Applied Mathematics & Information Sciences
An International Journal

http://dx.doi.org/10.18576/amis/190204

Estimating Potential Output Using a Production Function Approach

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Received: 22 Oct. 2024, Revised: 27 Nov. 2024, Accepted: 27 Nov. 2024
Published online: 1 Mar. 2025

Abstract: The valuable assessment of non-inflationary growth and macroeconomic policy effectiveness hinges upon the elucidation of potential output and output gap dynamics. This study employs the aggregate production function to derive estimations concerning the trajectory of potential output for Jordan throughout the observational span spanning from 1990 to 2019. Analysis of the data reveals a period from 1992 to 1996 characterized by Jordan's growth surpassing its potential output, contrasting with the subsequent period from 1999 to 2004 where potential output surpassed actual output levels. Such findings serve as indicative evidence of periods within Jordan's economic landscape marked by excess demand, notably during 1992-1996 and 2006-2011, juxtaposed with periods, including 1999-2004 and post-2018, where actual output fell short of potential output. Consequently, it is imperative to advocate for the implementation of further labor-intensive production methodologies to mitigate the burgeoning threat of unemployment during phases of labor surplus within the economy.

Keywords: Jordan, potential output, production function

1 Introduction

The concept of potential output, also known as natural gross domestic product (GDP), encompasses the utmost level of non-inflationary output expansion within an economy. It signifies a composite gauge of aggregate supply, aligning with the pinnacle sustainable degree of production attainable considering the existing resource endowment and technological capacities. It encapsulates the paramount indicator of an economy's aggregate supply potential and the sustainability of growth sans inflationary pressures, encapsulating the economic expansion potential relative to the optimal employment level (or the minimal unemployment threshold). Actual GDP is contingent upon demand dynamics across the business cycle, and the juxtaposition of these metrics underscores the utility of output gap and unemployment metrics in the orchestration of macroeconomic strategies, aiming to optimise output while minimising unemployment within tolerable inflation thresholds [1,2, 3].

Okun [7] characterised potential output as "the level of production achievable at full employment" and determined that "potential gross national product (GNP) embodies the notion of supply and serves as an indicator of productive capacity, yet it does not denote the output attainable through boundless quantities of aggregate demand." In contemporary scholarly discourse, potential output is synonymous with sustainable real GDP (and its corresponding growth rate). Consequently, potential output assumes significance in formulating economic policies, particularly in instances where actual output diverges from its potential counterpart. This variance hinges upon the pace at which actual output and

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employment converge towards potential levels of production and employment, alongside an acceptable threshold of inflation.

The Cobb-Douglas production function, which is based on theoretical concepts, is the approach used in this study to calculate Jordan's potential output and output gap measures for the years 1990 to 2019. As a result, this approach is considered very advantageous; it is distinguished by the calculation of possible output in an economic context and the precise assessment of the input element contributions.

This study's main goal is to estimate Jordan's potential output and output gap levels in order to assess the impact on monetary and fiscal policy. Given the scarcity of research on the calculation of potential production that is unique to Jordan, this study provides new insights in the field of Jordanian economic policy.

Evaluating potential output is crucial for policy decisions in Jordan for various purposes. Initially, while some research has been done on predicting potential output, it has not adequately tackled the problem. In order to achieve this objective, it is essential to determine if the economy is experiencing an excess or a shortfall in its capabilities, and to offer a comprehensive overview of the potential and future of the Jordanian economy, this research seeks to address this deficiency. This study also equips policymakers with adequate information to address these challenges, which is its primary contribution.

The broad trends in economic growth and inflation rates are presented in Section 2 of this paper. After that, Section 3 provides a thorough analysis of the empirical literature, and Section 4 outlines how to formulate the production function such that it may be estimated economically. Then, in Section 5, a description of the variables included in the model is given, along with an estimate of possible inputs. Section 6 delves into the subject of the estimation of potential output, while Section 7 presents the findings from these analyses.

2 Empirical Literature

Although potential production has a significant role in determining economic policy, little research has been done on the subject in Jordan. However, there is a wealth of literature available worldwide that explains several approaches to calculating possible production. An extensive summary of empirical studies on possible production is provided here.

