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Assessing fiscal sustainability in Egypt: a comparative study

Ola Al Sayed and Ashraf Samir
Department of Economics, Faculty of Economics and Political Science, Cairo University, Giza, Egypt, and
Heba Hesham Anwar
Macroeconomic Policies Center, Institute of National Planning, Cairo, Egypt

Abstract

Purpose – This paper aims to assess the fiscal sustainability in Egypt during the period 1990–2018 using deficit accounts (DA) approach. It also tries to investigate the possibility of applying generational accounts (GA) in Egypt as a new approach to assess fiscal sustainability.

Design/methodology/approach – This paper tries to assess fiscal sustainability in Egypt during 1990–2018 using DA and GA approaches. DA approach includes primary deficit indicator, tax gap indicator, augmented Dickey-Fuller stationarity test for debt/GDP ratio and Johansen co-integration test between government revenues and expenditures. However, concerning the possibility of applying GA in Egypt, field study form was designed including specific questions to academic and executive economic experts to investigate if it is possible to apply GA in Egypt.

Findings – The empirical findings of the field study indicate that Egypt witnessed fiscal sustainability during the period 1990–2018 using DA. On the other hand, there are various obstacles, including administrative, technical, legal and political obstacles which hinder Egypt from applying GA to assess fiscal sustainability.

Originality/value – To the best of the authors' knowledge, this paper assesses fiscal sustainability in Egypt using DA for a longer and updated time series within 1990–2018. In addition, it is the first paper to examine the possibility of assessing fiscal sustainability using GA approach in Egypt.

Keywords ADF test, Co-integration test, Deficit accounts, Egypt, Fiscal sustainability, Generational accounts, Net tax burden, Primary deficit, Tax gap

Paper type Research paper

1. Introduction

The current period has witnessed a growing interest in analyzing fiscal sustainability in many indebted countries in the world. In this context, this paper will apply a comparative analysis to assess fiscal sustainability in Egypt from two integrated and complementary approaches: the traditional approach "deficit accounts," hereafter; DA and the new approach "generational accounts," hereafter; GA.

In theory, fiscal policy is said to be sustainable when the ratio of public debt to output tends to be constant in the long term, i.e. when the ratio quickly return to its normal levels, despite the occurrence of emergent changes. In order to do so, government revenues must be sufficient to cover future debt burdens, without the need to reschedule debt or borrow again to repay the debt. Fiscal sustainability is achieved if the budget is able to finance public spending without making a fundamental change in this spending by cancelling one of the main functions performed by the state (European Commission, 2016).

JEL Classification — C83, D63, D64, E62, H20, H61, H62

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In addition, it is noteworthy that government fiscal policies have a great effect on the distribution of disposable income between members of the same generation or between different generations. Government spending on goods and services represents a burden of taxing either on present or future generations, so that if current taxes are insufficient in order to cover government expenditures, the tax rate will eventually increase in the future to repay the government debts that the government resorted to issue in advance.

GA is important in the sense that it differs from DA in evaluating fiscal sustainability, as GA is the most suitable technique to be used to assess sustainability of fiscal policy in terms of measuring distributional effects of tax burdens and social transfers on both current and future generations (Auerbach *et al.*, 1991).

GA approach is considered as an evolution of Ricardian equivalence proposition (Ricardo, 1820) to assess sustainability of fiscal policy. Both of them relied on the necessary condition of satisfying the intertemporal government budget constraint (hereafter IGBC) to achieve fiscal sustainability. Also Woodford (1996), Rakshit (2005) and Ruiz-deGamboa and Summerhill (2009) explicitly recognized that unless IGBC is operative, Ricardian equivalence would not hold true. Thus, the role of verifying this constraint for fiscal sustainability is crucial for Ricardian equivalence to hold as mentioned in previous studies.

GA and Ricardian equivalence also addressed the idea of the current and future status of fiscal policy, but were addressed in a deeper perspective through GA approach, which seeks to compute the net returns and fiscal burdens that future generations will bear compared to current generations. In addition, the application of GA does not depend on the principle of rational expectations, contrary to the Ricardian equivalence, where Ricardo originally assumed that rational expectations of individual behavior make government fiscal policy (such as reducing the current tax rate while maintaining the level of public spending) has no effect on the increase in aggregate demand. This is based on the rationality of individuals and their expectations that the government will eventually raise the tax rate in the future to pay off its current debt financed by borrowing. Also, GA approach does not address the impact of reducing the current tax on the rate of consumption and personal savings, as in the case of Ricardo. In addition, the Ricardian equivalence did not provide a clear measurement of the fiscal returns and burdens that will be borne by future generations compared to the current generations (Feldstein, 1988).

This paper tries to assess fiscal sustainability in Egypt during 1990/1991–2017/2018 using DA and GA approaches [1]. DA approach includes primary deficit indicator, tax gap indicator, augmented Dickey-Fuller stationarity test for debt/GDP ratio and Johansen co-integration test between government revenues and expenditures.

GA approach arose initially from IGBC. This constraint shows that all governmental liabilities have to be paid by either existing or coming generations. Thus, GA approach incorporates the expected demographic changes and the parameters of the current fiscal policy into IGBC because of the continuous variation of generations' size and structure. Unlike DA [2], GA approach is forward looking and provides us with extra insights about sustainability of current fiscal policy.

There are three sources of financing the present value (hereafter PV) of future government expenditures: the PV of governmental net wealth, the PV of net taxes on current generations, in addition to the PV of net taxes on future generations (Gokhale *et al.*, 1999). Thus, GA shows a comparison between the fiscal burden imposed on current and future generations.

