Sustainability of Pension Systems in the Small Island Developing States

the case of Mauritius

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Sustainability of Pension Systems in the Small Island Developing States: the case of Mauritius

A Scenario Analysis

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Introduction

Aging populations in developed countries and the relevance of sound pension systems has been a topic of importance in academic research in the past two decades. Pension reforms have been on the political agenda for many Western countries. Nevertheless, the development of healthy pension systems is crucial for other countries as well. This is especially true when the reality of an aging population and its devastating consequences have not been completely acknowledged (Mercer, 2016). One group of countries that deserves attention is the Small Island Developing States (SIDS hereafter). The SIDS are a set of countries and states that are mainly characterized by their vulnerabilities to factors outside of their control and resulting development challenges. Their economic marginalization renders them significantly disregarded while their peculiarity justifies their need for attention. Most SIDS already exhibit trends of increasing life expectancy and falling fertility rates. These indicators of an aging population make it crucial to ensure the SIDS' capacity to provide for the elderly in the long run. Sustainability of pension system is particularly challenging for the SIDS because of their vulnerabilities.

Formulating policies that support this sustainability requires a thorough understanding of the potential impact of external factors. Therefore, the question is as follows: How can external shocks to the economy of SIDS affect their pension systems? In other words, how much of an impact do forces outside of the SIDS' control can have on long run sustainability and a SIDS' retirement plans? This paper aims at answering these questions, using Mauritius as a case study. Mauritius has undergone tremendous economic growth in the past forty years. This has led to rapid demographic transition. This aging of population is unprecedented for the island, which suggests that it is time to ensure the island possesses a sound and sustainable pension system.

Using predictions and scenario analysis, this study finds that Mauritius' economy is sufficiently diversified to bear shocks without compromising pension system sustainability, compared to a no-shock scenario. However, sustainability is already at risk on the non-contributory side of pensions. These are predicted to start reaching alarming thresholds in the upcoming decade or two. Reforms in Mauritius should be structural rather than cyclical. They should focus on alleviating pressure on government expenditures on one hand, and on diversifying the asset allocation of pension funds on the other.

The analysis is conducted by the following means. First, Mauritius' economy and sources of vulnerabilities are examined, as well as current pension system in place. Second, sustainability is defined with metrics that allow inter-scenario comparison. Third, predictions are created to establish a baseline scenario and to permit simulated data of hypothetical shock scenarios. The analysis finds that shocks are not constraining in the short run, but have lasting long run impacts. Even without shocks, retirement pensions are at risk on the non-contributory side.

The structure of the paper presents as follows. Part 1 provides theoretical background on the SIDS. Part 2 presents the case of Mauritius. Part 3 defines sustainability and gives an overview of the pension system in Mauritius. Part 4 uses all previous elements to analyse the situation and answer the research question. This part presents the hypotheses, predictions, scenarios, conclusions and policy implications. A conclusion closes the paper.

Part 1. The Small Island Developing States

This section helps understand the nature of the Small Island Developing States, from the characteristics that define these states to the type of challenges they face. Understanding this establishes a strong foundation for the analysis and helps the reader understand how these countries are vulnerable and why they deserve attention.

Section 1 gives a general definition of the term SIDS. Section 2 elaborates on the characteristics and vulnerabilities that are specific to the SIDS. Section 3 gives an example of a typical SIDS economy, which illustrates their main problem. Section 4 gives an overview of the economic literature on the SIDS.

1.1 Definition

The Small Island Developing States are small insular states that share a common set of specific characteristics: smallness, remoteness, insularity and economic fragility. More than a general definition that includes any state that fits the description, the term 'SIDS' refers to a distinct group of fifty-seven states defined and recognized by the United Nations. In fact, this term shows to be a large and flexible one. The list of SIDS, displayed in Table 1, comprises sovereign nations (Palau, Seychelles), independent states (Niue, Cook Islands), autonomous states

(Aruba) and dependent territories (British Virgin Islands, French Polynesia). The SIDS comprise all types of economic performance ranging from low income countries (Timor-Leste, Sao Tome and Principe) to high income countries (Barbados, Mauritius). Some SIDS are not even islands or peninsulas (Guinea Bissau, Suriname).

Table 1 List of Small Island Developing States (SIDS) by regions of the world

Caribbean SIDS	AIMS* SIDS	Pacific SIDS
Anguilla	Bahrain	American Samoa
Antigua & Barbuda	Cape Verde	British Virgin Islands
Aruba	Comoros	Cayman Islands
Bahamas	Guinea-Bissau	Cook Islands
Barbados	Maldives	French Polynesia
Belize	Mauritius	Fiji
Cuba	Sao Tome & Principe	Guam
Curacao	Seychelles	Kiribati
Dominica	Singapore	Marshall Islands
Dominican Republic	Timor-Leste	Micronesia (Federated States of)
Grenada		Northern Marianas (Commonwealth of)
Guadeloupe		Nauru
Guyana		Niue
Haiti		New Caledonia
Jamaica		Palau
Martinique		Papua New Guinea
Montserrat		Samoa
Puerto Rico		Solomon Islands
St Kitts & Nevis		Tonga
St. Lucia		Tuvalu
St. Maarten		US Virgin Islands
St. Vincent & the Grenadines		Vanuatu
Suriname		
Turks & Caicos		
Trinidad & Tobago		

Source: UN-OHRLLS (2011)
* AIMS stands for Atlantic, Indian Ocean, Mediterranean and South-China Sea

Despite this diversity, the states listed in Table 1 share common features. Effectively, the SIDS are recognized as an official and statutory category of country because they bear many disadvantages associated with their characteristics, and significant challenges are the consequence of their unfavourable features. The path towards development is difficult, if not unfeasible. Even when growth is achieved it is unlikely to be sustained, and SIDS typically exhibit high volatility in growth. Importantly, the uncertainty of the risks they face makes them vulnerable. Mitigating risks becomes the main goal for these states. This emphasises the necessity of appropriate economic policies and the special attention required by SIDS. (Encontre, 1999). These vulnerabilities are explained in the following section.

1.2 Characteristics and vulnerabilities

The key characteristics of the SIDS are the following: smallness, remoteness, insularity, and openness. Further characteristics include growth volatility and poor resilience in the face of shocks. The disadvantages and vulnerabilities faced by the SIDS that stem from these characteristics can be roughly classified as economic and environmental. This section shed light on each type in turn.

1.2.1 Economic vulnerabilities

Most the economic disadvantages that the SIDS face are closely associated to smallness and remoteness (Encontre, 1999). Smallness can be defined in three ways: by the size of the population, the size of the land area or the size of the GDP (Briguglio, 1995). In the case of SIDS it rather refers to the smallness of population, usually under one million inhabitants, or smallness of the land area usually under 20,000 km^2. In both cases smallness comes at high cost: SIDS tend to be endowed with poor natural resources and poor human resources. Poor natural resources limit agricultural crops cultivation and prevents agricultural diversity. Complete depletion of non-renewable natural resources is easy, especially for SIDS with growing population where density slowly increases. Poor human resources create disparities in the labour market and problems in public administration of institutions. Moreover, smallness gives rise to a small domestic market and to the inability to benefit from economies of scale (Encontre, 1999). Remoteness results in high transportation, communication and infrastructure costs. Being located far away from foreign markets and trading partners significantly increases the costs of doing trade. Imported inputs are expensive. Consequently, so are outputs. This renders competitiveness challenging and SIDS are unable to influence prices.

Further characteristics other than smallness and remoteness induce challenges. Because of having poor resources, they tend to be open to trade, which translates into a high import content. They also tend to rely heavily on trade, as the few crops they produce represent most of their exports.

Economically speaking, the defining particularity of SIDS is the point to which they rely on a limited number of sources of income, trade being one of them. This stands to reason since their natural disadvantages do not give scope for many economic activities. In addition to the export

of commodities (mostly agricultural), typical source of income are tourism, remittances, foreign aid, in addition to the export of commodities, usually agricultural.

Notably, SIDS main sources of finance are foreign. Therefore, these states are heavily reliant on factors outside of their control, such as changes in international commodity prices, in international demand, in exchange rates or to any foreign shocks. They are vulnerable to trade policy changes such as quotas and tariffs which can further undermine their competitiveness. The consequence of this dependence and lack of diversification is the susceptibility to external shocks and the poor resilience that SIDS exhibit in the face of these. That is, dependence engenders a serious vulnerability due to the uncertain character of potential change in variable that importantly affects their economy. This idea is illustrated in section 1.3 with the example of Aruba.

1.2.2 Environmental vulnerabilities

Since most SIDS are islands with tropical climates, many of them are prone to natural disasters. These include cyclones, hurricanes, storms, tsunamis, earthquakes, volcanic eruptions, droughts, sea-level rise, ocean acidity and extreme weather conditions. Not only are the SIDS are exposed to environmental shocks, they usually have limited ability to mitigate them and they exhibit low levels of resilience. Even for higher income SIDS economies are fragile and bear very strong costs of recovery. Because of this vulnerability to environmental shocks, SIDS are around 34% more economically vulnerable than other types of developing countries (United Nations, 2017).

For instance, the Caribbean SIDS Haiti constantly experiences new environmental shocks. Initially a very poor nation, Haiti bears the consequences of being in a risky zone: In 2010, an immense earthquake devastated the island and was followed by hurricane Matthew in 2016. With agricultural crops as a main source of revenue and houses and infrastructures to rebuild, these environmental shocks evolve into economic ones. Moreover, the successive aspect of shocks leaves no time for the country to recover or build resilience.

1.3. A typical SIDS economy: Aruba

Aruba is a Caribbean island that belongs to the Kingdom of the Netherlands. As a SIDS, Aruba's economy reflects smallness and openness (Vanegas & Croes, 2003). Situated outside the Caribbean hurricane zone, the island does not suffer environmental shocks and is a perfect tourist destination (IMF, 2015). In fact, Aruba's economy rests strongly on tourism as well as two other pillars: international trade and financial services, and oil refining (Vanegas & Croes, 2003). All these activities are strongly dependent on foreign markets.

This vulnerability to foreign markets and lack of diversification in economic activities has been very costly to Aruba in the past years. In 2009, the oil refinery company Valero ceased operating at the beginning of the financial crisis. Consequently, the economy of Aruba entered in deep recession. Not only the oil industry contracted, tourism collapsed because of the crisis that started in the United States, where most tourists in Aruba come from. Growth rates in Aruba became negative, reaching -3.6% in 2007 and collapsing to -6.9% the following year (World Bank, 2017a). Shortly recovering in 2011 when the oil company restarted running, at a time when the tourism resumed, Aruba entered in recession again when Valero closed one year later for the second consecutive time (IMF, 2015). When recessions are consecutive, the second is typically deeper than the first (IMF, 2015). Effectively, this recession lasted several years, and in 2014 public debt exceeded 80% of GDP (IMF, 2015). Consequently, Aruba's real GDP reached its 1996-level (World Bank, 2017a). Aruba lost in three years what it had built in a decade. Today the economy is slowly recovering thanks to a tourism revival. However, it is not expected to return to its pre-crisis level any time soon.

This example illustrates the dangers of strong reliance on a few sources of income which future outcomes are uncertain. It shows how sensitive Aruba's economy is to volatility. However, few countries are as tourism-dependent as Aruba. With more than 85% of its economy being tourism-related, Aruba ranks first in relative importance of tourism's contribution to GDP worldwide (IMF, 2015; World Travel & Tourism Council, 2015a). Still, states such as Aruba need diversification and to build resilience against both internal and external shocks.

1.4. SIDS in the economic literature

The literature on SIDS is quite extensive. The most referenced academic papers are indisputably that of Briguglio (1995) and Encontre (1999), on which further studies have been built. Both authors expose the very nature of the SIDS, discussing the main vulnerabilities they face.

Briguglio (1995) covers all the previously developed: the smallness, the insularity, the remoteness, the proneness to natural disasters, the limited resources, the dependence on exports and the limited ability to influence prices and exploit economies of scales. He also attempts to quantify vulnerability by construction of an index. Encontre (1999), on the other hand, focuses on the ever-globalizing environment and the resulting potential economic marginalization of SIDS. He argues that globalization leads to trade liberalization and the attempt to become more competitive by reducing trade barriers. This aspect in particular is harmful to SIDS, as they lack the resources to keep up with global competitiveness and therefore to be players in the global economy (Encontre, 1999). The author emphasises the importance of economic specialization to decrease SIDS' vulnerability and improve their resilience Encontre (1999). In his opinion, the improvement of economic activities that already exist in the country provides the grounds for specialisation and should therefore be the focus of development policies (Encontre, 1999). Similarly, Pelling & Uitto (2001) discuss the impact of globalization on the SIDS. Despite identifying climate change as the main threatening global pressure, the authors focus on the positive impact of globalization (Pelling & Uitto, 2001). They highlight the benefits of international agreements and linkages, urbanization, foreign direct investment, cultural modernization and identity politics (Pelling & Uitto, 2001). If good governance exists within the SIDS, all the previous can act as tools to foster resilience (Pelling & Uitto, 2001).

The literature digs deeper into climate change and how it constitutes both a significant vulnerability and development challenge for SIDS. Schmutter, Nash & Dovey (2016) examine the global threats linked to ocean acidity. They identify biodiversity and aquaculture, tourism, food security and safety as the main areas of concern for the countries at risk (Schmutter, Nash & Dovey, 2016). Because the SIDS are not as exposed to such risks as other countries, they play an important role in the preservation of marine species in tropical areas that exhibit relatively low levels of acidity (Schmutter, Nash & Dovey, 2016).

Niesten, Gjertsen & Fong (2012) further emphasize the fact that SIDS depend highly on marine resources and the importance for them to undertake the best practices for their conservation. The authors also underline the importance of acknowledging the opportunity cost of conservation which is endured by resource owners, and to create interventions that address it (Niesten, Gjertsen & Fong, 2012). Moreover, there exist funding possibilities for the SIDS through bilateral agreements or partnerships with firms from the private sector (Niesten, Gjertsen & Fong, 2012).

Ghina (2003) addresses the matter of sustainable development within the SIDS and explores its challenges. Using the case of Maldives, Ghina (2003) finds that climate change and sea-level rise are elements that render sustainable development even more difficult for the SIDS. Even though it is challenging, sustainable development is still essential for the SIDS: for this reason, environmental problems such as climate change and sea-level rise should be given the priority, and the SIDS crucially need cooperation from developed countries to achieve sustainable development (Ghina, 2003).

On the other hand, Kelman (2013) argues that climate change is only one of many development challenges that countries that SIDS face. He explores how focusing solely on climate change depoliticize the other growth challenges at hand and suggests focusing on the root of the vulnerability to the many types of hazards, rather than climate change only (Kelman, 2013).

Recent research papers focus on various variables and how they affect the economy of the SIDS. Amuedo-Dorantes, Pozo & Vargas-Silva (2010) show that natural disasters in the SIDS strongly increase remittances and foreign aid, and remittances in turn affect the SIDS by depreciating their exchange rates. Feeny & McGillivray (2010) find that foreign aid exhibits efficiency in the SIDS, but less than in other countries and with diminishing returns. The authors argue that foreign aid is less effective in the SIDS than in other types of country because of their fragility and resulting hindered capacity of absorption (Feeny & McGillivray 2010). Thus, the aid that some SIDS receive can be considered excessive – such as Micronesia, Marshall Islands – and there is room for scaling the foreign aid flows to these countries (Feeny & McGillivray 2010). Santos-Paulino (2010) shows that external shocks account for a large proportion of current account balance fluctuations in the SIDS, and that changes in terms of trade have a negative impact on real GDP, rendering it a major source of vulnerability.

