EXPLORING THE NEXUS BETWEEN LABOUR FORCE PARTICIPATION AND POTENTIAL OUTPUT: EVIDENCE FROM TRINIDAD AND TOBAGO

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ABSTRACT

Labour force participation in Trinidad and Tobago is relatively low and has been on a declining trend for some time. However, there is scope for increasing participation, particularly among women and youths. Increases in labour force participation could make a contribution towards increasing Trinidad and Tobago's GDP potential. This study employs a structural vector autoregression (SVAR) approach to identify and measure the relationship between labour market participation and potential output, with the aim of identifying potential implications of a relatively low participation rate for Trinidad and Tobago. Annual time series data is used for the period spanning 1980 to 2020, which was collected from the Central Statistical Office of Trinidad and Tobago, the Central Bank of Trinidad and Tobago, Trinidad and Tobago's Ministry of Finance and Bloomberg. The dynamic analysis of the SVAR was undertaken using Structural Impulse Response Functions and Forecast Error Variance Decompositions. The main findings of the study suggest that potential output can be significantly triggered by improvements in labour force participation rates, particularly among the female and youth populations. Based on these empirical findings, we conclude/recommend that domestic growth strategies should centre on improving labour market conditions in order to boost participation rates.

Keywords: structural VAR, potential GDP, labour force participation, Trinidad and Tobago

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1 Introduction

Labour market conditions are a critical metric in gauging the pulse of the economic environment. In the prevalent literature on labour market economics, the labour force participation rate (LFPR) has acquired some centrality in discourses surrounding movement in gross domestic product and in explaining developments in potential output. Firstly, in order to thoroughly identify the contours of this relationship, a theoretical understanding of the underlying concept is necessary. McConnell, Brue and Flynn (2009) delivered a precise definition of the LFPR, which states that the LFPR is determined by comparing the actual size of the labour force with the potential labour force, also known as the "age-eligible population". Meanwhile the International Labour Organization (ILO) goes a step further in providing a comprehensive explanation: "The labour force participation rate is a measure of the proportion of a country's working-age population that engages actively in the labour market, either by working or looking for work; it provides an indication of the size of the supply of labour available to engage in the production of goods and services, relative to the population at working age[1]."

Similar to the ILO, Trinidad and Tobago's main institution for the collection and dissemination of labour statistics, the Central Statistical Office, defines the LFPR as a measure of the proportion of the working-age population that actively engages in the labour market, which can involve either being currently employed or seeking employment (Central Statistical Office, 2022). Furthermore, the working-age population in Trinidad and Tobago refers to the total non-institutionalised population between the ages of 15 to 64, which is a comparable definition to many other countries.

A priori, a positive relationship is expected between the LFPR and output, where a reduction in the number of persons participating in the labour force is associated with a decline in overall economic activity. Such a thinking is at the core of formulating policies to capitalise on the contributions of the labour force in accelerating economic growth, where the essential message is: to improve total output, it is necessary to increase the LFPR. Examining this testable theory is particularly important for developing countries, such as Trinidad and Tobago, as these economies, more so than others, tend to face the economic burden of low levels of labour force participation (Shahid 2014).

Over the recent decade (2010-2019), Trinidad and Tobago has experienced the twin occurrence of slowing economic output and a reduction in labour force participation. In 2010, the domestic economy expanded by 3.3 per cent, before recording a contraction of 0.2 per cent in 2019. Complementing this outturn was the simultaneous decline in the LFPR of approximately 4.7 per cent, moving from 62.1 per cent in 2010 to 57.4 per cent in 2019. Meanwhile, within one year of the coronavirus pandemic (COVID-19) which emerged in late-2019, Trinidad and Tobago's macroeconomic variables were severely weakened. Economic activity registered a record-high contraction of 7.4 per cent in 2020 – the highest since 1983, while the LFPR displayed its lowest recordable rate of 55.9 per cent since the 1980s. Furthermore, this trend shows a more pronounced link when disaggregated by female and youth participation rates. Marred by an increasing unemployment rate, Trinidad and Tobago's

[1] The definition is taken from the International Labour Organization Stat (2022): https://ilostat.ilo.org/resources/concepts-and-definitions/description-labour-force-participation-rate/.

tumbling LFPRs is a cause for concern, especially considering that 70 per cent of the population is in the working-age group of 15-64 years.

Consequently, this paper seeks to identify and measure the relationship between labour market participation and potential output, with the aim of identifying potential implications of a relatively low participation rate for Trinidad and Tobago. Our research uses a structural vector autoregression (SVAR) approach to examine this nexus. Further, to provide a richer analysis of the demographic characteristics of the LFPR, individual examinations of the female, male and youth (15 to 24 years) participation rates will also be undertaken. Emphasis will be directed at incorporating potential gross domestic product as this perspective will describe whether the output losses are transitory or permanent.

While several studies have sought to examine the relationship between the LFPR and potential output globally, the extent of such research in the context of the Caribbean region is sparse. Therefore, the current research will build on the work of Caribbean authors by econometrically testing the concept, as this method of estimation, to the knowledge of the authors, has not been undertaken regionally. Although there have been several contributions to the qualitative descriptions on labour force and unemployment statistics for the Caribbean region (Downes 1998, 2006, 2009, Moonilal 2006, Kandil, et al. 2014, inter alia), labour market researchers have been historically stalled by limitations surrounding availability of key statistics, leading to little econometric analysis of labour market conditions (Downes 1998). As a result, there have been limited advances by way of quantitative investigations into the distinct relationship between the two main variables of this study.

The organisation of the paper is as follows: Section 2.0 presents other theoretical studies conducted on the topic, where it emerges that while the international literature has empirically examined the association between the LFPR and output, regional studies on this relationship are limited. Section 3.0 surveys relevant country-level statistics or stylised facts relating to the Trinidad and Tobago economy, such as participation rates and economic growth, while also identifying quantitative linkages between the LFPR and output. This will be followed by Section 4.0, where an explanation of the data and methodology used to examine the concepts is presented. In this section, the main statistical technique used is the SVAR for the entire sample as well as female, male and youth sub-samples. The results and analysis of these estimations will be presented in Section 5.0. Lastly, Section 6.0 summarises the main findings and proposes a way forward for tackling Trinidad and Tobago's declining LFPR by also drawing on lessons learnt from similar economy-types in the literature.

2 Literature Review

A synchronous relationship exists between the LFPR and potential output, making this concept a widely researched area of macroeconomics. From as early as the 1970s, various studies have attempted to model the existence of these variables in an effort to assist policy practitioners in understanding how the labour force can spur economic development.

One of the earliest pieces of literature on the nexus between the labour force and economic development was produced by John Dana Durand in 1976 entitled "The Labor Force in Economic Development." The book explored the composition and structural changes to the labour force that occur alongside economic development. Based on global labour force and population statistics censuses taken for 100 countries during 1946 to 1966, it examined labour force characteristics (such as size of the labour force, as well as sex and age patterns associated with participation in particular economic activities) that accompany economic development. It is one of the first large-scale studies that offered an examination of this area according to participation rates by women, young people and the elderly. Among the male population, it is noted that as the level of economic development increases, there is a falling participation rate of men in production which can be attributed to a combination of later entry into the labour force (due to years of schooling and training) and earlier retirement (due to higher income earnings and the development of social security). Interestingly, health improvements among middle-aged and older men does not appear to improve the participation rate.

Participation of women in economic production produces noteworthy results where the chief result presents a "hypothesis of convergence" (Durand, 1976). This term is used to represent the finding that as the rate of female labour force participation increases at a particular stage of a country's economic development, the higher the likelihood that their participation falls off as economic development progresses. The author's final conclusion states that, "cultural, institutional, and other factors related to the regional grouping play a more important part than do factors related to the level of economic development in determining the pattern of women's participation in income-producing employment" (Durand, 1976). In terms of age structures, Durand (1976) reports that despite later entry into and earlier exit from the labour force, the crude participation ratio among high-income countries is higher when compared to low-income countries, enabling the former to experience a higher per capita income.

More statistically integrated frameworks have also been used to study the relationship between the LFPR and output. For example, Shahid (2014) sought to investigate the short- and long-run relationships between both labour force participation and gross fixed capital formation to economic growth in Pakistan, through the techniques of co-integration and vector error correction modelling. Econometric evidence pointed to mixed results where labour force participation displayed a negative and significant relationship with economic growth, while gross fixed capital formation revealed a positive significant relationship. In terms of the former relationship, recommendations were advanced to improve on this association which included the construction of new education and training institutes to develop the pool of skilled labour. Similarly, Yakubu, Akanedbu and Jelilov (2020) examined these similar relationships through identical modelling techniques for the commodity-exporting economy of Nigeria. The findings were complementary in nature where a negative long-run causal association was established between the LFPR and real gross domestic product. The authors attributed this inverse

relationship to the high rate of unemployment and inequallity in employment opportunities, largely due to gender, in Nigeria. Given the conclusion that labour force participation impacts economic development, the authors highlighted that policy makers should devise strategies aimed at increasing the proportion of the adult population seeking jobs, paritcularly young graduants. Emphasis was also placed on encouraging young females to remain in school and receive a quality education.

