global financial system and free flow of capital and investment (ii) To comply with all applicable regulatory and disclosure requirements in the countries in which they invest (iii) To invest on the basis of economic and financial risk and return-related considerations, and (iv) To have in place a transparent and sound governance structure that provides for adequate operational controls, risk, management, and accountability”—see IWG (2008, p.4).

As mentioned in section two, the SWF of T&T (HSF) has a stabilization component and a saving component. So, HSF satisfies the first aim of the Santiago Principal. Moreover, an independent board manages HSF and the fund is controlled in a transparent way. So, HSF also satisfies the second and fourth aims of the Santiago Principal. Section two also mentioned that 82.10% of the HSF assets were invested in the US financial market on December 31, 2019. As the lion’s share of the HSF assets is invested in one country, there is a financial risk related to the investment. We propose the policymakers of T&T to concentrate on the third aim of the Santiago Principal by diversifying the investment by investing some part of HSF in other safe assets (say in German government bonds) to minimize the financial risk.

This study’s findings are consistent with those of SWFs in other countries. El-Kharouf et al. (2010) assess the historical evolution and impact of the Gulf Corporation Council (GCC) sovereign wealth funds (SWFs) on the oil-based GCC economies. They find that, after the financial crisis of 2007–2009, almost all GCC governments invested a portion of their SWFs into their domestic markets. For example, Kuwait channeled funds from the Kuwait Investment Authority (KIA) to help its ailing domestic banks. Moreover, the KIA helped support the Kuwaiti stock market by investing US$ 7.36 billion for purchasing shares. Other research (Bagattini 2011) focuses on the fiscal performance of 12 countries over the period of 1992–2007, and indicates that (in general) countries with a SWF improved their fiscal position. That research finds that, on average, government fiscal balances improved by 4% and the public debt-GDP ratio decreased by 19% for the countries with a SWF. So, the main finding of the current research, a SWF is beneficial for a country, is consistent with other studies in the literature.

**Conclusion**

This paper analyzed the case of Trinidad and Tobago (T&T), a small developing economy in the Caribbean region, and assesses if, and to what extent, the Sovereign Wealth Fund (SWF) has an impact on the economic growth of the island. In 1997, T&T announced plans to create a SWF and the country created the Interim Revenue Stabilisation Fund (IRSF) on September 29, 2000, to create wealth for current and future generations. Later on, the IRSF was replaced by the Heritage and Stabilisation Fund (HSF) in March 2007. The study finds a statistically significant and positive impact of the SWF on the economy of T&T.

During several crisis periods, the government of T&T used the SWF to finance public expenditure and the Public Sector Investment Programme (PSIP). Thus, the fund has contributed to an improved quality of life, better infrastructure, employment generation, and stronger institutional systems for the economy of T&T. As a result, the fund contributed to a higher per capita GDP in T&T. The synthetic control method indicates the average increase in real per capita GDP, between 1997 and 2017, was $5104.57 (expressed in constant 2010 US$). The cumulative welfare change due to the existence of the SWF is estimated at $107,196 (expressed in constant 2010 US$) per capita between 1997 and 2017.

We suggest the government of T&T follow flexible policies to get the greatest benefit from the SWF during
the next few years. The “cushion” capacity of the fund to stabilize the economy of T&T may be inadequate during the post-COVID years. According to Statista\(^\text{17}\), the government expenditure was over 34% of the GDP of T&T in 2019. The government of T&T is expected to continue high government expenditure in the next few years to prevent a recession during these difficult years. At the same time, if T&T faces reduced export demand for energy products because of the sluggish growth during the post-COVID periods, the export earnings of T&T will decrease in the near future. The overall situation may create a large budget deficit for T&T in the coming years. Government expenditure may have to be adjusted to protect the effectiveness of the SWF as a buffer for the economy. We suggest eliminating less productive projects from future budget plans to keep the budget deficit low so that the SWF can meet the deficit and help maintain growth for the economy of T&T.

The success story of T&T’s SWF can be an example for other countries that do not have this type of saving funds. We suggest small land, non-renewable resource-dependent, and non-diversified economies should use their savings to create SWFs. This “rainy day” fund will work as a cushion to protect the economy during crisis period, and it will help continue development projects. We suggest the SIDS countries, especially the other Caribbean countries, create SWFs and follow the Santiago Principles of promoting transparency, accountability, good governance, and prudent investment practices to achieve the greatest benefits from the fund and foster sustainable economic growth.

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