1.5 The case of Mauritius

In this study, Mauritius is used as a case study for establishing whether a SIDS can have a financially sustainable pension system. There are several valuable reasons to choose Mauritius for this purpose. The first is one of feasibility: given its relatively large size for a SIDS and its upper-middle income status, Mauritius has solid institutions and data is carefully collected and thereby more accessible compared to other SIDS. Second, Mauritius has a miraculous history of economic development, which is developed in part two.

Part 2. The Republic of Mauritius

This section provides background on Mauritius. Section 1 establishes the socio-geographic setting in which lies Mauritius. Section 2 focuses on the economy of Mauritius which helps understanding its economic situation. Section 3 shows the demographic evolution in consequence of the developing economy and establishes a starting point for the pension analysis.

2.1. Setting

Figure 1 Location of Mauritius
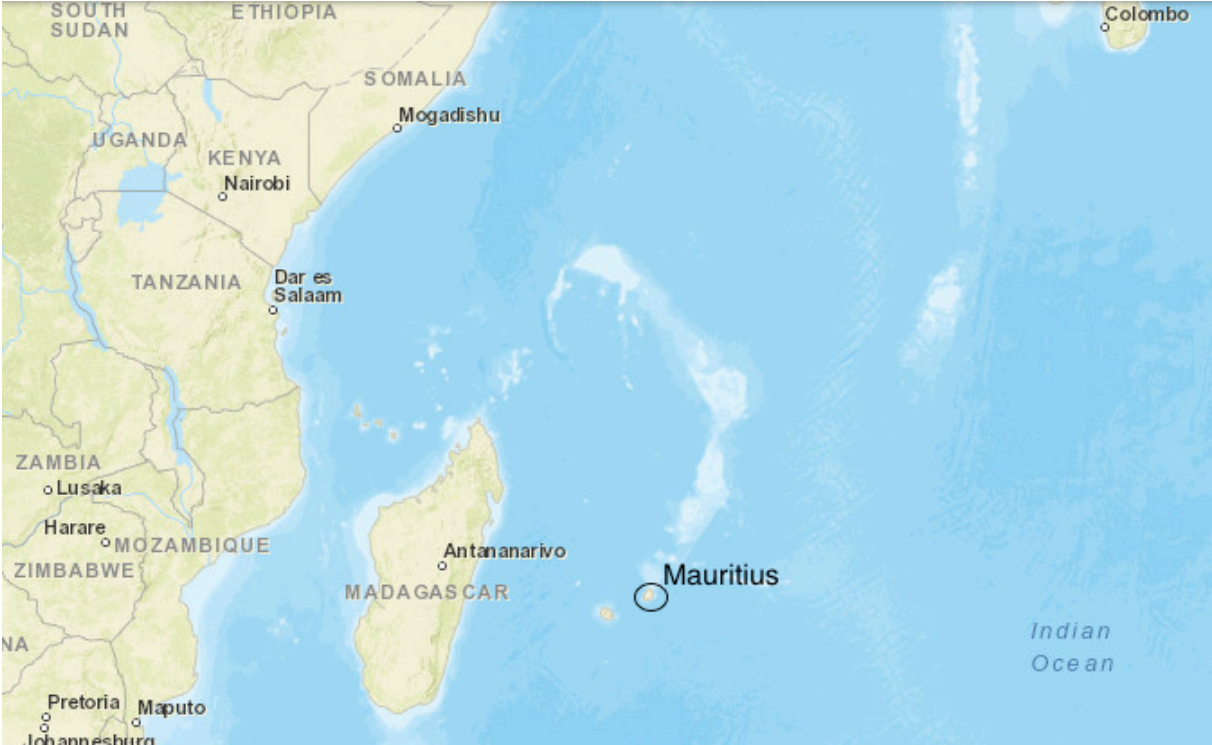
Source: The World Bank (2017c), edited

The Republic of Mauritius ('Mauritius' hereafter) is a SIDS located in the Indian Ocean, east of Madagascar, as shown in Figure 1. The nation is composed several islands: one main island referred to as 'Mauritius', the islands of Rodrigues, Agaléga, Port-Mathurin and other small islands, some of which are sandbanks. Port Louis is the capital city located in the island of Mauritius.

As a SIDS, Mauritius is a very remote insular state: geographically very excluded, the island is fully surrounded by water and located some 220 km to its closest neighbour, the French

overseas territory Reunion. In fact, Mauritius is the African nation located the furthest away from continental Africa, as well as the nation that experiences the most remoteness worldwide (Frankel, 2010). This can be clearly seen in Figure 1. The population is large for an island (1.26 million inhabitants) and the land area is modest (2030km^2) (World Bank, 2017b). This blend renders Mauritius the most densely populated country in Africa. Named after the Prince Maurice van Nassau, it is believed that the island was discovered by the Portuguese before being taken over by the Dutch in 1598, by the French in the 18th century and then by the British in the 19th century, from which it officially declared independence in 1968 (Government of Mauritius, 2017). This successive colonization is one reason for the ethnic diversity of the country.

The island experiences a tropical climate. During the year, a cool and dry winter follows a warm, humid and sometimes rainy summer. Mauritius is prone to environmental shocks, in particular to drought and cyclones. In 2016, 42.3% of the total land area was kept for agriculture, and the urban population constituted 39.6% of the total population (World Bank, 2017b).

2.2. The Economy of Mauritius

2.2.1 The Mauritian miracle: Some history

Prior to its independence in 1968, Mauritius was a monocrop economy dependent on sugar exports (Subramanian, 2001). This made Mauritius very vulnerable to external shocks and the island was consequently not seen as a strong candidate for economic growth (Subramanian, 2001). This view was held by Nobel Price economist James Meade, who stated in his report to the government of Mauritius that the island 'face[d] ultimate catastrophe' (Meade, 1961). Further arguments Meade (1961) gave was Mauritius' poor natural resources, growing population and ethnic tensions. Effectively, the population had a mixed heritage because of the island's history of successive colonization. Nevertheless, Mauritius experienced tremendous development (Subramanian, 2001). Figure 2 shows real GDP in Mauritius has increased six-fold in fifty years.

Figure 2 GDP in Mauritius in billions of dollars (constant 2010 US$)
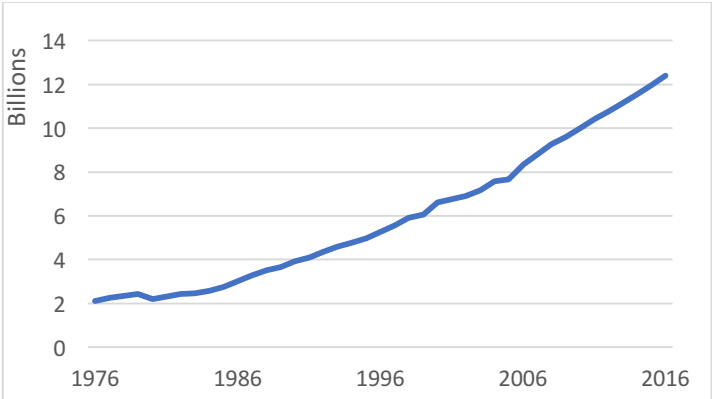
Source: World Bank Data (2017b)

Mauritius' achievement is further reflected in various development indicators. Life expectancy has risen from 59 to 74 years old in five decades (World Bank, 2017b). Gender parity has been achieved at all levels of education, only showing a slight disparity in favour of women at the tertiary level (World Bank, 2017b). The literacy rate for adults was 90% in 2015, compared to 79% in 1990 (World Bank, 2017b).

The island has demonstrated its ability to sustain growth. Its success story despite a Nobel Prize predicting it was doomed has been a surprise to many. Despite its initial dependency on sugar exports, Mauritius has diversified its economy over time.

2.2.3 The economy today: Sources of income

On the path to development Mauritius has largely expanded its economic activity and is no longer commodity-dependent. Agriculture is more diversified and crops now include corn, bananas, tea and cattle in addition to the traditional sugar cane. Industrial sector activities include mining and quarrying, electricity, gas and water supply activities, and manufacturing. Manufactured products such as textiles and clothing are exported. Moreover, the service sector has largely taken over, and now constitutes an approximate 73.8% of GDP (Central Intelligence Agency, 2017). Services include tourism (restaurants and hotels), transportation, information and communication technologies (ICT), as well as banking and financial services.

Mauritius is currently the fastest growing economy in Africa (African Economic Outlook, 2016) and the best place for doing business in Africa (World Bank, 2016). Despite the financial crisis by which the island has been affected due to contagion from the European Union and the

United States – both upon which Mauritius depends on for tourism, trade and FDI - Mauritius' economy still presents a favourable outlook. (Central Intelligence Agency, 2017).

Figure 3 hereunder displays the entirety of Mauritius' economic activities and their corresponding shares of GDP in the year 2013.

Figure 3 Economic activities as a percentage of GDP in Mauritius, year 2013
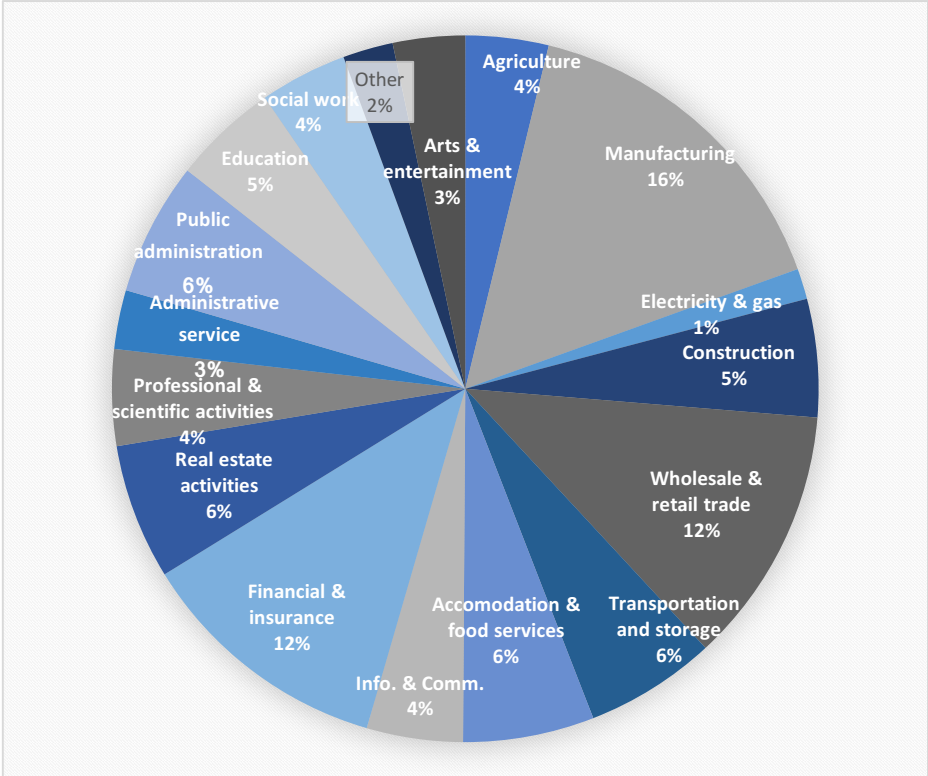
Source: Statistics Mauritius (2016a)

From this figure, it is evident that the economy is diversified. Unlike most SIDS (such as the previously discussed case of Aruba), Mauritius retrieves income from many different economic activities. Still, some sources are far more important than others: namely manufacturing, trade, and tourism. The most important contributors to the country's economy are discussed hereafter.

Manufacturing

Manufacturing appears to be the largest industry and source of income in Mauritius. It is the sector that experienced the highest growth during the path towards development. Employment was strongly boosted due to this growth. Manufactured products are mainly sugar, food and more importantly textiles and clothing.

Trade

Wholesale and retail trade is another significant source of income for Mauritius. In 2015 approximately 48% of exports value consisted of manufactured products (Statistics Mauritius, 2016). Manufactured exports include textile, pearls and stones. Other main commodities exported are sugar, fish and diverse crude materials.

Tourism

In 2014 tourism contributed to 11.3% of GDP directly and 25.5% in total (when including all channels) and this share is expected to grow in the upcoming years (World Travel & Tourism Council, 2015b). Although tourism is not directly seen on the chart, it contributes to GDP extensively. First, it directly involves industries such as accommodation and food service activities (hotels and restaurants), entertainment activities, transportation and others. Second, tourism affects the economy through indirect and induced channels. Indirect channels include investment activities and government spending for tourism purposes, while induced channels refer to the daily expenditures undertaken by employees from the tourism sector, thereby generated by tourism itself (World Travel & Tourism Council, 2015b). Tourism is indisputably a very important source of income: Mauritius offers luxury tourism as opposed to mass tourism, which is more feasible and profitable given the small size of the island.

Aside from growth, improvements in development indicators and economic diversification, Mauritius exhibits another important trend: an aging population.

