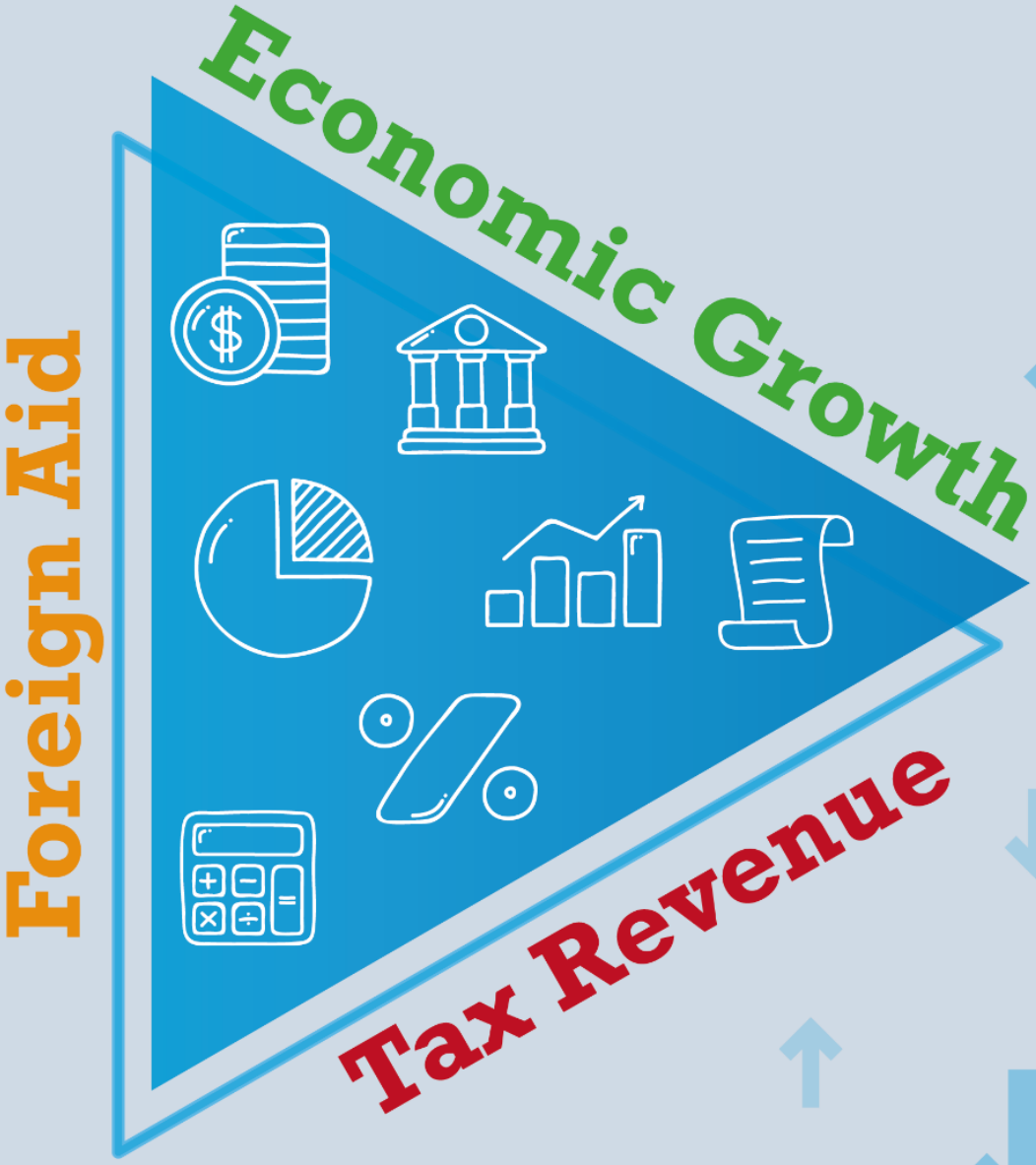

The Interplay Between Economic Growth, Tax Revenues, and Foreign Aid

November 2017

منتدى الاستراتيجيات الأردني
JORDAN STRATEGY FORUM

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The Jordan Strategy Forum (JSF) is a not-for-profit organization, which represents a group of Jordanian private sector companies that are active in corporate and social responsibility (CSR) and in promoting Jordan's economic growth. JSF's members are active private sector institutions, who demonstrate a genuine will to be part of a dialogue on economic and social issues that concern Jordanian citizens. The Jordan Strategy Forum promotes a strong Jordanian private sector that is profitable, employs Jordanians, pays taxes and supports comprehensive economic growth in Jordan.

The JSF also offers a rare opportunity and space for the private sector to have evidence-based debate with the public sector and decision-makers with the aim to increase awareness, strengthening the future of the Jordanian economy and applying best practices.

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Executive Summary

Public finance is about the revenue and expenditure sides of the government, and the impact of these activities on the well-being of society. Public finance deals with tax revenues, spending programs, budget procedures, macroeconomic stabilization policy and procedures, and public debt management.

The subject matter of public finance in Jordan must remain, for several reasons, at the top of the agenda by the government.

1. Since 1965, no government has experienced a surplus in its budget.

2. During the period 1965-2016, the budget deficit (without aid) to GDP ratio was greater than 20% in thirteen years, 10% - 19.9% in 20 years, 6% -9.9% in 14 years, and 4% - 5.9% in 5 years.

3. What reduces the budget deficit, without seeking foreign aid, is:
   - Reduction in public spending with its impact (negative) on economic growth
   - Increase in public revenues from either tax or non-tax sources.

   When these two options are not available, the government seeks to reduce the deficit by relying more on foreign aid from international sources, or local debt with high interest rates or through the issuance of bonds.

4. The existing tax revenue to GDP ratio in Jordan (around 15%) is lower than in many emerging and advanced economies including Turkey (22%), Greece (26%), Denmark (47%), and the OECD countries (26%)!

5. More tax revenues promote economic growth especially if spent on public services (education, health, and transport) and efficiently on infrastructure.

6. Jordan has been receiving large capital inflows in the form of grants and concessional loans (Overseas Development Aid / ODA). In actual fact, the World Bank database indicates that during the period 1965 – 2015, Jordan received the largest per capita ODA in the world ($9,158).

7. The interplays between tax revenue, foreign aid, and economic growth are interesting, and if Jordan wants to graduate from the consistent budget deficits, and the resultant growing debt, the government must understand and appreciate these interplays.

Due to their importance, this Jordan Strategy Forum paper examines the interplay between tax revenue, foreign aid, and economic growth, by explaining how each is affected by the other two. Within this context, we must not forget that the overall objective is to realize economic growth, and not to receive more foreign aid or debt. The objective must be to increase tax revenue and seek greater foreign assistance that promote strong economic growth sufficient enough to provide the government with the necessary resources, taxes and other, to play a more active role in improving the well-being of the Jordanian citizen.

First, the interplay between economic growth and tax revenue.

There is one important concept that helps in understanding this interplay and that is Tax Elasticity. Elasticity measures the responsiveness of tax revenue to changes in income (GDP). The higher this elasticity, the higher taxes are collected when the economy grows.

This JSF paper, measures tax elasticity in Jordan during the period 1983-2016 by estimating the impact of economic growth on tax revenue. The results could not be more than interesting:

Tax elasticity in Jordan is equal to +1.09 and this means that when GDP grows by 1%, tax revenue increases by 1.09%, and tax revenue to GDP ratio increases by 0.09%. The fact that tax elasticity is close to one, it is not easy for the Jordanian economy to increase its tax revenue to GDP ratio (tax effort) through economic growth. Indeed, the economy must grow by 5% annually for ten years in order to increase tax revenue to GDP ratio by 4.5% and become 20%, and this scenario is not practical for two reasons:

First, it is not an easy matter to achieve 5% annual real economic growth.