Traditional indicators of fiscal sustainability assessment cannot quantify tax burdens between present and future generations (Kotlikoff, 1984; Auerbach and Kotlikoff, 1999), as governments can announce any size of the deficit or surplus through their ability to manipulate the items of the budget.

Consequently, if DA has nothing to do with measuring the impact of fiscal policy on present and future generations, then the answer lies in GA approach according to economic

theory, as it expresses a set of accounts for each generation, which equals net tax payments that government predicts to gather from each generation over its remaining life time (Auerbach *et al.*, 1991). Then, GA is comprehensive in the sense that it takes into account all the tax revenues collected and expenses for each generation (Dore and Levy, 1998).

In this context, this paper adds to existing literature as it assesses fiscal sustainability in Egypt using DA for a longer and updated time series within 1990/1991–2017/2018. In addition, it attempts to investigate the possibility of applying GA in Egypt as a new approach to assess fiscal sustainability.

The rest of the paper is organized as follows: Section 2 presents literature review about fiscal sustainability assessment in Egypt and empirical studies about DA and GA. Section 3 illuminates the conceptual framework of GA approach, whereas Section 4 describes the methodology and data used. In Section 5, the main results are explained, and Section 6 concludes and provides some further discussions. Main references are listed in Section 7, and appendices is the last section.

2. Literature review

2.1 Fiscal sustainability – literature review and empirical evidence

The development of the concept of fiscal sustainability was linked to the development of the state's role in economic activity according to the various schools of economic thought. The supporters of the classical school, the most famous of whom were Adam Smith, Malthus, Ricardo, John Stuart Mill and Say, supported the principle of the rule of economic freedom based on the vision presented by Adam Smith through what is known as the "Invisible Hand" which corrects and automatically restores the economy to full employment without the need for the state to interfere in economic activity. The classic economists limited the role of the state in executing some functions, such as external defense, internal security and justice, and providing some basic services that the private sector is unable to perform. Consequently, the state's economic role has diminished internally, due to its functions at the external level (Denis, 2005).

While the Keynesians supported the state's intervention in economic activity, especially after the Great Depression in 1929. The failure of the classical theory to confront the problems of strong economies – especially the global recession of 1929 – led to the emergence of a set of economic ideas that criticized the ideas of the classic economists and supported the state's intervention to confront the crisis by increasing government spending in order to eliminate unemployment and return to the level of full employment again, hence interest in the term fiscal sustainability began, especially after the increase in government debt resulting from the expansionary fiscal policy adopted by the state to counter the recession crisis. In this context, Keynes defined fiscal sustainability as "government debt burdens not exceeding the ability of taxpayers" (Gunter, 2003).

Concerning empirical literature on developing countries Jha and Sharma (2004) presented an assessment of fiscal sustainability in India using DA approach that relies on unit root tests and co-integration between government revenues and expenditures. The study found first-degree co-integration between revenues and expenditures time series and consequently, fiscal sustainability is achieved in India. Narayana (2014) assessed fiscal sustainability in India using GA during the period from 2005 to 2100, and he concluded that the current fiscal policies of India are not sustainable.

In a similar study applied on Vietnam Hoai *et al.* (2015) concluded that the stability of public debt in Vietnam during the period 1990–2013 was not stationary, which means that fiscal sustainability in Vietnam during that period was not achieved.

In addition, Amankwah *et al.* (2018) assessed fiscal sustainability in Ghana during the period 1990–2016, and they concluded that debt rates are sustainable in Ghana, and that government revenue and expenditures are co-integrated.

2.2 Fiscal sustainability in Egypt

Before presenting previous papers that addressed fiscal sustainability in Egypt, the paper first elaborates briefly the relation between budget deficit and government debt during 1990/1991–2017/2018.

Egypt has witnessed unprecedented ratios of budget deficit to GDP that reached 20% in 1990/1991 before concluding its Economic Reform and Structural Adjustment Program (ERSAP) with IMF, then it decreased to reach 1.3% in 1994/1995 due to implementing prudent fiscal policies that targeted rationalizing government spending.

It is noteworthy that high ratio of budget deficit to GDP was synchronized with high government debt/GDP ratio in 1990/1991 that was around 86.3%, then it became 67.2% in 1994/1995. In addition, the ratio of budget deficit to GDP continued rising from 2.9% in 1998/1999 to 9.3% in 2004/2005 due to increase in government spending especially on consumption not investment. Obviously, this accompanied by an immediate increase in government debt/GDP ratio to reach 95% in 2004/2005 due to excessive issuance of treasury bonds and treasury bills to finance budget deficit (MoF, 2007).

Then during the global financial crisis-the budget deficit ratio to GDP exhibited 8% 2008/2009 and debt/GDP ratio became 67% in 2008/2009. Then, Egypt witnessed January 25 revolution that affected negatively on budget figures. During 2010/2011, budget deficit reached 9.8% of GDP and debt/GDP ratio was 70% (Ministry of Planning, Monitoring and Administrative Reform, 2011).

Debt/GDP ratio became around 90% in 2015/2016 which was before implementing the economic reform program with IMF in November 2016. This program has a fruitful effects on improving budget deficit and debt/GDP ratio in Egypt till 2019 as budget deficit/GDP decreased from 12.2% in 2015/2016 to 7.2% in 2019/2020 and debt/GDP ratio also decreased from 108% in 2016/2017 to 89.2% in 2019/2020 [3].

But concerning fiscal sustainability in Egypt, there are number of papers that tackled issue of fiscal sustainability in Egypt, noting that all of them emphasized on assessing fiscal sustainability in Egypt using the traditional approach (DA) only.