In order to analyse the limits on economic development, Okun's equation [7] and the Phillips curve were integrated into a research that estimated potential production for the Jordanian economy between the years 1976 to 2009. The study used the three-gap approach and concentrated on the trade, fiscal, and domestic saving deficits [8,4,5,6]. By establishing a relationship between the GDP and the unemployment rate and measuring the Okun coefficient and the natural rate of unemployment, potential production was determined. It was expected that there would be a fixed elasticity between actual output ratio and potential output, with an applied elasticity coefficient of 0.28 [7]. Furthermore, estimating the Jordanian economy's Phillips curve equation produced a natural unemployment rate of around 4%. The study's conclusions showed that Jordan grew faster than it might have between 2003 and 2004 and 2006 and 2007, and that in 2007 and 2008, potential output exceeded actual output, pointing to an instance of excess demand [10,11, 12].

A recent study evaluated Romania's potential GDP and determined the output gap by using the production function [13]. Potential GDP is estimated with two purposes in mind: first, it helps to accurately determine macroeconomic policies; second, it is an investigational project meant to improve understanding of economic activity. There are two types of methodologies used to estimate potential GDP: statistical and structural approaches. Since potential GDP is unobservable, it makes sense to estimate it using the Kalman Filter algorithm, which connects unobservable factors to observable variables [1]. In addition, a variety of methods were utilised to estimate the output gap and potential output, including structural models, multi-variable models, and single-variable models [14].

The utilisation of the output gap as a pivotal indicator of inflationary pressures by the Reserve Bank of New Zealand is underscored. An alternative gauge to the extant measure of potential output utilised by the bank was procured through the employment of structural vector autoregression (SVAR) methodology, incorporating long-term constraints [15]. Although alignment between the official measure of the output gap and the SVAR model prevailed during the 1970s and 1980s, discernible disparities emerged amidst the economic reform era in the 1980s [16].

Three distinct approaches were delineated for the estimation of the Malaysian economy, encompassing single-variable, multi-variable, and structural models. While the incorporation of potential output is more effectively achieved through multi-variable and structural models, a portfolio of models is frequently upheld by policymakers to uphold diversity, thereby facilitating enhanced validation of outcomes [17]. The Cobb-Douglas production function is embraced in this study, as it is in numerous others within the academic discourse.

3 Production Function and Parameter Estimation

In the estimation of potential output for Jordan, the Cobb-Douglas production function [23] incorporating constant returns to scale was employed, adhering to the established structure of the production function as delineated in Equation (1):

$$Y_t = A_t L_t^{\alpha} K_t^{\beta} \tag{1}$$

Where Y represents gross domestic product (GDP), A signifies total factor productivity (TFP), L denotes labor, and K represents capital stock. The output elasticity of labor and capital is denoted by α and β, respectively, with their collective sum equating to unity.

The transformation of Equation (1) through the application of the natural logarithm results in the derivation of a linear regression model, under the assumption of constant returns to scale, wherein α is substituted by $(1-\beta)$:

$$\ln Y_t = \ln A_t + (1-\beta)\ln L_t + \beta \ln K_t \tag{2}$$

The model can be reconfigured and estimated through an unrestricted linear regression framework, delineated as follows:

$$y_t = \ln Y_t - \ln L_t = \ln A_t(\ln K_t - \ln L_t) \tag{3}$$

Then,

$$y_t = \beta_0 + \beta_1 X_1 + \varepsilon_t \tag{4}$$

Where:

$$y_t = \ln Y_t - \ln L_t x_t = \ln K_t - \ln L_t \beta = \ln A_t \tag{5}$$

The specifications provided suggest that the significance of the impact of capital and labor supply on output is notable, with labor supply exerting a greater influence compared to capital stock. Through the utilisation of dynamic ordinary least squares (OLS) methodology for estimating the input parameters of the production function within the context of Jordan, the shares of labor (α) and capital (β) were determined. It was found that the share of labor in total output surpassed that of capital, implying a greater contribution of labor to the total output compared to capital.

4 Estimation of Potential Inputs

In order to assess potential output, it is imperative to quantify potential inputs, namely labor, capital, and total factor productivity (TFP).