2.3 Aging population in Mauritius: Descriptive demographics

The development of Mauritius has brought a new challenge: the demographic transition. Population was already growing in 1968, and increased almost linearly until 2000, as shown in Figure 4. The figure also shows that in 40 years the population has doubled. Moreover, population growth has diminished as the population increased.
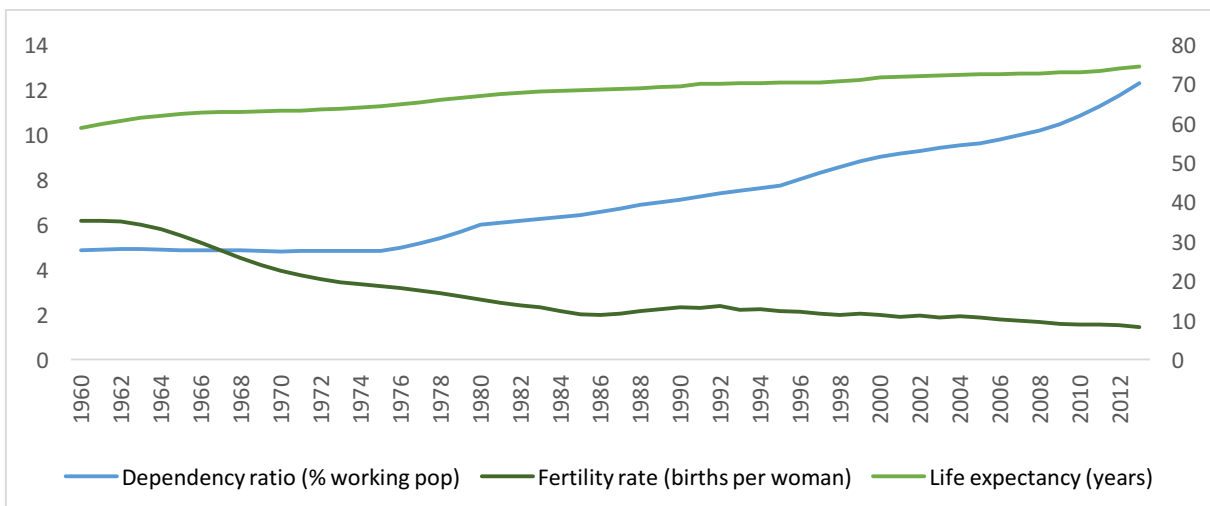
Figure 4 Population (panel a) and population growth (panel b) in Mauritius, 1960-2015
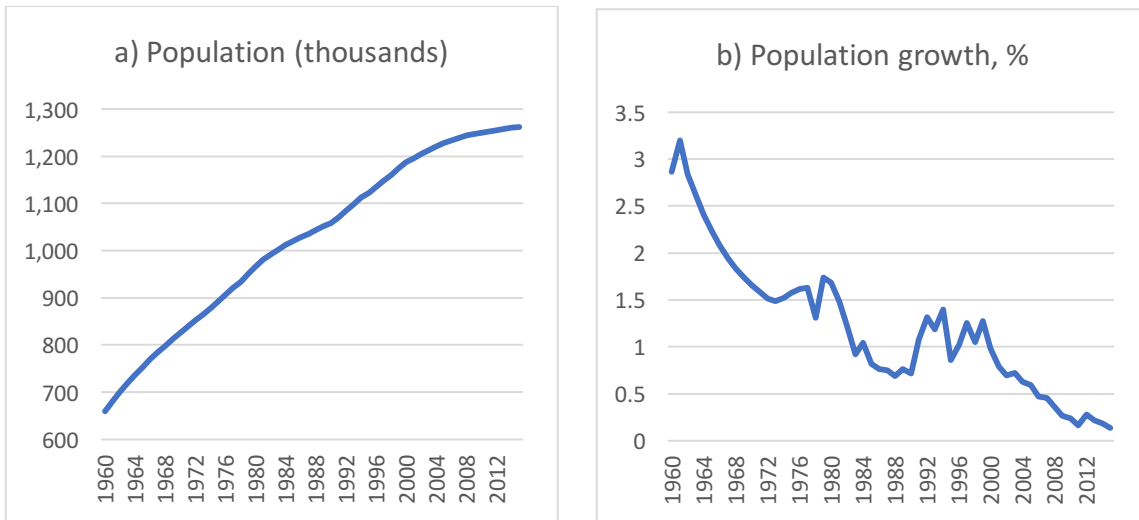
Source: World Bank (2017b)

Figure 5 shows that in fifty years, Mauritius has exhibited the typical trends of increasing life expectancy (58 to 74 years), falling fertility rates (6 to 1 children per woman) that come with development. Correspondingly, the dependency ratio has tripled, from 4.8 to 12.3% of the working population.
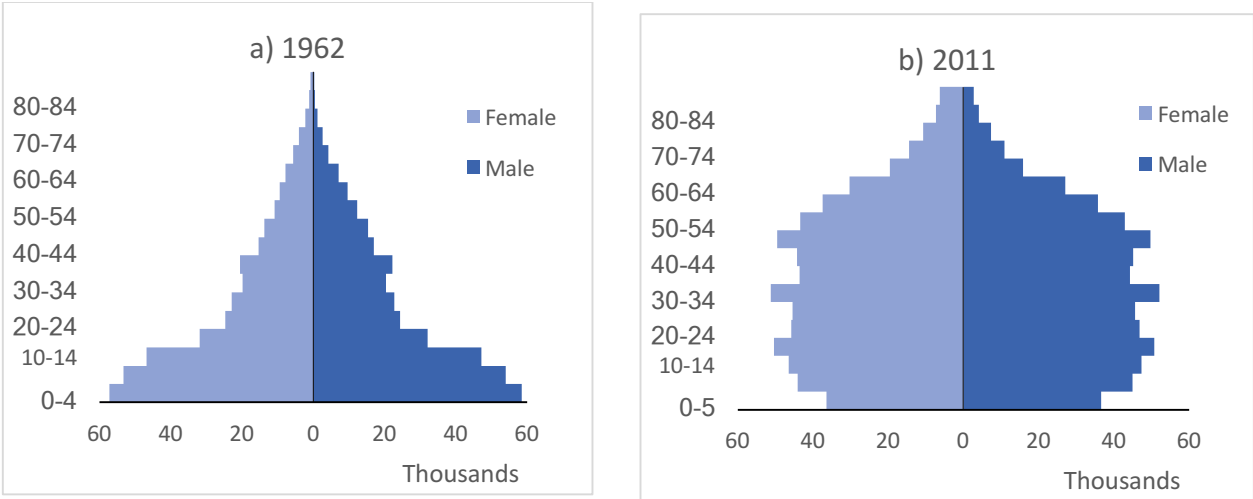
Figure 5 Life expectancy, fertility rate and dependency ratio in Mauritius, 1960-2012

Source: World Bank (2017b)

Figure 6 shows that Mauritius has shifted from Stage 1 to Stage 4 of the demographic transition process in only forty years.
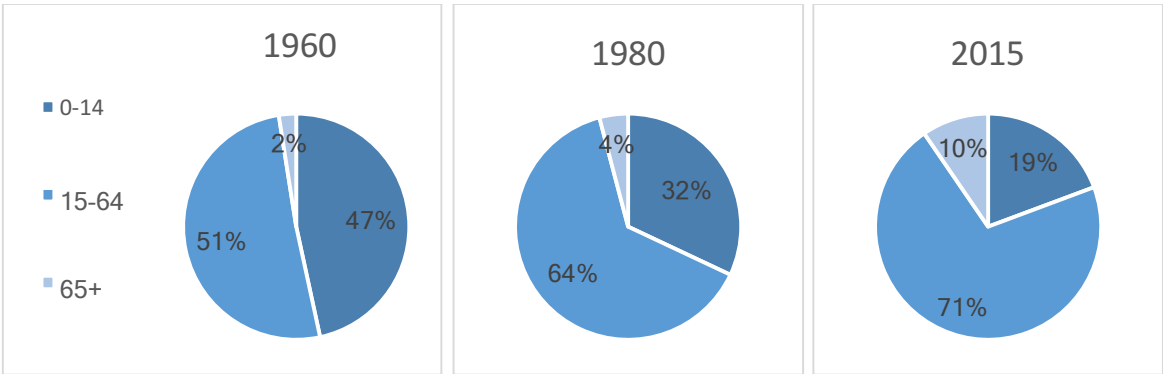
Figure 6 Population pyramids in Mauritius, stage 1 in 1962 (panel a) and stage 4 in 2011 (panel b)

Source: Statistics Mauritius (2015a)

Figure 7 shows that people older than 65 years now represent 10% of the population, as opposed to 2% in 1960.

Figure 7 Population repartition, 1960, 1980 and 2015

Source: World Bank (2017b)

As the elderly represent an increasing share of the population, pension systems are challenged. The rapidity at which the population has transitioned underlines the urgency of inquiring on the health of the pension system in Mauritius. Given the long run aspect of the issue, sustainability is the very important outlook by which pension systems need to be approached.

Given the long run aspect of the issue, sustainability is crucial to the approach of pension systems, and is discussed in part 3. Sustainability is thoroughly discussed in Part 3.

Part 3. Pension Systems and Sustainability

This section introduces the topic of sustainability of pension systems. Section 1 gives an overview of the literature on the topic. Section 2 elaborates on the definition of sustainability to use it as a guideline and starting point to build the analysis. Section 3 describes extensively the current pension arrangements in Mauritius, which will also serve to see how the analysis can be conducted.

3.1. Sustainability literature

Given the increasing problem of aging populations, the academic research on pension systems is wide. Many researchers and institutions study the adequacy, sustainability of pension design in addition to proposing policy reforms. When it comes to determining the sustainability of a system, authors use various approaches for its assessment since there is no consensus. Famous academic references include the indexes by Mercer and Allianz. Mercer (2016) uses three sub-indexes: adequacy, sustainability, and integrity. The sustainability sub-index is based on factors such as the level of assets held in pension arrangements and funds, the coverage ratio, the pensionable age, and life expectancy (Mercer, 2016). These factors are in fact indicators of sustainability rather than pure measures of sustainability, variables which are likely to influence it in the long run (Mercer, 2016). Similarly, Allianz (2016) gives scores on demographics, public finances and pension systems factors to create the Pension Sustainability Index (Allianz, 2016). IMF authors Chand & Jaeger (1996) identify the fiscal consequences of aging population in a range of developed countries. They find that although countries are not equal in terms of impact, mainly due to different designs in pension systems, they all face severe deficits and growing public debt accumulation. Mattil (2006) uses a theoretical framework to contrast differences in structure of the German and the British pension systems and to emphasize the sustainability outcomes of specific designs. The OECD publishes pension systems reports: When reviewing the sustainability of the Irish pension system, the authors use uses projections to examine the existence of a 'long term actuarial equilibrium' where contributions are sufficient to cover projected benefits and this for a sufficiently long period of time (OECD, 2014a).

This study contributes to the literature by focusing on the intersection of the issue of economic fragility in the SIDS and the issue of aging populations and consequences on pensions. It differs from other articles on Mauritius' pension system by incorporating a scenario analysis which

not only considers alternative states of the future but also represents adequately the uncertain aspect of the future economy and its impact on pensions.

3.2. Definition of sustainability

Chapman (2008) defines sustainability of the state as the long run ability to meet its financial responsibilities in a consistent way. Therefore, financial sustainability requires that inflows are always enough to pay out outflows. A balance between flows is required, a dynamic that ensures that this balance stays positive.

In their review of the Irish pension system, the OECD gives a similar definition. The OECD (2014) argue that "the most logical approach to defining financial sustainability involves some form of long term actuarial equilibrium" (OECD, 2014a, p.66). This very equilibrium implies that "the pension system is in balance over time: the stream of contributions and other revenues over a suitably long horizon (50-75) years is enough to pay for projected benefits over that period" (OECD, 2014a, p.66).

The analysis is based on these definitions. In the context of a pension system, the balance will be examined as a measure for sustainability for the government and the pension funds. This will be seen separately for non-contributory pensions and for contributory pensions, until 2050. This is explained in Part 4.

Before examining the sustainability of Mauritius' pension system by these definition, a complete overview of the latter is provided. Current pension arrangements are described in detail in the next section.

3.3. The pension system in Mauritius: Design

The pension system in Mauritius is composed of a mandatory pay-as-you-go (PAYG) public scheme, a mandatory and funded defined-benefit schemes, and voluntary savings through the funds or informally.

The PAYG part comes under the form of a universal pension called the Basic Retirement Pension (BRP). The funded schemes are contributory and managed by the government. The overall design is summarized in the table hereunder.

Table 2 Overview of the Pension System in Mauritius

Tier	Name	Nature	Type	Introduced in
I	Universal Basic Retirement Pension	Mandatory	PAYG	1951
II	Contributory Schemes (NPF, NSF)	Mandatory	Funded	1978
III	Voluntary Private savings	Voluntary	Funded	/

These three tiers are therefore the three sources in an old person's retirement income, listed in Table 2 in terms of importance. Therefore, an old person receives most of its retirement income from the universal pension given by the government (PAYG nature), a significant part from social benefits received thanks to his contributions, and may have additional income from his own personal savings.

3.3.1 Universal pensions

The Basic Retirement Pension (BRP) is the most important component of the pension system in Mauritius in terms of income coverage (Soto, Thakoor & Petri, 2015). Part of the National Pensions Scheme, it is non-contributory, mandatory and entirely financed by the government. The pension is said to be universal since it comes under the form of a flat rate distributed to every person over 60 years old, regardless of their current occupation. That is, beneficiaries do not need to be retired to receive pension benefits.:. The monthly payment depends on the person's age as described in Table 3.

Table 3 Basic Retirement Pension (BRP) monthly benefits by age group (December 2014)

Age (years)	Monthly benefits (2002-2003)	Monthly benefits (2014)
60-69	Rs 1,700	Rs 5,000
70-89	Rs 1,700	Rs 5,000
90-99	Rs 6,400	Rs 15,000
100+	Rs 7,300	Rs 20,000

Source: Willmore (2003), Statistics Mauritius (2017e)

Founded in 1951, the main objective of the first tier is poverty reduction for the elderly through income redistribution. This tier ensures that Mauritius' elderly have a minimum amount of money to live on. When first introduced, it was designed to be temporary. However, further pillars were gradually added to form the current pension system of Mauritius (Willmore, 2006). For this reason, this system can be described as accidental rather than purposefully designed (Willmore, 2006).

Table 3 shows that the pension amount is an increasing function of the beneficiary's age. The oldest-old therefore receive the largest pensions. Moreover, pension amounts increase significantly over time. This is clearly seen when comparing the monthly benefits column of the fiscal year 2002-2003 to the calendar year 2014. This is mainly because pension amounts are annually adjusted for price inflation. Unfortunately, the BRP is costlier over time: In 2014 the universal pension represented 28% of government expenditure, compared to 27.3% in 2011, and 7.3% of GDP, compared to 6.7% in 2011 (Statistics Mauritius, 2016).

In addition to the BRP, two more components of non-contributory retirement income put pressure government expenditures. First, the Enhanced Basic Retirement Pension (EBRP), which is an additional amount distributed to pensioners who suffer from a handicap such as blindness, complete paralysis or who require care from a tier (Statistics Mauritius, 2016). Second, the Child's Allowance (CA), is a pension distributed to children of pensioners who receive the BRP (Statistics Mauritius, 2016). In the analysis, all three components are considered when speaking of non-contributory retirement pensions.

3.3.2 Contributory schemes: NSF and NPF

The two pensions funds managed by the government are the National Pension Fund (NPF) and the National Savings Fund (NSF). These schemes are mandatory for workers affected. That is, employees are required to contribute from the age of 18 until they reach the pensionable age. For all schemes the pensionable age is 63 compared to 60 for the BRP: it is however being gradually increased to 65 by 2018 to adjust for increasing life expectancy (Soto, Thakoor & Petri, 2015).

National Pension Fund (NPF)

The National Pension Fund (NPF) is a partially funded defined-contribution scheme administered by the government and designed for workers in the private sector. Introduced in 1978 its initial objectives were to provide pensions for workers that were not civil servants, but also to build up a fund for national development. Today the fund covers a fair part of the private sector, except for para-statal employees and workers from the sugar industry who are covered under their own schemes. Employees are required to contribute 3% of their wage, while employers are asked 6% (Soto, Thakoor & Petri, 2015).

National Savings Fund (NSF)

The National Savings Fund is the twin scheme of the NPF. It is a fully funded defined-contribution scheme administered by the government. Workers are required to contribute 2% of their wage and will thus receive a lump sum payment when retiring (Soto, Thakoor & Petri, 2015).

Figure 8 shows the asset allocation of the NPF and NSF in 2016.