For instance Izquierdo and Panizza (2004) tackled fiscal sustainability term and its indicators of measurement, focusing on the economies of emerging countries. It tested the sustainability of public debt in Egypt throughout 1990–2004 using primary deficit indicator, and they found that the debt structure in Egypt is stable during the study period. But Alba *et al.* (2004) analyzed the main fiscal variables responsible for increasing public debt to determine whether this debt is caused by structural or cyclical factors using a simulation to (Debt/Output) trajectory. The study concluded four main results: first, the high rate of debt/output in Egypt compared to a sample of low-middle-income countries; second, this debt explains structural, not periodic, considerations; third, structural weaknesses in the budget are linked to lower tax revenues and increased spending on wages and subsidies; fourth, the simulation performed recommended the importance of a fiscal adjustment to reduce the increase in debt and achieve fiscal sustainability. In addition Kia (2005) addressed the concepts of fiscal sustainability and assessed sustainability in Iran, Turkey and Egypt during 1975Q1–2002Q4, and Johansen co-integration test was performed. The study concluded that there is co-integration relationship between government revenues and expenditures in Egypt.

Abdel Latif and Shehata (2006) presented the historical development of fiscal sustainability in Egypt, in addition to analyzing the fiscal statement of the general budget from 1978 to 2004, and tested stationarity of debt-to-output ratio, and the primary deficit

indicator. The study concluded that the fiscal situation in Egypt during the study period can be characterized by instability as the indicators of fiscal sustainability assessment are only indicative and not ruling in deciding whether or not fiscal sustainability is achieved.

Albedwehy (2008) applied deficit accounts approach to assess fiscal sustainability in Egypt. The results showed that there is co-integration between public revenues and expenditures, as well as the first series of differences for the variable ratio of debt to output was stationary after performing ADF test, so the study concluded that the fiscal policy in Egypt is sustainable. Also El Mahdy and Torayeh (2009) discussed the sustainability of debt and economic growth in Egypt, and used the primary deficit indicator to test the sustainability of the debt, and the results of the study showed that during the period 2000–2006, the domestic debt was characterized by sustainability. The results suggested that debt in Egypt was sustainable during the study period. Also, it asserted that substantial fiscal reforms are needed to keep debt sustained in future and policies should be adopted to maintain an increasing growth-interest rate differential.

In a word, most of previous studies in Egypt showed that fiscal policy is sustainable when they applied deficit accounts approach.

2.3 Deficit accounts and generational accounts: empirical studies

There are endless empirical studies in implementing DA and GA [4]. In this context, this part will address case studies of some pioneering countries that reached different conclusions when applied DA and GA approaches such as UK and Belgium. In addition, it will tackle case studies of other countries that reached same conclusion when applied DA and GA approaches such as Germany and Italy, noting that choosing such countries could be justified by availability of studies that applied DA and GA in each one of them and also to have a look on different economies in Europe to take some lessons in Egyptian case [5].

While applying DA and GA in the UK, it gives different conclusion as Fan and Arghyrou (2013) applied DA in the UK for the period 1955–2006 and concluded that UK fiscal policy has been sustainable throughout the study period. Cardarelli *et al.* (2000) concluded that existing fiscal policy is generationally imbalanced and unsustainable.

The same happened in Belgium as the two approaches gave different conclusions as Afonso and Rault (2009) assessed fiscal sustainability for a panel of 15 EU countries including Belgium for the period 1970–2006 using DA, and concluded that fiscal policy was sustainable both for the EU-15 panel set, and within subperiods 1970–1991 and 1992–2006. But Decoster *et al.* (2014) assessed the sustainability of fiscal policy in Belgium using GA and concluded that ongoing fiscal policy, taking the demographic change into consideration, violates the IGBC, and hence is unsustainable. Belgium faces a long-term structural deficit of 11.5% of future GDP mainly because of aging and increase in expenditures on the elderly.

Moreover, in Germany, performing GA and DA approaches gave the same results; Greiner and Semmler (1999) used annual data from 1955 to 1994, and the results indicated that the IGBC for Germany was not met and fiscal sustainability did not occur. Also Kotlikoff and Raffelhüschen (1999) applied GA approach in 22 countries [6] including Germany and found that the United States, Germany and Japan have severe generational imbalances, which impose burden on future generations.

In addition, both approaches provided the same conclusion in Italy as Bravo and Silvestre (2002) tested for sustainability during 1960–2000 by performing an empirical analysis of co-integration between public expenditures and revenues (as ratios of GDP), pointing to unsustainable fiscal policy in Italy; Sartor *et al.* (1999) assessed the sustainability of fiscal policy in Italy using GA (1995 as a base year) and found that fiscal policy was far from generational equity in 1995. It showed also, if current tax and expenditure programs remain unchanged, the difference in the percentage of net tax payments between current and future

generations is 224%, which will be reduced if the 1995 Pension Reform Act is taken into account.

To sum up, applying DA to assess fiscal sustainability in the aforementioned countries did not illustrate the whole aspects of fiscal sustainability, rather GA complemented the other phases of fiscal sustainability in terms of comparing net tax payments between current and future generations. For Egyptian case, the concerned authorities such as Ministry of Finance (MoF) and other statistical agencies should focus on assessing fiscal sustainability not only by DA abut also by GA to capture the whole pillars of fiscal sustainability especially that, Egypt suffers from high dependency ratio [7] as it increased from 59.6% in 2010 to 64% in 2018 according to World Bank data [8].

3. Conceptual framework of generational accounts

In the early 1990s, Auerbach *et al.* (1991) introduced a new technique to assess the sustainability of fiscal policy, GA, which aims to measure the distributional effects of current fiscal policy on current and future generations [9], and also to test the sustainability of fiscal policy in USA GA approach shows the PV of the net taxes expected to be incurred by current and future generations.