Second, even if achieved, it would take "too long" to increase the tax effort from the existing 15.5% to 20% (10 years). This has negative implications to public finance because the government's responsibilities are expected to increase during periods of strong economic growth and this implies that the government, unless it increases revenues, would have no choice but to borrow locally and internationally, and hence, increasing public debt.

Second, the interplay between tax revenue and economic growth.

No one can argue that taxes do not affect economic growth. While some argue that taxes negatively affect growth because they discourage investments, others argue that taxation is central for many aspects of the economic and institutional environment. "Tax revenues fund public infrastructure, education and schools, legal systems, and much more. Entrepreneurs and innovators often rely heavily on these public goods, and higher taxation can be growth enhancing if it supports the stronger provision of public goods because it raises the expected returns to entrepreneurial efforts" (Aghion, 2016).

In this policy paper, the JSF examined the impact of tax revenue on economic growth, and the results are encouraging. It is reported that the impact of tax revenue on real economic growth is **positive,** and this implies that when tax revenue increases, economic growth increases as a result. In addition, the results indicate that tax revenue reflects an **increasing power** in explaining the annual variability (changes) of real economic growth rates over time. However, the extent of this influence is much less than when ODA only is included in the analysis.

Third, the interplay between aid and tax revenue.

The effectiveness of aid always been a controversial issue. While some argue that aid enlarges public bureaucracies, or simply wasted, others argue that aid reduces poverty and promotes real economic growth. Also, aid has been examined in terms of its impact on the fiscal mobilization process of aid-recipient countries. "Large aid inflows not only undermine governments' tax efforts, but also create a crowding-out effect on capital expenditure. Sustained external financing fuels current expenditure and creates the "aid illusion" effect" (IMF July 2016). In other words, when capital spending (financed by aid) increases, this increase would reciprocally increase current spending as capital spending must be maintained and managed. Unless public finances are healthy, future capital and current spending would decrease and increase respectively. When public finances are weak, future capital investment would decrease for the benefit of current spending. The Dutch Disease reduces the fiscal mobilization process in countries which receive foreign aid.

In this policy paper, the Jordan Strategy Forum (JSF), examines the impact of aid on tax revenue in Jordan. Based on our analysis, the results are:

1. The impact of grants and ODA on tax revenue is negative. When aid and ODA increase, tax revenue to GDP ratio falls.
2. The impact of grants is more important in undermining the governments' tax effort.
3. Aid reflects an increasing power in explaining the annual variability of tax revenue over time. However, the extent of

this influence is much less than when we include ODA in the analysis.

Based on the findings of this JSF study, we recommend the followings:

1. Jordan must work on "increasing" tax elasticity, and based on the international evidence, this can be done by:
   - Widening the tax base.
   - Improving tax collection.
   - Diversifying tax sources.
   - Improving macroeconomic stability (inflation and annual changes in GDP).

Due to Jordanian special circumstances, and to start with the more important and higher impact, the JSF recommends that priority must be given to tax collection efficiency. This factor will widen the tax base, increase tax income, and increase tax elasticity. Within this context, that fact that the professionals and SME sector (private individuals) contribute 1.98% only towards total tax revenues, the JSF recommends that the government must adopt a new, fair and efficient system in the collection of taxes from this sector free from avoidance and evasion.

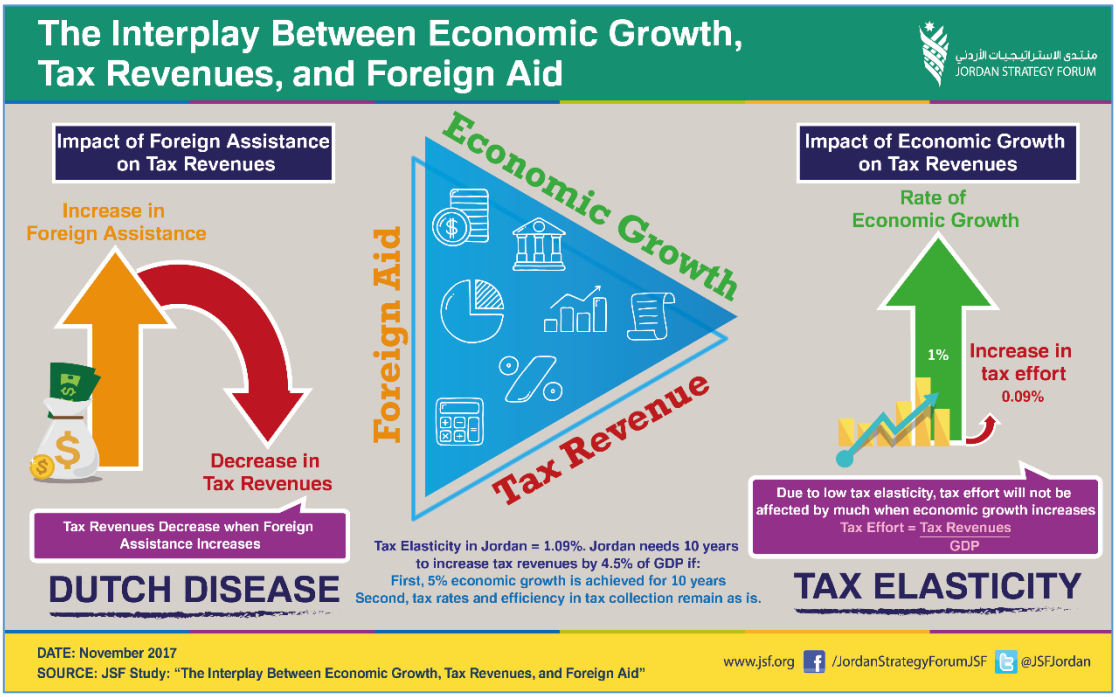
2. Jordan must seek greater levels of macroeconomic stability. In a recently published paper by the JSF (On the Challenges of the Jordanian Economy: The Need for a Fresh Look: Why and How?, 2017), it was argued that the recent performance of the Jordanian economy suffers from macroeconomic instability, and this must have decreased tax elasticity.

3. If aid undermines the tax effort, this inflow should be managed with great caution and directed towards promoting economic growth, and increasing capital spending. Aid should not be used to finance current spending.

4. The fact that higher levels of tax effort have positive implications in economic growth and budget deficit, the government must increase its efforts and ability on improving this aspect. This effort must be maintained with or without aid.

5. Greater efficiency levels in public investments is especially critical when aid is forthcoming.

6. Lastly, the JSF sees that this policy paper has a number of additional implications including an examination of the impact of not only economic growth on tax revenue, but also the impact of major changes in the tax system, in terms of rates and base on tax revenue.



1. Introduction

The intention of any tax system is to finance public spending, redistribute income, stabilize the economy, and to influence the allocation of resources. The overall objective of taxation is to promote real economic growth and development. Within this context, the size and mix of public spending also impacts growth and inequality. Unless governments function effectively, large public sector weakens growth. Also, public spending components (i.e. capital investment) matter for growth and inequality.

Relative to advanced economies, it is known that developing countries have low tax effort. Indeed, given the low tax to GDP ratios in some countries, one wonders how their governments fund public spending in general, and development plans in particular.

The fact that many of the low tax effort countries are aid-dependent, one also wonders what this form of capital inflow play. "The relatively high share of aid in government budgets in some countries has raised concerns about the detrimental effects of aid dependency on domestic revenue effort" (IMF, 2016). In other words, the so-called Dutch disease might weaken the revenue mobilization effort of aid-recipients.