Figure 8 NPF and NSF asset allocation
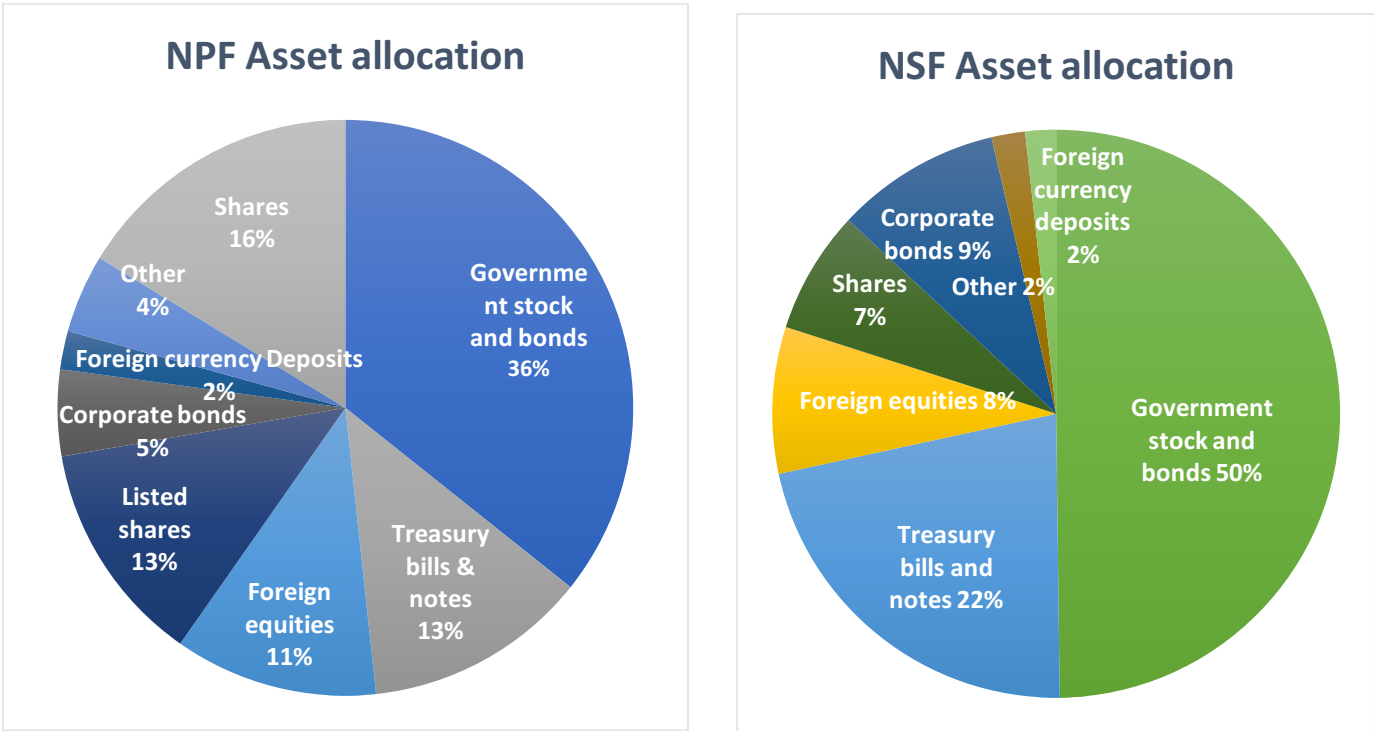
Source: Government of Mauritius, Ministry of Social Security (2017)

Figure 8 shows that the pension funds invest significantly in stocks and bonds of the government of Mauritius. While the government is exposed to foreign sources of finance, the funds themselves are exposed to the government. Therefore, returns (or in case of default, contributions) are exposed to internal shocks, but still indirectly exposed to external shocks.

3.3.3 Occupational private schemes and private pensions

To further increase their future pension income, workers can invest additionally (private voluntary pensions) into existing schemes or to informally save from their regular income (individual pensions). Both constitute the third tier of the Mauritian pension system. Unfortunately, this tier is very unregulated. Reforms for the regulations of this third tier would likely encourage individual pension savings as well as national savings in general.

With a better understanding of what sustainability means in the context of pension systems and with an overview of the current pension system in Mauritius, the future evolution of sustainability in Mauritius can be analysed for different scenarios. This is presented in Part 4.

Part 4. Sustainability of the Mauritian Pension System and Scenario Analysis

Part 1, 2 and 3 have explained the importance of sustainability of pension systems for the SIDS and for Mauritius. These parts have also given enough information to construct a reasoning for the analysis. This section presents the analysis and corresponding methodology based on this reasoning.

Section 1 introduces scenario analysis by shedding light on the definition, types, aims and methodologies of scenarios. Section 2 places the use of scenarios in the context of this study. Section 3 explains the implicit and explicit assumptions taken for building the scenarios. Section 4 explains the reasoning, methodology and data used. Section 5 computes the predictions and scenarios. Section 6 comments on the scenarios created and the conclusions to be drawn from them. Section 7 explains the limitations of scenarios and more particularly of this analysis.

4.1 The use of Scenario Planning

A scenario is a story, a description of a possible future situation given the present, and includes the unfolding of events that lead to that situation (Koskow & Gassner, 2008). Scenario analysis is a field that has been gaining popularity in the past years (Volkery & Ribeiro, 2009). This type of analysis is typically used for strategic purposes in the context of a business, an organization or for public policy. Scenarios are descriptive and do not speak for themselves, but are illustrations of the future created for decision-making.

Coates (2000) identifies two types of scenario analysis. The first one attempts to identify the effects of a policy by creating scenarios where the policy has been established (Coates, 2000). These studies usually comprise a 'business as usual' scenario, a baseline describing the unfolding of events without the policy application, and compares it to the scenarios with the policy (Coates, 2000). The second category creates descriptive stories about the future with the aim of developing policies or making decisions (Coate, 2000).

Due to the variety of contexts in which scenario planning can be applied – such as urban planning, business, and many more – there is not one and only approach or clearly defined methodology (Koskow & Gassner, 2008). Some authors even argue that because of the importance of the context in the creation of scenarios, there will never be a standard method (Volkery & Ribeiro, 2009).

How does one create scenarios then? Coates (2000) argues that 'scenarios are like dancing: One way to do it is by doing it' (Coates, 2000). In other words, it is possible to follow general guidelines, but not one precise method applies to all cases (Coates, 2000). This imprecision explains why scenario creating may be considered an art rather than a science. Nevertheless, scenario planning is not bereft of methods either: Authors in the academic literature tend to use techniques that they would use in other types of studies, such as trend analysis or cross-impact analysis (Koskow & Gassner, 2008).

Despite the lack of existence of a standard method, scenarios help avoiding errors in complex decision-making (Enzman, Beauchamp & Norbash, 2011). Moreover, scenarios are an exhaustive that allows to take both quantitative and qualitative information into account (Greeuw & al, 2000). Studies suggest that scenarios improve organizational performance (Volkery & Ribeiro, 2009). When their limitations are taken into account, they are a relevant tool (Volkery & Ribeiro, 2009).

Nevertheless, since there effectively are limitations to scenarios, it is important to be cautious in regards to the claims made that follow a scenario analysis (Volkery & Ribeiro, 2009).

4.2 Scenarios in the context of this study

As previously discussed, uncertainty is an important concept to the SIDS. Since the SIDS often depend on external sources of finance, and variables outside of their control, there is vast uncertainty regarding potential shocks and how they might be affected, hence the importance of building resilience.

Economic resilience may come under the form of diversification: in the case of Aruba, diversification is necessary if the island is to stabilize its GDP and ensure growth and development. As seen in previous sections, Mauritius already has a diversified economy, and developing its activities has greatly contributed to its growth. Nevertheless, a new question is raised for Mauritius with the shift in demographic trends. How may uncertain, external shocks affect the sustainability of its pension system? The likelihood of these events cannot be predicted, but how can they affect the nation's elderly?

This is where scenarios come in. Uncertainty and impact are the two central concepts in the creation of scenarios. Scenarios are not about turning uncertainty into probabilities, but to help in making decisions in the face of uncertainty. Scenarios are an illustration of future hypothetical states. Creating them allows to mitigate this uncertainty by imagining future possibilities and determining how to take action in the present as a result. Special attention is given to potentially high-impact sources of uncertainty through the scenarios.

The aim of this scenario analysis is not to determine whether Mauritius has a sustainable pension system, but rather to illustrate how potential events may affect the sustainability of its pension system in the long run. Therefore, the scenarios to be created must fulfil two main roles: an illustrative and descriptive role, and the role of being a tool for policy formulation.

4.3 Assumptions to the Scenarios

Formulating assumptions is a necessary step to this analysis. Assumptions fulfil the roles of establishing clarity as to the situation to be quantified and, as well as simplifying the complex set of circumstances at hand and consequently rendering an analysis feasible. They also set forth a foundation upon which hypotheses can be built.

This section examines both the explicit assumptions that are part of the analysis, and the implicit assumptions inherent to scenario planning.

4.3.1 Implicit Assumptions

Koskow & Gassner (2008) argue that scenario planning aims at taking decisions in the present given an analysis of the future, and that this very definition automatically implies an assumption about the relation between the present and the future (Koskow & Gassner, 2008). Three types of relation are possible: a predictable future implies that the future can be quantified given present and past knowledge; an evolutive future assumes that present knowledge is not adequate for descriptions and predictions of the future; and a malleable future also means that the future cannot be predicted, but that its development is still somewhat possible (Koskow & Gassner, 2008). By these definitions, this study assumes the future to be predictable. This is a necessary assumption if one requires forecasting future values. As will be seen in sections to come, past values need to be examined to compute future values.

Another implicit assumption concerns price inflation in Mauritius. Inflation is disregarded when computing predictions. One reason is that it can hardly be predicted. However, since past values are used to predict future values, inflation is implicitly accounted for.

Similarly, demographics are implicitly considered when predicting future values. For instance, the trends of aging population shown section 2.3 are reflected in the hypotheses considered when forecasting non-contributory retirement pensions.

4.3.2 Explicit Assumptions

As explained in section 3.3, the most important elements of the old-age pension system are the three following elements. First, the non-contributory universal pension distributed by the government. Second, the contributory pensions (monthly payment) distributed by the NPF. Third, the contributory pensions (lump sum) distributed by the NSF.

These three elements are the pillars of the system. They each represent a significant share of old-age income and altogether constitute most of it. Therefore, if one of the corresponding entities (government, pension fund) reaches bankruptcy, the whole system cannot be considered sustainable. For this reason, although the pension funds are managed by the government, in the analysis they are treated as distinct entities and therefore are examined separately. Pension funds have separate accounts from the government since contributory benefits are strictly distributed to beneficiaries who pay contributions, while non-contributory benefits are distributed to all pensioners who meet the criteria described in previous sections.

This treatment implies that different entities do not compensate financially for each other. If the NPF or NSF present a budget deficit the government will not compensate it through its budget, and vice versa. This assumption follows from the very idea of sustainability and balance of flows discussed, since the former must imply that pillars do not fall upon each other, even if they have a common ground.

Assumption 1: The government does not compensate for the funds, and vice versa

In practice, this possibility is not completely excluded, but this assumption emphasizes the need for entities to be independent from each other to be considered sustainable.

Still following the definition of sustainability given in previous sections, the entities are examined in terms of inflows and outflows. Effectively, bankruptcy is reached when expenses exceed contributions (outflows > inflows), in other words when either one of the funds or the government present a budget deficit. The aim is therefore to investigate if one of the entities is likely to eventually present a budget deficit.

Assumption 2: Bankruptcy is reached when outflows exceed inflows

This in turn implies another assumption: that the government does not take external debt for its old-age payment obligations. This follows from assumption 1, since a system is sustainable if it does not require internal or external help. Therefore, the government should be able to finance its obligations without taking credit to be considered sustainable.

Assumption 3: Government does not take debt to pay its pension liabilities

Again, this assumption does not completely exclude this possibility in practice, but rather considers that it is necessary for sustainability not to rely on external debt.

4.4 Reasoning, methodology and data

Sustainability can be thought of in terms of inflows and outflows. Whether on the non-contributory or contributory side, enough revenue is needed to distribute pensions for a sustained, unlimited period. The variables to be examined are therefore pension revenue and expenses, but more importantly, the balance between the two.

This balance needs to be measured on both the contributory and non-contributory side. For the pension funds, measuring this balance is easily done through the fund's surplus. This is because inflows to the funds are solely used for the distribution of social benefits. However, the same cannot be said for non-contributory pensions (old-age). The government uses its budget for various purposes and only one share of it is destined to old-age pensions. Therefore, examining a government surplus or deficit would not inform on pension sustainability, but rather overall fiscal sustainability, which is outside the scope of this study. A different balance metric is therefore required. The metric used in this study is the following:

$$\text{Retirement pensions} = \frac{\text{Old} - \text{age non} - \text{contributory pensions}}{\text{Government revenue}}$$

In other words, government spending for the basic retirement income, including enhanced retirement income and child's allowance, is related to total government revenue. Government revenue includes taxes, grants and other income. In this case, taxes constitute the large majority of government income.

Examining this share is merely a different manner of relating inflows and outflows to one another. Displaying information in this manner provides additional benefits. Relative amounts hold greater meaning and intuitive understanding than absolute financial amounts. This is especially useful when working with an uncommon currency such as Mauritian Rupees, while avoiding the possible inaccuracies from dollar conversion.

These metrics are computed for the period available. All data is retrieved from Statistics Mauritius, managed by the Ministry of Finance and Economic Development and available on the Government of Mauritius' website. Financial amounts represent millions of Mauritian Rupees (Rs).

The downfall in jugging this metric is the lack of a benchmark. As pointed out by OECD authors in the OECD Review of Pensions Systems in Ireland, there is no agreed benchmark beyond which government expenses are considered unsustainable (OECD, 2014a). Fiscal costs that are considered heavy for some countries are sustainable for others (OECD, 2014a). Surpluses only need to be positive, but old-age expenses as a share of government revenue are harder to evaluate. Without a benchmark, they can only be judged subjectively. Nevertheless, values can be still be considered realistic, unrealistic or even alarming. If the retirement pension ratio is 0%, no universal pension is distributed. If it is 100%, then the entirety of government revenue

through taxes, grants and other income is distributed to pensions. The ratio can therefore be anywhere between both extremes. A negative retirement pension ratio is not mathematically possible, and a ratio higher than 100 would violate assumption 3.

It can be investigated whether the values for this ratio will be realistic in the future. If the same economic conditions and policies apply, these numbers can be expected to evolve following an observable pattern. This is discussed in the next section. However, Mauritius' economy is affected by external factors. Even with a diversified economy, and upcoming reforms, the economy relies on the good performance of its economic pillars: the industries that contribute the most to revenues. Mauritius is therefore vulnerable to them.

To examine the sustainability of the pension system, the analysis investigates how the chosen metrics for sustainability are affected by shocks to the economy, for the different entities at play. Therefore, scenarios are created to see how external shocks affect the economy and how they affect the chosen criteria. This shows how sustainability can be affected by future potential events. Table 4 gives an overview of this reasoning.

Table 4 Overview of reasoning

Type of pension	Non-contributory	Contributory
Corresponding entity	Government	Pension funds
Sustainability metric	Retirement pensions (% of government revenue)	Surplus (Rs million)
Underlying variables	Non-contributory pensions, government revenue	Contributions, Expenses
Driving forces	Sources of income	Asset allocation

The methodology used to create scenarios is the following. A baseline scenario is created through forecasting. Other scenarios are created by manually incorporating shocks and recomputing the forecasts with the shocks included. Since sustainability is observed in the very long run, predictions are extended until 2050.

4.5 Predictions and Scenarios

This section computes the predictions and creates the scenarios.