GA approach is a relatively recent methodology for long-term fiscal analysis and planning. It provides answers to a number of critical questions such as how large a fiscal burden does existing policy imply for future generations. GA also tests if fiscal policy is sustainable without critical cutbacks in government purchases. GA provides alternative policies that would suffice to produce generational balance, a situation in which future generations face the same fiscal burden as do current generations when adjusted for growth (Kotlikoff and Raffelhüschen, 1999). Accordingly, it measures the fiscal burden inherited by current generations to future generations, and also it investigates if the fiscal policy can be sustained without depriving current and future generations of social transfers or without cutting government spending. In addition, GA helps suggesting alternative policies that should be enforced to achieve fiscal balance between generations; that is, to equate fiscal burdens on both current and future generations.

GA approach aims to balance between the benefits that current generations receive from government spending and the costs they incur in return for those benefits, compared to the benefits and fiscal burdens that future generations will bear given persistence of current fiscal policies. Consequently, continuing high deficit of the state budget, this deficit becomes a burden on future generations when serving or repaying the public debt resulting from this deficit, in the form of imposing higher tax rates on future generations in return for expenditures and services provided to current generations. GA has been applied in many developed countries such as France, the United States, Italy and others, but most have also failed to achieve fiscal sustainability, as the net tax burden imposed on current generations is not equal to what imposed on future generations (Gokhale *et al.*, 1999; Auerbach *et al.*, 1991).

This methodology of applying GA starts from satisfying IGBC. This constraint, written in equation (1), requires the existing net wealth plus the PV of current and future generations' net tax payments to be sufficient to cover the government's future consumption (Auerbach *et al.*, 1991). IGBC can be formulated as follows:

$$\text{PV Of Net Tax Payments of Current Generations(A)} + \text{PV of Net Tax Payments of Future Generations(B)} = \text{PV Of Governments Future Consumption(C)} + \text{Gov. Net Wealth(D)}$$

Or:

$$\sum_{s=0}^{L} N_{t,t-s} + \sum_{s=1}^{\infty} N_{t,t+s} = \sum_{s=t}^{\infty} G_s (1+r)^{-(s-t)} + W_t \quad (1)$$

where

Nt, t−s: PV of the remaining net taxes for the current generation born in year *t−s;*

Nt, t + s: PV of the net taxes for the future generation born in year *t + s;*

L: Age ceiling;

Gs: Government consumption;

Wt: Net wealth of government at time *t*;

r: The discount rate, which used to compute the PV of future consumption, income, transfers and taxes.

The notion of "discounting to the PV" is incorporated in the following way:

$$N_{t,k} = \sum_{s=\max(t,k)}^{K+L} T_{s,k}\, P_{s,k} (1+r)^{-(s-t)} \quad (2)$$

$$T_{s,k} = \sum_{n} \tau_{s,k,n} \quad (3)$$

$$\tau_{s,k,n} = (1+g)^{s-t}\ \tau_{t,t-(s-k),n} \quad (4)$$

$$GA_{t,k} = \frac{N_{t,k}}{P_{t,k}} \quad (5)$$

It is noteworthy that Auerbach *et al.* (1991) constructed their model assuming that discount rate, economic growth and fiscal policy remain fixed throughout the model. The IGBC is used to compute GA that measure the distributional effects of current fiscal policy between present and future generations. GA refers to the current discounted value of the net tax expected to be paid by each individual of each generation, and therefore GA is not the current generations pay taxes but also include what will be borne by future generations. IGBC is used to describe the distributional impacts of current and future generations of the ongoing fiscal policy. From IGBC, it is clear that the government must finance its expenditures either through its own assets or through tax revenues from current and upcoming generations.

Applying GA indicates the PV of net taxes those current and future generations expected to disburse to the government now and in the future. These accounts could be interpreted in the context of IGBC. This constraint stipulates that GAs of all existing and future generations added to current net wealth of government should be enough to finance the PV of current and future government consumption.

Thus, net public debt *Dt* plus the PV of all net government purchases *Gt,y* have to be financed by the PV of the lifetime net taxes *Nt,k* paid by both existing and future generations. IGBC is shown in equation (1)

The net taxes that future generations have to pay $\sum_{s=1}^{\infty} N_{t,t+s}$ could be computed as a residual. Equation (1) could be rewritten as:

$$\sum_{s=1}^{\infty} N_{t,t+s} = \sum_{s=t}^{\infty} G_s (1+r)^{-(s-t)} + W_t - \sum_{s=0}^{L} N_{t,t-s}$$

But, GA approach suffers from number if critiques (Rhodes and Williamson, 2011), for example, there is some sort of ambiguity around choosing the right discount rate in excuting GA approach (Haveman, 1994). Another important critique is the deficiency of GA to embody the expected returns of government expenses on fields such as infrastructure and research, i.e. it is quite difficult to quantify the return of public spending on scientific research. Often the return on such spending cannot be evident immediately, but it needs a long time subsequent to spending on research. Therefore, it is not an easy process to allocate gains from spending on similar projects on specified generation – which for whom – in the years before and after the spending during the chosen year. But if this type of expenses is to be incorporated, as it ought to be, there must also be an effort to quantify benefits received by different generations (Helliwell, 1998). Also, not all government expenditures have been considered into GA models such as government regulations that include expenses on protecting the environment and reducing the level of environmental degradation (CBO, 1995).

Due to the above mentioned obstacles that hinder implementation of GA solely, it could be applied in combination with DA approach (Cutler, 1993; Haveman, 1994).

