THE IMPACT OF CLIMATE CHANGE ON TRINIDAD AND TOBAGO'S BALANCE OF PAYMENTS

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ABSTRACT

Climate change mitigation policies entail significant risks to commodity exporters like Trinidad and Tobago. In particular, transition risk can negatively affect domestic economic activity and the external accounts. Consequently, this paper seeks to assess the impact of transition risk on Trinidad and Tobago's balance of payments. Utilizing the International Monetary Fund's (IMF) "At-risk" framework, relevant domestic and external factors affecting the current account balance are identified, which is then used to estimate the probability distribution of the current account balance forecast. Based on quarterly data from 2012 to 2022, results show that external factors such as the Energy Commodity Price Index (ECPI) and domestic factors like energy production significantly influence the current account balance. Further, shocks to international energy commodity prices and production in line with the Paris Agreement Net Zero Emissions (NZE) objectives represent major downside risks to the probability distribution of the current account balance. Consequently, policymakers should intensify efforts to reduce the reliance on fossil fuels, increase investment in renewable energy and expand production and exports of the non-energy sector.

Keywords: Climate Change, Balance of Payments, 'At-risk', quantile regression, probability distribution.

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Executive Summary

Human activity has warmed the Earth's average surface temperature by roughly 0.07°C per decade since the 1880s (Ghosh 2021). In the past decade, society's dependence on fossil fuels has accelerated the pace of heating at an unprecedented rate leading to extreme weather events. To meet this threat of climate change, in 2015, the Paris Agreement was adopted by 196 parties with the aim of reducing global temperatures to below 2.0°C, compared to pre-industrial levels (UNFCCC 2015). This would be achieved through the reduction of greenhouse gas (GHG) emissions to net zero by 2050. The consequences of climate change can be defined in two broad categories; physical risks which arise from the direct economic losses and fatalities associated with an extreme weather hazard, and transition risks which refer to the uncertainties and policies that follow from a societal and economic shift to a low-carbon environment (Li, Chenlin and Chua Shu Yi 2022).

Climate change disproportionately affects developing countries as they are less able to adapt compared to developed countries. Notwithstanding their modest contributions to GHGs, commodity-dependent developing countries (CDDCs) would be strongly affected by the implementation of the Paris Agreement (UNCTAD 2019), as these countries are susceptible to shifts in climate change mitigation policies by importing countries and their renewable energy strategies (CEPAL 2011). The literature highlighted several channels through which a country's external accounts can be affected namely merchandise trade, services, remittances, foreign investment and external debt. Additionally, the focus was narrowed to oil exporting country assessments of the potential effects of transition risk for Norway, Russia, Sub-Saharan Africa and Latin American and Caribbean region. Al-Sarihi (2018) indicated that the implementation of mitigation measures to reduce carbon emissions could change the trading landscape of hydrocarbon markets by reducing the demand for fossil fuel exports, leading to lower prices and diminished gross domestic product (GDP) growth. For example, the introduction of a large carbon tax would impact developing countries that are highly dependent on oil and gas as a source of exports (Gallagher et al 2021). Results from Campiglio et al (2021) suggest that the reduction in fossil fuel consumption, together with a rise in renewable energy usage and trade in low-carbon technology/capital goods and critical minerals, will have implications for global trade and financial flows.

Thus, climate change mitigation policies entail significant risks to commodity exporters like Trinidad and Tobago. In particular, transition risk can negatively affect domestic economic activity and the external accounts. Trinidad and Tobago has a long history in the petroleum industry which dates back more than 100 years. Given its small size and highly energy-intensive industries that rely on the use of fossil fuels, the country's Carbon Dioxide (CO_2) emissions from energy use make it one of the highest emitters per capita in the world. Trinidad and Tobago relies

heavily on earnings from natural resources (oil and gas) to support economic development, with the energy sector representing the key source of foreign exchange earnings. In light of this, the transition to a low-carbon environment could result in output losses and shrinking exports. These impacts can be captured in the movement of key balance of payments (BOP) variables, making it an important avenue of the macroeconomic investigation into climate change. In this vein, the paper aims to shed light on the impact of climate-related risks on the BOP, particularly the current account balance.

The methodology primarily follows the "At-risk" framework developed by Prasad et al. (2019)[1] which is adjusted to represent the external current account balance. The first step involves the selection of appropriate variables and the construction of partitions. The indicators most relevant for each partition are determined based on principal component analysis. In the second step, quantile regressions are used to estimate the relationship between selected explanatory variables and future quantiles of the current account. The final step involves the generation of future current account distributions. After the quantile regression is estimated, the conditional distribution of future current account distributions is derived by fitting a t-skew distribution to predicted values of the estimated conditional quantiles regressions. Further, to analyse the impact of transition risks on Trinidad and Tobago's current account balance, projected energy prices from the International Energy Agency (IEA) Net Zero by 2050 A Roadmap for the Global Energy Sector and World Energy Outlook 2022 were utilised over the medium term (2023 to 2025)[2]. Notably, crude oil prices are anticipated to fall by 21.0 per cent by 2025, reflecting a decline in oil and gas demand, while crude oil production is anticipated to fall by 14.0 per cent[3]. Quantile regressions are used to project the entire current account distribution over the 12 quarters.

Given that Trinidad and Tobago is an energy-based economy, the performance of the current account is driven by both domestic and external factors. Consequently, domestic factors (domestic partition) selected were energy production, non-energy production, domestic inflation and the trade-weighted real effective exchange rate (TWREER). Similarly, external factors (external partition) that affect the performance of the current account include the Energy Commodity Price Index (ECPI), global growth, global inflation and the United States (US) Federal Funds rate. Data sources include the Central Bank of Trinidad and Tobago, Central Statistical Office (CSO), the International Monetary Fund (IMF's) World Economic Outlook (WEO) database and the US Federal Reserve.

[1] The Growth-at-Risk (GaR) framework links macrofinancial conditions to the probability distribution of future real GDP growth.

[2] The IEA's Net-Zero Emissions (NZE) by 2050 Scenario outlines what is needed for the global energy sector to achieve net-zero CO_2 emissions by 2050. Alongside corresponding reductions in greenhouse gas (GHG) emissions from outside the energy sector, this is consistent with limiting the global temperature rise to 1.5 °C.

3 The scenario assumes that no fossil fuel exploration is required and no new oil and natural gas fields are required beyond those that have already been approved for development. Further, prices are increasingly set by the operating costs of the marginal project required to meet demand, and this results in significantly lower fossil fuel prices than in recent years.

Consistent with energy exporting economies, the ECPI as well as global inflation and global growth, displayed the largest impact of explaining fluctuations in the current account balance, while domestic variables such as energy and non-energy production and domestic inflation exhibited the greatest influence on the current account balance. Furthermore, the results of the quantile regressions indicated a positive relationship between external factors and the current account as well as domestic factors and the current account in all quantiles. However, the external factors exhibited a stronger relationship than domestic factors. This suggests that international energy commodity prices have a stronger impact on the current account than domestic conditions such as energy production. The conditional distribution of the current account balance one quarter ahead indicates the current account is likely to record a surplus. The results are consistent with the current energy price environment. Notably, global energy commodity prices are anticipated to remain elevated due to the ongoing Russian-Ukraine war.

Following the quantile regression, scenario analysis was undertaken to determine the impact of transitional risk on Trinidad and Tobago's current account balance. Consistent with the IEA's NZE forecasts, the ECPI was shocked by the projected fall in crude oil and natural gas prices necessary to achieve NZE objectives from 2023 to 2025. Shocks to the ECPI shifted the density function to the left, suggesting a deterioration in the current account balance. Given that Trinidad and Tobago's current account performance is driven by exports, particularly energy exports, shocks to global energy prices narrow the current account and represent significant downside risks to the domestic economy. In light of these results, it is recommended that policymakers intensify their efforts to reduce the reliance on fossil fuels, increase investment in renewable energy and expand production and exports of the non-energy sector.

1 Introduction

Human activity has warmed the Earth's average surface temperature by roughly 0.07°C per decade since the 1880s (Ghosh 2021). Society's dependence on fossil fuels has accelerated the pace of heating at an unprecedented rate in the past decade which has led to extreme weather events such as, heat waves, cold snaps, droughts and floods, as well as natural disasters. To meet this threat of climate change, in 2015, the Paris Agreement was adopted by 196 parties with the aim of reducing global temperatures to below 2.0°C, compared to pre-industrial levels (UNFCCC 2015), through the reduction of greenhouse gas (GHG) emissions to net zero by 2050. On a macroeconomic level, the consequences of climate change can be defined in two broad categories; *physical risks* which arise from the direct economic losses and fatalities associated with an extreme weather hazard, and *transition risks* which refer to the uncertainties and policies that follow from a societal and economic shift to a low-carbon environment (Li, Chenlin and Chua Shu Yi 2022). Concerns relating to the energy transition's real economic costs have delayed the adaptation of key climate-related policies for decades. Furthermore, with recent surges in commodity prices, concerns relating to energy security may further stall the implementation of necessary climate mitigation policies (IMF, WEO October 2022).

Developing countries bear the burden of disproportionate economic costs associated with climate change due to an inability to adapt as effectively as their developed counterparts. In particular, commodity-dependent developing countries face a more pronounced impact given their fossil fuel dependence as the race to eliminate carbon emissions by 2050 threatens a key source of income. Domestically, Trinidad and Tobago's economic characteristics make the economy a unique case when assessing this climate change agenda. Trinidad and Tobago has financially benefitted from a long history in the petroleum industry which dates back more than 100 years. Overall, given its small size and its highly energy-intensive industries that primarily rely on the use of fossil fuels, the country's CO_2 emissions from energy use make the small-island state one of the highest emitters per capita in the world. As an energy commodity-exporter, the economy relies heavily on earnings from natural resources (oil and gas) to support economic development, with the energy sector representing the key source of foreign exchange earnings. In light of this, the transition to a low-carbon environment could result in output losses and shrinking exports as well as episodes of a weaker currency. These impacts can be captured in the movement of key balance of payments (BOP) variables, making it an important avenue of the macroeconomic investigation into climate change.

As the dangers of global warming continue to be felt across the globe, researchers have increased their interest in understanding the impact of this phenomenon on the macroeconomy. While numerous studies have focused on the effects of transition risks in the international arena including the impact of mitigation strategies on economic activity, the labour market and international trade, there is a dearth in the literature on the effects of green transition policies in the Caribbean. For Trinidad and Tobago in particular, the green transition will induce a significant economic transformation which may require external account adjustments over time. In this vein, the paper aims to present one of the initial accounts of the impact of climate-related transition risks on Trinidad and Tobago's BOP aggregates, in particular the external current account by employing the International Monetary Fund's "At-risk" model.