4.1 Potential TFP

The process entails the estimation of total factor productivity (TFP) using equation (1):

$$A_t = \frac{Y_t}{L_t^{\alpha} K_t^{\beta}} \tag{6}$$

Which can be rewritten as:

$$\ln A_t = \ln Y_t - \alpha \ln L_t - \beta \ln K_t \tag{7}$$

The utilisation of the Hodrick Prescott (HP) Filter for the estimation of potential total factor productivity is demonstrated herein. Figure 1 portrays the comparison between actual and potential TFP, showcasing a discernible downward trajectory throughout the observed timeframe.

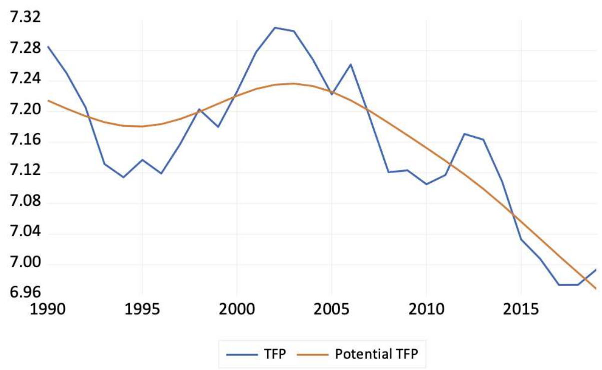

Fig. 1: Actual and Potential Total Factor Productivity for the Jordanian Economy: 1990-2019

4.2 Capital

The indicator employed for assessing capital within the Jordanian context was the data pertaining to gross fixed capital formation. Within this framework, capital was quantified through the amalgamation of new investments and net depreciation. Moreover, estimations were conducted to ascertain potential capital within the specified context.

4.3 Potential Labor Input

The estimation of potential labor input was conducted utilising the HP trend methodology, as referenced in [25]. Figure 2 illustrates the comparative analysis between potential and actual labor force sizes in Jordan. It is discernible that the trend of potential labor depicts a consistent increase throughout the timeframe spanning from 1990 to 2019. Notably, instances where potential labor supply exceeded actual labor supply were observed during the intervals of 1992-2000, 2006-2010, and 2014-2018. Towards the conclusion of the examined period, actual labor supply was noted to be inferior to potential labor supply.