4. Methodology and data

This paper assesses fiscal sustainability in Egypt using DA approach during the period 1990/1991–2017/2018 and tries to investigate the possibility of applying GA approach in Egypt.

4.1 DA

The DA approach applied in this paper seeks to describe and analyze the previous fiscal situation in Egypt and includes mathematical methods for assessing fiscal sustainability, such as primary deficit indicator and the tax gap indicator, in addition to time series tests that include augmented Dickey-Fuller stationarity test for debt/GDP ratio, and Johansen co-integration test between government revenues and expenditures. However, executing GA approach in Egypt is almost impossible at least for the time being because of deficiencies of data sets that are crucial in calculating GA.

Primary deficit indicator shows that fiscal sustainability is occurred while maintaining a ratio of an initial surplus of budget to GDP to ensure the stabilization of debt/GDP ratio (Izquierdo and Panizza, 2004). This indicator depends on calculating the value of the primary deficit (+) or the primary surplus (−) of the public budget, through getting the difference between the primary expenditures and the primary revenues. The data sources of this indicator are previous issues of financial statements for different years that are published on annual basis from MoF. Then the primary deficit/GDP ratio was obtained.

Tax gap indicator indicates the need to reduce the difference between the target (tax revenues/GDP) rate – that achieves fiscal sustainability – and the actual (tax revenues/GDP), and the target (tax revenues/GDP) rate (t^*) is given by the following equation (Blanchard, 1990):

$$t^*PE + (r - g)\ d$$

where

t^*: the target tax rate of GDP that ensures fiscal sustainability

PE: ratio of primary expenditures to GDP

r: the real interest rate

g: real GDP growth rate

d: ratio of domestic debt to GDP

Calculating this indicator based on data from MoF [10], while data on real interest rate is obtained from the World Bank website, whereas the data of both the real growth rate and the GDP at factor cost were obtained from the follow-up reports on the economic and social performance issued by the Ministry of Planning, Follow-up and Administrative Reform.

Regarding augmented Dickey–Fuller for stationarity test for debt/GDP ratio time series [11], its methodology can be stated as follows:

H0. Suggests the time series has a unit root, meaning that it is non-stationary.

H1. Suggests the time series does not have a unit root, meaning it is stationary.

Accordingly, to take decision, we depend on p-value. If p-value > 0.05, then we do not reject the null hypothesis (H0), and the data is non-stationary. But if p-value ≤ 0.05, we reject the null hypothesis (H0), the data is stationary.

This test is based on the fact that the variable is AR (1) and can be expressed in the form (Dickey and Fuller, 1981)

$$Y_t = \rho\ y\ \ (t-1) + \varepsilon$$

For this variable to be static, the absolute value of the parameter $|\rho|$ must be less than 1 and if $|\rho| = 1$ the variable is not static, so the hypothesis of ADF test can be formulated as follows:

$$H0:\ \ \rho = 1$$

$$H1:\ \ \rho = 1$$

The rejection of null hypothesis indicates that the time series for debt/GDP ratio is stationary and thus means fiscal sustainability is achieved, but in the case of non-rejection of H0, this means no fiscal sustainability.

However, Johansen co-integration test between government revenues and expenditures depends on the following equation (Johansen, 1991):

$$Rev_t = \ \rho_1 + \ \rho_2\ Exp_t + \varepsilon_t$$

This test used to assess fiscal sustainability according to the association between government revenues and expenditures. If $\rho_2 = 1$, this means the occurrence of fiscal sustainability, i.e. there is a perfect association between government revenues and expenditures, but if $\rho_2 < 1$, this means there is weak fiscal sustainability, i.e. there is weak association between government revenues and expenditures.

4.2 GA

On the other hand, GA has its own unique methodology that was first developed by Auerbach *et al.* (1991). Briefly, its methodology depends on meeting IGBC as a necessary condition to compute GA for current and future generations. To meet this condition, previous empirical literature in many countries all over the world predicted the average values of different types of taxes and transfer payments by sex and age that begins with government estimations of total amounts of each tax type and transfer payment in coming years. These total amounts are then distributed by age and sex based on cross-sectional relative age-tax and age-transfer profiles derived from micro-data sets.

Unfortunately, in Egypt, it is almost unattainable to get micro-data sets about tax and transfers profiles for different age groups. That's why, this paper followed a parallel methodology that is based on conducting a field study that depended on personal interview form directed to 51 academic and executive economic experts to explore their views on the extent to which Egypt could apply GA to assess fiscal sustainability. The interview form

used to carry out the field study seeks to know if it is possible to estimate the future net tax burden on future generations given that the current fiscal policy in Egypt will not change. The form questions are tackling six issues [12]. The paper used a personal interview form. It was designed specifically for those executives and academics as a survey tool using a random sample method to ensure that the results are not biased, the sample size was (51) of academic and executive economic experts. The field study was carried out during the period July 2019–October 2019.

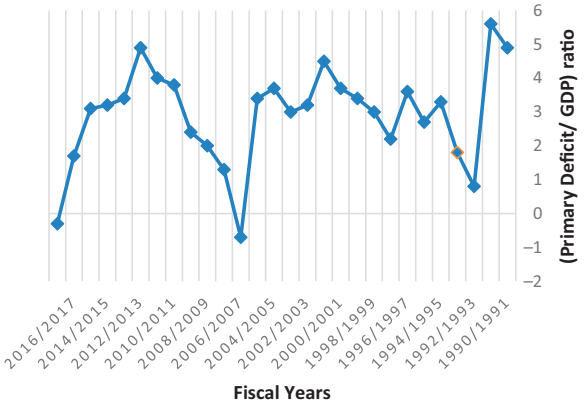
5. Results

5.1 Empirical results of mathematical methods for assessing fiscal sustainability in Egypt

According to primary deficit (or Surplus) indicator, the ratio of the primary deficit to the gross domestic product continues to decrease from 1990/1991 till 2017/2018, as it was about 4.9% in 1990/1991 then it decreased to 0.8% in 1992/1993, and turned into a primary surplus in 2006/2007 with a ratio of −0.7% (see Figure 1).