The issue of public finance must remain at top of policy agenda in Jordan. This is due to a number of observations:

1. The currently existing tax revenue (around 15% of GDP), is much lower than those which exist in, for example, Turkey (22%), Greece (26%), Denmark (47%), and in the OECD countries (26%).
2. The currently existing total public spending (around 29% of GDP) is lower than those which exist in, for example, Turkey (38%), Germany (45%), Ukraine (46%), and France (57%).
3. The capital spending component of total public spending has been falling at alarming rates. Capital spending to GDP ratio has fallen from 15.2% (1980-1990) to 8.4% (1990-2000), 7.5% (2000-2005), 6.9% (2005-2010), 4.2% (2011-2015), and to 3.7% by the end of 2016.
4. Since 1970, all governments have had to live with budget deficits.
5. Jordan has been receiving large capital inflows in the form of grants and concessional loans (Overseas Development Aid / ODA). Indeed, during the period 1965 – 2015, Jordan received the largest per capital ODA in the world ($9,158).
6. If Jordan mobilizes an extra 7% of GDP in taxes, to reach the 22% Turkish ratio, public revenue will increase by a whopping JD2.0 billion. Such a figure puts the JD886.2 million and JD836.0 million that Jordan received in aid in 2015 and 2016 respectively in their proper perspective!

Relative to the above briefly outlined arguments and observations, this paper examines the Jordanian "interplay" between real economic growth, tax revenue, and aid. In specific terms, this paper provides answers to the following questions:

1. What is the impact of economic growth on tax revenue (elasticity of tax)?
2. What is the impact of tax revenue on economic growth?
3. What is the impact of aid on tax revenue?

The rest of the paper is organized as follows. In section 1, the economics of public finance and role of fiscal policy in economic growth and development are briefly discussed. In section 2, the Jordanian experience in public spending, tax effort, and aid is outlined. The results of our analysis are presented and discussed in section 3. Finally, section 4 summarizes the main findings and puts forward a number of policy recommendations.

2. The Economics of Public Finance: Background

Public finance is public sector economics. It is about the revenue side and expenditure side of the government and the impact of these measures on the well-being of society. More specifically, public finance is all about tax systems, expenditure programs, budget procedures, stabilization policy and instruments, public debt issues, and the level of the government's involvement in the economy.

From a socio-economic point of view, public / government intervention in the economy is necessary because of three main arguments and these are: Resource Allocation, Income Distribution, and Macroeconomic Stabilization.

1. **Resource Allocation**
   It is obvious that public goods and services (i.e. health, transport, education, and others) promote inclusive growth and reduces inequality.

   "Basic education increases the efficiency of each individual worker…. Lack of basic education can become a constraint on business development, with firms finding it difficult to move up the value chain by producing more sophisticated or value-intensive products" (World Economic Forum).

2. **Income Distribution**
   No one doubts that extreme inequalities of income, wealth, or opportunity are unfair. This is why, in addition to the tax system, public investment in education, transport, and health care promotes real economic growth and reduces poverty.

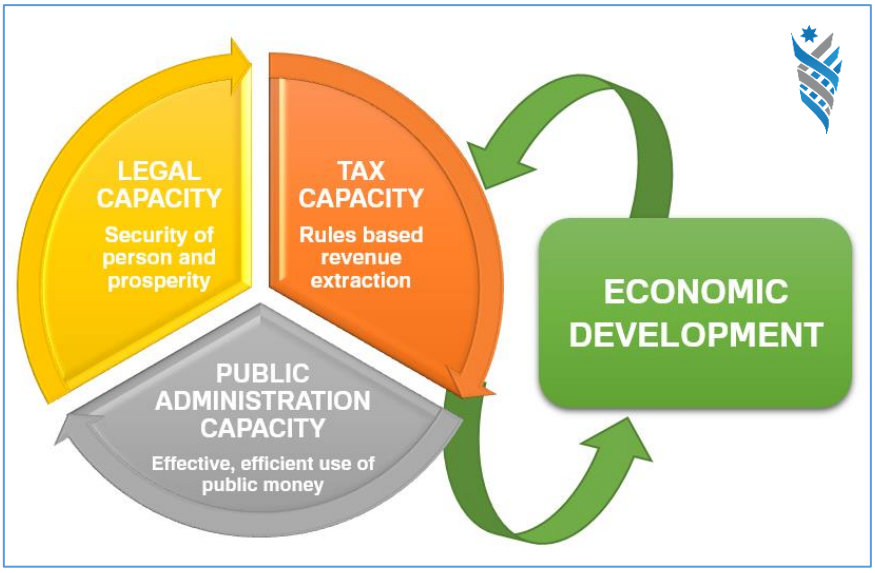
   "Better infrastructure, both in quantity and quality, improves income distribution. This result, together with the proven role of infrastructure in enhancing productivity and growth, suggests that infrastructure development can have double effects on poverty reduction and inclusive growth … Education spending to enhance human capital could increase the earning power of lower-income groups disproportionately more" (IMF).

3. **Macroeconomic Stabilization**
   Macroeconomic stability (annual change in real GDP growth rate, inflation rate, budget deficit and debt sustainability) promotes stable and sustainable growth because it reduces uncertainty, and increases national savings and private investment. Also, the negative impact of instability tends to hurt the poor more than the better-off.

   "Increasing output volatility by one standard deviation leads to a 1.3 percentage point reduction in growth per capita; this decline is even more sizeable (2.2 percentage points) during crises" (World Bank).

   The link between taxation and economic growth and development is illustrated in Figure 1 (IMF 2016B).

Figure 1: The Link Between Taxation & Economic Growth and Development



The interaction between tax capacity, legal capacity, and public administration capacity is what really determines the capacity of the state.

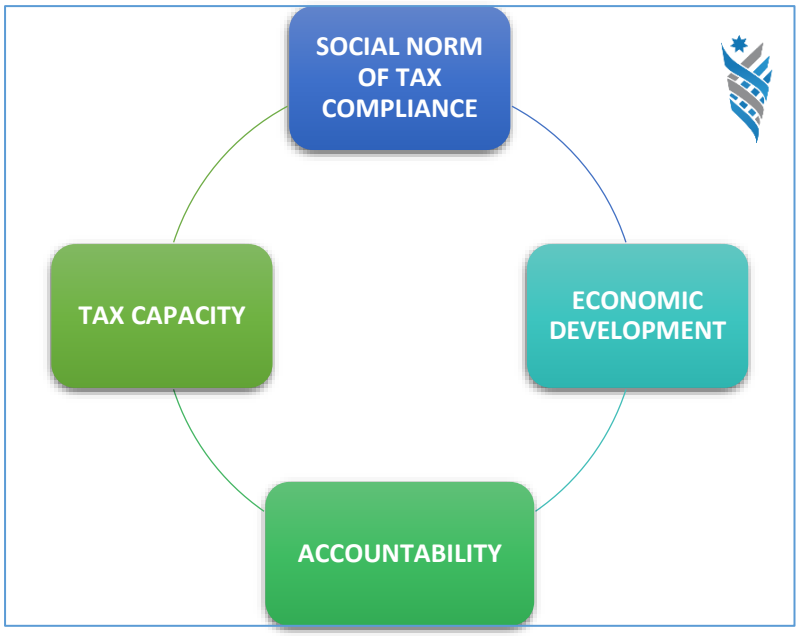
1. Tax capacity provides the government with sufficient revenue to finance its activities and play a productive role in the economy.

2. Legal capacity enables the government to secure regulations that support competition, protection of property rights, and the enforcement of contracts.

3. Public administration capacity refers to the government's effectiveness and efficient use of public funds.

The tax capacity depends on, not only the tax law itself and its enforcement, but also on compliance. The more a government is effective and trustworthy, the more legitimacy it is likely to attain, and the more it will be able to elicit compliance without excessive monitoring or punitive action" (IMF, 2016B).