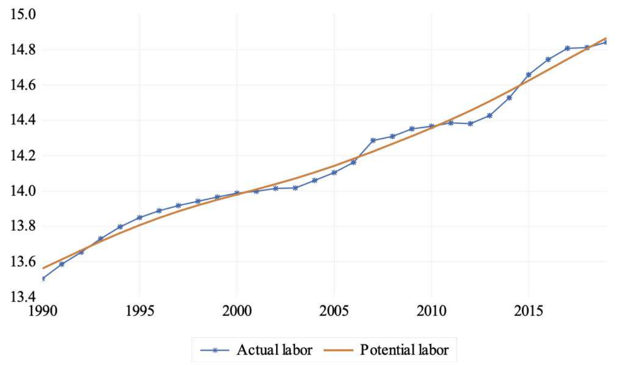

Fig. 2: Actual and Potential Labor Supply for the Jordanian Economy: 1990-2019

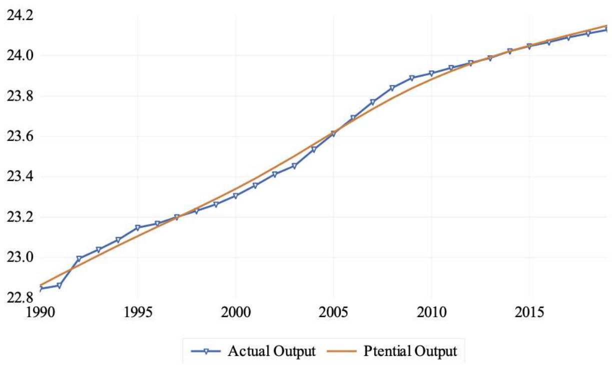

Fig. 3: Actual and Potential Output for the Jordanian Economy

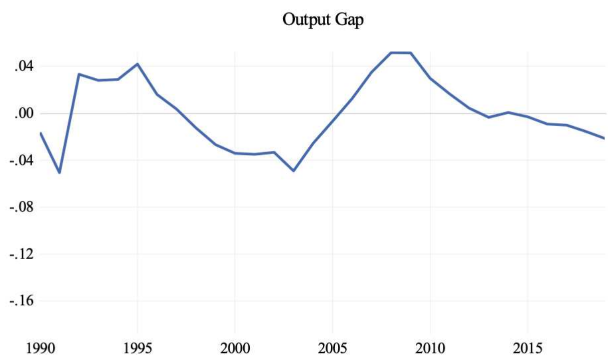

Fig. 4: Output Gap in the Jordanian Economy

5 Potential Output

Finally, through the incorporation of labor and capital input trends alongside the HP filtered residual into the production function equation, an estimation of potential output is derived:

$$Y_t^* = TFP_t^* L_t^{0.70} K_t^{0.30} \quad (8)$$

The outcomes of potential output are depicted in Figure 3, with a summary table available in the appendix for reference. It is observed that potential output closely tracks the fluctuations of actual output across multiple time intervals. During the years spanning from 1990 to 1992, 1998 to 2004, and subsequent to 2018, actual output exhibited negative trends. Moreover, instances of surplus capacity within the Jordanian economy were noted, with pronounced positive output gaps occurring during the periods of 1992 to 1996 and 2007 to 2011. These findings suggest an overutilisation of capacity within the Jordanian economic framework during these specific temporal domains. Thus, the empirical evidence supports the contention that the Jordanian economy encountered periods of demand surplus characterised by rapid expansion of the gross domestic product.

Fluctuations in output gaps, as depicted in Figure 4, have intermittently shifted from positive to negative. Throughout the preceding two decades, output gaps predominantly assumed negative values, with the exception of the timeframe spanning from 2005 to 2012. Notably, the apex of positive output gap manifestation within the Jordanian economic context was observed during the interval of 2008 to 2009, peaking at 5.2%.

5.1 Contribution to Potential Growth

The utilisation of the production function framework facilitates the estimation of the contribution of each production factor to the potential growth of gross domestic product. The assessment of alterations in these contributions serves as an indicator of structural shifts within the Jordanian economy. The production function was derived by estimating the potential values of output, labor, and capital utilising an unrestricted Cobb-Douglas function, resulting in the subsequent outcomes:

$$\ln Y_t = 2855.4 L_t^{1.12} K_t^{0.35} \quad (9)$$

Equation (8) delineates that the potential contributions of labor and capital to potential output were 1.12 and 0.35, respectively, characterised by increasing returns to scale (1.47).

6 Conclusion

The production function technique was used to determine Jordan's potential output. Apart from the twenty-three percent negative gaps that occurred between 1998 and 2004, the data also showed a partial match between the actual output and future employment. It has been demonstrated that the actual production of the Jordanian economy varies according to the stage of the business cycle, occasionally surpassing or falling short of potential output. This suggests that there may be some flexibility for either tightening or loosening monetary policy in order to encourage development without putting inflationary pressures on growth or restraining growth in the pursuit of price stability. Sources [1] and [23] state that these findings were in line with previous studies.

The results of this study have importance for fiscal policy in identifying periods of excess demand and periods of excess capacity. It enables fiscal policies to be followed to enhance economic development without causing inflation when capacity is excess, i.e. when actual output exceeds potential output.

Restructuring the labour market is necessary to increase productivity as the labour share is double that of capital and excess labour necessitates labour-intensive forms of production.

Acknowledgement

This research is funded by Zarqa University-Jordan.

References

[1] Shaheen, F., Haider, A., Jabeen, S., ul Husnain, M. I. (2015). Estimating Potential Output for Pakistan: A Production Function Approach, British Journal of Economics, Management & Trade, BJEMT, 9(4): 1-13.

[2] Alolayyan, M.N., Alnabelsi, A.B., Bani Salameh, W.N., Al-shanableh, N., Alzyoud, M., Alhalalmeh, M.I., Hunitie, M.F., Al-Hawary, S.I.S., Mohammad, A.A., & Aldaihani, F.M. (2024). "The mediating role of medical service geographical availability between the healthcare service quality and the medical insurance". In: Hannoon, A., and Mahmood, A. (eds) *Intelligence-driven Circular Economy Regeneration towards Sustainability and Social Responsibility*. Studies in computational intelligence. Springer, Cham. Forthcoming.