Over time, the role played by females in the workforce has gotten signifcant recognition and research has highlighted how worldwide increases in female labour force participation rates (FLFPR) can contribute to economic development. Several students of labour market dynamics have made reference to a feminisation U-shaped hypothesis based on trends between female labour force participation and economic development. Under this thoery, the connection indicates that the FLFPR declines at first and then subsequently increases in line with economic development, therefore forming a U-shape (for exmple Sinha 1967, Durand 1975, Cağatay and Özler 1995). The background of this shape stems from the argument that when a country is undergoing economic contractions women work out of necessity, in mainly subsistence agriculture or domestic work. However, as the economy expands, employment shifts from an agrarian society to an industrial and service-based economy which tends to employ more men, resulting in the downward sloping line of the U-hypothesis. Subsequently, as the economy enters a higher level of economic development, female enrolment rates at school increase, fertility rates decrease and social stigmas associated with women working falls, which opens an avenue for more women to access employment opportunities (Rahma, 2020). This leads to the rising limb of the U-hypothesis, and this hypothesis which dates to the 1960s has become a stylized fact in development economics literature.

Rahma (2020) conducted a comprehensive panel study spanning 154 countries, which included Trinidad and Tobago, to examine the directional relationship between labour force participation and economic growth. Using Granger causality testing, a bi-directional relationship was established where female labour force participation Granger causes growth and vice versa. Broadly, the results conclude that economic growth is significantly linked to increasing female participation within the workforce. Furthermore, as the FLFPR increases, the relative economic statuses of these women will be improved, which will contribute positively to overall economic efficiency. Recommendations to promote a higher FLFPR included a focus on establishing effective policies to eliminate current barriers faced by women joining the labour force.

Importantly, some studies have also found an inverse relationship between female labour force participation and economic growth. However it should be noted that these findings are predominantly concentrated within more traditional type economies. A recent paper by Anyanwu, et al. (2021) which examined the female labour force participation and economic growth nexus for Nigeria highlighted that increases in economic growth, declines in fertility rates, and expansion in female education did not result in a commensurate increase in female participation. This result is of concern as it is empirically proven that women, through both formal and informal production, play an active role in furthering economic development. Therefore, in the interest of promoting economic growth and development in Nigeria, the study recommends that active labour market policies are required to encourage female labour market participation.

While several studies have examined the relationship between the LFPR and potential output globally, the extent of such research in the context of Trinidad and Tobago is sparse. Downes (1998) highlights the prevalence of unemployment as a major economic problem facing Caribbean governments. He credits much of this to the structural dynamics of these economies, the nature of the education system and its disconnect with the needs of the labour market. Referencing Ramesar (1977), Downes notes that the long-term presence of a labour surplus dates to the time of the First World War. During this period, the country was largely a mono-crop economy with high dependence on the agricultural sector. In this post-emancipation era, several persons had developed negative attitudes toward agricultural work and preferred to wait for higher paying non-agricultural related jobs, suggesting evidence of low participation rates. This challenge was compounded by the inability of the non-agricultural sector to absorb large proportions of the labour force at that time. To date, this same challenge is best manifested in the capital-intensive petroleum industry which continues to be the main driver of economic activity in the country.

While Downes (1998) did not examine the relationship between the LFPR and output, the author did take a look at the necessary conditions to reduce unemployment in Trinidad and Tobago. Using a mix of econometric techniques, he deduced in both the short and long run, changes in both real GDP and real average earnings have a statistically significant impact on the unemployment rate. Increases in real GDP reduce the unemployment rate in both the short run and long run, while increases in the real average earnings increase the unemployment rate in the long run. This is particularly interesting, given that Grigoli, et al. (2018) highlight earnings as a driver of labour force participation, while several studies have alluded to it as a driver of output. This raises questions regarding the short-run versus long-run implications of increased labour force participation on unemployment. These issues however fall outside the scope of this study.

Regarding participation rates, Downes (2006) highlights that a common trend in the Caribbean has been the gradual increase of female participation coupled with the constancy of male participation. Overall participation rates in the region were just under 70 per cent over the period 1996 to 2002. Rates generally trended upward largely on account of female participation given that since the 1960s, females appeared to be entering the labour force at a much higher rate than their male counterparts. Downes (2006) attributed this to higher educational attainment, improvements in household production technology, expansion of activities in the economy which have been a traditional source of employment for women, declines in fertility rates and average household size which reduced the need to stay at home for longer periods. Further, he posited that increased female participation was fuelled by the self-actualisation of women and the drive for financial independence.

Kandil, et al. (2014) contend that structural institutional challenges remain at the centre of labour market issues in the region. Despite the general improvement in educational attainment, there remains a small cadre of professional, technical and managerial personnel, which has resulted in a mismatch between labour demand and supply. Further, there has been a general upward trend in real wages with less than proportionate improvements in productivity. The region also appears to be characterised by a low rate of labour force growth, suggesting high emigration rates and an ageing population. FLFPRs have also been rising while the male participation rates have been stagnant.

Downes (2009) examined the effects of the global economic crisis on the labour markets of the Caribbean. With the exception of Trinidad and Tobago, unemployment rates in the region exceeded 10 per cent. The prevalence of the low rate domestically was partly reflective of economic growth but also a discrepancy in the way unemployment is defined compared with other Caribbean countries. The decline in economic activity in the region created broad effects in the labour market: firstly, an added worker effect, characterised by the entry of persons into the labour market on account of the main breadwinner being laid off and secondly a discouraged worker effect where persons remove themselves from the labour market on account of the difficulty of the job search process. In the aftermath of the 2008-2009 global financial crisis, LFPRs were fairly constant in most countries thereby making it difficult to determine which effect outweighed the other, though there was slight evidence to suggest the dominance of the discouraged worked effect.

Summarily, a review of the literature suggests a direct relationship between the LFPRs and economic output. It also offers ample evidence to warrant a thorough examination of the participation rates by gender. Though the literature on the labour market is somewhat diverse, and points to several unique structural dynamics of such, in the context of Trinidad and Tobago there is a dearth of literature on the relationship between participation rates and potential output. Domestically, participation rates appear to be characterised primarily by an increase in female labour force participation and a constancy of male participation. This paper therefore seeks to address a critical issue in an area that is relatively unexplored in the local context.

3 Stylized Facts

Trinidad and Tobago's growth performance in the last four decades (1980-2020) can be divided into four (4) distinct periods of high and low economic activity. A period of high growth occurred in the early 1980s followed by recessionary conditions during the next ten years between 1983 and 1993. In the subsequent 14-year period (1994-2008), the economy underwent structural transformation allowing economic activity to recover and expand. Thereafter, the economy suffered declining levels of economic activity from 2009, from which it has not yet been able to recover (**Figure 1a**). Given that Trinidad and Tobago is an energy-based commodity exporting economy, international energy price fluctuations have been largely responsible for the country's bust and boom cycles. Periods of positive GDP growth have coincided with high energy prices, while periods of subdued activity have occurred in a low energy price environment.

In the first period of analysis (1980-1982), Trinidad and Tobago experienced a rapid increase in its growth rate which can be associated with elevated international oil prices. After the oil price shock of 1979, the country witnessed booming economic conditions and exceptionally high growth rates, which peaked at 10.4 per cent in 1980. [2]

During the second period of analysis (1983-1993), a structural shift occurred in 1983 that was triggered by a combination of external factors and poor economic policies. With the collapse of oil prices in 1982, the terms of trade and level of exports deteriorated sharply, foreign exchange reserves were depleted, and the external debt became unserviceable. As a result, GDP growth plunged into negative territory for several years over the period 1983 to 1993.