Comparable to a 'business-as-usual' situation, the baseline scenario describes the future when no major event happens. The scenario is mainly described by predictions on how the different

variables at hand evolve over time, given past data. Computing predictions require establishing hypotheses on how these may evolve. Two possibilities are considered:

Hypothesis 1: The underlying variables follow an autoregressive process

Hypothesis 2: The underlying variables follow a trend

These two hypotheses are examined for the non-contributory and contributory parts.

The first prediction depends on the data available for the variables. Therefore, if data is available from 2007 to 2014, 2015 is the first forecast.

The scenarios created are summarized in Table 5.

Table 5 Scenarios of the analysis

Scenario name	Description	Nature of shock
Baseline	'Business-as-usual': Benchmark values	No-shock scenario
Tourism	A contraction of the tourism sector	External
Manufacturing	A contraction of the manufacturing sector	Internal or External
Financial	A collapse of one asset in the pension portfolios	Internal or External

4.5.1 Hypotheses and baseline scenario: Non-contributory pensions

4.5.1.1 Hypothesis 1: Autoregressive analysis

If variables follow an AR(1) process, they can be represented by the following equation:

$$y_t = \alpha + \beta\, y_{t-1}$$

Where y_t is the observation at time t, and y_{t-1} is its lag. That is, for a first-order autoregressive process. If they follow an AR2 or AR3, the corresponding number of lags is simply added to the equation as explanatory variables.

The available data for the regression is shown in Figure 9.

Figure 9 Non-contributory pensions and government revenue (Rs million), 1972-2014
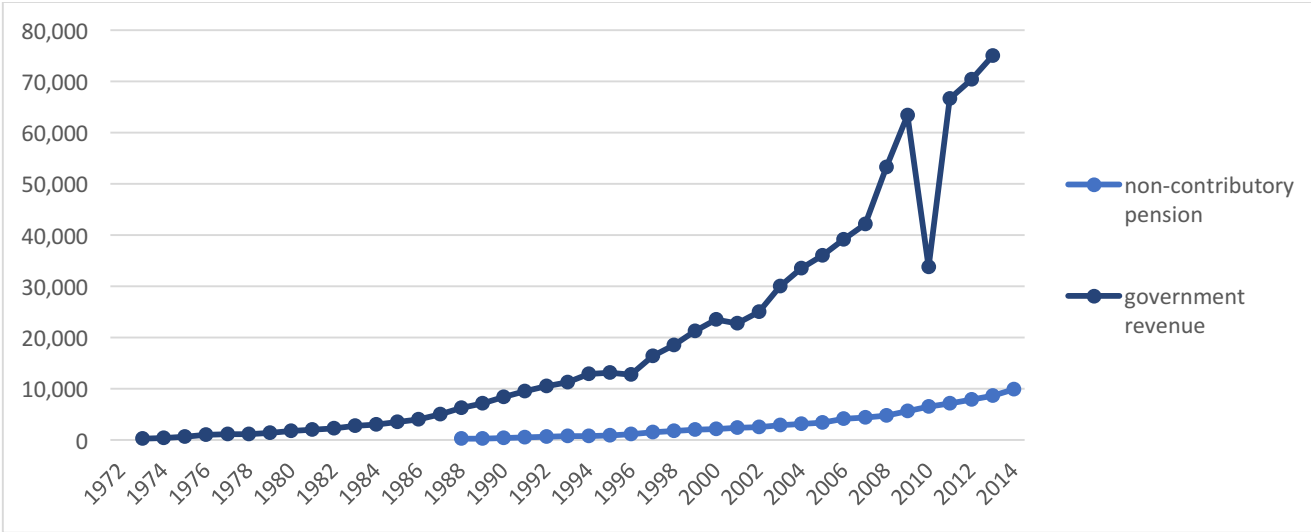
An obvious observation is that the 2010 government revenue exhibits a significant drop. This corresponds to the year of a change in Mauritius' counting methodology from a financial year basis to a calendar year basis (Statistics Mauritius, 2016). This observation is therefore likely to be erroneous. This is taken into account by running the regression three times, for three different treatments of the observation:

- With the 2010 observation
- Without the 2010 observation
- With a recomputed version of the 2010 observation

The first way requires no modification. In the second, the observation is completely deleted, both the x-value and y-value, since the regression cannot be run with a x-value without a corresponding y. In the third version, the average between the 2009 and 2011 observation is used. Unfortunately, the two latter versions lead to very unrealistic results. The patterns coming out of these regressions resemble exponential functions. However, it seems unreasonable to assume that government revenue will increase tenfold in the next forty years.

More generally, it is not reasonable to assume that it will grow at an increasing rate: since Mauritius is now an upper-middle income nation, this would defy convergence theory's hypotheses that industrialized countries experience slower growth due to diminishing returns to capital (Gottfries, 2013; Perkins et al, 2013).

Although the first regression leads to different, plausible results, it cannot be used due to the inaccuracy of the 2010 value.

Similar unrealistic results are found for AR2 and AR3 regressions for government revenue, and for all orders of non-contributory pensions.

Therefore, this hypothesis is rejected.

4.5.1.2 Hypothesis 2: Trend Analysis

Some time series contain a time trend that cannot be ignored (Wooldridge, 2000). Trend analysis consists of identifying trends with the help of past data and extrapolating them to the future (Kosow & Gassner, 2008). If variables follow a trend, they can be represented by the following relation:

$$y_t = \alpha + \beta * t$$

Where y_t is the observation at time t, and t is the time component that incorporates the trend. Figure 10 shows the same variables as in Figure 9, but with trendlines fitted into the data.

Figure 10 Non-contributory pensions, and government revenue (Rs million): Past data and trend lines, 1972-2014
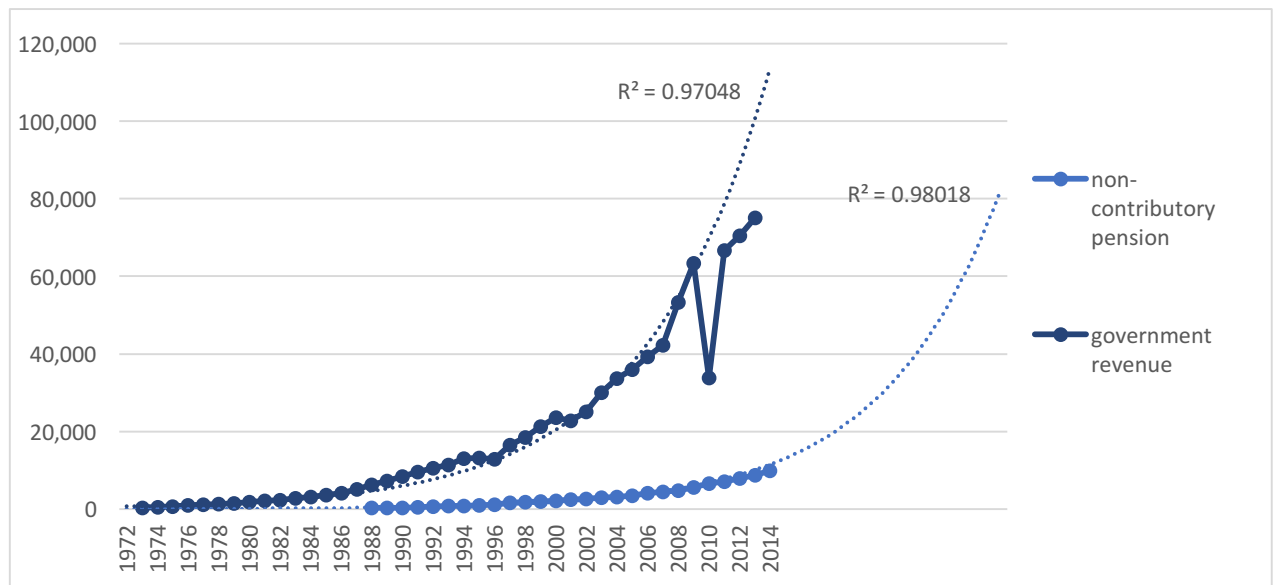
The figure suggests that non-contributory pensions and government revenue can be approximated by an exponential trend. This is particularly suggested by the high R^2s of each variable, which indicate a good fit. Treating the 2010 observation as an outlier does not alter the goodness of fit. This value is therefore kept for the analysis. The extensions of the trend functions show how the variables may evolve.

Since these functions exhibit the best fit, they seem to be appropriate for extrapolation. However, as for hypothesis 1, there is no reason to suggest that government revenue will rise exponentially. In fact, although the function seems to be a perfect fit for government revenue until 2008, it fails to correctly predict values from 2008 onwards. Moreover, even though non-contributory pensions could be expected to increase significantly in the next decades given demographic trends, exponential growth seems an unlikely prediction.

Therefore, other trends need to be considered. When looking closely at government revenue, it can be seen that the variable has taken a different trajectory in the last few years, which is why an exponential does not correctly predict values from 2008 onwards. This new trajectory is seen more clearly in Figure 11, showing data from 2000 onwards. This time, the 2010 observation is removed, since it has more distorting power with a lower total number of observations. The linear fitted line exhibits a much better fit in this restricted period than in the non-restricted period shown in Figure 10.

Figure 11 Government revenue and Non-contributory pensions, 2000-2013 (Rs million)
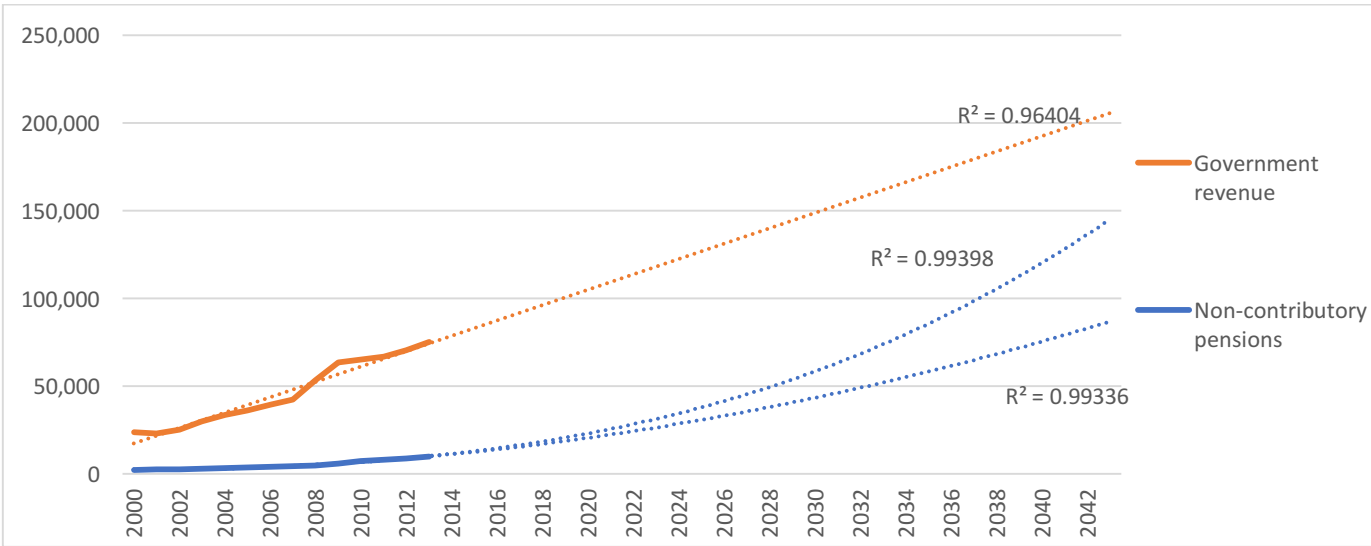
Therefore, government revenue is more likely to increase linearly, and non-contributory pensions may evolve at a non-steady rate in two manners. These functions are a second- and a third-degree polynomial. Higher-degree polynomials lead to negative values. These trends make sense and can be considered given the aging population in Mauritius: Old-age non-contributory pensions can be expected to rise more than linearly in the years to come.

Now that the trends are clearly identified, predictions can be computed. Predictions are merely fitted lines extrapolated. They lead to Figure 12 and Figure 13.

Figure 12 Government revenue predictions (Rs million)
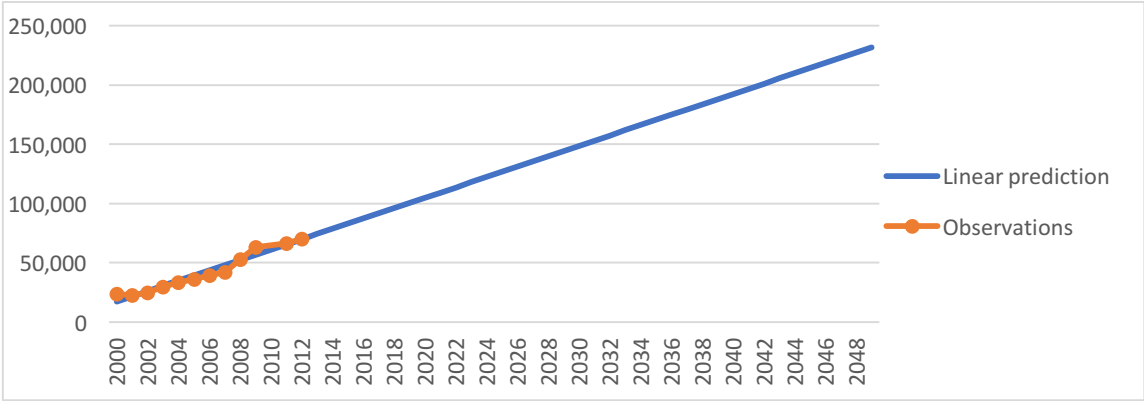
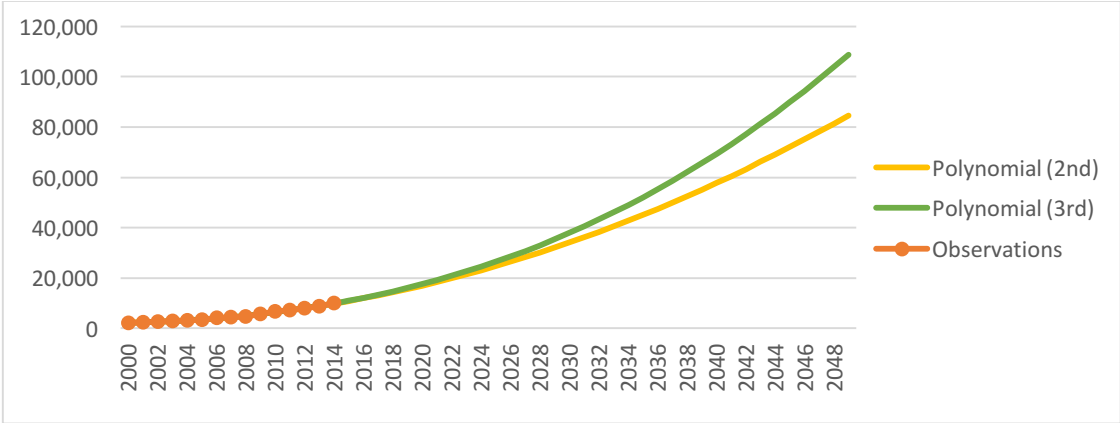**Figure 13** Non-contributory pensions predictions (Rs million)

Figure 12 and 13 show realistic predictions. Assuming continued real growth that Mauritius has so far exhibited it can be assumed that government revenue increases linearly. Given aging population and the fact that retirement pensions are an increasing function of age, pensions can effectively increase as shown in Figure 13.