This improvement in primary deficit/GDP ratio in Egypt in FY 2006/2007 could be attributed to the implementation of a number of precautionary fiscal policies by the state. Public revenues have increased at a rate of about 16%, while public expenditures have increased at an annual growth rate of about 13%, due to collection of some exceptional revenue from the sale of state-owned assets, the most important of which is the proceeds from the sale of the third license for mobile phone services at that time. Therefore, a primary surplus was achieved for the second time at the end of the fiscal year 2017/2018, as it reached −0.3%, due to the implementation of the Economic Reform Program in Egypt that was concluded with the International Monetary Fund in November 2016, meaning that fiscal policy is sustainable in Egypt during 1990/1991–2017/2018.

Also, according to tax gap indicator, the percentage of targeted (taxes/GDP) rate (t^*) always exceeds the percentage of actual taxes that are collected annually (t), along the period from 1990/1991 to 2016/2017, while the gap between the target taxes and actual taxes decreased from 10.8% in the 2012/2013 fiscal year, to 0.97% in the last fiscal year 2017/2018, due to the increase in the absolute value of public revenues as a result of the reform measures implemented by the Egyptian government during 2016 (see Figure 2), where the value-added tax law was passed in September 2016 to replace sales tax, and a tax dispute resolution law



Source(s): Authors' calculations based on time series data from different issues of yearly financial statement from MoF

Figure 1.
Evolution of primary deficit/GDP ratio in Egypt during FY 1990/1991–2017/2018

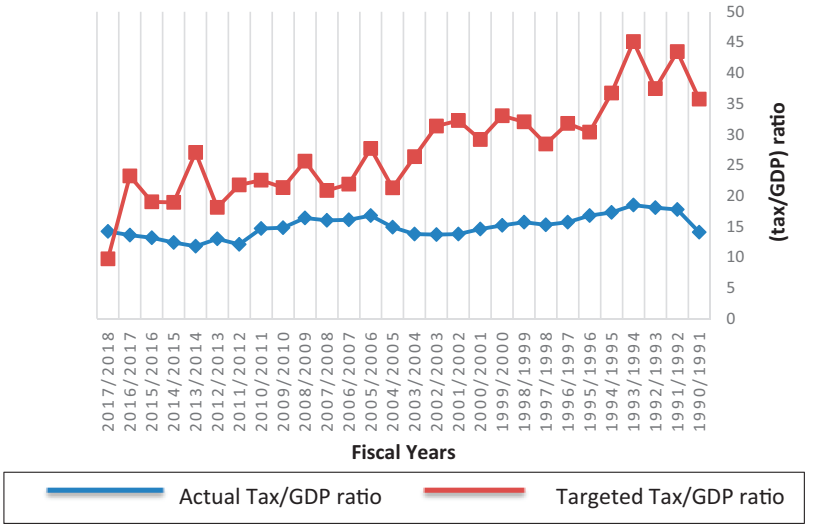


Figure 2.
Evolution of tax gap indicator in Egypt during FY 1990/1991–2017/2018

Source(s): Authors' calculations based on time series data from different issues of yearly financial statement from MoF

was passed in August 2016 to enhance confidence among investors and the authority of public taxes, and to encourage the informal sector to join the formal sector (Ministry of Finance, 2017). According to tax gap indicator, fiscal policy seems to exhibit sustainability in Egypt during 1990/1991–2017/2018.

5.2 Empirical results of time series tests for assessing fiscal sustainability in Egypt

The stationarity test of the variable domestic debt. . . indicates that. . . test of the variable domestic debt/GDP ratio in Egypt from the fiscal year (1990/1991) to the fiscal year (2017/2018) indicate that the time series of this variable is not significant at 5%, which means that fiscal sustainability is not achieved. However, after running the same test for the second differences of domestic debt/GDP ratio during the period from the fiscal year 1990/1991 to the fiscal year 2017/2018, it reveals that it is significant at 5% level of significance, which is sufficient – not necessary – condition to ensure fiscal sustainability [13].

The results of Johansen co-integration test between government revenues and expenditures (after taking the first differences of the logarithm of the time series for each) during the period from the fiscal year 1990/1991 to the fiscal year 2017/2018 show that the null hypothesis of no co-integration is not accepted. This can be expressed as follows:

$$\Delta\ (Log\ Rev.) = -0.14 + 0.8\ \Delta\ (Log\ Exp.) + \varepsilon_t$$

The previous equation indicates that there is a positive relationship between government revenues and expenditures, as the expenditure coefficient ($\rho_2 = 0.8$) is approaching unity, and therefore the fiscal sustainability is achieved in Egypt [14].

In brief, all previous indicators and tests of assessing fiscal sustainability in Egypt during 1990/1991–2017/2018 using DA approach emphasized on the occurrence of fiscal sustainability in Egypt during the study period.