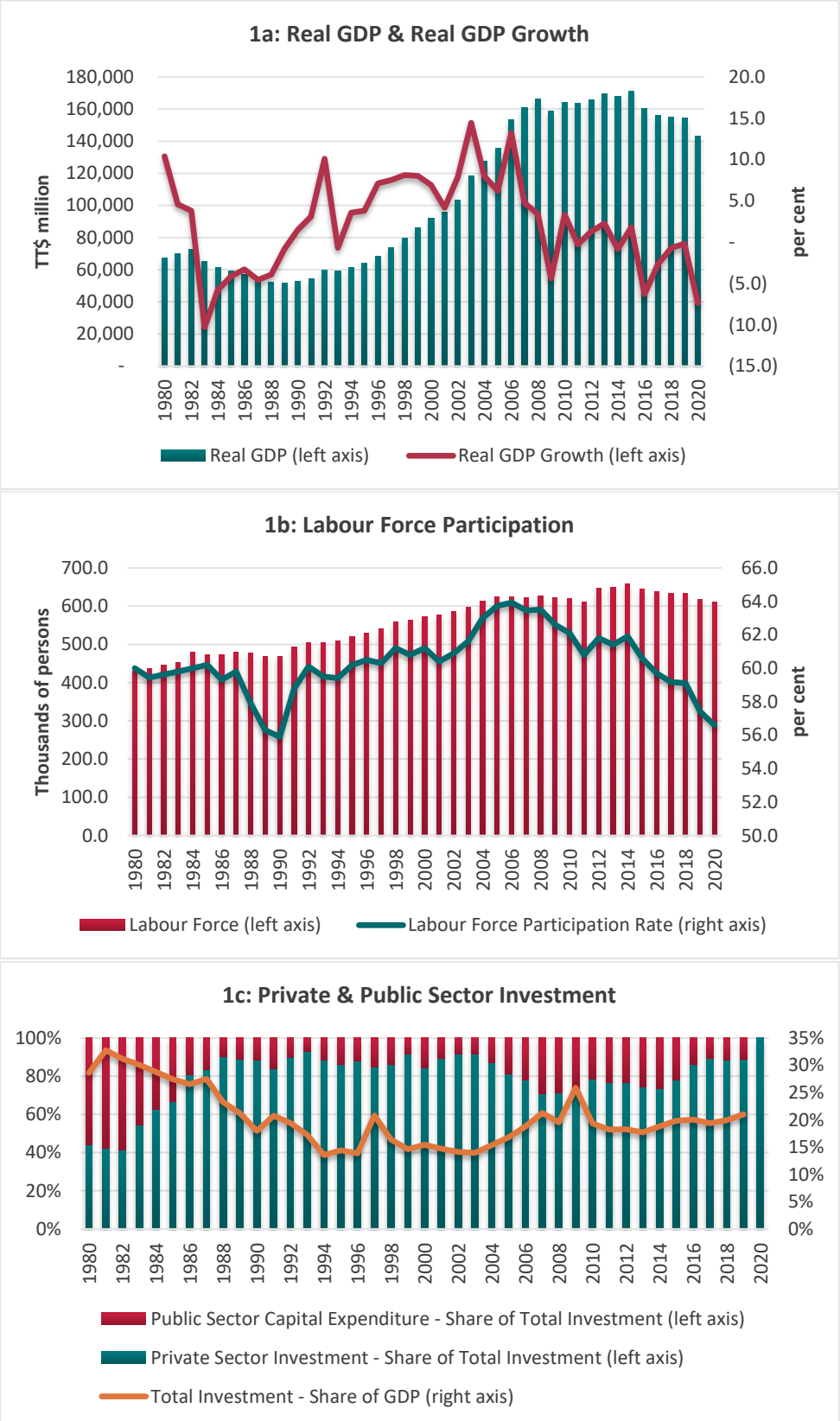
The third period (1994-2008) can be characterised as a period of macroeconomic stabilisation and structural adjustment. During these years, a major developmental strategy was undertaken, which entailed the diversification of the hydrocarbon sector as Trinidad and Tobago transitioned into a gas-based economy. The strong economic growth that occurred during this period was largely attributed to the rapid expansion of the energy sector, particularly related to the sale of natural gas-based products (liquified natural gas (LNG), fertilisers, and methanol) on global markets.

In 2009, Trinidad and Tobago faced three simultaneous shocks – the global financial crisis, the end of the country's third energy boom, and the eruption of the CLICO crisis. The price of crude oil decreased by 38 per cent in 2009 (averaging US$62 per barrel) and resulted in domestic real GDP declining sharply, bringing an end to 14 successive years of economic growth. In 2010, oil prices improved significantly to an average of US$80 per barrel and continued to strengthen between 2011 and 2014 at an average of US$95 per barrel. Natural gas prices, however, never recovered to the pre-crisis levels[3].

[2] Inflation-adjusted West Texas Intermediate (WTI) oil prices moved from US$56.14 per barrel in 1978 to US$83.86 per barrel in 1979, and peaked at US$111.30 per barrel in 1980.

[3] Over the period 1997-2008, Henry Hub natural gas spot prices averaged US$5.09 per mmbtu, peaking at US$8.86 in 2008. In the post-financial crisis era, spot prices averaged US$3.36 per mmbtu over the period 2009-2019. Prices plunged even further in 2020, to average US$2.01 per mmbtu.

Figure 1: Real GDP, Labour Force Participation & Investment



Sources: World Bank Development Indicators Database, Central Bank of Trinidad and Tobago, Central Statistical Office, and Ministry of Finance

Between mid-2014 and early 2016, the global economy faced one of the largest oil price declines in modern history (a 70 per cent price decline). This price decline was reflected in a contraction in Trinidad and Tobago's economy; in 2016, real GDP growth declined by 6.3 per cent. Before the onset of the COVID-19 pandemic, the economy was struggling to regain the momentum experienced in the pre-international crisis era when annual GDP growth averaged over 8.0 per cent between 2000 and 2007. During 2020, the socio-economic challenges brought on by the pandemic, coupled with pre-exisitng economic and financial stresses, contributed to a contraction of 7.4 per cent in domestic activity.

Over the entire review period, the labour force grew by 41.9 per cent, moving from 430.6 thousand persons in 1980 to 611.2 thousand persons in 2020. However, since the mid-2000s the size of the labour force has exhibited a downward trend. Similarly, the LFPR has also been declining steadily, moving from a peak rate of 63.9 per cent in 2006 to 56.6 per cent in 2020 – the lowest rate since 1990 (**Figure 1b**). Apart from the economic fallout of COVID-19 in 2020, this decline in labour force participation can be partly explained by changes in the country's demographic charactersitics, particularly the ageing population[4]. Moreover, the share of the working-age population that is "not in the labour force"[5] increased by 7.7 per cent over the review period. Paul, Hosein and Deonanan (2018) analysed the decline in the labour force participation rate in Trinidad and Tobago over the period 1991 to mid-2017. The authors found that since 2006, approximately half of the decline in the LFPR was due to demographic factors (ageing population). Moreover, (negative) short-run causality was found to run from transfers and subsisdies to the LFPR and to run (positively) from real GDP growth to the LFPR. Meanwhile, in the long run, real GDP growth, average weekly earnings and transfers and subsidies collectively had a significant impact on the LFPR (Paul, Hosein and Deonanan 2018).

Historically, the labour force participation rates for men and women have had a large disparity. However, this disparity has been narrowing as the male participation rate has been declining throughout the review period, moving from 82.0 per cent in 1980 to 65.4 per cent in 2020, while female participation has increased from below 40 per cent in the 1980s to over 50 per cent during 2004 to 2016. Since then, the trend in female participation has reversed and is now declining, reaching 47.8 per cent in 2020. Despite this, there still remains a sizeable gap of almost 20 percentage points between the male and female participation rates. The presence of children in the household, chronic illness, and accessing social security programmes negatively impact female labour force participation in Trinidad and Tobago (Roopnarine and Ramrattan 2012). Conversely, being the head of the household, single (marital status), and the level of education have positive influences on female labour market participation (Roopnarine and Ramrattan 2012). Notably, in Trinidad and Tobago, education plays a greater role in determining the likelihood of women participating in the labour market than it does for men (Dialsingh 2018).

In terms of the youth population, (persons aged between 15 and 24 years), before the COVID-19 pandemic in 2019, youth accounted for around 10.0 per cent of the labour force with a participation rate of around 39.0 per

[4] The United Nations defines a country as 'ageing' when 10 per cent or more of its population is over the age of 60 years. For 2020, data from the Central Statistical Office revealed that 13.4 per cent of the population was over the age of 60 years (Source: Review of the Economy 2020).