Figure 2: Tax Capacity, Social Norm of Tax Compliance and Accountability



Given the socio-economic importance of government fiscal policy in general, and tax effort in particular, and foreign aid, one should not be surprised that the issues of tax revenue and aid have always been matters of much debate in the press and among various stakeholders. Within this context, it is stated that " the strength of tax capacity depends crucially on social norms of compliance…the more a government is effective and trustworthy, the more legitimacy it is likely to attain, and the more it will be able to elicit compliance without excessive monitoring or punitive action" (IMF 2016B).

The fact that public finance in general, and tax effort and aid in particular, have a number of important socio-economic implications, it is expected that these issues have attracted the attention of the media and other stakeholders. Within this context, the issues that have attracted the attention of researchers, policy-makers, as well as think tanks and these are:

1. The Impact of Economic Growth on Tax Revenue (Tax Elasticity).
2. The Impact of Taxes on Economic Growth.
3. The Impact of Aid on Tax Revenue.

2.1 The Impact of Economic Growth on Tax Revenue (Tax Elasticity)

The concept that measures the interplay between economic growth and tax revenue is Tax Elasticity. This measures the responsiveness of tax revenue to changes in income (GDP), and the higher this measure is, the more tax revenues are collected due to increases in real economic growth.

The issue of measuring tax elasticity and tax buoyancy have led to the publication of numerous applied research papers by academia, research centers, ministries of finance, think tanks, central banks, as well as by international organizations such as the IMF, World Bank, and the OECD. Our objective is not to review this literature. However, the following quotation will help make the relevant arguments.

"Whether growth will raise revenue and allow keeping the fiscal balances in check depends on one important ingredient of a tax system, the so-called tax buoyancy: the measure of how tax revenues vary with changes in output" (IMF / January 2017).

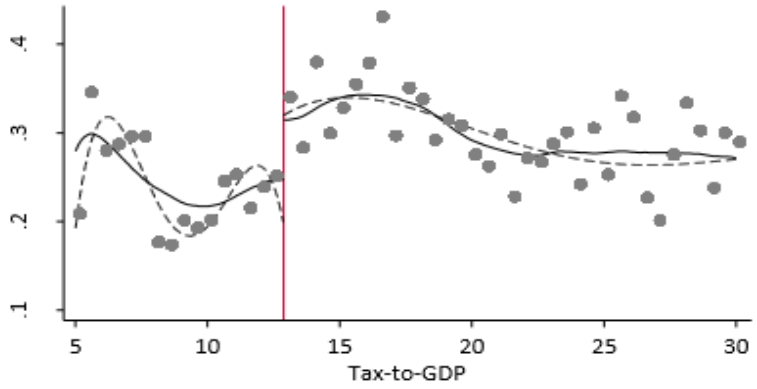
"When a country has elasticity of taxation greater than unity, it has a revenue growth larger than the growth rate of national income. Buoyant and elastic tax system raises tax-to-GDP ratio and helps to keep fiscal and debt position consolidated, and reduces foreign dependence for development financing" (Nepal Rastra Bank, 2017).

2.2 The Impact of Taxes on Economic Growth.

The fact that building tax capacity has direct bearings on the process of economic growth and development, the question that needs answering is this: **Is there a minimum tax to GDP ratio that accelerates growth and development?** This question has been answered in a recently published IMF Paper (November 2016B). In this paper, two separate databases are used. The first part of the analysis uses relevant data that covers a total of 139 countries (1965-2011). The second part of the analysis uses historical database for 30 advanced countries (1800-1980). The results could not be more compelling.

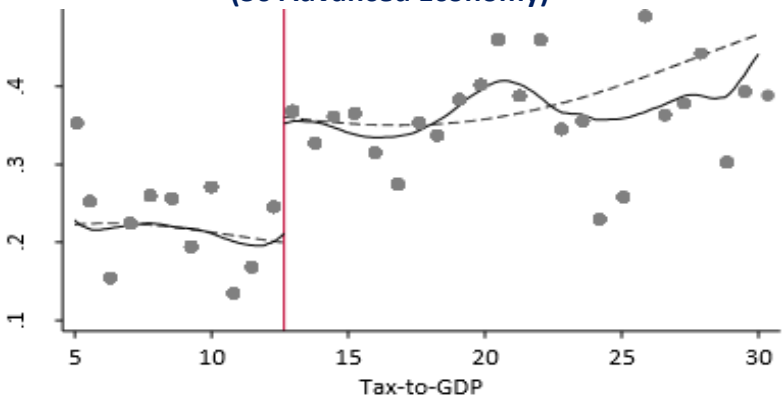
First, based on their detailed analysis, it is stated that "that once the tax-to-GDP level of the average country in our sample reaches around 12.88 percent, its real GDP per capita increases sharply and in a sustained manner over several years. " (IMF 2016). This can be clearly seen in Figure 3.

Figure 3: Impact of Tax Threshold on 10-Year Cumulative Growth (139 Country)



Second, based on the analysis of the 30 advanced economies, it is stated that " we observe a sharp increase in average cumulative GDP per capita growth rates just above the estimated revenue threshold of 12.65 percent" (IMF 2016). This can also be seen in Figure 4.

Figure 4: Impact of the Tax Threshold on 10-year Cumulative Growth (30 Advanced Economy)



2.3 The Impact of Aid on Tax Revenue.

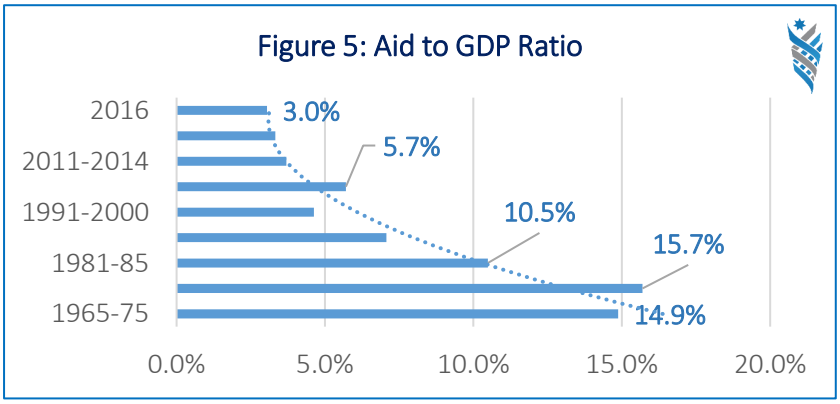
As far as aid is concerned, its effectiveness had always been a controversial issue. For example, while some argue that aid enlarges public bureaucracies, or simply wasted, others argue that aid reduces poverty and promotes real economic growth. In addition, the economics of aid has been looked at in terms of its impact of the fiscal mobilization process of aid-recipient countries.

"Large aid inflows not only undermine governments' tax efforts, but also create a crowding-out effect on capital expenditure. [Sustained external financing fuels current expenditure and creates the "aid illusion" effect" (IMF 2016B).