[3] Azzam, I., Alserhan, A., Mohammad, Y., Shamaileh, N., & Al-Hawary, S. (2023). "Impact of dynamic capabilities on competitive performance: A moderated-mediation model of entrepreneurship orientation and digital leadership". *International Journal of Data and Network Science*, 7(4), 1949-1962.

[4] Abu Hilal, S.I., Al-Hawary, S.I.S., Al-Tit, A.A., Masadeh, M., Alabda, H.E., Almajali, R.M., Kutieshat, R.J., Mohammad, A.A., & Vasudevan, A. (2024). "The Impact of Digital Human Resource Management on Sustainability of Private Universities in Jordan". In: Musleh Al-Sartawi, A.M.A., Ghura, H. (eds) *Artificial Intelligence, Sustainable Technologies, and Business Innovation: Opportunities and Challenges of Digital Transformation*. Studies in computational intelligence. Springer, Cham. Forthcoming.

[5] Jwainat, M.Y., Al-Hawary, S.I.S., Alzyoud, M, Abu Haija, A.A., Alserhan, A.F., Alqahtani, M.M., Mohammad, A.A., Samara, E.I., Al-hawajreh, K.M., & Alhalalmeh, M.I. (2024). "The Impact of Sustainable Supply Chain Management on Entrepreneurial Performance: An Empirical Study at Five-Star Hotels". In: Hannoon, A., and Mahmood, A. (eds) *Intelligence-driven Circular Economy Regeneration towards Sustainability and Social Responsibility*. STUDIES IN COMPUTATIONAL INTELLIGENCE. Springer, Cham. Forthcoming.

[6] Al-Husban, D. A. A. O., Al-Adamat, A. M., Haija, A. A. A., Al Sheyab, H. M., Aldai-hani, F. M. F., Al-Hawary, S. I. S., & Mohammad, A. A. S. (2023). "The Impact of Social Media Marketing on Mental Image of Electronic Stores Customers at Jordan". *In Emerging Trends and Innovation in Business and Finance* (pp. 89-103). Singa-pore: Springer Nature Singapore (2023).

[7] Okun A. M. (1970). The political economy of prosperity. Washington, DC, The Brookings Institution.

[8] Al-Sawaie, K. M. (2017). Economic growth issues: the case of Jordan, Noor Publishing, 1ed., Germany.

[9] Okun, A. M. (1962). Potential GNP: Its Measurement and Significance. In Proceedings of the Business and Economic Statistics Section of the American Statistical Association. Alexandria, VA. American Statistical Association, 89-104.

[10] Duguleana, C., Duguleana, L. (2014). Potential GDP in Romania, Bulletin of the Transilvania University of Braşov, Series V: Economic Sciences, 7(56), 221-228.

[11] Alzyoud, M., Hunitie, M.F., Alka'awneh, S.M., Samara, E.I., Bani Salameh, W.M., Abu Haija, A.A., Al-shanableh, N., Mohammad, A.A., Al-Momani, A., & Al-Hawary, S.I.S. (2024). "Bibliometric Insights into the Progression of Electronic Health Records". In: Hannoon, A., and Mahmood, A. (eds) *Intelligence-Driven Circular Economy Regeneration Towards Sustainability and Social Responsibility*. Studies in computational intelligence. Springer, Cham. Forthcoming (2024).

[12] Alolayyan, M.., Al-Hawary, S. I.., Mohammad, A. A., & Al-Nady, B. A. (2018). "Banking Service Quality Provided by Commercial Banks and Customer Satisfaction: A structural Equation Modelling Approaches". *International Journal of Productivity and Quality Management*, 24(4), 543–565.

[13] Sorin Vlad, S., Balan, I. (2018). Kalman Filters for Estimating the potential GDP, Journal of Applied Computer Science & Mathematics, 12(25), 39-43.

[14] Andrei, A.-M., & Paun, R.-M. (2014). Using Filters and Production Function Method for Estimating Output Gap and Potential Gdp for Romania. Economic Computation & Economic Cybernetics Studies & Research, 48(3), 1-21.

[15] Proietti, T., Musso, A., & Westermann, T. (2007). Estimating potential output and the output gap for the euro area: a model-based production function approach. Empirical Economics, 33(1), 85-113.