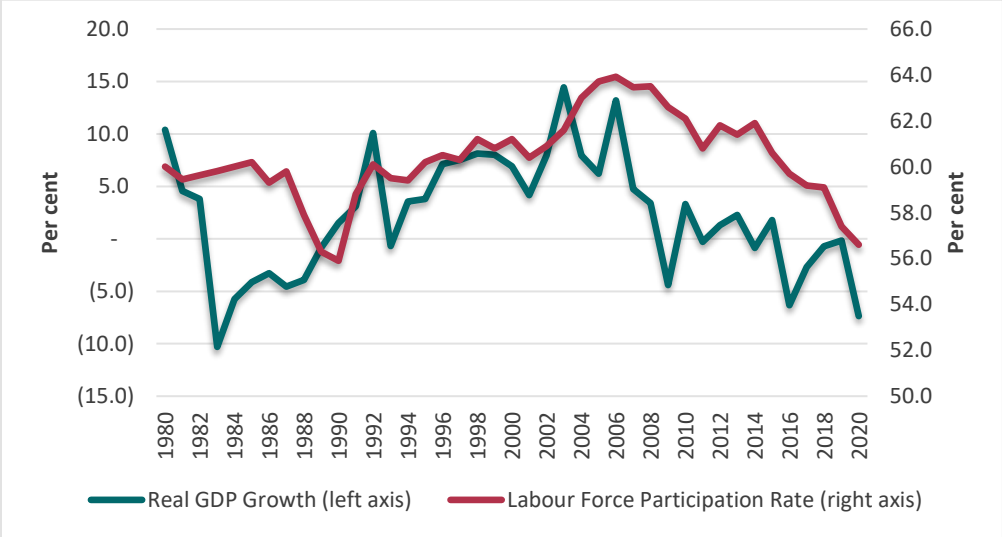
[5] "Not in the labour force" refers to those persons of working age (15-64 years) who are not economically active for diverse reasons such as, education, retirement, infirmity, etc.

cent. The youth labour force participation rate hovered around 52.0 per cent in the 1980s and 1990s, but has been on a consistent declining trend since 2007. It should be noted though, that a relatively low youth labour market participation is not necessarily adverse for the macroeconomy as it may be indicative of a decision by youths to further their education.

As stated above, Trinidad and Tobago is an energy-driven economy. The petroleum and gas industry is highly capital intensive, accounting for, on average, only 3.3 per cent of total employment (1987-2019). The most labour intensive industry in Trinidad and Tobago is the construction (including electricity and water) sector, which has provided, on average, 15.3 per cent of all jobs. Other major labour-intensive industries include manufacturing (including other mining and quarrying) (9.5 per cent); transport, storage and communication (7.2 per cent); and agriculture (6.4 per cent).

Correlation between labour force participation and real GDP growth is 'moderate' with a correlation coefficient of 0.44 (**Figure 2**). However, when disaggregated by gender, female labour market participation has a greater correlation (0.24) with real GDP growth compared with the correlation between male labour market participation (0.11) and real GDP growth. The same holds true for youth participation by gender – female youth labour market participation is moderately correlated (0.53) with real GDP growth compared with a very weak correlation (0.07) for male youth participation.

Figure 2: Real GDP Growth and Labour Force Participation



Source: Central Statistical Office

According to the *System of National Accounts, 2008* (2008 SNA)[6], gross fixed capital formation (or gross fixed investment) refers to the total value of producers' acquisitions less disposals of fixed assets. Fixed assets refer to produced assets such as machinery, equipment, buildings or other structures that are used repeatedly or continuously in production over several accounting periods (more than one year). Gross fixed capital formation

[6] The *System of National Accounts, 2008* (2008 SNA) is a statistical framework that provides a comprehensive, consistent and flexible set of macroeconomic accounts for policymaking, analysis and research purposes.

(GFCF) is usually captured at the national level when GDP is measured using the expenditure approach and is an indication of how much of the new value-added in an economy is invested rather than consumed. Trinidad and Tobago does not currently measure GDP using the expenditure approach so a proxy measure of GFCF was used for this research – the sum of private sector investment and public sector capital expenditure. The authors acknowledge that this proxy measures total investment, which may also include financial assets rather than being a flow value of the net additions to fixed assets (i.e., GFCF).

During the 1980s and 1990s, total investment as a share of GDP exhibited a declining trend, moving from a peak share of 33 per cent of GDP in 1981 to 15 per cent in 1999 (**Figure 1c**). Following this, there was a reversal in this trend and total investment as a share of GDP increased gradually up until 2009 when its share of GDP peaked at 26 per cent. Growth in investment as a share of GDP has since tapered off and has ranged between 18 per cent and 21 per cent between 2010 and 2020. For most of the review period, the private sector accounted for a larger share of total investment, averaging close to 80 per cent.

4 Data and Methodology

4.1 Data

In this study, the variables chosen are in keeping with the empirical literature and modelled in a series of regression equations. A dataset of four variables is used for populating each equation which span an annual time series from 1980 to 2020, reflecting a total of 41 observations per series (see **Appendix A.1** for descriptive statistics). Variables were compiled from multiple sources; the Central Statistical Office of Trinidad and Tobago (CSO), the Central Bank of Trinidad and Tobago (CBTT), Trinidad and Tobago's Ministry of Finance and Bloomberg. All data were individually log transformed before incorporating into the model to reduce model instability.

First, at the head of the model, West Texas Intermediate [WTI] oil prices are used as the main external shock given that Trinidad and Tobago is characterised as an energy-based economy. Following the recommendation by Favero (2001), an exogenous variable was also included as this increases the chances for identification in macroeconomic modelling. Second, total investment [INV] was used as a proxy to represent gross fixed capital formation as this data is not compiled by Trinidad and Tobago's official sources. Total investment was calculated by aggregating private sector investment (commercial banks private sector loans outstanding by purpose) and public sector investment (Central Government capital expenditure). Third, the labour force participation rate [$LFPR$] is included as one of the two key variables under investigation. However, to provide a richer understanding of the labour market in Trinidad and Tobago, separate equations are estimated for female [$FLFPR$], male [$MLFPR$] and youth [$YLFPR$] labour force participation rates. Lastly, the trend component of nominal GDP was utilised to represent potential output [HP_GDP]. This was derived by applying the Hodrick Prescott (HP) filter which is a simple smoothing technique commonly used for decomposing a series into its cyclical and long-term trend components. The HP filter is flexible in deriving the trend output which is produced by minimizing the squared distances between actual and potential output at each point in time throughout the sample period (Konuki, 2008).

4.2 Methodology

Structural Vector Autoregression (SVAR) Analysis

To analyse the possible effects of labour force participation on potential economic growth in Trinidad and Tobago, we employed a structural vector autoregressive (SVAR) model – the AB-model proposed by Amisano and Giannini (1997). One of the major benefits of using the SVAR methodology instead of the simple unrestricted vector autoregressive (VAR) model is that it allows researchers to use theoretical assumptions in the model by imposing explicit restrictions for the structural relationships. Also, the introduction of theoretical restrictions aids with overcoming econometric identification issues.

The underlying SVAR model can be written as:

$$Ay_t = C(L)y_{t-1} + B\varepsilon_t \qquad [1]$$

where A is a KxK matrix that captures the structural contemporaneous relationships among the variables, y_t is a K-dimensional vector of observable variables, C is a polynomial function of order p, L is the lag operator, and ε_t is a K-dimensional vector of structural innovations with mean zero and identity covariance.

However, this structural equation cannot be estimated directly due to identification issues. Instead, we estimate an unrestricted VAR of the form:

$$y_t = A^{-1}C(L)y_{t-1} + A^{-1}B\varepsilon_t \quad [2]$$

The reduced form model used for the structural analysis can then be defined as follows:

$$Ae_t = B\varepsilon_t \quad [3]$$

where e_t is the reduced form disturbance vector, while ε_t represents the unobserved structural innovation vector, both with a length k. Thus, equation [3] relates the reduced form disturbances to the underlying structural shocks where the B matrix filters the reduced form shocks so that the structural shocks can be identified. The reduced form VAR residuals can be estimated from the data as:

$$e_t = A^{-1}B\varepsilon_t \quad [4]$$

The SVAR analysis requires some restrictions for the A and B matrices. By imposing structure on the A and B matrices in equation [4], we impose restrictions on the structural VAR in equation [1]. For identification of the AB model, a system with k variables, there must be at least $\frac{k^2-k}{2}$ restrictions imposed. These restrictions typically (but not always), take the form of restricting matrix B's off-diagonal elements to be equal to zero, and as such constitute restrictions on the contemporaneous effect of one variable on another. If the model is over-identified, the value of a likelihood ratio (LR) statistic will be reported.