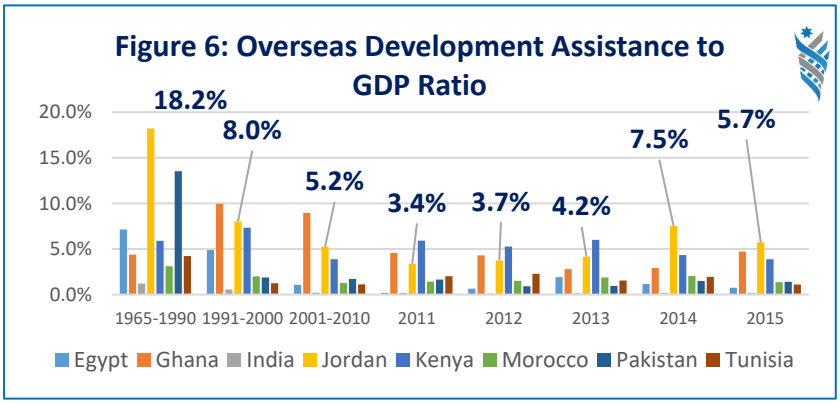
The above conclusion need not be generalized to all recipients. For example, it is stated that "we find no evidence of an adverse effect of aid on tax revenue, which implies that the government of Ethiopia is not substituting taxes with aid, nor has it been discouraged in its tax mobilization efforts. On the contrary, we find a positive and robust relation between tax revenue and both grants and loans in the long-run" (Mascagni and Timmis, 2017). "Our findings also suggest that revenue conditionality has been effective in offsetting the potential negative effect of aid on tax revenue" (Crivelli and Gupta, 2017).

3. Aid, Public Spending, Tax Effort, and Growth: The Story in Jordan

To understand the Jordanian experience in terms of the interplay between aid, tax effort, and real economic growth, it is useful to highlight a number of observations.

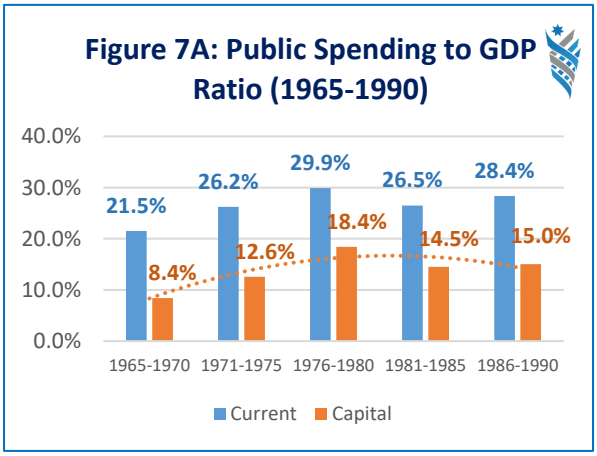


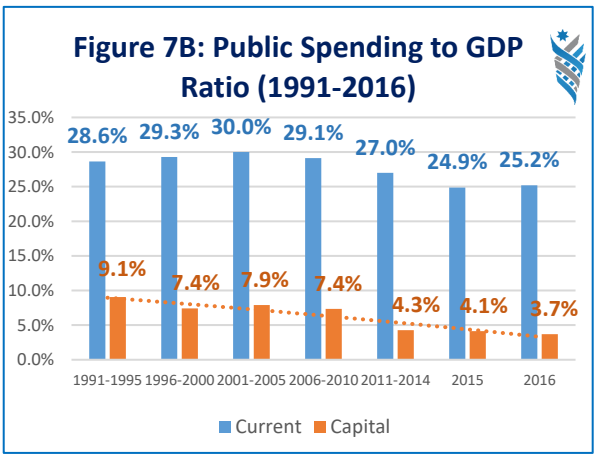
First, during the period 1965-1985, aid was significant. Since then, while still significant, aid has been reflecting a downward trend (Figure 5).

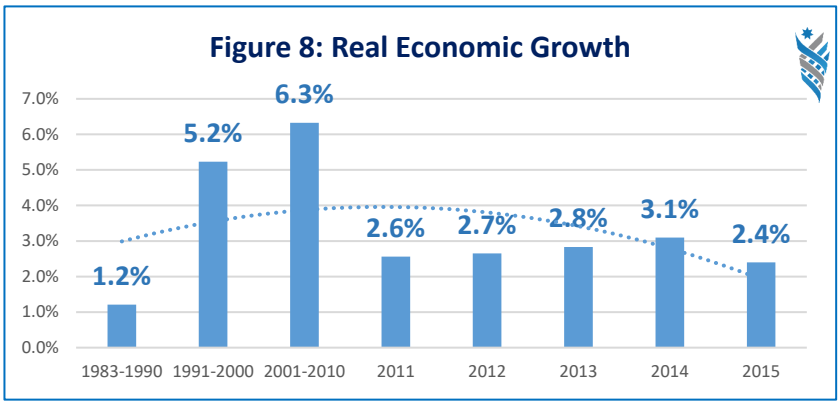


Second, relative to other aid-recipients, the World Bank data shows that Jordan has been receiving more development assistance than many other countries (Figure 6).

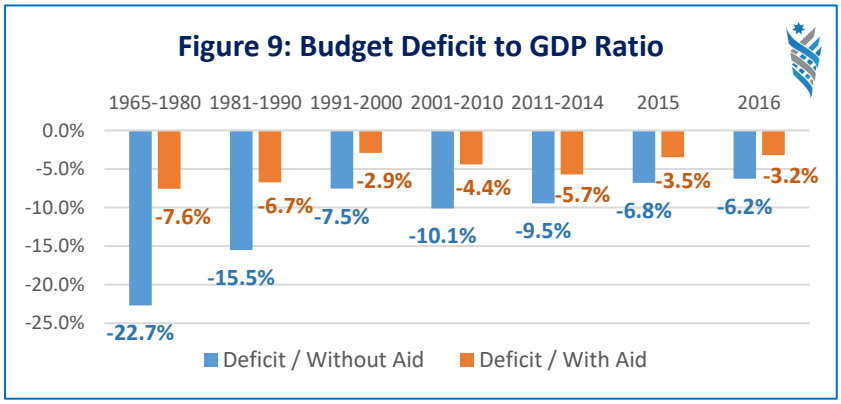
Third, the huge capital inflows in the form of aid and concessional loans enabled the government to heavily in human and physical infrastructure and in resource-based projects (Figure 7A). However, since 199, the capital spending component of total public spending has been falling at some alarming rate (Figure 7B).





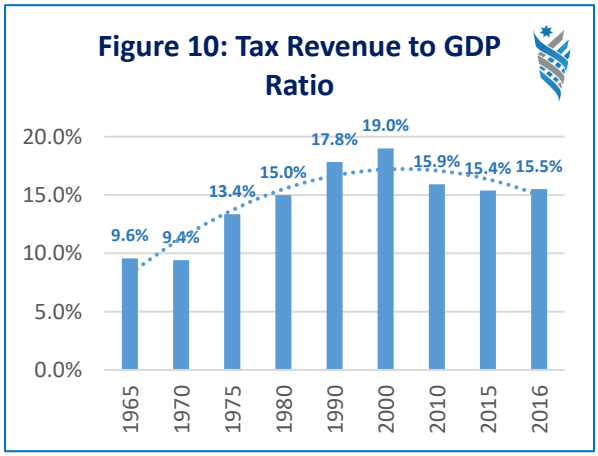


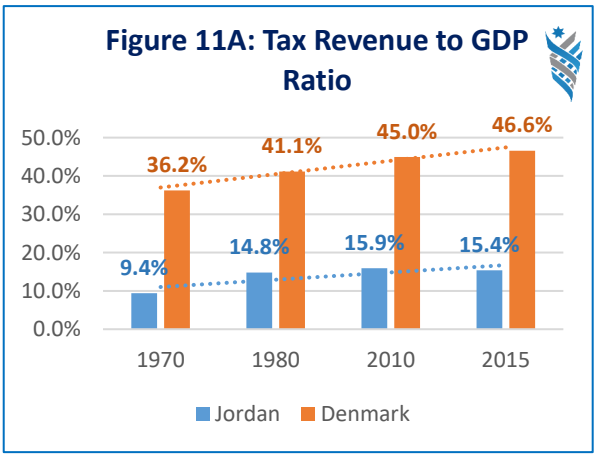
Fourth, no one doubts that the increase in capital spending caused some strong economic performance. For example, during the period 1973-1982, the mean annual growth rate in real GDP was equal to 11.6%. However, since then, the economy could not repeat this economic performance (Figure 8).