With the predictions of the underlying variables, it is possible to see how the ratio may evolve over time. The span of predictions is computed by combining the two possibilities for non-contributory pensions with the one possibility for government revenue. This is shown in Figure 14.

Figure 14 Non-contributory pensions as a share of government revenue
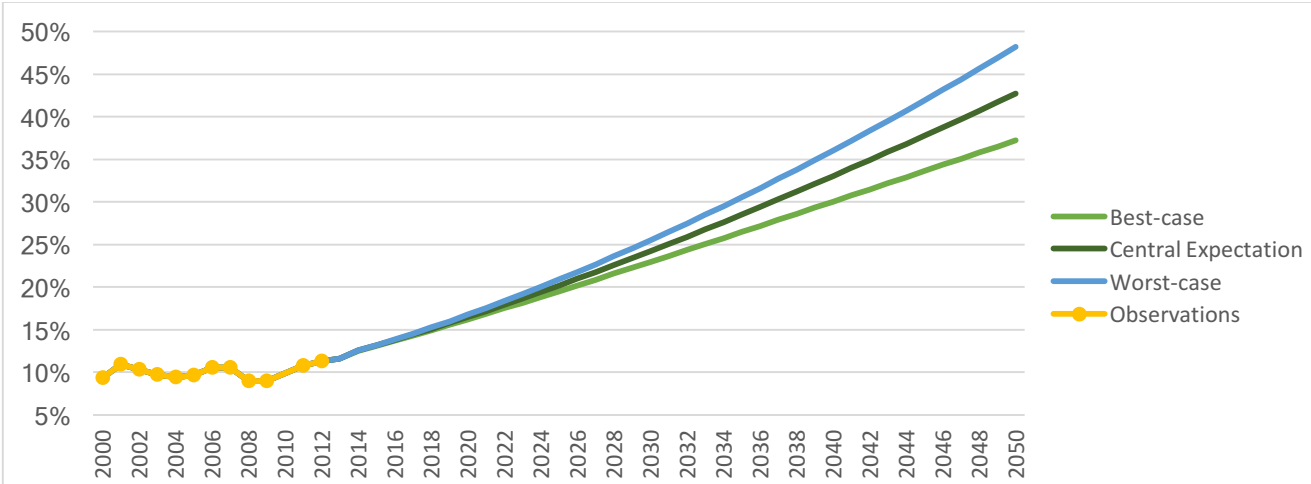
The two extremities of the span are set as best-case and worst-case scenario. While these do not make a different in the short and medium run – all approximately 21% in 2025 – the spread increases over time, and in the long run the two cases exhibit very large differences: 37.2% compared to 48.2% in 2050, a difference of 11 percentage points. Pensions are likely to increase anywhere between this range. Averaging the extremities of the spread gives a central expectation for the ratio.

These predictions are intuitively realistic. Given current changes in demographics, government revenue may steadily increase over time, but pensions to the elderly are likely to increase at an even higher rate.

The figure also shows that the ratio was around 10% in the beginning of the decade, and is expected to be around 20% in 2024, and reach 30% in 2037 (central expectation).

Spending 10% to 15% of all government budget towards universal pensions for the retirees seem reasonable. However, these numbers increase at an alarming rate. Numbers show that even the best-case scenario is not a good scenario. Spending 25% for old-age pensioners only, without accounting for other types of social security cannot be considered desirable. This first alarming threshold is reached in 2031 (central expectation). As discussed in later, this shows that policies and reforms should be undertaken before this date.

4.5.2 Hypotheses and baseline scenario: Contributory pensions

4.5.2.2 Hypothesis 1: Autoregressive process

The hypotheses for the contributory part are the same. The hypothesis of an autoregressive process, whether first, second, or third order, also give unrealistic results. Therefore, this hypothesis is rejected.

4.5.2.2 Hypothesis 2: Trend Analysis

Figure 15 and 16 show how the contributions and expenses evolve for the NPF and NSF during the available period.

Figure 15 NPF Contributions and expenses (Rs million), 2002-2008
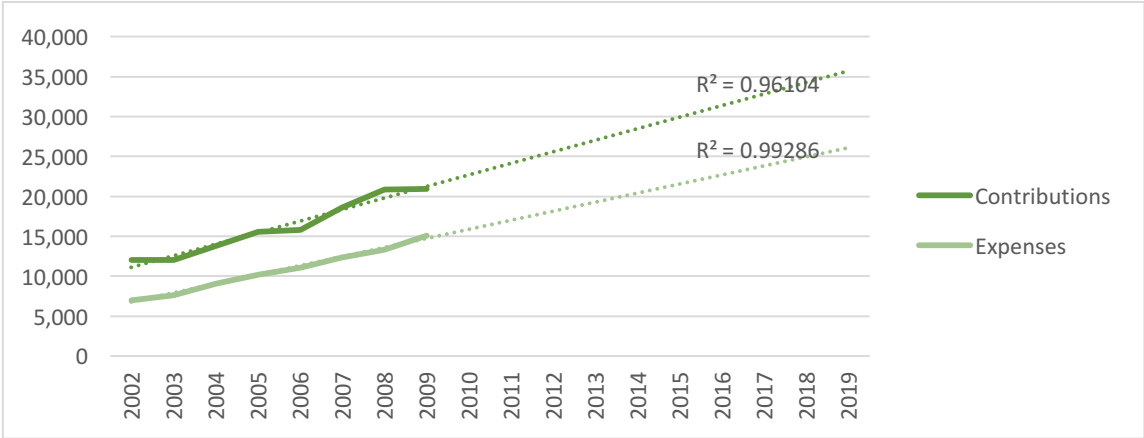
Figure 16 NSF Contributions and Expense (Rs million), 2007-2014
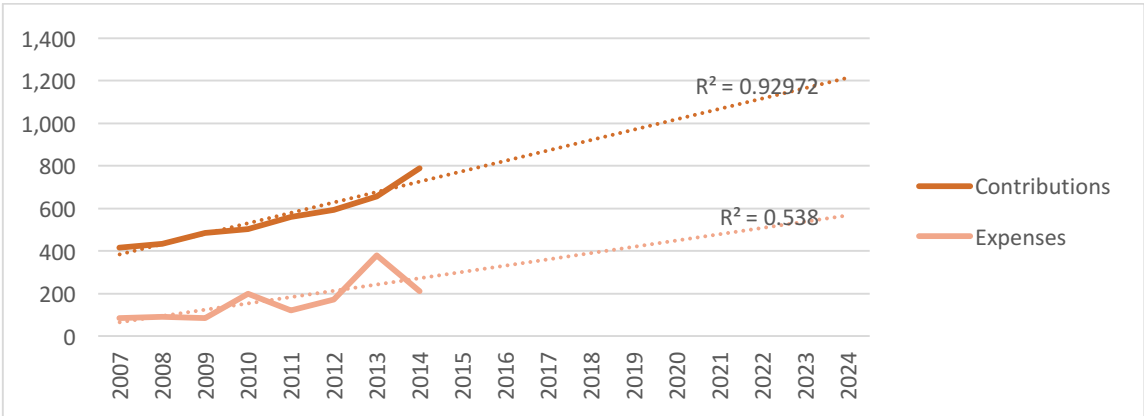
In this case, there a less observations variable, however the trends are very clear. Although NSF expenses show greater variability, all variables evolve linearly. This is therefore the trend to be extrapolated. Figure 17 and Figure 18 show the observations and the corresponding predictions.

Figure 17 NPF predictions and observations, contributions and expenses (Rs million), 2007-2050
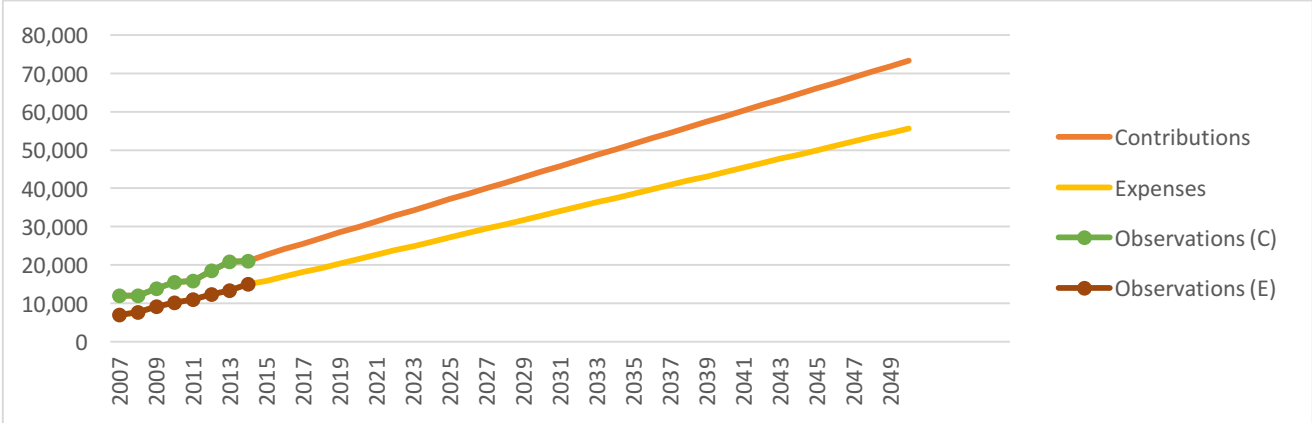
Figure 18 NSF predictions and observations, contributions and expenses (Rs million), 2007-2050
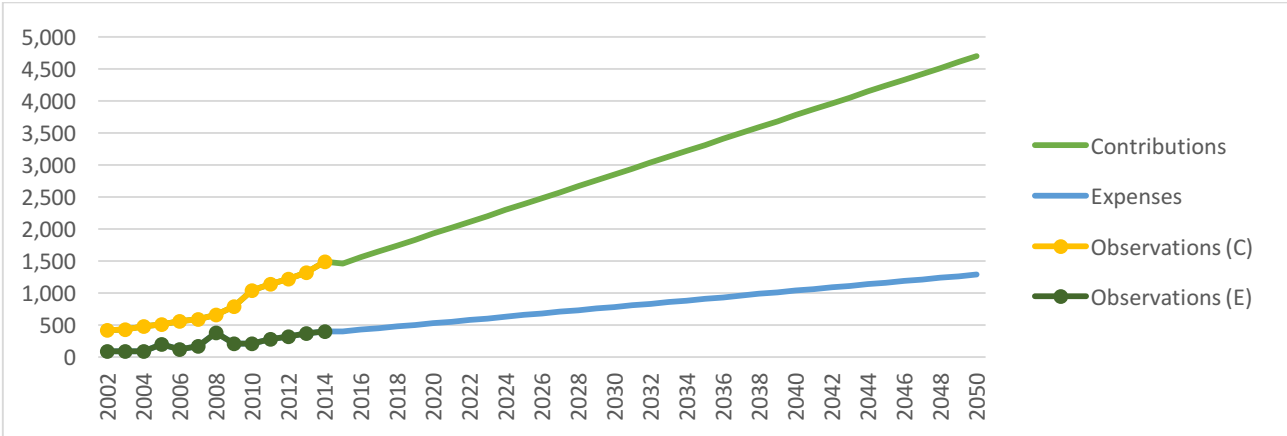
The numbers show that the NPF manages a capital much larger than that of the NSF. This makes sense since the NPF distributes monthly payments, while the NSF offer pensioners a lump sum at retirement. The NPF predictions also show a better balance between its inflows and its outflows, while predictions for the NSF exhibit a divergence between flows, since contributions evolve at a higher rate than expenses.

With the underlying variables forecasted until 2050, the surplus for each fund can be computed. This is shown in Figure 19.

Figure 19 Contributory surplus of NPF and NSF, predictions, (Rs million), 2007-2050
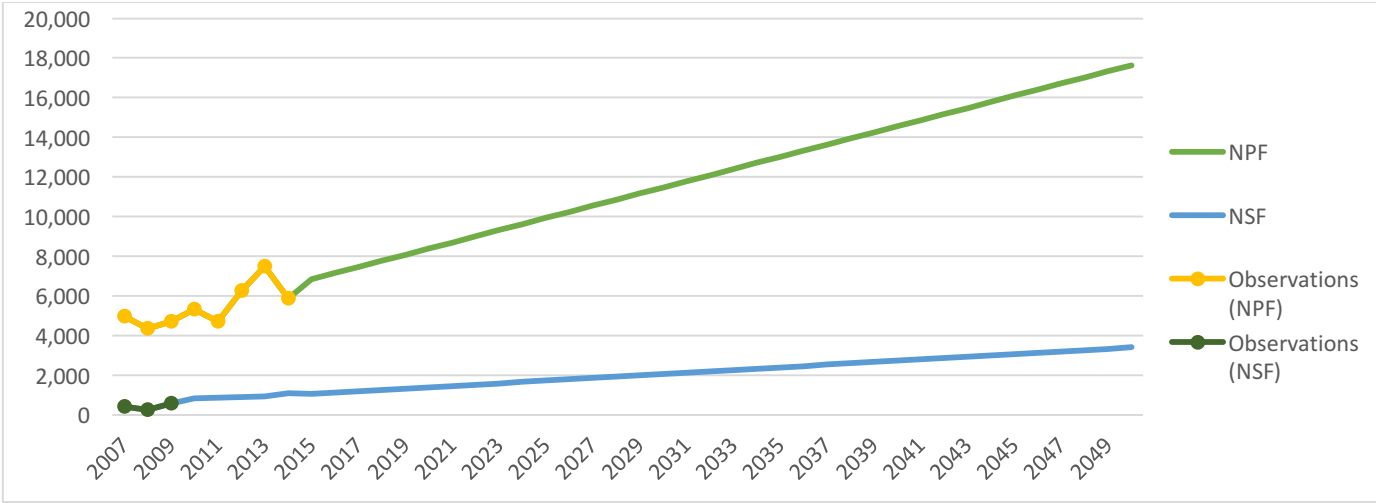
The NSF has a smaller surplus that increases at a much lower rate than the NPF's surplus. However, both the NPF and NSF are expected to keep a positive surplus for the entire prediction period. In a no-shock scenario, both funds need not be alarmed. The creation of such surpluses could be beneficial support the government in a case of emergency. However, considering that the funds' surpluses can be continuously used as provision for the government's deficiencies cannot be viewed as a sustainable equilibrium, since eventually these too will be depleted. Moreover, this would violate assumption 1.

The values in Figure 14 (non-contributory) and in Figure 19 (contributory) represent the baseline scenario and are therefore used as a benchmark for the rest of the analysis. Investigating scenarios will show how these ratios change when changes in external factors take place, and therefore, how sustainability can be compromised.

4.5.3 Tourism

As seen in the case of Aruba, shocks in the tourism sector can have a tremendous economic impact on SIDS. In Mauritius, luxury tourism is an important source of income. It impacts the economy both through direct, indirect and induced channels.

This scenario assumes a hypothetical two-year shock in the tourism sector from 2020 onwards, translated by a 20% decrease in fiscal revenues earned through tourism. This is equivalent on average to a 5% bi-annual contraction for the entire duration period.