For the purpose of identifying our model, we apply the structural restrictions to examine the determinants of potential output [HP_GDP_t]. The vector y_t contains the macroeconomic variables discussed above, denoted as $y_t = [WTI^*, INV, LFPR, HP\_GDP]$. The structural parameters are estimated by means of maximum likelihood estimator. More explicitly, for the AB model used in this study, the coefficients on the diagonal of the A matrix are normalised to unity, while the number of zero restrictions on the coefficients is 7, so our model is over-identified with 1 degree of freedom.

$$e_t = A^{-1}\begin{bmatrix} 1 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 \\ a_{31} & 0 & 1 & 0 \\ a_{41} & a_{42} & a_{43} & 1 \end{bmatrix}.B\begin{bmatrix} b_{11} & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 \\ 0 & 0 & b_{33} & 0 \\ 0 & 0 & 0 & b_{44} \end{bmatrix}.\varepsilon_t \begin{bmatrix} WTI_t^* \\ INV_t \\ LFPR_t \\ HP\_GDP_t \end{bmatrix} \quad [5]$$

In the above system [5], oil prices are set ahead of all the variables to represent that crude oil prices are considered exogenous in the model. Given that Trinidad and Tobago exports energy-related products, oil prices are assumed

to contemporaneously affect all variables in the system. Domestic variables [INV, LFPR, HP_GDP] are assumed not to contemporaneously affect crude prices [WTI*] due to the fact that the Trinidad and Tobago economy is very small and therefore highly unlikely to have any substantial impact on the international price for crude oil. We assume there are no feedback effects from labour force participation rates onto total investment and vice-versa. Restrictions in equation [5] indicate that all variables are assumed to contemporaneously affect potential output. In terms of lag selection, we departed from the standard optimal lag length tests and used a common alternative, as was suggested by Lüktephol (2007), instead. We estimated the VAR using the optimal lag length that was absent of autocorrelation and heteroscedasticity. The stability of the model was assessed using the eigenvalues of the companion matrix of the VAR model – if all the eigenvalues are inside the unit circle, the model is stable. Given the country's relatively low female labour force participation and high unemployment among the youth, equation [5] was reconstructed to specifically analyse the impacts of the female labour force participation rate $[\mathrm{FLFPR}]$ and the youth labour force participation rate $[\mathrm{YLFPR}]$ on potential GDP. Furthermore, the impact of the male labour force participation rate $[\mathrm{MLFPR}]$ on potential output was also analysed for comparative purposes.

Notably, a key assumption in the model is that factor productivity (labour and capital) remains unchanged. The research did not include an investigation into whether the decline in LFPR was due to changes in factor productivity or shifting shares of labour and capital application over time, which could have come about due to technological advancements, digitalisation, and the like.

The dynamic analysis from the SVAR model was conducted through Impulse Response Functions (IRF) and Forecast Error Variance Decomposition (FEVD). Our study used the Structural Impulse Response Functions (SIRF) as these take into account the contemporaneous order of the restrictions in the model. Structural impulse response functions were used to measure the accumulated response to one standard deviations of labour force participation rates and total investment on current and future values of potential output. We also estimated a 10-period ahead (10 years) variance decomposition of all the macroeconomic variables.

5 Results and Analysis

The time series properties and model selection procedure including lag length criteria, stability test, heteroscedasticity and serial correlation Lagrange Multiplier (LM) tests, showed that the SVAR model of lag length three is valid and stable.[7] Although the AIC and FPE suggested a VAR model with 4 lags, as suggested by Lüktephol (2007), we chose a VAR model with 3 lags instead to ensure no heteroscedasticity and serial correlation among the residuals. Because the SVAR is over-identified, the validity of the over-identifying restrictions was tested using a likelihood test whose null hypothesis is that the additional restrictions are valid. The results indicate that the null hypothesis cannot be rejected at all conventional levels of significance with $p = 0.1143$; $\chi^2(1) = 2.493$. The estimation results of the SVAR model are presented in **Appendix A.6**. The results from the structural impulse response functions and variance decompositions are discussed below.

5.1 Impulse Response Functions

The impulse responses generated from the model yield results consistent with the literature regarding the relationship between potential output and labour force participation. A positive shock to total labour force participation generates continuous improvements in potential output over the entirety of the ten-year forecast period (see **Appendix A.7a**). Conversely, a positive shock to total investment generates a persistently negative effect on potential output. It should be noted that the impact on potential output does increase in the long run, though it never turns positive. This result is consistent with findings from Yakubu, Akanegbu and Jelilov (2020) where no short-run causality was found running from gross fixed capital formation to real GDP for the case of Nigeria. However, for Trinidad and Tobago, the results of the model suggest that investments in the domestic economic landscape, as defined in this paper, appear to be inefficient. This may call to question the suitability of the proxy utilized as an appropriate substitute for gross fixed capital formation. Notwithstanding, this result raises concerns surrounding the inability of capital expenditure by the State and lending by commercial banks to trigger a positive response in economic growth. This finding also corroborates Seerattan (2012) who noted the inefficiency of capital expenditure in commodity-exporting countries in the region such as Trinidad and Tobago. According to the author, capital expenditure is perceived as a more productive avenue to facilitate economic growth. However, in the context of fiscal consolidation, the Caribbean experience is characterised by downward revisions to the capital expenditure programme on account of the political sensitivities associated with a cut to wages and subsidies which can inhibit the contribution of capital expenditure to enhancing growth. Additionally, the results support the notion of developing labour-intensive growth strategies in the domestic setting.

A second iteration of the model examined the impact of increased female labour force participation on potential GDP. In this version, the impact was again increasingly more positive over the entire forecast horizon (see **Appendix A.7b**). This long-run relationship between female labour participation and GDP is corroborated in both the early literature (such as Sinha 1967, Durand 1975, Cağatay and Özler 1995), and more recently, in Rahma 2020. Although female participation has increased from below 40 per cent in the 1980s to over 50 per cent during 2004 to 2016, greater efforts to entice women to participate in the labour market will auger well for future economic

[7] See **Appendix 1** for results of these model diagnostic tests.

growth. Education is one avenue that could be used to encourage women to participate in the labour market as Dialsingh (2018) found that in Trinidad and Tobago, education plays a greater role in determining the likelihood of female labour market participation than it does for males. Interestingly, in this iteration, the impact of investment on potential GDP follows a similar pattern as total labour market participation, but turns positive in the final period (10th year ahead). This suggests that investment in Trinidad and Tobago has a stronger impact on potential GDP in the long-run than it does in the short-run.

A third iteration of the model investigated the relationship between potential output and youth labour force participation (see **Appendix A.7c**). While the impact of increased youth labour force participation on potential output was marginal in the short run, the medium to long term impact was clearly positive. The International Labour Organisation (2019) noted that employment growth among adults has systematically exceeded that of youths, pointing to issues in job creation for young workers. The same holds true for Trinidad and Tobago. Unemployment among school leavers (15-19 years) is particularly severe, with females being more affected. Meanwhile, the unemployment rate progressively declines in the older age categories. Again this points to the need for the development of employment programmes targeted at the nation's youth, particularly, female youths. Notwithstanding this, decreasing youth labour market participation is not necessarily adverse for the macroeconomy as it may be indicative of a decision by youths to further their education. In this iteration of the model the impact of investment on potential output was sizably more negative than previous iterations.

For comparative purposes, a fourth iteration of the model investigated the relationship between potential output and male labour force participation (see **Appendix A.7d)**. Interestingly, the impact of increased male labour force participation on potential output was muted over the entirety of the forecast. Literature on the dynamics of this relationship is scant. In the context of the Caribbean, Downes (2006) notes the constancy of male labour force participation rates over the years, with increases in total labour force participation rates being driven predominantly by the entrance of female participants into the labour market. We therefore postulate that on account of the already relatively high male labour force participation rates domestically, any increase in male labour force participation will have the muted effect on growth being displayed in the model. This therefore supports the need for policy action to focus specifically on increasing youth and female labour force participation in order to facilitate growth. In this iteration of the model the impact of investments on potential output mirrors that of the first iteration where output increases in the long run, though it never turns positive.

5.2 Variance Decomposition

It is useful to analyse the variance decompositions derived from the models (see **Appendix A.8a**) as it allows us to decompose the variance of the forecast error into the contributions from specific exogenous shocks. The results for total labour force participation highlight that in the earliest stages, most of the variations in potential output come from potential output itself. Interestingly, the value of this contribution is fairly constant throughout the forecast period. Investment, as defined in the model, accounts for 17.5 per cent of the variation in the earlier years and gradually falls over the forecast period, contributing only 1.1 per cent to the variation in potential output by the 10th year. The narrative is reversed when we examine contributions from the labour force participation rate which contributes to 9.8 per cent of the variation in potential output in the initial year and gradually increases

over the forecast horizon to 23.9 per cent. Investment appears to have a greater short-term impact on potential GDP, which gradually erodes in the long run. On the other hand, over the long run labour force participation appears to be a second greatest driver of growth, behind potential GDP itself. These results support the need for more labour-intensive growth strategies which can positively impact economic growth.