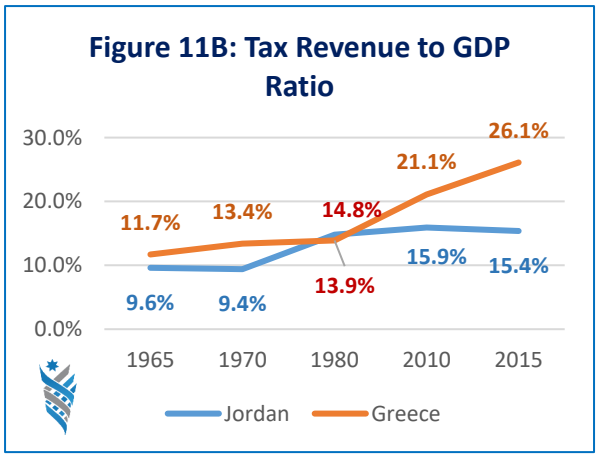


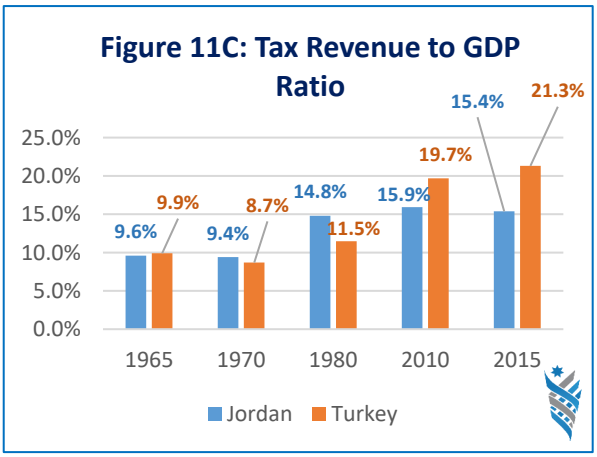
Fifth, In spite of the significant aid inflows, the government has always suffered from consistent budget deficit. In actual fact, in no year during the period 1965-2016, the government experienced a surplus.

Sixth, the tax effort has increased by only 5.9% of GDP (Figure 10). This increase is relatively low (Figures 11A, 11B, and 11C).





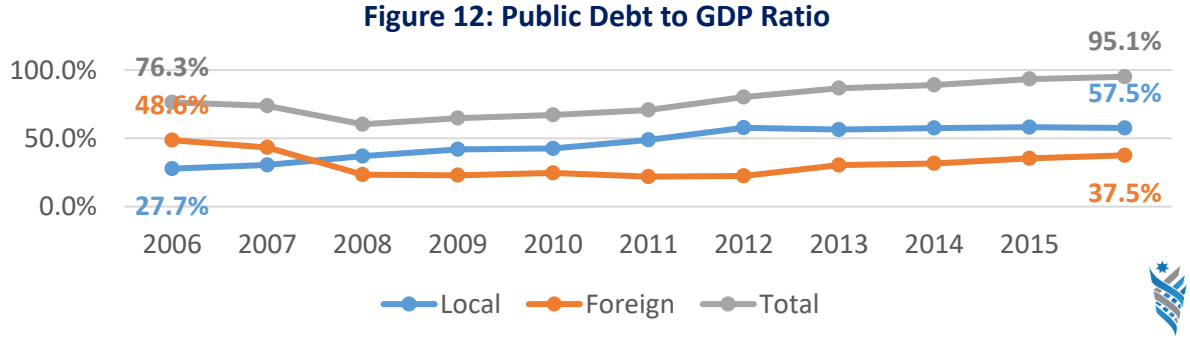




Seventh, in a recently published paper by the JSF (2017), it is stated that "income tax from individuals (salaried individuals) and private individuals (professionals and SMEs) contributes ONLY 4.3 percent towards total tax revenue. Even more important, is the fact that salaried individuals pay more than private individuals (SMEs)!

Finally, relative to all of the above observations, it is important to note that recently, local and international debt have been increasing.

Figure 12: Public Debt to GDP Ratio



Against the above brief account of the Jordanian economy's performance in terms of aid, tax revenue, public spending, budget deficit, and real economic growth, the objectives of this paper are three:

1. To examine the impact of economic growth on tax revenue (tax elasticity).
2. To examine the impact of taxes on real economic growth.
3. To examine the impact of aid on tax revenue.

4. The Data, Methodology, and Empirical Results

To examine the dynamic relationship between economic growth and tax revenue, tax revenue and economic growth, and aid and tax revenue, we use annual data during the period 1983-2016. As an indicator of economic growth, we use the real GDP growth rate. As for aid, and tax revenue, we normalize them (divide them) by nominal GDP. ***For the technical reader, our empirical methodology is explained in Annex A.*** In Table 1, we report the descriptive statistics of the macroeconomic models variables in terms of their mean, median, maximum, minimum, and standard deviation values. Based on the reported values, we can make the following observations.

Analysis Observations

First, during the period 1983-2016, the national economy realized a maximum and minimum real growth of 18.6% and -13.5% respectively. Overall, the economy has not experienced consistent real economic growth, and this can be seen in Figure 8 above.

Second, the mean value of total tax revenue to GDP ratio was equal to 17.3% of GDP. While this ratio is relatively low, it is interesting to note that during the period 1992-2007, this ratio was equal to 20.6%. Since 2008, and by the end of 2016, however, it hit the 15.5% of GDP mark.

Third, while openness of the Jordanian economy had the largest standard deviation (14.7%), it must be noted that was due to the large increase in this measure during the period 2004-2008 (international oil prices). It is also useful to note that the degree of openness is due largely to imports and not exports. GDP.

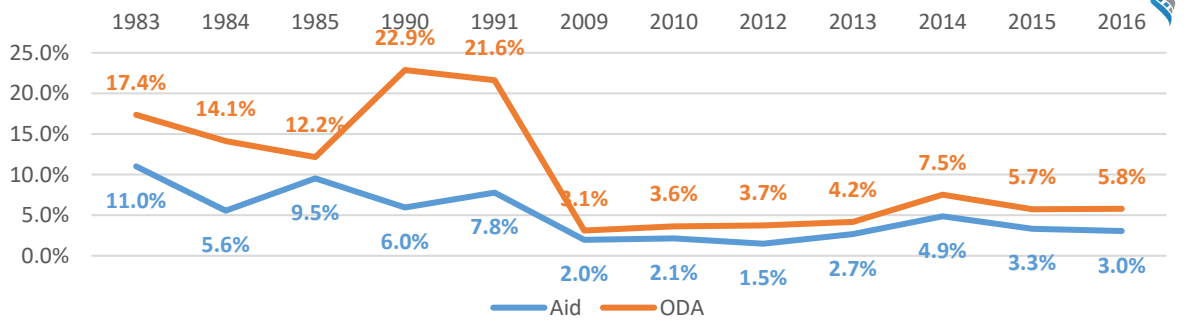
Fourth, on average, the ratio of bank credit to GDP reflects an upward trend. For example, this ratio increased from 60% (1983-1990) to 73% of GDP (2008-2016). What is also encouraging is the fact that since the year 2008, bank credit has been stable.

Finally, aid and overseas development assistance had annual mean values of 5.5% and 7.8% of GDP respectively. While these numbers are relatively high, it is interesting to note that during the period 1983-2016, overseas development assistance has not maintained its "large" difference with aid. In actual fact, concessional loans decreased more than aid (Figure 13).