The research paper is structured as follows: Section 2.0 contains a review of the literature surrounding the channels through which climate-related risks, particularly transition risks, can affect specific accounts in the BOP, as well as a narrowed focus on the potential effects of transition risk on selected oil exporting economies. This is followed by Section 3.0 which presents Trinidad and Tobago's economic characteristics as well as key climate change developments within the domestic economy. Meanwhile, Section 4.0 highlights the data and methodology employed in the "At-risk" model. The results and analysis are presented in Section 5.0. The paper concludes in Section 6.0 which summaries the main findings and provides recommendations for supporting the green transition related to the external current account.

2 Literature Review

Climate change disproportionately affects developing countries as they are less able to adapt when compared to developed countries (WTO 2009, Wade and Jennings 2016). Particularly affected are commodity-dependent developing countries (CDDC). Notwithstanding their modest contribution to GHG emissions, CDDCs would be strongly affected by the implementation of the Paris Agreement (UNCTAD 2019). Climate change and the global climate agenda have the potential to alter a country's external position with the rest of the world. These effects can be measured through movement in the balance of payments (BOP) accounts. To assess these potential implications, a review of the literature, at both the regional and international level, as it pertains to the impacts on specific accounts will be discussed.

Merchandise Trade

Climate change can lead to alterations in traditional comparative advantages like agriculture and tourism - essential sectors in many low- and middle-income countries (LMICs) (WTO 2009). This leads to transitions in the pattern and volume of international trade flows. In particular, CDDCs are susceptible to shifts in climate change mitigation policies by importing countries and their renewable energy strategies. For instance, for a small energy-exporting like Trinidad and Tobago, the implementation of a foreign oil substitution policy by the United States, its main trading partner, could result in a reduction in Trinidad and Tobago's exports of liquefied natural gas (LNG) and an estimated falloff in exports earnings equivalent to 2.2 per cent of 2009 GDP (CEPAL 2011).

Nevertheless, new trade opportunities are made available from changes in demand to products that are less carbon-intensive, such as electronics and other light manufacturing (Brenton and Chemutai 2021, Bems and Juvenal 2022). There are substantial emerging opportunities to diversify exports in the transition to a low-carbon economy. However, LMICs face severe challenges regarding resource and capacity constraints and may not be able to capitalise on carbon competitiveness. Domestic firms' inability to measure and verify carbon reductions for a given good or service may result in exports from LMICs being unfairly taxed at the border and risk being excluded from international value chains (Brenton and Chemutai 2021).

The shift toward a low-carbon economy requires financing, investment in green energy and renewables, technology transfer, and cooperation between advanced and developing countries (WTO 2009, Bems and

Juvenal 2022). Trade facilitates technological transfer to developing countries through imports of intermediate and capital goods, which these countries cannot produce independently, and knowledge sharing from developed countries to developing countries on production methods and designs. However, depending on the degree of protection of intellectual property rights, developing countries may be financially constrained in the acquisition of expensive patented technologies.

Services

Cross border transport (air, sea, road and rail) plays a key role in fostering increased globalisation (OECD 2010). However, transport contributes to over one-quarter of global CO_2 emissions and is one of the few industrial sectors where GHGs emissions are still growing (Chapman 2007). In general, GHG mitigation and the transition to a low-carbon economy require a wide range of services, including imported services, to complement the deployment of appropriate technologies. Steenblick and Grosso (2011) outlined some of the main cross border services; business services, telecommunications services, financial services, and construction and related engineering services. These services can be provided via the internet, training of client's personnel, construction and operation of production facilities and temporary physical movement of natural persons for expert judgement or supervision. Specific examples of prominent services related to GHG mitigation and adaptation are services associated with renewable energy-based electricity, fossil-fuel electricity production, steel production, finding leaks in natural gas pipelines, data analysis services, services associated with CO_2 capture and storage and carbon-market services.

Foreign Investments

Climate change related risks can adversely impact selected capital inflows to an economy. Historically, environmental considerations in a firm's decision to engage in overseas investments focused on the extent to which a host country may have less stringent regulations requiring the firm to internalise environmental externalities (Li and Gallagher 2022). However, with the growing threat of transitional climate change risks, multinational companies have begun to incorporate this exposure into their foreign investment decisions. Increasing climate change risks have been felt in varying industries.

Based on an investigation by Gu and Hale (2022) that examined whether multinational firms react to climate change risks by changing their level of FDI, it was noted, in part, that higher transitional risks reduce FDI in the affected country. Importantly, evidence showed that industries with high emission productivity tend to experience more transition risk as the parent companies take on the responsibility of

mitigating and adapting to climate change. It has also been argued that climate change variability may reduce the local productivity capacity of an economy, thereby lowering its ability to effectively absorb foreign investment inflows (absorptive capacity) and benefit from the economic returns of additional capital (Dell, Jones and Olken 2012, Drabo 2021). Absorptive capacity can be reduced through the destruction of infrastructure, loss of human life, and deterioration of the macroeconomic environment and institutions (Drabo 2021). These circumstances can easily alter a foreign firm's decision to engage in investments within the host country, thereby lowering the level of inward foreign investment.

Notwithstanding, the global push towards greener environmentally friendly practices to curb the effects of climate change has led to a ballooning in mitigation- and adaption-related investments. As the race towards net-zero carbon emissions by 2050 becomes a key factor in policies at both the country and industrial levels, investment prospects are presenting itself which can reduce GHG emissions and boost resilience to climate change (IPCC 2014). Innovative opportunities offered by enabling target countries, for instance public-private partnerships that can build capacity in impactful projects such as renewable technologies in low-carbon electricity supply and energy efficiency for economic key sectors (UNCTAD 2022a), can play a crucial role in redirecting some of the inward foreign investment back to these economies. According to the UNCTAD (2022b), international private investment in climate change is concentrated in mitigation measures accounting for roughly 95.0 per cent (the remainder in adaptation investments) of these investments, where renewable energy and energy-efficient projects represent the lion's share of the investment. Given the scope of most mitigation projects, private foreign investment is usually crucial for both capital financing needs and intellectual know-how in order to effectively execute the project, particularly among developing economies. To attract international investment in these domestic infrastructure projects, Governments can provide public support through facilities including; equity participation, grants, incentives and tax breaks (UNCTAD 2022a).

Remittances

It has also been stated that migrants' remittances are a potential source of funding that can bridge the gap in climate financing and building resilience. Research on the link between migrant remittances and climate change adaptation argued that remittances provide a complementary opportunity for funding which can have a significant impact on individuals who are particularly vulnerable to the effects of climate change (Musah-Surugu, et al. 2018). Traditionally, central government financing through debt, FDI, donor aid and other private sector financing represent the main streams of funding for climate change

adaptation. However, migrants' remittances represent a definite financial resource that has the propensity to reach targeted vulnerable houses more directly than public finance flows, thereby closing the gap at the local level (Musah-Surugu, et al. 2018).

Prior to the COVID-19 pandemic and other episodes of financial crises, remittances have proved to be a vital income stream in supporting poorer households against shocks, making it an important asset in building climate change resilience (Malpass 2022, Musah-Surugu, et al. 2018). According to the World Bank (2022), remittance flows to LMICs are estimated to have increased by 4.9 per cent reaching US$626.0 billion in 2022, when compared to the previous year, which has surpassed FDI, official development assistance and portfolio investment flows for this group.

External Debt

In countries where access to climate financing in the form of investments is less available, Governments have had to rely on external debt to fund reconstruction and climate-resilient development activities. This increased indebtedness, which is accompanied by higher interest rates, makes it more difficult for countries to respond to the worsening impacts of climate change. The Intergovernmental Panel on Climate Change (2022) thoroughly explored the relationship between rising climate vulnerability and its impact on the cost of debt, with some emphasis on developing economies. Based on the report, over the period 2014 to 2018, financial commitments to developing countries were concentrated in the form of debt rather than grants, and excluding multilateral development banks, only 51.0 per cent of these commitments aimed at adaptation were dispersed.

While climate change has touched all corners of the globe, SIDS are disproportionately affected with high human vulnerability. In fact, SIDS are facing growing climate change-related costs amid eroding capacities and resources to address the ensuing loss and damage, including diminishing national capital reserves (IPCC 2022). This vulnerability has the potential to plunge SIDS into a mounting climate-debt trap that can increase capital outflows and deteriorate the country's BOP position over time. However, international sources for climate finance, such as the Green Climate Fund, which was established in 2010 and is the world's largest dedicated multilateral climate fund and the main multilateral financing mechanism, are aimed at supporting developing countries in achieving a reduction in GHG emissions and an enhancement of their ability to respond to climate change. Additionally, multilateral financial institutions such as the IMF and World Bank have recently scaled up their climate finance for emerging market economies. In

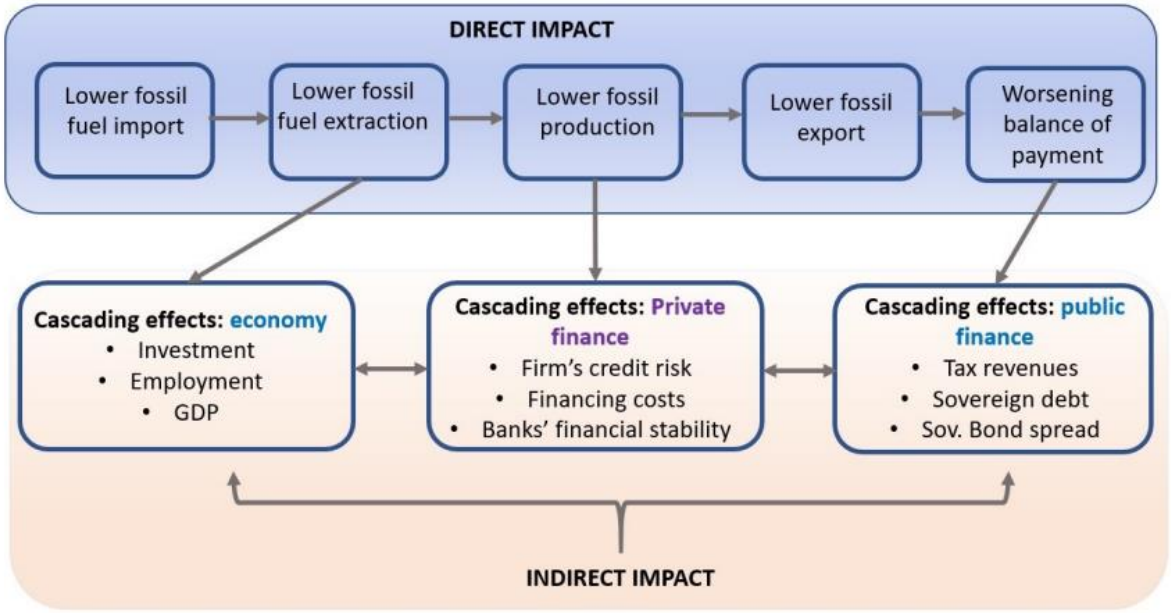
particular, the IMF's Resilience and Sustainability Trust (RST) provides low-income and vulnerable middle-income countries with longer-term, affordable financing, while the World Bank delivered a record US$31.7 billion in financing for fiscal year 2022, up from US$26.6 billion during the previous year, to help developing countries address climate change needs (World Bank 2022).

