The Impact of Foreign Direct Investment on Dynamic Net Social Welfare in Saudi Arabia -A quantifying macroeconomic approach-Time Series Analysis

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Abstract

The paper adopts a theoretical framework that depends on the development of Weitzman (2001)'s theory in dynamic net social welfare and tries to quantify the concept of the net social welfare within a theoretical macroeconomic framework.

The paper tests the impact of the foreign direct investment inflows to Saudi Arabia on the social welfare of Saudi Arabia according to the definition adopted in this paper over time. To do so the paper utilized an intervention time series analysis that gave a clear evidence of the significant positive impact of the foreign direct inflows on the social welfare of Saudi Arabia over time on the macro-level.

The paper is important for policy decision makers in the country to adopt more openness policies to enhance social welfare over time.

Keywords: Saudi Arabia, National Accounts, Sustainable Development, Dynamic Social Welfare, Dynamic Macroeconomic Analysis, Quantitative Macro-Analysis, Foreign Direct Investment, Consumers' Surplus.

Introduction

The paper adopts a theoretical framework that depends on the development of Weitzman (2001)'s theory in dynamic net social welfare and tries to quantify the concept of the net social welfare within a theoretical macroeconomic framework. To do so; a national income approach has been adopted to represent the theoretical concept of the consumer's surplus and welfare measurement in microeconomics. The paper also tests empirically the impact of the foreign direct investment inflows to Saudi Arabia on its social welfare over time. To do so the paper adopted a linear intervention time series analysis in order to capture the dynamic effect of the foreign direct inflows to the country over time.

The analysis show a clear evidence of positive – non-harming – effect on the social welfare of the country which can add to the literature of foreign investment and openness a new supportive evidence of adopting more open policies in the economy. From the other hand; the paper presents a new quantifying approach to test the dynamic social welfare in general. The paper does not aim to review previous literature in related topics. It rather presents an evidence to help policy takers regarding adopting open policies that attract more secure foreign investment to the economy.

The paper is structured after the introduction as follows: section II presents the theoretical discussion, section III presents the time series data used for the analysis and time span. Section IV presents the empirical analysis and its result. Section V presents the summary, the conclusion, and the implications.

Theoretical Framework

The proposed research adopts Li & Lofgren (2009) definition of net social welfare that depends on Weitzman (2001)'s development of dynamic welfare comparison theory.[i]

According to Weitzman (2001), "the difference in intertemporal welfare between two points in time of the same economy can be exactly measured by the difference in real national income plus a consumer surplus term." Yet, the current proposed research utilizes a different methodology to address the impact of the foreign direct investment in Saudi Arabia on the dynamic net social welfare of the country.

The analysis will be managed within a dynamic open macro-economy framework.

Analytically speaking; it is well known that consumer's surplus can be measured by the difference between what the consumer is willing to pay and what he/she is actually paying. From a macro-economic perspective; we can take the CPI as a proxy of what the consumers are actually paying in the economy while the entire area under the aggregate demand is what the consumers are willing to pay. In different words; the consumer surplus is theoretically feasible within the area located under the demand and above the price. If we consider on the macro-level that the entire demand is the gross nominal private consumption, then; the consumer surplus on the macro-level can be determined mathematically as follows:

The consumer surplus = ln (nominal gross consumption) – ln (CPI); this equals the real gross consumption. Therefore; the real gross consumption in the economy can be considered a proxy of the consumer surplus.

Recalling Weitzman's statement mentioned above; then;

The intertemporal welfare between two points in time t & t-1 = (The real national income + the real gross consumption) $_t$ – (the real national income + the real gross consumption)$_{t-1}$

The paper tests then the inflows of foreign direct investment to Saudi Arabia on the social welfare over time according to the above definition.

The variability of the output of the above equation could be an enough measure of the risk itself on the macro level since it includes implicitly the change of the status of the economy over time.

Data

Time series data of the inflows of foreign direct investment to Saudi Arabia in millions of dollars, time series data of the foreign exchange rate of Saudi Rial, time series data of the nominal gross national income in billions of Rials, time series data of gross household consumption in billions of Rials, time series data of the CPI of Saudi Arabia and the GDP deflator of Saudi Arabia are collected from the IMF: International Financial Statistics Yearbook

(2010). Raw data are modified in a consistent manner. Figures A.1 and A.2 in the appendix consecutively show the time path of the intertemporal social welfare over time after modifying its components depending on the definition discussed in the above section and the time path of the foreign investment inflows to Saudi Arabia in addition to their descriptive statistics.

The Empirical Analysis

To find the impact of the FDI inflows to Saudi Arabia on its dynamic social welfare according to the definition adopted in this paper; a linear intervention model is employed in this paper. The model is given by the following equation (equation 1):

$$WELFARE_t = a_0 + A(L)WELFARE_{t-1} + c_0 \, REALFDI_t + B(L) \, \varepsilon_{t,} \qquad (1)$$

Where, *WEKFARE* represents the social welfare in Saudi Arabia *REALFDI* is an intervention variable that represents the real foreign direct inflows to Saudi Arabia, ε_t is a white noise disturbance term, *t* refers to time, and $A(L) \, [1 + a_1L + a_2L^2 + ... + a_qL^q]$ and $B(L) \, [1 + b_1L + b_2L^2 + ...+ b_qL^q]$ are polynomials in lag operator *L*.