TABLE 1

Variable	Mean	Median	Maximum	Minimum	Std. Deviation
GROWTH	4.141%	3.433%	18.665%	-13.452%	4.671%
TAX	17.327%	17.819%	24.689%	10.600%	4.00%
OPENNESS	78.836%	77.721%	100.122%	48.017%	14.798%
CREDIT	69.876%	70.234%	91.769%	55.596%	9.115%
GRANTS	5.474%	4.945%	12.968%	1.490%	2.795%
GRANTS & CONCESSIONAL LOANS	7.779%	5.933%	22.876%	3.108%	4.922%

Figure 13: Aid & Overseas Development Assistance

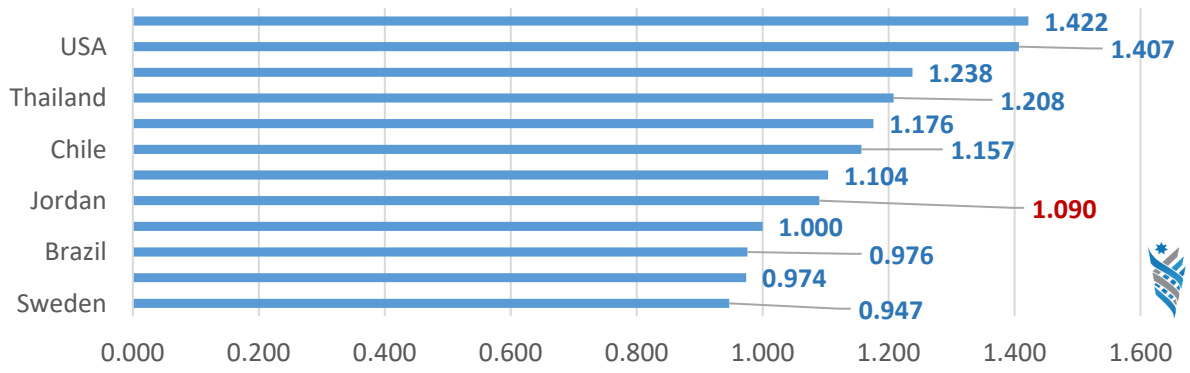


The technical results of the JSF analyses are presented in Annex B (Impact of growth on tax revenue), Annex C (impact of tax revenue on growth), and Annex D (impact of aid on tax revenue). Based on the reported results, we make the following main conclusions.

Main Conclusions

1. The long-run tax elasticity is equal to 1.09. This means that when real GDP grows by, for example, 5%, tax revenue to GDP ratio increase by 0.45% **[5 * .09 = 0.45]**. To put our measure (+1.09) in its international perspective, it is useful to report the tax elasticities which are estimated by the IMF (2017) for a large number of countries. On average, tax elasticity in Jordan is close to international mean. However, in some countries, it is much higher!
2. **The impact of tax revenue on real economic growth is positive.** This result is encouraging because it indicates that tax revenues which are spent on public goods and investments promote real economic activities, and hence growth.
3. Tax revenue reflects an increasing power in explaining the annual variability (changes) of real economic growth rates over time!
4. Aid elasticity is negative and equal to -0.04. This indicates that when aid increases by, for example, 5%, tax revenue to GDP ratio falls by 0.2%! **This indicates that public finance suffers from the so-called Dutch disease.**
5. Aid reflects an increasing power in explaining the annual variability (changes) of tax revenue over time!
6. **The impact of aid and overseas development assistance on tax revenue is negative!**
7. Aid and overseas development assistance reflects some power in explaining the variability of tax revenue over time. However, the extent of this influence is much less than when aid only is included in the analysis.

Figure 14: International Tax Elasticities



5. Implications & Recommendations

Based on the above, Jordan Strategy Forum recommends the following:

1. Jordan must work on "increasing" tax elasticity, and based on the international evidence, this can be done by:

   - Widening the tax base.
   - Improving tax collection.
   - Diversifying tax sources.
   - Improving macroeconomic stability (inflation and annual changes in GDP).

   Due to Jordanian special circumstances, and to start with the more important and higher impact, the JSF recommends that priority must be given to tax collection efficiency. This factor will widen the tax base, increase tax income, and increase tax elasticity. Within this context, that fact that the professionals and SME sector (private individuals) contribute 1.98% only towards total tax revenues, the JSF recommends that the government must adopt a new fair and efficient system in the collection of taxes from this sector.

2. Jordan must seek greater levels of macroeconomic stability. In a recently published paper by the JSF (On the Challenges of the Jordanian Economy: The Need for a Fresh Look: Why and How?, 2017), it was argued that the recent performance of the Jordanian economy suffers from macroeconomic instability, and this must have decreased tax elasticity.

3. If aid undermines the tax effort, this inflow should be managed with great caution. The government's efforts and capacity building should focus on strengthening tax capacity and public investment implementation. This is important especially if and when the economy is rationed from aid inflows.

4. The fact that higher levels of tax elasticity have positive implications in economic growth and budget deficit, the government must increase its efforts and ability on improving tax elasticity. This effort must be maintained with or without aid.

5. Greater efficiency levels in public investments is especially critical when aid is forthcoming.

6. Lastly, the JSF sees that this policy paper has a number of additional implications including an examination of the impact of not only economic growth on tax revenue, but also the impact of major changes in the tax system, in terms of rates and base on tax revenue.

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Annex A

First, we specify two models as follows:

$$\ln(TAX)_t = \lambda + \beta \ln(GDP)_t + \varphi \ln(AID)_t + \varepsilon_t \quad (1)$$

$$REALGROWTH_t = \lambda + \beta TAXREVENUE_t + \psi OPENNESS_t + \varphi CREDIT_t + \varepsilon_t \quad (2)$$

where, for equation (1), REALGROWTH is equal to real GDP growth rate, TAXREVENUE is total tax revenue to GDP ratio, OPENNESS is exports plus imports to GDP ratio, and CREDIT is total credit to the private sector to GDP ratio. In equation (2), ln(TAX) stands for the natural logarithm of total tax revenue, ln(GDP) is the natural logarithm of real GDP, and ln(AID) stands for natural logarithm of total grants, or grants plus concessional loans (overseas development assistance).

The expected signs of the parameters are: $\lambda>0$, $\beta>0$, $\psi>0$, $\varphi>0$. The error term (ε) is assumed to be independently and identically distributed. Finally, the subscript (t) denotes time (1983-2016).

Second the nature of the used data is examined in terms of their standard descriptive statistics (mean, median, and standard deviation).

Third, the time series properties of the data is checked for stationarity using the Dickey-Fuller and Phillips-Peron tests.

Fourth, the tendency for the variables to move together in the long-run (co-integration) is examined using the Johansen-Muselius procedures. The co-integrating rank (r) is tested using the maximum Eigenvalue (λmax) and the trace test (λtrace). These values are computed as follows:

$\lambda_{max} = -T \log(1 - \lambda_{r+1})$, where, the suitable null is r = g co-integrating vectors with (g = 0, 1, 2, 3, …) against the alternative which is $r \leq g + 1$.

$\lambda_{trace} = -T (1 - \lambda_i)$

where, the null is r = g against the general specification $r \leq 1$.

Fifth, based on the co-integration results, a vector error-correction (VEC) model is estimated to examine the long-run and short-run causality dynamics. The objective of this exercise (VEC model) is to specify the speed of adjustment from the short-run equilibrium to the long-run equilibrium condition.
Based on the main expression (1), the VEC model is expressed as follows:

$$\Delta GROWTH_t = \alpha + \lambda e_{t-1} + {}_{t-i} + {}_{t-i} + {}_{t-i} + {}_{t-i} + \varepsilon_t \quad (3)$$

$$\Delta TAX_t = \alpha + \lambda e_{t-1} + {}_{t-i} + {}_{t-i} + {}_{t-i} + {}_{t-i} + \varepsilon_t \quad (4)$$

In the above expressions (3 and 4), we can state that a long-run convergence does occur between the variables of the parameter (λ) of the error correction term is negative and statistically significant.