Case Studies

This section narrows the focus to individual country assessments of climate-related risk, particularly transition risk, and associated mitigation policies implemented by oil exporting economies. Selected countries such as Norway, Russia, and other emerging and developing countries will be examined. More specifically, reference will be made to the impact on firms and the Norwegian economy (via the oil sector) from an increase in domestic carbon prices, as well as the impact of transition risk on the demand for exports and the availability of financing for Russian companies. Implications of achieving climate targets on oil production in regional and emerging markets economies will also be included in this section.

The introduction of mitigation policies could have far-reaching implications for fossil-fuel dependent economies. Al-Sarihi (2018) indicated that the implementation of mitigation measures to reduce carbon emissions could change the trading landscape of hydrocarbon markets by reducing the demand for fossil fuel exports, leading to lower prices and diminished GDP growth. Mercure et al. (2018) pointed out that the rapid reduction in fossil fuel consumption and transition toward renewables will result in a decline in the value of fossil fuel assets and a loss in income. Similarly, Gallagher et al. (2021) illustrated that an introduction of a large carbon tax would impact developing countries that are highly dependent on oil and gas as a source of exports. A shock to oil or gas prices lowers exports and immediately impacts BOP **(Figure 1).**

Figure 1: Macro-Critical Aspects of Spillover 'Transition Risk'



Source: Gallagher et al. (2021)

Campiglio et al. (2021) examined the transboundary climate-related and financial risks that could result from a decarbonisation of the world economy. The study employed a global macro-econometric model to assess the potential impacts of a decarbonisation of the world economy on trade, output, investment and employment as well as international macroeconomic and financial spillovers for over 70 regions and 43 industrial sectors. The results suggest that a reduction in fossil fuel consumption together with a rise in renewable energy usage and trade in low-carbon technology/capital goods and critical minerals will have implications for global trade and financial flows. More specifically, changing patterns of trade in energy commodities will impact the BOP of both exporting and importing countries and the size and direction of international financial flows.

Russia, one of the largest fossil fuel exporters in the world, faces significant risks as the world aggressively moves to reduce carbon emissions. For instance, Makarov et al. (2021) examined the effect of the introduction of the European Union's (EU) Carbon Border Adjustment Mechanism (CBAM) on Russia's exports to the EU and European Free Trade Association (EFTA) countries. The study revealed that the implementation of the CBAM will lead to a reduction in Russia's exports due to European countries' substituting their imports for domestic production, as well as switching to imports from other world regions, where the production emission content might be lower. More specifically, the introduction of

CBAM in the Carbon price/CBAM scope 1 (direct emissions) and scope 2 (indirect emissions) will result in an average loss of 7.1 per cent of real exports to the EU in 2030–2035. However, if only scope 1 emissions are covered, the loss will account for 2.8 per cent.

Meanwhile, **Norway** is considered a small player in the oil and gas market, accounting for approximately 2.0 per cent of global crude oil production and 3.0 per cent of natural gas (Jordhus-Lier et al. 2022). However, Norway is the world's third largest exporter of gas and accounts for 20.0-25.0 per cent of the gas consumed in the EU. The oil and gas sector represents 14.0 per cent of Norway's Gross Domestic Product (GDP) and 41.0 per cent of exports. Therefore, a sharp slowdown in the oil and gas sector would create a trade imbalance with significant macroeconomic effects on the exchange rate and monetary and fiscal policies. Grippa and Mann (2020) assessed the impact of higher global carbon prices on external demand and the Norwegian economy. The result through comparative statistics revealed that the imposition of a global carbon price of US$75 per ton of CO_2-equivalent would correspond to a tax of US$31.4 per barrel of oil, reducing the equilibrium quantity by roughly 7.0 per cent. Additionally, the consumer price would increase by about 36.0 per cent, while the producer price would fall by about 16.0 per cent, and global producers would face a 26.5 per cent drop in revenues. With respect to the Norwegian economy, it was estimated that the changes in global oil markets following a $75.0 carbon tax would lead to a reduction in Norwegian oil revenues of 26.5 percent.

Moerenhout and Bellmann (2021) noted that net-zero and circular economy commitments appear likely to have a larger potential impact on **Sub-Saharan African** exports of crude and refined oil, and smaller potential short-term impacts on export markets for LNG and coal, although all three fossil fuels are likely to face a tightening market in the medium-term. Meanwhile, Leke, Gaius-Obaseki and Onyekweli (2022) highlighted several challenges facing South Africa's oil and gas sector. Firstly, countries dependent on oil and gas exports would find it increasingly difficult to sustain high returns as companies will be impacted by the introduction of carbon pricing and taxes. Additionally, oil and gas sector projects face greater scrutiny as investors have incorporated other factors including environmental, social, and governance into their decisions, resulting a widening gap between oil and gas company valuations and renewable energy company valuations. Notably, more than half of African oil and gas producing countries rely on oil and gas exports for more than 50 percent of their total export revenues. Further, several countries are dependent on global capital pools to fund their hydrocarbon projects and maintain their oil and gas operations. Leke, Gaius-Obaseki and Onyekweli (2022) noted that as global capital pools for hydrocarbon projects

begin to reduce, the cost of oil and gas production in Africa is expected to rise, making African oil and gas projects potentially even less competitive in global markets.

The **Latin American and Caribbean region** could also be impacted as the global economy moves towards a low-carbon environment. Mercure et al. (2018) estimated that the losses associated with stranded fossil fuel assets in the Latin American region could account for an approximate GDP loss of US$300.0 billion up until 2035.

3 Stylized Facts

Trinidad and Tobago has a long history in the petroleum industry which dates back more than 100 years. As early as 1857, the first oil well was drilled in the vicinity of the Pitch Lake located in La Brea[4]. By 1914, driven by the start of World War I, oil production received a significant boost bringing production to over one million barrels per year. As the industry continued to develop, the first oil refinery was commissioned in 1917. Since then, the country's energy landscape has evolved to include other related streams, playing a central role in propelling economic growth. During the 1970s, Trinidad and Tobago's energy production structure diversified from a predominately oil-based system to include natural gas and gas-based petrochemical production. The development of the natural gas sub-sector and its pivotal role in spawning the burgeoning petrochemical sub-sector, largely for the purpose of exports, created the need for liquefied natural gas (LNG) leading to the establishment of the Atlantic Liquefied Natural Gas Company (ALNG) in 1999. By 2000, the energy sector accounted for 31.3 per cent of GDP, which gradually increased to a high of just over 50.0 per cent of GDP in 2008 **(Figure 2).**

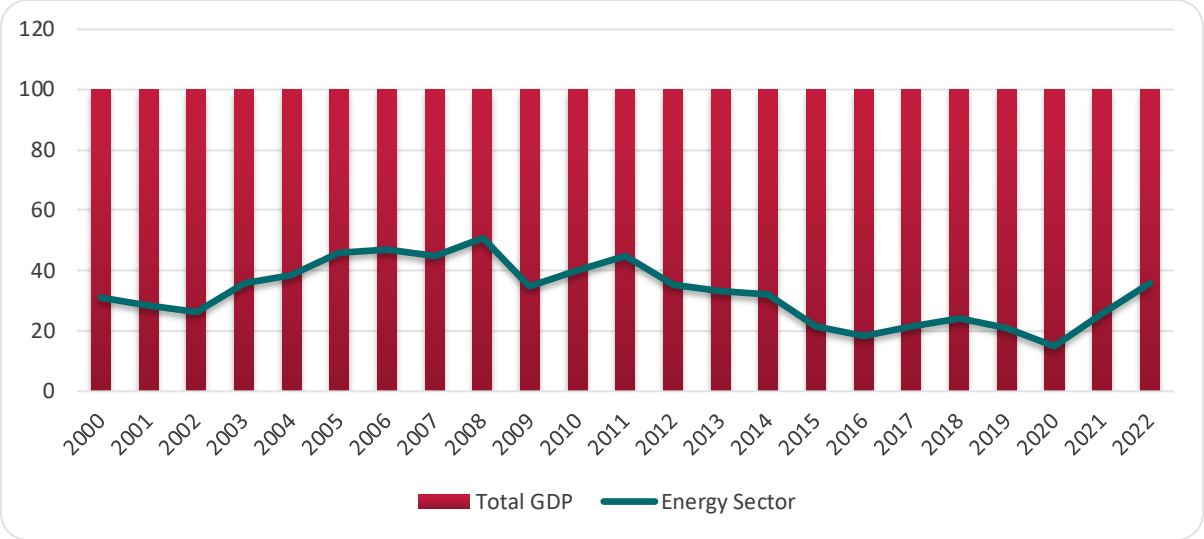
At this point, Trinidad and Tobago represented a significant exporter of ammonia and methanol and the number one exporter of LNG in the Western Hemisphere[5]. However, by the end of the year, faced with multiple exogenous shocks, such as the 2008 Global Financial Crisis, falling external demand for energy products and anaemic energy prices[6], the contribution of the energy sector to GDP began to decline. Subsequently, this relationship has gradually decelerated to a low of 15.0 per cent of GDP in 2020 amid the disruption to economic activity brought on by the coronavirus pandemic (COVID-19). Despite the boost to energy prices in the following years (2021 and 2022), owing to the combined effects of a resumption in economic activity and the Russia-Ukraine war, the contribution of the energy sector to GDP remains significantly below the level recorded in 2008.

[4] For historical information on Trinidad and Tobago's energy sector see link.

[5] Information on energy sector developments in 2008 is sourced from Trinidad and Tobago's Budget Statement 2008.

[6] In June 2008, the oil price, as measured by the West Texas Intermediate gauge, was recorded at US$133.9 per barrel, however by December 2008, it plummeted by 69.1 per cent to US$41.4 per barrel in December 2008. Similarly, the natural gas price, as measured by the Henry Hub gauge, fell from US$12.7 per mmbtu in June 2008 to US$5.8 per mmbtu in December 2008.