This can happen for many reasons. In 2015, tourists from France and the Reunion island – which itself belongs to France – together account for approximately 35% of all tourists in Mauritius (Statistics Mauritius, 2017c). This number is larger when accounting for other members of the Eurozone. Therefore, a large depreciation of the euro against the Mauritian Rupee could explain a tourism contraction, or any other type of economic crisis affecting France or the Eurozone. Alternatively, the growing prevalence of terrorism has clear consequences for the tourism sector as people are reluctant to travel by plane – or travel at all. As fear spreads easily after attacks, tourists are likely to carefully select destinations that they view as safe. Due to the military coalition, Western countries tend to be more targeted. Therefore, Mauritius is not exempt to suffer the consequences in the years to come.

Different reasons for a contraction in tourism all have undoubtedly further repercussions of their own. This section aims to illustrate the common impact they would have on the sustainability of the pension system. Economic shocks such as a tourism contraction will intuitively have an impact on non-contributory retirement pensions. In this analysis, this is translated by a change in the retirement pension ratio through a change in government revenue.

Earnings from tourism activities as a share of GDP is used as a proxy for the share of fiscal revenues earned through tourism. In the past available years[1], this value has been on average 13.6% (Statistics Mauritius, 2017f). Given the significant direct impact of tourism while still having a diversified economy, this value is realistic and can be representative of the direct channel. Figure 20 shows the direct impact of such shock on the retirement pensions ratio in the short run (central expectation).

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[1] 2003 to 2012

Figure 20 Short run direct impact of a temporary shock in tourism (direct) on retirement pensions (% of government revenue): central expectation
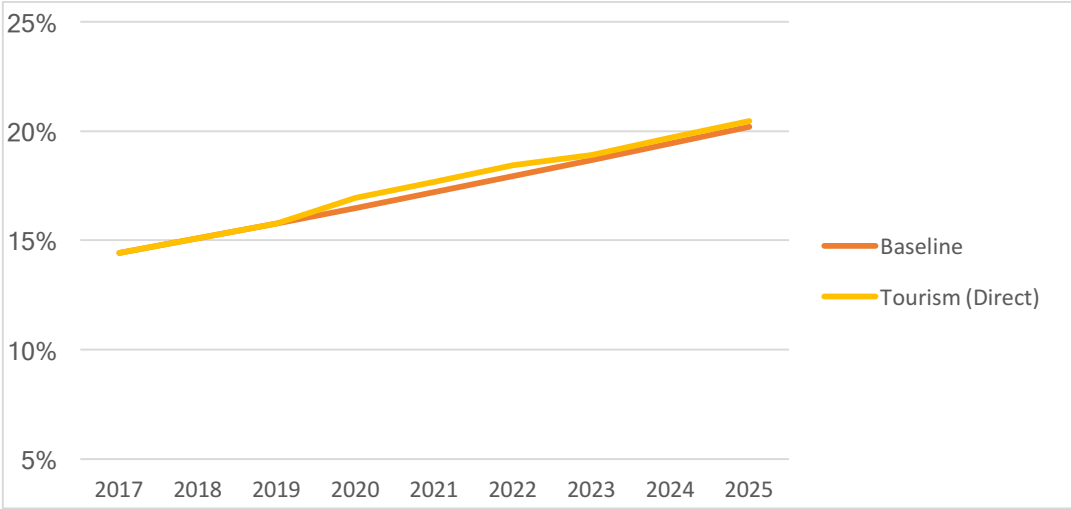

Figure 20 shows that in the short run, the 20% decrease in tourism revenues engenders a rise of the ratio to 16.95% instead of 16.49% in the baseline scenario, which corresponds to a 2.8% rise. This short run change seems small and not constraining. The figure also shows that the impact is clear during the contraction period (2020 to 2022), but that when the economy overcomes the shock, the lines converge and the difference with the baseline scenario is minimal.

Nevertheless, this accounts for the direct impact in tourism. As explained, tourism also affects the economy through indirect and induced channels. When accounting for these impacts, the total contribution of tourism in Mauritius has been estimated to be 25.5% of GDP in 2014, a to represent an increasing share in the following years (World Travel & Tourism Council, 2015b). Using this number as a proxy for the total share of fiscal revenues earned through tourism, the total impact can be estimated.

Indirect and induced channels are more likely to be seen in the long run rather than in the short run. This is because the dynamics that explain a larger total impact compared to a direct one take place in the economy over a longer period of time. Figure 21 shows the long run impact of tourism, comparing direct and total impact with the baseline scenario (central expectation).

Figure 21 Long run impact of a temporary shock in tourism (direct and total) on retirement pensions (% of government revenue): central expectation
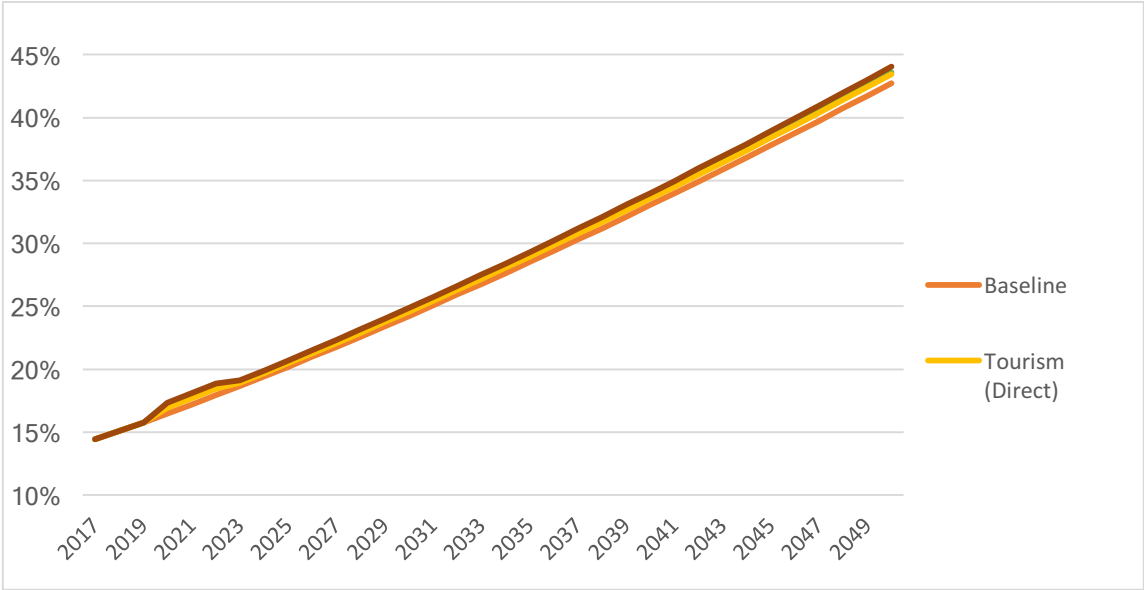

Figure 21 suggests that when taking other channels into account, the long run impact on the economy is more visible. For example, in 2030 retirement pensions become 24.87% of government revenue rather than 24.23% in a no-shock scenario. This corresponds to a 2.6% rise in government expenses, which is significant. Moreover, the figure shows that after the shock, the retirement pension ratio never comes back to the baseline level. This suggests that a temporary in tourism has permanent effects on retirement pensions sustainability.

Figure 21 also suggests that since the total impact is much larger than the direct, especially in the long run, this means that looking at direct impacts significantly underestimate the effect of such shock.

Figure 22 shows the long run impact of such shock for all expectations of future retirement pensions, compared to the baseline.

Figure 22 Long run impact of a temporary shock in tourism (panel b) on retirement pensions (% of government revenue) compared to a no-shock scenario (panel a): best-case, worst-case and central expectation**.**
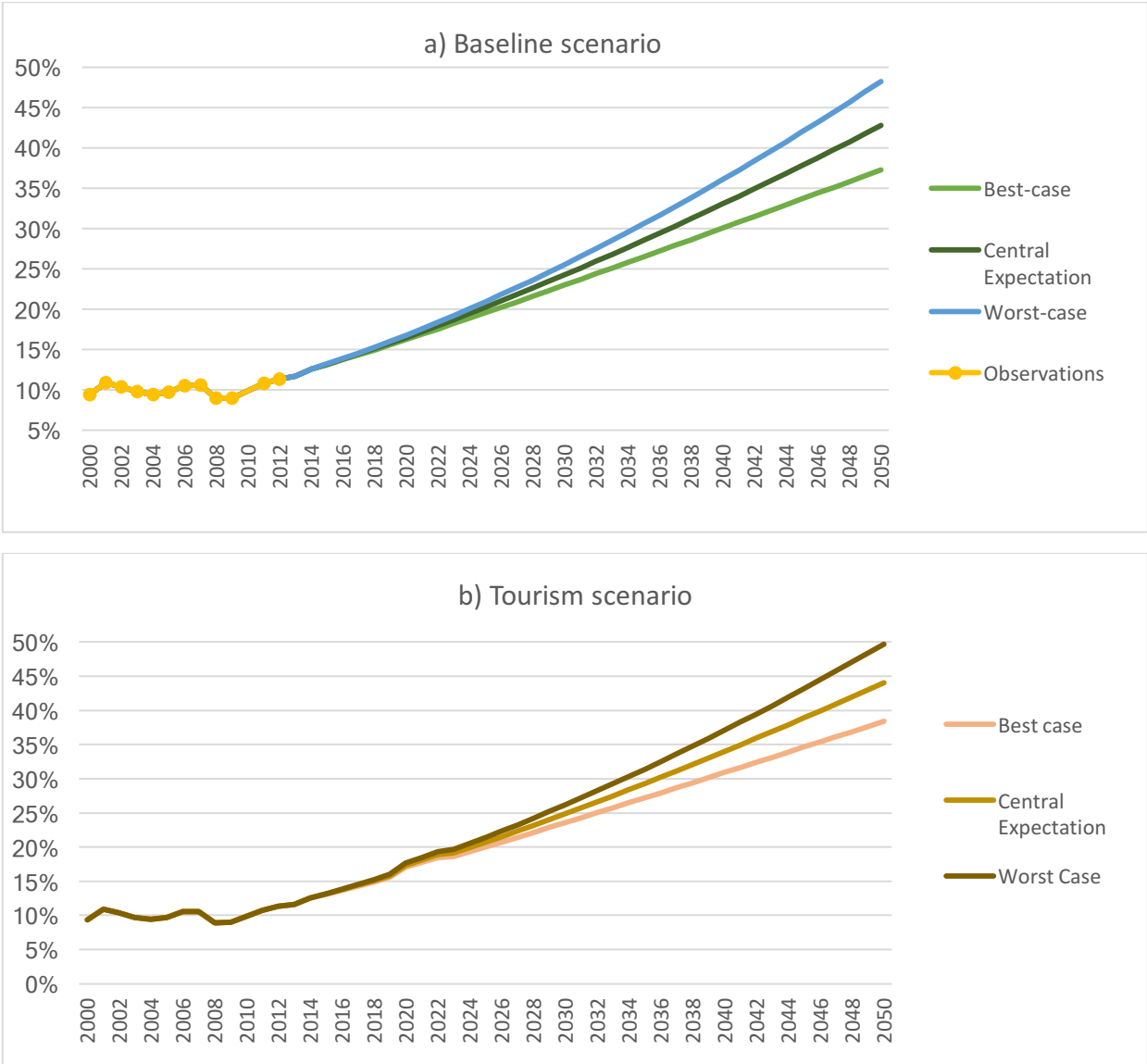
In panel b) of Figure 22, the short run 'jump' of the ratio is seen more clearly. More importantly, the ratio is higher in the long run for all three expectations of the evolution of retirement pensions (best-case, worst case and central).

Moreover, alarming thresholds are reached earlier in the case of a shock in tourism. Retirement pensions expenditures reaches 25% of government revenue in 2031 with the tourism shock instead of 2033 with no shock, in a best-case scenario. The quicker rise of the ratio shows that because of the shock, in the long run sustainability is compromised. Therefore, although the shock seems to be barely visible in the long run, when compared to a no-shock scenario it presents irreversible consequences.

4.5.4 Manufacturing sector

Similarly to the previous section, this scenario assumes a contraction in the manufacturing sector. Magnitude and duration are the same, which facilitates inter-scenario comparison.

A manufacturing crisis can happen for several reasons. Changes in raw materials prices and oil prices are possibilities, especially since the latter exhibit strong volatility. Given the technology-oriented character of the manufacturing industry, any advancement in technology can also represent a threat to the manufacturing sector. If this happens, employers need not only incur the costs of replacing their machinery, but also deal with the obsolescence of skilled labour engendered by such change. Finding better-skilled labour may prove to be an even bigger challenge for a SIDS such as Mauritius. As previously explained, a small population translates into limited human resources which engender discrepancies in the labour market. This may realistically happen over a two-year period. Finally, manufacturing firms may also suffer the consequences of an environmental catastrophe proper to Mauritius such as droughts, which would provoke strong repair costs.

As seen on Figure 3, the share of manufacturing is 16%. This is similar to the direct impact of tourism, therefore the figures have very similar best and worst case scenarios. Figure 23 shows the same variables than Figure 20, with the shock in manufacturing added.

Figure 23 Short run direct impact of a temporary shock in manufacturing on retirement pensions (% of government revenue): central expectation
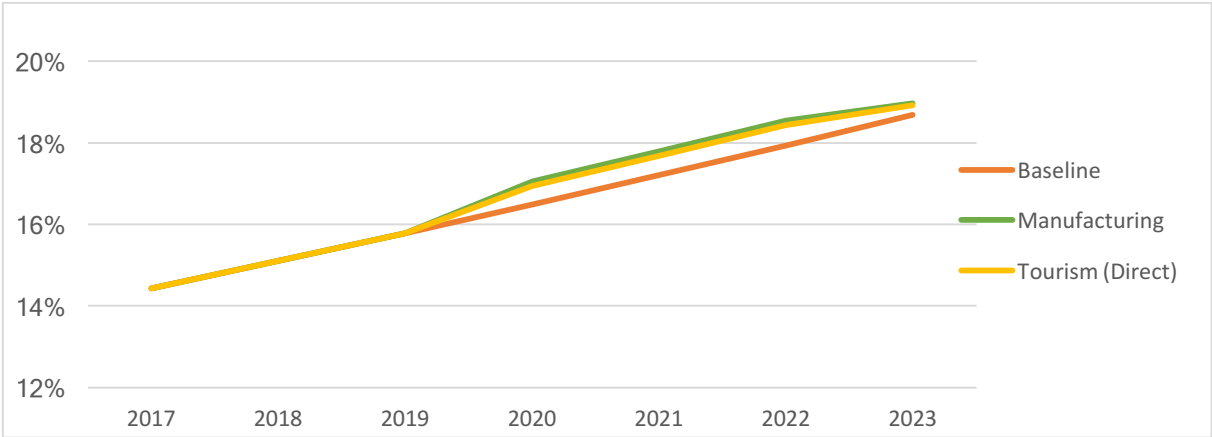

Figure 23 shows that in the short run, the impact of manufacturing on retirement pensions is very similar to the impact of tourism, although slight larger. This is when taking the direct impact into account. As previously explained, when taking into account the total impact, the long run difference differs. This is shown in Figure 24.