Analysis of the variance decomposition for females only (see **Appendix A.8b**) shows a similar trend as for the total participation analysis. Most of the variation in potential output is explained by this variable itself. The investment variable accounts for 13.1 per cent of the variations in the first year and rapidly slows over the forecast horizon. The contribution of female labour force participation to potential GDP is much smaller in this iteration of the model measuring 3.0 per cent in the first year, but gradually ascends to 11.7 per cent by the 10th year. This again highlights the long run positive impact of increased female labour force participation on potential output.

The variance decomposition for youths only follows a similar trend from the previous two iterations of the model (see **Appendix A.8c**). Again most of the variation in potential GDP is accounted for by the potential output variable itself. The contribution of the investment slows from 16.5 per in the first year to 3.8 per cent by the 10th year. Interestingly in the youths only iteration of the model, though the trend is the same, the contribution of investment to potential output is more pronounced over the long run than the previous two iterations. The contribution of youth labour force participation follows a similar trend to the previous two iterations, steadily increasing in value over the forecast horizon. Unlike the previous two iterations however, the contribution of youth labour force participation is negligible in the first four years moving from 0.2 per cent to 0.5 per cent, before rapidly increasing from the 5th year, reaching 15.4 per cent by the 10th year.

Analysis of the variance decomposition for males only (see **Appendix A.8d)** highlights that most of the variation in potential GDP is accounted for by the potential output variable itself, with that contribution increasing significantly in the long run. Similar to previous iterations, the contribution of investments slows in the long run, moving from 18.6 per cent in the first year to 1.3 per cent by the final year. This again highlights a more pronounced impact of investments on potential output in the short run, with an inability to significantly contribute in the long term. However, unlike previous iterations of the model, the impact of male labour force participation steadily declines over the forecast horizon, moving from 11.0 per cent in the first year to 0.5 per cent by the tenth year. This corroborates the need for policy action to target female and youth participation as improvements to male labour force participation do not appear to support potential output. Notably, in this iteration, the contribution of external factors to output is increasingly more prominent in the long term. This is evidenced by the share of West Texas Intermediate (WTI) crude oil prices in accounting for variations in potential GDP, moving from 0.2 per cent in the first year to 10.6 per cent in the final year.

6 Conclusion and Recommendations

The aim of this paper was to identify and measure the relationship between labour market participation and potential output in Trinidad and Tobago. The analysis was premised on the use of a structural vector autoregression (SVAR) approach to examine this nexus. Additionally, the paper offers a richer analysis of the demographic characteristics of labour force participation, with individual examinations of the female, youth (15 to 24 years) and male participation rates. The results highlight the need to undertake labour-driven growth strategies as this appears to be a key tool in closing the gap between actual and potential gross domestic product, with specific emphasis on the generation of further participation among the female and youth labour force. Increased male labour force participation has a muted effect on growth, thereby highlighting the significant value of female and youth labour in buttressing potential output. It should also be noted that policy actions to improve output have to be undertaken in the context of the country's overall economic development framework. Additionally, increased investment appears to be a non-factor in closing the output gap, suggesting that further research should examine whether private and public sector investments are yielding optimal results.

The results point to a need to thoroughly examine the effectiveness of investment in both the private and public spheres as a trigger for improving potential output. The response of potential output to increased investment, as defined in this study, is predominantly negative in some cases and, at best, muted in others. This suggests that in the public realm, capital expenditure is potentially failing to generate future potential output, a point noted in a previous study by Seerattan (2012). Analysis of the variance decompositions showcase that there is some contribution to output in the short run but this is gradually reduced in the long term. This may warrant further investigation into the current structure of the public expenditure programme. In the private sector, it potentially speaks to a possible misalignment of private sector investment with economic growth. However, consideration has to be given to the suitability of the proxy utilized for private sector investment as it may not give a complete perspective of actual private sector investment. Ultimately the results highlight a failure of increased investment to trigger potential economic growth over the long run whilst also pinpointing the significant potential gains to growth that can be generated from expansions in labour force participation, particularly among females and youths.

Policy actions should therefore be aimed at expanding labour force participation rates. Paul, Hosein and Deonanan (2018) suggest that half the decline in the labour force participation is attributable to an ageing population. In this vein, consideration should be given to an increased retirement age. Attempts should also be made to offer disincentives for early retirement. Casey (1998) speaks to the adoption of gradual retirement versus early retirement where persons gradually reduce their number of work days between the point at which they qualify for early retirement and at which they actually retire. In general, research has found that the macroeconomic environment has a strong impact on labour force participation (Downes, 2006 and Grigoli et. al, 2018). Labour force participation tends to be stronger in positive economic times, given that the demand for labour has a tendency to increase in these periods, which is also typically associated with higher wage rates. As such, a first point of call would be for the Government's direct involvement in facilitating and encouraging overall macroeconomic growth and stability. Paul, Hosein and Deonanan (2018) also allude to this factor, suggesting a positive causal relationship between GDP growth rates and the labour force participation rate.

This however becomes particularly tricky given the apparent inefficiency in investment. More specifically, the Government can act as a facilitator to allow the private sector to engage in new types of businesses, particularly in the non-energy sector and to explore new export markets. This will call for greater economic diversification and improved competitiveness among the various non-energy sector entities. A commitment to such policies can have the effect of encouraging the establishment of new high-end businesses that will transform knowledge into commercial value in the form of increased productivity as well as new products, processes, services, and systems. The government should also focus on facilitating new areas of growth, such as those in the blue and green economy, the digital and sharing economy, and the orange (or creative) economy. As an extension of this, the added economic prosperity can reduce reliance on the State and facilitate a drawdown in transfers and subsidies which was identified by Paul, Hoesin and Deonanan (2018) as having a negative relationship with labour force participation rates. Monetary policy action should also be executed in tandem with fiscal policy in the facilitation of macroeconomic stability as this will foster greater labour force participation.

Additionally, greater access to opportunities needs to be generated specifically among the youth and female populations, as increased opportunities will facilitate higher participation in the labour market. This is imperative given the lack of evidence to support increased male participation having a notable effect on potential output. Regarding youths, emphasis can be placed on the development of programmes that generate employment (and hence greater labour market participation) in the realm of entrepreneurship, creative industries, vocational training programmes, in addition to the more prominent 'science, technology, engineering and mathematics' (STEM) education. Also, students who are less academically inclined could be allowed to enter the labour force earlier via apprenticeship programmes. While the creation of these opportunities is important, it is also imperative that these avenues are reachable and accessible to the different strata of the population. In this regard, there is an opportunity for private-public partnership in the sphere of education and training. Private sector firms can invest directly in the development of human capital, through funding of niche or specialised programmes that specifically relate to the work undertaken at these firms, which in turn can act as a breeding ground for youth employment back into these same firms. Early entry of youths into the labour force can also be facilitated by adopting a merit-based approach to subsidising tertiary education. This will have the effect of allowing those who are not academically inclined to enter the labour force earlier.

Regarding female participation, the Government can consider providing childcare subsidies to low-income households for young children within a stated age bracket as well as increasing the length of paternity leave to equalise the economic costs of hiring women (in reference to paid maternity leave). The implementation of more flexible working arrangements with initiatives such as work from home arrangements may also help to attract greater participation from factions of the society that have to weigh the opportunity cost of being a homemaker versus entering into more traditional types of labour. Furthermore, the Government should include in the Equal Opportunity Act (2000) that men and women should receive *equal remuneration for work of equal value*. The evidence supports a need for this given the impact of increased female participation to potential output which outweighs that of their male counterparts.