Figure 2
Energy Sector's Contribution to Gross Domestic Product
/Per Cent/



Source: Central Statistical Office

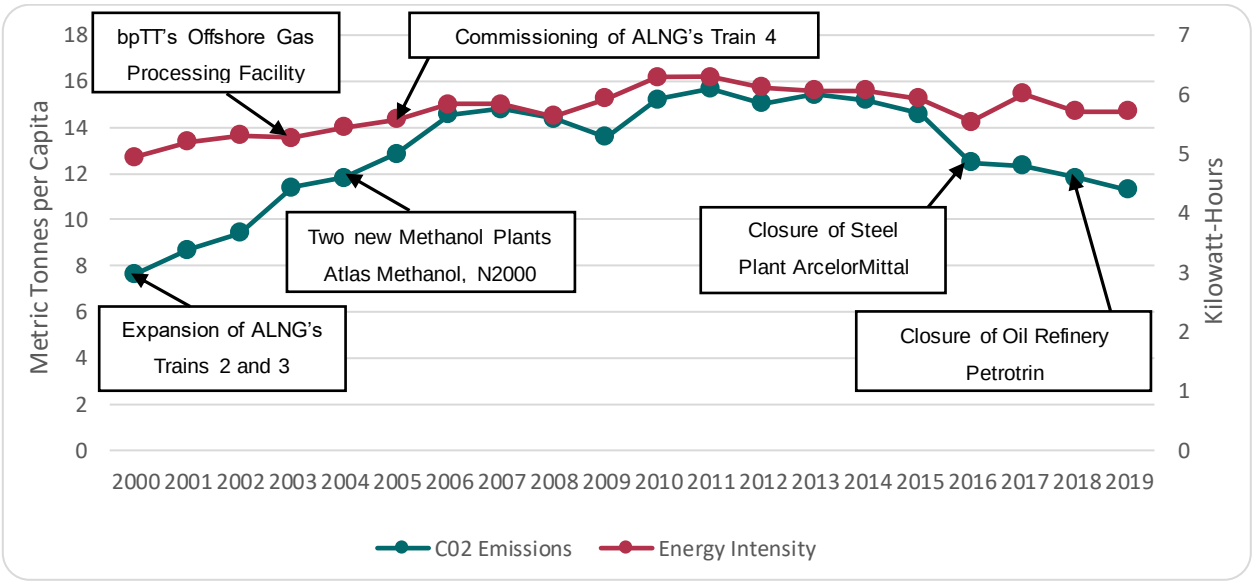
Historically, a direct link can be traced from the developments in Trinidad and Tobago's hydrocarbon industry to trends in the country's energy intensity, measured as the primary energy consumption per unit of GDP[7], and CO_2 emissions in metric tonnes per capita (mt/cap). During the 2000s, as the sector experienced significant milestones, including the expansion of ALNG's Trains 2 and 3 (2000) for the processing of LNG, the commissioning of bpTT's offshore gas processing facility (Cassia B) (2003), the establishment of two new petrochemical plants (Atlas Methanol and N2000) (2004) and the commencement of ALNG's Train 4 (2005) [8], increases were noted in both energy intensity and the level of CO_2 emissions. In particular, energy intensity increased by 27.2 per cent from roughly 5.0 Kilowatt-hours (kWh) in 2000 to 6.3 kWh in 2010, while the level of CO_2 emissions almost doubled, moving from approximately 7.7 mt/cap in 2000 to 15.2 mt/cap in 2010.

During the following decade, as the momentum in energy sector developments moderated, which coincided with the closure of the domestic steel plant ArcelorMittal (2016) and the state-owned oil refinery Petrotrin (2018), energy intensity and the level of CO_2 emissions displayed a downward trend **(Figure 3).** Consistent with these closures, Trinidad and Tobago's energy intensity experienced declines of 6.5 per cent (year-on-year) and 5.1 per cent (year-on-year) in 2016 and 2018 respectively.

[7] Energy intensity is measured in kilowatt-hours (kWh) per 2011 $ purchasing power parity (PPP).
[8] For historical information on Trinidad and Tobago's energy sector see link.

Notwithstanding the falloff in CO_2 emissions over the reference period to 11.3 mt/cap in 2019, the small-island state remained one of the highest emitters per capita in the world. Despite a lack of data onwards, given the significant reduction in domestic energy sector activity and global energy demand in 2020 owing to the pandemic, it can be assumed that energy intensity and CO_2 emissions were lower during the year. Efforts towards reducing emissions are expected to continue as part of the national climate change agenda which was outlined in the country's Nationally Determined Contributions (NDC). The aim is to reduce cumulative carbon emissions by 15.0 per cent by 2030[9] from business as usual (BAU) in three key sectors: power generation, transport, and industrial processes[10].

Figure 3
Trinidad and Tobago's Energy Intensity and Carbon Dioxide Emissions



Sources: World Bank Data, Our World in Data, and Ministry of Energy and Energy Industries

Trinidad and Tobago's energy sector is a significant contributor to its external accounts. The exports of energy products are the country's main foreign exchange earner representing, on average, 82.7 per cent of total exports over the period 2000 to 2022. Consistent with the developments in the local energy sector, increased export volumes coupled with the high-price environment led to a rise in energy export revenues in the early 2000s[11] **(Figure 4).** Exports peaked at US$18.6 billion in 2008 before falling by 50.5 per cent

[9] This is equivalent to 103 million tonnes of carbon dioxide.
[10] According to the Ministry of Planning, the agency responsible for coordinating the country's overall climate change policy, the estimated cost of meeting this objective is US$2.0 billion, which is expected to be funded by both international and domestic sources.
[11] In 2000, the sharp rise in the value of exports was underpinned by higher oil prices and increased output of LNG associated with a full year of production from the new LNG plant. In that same year, ammonia, urea and methanol accounted for approximately 20.0 per cent of total exports.

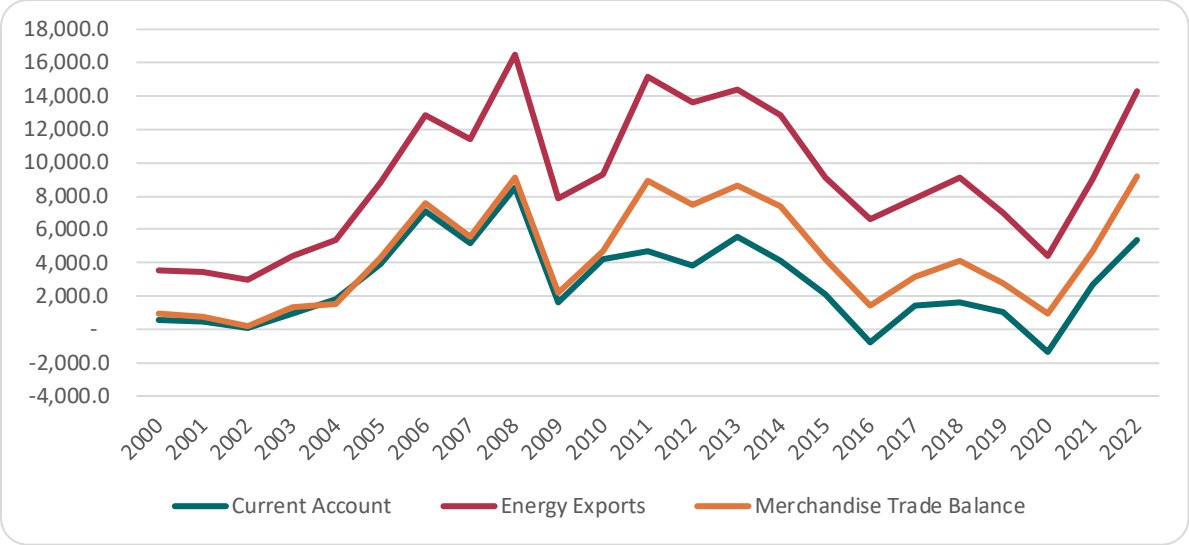
(to US$10.0 billion) in 2009 due to the sharp decline of international energy prices[12] and subdued external demand in the country's major trading partners. The rapid pace of ongoing infrastructural developments, mainly within the energy sector, led to a steady rise in imports during 2000 and 2008. Imports fluctuated thereafter before experiencing a fall-off in 2019 due to the reduction of crude oil imports, for the purpose of refining, at Petrotrin.

Over the review period, Trinidad and Tobago's external current account recorded consecutive surpluses, with the exception of 2016 and 2020, driven primarily by net earnings on the merchandise account[13]. The intensity of the impact of the COVID-19 pandemic in 2020 and the resultant lock-down measures of key economic sectors, which particularly disrupted the energy sector, can be likened to the possible shock to the domestic energy sector, and by extension, the external accounts, that may emanate from the global transition to net-zero emissions. In 2020, energy exports experienced a sharp fall-off to roughly US$4.4 billion, losing almost half of its value compared to 2019. This was the lowest level seen since 2002. Despite the simultaneous decrease in the value of imports due to supply disruptions, the net goods trading position remained in surplus, albeit at a historically lower level.

[12] West Texas Intermediate (WTI) prices declined by 38.1 per cent year-on-year, to average US$61.7 per barrel in 2009, and Henry Hub natural gas prices fell 56.2 per cent year-on-year to average US$3.9 per mmbtu.

[13] The deficits registered on the current account were reflective of the falloff in the value of exports, mainly underpinned by the reduction in non-energy exports from the closure of ArcleorMittal, together with a subdued energy price environment (2016). Meanwhile, the closure of the nation's borders amid the pandemic was responsible for the deficit in 2020.