The main results of the field study form revealed that GA approach is not currently applied in Egypt as there are several obstacles that hinder applying of GA approach in assessing the fiscal sustainability in Egypt, including technical, legal and institutional limitations, in addition to demographic structure. Technical limitations include lack of data, obstacles related to competencies and the human element, i.e. lack of the know-how, and stakeholders' knowledge of the databases needed to apply GA in Egypt is low. Also, technical limitations include many assumptions to apply GA such as fixing the interest rate, the growth rate, using a base year throughout the application period, and the necessity to satisfy the government budget constraint. All of them are considered as constraints confronting applying GA in Egypt. Therefore, results of applying GA approach becomes vulnerable to any change in the model hypotheses. Also, data about net current government wealth in Egypt is considered one of technical limitations related to application of GA in Egypt. Although net current government wealth in Egypt is computed, the methods used to compute the current net government wealth are not accurate enough, which is a major element in IGBC in order to compute GA for current and future generations in Egypt.

Legal and institutional obstacles exist in the context of lack of coordination among Ministry of Planning, CAPMAS, the International Monetary Fund (IMF) and the World Bank, which are considered the most important partners expected to cooperate with the MoF in applying GA to assess fiscal sustainability in Egypt. In addition, there is sort of deficiency regarding coordination between MoF and the Central Agency for Public Mobilization and Statistics (CAPMAS) on data, information and statistics on taxes and social transfers on an ongoing basis. Also, there is no clear cooperation theme between the MoF and other relevant government institutions, regarding organizing several joint committees with the Ministry of Planning, the Ministry of Local Development and the National Investment Bank regarding the fiscal sustainability reports in Egypt and their consistency with Egypt's Vision 2030 for sustainable development.

In addition, MoF does not have a clear strategy to fulfill requirements needed to apply GA in Egypt. For instance, MoF does not have databases of taxpayers of all kinds (income, value added, real estate tax, corporate profits) according to age groups. Also, MoF and CAPMAS do not have a transparent plan to build databases on (social transfers, pensions, unemployment benefits and health care) received by the individual according to age groups. In addition, MoF does not announce explicitly whether it forecasts the future fiscal situation in Egypt by any other methods.

It is noteworthy to affirm the remarkable effect of the current demographic structure in Egypt on applying GA approach because Egypt suffers from high dependency ratio that reached 64% in 2018 (World Bank data, 2019), and this means increase in ongoing government expenditures on healthcare provided to children and the elders and also expansion on paying pensions to the elders which will inevitably imposes extra burden on next generations.

6. Conclusion

This paper investigates a comparative analysis between deficit accounts (DA) and generational accounts (GA) as two supplementary approaches of fiscal sustainability assessment in Egypt during the period 1990/1991–2017/2018, using the new data set on deficit accounts measures.

Implementing DA indicators – that is widely used – to assess fiscal sustainability in Egypt reveals that the fiscal policy in Egypt exhibits sustainability during 1990/1991–2017/2018.

Concerning minimizing the tax gap in Egypt, it is also noteworthy to affirm the role of MoF to set and apply strict measures to prevent tax evasion from tax payers. Also, this paper recommends that the MoF should include the informal sector in the formal sector through activating the electronic tax invoice in order to broaden the tax base.

However, applying GA in Egypt is inapplicable with many theoretical and empirical limitations that hinder execution of this approach, including technical, legal and institutional limitations, in addition to demographic structure.

The main policy implications of the empirical results of this paper suggest a stronger focus on promoting the existing data sets and creating new micro-data sets about tax and transfers profiles for different age groups in order to measure the distributional effects of current fiscal policy on current and future generations in Egypt. In particular, there is a critical role for different institutions such as CAPMAS and MoF to coordinate properly the prerequisite data for GA calculation in Egypt as this approach is well known and well applied in many countries worldwide, especially that there are a lot of advantages if Egypt applied GA approach because it is relatively a new approach used to assess fiscal sustainability compared to deficit accounts. GA, if applied in Egypt, will provide a realistic indication of the distributional effects of Egypt's current fiscal policy in terms of distribution of the net tax burden on current and future generations to assess the sustainability of the fiscal policy in Egypt. Also, GA approach outweighs the DA approach in representing the real distributional welfare effect of current fiscal policy. In case of applying GA in Egypt, alternative fiscal policies should be implemented to treat drawbacks of the conventional approach. In addition, the GA approach includes environmental considerations in order to achieve intergenerational justice in a more comprehensive sense than tax distribution justice.

Notes

1. Fiscal year in Egypt starts from 1st July each year till 30th June in the following year.
2. Traditional deficit accounts include primary deficit indicator, tax gap indicator (Blanchard, 1990), stationarity test for debt/GDP ratio and co-integration test between revenues and expenditures (Payne, 1997).
3. http://www.mof.gov.eg/MOFGallerySource/Arabic/budget2019-2020/Financial-Statement-2019-2020.pdf
4. See also (Deeg *et al.* 2009), (Rizza and Tommasino, 2010), (Eschker, 2003), (Hagist *et al.*, 2012), (Medijainen, 2010), (Auerbach and Chun, 2006), (Takayama *et al.*, 1999) and (Güre and Haciibrahimoglu, 2013).
5. For example, Italy was chosen as a guide only for the experiences of one of the European Union countries, especially in light of the strict fiscal policies that the union applies. As the government debt to GDP ratio reached 131.2% in 2017, and the government spending ratio to GDP was 48.7% in 2017 according to the European Central Bank data. It must be noted here that there are differences between the structure of the Egyptian economy and the structure of the Italian economy, as Italy is one of the developed countries in the European Union, but it has a fundamental problem in the levels of government debt for GDP, which requires a deep study.
6. Countries are: Argentina, Australia, Austria, Belgium, Brazil, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, The Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Thailand, UK, and USA.
7. The dependency ratio relates the number of children (0–14 years old) and older persons (65 years or over) to the working-age population (15–64 years old). https://www.un.org/esa/sustdev/natlinfo/indicators/methodology_sheets/demographics/dependency_ratio.pdf
8. https://data.worldbank.org/indicator/SP.POP.DPND?locations=EG
9. Generational Accounts can provide explicit analysis of the impact of fiscal policy on the welfare of different generations. In other words, this approach represents a mix between welfare economics and fiscal policies (Dore and Levy, 1998).
10. Data from MoF includes the ratio of domestic debt to GDP, general expenditures, and interest payments.