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Appendix 1: Diagnostic and Stability Tests

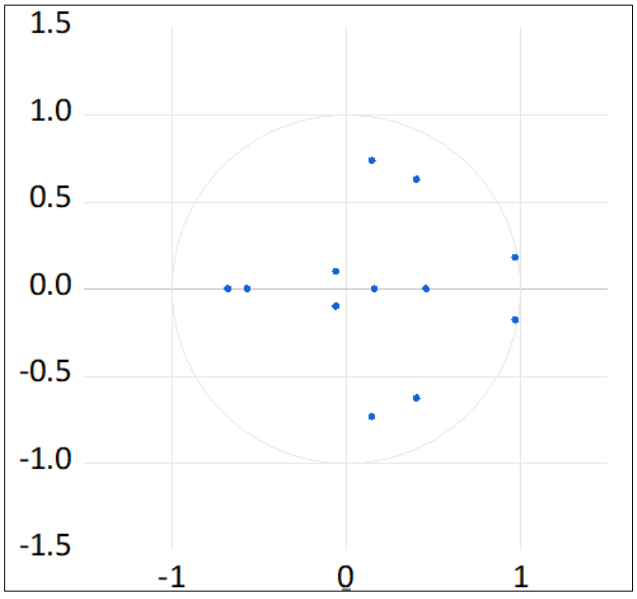
A.1 Descriptive Statistics of the Model Variables

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	No. of Observations
Potential Output (log)	5.0	5.0	5.2	4.7	0.2	41
WTI (log)	1.5	1.5	2.0	1.2	0.3	41
Total Investment (log)	4.0	3.9	4.5	3.6	0.4	41
Total Labour Force Participation Rate	60.2	60.3	63.9	55.9	2.1	41
Female Labour Force Participation Rate	46.1	47.0	53.1	37.4	5.0	41
Male Labour Force Participation Rate	74.4	74.6	82.0	65.4	4.2	41
Youth labour Force Participation Rate	49.4	50.7	55.6	35.3	4.8	41

A.2a Stability Test

The model estimated for Labour Force Participation Rate is stable (stationary) if all roots have modulus less than one and lie within the unit root circle.

Inverse Roots of AR Characteristic Polynomial



Source: EViews 11

A.2b Stability Test

Roots of Characteristic Polynomial
Endogenous variables: DLOG(WTI) DLOG(I_TOT) D(LFPR) DLOG(HP_GDP)
Exogenous variables: C
Lag specification: 1 3
Date: 06/10/22 Time: 11:32

Root	Modulus
0.972394 - 0.178474i	0.988637
0.972394 + 0.178474i	0.988637
0.150613 - 0.734730i	0.750008
0.150613 + 0.734730i	0.750008
0.406122 - 0.627083i	0.747106
0.406122 + 0.627083i	0.747106
-0.676946	0.676946
-0.566613	0.566613
0.460336	0.460336
0.164870	0.164870
-0.056782 - 0.100898i	0.115779
-0.056782 + 0.100898i	0.115779

No root lies outside the unit circle.
VAR satisfies the stability condition.

Source: EViews 11

A.3 Test for Lag Length

Although AIC and FPE suggest a VAR(4) model, we chose a VAR model with 3 lags instead to ensure no heteroscedasticity and serial autocorrelation among the residuals.

VAR Lag Order Selection Criteria
Endogenous variables: DLOG(WTI) DLOG(I_TOT) D(LFPR) DLOG(HP_GDP)
Exogenous variables: C
Date: 06/10/22 Time: 11:36
Sample: 1980 2020
Included observations: 36

Lag	LogL	LR	FPE	AIC	SC	HQ
0	47.22693	NA	1.06e-06	-2.401496	-2.225550	-2.340086
1	120.7514	126.6256	4.39e-08	-5.597303	-4.717570	-5.290252
2	231.2972	165.8186	2.38e-10	-10.84984	-9.266325	-10.29715
3	266.2506	44.66267*	9.12e-11	-11.90281	-9.615506*	-11.10448
4	287.8398	22.78857	8.08e-11*	-12.21332*	-9.222229	-11.16935*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: EViews 11

A.4 Test for Heteroscedasticity – VAR(3)

VAR Residual Heteroskedasticity Tests (Levels and Squares)
Date: 06/10/22 Time: 11:37
Sample: 1980 2020
Included observations: 37

Joint test:

Chi-sq	df	Prob.
249.7047	240	0.3201

Source: EViews 11

A.5 Test for Serial Correlation

VAR Residual Serial Correlation LM Tests
Date: 06/10/22 Time: 11:33
Sample: 1980 2020
Included observations: 37

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	31.19406	16	0.0127	2.261097	(16, 52.6)	0.0137
2	26.04895	16	0.0533	1.802136	(16, 52.6)	0.0560
3	17.80727	16	0.3353	1.144761	(16, 52.6)	0.3416

Source: EViews 11

A.6

Estimated Results of the SVAR Model: Full Sample

Structural VAR Estimates
Date: 06/09/22 Time: 11:41
Sample (adjusted): 1984 2020
Included observations: 37 after adjustments
Estimation method: Maximum likelihood via Newton-Raphson (analytic derivatives)
Convergence achieved after 29 iterations
Structural VAR is over-identified

Model: Ae = Bu where E[uu']=I

A =

1	0	0	0
C(1)	1	0	0
C(2)	0	1	0
C(3)	C(4)	C(5)	1

B =

C(6)	0	0	0
0	C(7)	0	0
0	0	C(8)	0
0	0	0	C(9)

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-0.295652	0.076152	-3.882382	0.0001
C(2)	-1.121221	0.659672	-1.699664	0.0892
C(3)	-0.000174	0.000186	-0.933463	0.3506
C(4)	0.001008	0.000348	2.893293	0.0038
C(5)	-8.70E-05	4.02E-05	-2.162507	0.0306
C(6)	0.250127	0.029077	8.602324	0.0000
C(7)	0.115863	0.013469	8.602324	0.0000
C(8)	1.003668	0.116674	8.602324	0.0000
C(9)	0.000237	2.76E-05	8.602324	0.0000

Log likelihood	229.6699		
LR test for over-identification:			
Chi-square(1)	2.493210	Probability	0.1143

Estimated A matrix:

1.000000	0.000000	0.000000	0.000000
-0.295652	1.000000	0.000000	0.000000
-1.121221	0.000000	1.000000	0.000000
-0.000174	0.001008	-8.70E-05	1.000000

Estimated B matrix:

0.250127	0.000000	0.000000	0.000000
0.000000	0.115863	0.000000	0.000000
0.000000	0.000000	1.003668	0.000000
0.000000	0.000000	0.000000	0.000237

Estimated S matrix:

0.250127	0.000000	0.000000	0.000000
0.073951	0.115863	0.000000	0.000000
0.280448	0.000000	1.003668	0.000000
-6.71E-06	-0.000117	8.73E-05	0.000237

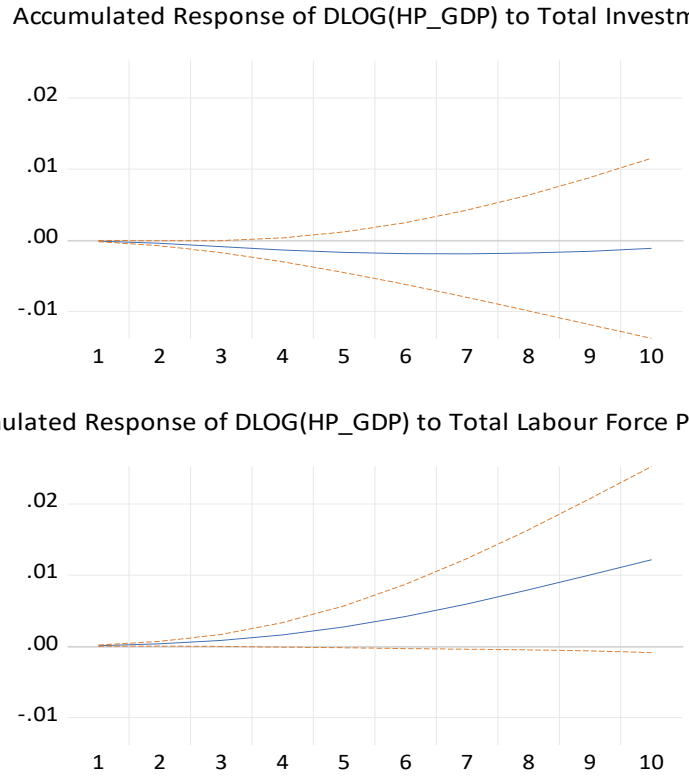
Estimated F matrix:

0.173944	0.021665	0.040941	0.091305
0.092240	0.085320	0.010915	0.027874
0.188635	-0.046799	0.568240	-0.114480
0.004959	0.002903	0.013521	0.021784

Source: EViews 11

A.7a

Accumulated Response of Potential GDP - Total Investment & Total Labour Force Participation
(Structural Impulse Response Function)