Figure 4
Selected Components of Trinidad and Tobago's External Current Account
/US$ Millions/



Source: Central Bank of Trinidad and Tobago, Central Statistical Office

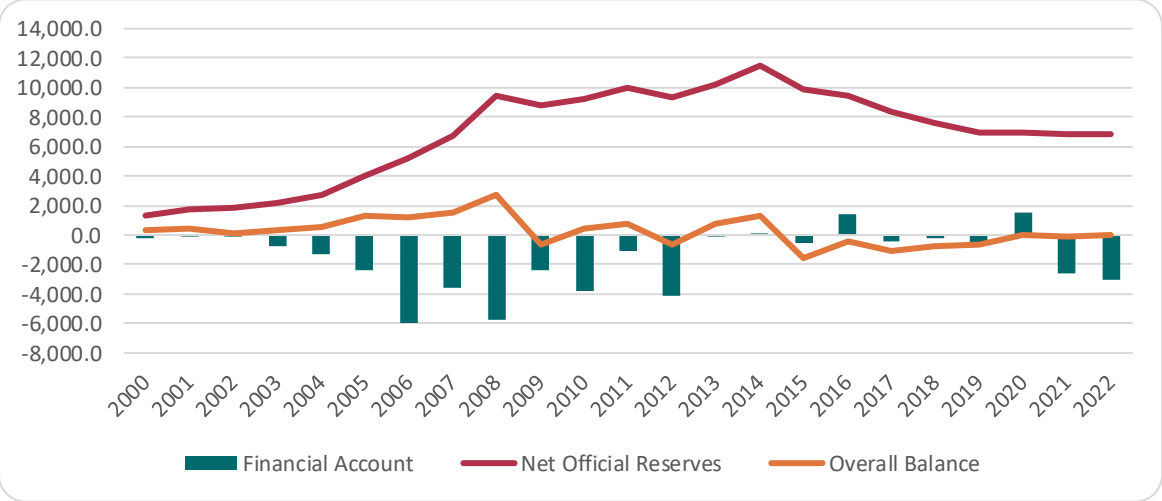
The financial account mainly recorded net outflows over the period 2000 to 2022 and within the most recent decade (2013 to 2022). This movement largely stemmed from transactions in direct investment, particularly from a reduction in liabilities and increased domestic holdings of portfolio investment assets abroad. FDI is a major source of financial flows for Trinidad and Tobago, of which the energy sector has been the primary recipient. Apart from the energy sector, the local iron and steel industry was also a beneficiary of inward FDI. In particular, ArcelorMittal was the largest earner of foreign exchange outside the energy sector (Bobb et al, 2020). Its closure in 2016 not only affected non-energy exports but also led to a reduction in FDI in the domestic economy.

Trinidad and Tobago's exposure to transition risk is anticipated to be high given that large energy multinationals such as BP Global, Shell and EoG Resources, which have subsidiaries in the local economy, have begun implementation of climate change mitigation strategies, setting targets to become net zero energy businesses by 2050 or sooner. More specifically, BP Global's objective inter alia, includes a 20.0 per cent reduction in operational emissions by 2025 and 50.0 per cent by 2030 against its 2019 baseline (54.4 $MtCO_2e$), a 10.0-15.0 per cent reduction in CO_2 emissions from the combustion of upstream production of crude oil, natural gas and natural gas liquids (NGLs) by 2025 and 20.0-30.0 per cent by 2030

against its 2019 baseline (361MtCO_2e), and a 50.0 per cent reduction in methane intensity[14] from upstream operations (BP 2023). Similarly, Shell set a target to reduce absolute emissions from their business operations (direct and indirect) by 50.0 per cent by 2030 (compared to 2016 levels on a net basis), as well as the short-, medium- and long-term targets to reduce the net carbon intensity of their energy products. By 2025, the company aims to eliminate flaring of gas, which generates carbon emissions from its upstream operations. Shell expects a reduction in its annual oil production of 1.0-2.0 per cent, including divestment and natural decline, from its upstream operations (Shell Global 2021). EoG Resources' has outlined its net zero plan for GHG emissions by 2040. Some of EoG Resources' near-term emission targets (by 2025) highlighted are 13.5 per cent GHG intensity rate by 2025, 0.06 methane emissions percentage, and zero routine flaring (EOG Resources 2023).

Movements in the current and financial accounts resulted in surpluses in the overall BOP and accumulation of reserves in the early 2000s **(Figure 5)**. However, given the reversed trend in the overall balance to mostly deficits from 2015 onward, the country's stock of official reserves deteriorated from a high of US$11.5 billion in 2014 to US$6.8 billion in 2022. Notwithstanding, Trinidad and Tobago's external accounts managed to remain resilient based on traditional indicators of reserve adequacy[15].

Figure 5
Trinidad and Tobago's Financial Account, Overall Balance and Net Official Reserves
/US$ Millions/



Source: Central Bank of Trinidad and Tobago

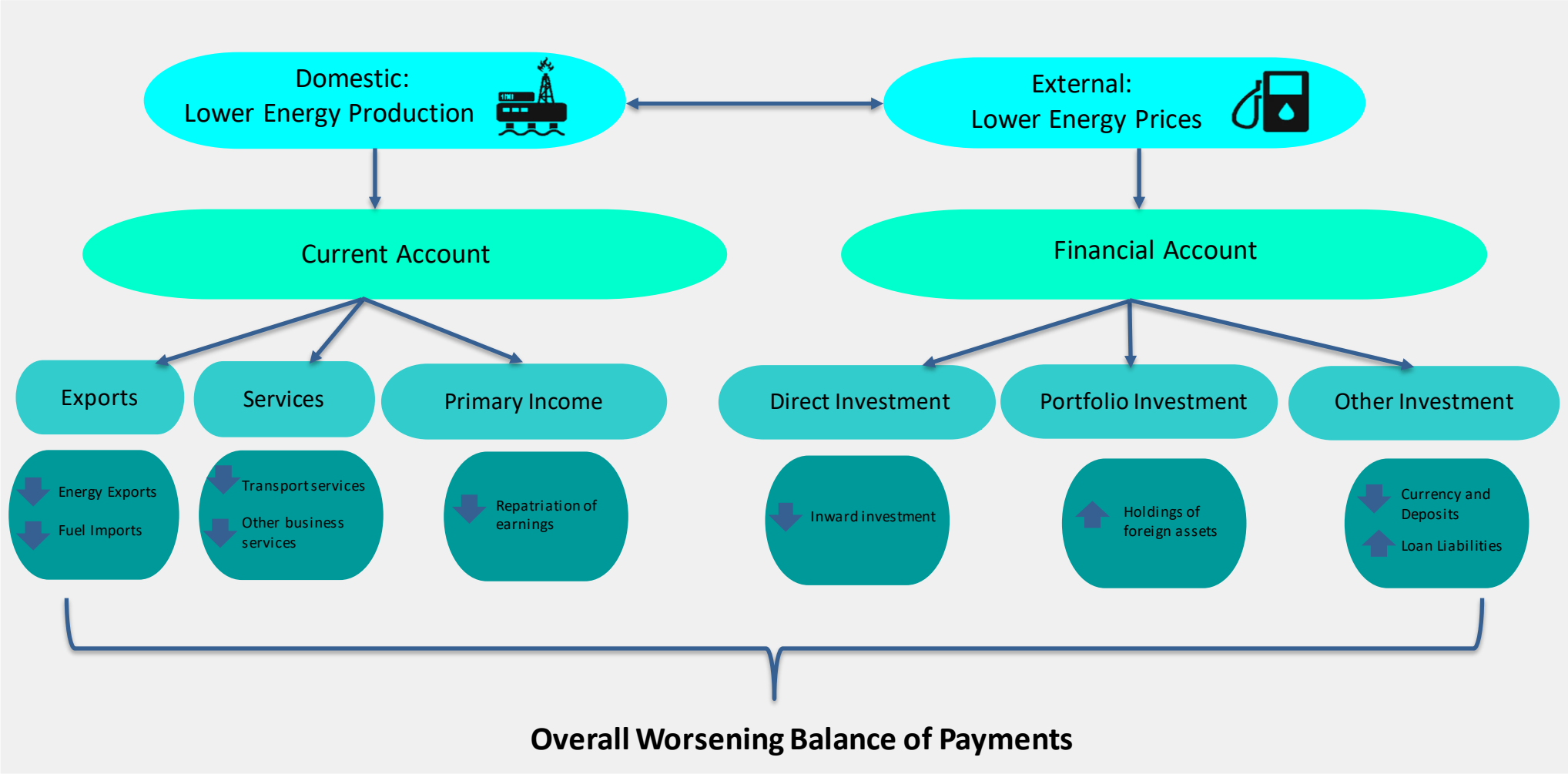
[14] Methane intensity refers to the amount of methane emissions from bp's operated upstream oil and gas assets as a percentage of the total gas that goes to the market from those operations.
[15] Traditional reserve adequacy metrics (and associated international benchmarks) include import cover (6.0 months of imports cover), ratio of reserves to broad money (0.2 or 20.0 per cent), and the ratio of reserves to short-term external debt (1.0 or 100.0 per cent).

Based on the literature and Trinidad and Tobago's economic characteristics, it is anticipated that stemming from the energy transition there is likely to be an overall worsening of the country's BOP, ceteris paribus **(Diagram 1).** The reduction in domestic energy production from multinationals transitioning to net-zero, coupled with lower international energy prices, underpinned by the reduction in global energy demand, would result in a reduction in the value of energy exports and fuel imports. However, the decline in imports may only partially offset the falloff in exports, leading to an overall deterioration in the merchandise trade balance. Trinidad and Tobago's services (net) mainly recorded deficits over the review period and with the anticipated increase in imports of services (to complement the deployment of appropriate technologies), the deficit on the services account is expected to widen. This movement may be tempered somewhat by improvements in the primary income account from the effects of a reduction in repatriated earnings (lower payments/outflows), which is concentrated in the energy sector. Despite this avenue for improvement in the current account balance, given that merchandise trade is the main driver of the current account, it is expected that the overall current account balance would deteriorate. At the same time, net outflows[16] are likely to be recorded in the financial account from transactions in the investment categories. Direct investment liabilities (direct investment in Trinidad and Tobago) may be reduced as parent energy companies adapt and mitigate against climate change related risks. Additionally, as ESG investments become more popular, domestic investors may also factor these securities into their portfolios, leading to an increase in domestic holdings of these instruments abroad. Other investment assets may also be affected through lower inflows from energy exports which could translate to lower currency and deposits held abroad. Counteracting this may be an increase in loan liabilities from the contracting of external debt for climate financing.

[16] Net outflows can arise from an increase in outflows or a decrease in inflows.

Diagram 1

Transmission Channels to the Balance of Payments



Source: Author's Illustration

4 Data and Methodology

The methodology primarily follows the "At-risk" framework as developed by Prasad et al. (2019)[17] which was recalibrated to represent the external accounts for the purposes of the current research. This framework estimates the severity and the likelihood of a sharp economic slowdown. In line with Prasad et al. (2019), the analysis first establishes the relationship between future current account balances and macroeconomic variables using the quantile regression approach. Following this, the current account distribution is derived by fitting a parametric distribution using the estimated current account quantiles. The distribution of the future current account balances is estimated based on information contained in macroeconomic variables. The advantage of employing the "At-risk" approach is it produces an entire distribution allowing for the assessment of upside and downside risks compared to other models that make point forecasts. In terms of the present investigation, this feature will facilitate the analysis of key drivers of future current account balances, including their relative importance, which varies across the current account balance distribution and the forecasting horizon.