Sixth, we estimate Granger causality between our dependent variable and each of the independent variables. Using expression (3 and 4), changes in TAXREVENE, OPENNESS, and CREDIT cause real economic growth (GROWTH) if the ci's, di's, ei's, are statistically significant. The same applies to expression (4).

Finally, we perform variance decomposition analysis to gain more information about which variable has been gaining increasing power in explaining the variability of the dependent variable (GROWTH AND TAX).

Appendix B: Impact of Growth on Tax Revenue

TABLE THIRTEEN
Augmented Dickey-Fuller Unit Root Test

	Level	First-Difference
Variable		
TAX	-1.515	-3.897*
GDP	2.579	-4.422*
GRANTS	-1.997	-7.254*
ODA	-1.131	-6.113*
* Implies significance at the 99 percent confidence level.		

TABLE FOURTEEN
Johansen Multivariate Co-Integration Test

Hypothesized No. of CE(s)	Trace Statistic	P-Value	Max-Eigen Statistic	P-Value
None*	42.818	0.006	20.152	0.097
At most 1*	22.666	0.022	16.419	0.041

TABLE FIFTEEN
Long Run Relationship

Variable	Coefficient
GDP	1.090
GRANTS	-0.040

TABLE FIFTEEN
Estimates of VEC Model

Variable	Coefficient	Std. Error	t-statistic
λe_{t-1}	-0.233	0.110	-2.113*
ΔTAX(-1)	-1.005	0.253	-3.976*
ΔTAX(-2)	-0.398	0.231	-1.720*
ΔGDP(-1)	0.281	0.419	0.672
ΔGDP(-2)	0.301	0.394	0.765
ΔGRANTS(-1)	-0.188	0.080	-2.323*
ΔGRANTS(-2)	-0.086	0.053	-1.614*
Adjusted R-Squared	0.543		
F-Statistic	5.308		

TABLE SIXTEEN
Variance Decomposition of Tax

Period	TAX	GRANTS	GROWTH
1	100.000	0.000	0.000
2	81.027	11.349	7.622
3	83.725	9.295	6.979
4	76.064	12.293	11.641
5	76.313	11.629	12.057
6	74.447	12.390	13.162
7	73.879	12.556	13.563
8	73.237	12.585	14.178
9	72.642	12.829	14.528
10	72.201	12.948	14.850

TABLE SEVENTEEN
Pair-wise Granger Causality Tests

Null Hypothesis	F-Statistic	Probability
GRANTS does not Granger cause TAX	0.592	0.561
TAX does not Granger cause GRANTS	2.867	0.074
GROWTH does not Granger cause TAX	3.814	0.035
TAX does not Granger cause GROWTH	4.997	0.015

Appendix C: Impact of Tax on Growth

TABLE ONE
Augmented Dickey-Fuller Unit Root Test

	Level	First-Difference
Variable		
GROWTH	-2.049	-4.054*
TAXREVENUE	-0.179	-5.262*
OPENNESS	-0.397	-4.494*
CREDIT	-0.923	-4.864*
* Implies significance at the 99 percent confidence level.		

TABLE TWO
Johansen Multivariate Co-Integration Test

Hypothesized No. of CE(s)	Trace Statistic	P-Value	Max-Eigen Statistic	P-Value
None*	49.864	0.003	25.273	0.009
At most 1	24.591	0.176	12.935	0.458

TABLE THREE
Long Run Relationship

Variable	Coefficient
TAX	0.516
OPENNESS	0.051
CREDIT	-0.090

TABLE FOUR
Estimates of VEC Model

Variable	Coefficient	Std. Error	t-statistic
λe_{t-1}	-1.428	0.226	--6.307*
ΔGROWTH(-1)	-0.277	0.175	-1.587*
ΔGROWTH(-2)	-0.034	0.136	-0.249
ΔTAX(-1)	-0.331	0.485	-0.682
ΔTAX(-2)	-0.062	0.399	-0.154
ΔOPENNESS(-1)	-0.223	0.123	-1.821*

ΔOPENNESS(-2)	-0.203	0.084	-2.423*
ΔCREDIT(-1)	0.435	0.235	1.852*
ΔCREDIT(-2)	0.134	0.192	0.696
Adjusted R-Squared	0.844		
F-Statistic	16.719		

TABLE FIVE
Variance Decomposition of Growth

Period	GROWTH	TAX	OPENNESS	CREDIT
1	100.000	0.000	0.000	0.000
2	80.649	17.878	0.057	1.414
3	81.522	16.447	0.095	1.935
4	76.141	18.516	2.729	2.614
5	76.389	17.921	3.248	2.442
6	74.609	20.276	2.894	2.221
7	75.010	20.440	2.586	1.963
8	75.116	20.774	2.335	1.775
9	75.032	21.121	2.219	1.627
10	74.698	21.780	2.028	1.493

TABLE SIX
Pair-wise Granger Causality Tests

Null Hypothesis	F-Statistic	Probability
TAX does not Granger cause GROWTH	2.105	0.141
GROWTH does not Granger cause TAX	1.244	0.340
OPENNESS does not Granger cause GROWTH	2.035	0.151
GROWTH does not Granger cause OPENNESS	1.095	0.349
CREDIT does not Granger cause GROWTH	0.189	0.829
GROWTH does not Granger cause CREDIT	2.375	0.113

Appendix D: Impact of Aid on Tax Revenue

TABLE SEVEN
Augmented Dickey-Fuller Unit Root Test

	Level	First-Difference
Variable		
TAX	-0.179	-5.262*
AID	-1.922	-8.412*
GROWTH	-2.049	-4.054*
* Implies significance at the 99 percent confidence level.		

TABLE EIGHT
Johansen Multivariate Co-Integration Test

Hypothesized No. of CE(s)	Trace Statistic	P-Value	Max-Eigen Statistic	P-Value
None*	37.956	0.0046	22.796	0.0289
At most 1	15.160	0.056	9.502	0.247

TABLE NINE
Long Run Relationship

Variable	Coefficient
AID	-0.327
GROWTH	0.013

TABLE TEN
Estimates of VEC Model

Variable	Coefficient	Std. Error	t-statistic
λe_{t-1}	-0.279	0.131	-2.129*
ΔTAX(-1)	-0.853	0.203	-4.200*
ΔTAX(-2)	-0.296	0.187	-1.586*
ΔAID(-1)	-0.543	0.209	-2.586*
ΔAID(-2)	-0.281	0.159	-1.761*
ΔGROWTH(-1)	0.367	0.124	2.941*
ΔGROWTH(-2)	0.139	0.079	1.759**
Adjusted R-Squared	0.552		
F-Statistic	5.471		

TABLE ELEVEN
Variance Decomposition of Tax

Period	TAX	AID	GROWTH
1	100.000	0.000	0.000
2	74.458	13.228	12.313
3	64.951	15.408	19.639
4	53.315	19.606	27.078
5	54.140	18.560	27.299
6	50.725	19.605	29.669
7	50.112	20.036	29.852
8	47.983	20.597	31.420
9	47.534	20.559	31.906
10	46.179	21.120	32.701

TABLE TWELVE
Pair-wise Granger Causality Tests

Null Hypothesis	F-Statistic	Probability
AID does not Granger cause TAX	2.105	0.141
TAX does not Granger cause AID	1.244	0.340
GROWTH does not Granger cause TAX	2.035	0.151
TAX does not Granger cause GROWTH	1.095	0.349