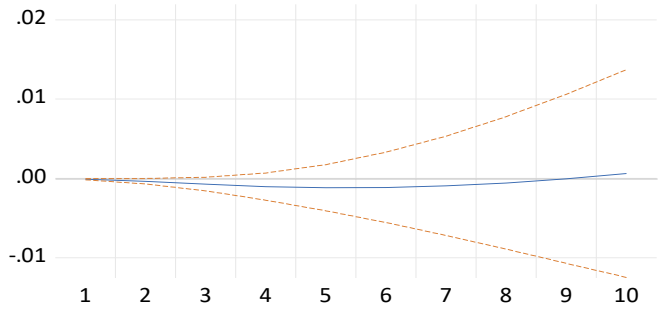


Source: EViews 11

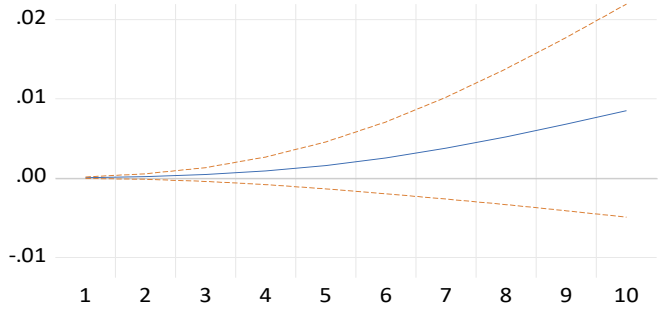
A.7b

Accumulated Response to Potential GDP - Total Investment & Female Labour Force Participation
(Structural Impulse Response Functions)

Accumulated Response of DLOG(HP_GDP) to Total Investment



Accumulated Response of DLOG(HP_GDP) to Female Labour Force Participation

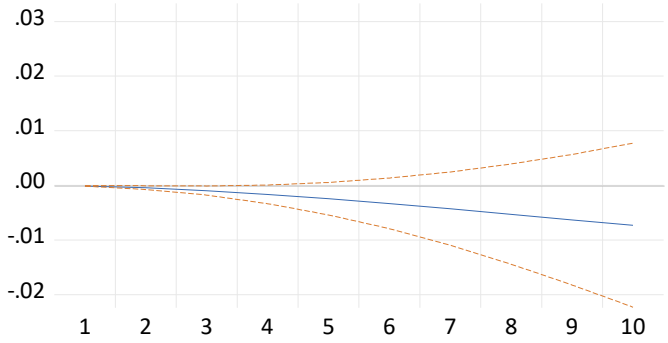


Source: EViews 11

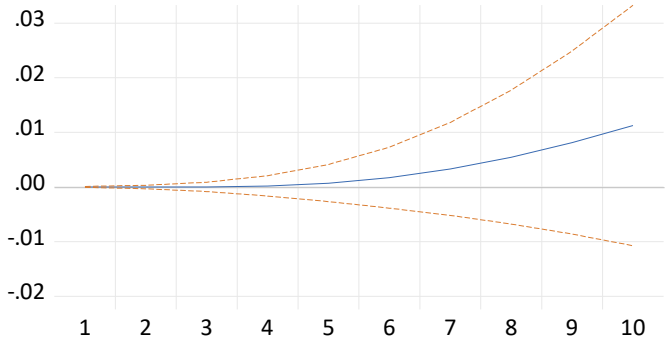
A.7c

Accumulated Response to Potential GDP - Total Investment & Youth Labour Force Participation
(Structural Impulse Response Functions)

Accumulated Response of DLOG(HP_GDP) to Total Investment



Accumulated Response of DLOG(HP_GDP) to Youth Labour Force Participation

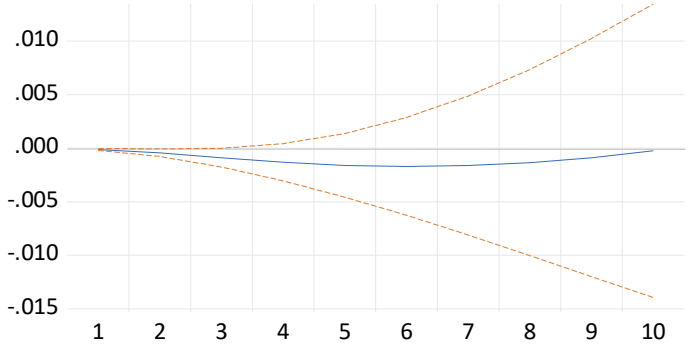


Source: EViews 11

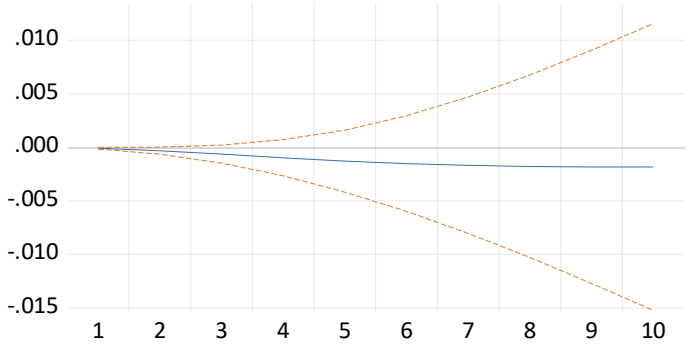
A.7d

Accumulated Response of Potential GDP - Total Investment & Male Labour Force Participation
(Structural Impulse Response Function)

Accumulated Response of DLOG(HP_GDP) to Total Investment



Accumulated Response of DLOG(HP_GDP) to Male Labour Force Participation



Source: Eviews11

A.8a

Variance Decomposition of First Iteration Involving Total Labour Force Participation Rate

Period	S.E.	WTI	Inv	LFPR	HP_GDP
1	0.250127	0.057956	17.56277	9.811224	72.56805
2	0.270287	0.105188	17.06654	10.93326	71.89501
3	0.281141	0.068396	13.30964	12.07761	74.54435
4	0.290820	0.035727	8.584615	14.41856	76.96109
5	0.296495	0.047876	5.109111	16.73492	78.10810
6	0.301815	0.237889	3.062015	18.91209	77.78801
7	0.303211	0.564595	1.959834	20.78544	76.69013
8	0.304083	0.917232	1.393680	22.22237	75.46672
9	0.305107	1.253960	1.143162	23.20901	74.39387
10	0.305339	1.584619	1.095678	23.87288	73.44683

Factorization: Structural

Source: Eviews11

A.8b

Variance Decomposition of Second Iteration Involving Female Labour Force Participation Rate

Period	S.E.	WTI	Inv	FLFPR	HP_GDP
1	0.252654	0.073126	13.06625	3.042809	83.81781
2	0.270449	0.463011	11.72768	3.494060	84.31525
3	0.278383	0.766965	8.336775	3.646880	87.24938
4	0.296681	1.028998	4.709084	4.663737	89.59818
5	0.301790	0.947665	2.465943	5.880087	90.70631
6	0.304900	0.724060	1.406285	7.232535	90.63712
7	0.305121	0.531870	1.001123	8.664667	89.80234
8	0.307338	0.406315	0.941872	9.895736	88.75608
9	0.307568	0.326742	1.082541	10.88409	87.70663
10	0.307886	0.272880	1.341223	11.71722	86.66868

Factorization: Structural

Source: Eviews11

A.8c

Variance Decomposition of Third Iteration Involving Youth Labour Force Participation Rate

Period	S.E.	WTI	Inv	YLFPR	HP_GDP
1	0.229706	0.035073	16.50522	0.218127	83.24158
2	0.268848	0.596419	17.38641	0.044995	81.97218
3	0.275159	1.590695	15.52512	0.016743	82.86744
4	0.294112	2.662728	12.23378	0.464046	84.63944
5	0.298917	3.130799	9.367614	1.827860	85.67373
6	0.308493	3.304427	7.346046	4.184299	85.16523
7	0.311018	3.330760	6.000854	7.156526	83.51186
8	0.313461	3.348984	5.042492	10.14872	81.45981
9	0.316479	3.409450	4.318446	12.92974	79.34236
10	0.317068	3.476536	3.758145	15.43890	77.32642

Factorization: Structural

Source: EViews 11

A.8d

Variance Decomposition of Fourth Iteration Involving Male Labour Force Participation Rate

Period	S.E.	WTI	Inv	MLFPR	HP_GDP
1	0.240389	0.213125	18.63017	10.99528	70.16143
2	0.273070	0.315955	16.57535	8.762938	74.34575
3	0.285621	0.680251	12.23522	6.096962	80.98757
4	0.297045	1.159494	7.507213	4.152485	87.18081
5	0.300843	2.245945	4.251260	2.731804	90.77099
6	0.301370	3.949851	2.428269	1.749653	91.87223
7	0.301656	5.852369	1.542945	1.161312	91.44337
8	0.302138	7.611456	1.185046	0.815192	90.38831
9	0.302282	9.188626	1.148084	0.603150	89.06014
10	0.302413	10.57508	1.315411	0.470178	87.63933

Factorization: Structural

Source: Eviews11