The first step involves the selection of appropriate variables and the construction of partitions, which are groupings of related macroeconomic variables instead of individual variables. The use of partitions helps to extract common trends among relevant macroeconomic variables and remove idiosyncratic noise, thereby improving the quality of the subsequent quantile regressions. The most relevant indicators for each partition are determined based on principal component analysis, which extracts common trends from a large array of indicators. Given that Trinidad and Tobago is an energy-based economy, the performance of the current account is driven by both domestic and external factors. Consequently, domestic factors (domestic partition) comprise energy production, non-energy production, domestic inflation and the trade-weighted real effective exchange rate (TWREER). Similarly, external factors (external partition) that affect the performance of the current account include the Energy Commodity Prices Index (ECPI)[18], global growth, global inflation and the US Federal Funds rate **(Table 1).**

In the second step, quantile regressions are used to estimate the relationship between selected explanatory variables and future quantiles of the current account balance. Notably, a quantile regression at the 10th percentile would estimate a relationship when the current account balance is weak, while a quantile regression at the 90th percentile would be based on stronger current account outcomes. For a set of horizons $h \in \{1, 4, 8, 12\}$ where h represents the number of quarters ahead, the following specifications are estimated:

[17] The growth-at-risk (GaR) framework links macrofinancial conditions to the probability distribution of future real GDP growth utilising an Excel/Python-based tool.
[18] The Energy Commodity Price Index (ECPI) is a summary measure of the price movements of Trinidad and Tobago's top ten energy-based commodity exports. Liquefied natural gas, Crude oil, Ammonia, Methanol, Gas oil (Diesel), Motor gasoline, Natural gasoline, Jet fuel/Kerosene, Propane and Urea.

$$y_{t+h} = \alpha^{\tau} + \sum_{i \in I} \beta_i^{\tau} X_{i,t} + \varepsilon_{i,t}^{\tau}$$

Where y_{t+h} represents the future current account position *h* quarters ahead, $X_{i,t}$ is the partition *i* (domestic and external factors), β_i^{τ} the coefficient of the τ quantile regression, α^{τ} the associated constant and $\varepsilon_{i,t}^{\tau}$ the residual. The quantile regressions are estimated at different points of the distribution of y_{t+h}, $\tau \in \{0.1, 0.25, 0.5, 0.75, 0.9\}$. Each β represents the macroeconomic linkage between the variable $X_{i,t}$ and the future current account balance at different points of the distribution.

The final step involves the generation of future current account distributions. Following the quantile regression estimation based on partitions of macroeconomic variables, the conditional distribution of the future current account is derived by fitting a t-skew distribution to predicted values of the estimated conditional quantile regressions. The complete distribution of future current account balances, conditional on the state of the macroeconomic environment, enables assessments of the likelihood of future current account balances. Further, to analyse the impact of transition risks on Trinidad and Tobago's current account balance, projected energy prices from the International Energy Agency (IEA) Net Zero by 2050 A Roadmap for the Global Energy Sector and the World Energy Outlook 2022 were utilised over the medium term (2023 to 2025). Notably, crude oil prices and production are anticipated to fall by 21.0 per cent and 14.0 per cent, respectively, over the reference period. It is assumed that international energy commodity prices such as crude oil, natural gas and petrochemicals follow a similar trend. Consequently, the ECPI was shocked to reflect the decline in crude oil prices while domestic energy production was shocked in line with the reduction in crude oil supply[19]. Quantile regressions are used to project the entire current account distribution over the next 12 quarters.

Data for the current account balance, the ECPI and the TWREER are obtained from the Central Bank of Trinidad and Tobago, while energy production, non-energy production and domestic inflation are obtained from the Central Statistical Office (CSO). Global variables such as real GDP growth and global inflation are obtained from the IMF's World Economic Outlook (WEO) database. The data relating to the US federal reserve target range is sourced from the US Federal Reserve. The examination of climate change on the current account balance employs quarterly data from the first quarter of 2012 to the fourth quarter of 2022.

[19] Due to limited data on climate change mitigation policies' impact on domestic energy production, projected energy production data from the IEA was utilised.

Table 1: List of Domestic and External Variables

Domestic Variables	External Variables
Energy production (EGDP)	Energy Commodity Price Index (ECPI)
Non-energy production (NGDP)	Global Growth (Growth)
Domestic inflation (INF)	Global Inflation (Inflation)
Trade-weighted real effective exchange rate (TWREER)	US Federal Funds Rate (US FED)

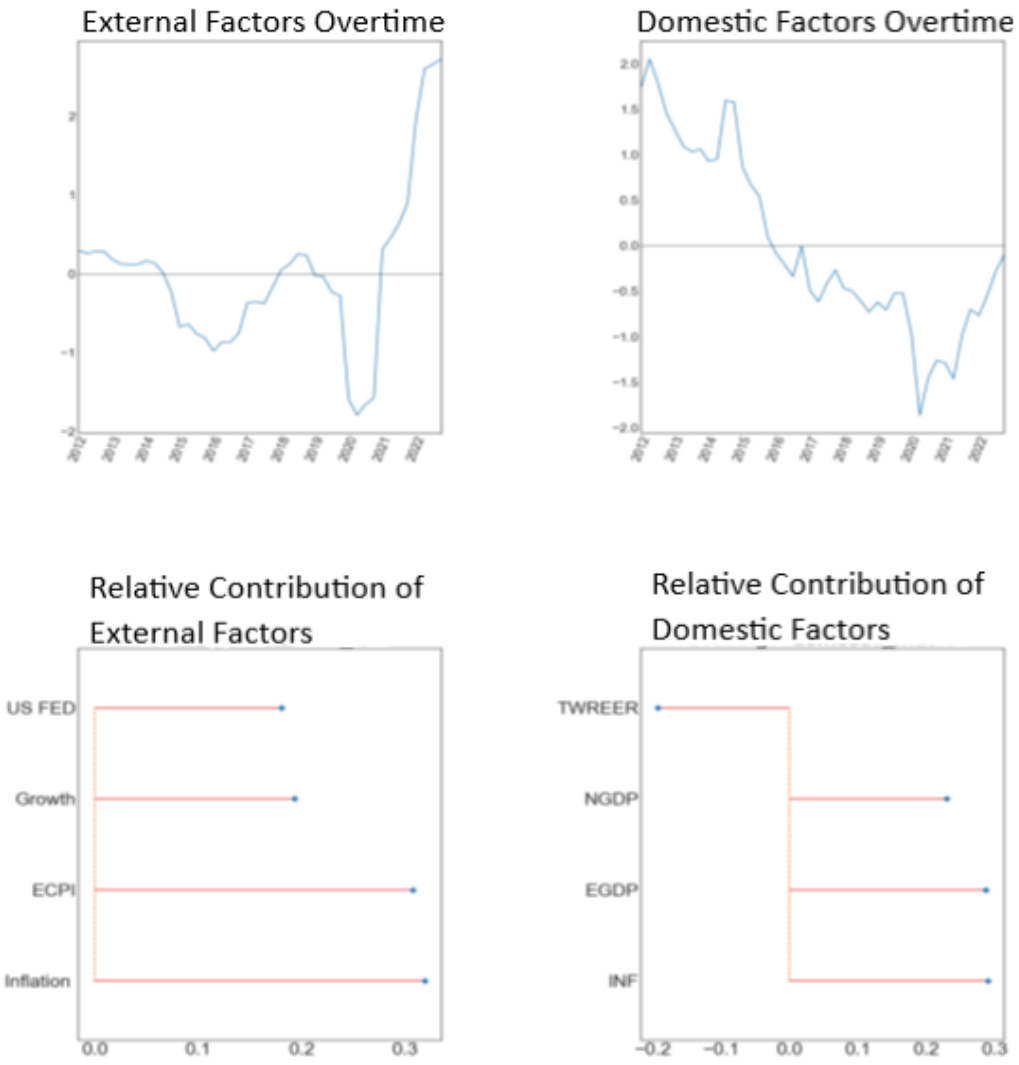
Source: Authors Illustration

5 Results and Analysis

The results show that the domestic factors index was largely negative over time, possibly attributed to the subdued economic activity over the reference period, particularly within the domestic energy sector **(Figure 6).** The energy sector contracted on average by 3.1 per cent from the first quarter in 2013 to the fourth quarter in 2022. Meanwhile, over time, the external factors index captures two major troughs in 2016 and 2020, coinciding with declines in global energy prices. In 2016, the plunge in energy prices reflected supply factors- higher US oil production and a shift in Organisation of the Petroleum Exporting Countries (OPEC) policies and demand factors- weakening global growth prospects. In 2020, international energy commodity prices fell sharply due to COVID-19 mitigation policies. Regarding the relative importance of external factors in explaining fluctuations in the current account balance, the ECPI, global inflation and global growth displayed the largest impact, while domestic variables such as energy and non-energy production and domestic inflation exhibited the greatest influence on the current account balance. These results are consistent for small open energy exporting economies where global energy prices and domestic energy production drive economic activity and external accounts.

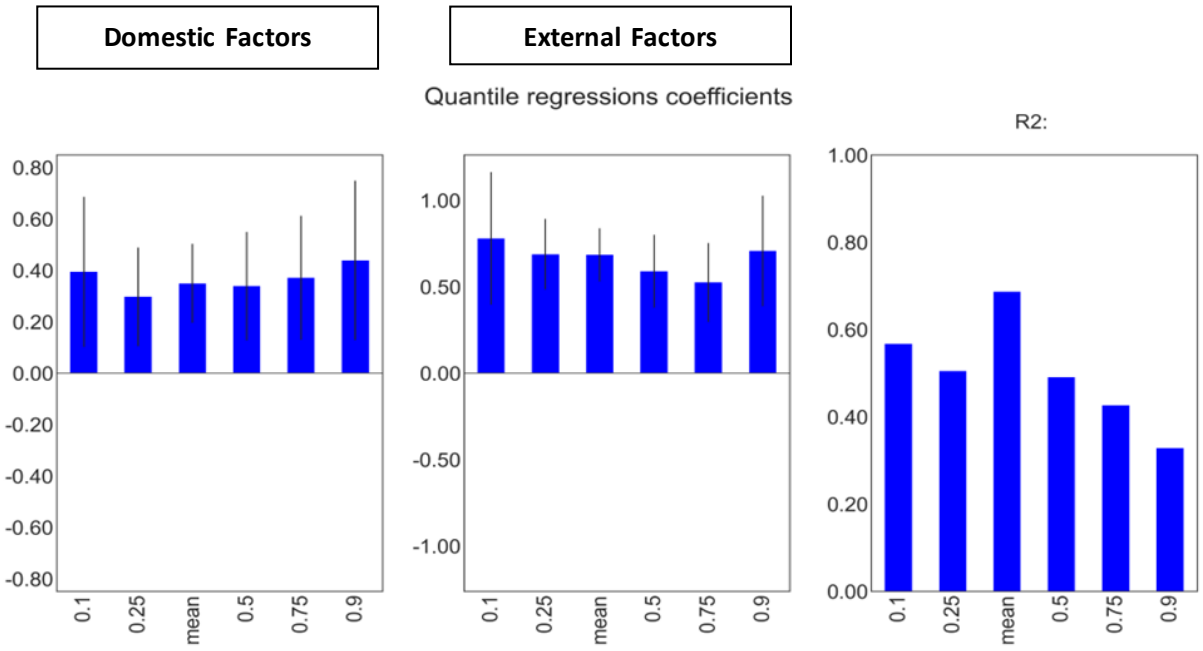
Regarding estimating the quantile regression used to predict the current account balance one quarter ahead, the results indicated a positive relationship between external factors and the current account as well as domestic factors and the current account in all quantiles **(Figure 7)**. However, the external factors exhibited a stronger relationship than the domestic factors. This suggests that international energy commodity prices have a stronger impact on the current account than domestic conditions such as energy production.