Figure 24 Long run impact of a temporary shock in manufacturing on retirement pensions (% of government revenue): central expectation
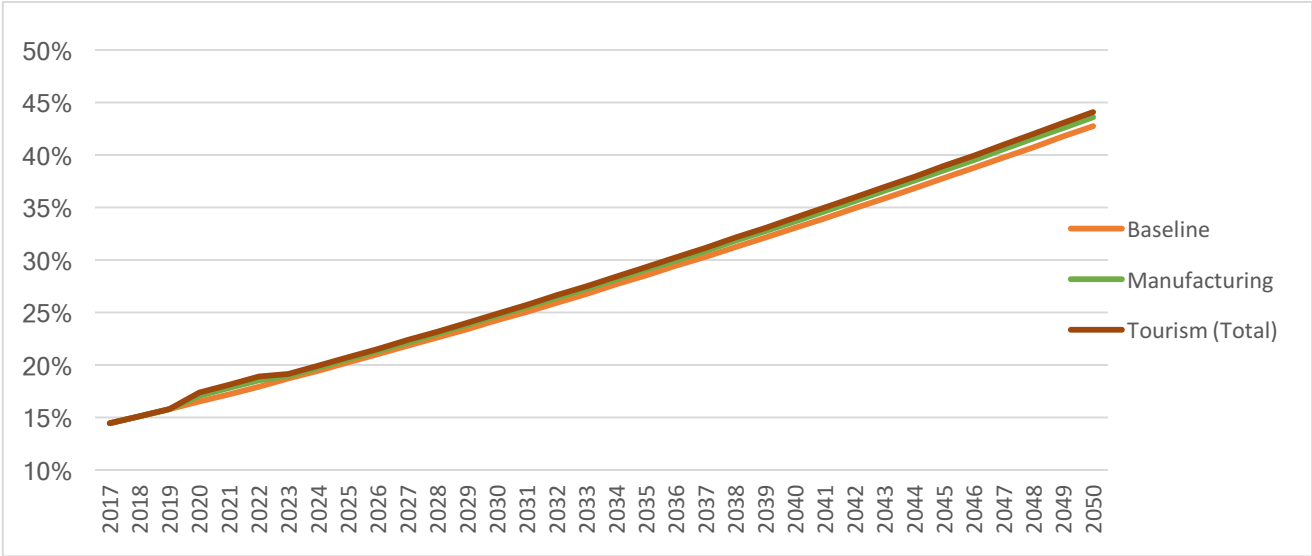

Figure 24 shows that in the long run, a temporary contraction in manufacturing has a less significant impact than a contraction in tourism, for the same duration and magnitude. This shows that tourism is a more important pillar to Mauritius in the long run when taking all channels into account. This could be left unseen when looking at short run impact only, or if one does not properly account for all channels of tourism.

Figure 24 shows also shows that similarly, a manufacturing shock has permanent impact on the retirement pension ratio, since the latter never returns to a non-shock level.

4.5.5 Collapse of a pension portfolio asset: Sovereign default

Although bonds are usually thought of as risk-free, a government can always default on its debt. This is especially true for developing countries such as Mauritius.

Mauritius has not defaulted on its sovereign debt since 1985 (Asonuma, 2016). However, government debt is currently rated by Moody's as Baa1, or "stable" (Moody's, 2017). This means that Mauritius is not totally immune to a sovereign default. Even though sovereign defaults are not so common, it makes sense to consider this possibility.

A sovereign default has tremendous impact on bondholders. Institutional investors tend to be large sovereign bond holders. As seen in Figure 8, pension funds in Mauritius are no exception since the NPF and NSF respectively allocated 42.65% and 49.8% of their asset to government stocks and bonds.

Similarly to previous scenarios, this scenario assumes a default duration of two years, which facilitates inter-scenario comparison. This is a realistic possibility. Figure 25 and 26 illustrates the direct impact on the such default on the surplus.

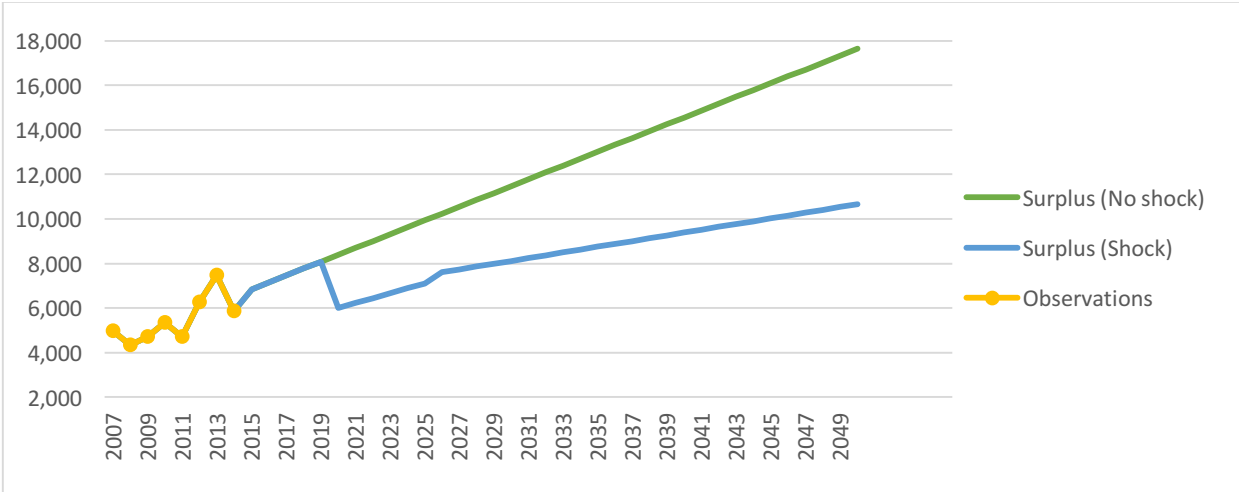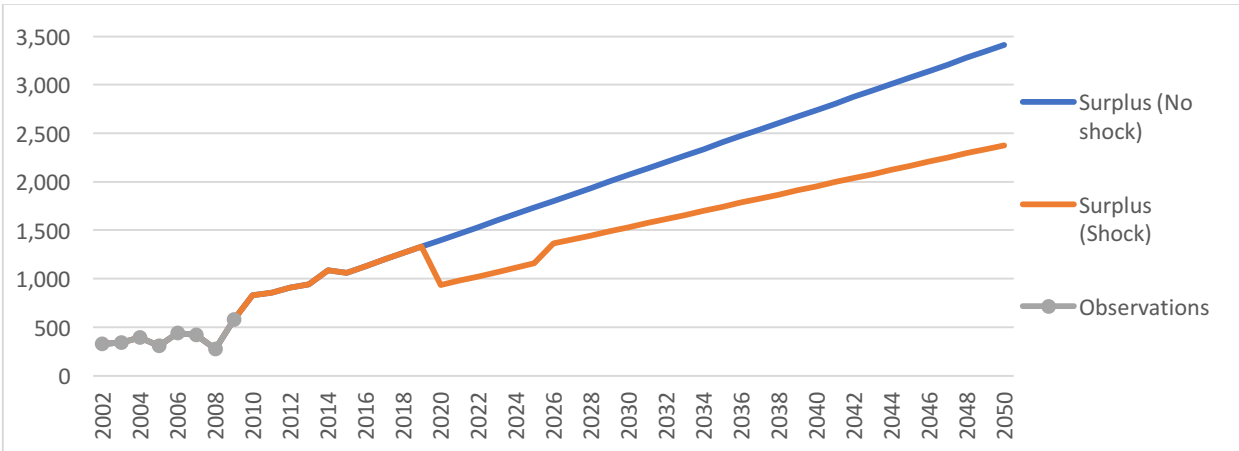**Figure 25** Impact of government bond default on NPF

Figure 26 Impact of a government bond default on NSF

Both funds' surpluses exhibit similar patterns of a sudden decrease, followed by a period of recovery and a continuous increase, at a lower level and slower rate compared to the baseline scenario. The loss in capital results from losing the investment principal. The figures suggest that despite very significant loss, both funds would still have positive surpluses and be able to pay their pension liabilities in the long run. Therefore, this shock would not be detrimental to sustainability. Nevertheless, sustainability may be compromised if the government defaults several times in this fifty-year period. Effectively, emerging countries that default on their sovereign debt are found to be more susceptible to default again in the future (Asonuma, 2016).

In practice, the total impact of such a shock would be far more compromising for the Mauritian economy. Since sovereign defaults are usually engendered by an economic crisis, non-contributory pensions (as a percentage of government budget) would also be affected. Hence, the total impact to sustainability would consider both non-contributory and contributory pensions, which may resemble to a combined impact of the scenarios in this study.

Moreover, a sovereign default would decrease Mauritius' credit rating and alter the country's credibility for future borrowing.

Therefore, although the figure suggest that sustainability is not compromised, given the criteria and metrics chosen to define sustainability, consequences would be larger than they appear here.

4.6 Sustainability and scenarios: Concluding comments

Given the model used in this study, including the assumptions, predictions hypotheses and methodology chosen, the following conclusions can be made.

First, shocks in tourism and manufacturing would both impact non-contributory pensions directly. The impact of a shock in tourism on the sustainability of non-contributory retirement pensions is small but visible in the short run. That is, when looking at the direct impact. In the long run, total impact shows that the temporary shock has larger and permanent effects. Shocks in the retirement pension ratio never return to the baseline level. Overall, a shock in tourism would put greater pressure on government expenditures than a shock in manufacturing, at least in the long run.

Second, a manufacturing shock may have a larger impact than a tourism shock in the short run, but a larger lasting impact. Effects on sustainability for this shock are also permanent.

Third, a sovereign default would have direct impact on contributory pensions as pension funds would lose a large share of their budget surplus. Short run loss will be large, but this would not compromise sustainability in the short run since the funds both have positive budget surpluses. However, sustainability may be severely compromised in the long run if sovereign defaults are successive. They are not only more likely to be successive in emerging markets, they are usually accompanied by an economic crisis. In this case, the impact would resemble the combined impact of economic shock scenarios (tourism or manufacturing) and the asset collapse scenario. This shock is more difficult to estimate accurately given the other macroeconomic consequences it entails.

The scenarios have shown that contributory pensions are less at risk than non-contributory pensions in scenarios of shocks. However, the baseline scenario is not an optimal scenario in itself. Although Mauritius has an economy that is diversified enough to allow shocks, without shocks its long run sustainability is already at risk due to the generosity of non-contributory retirement pensions. Even when disregarding non-contributory pensions that are not related to retirement (widows, orphans, handicapped), pensions as a share of government revenue reach alarming thresholds very quickly, the first being 25% in 2031.

4.7 Limitations

As discussed by Volkery & Ribeiro (2009), claims from scenario analysis must be made cautiously since scenarios have limitations.

The first and most obvious limitation is that the results and conclusions only hold under the assumptions and hypotheses. The realism of both implicit and explicit assumptions can be challenged. For example, forecasting implies that the past helps predict the future. Amalric (2006) argues that "the past may not be a very good indication of what the future holds in store" (Amalric, 2006, p.445). Moreover, because of building hypotheses for forecasting, predictions are restricted to only one or two ways of how variables may evolve, and therefore considers only a very few possible outcomes, in some case only one.

Second, there is another way in which the analysis is very simplified. The econometric techniques used in this analysis does not incorporate correlations, such as inter-sector linkages or inter-asset dependencies. That is, impacts can be quantified with much more precision by incorporating more advanced methods. Third, there is great subjectivity in the entire analysis. On one hand, in the choice of how to quantify sustainability and the impact of shocks, and on the other hand, in the interpretation of scenarios and results. Fourth, there is limitation in the data used. Although data is more easily found for Mauritius than for other SIDS, data is not always available depending on variables. Moreover, the change from fiscal year to calendar year implies that inter-year comparison is not always possible.

One may question the usefulness of such an analysis given the limitations and subjectivity involved. However, the usefulness of scenarios lies in their illustrative purpose. Scenarios allow to anticipate future threats, warn against potential vulnerabilities, broaden the span of possibilities, and give an idea of potential effects in the case of constraining events. Although

specific number should not be taken to the letter as they would be in a causation analysis, they provide useful indications to help to make decisions, in particular public policy.

4.7 Policy recommendations

Two important points are to be considered for reform options. First, Mauritius has a sufficiently diversified its economy to bear cyclical shocks without dangerously compromising the sustainability of its pension system. This is in line with Frontier Strategy Group's (2016) finding that Mauritius is the most resilient economy in Africa. Second, non-contributory pensions are already at risk and the pressure on government expenditures will increase over time, regardless of the emergence of external shocks. Therefore, Mauritius need to implement reforms that promote sustainability by reducing this pressure. Structural reforms may prove more fruitful for Mauritius than cyclical ones.

Reform options are the following. First, the pressure on government expenditures could be relieved by reducing pension generosity, especially to the oldest old who currently receive three to four times more pensions than other pensioners, and whose cohort will increase over time given demographic trends. This however, would promote sustainability by impairing adequacy. Second, the example of Mauritius illustrates well the benefits of diversification. However, pension funds do not seem to apply this diversification to the asset allocation of their capital. The NPF and NSF allocate almost half of their capital to government securities. The impact of a sovereign default would endanger sustainability. Pension funds in Mauritius would benefit from diversifying their asset to reduce risks and build resilience. Moreover, Mauritius could invest into credit default insurance to mitigate the risks of a sovereign default, such as credit derivatives. Third, private savings could be encouraged so that government revenue can decrease retirement pensions expenditures (or ensure it does not increase) without altering pensioners' replacement rate. Fourth, pressure on government expenditures can also be reduced by raising the pensionable age to be in line with life expectancy. Moreover, a further requirement could be that workers are in fact retired to benefit from retirement pensions, instead of distributing pensions to anyone over 60 years old. Finally, incentives could be given for workers to retire later than they tend to.

Conclusion

External shocks can have a tremendous impact on the economy and pension systems of SIDS. However, development and economic diversification have made Mauritius resilient. As a result, the country is less vulnerable to external shocks, and its pension system better able to cope with their effects. Therefore, diversification of the economy protects the sustainability of a pension system, which is particularly important for SIDS.

Scenario analysis suggests that shocks in Mauritius have short run consequences but do not significantly compromise the sustainability of the system in the long run. However, Mauritius' pension system is plagued with a different problem: the sustainability of its non-contributory pensions is already at risk. Non-contributory pensions as a percentage of government revenue are predicted to reach alarmingly high thresholds in the upcoming decade. This analysis suggests that rate of increase in government revenue percentage for non-contributory pensions is only slightly accelerated in case of an economic shock.

Reforms specific to Mauritius should be structural rather than cyclical. On one hand, they should focus on alleviating pressure on government expenditures. This includes raising the pensionable age, distributing pensions conditionally on retirement status, reconsidering generosity of pensions, giving incentives for workers to retire later, and encourage private savings. On the other hand, reforms should focus on diversifying the asset allocation of pension funds. Diversification has been shown to be the key to resilience and risk reduction.

Further research can be conducted to see the impact of these policies through scenario analysis. This can be done by creating a baseline scenario where no policy is applied, and scenarios including different policies. By comparing the impact of policies to sustainability metrics, the need for policy can be emphasized and the specific policy to apply can be easily chosen.

Although these conclusions are proper to Mauritius, they can be extended to other SIDS under the condition that they have a similarly diversified economy. Vulnerable economies such as Aruba should focus on achieving resilience through diversification of their economy first.

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