[16] Konuki, T. (2010). Estimating Potential Output and the Output Gap in Slovakia. Eastern European Economics, 48(2), 39-55.

[17] Claus, I. (2003). Estimating potential output for New Zealand. Applied Economics, 35(7), 751.

[18] Shahrier, N. A., & Lian, C. L. (2019). Estimating Malaysia's Output Gap: Have We Closed the Gap? Singapore Economic Review, 64(3), 647-674.

[19] Al-Sawaie, K. M. (2017). Determinants of Jordanian trade balance: An ARDL approach, Zarqa Journal for Research and Studies in Humanities, 17(1), 138-149.

[20] Al-Sawaie, K. M. (2020). The Relationship between Unemployment and Economic Growth in Jordan: An

Empirical Study using the ARDL Approach, International Journal of Innovation, Creativity and Change, 14(2), 1068-1083.
[21] Al-Sawaie, K. M. (2020). Macroeconomic Determinants of Bank Credit: Evidence from Jordan, International Journal of Innovation, Creativity and Change, 12(11), 501-510.
[22] Al-Sawaie, K. M. et al. (2023). Jordanian Imports: Income and Price Elasticity of Demand, International Journal of Innovation, Artificial Intelligence (AI) and Finance, Springer Nature Switzerland, 488, 744-752.
[23] Cobb CW, Douglas PH. (1928). A theory of production. American Economic Review, 18(Supplement):139-165.
[24] Hodrick RJ, Prescott EC. (1980). Post-war U.S. Business cycles: An empirical investigation. Carnegie Mellon University, Discussion Paper No. 451.
[25] Adnan S, Bukhari HAS, Khan SU. (2008). Estimating output gap for Pakistan economy: Structural and statistical approaches. MPRA Paper No. 9736 SBP Working Paper Series.

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Appendices

Table 1: Actual Output, Potential Output, and Factors Contributing to Potential Output Growth in Jordan

Years	Actual output	Potential output	Potential labor supply growth	Capital growth	TFP growth	Potential output growth
1990	22.845	22.861	-	-	-	-
1991	22.861	22.912	0.384	67.1	-0.146	0.220
1992	22.995	22.962	0.378	-136.9	-0.137	0.219
1993	23.039	23.011	0.366	148.6	-0.111	0.215
1994	23.088	23.059	0.348	0.0	-0.067	0.209
1995	23.148	23.106	0.323	-22.0	-0.012	0.203
1996	23.168	23.152	0.296	-6.5	0.043	0.199
1997	23.201	23.197	0.269	-73.9	0.094	0.197
1998	23.231	23.243	0.245	-335.1	0.130	0.198
1999	23.264	23.291	0.226	-76.0	0.147	0.204
2000	23.306	23.340	0.214	488.6	0.146	0.212
2001	23.357	23.392	0.210	65.7	0.123	0.222
2002	23.413	23.446	0.214	20.6	0.078	0.233
2003	23.454	23.503	0.226	-12.0	0.019	0.242
2004	23.536	23.562	0.243	-64.1	-0.045	0.249
2005	23.614	23.621	0.263	-182.4	-0.104	0.251
2006	23.692	23.679	0.281	-185.6	-0.153	0.248
2007	23.771	23.736	0.294	-99.7	-0.193	0.239
2008	23.841	23.789	0.302	-123137.1	-0.217	0.225
2009	23.890	23.839	0.309	-20.9	-0.227	0.207
2010	23.913	23.883	0.318	2.9	-0.230	0.187
2011	23.940	23.923	0.332	-32.2	-0.235	0.168
2012	23.964	23.960	0.350	-93.5	-0.247	0.151
2013	23.989	23.992	0.373	-444.9	-0.269	0.137
2014	24.023	24.022	0.394	-72.9	-0.293	0.125
2015	24.047	24.050	0.409	-13.0	-0.311	0.115
2016	24.067	24.076	0.414	863.7	-0.318	0.108
2017	24.091	24.101	0.412	-38.0	-0.318	0.104
2018	24.110	24.126	0.408	-77.5	-0.314	0.101
2019	24.128	24.150	0.404	813.2	-0.311	0.100