Figure 6: Relative Importance of External and Domestic Indicators



Source: Authors' Calculations

Figure 7: Short-Term Quantile Regression Coefficients (1-Quarter Ahead)

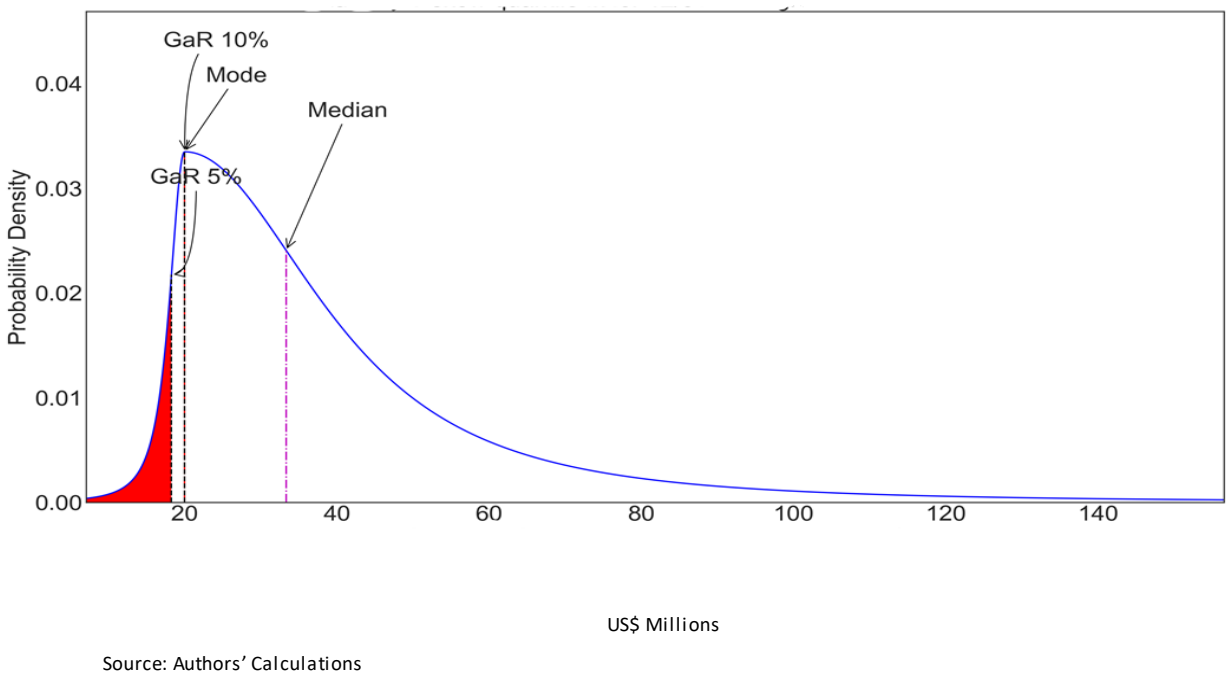


Source: Authors' Calculations

Based on the baseline regression, the future current account balance distribution is derived one quarter ahead. The conditional distribution of the current account balance one quarter ahead indicates a 5.0 per cent probability that the current account balance will record a surplus of US$18.3 million **(Figure 8)**. Additionally, the probability of the current account recording a value below zero or a deficit is 0.0011 per cent. The results are consistent with the current energy price environment. Notably, global energy commodity prices are anticipated to remain elevated due to the ongoing Russian-Ukraine war.

Figure 8: Conditional Distribution of the Current Account Balance

(1 quarter ahead)



Source: Authors' Calculations

Further to the quantile regression, scenario analysis was undertaken to determine the impact of transitional risk on Trinidad and Tobago's current account balance. Under the baseline scenario, there is a 5.0 per cent probability that the current account balance will amount to US$18.3 million over the next 12 quarters and the probability of the current account balance recording a deficit is 0.0011 per cent. Therefore, under the baseline scenario, the current account is likely to remain in surplus over the next three years.

Consistent with the IEA's NZE forecasts, shocks to the ECPI and the EGDP were applied in line with the projected decline in crude oil prices and a reduction in crude oil supply from 2023 to 2025. In particular, crude oil prices were anticipated to decline by 21.0 per cent over the reference period, while crude oil production is projected to fall by 14.0 per cent over the forecast period. A shock to the ECPI based on the projected declines in crude oil prices and supply shifts the distribution of the current account balance to the left. Further, there is a 5.0 per cent probability that the current account balance will record a deficit of US$291.1 million over the next 12 quarters and a 100 per cent chance that the current account will record a deficit. Given that Trinidad and Tobago's current account performance is driven by exports, particularly energy exports, shocks to global energy prices lead to a

deterioration in the current account balance and represent significant downside risks to the domestic economy. These results are consistent with Al-Sarihi (2018), who indicated that the introduction of climate change mitigation policies would result in lower energy prices and GDP for energy exporters.

6 Conclusion and Recommendations

The global thrust toward a low-carbon economy would significantly impact energy-exporting economies. Lower international energy commodity prices would adversely affect these countries' fiscal and external accounts. Against this backdrop, the research paper investigated the potential impact of climate change and associated mitigation policies on Trinidad and Tobago's balance of payments, mainly the current account. Through the employment of the IMF's "At-risk" framework, the results indicated that both external and domestic factors influenced Trinidad and Tobago's external current account balance. Notably, external factors such as the ECPI, had a greater impact on the current account balance than domestic factors like energy production. Furthermore, the results from the current account distribution for one quarter ahead suggest that the current account balance is likely to record a current account surplus. Finally, scenario testing which incorporated shocks to the ECPI in line with the NZE objective, indicated a significant shift of the current account distribution to the left, suggesting a deterioration of the current account balance over the medium term (2023 -2025).

Based on these outcomes, the domestic economy should consider intensifying efforts to reduce its reliance on fossil fuels and boost investment in renewable energy. Strategically, steps should be taken to shift the composition of exports from crude oil, refined products, natural gas and petrochemicals (grey economy) to green hydrogen (GH2) and downstream green products. The Inter-American Development Bank and the National Energy Corporation of Trinidad and Tobago (2022) indicated that Trinidad and Tobago could leverage its existing petrochemical facilities, operational experience and associated infrastructure. The study proposed a 35-year plan which includes three stages for the investment in renewable energy. The first phase focuses on developing enabling policies and regulatory framework as well as establish visible decarbonisation initiatives in the country geared at the green transition. The goal of the second phase for Trinidad and Tobago is to install 25 gigawatt (GW) of offshore wind capacity with 10.5 GW output to feed electrolysers to produce 1.5 million tonnes per annum (Mtpa) of green hydrogen. In the final phase, the aim is to reach 57 GW of offshore wind capacity with 25 GW output to feed electrolyser to produce 4 Mtpa of green hydrogen by 2065. The successful implementation of green hydrogen would assist the domestic economy in reducing its carbon footprint and boosting the production and exports of green energy products.

The implementation of strategies to increase production and exports of the non-energy sector would also assist in the diversification of the domestic economy. While there are several initiatives to boost manufacturing exports such as the Export Booster Initiative and the EXIM Bank foreign exchange facility, a greater effort is needed to penetrate new markets. The completion of new trade agreements and partial scope agreements may serve to boost the manufacturing sector's production and exports.

The transition to a low-carbon economy would require significant financing from both public and private sectors as well as international sources. Domestically, greater utilisation of the Government-established Green Fund could help with the initial investment needs to decarbonise the domestic economy. The Green Fund levy is charged at 0.3 per cent on gross income of companies. At the end of September 2020, the balance of the Green Fund amounted to $7.6 billion. The removal of administrative barriers would increase accessibility to the Fund, allowing more institutions to undertake green initiatives in the domestic economy. Another possible option for raising financing for climate change is through the issuance of green bonds. World Bank (2023) defines green bonds as a debt security that is issued to raise capital specifically to support climate-related or environmental projects. Across the globe, several countries have issued green bonds. For instance, the International Finance Corporation (2022) indicated that green bond issuers in Emerging Market and Developing Economies (EMDEs) recorded their strongest year in 2021, with US$95.0 billion in issuance up from US$41.0 billion in 2020 and US$53.0 billion in 2019. An additional US$64.0 billion of social, sustainability, and sustainability-linked bonds brought the total EMDE Green, Social, Sustainability and Sustainability-linked (GSSS) bond issuance in 2021 to US$159.0 billion. China remains the largest issuer of green bonds among EMDEs, with issuance of US$59.0 billion in 2021 or 63.0 per cent of the total. It should also be noted within the Latin America and the Caribbean region, while Chile, Brazil and Colombia were the top three issuers of GSSS bonds, countries such as Dominica and Barbados also contributed to the issuance of GSSS bonds. In particular, the Dominican Republic issued green bonds with renewable energy firms for US$20.0 million, while Barbados issued a sustainability bond of US$7.0 million. Therefore, the issuance of GSSS bonds represents a major source of finance for investment into green products and renewable energy. Additionally, Trinidad and Tobago should seek financing from international financial and developmental organisations such as the World Bank and the United Nations Green Climate Fund to help lower carbon emissions and boost the production of green products.

Foreign direct investment (FDI) could play a significant role in financing renewable energy projects. In Trinidad and Tobago, FDI is dominated by the energy sector. Going forward, a change in the composition of FDI is needed to decarbonise the domestic economy. In order to attract green investment, appropriate incentives such as reduced corporate income tax rates, tax holidays, investment allowances and tax credits, accelerated or free depreciation exemptions from import tariffs on inputs and export-processing zones should be implemented. Generally, investment firms would consider economic, regulatory, technical and environmental factors before investing in an economy. Further, Public-Private Partnerships (PPP) could be used to unlock financial flows to fund climate change policies. The research has shown that the responsibilities, risk-sharing and rewards would have to be clearly defined.