11. The authors used E-views Statistical Package to apply ADF Test.
12. For more details about the content of questions in the designed form and affiliation of the interviewees, see Appendix 3.
13. See Appendix 2, Table A1.
14. See Appendix 2, Table A2.

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Appendices

Appendix. 1

Steps to compute GA

The Government Inter-temporal Budget Constraint:

$$\sum_{s=0}^{L} N_{t,t-s} + \sum_{s=1}^{\infty} N_{t,t+s} = \sum_{s=t}^{\infty} G_s \, (1+r)^{-(s-t)} + W_t \tag{A1}$$

All terms of the equation can be computed with existing figures except the amount of net tax burden left for future generations.

It could be obtained after executing needed estimations and forecasts and then discounting.

$\sum_{s=0}^{L} N_{t,t-s}$ represents the PV of the remaining net tax burden (all taxes paid less transfer received) of the existing generations.

A person born in the base year is written as *Nt,t* and is assumed to live a life time of. $L-s\,(=0)=L$ years, while a person born in year $t-L-1$ will bear a net tax burden of just one year. GAs of all age groups will be summed up until the last member of the current generation dies.

$\sum_{s=1}^{\infty} N_{t,t+s}$, represents the PV of the net tax payments of future generations. The term begins with the first future generation after the base year and totals the net tax burdens until infinity.

$\sum_{s=t}^{\infty} G_s\,(1+r)^{-(s-t)}$ represents the present value of government consumption and W_t indicates net wealth of government.

Null Hypothesis: there is fiscal equity between current and future generations.
(Fiscal Sustainability occurred)

Alternative Hypothesis: there is no fiscal equity between current and future generations (No Fiscal Sustainability)

Mathematically;

$$\text{Ho:}\quad \theta = 1$$

$$\text{Ha:}\quad \theta \neq 1$$

Where:

$$\frac{GA_{t+1,t+1}}{GA_{t,t}\;(1+g)} = \theta$$

Where the numerator expresses the PV of the net tax payments to future generations, while the denominator expresses the PV of the net tax payments to present generations. If it is $\theta > 1$, this means that justice will not be achieved between generations, and that future generations will bear a greater tax burden than the current generations.

If $\theta = 1$, this means fairness between generations, and that future generations will bear the same tax burden that current generations pay.

Whereas if $\theta < 1$, this means that this means that there is no justice between generations, and that future generations will bear a lower tax burden than the current generations.

$$\boldsymbol{N_{t,k}} = \sum_{\boldsymbol{s=\max\,(t,k)}}^{\boldsymbol{K+L}} \boldsymbol{T_{s,k}}\;\boldsymbol{P_{s,k}}\,(1+\boldsymbol{r})^{-(\boldsymbol{s-t})} \tag{A2}$$

$$\boldsymbol{T_{s,k}} = \sum_{\boldsymbol{n}} \boldsymbol{\tau_{s,k,n}} \tag{A3}$$

$$\boldsymbol{\tau_{s,k,n}} = (1+\boldsymbol{g})^{\boldsymbol{s-t}}\;\boldsymbol{\tau_{t,t-(s-k),n}} \tag{A4}$$

$$\boldsymbol{GA_{t,k}} = \frac{\boldsymbol{N_{t,k}}}{\boldsymbol{P_{t,k}}} \tag{A5}$$

Appendix 2

Augmented Dickey-Fuller Unit Root Test on D(DEBT_RATIO,2)

Null Hypothesis: D(DEBT_RATIO, 2) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag = 6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		−5.639038	0.0001
Test critical values:	1% level	−3.724070	
	5% level	−2.986225	
	10% level	−2.632604	

*MacKinnon (1996) one-sided p-values.

Table A1.
ADF Unit root test

Johansen Cointegration Test

Date: 11/27/19 Time: 14:19
Sample (adjusted): 1992 2017
Included observations: 26 after adjustments
Trend assumption: Linear deterministic trend
Series: LOG_EXP LOG_REV
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.366875	17.33135	15.49471	0.0262
At most 1 *	0.189013	5.447071	3.841466	0.0196

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) *p*-values

Table A2.
Johansen co-integration test

Appendix 3

Question number	Target
First question	Deals with the extent to which Egypt can apply generational calculations in light of similar international experiences
Second question	Investigate the various obstacles that prevent the application of generational accounts in Egypt
Third question	Tries to outline the path of fiscal sustainability in Egypt
Fourth question	Examines the expected gains from applying generational accounts rather than applying traditional deficit accounts in Egypt
Fifth question	Deals with current approaches used to assess fiscal sustainability in Egypt
Sixth question	Attempts to know the perception of Egyptian executives and academic experts on generational accounts approach

Table A3.
Main Questions in the designed form of the field study

The study community consists of academic experts in universities, institutes and research centers, in addition to a number of executive experts from the top administrative leaders in the ministries concerned with the application of GA in Egypt. The interviewees are from Faculty of Economics and Political Science at Cairo University, Institute of National Planning, in addition to experts from Ezz Steel Group, Central Agency for Public Mobilization and Statistics, Ministry of Finance, and Ministry of Planning, Monitoring and Administrative Reform.

Corresponding author
Ola Al Sayed can be contacted at: olaalsayed@feps.edu.eg