Going forward, the analysis of the paper will be expanded to capture further impacts of climate change mitigation policies on the domestic economy. Given that Trinidad and Tobago depends heavily on foreign direct investment from the energy sector, the analysis will be extended to include the impact of transitioning to a low-carbon economy on foreign direct investment. The shift towards a greener economy is anticipated to impact the level and composition of foreign direct investment. Globally, countries continue to adopt carbon pricing instruments. Given the potential impact of carbon pricing systems on energy demand and prices, the model will be recalibrated to include the effects of carbon pricing on the external accounts. Finally, the analysis would be extended to include specific components of the balance of payments such as non-energy trade and the financial account.

References

Al- Sarihi, Aisha. 2018. "Prospects For climate Change Integration Into The GCC Economic Diversificaton Strategies ." *LSE Middle East Centre Paper Series .* http://eprints.lse.ac.uk/86873/.

Bems, Rudolfs and Luciana Juvenal. 2022. "Climate Change Mitigation Will Cause Large Adjustments in Current Account Balances." *International Monetary Fund.* August 16. https://www.imf.org/en/Blogs/Articles/2022/08/16/climate-change-mitigation-will-cause-large-adjustments-in-current-account-balances.

Bobb, Ashley, Lauren Sonnylal, Kester Thompson, Reshma Mahabir. 2020. "Impact of the Closure of a Large Foreign Direct Investment: The Case of ArcelorMittal in Trinidad and Tobago." *Central Bank of Trinidad and Tobago Working Paper Series* WP 01/2020.

Bp. n.d. *Five Aims to Get BP to Net Zero .* https://www.bp.com/en/global/corporate/sustainability/getting-to-net-zero/five-aims-to-get-bp-to-net-zero.html.

Campiglio, Emanuele, Etienne Espagne, Jean-Francois Mercure, William Omam, Hector Pollitt, Gregor Semieniuk, and Romain Svartzman. 2021. "Transboundary Climate-Related Risks: Analysing the Impacts of a Decarbonisation of the Global Economy on International Trade, Finance, and Money." *Paper prepared for the 9th IMF Statistical Forum, 17-18 November 2021-Draft as of October 2021.* Paper.

CEPAL. 2011. *The Economics of Climate Change in the Caribbean.* Port-of-Spain, Trinidad and Tobago: United Nations Economic Commission for Latin America and the Caribbean.

Chapman, Lee. 2007. "Transport and climate change: a review ." *Journal of Transport Geography* 354-367.

EoG Resources . 2023. *Company Fact Sheet April 2023.* Accessed July 2023. https://www.eogresources.com/documents/EOG%20Fact%20Sheet%20(April%202023).pdf.

Gallgagher, Kevin, luma Ramos, Corinne Stephenson, and Irene Monasterolo. 2021. "Climate Change and IMF Surveillance he Need for Ambition ." *Global Development Policy Centre GEGI Policy Brief 014* 03/2021 Boston University .

Ghosh, Iman. 2021. "Climate Chaange." *World Economic Forum.* February 9. Accessed December 02, 2022. https://www.weforum.org/agenda/2021/02/global-warming-climate-change-historical-human-development-industrial-revolution/.

Government of the Republic of Trinidad and Tobago. 2021. *First Biennial Update Report of the Republic of Trinidad and Tobago.* Port of Spain : Ministry of Planning and Development .

Grippa, Pierpaolo, and Samuel Mann. 2020. "Climate-Related Stress Testing: Transition Risks in Norwary." *SSRN Electronic Journal.* https://doi.org/10.2139/ssrn.3758065.

Gu, Grace Weishi, and Galina Hale. 2022. *Climate Risks and FDI.* Working Paper Series 30452, National Bureau of Economic Research.

Inter-American Development Bank and National Energy Corporation of Trinidad and Tobago. 2022. *The roadmap for a green hydrogen economy in Trinidad and Tobago.* https://publications.iadb.org/en/roadmap-green-hydrogen-economy-trinidad-and-tobago.

IEA. 2021. *Net Zero by 2050: A Roadmap for the Global Energy Sector .* Report , PAris : International Energy Agency.

IEA. 2022. *World Energy Outlook 2022.* Report , PAris : International Energy Agency.

Net Zero by 2050: A Roadmap for the Global Energy Sector . Report , PAris : International Energy Agency.

International Finance Corporation. 2022. “Emerging Market Green Bonds.” *Emerging Market Green Bonds Report 2021*. Riding the Green Wave. https://www.ifc.org/en/insights-reports/2022/emerging-market-green-bonds-report-2021.

Intergovernmental Panel on Climate Change. 2014. "Climate Change 2014: Synthesis Report." Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.k. Pachauri and L.A. Meyers(eds.), Geneva, Switzerland .

Intergovernmental Panel on Climate Change. 2022. "Climate Change 2022: Impacts, Adaptation and Vulnerability." Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel of Climate Change. https://report.ipcc.ch/ar6/wg2/IPCC_AR6_WGII_FullReport.pdf.

IPCC. 2014. "Climate Change 2014: Synthesis Report." Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.), Geneva, 151.

Jordhus-Lier, D., Houeland, C., Holmås, H.E., Szulecki, K., and Østring, P.R. 2022. "Petroleum Transition Pathways in norway: How do Noweigan stakeholders envision pathways to net-zero and phase-out for the country's oil and gas sector?" *University of Oslol, Fafo .*

Leke, Acha, Peter Gaius-Obaseki, and Oliver Onyekweli. 2022. *The Future of African Oil and Gas: Positioning for the Energy Transition .* Mc Kinsey & Company .

Li, Xia, and Kevin P. Gallagher. 2022. "Assessing the climate change exposure of foreign direct investment." *Nature Communications* (1451). doi:https://doi.org/10.1038/s41467-022-28975-5.

Makarov, Igor, Daniel Besley, Dudu Hasan, Jakub Boratynski, Maksym Chepeliev, Elena Golub, Vladislava Nemova, and Ilya Stepanov. 2021. "Russia and Global Green Transition." https://doi.org/10.1596/36757.

Malpass, David. 2022. "Remittances are a critical economic stabilizer." *World Bank Blogs.* December 06. Accessed January 23, 2023. https://blogs.worldbank.org/voices/remittances-are-critical-economic-stabilizer.

Mercure, J.-F., H. Pollitt, J. E. Viñuales, N. R. Edwards, P. B. Holden, U. Chewpreecha, P. Salas, I. Sognnaes, A. Lam, and F. Knobloch. 2018. "Macroeconomic Impact of Stranded Fossil Fuel Assets." *Nature Climate Change 8, no.7 (2018): 588-93* https://doi.org/10.1038/s41558-018-0182-1. .

Ministry of Planning and Development . n.d. *T&T to Reduce Publikc Transport Carbon Dioxide Emission by 15% by 2030 .* Accessed 17 July, 2023. www.planning.gov.tt. Accessed July 17, 2023. https://www.planning.gov.tt/content/tt-reduce-public-transport-carbon-dioxide-emissions-15-2030.

Moerenhout, Tom, and Christophe Bellmann. 2021. "Impacts of Climate Change Policies on Developing Country Export Markets." *International Institute of Sustainable Development .*

Moore, Winston. 2010. "The impact of climate change on Caribbean tourism demand ." *Current Issues in Tourism* 495-505.

Musah-Surugu, Issiah Justice, Albert Ahenkan, Justice Nyigmah Bawole, and Samuel Antwi Darkwah. 2018. "Migrants' remittances A complementary source of financing adaptation to climate change at the local level in Ghana." *International Journal of Climate Change Strategies and Management* 10 (1): 178-196.

Nikkei Asian Review. 2018. *Storm clouds loom for Asian companies unready for climate change .* Accessed January 2023. https://asia.nikkei.com/Spotlight/Asia-Insight/Storm-clouds-loom-for-Asian- .

OECD. 2010. *Globalisation, Transport and the Environment.* Paris: OECD Publishing .

Partnership on Trnasparency in the Paris Agreement . 2019. *Trinidad and Tobago's NDC Implementation Plan: A Policy Blueprint to Guide Effective Mitigation Action.* eutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH (in cooperation with the United Nations Development Programme-UNDP).

Prasad, Ananthakrishnan, Selim Elekdag, Phakawa Jeasakul, Romain Lafarguette, Adran Alter, Alan Xiaochen Feng, and Changchun Wang. 2019. "Growth at risk: Concept and Application in IMF Country Surveillance." IMF Working Paper. WP/19/36.

Shell Global. n.d. *Achieveing Net-Zero Emissions .* Accessed July 2023. https://www.shell.com/powering-progress/achieving-net-zero-emissions.html.

Shell Global. 2021. *Shell Accelerates Drive for Net-Zero Emissions with Customer-First Strategy.* Accessed July 2023. https://www.shell.com/media/news-and-media-releases/2021/shell-accelerates-drive-for-net-zero-emissions-with-customer-first-strategy.html.

Solano-Rodriguez, Balthazar, Steve Pye, Pei-Hao Li, Paul Ekins, Osmel Manzano, Adrien Vogt-Schilb. 2019. *Implications of climate targets on oil production and fiscal revenues in LAtin America and the Caribbean .* Discussion Paper, No. IDB-DP-00701, Inter-American Development Bank.

Steenblik, Ronald and Massimo Geloso Grosso. 2011. *Trade in Services Related to Climate Change: An Exploratory Analysis.* OECD Trade and Environment Working Papers, OECD.

UNCTAD. 2019. *Commodity-dependent Countries Must Diversify to Avoid Eocnomic Collapse.* September 17. Accessed January 2022. https://sdg.iisd.org/news/unctad-commodity-dependent-countries-must-diversify-to-avoid-economic-collapse/.

UNCTAD. 2022. *World Investment Report 2022.* UNCTAD.

United Nations Conference on Trade and Development. 2022. *Investment and climate change.* Note, Trade and Development Board, UNCTAD Secretariat.

United Nations World Tourism Organization. 2012. *Challenges and Opportunities for Tourism Development in Small Island Developing States.* Madrid, Spain: UNWTO.

World Bank. 2022. *Remittances Brave Global Headwinds.* Migration and Development Brief 37, World Bank. https://www.knomad.org/sites/default/files/publication-doc/migration_and_development_brief_37_nov_2022.pdf.

World Bank. 2022. *World Bank Group Delivers Record $31.7 Billion in Climate Finance in Fiscal Year 2022.* Press Release, Washington D.C.: World Bank Group.

World Bank. 2022. What are Green Bonds? https://documents1.worldbank.org/curated/en/400251468187810398/pdf/99662-REVISED-WB-Green-Bond-Box393208B-PUBLIC.pdf

World Trade Organization. 2009. *Trade and Climate Change*. Geneva, Switzerland: WTO-UNEP Report.