Prior to estimating the parameters in equation 1, the time series of the dependent variable; *WELFARE* properties is checked. The Philips Perron unit root test in level by including in test equation both trend and intercept is used for testing the stationary of the data series of *WELFARE*. No evidence of unit root test was found. The series of *WELFARE* has been also checked for the presence of autoregressive conditional heteroskedasticity (ARCH) effects by using the correlegram test. An evidence of conditional heteroskedasticity in the series of *WELFARE* has been found at the first 3-lags. Therefore; the ARCH method is used for the regression. The below equation (2) shows the results of the best-fit intervention model that has the lowest AIC and SC and satisfies all diagnostic checks, with 27 observations (1981 - 2007). The series starts from 1981 to include all periods of joining the GCC and ends at 2007 to exclude the instability happened after the global financial crisis started in the last quarter of 2007. All alternatives of ARMA models have been checked until ARMA (3, 3) with and without restricted orders. The result is illustrated in table 1 below:

Table 1:
The results of the best fit intervention model specified in equation 1 above. The dependent variable is *WELFARE*. Method: ML - ARCH (Marquardt) - Normal distribution. Sample: 1981 – 2007. Sample (adjusted): 1983 2007. Included observations are 25 after adjustments. Convergence achieved after 70 iterations. Equation used*: GARCH = C(5) + C(6)*RESID(-1)^2 + C(7)*GARCH(-1)*. Residual test by using Q-statistics at 12-lags show no evidence of autocorrelation.

	Coefficient	Std. Error	Z-Statistic	Prob.
C	25.85788	7.766045	3.329607	0.0009
REALFDI	1.037433	0.312967	3.314835	0.0009
AR(3)	0.477350	0.195452	2.442289	0.0146
MA(3)	-0.981826	0.019494	-50.36603	0.0000
AIC	9.513271			
SC	9.854556			
Adj R^2	0.396244			
Prob. F-Statistic	0.015526			

From table 1 we can conclude that the real foreign direct investment to Saudi Arabia has a significant positive effect on its social welfare over time. Figure A.3 in the appendix illustrates the difference between the raw time path of *WELFARE* and the modified time path of *WELFARE that is given the notation (WELFAREF)* after taking into consideration the effect of the *REALFDI* on its series.

It is obvious from figure A.3 in the appendix and its attached descriptive statistics that the variability is relatively smoothed by taking the effect of the *REALFDI* into account. The plausible interpretation could be that the inflows have a real positive –not harming- impact on the social welfare of Saudi Arabia.

**Summary, Conclusion, and Implications**
This paper adopted a theoretical macroeconomic concept of the dynamic social welfare developed by Weitzman (2001)'s theory in dynamic net social welfare and modifying it depending on the concept of consumer's surplus in microeconomics. In order to figure out the impact of the foreign direct investment inflows to Saudi Arabia; the paper utilized a linear intervention time series model that show a clear evidence of a positive significant effect of the foreign direct inflows to the country on its social welfare over time. The paper can give a clear evidence to policy makers in the country to encourage more inflows of secure foreign

investment to the country. However, if microeconomic – panel data are available; the paper would reach to more evidences but microeconomic panel data for each sector was difficult to be available to the author.

References

Barro, Mankiw, G., and Sala-i-Martin, X. (1995), "Capital mobility in neoclassical models of growth", *The American Economic Review*, 85 (1), 103-115.

Barro, R.J., Sala-i-Martin, X. (2003), Economic growth, MIT press.

Enders, W. (1995), Applied econometric time series, (Wiley, NJ).

Enders, W., Sandler, T., and. Cauly, J. (1990), "Assessing the impact of terrorist thwarting policies: an intervention time series approach", *Defence Economics* 2, 1–18.

Fomby, T.B., Hayes, K.J. (1990), "An intervention analysis of the war on poverty: poverty's persistence and political-business cycle implications", *Journal of Econometrics* 43, 197–212.

GATT (1993), *Trade Policy Review*, South Africa, Sept., 21-23.

Hufbauer, G.H., Schott, J. and Elliott, K.A. (1990), "Economic sanctions reconsidered: History and current policy", (Institute for International Economics, Washington DC).

Lloyd T.A. (1993), "Outliers in agriculture: An intervention analysis of agricultural land values", *Journal of Agricultural Economics*, 44, 443-55.

Martin L. Weitzman (1976), The Quarterly Journal of Economics, 90 (1): 156 – 162.

Mohamed, Ghada. (2007), "Does the 1986-1991 financial embargoes affect the long run economic growth rate of South Africa?-Dynamic analysis', *International Journal of Business & Economics*, 6 (1), 63-73.

Mohamed, Ghada. (2012) & Manuchehr Irandoust (2012), Modeling of financial embargo on South Africa: theory and application, Society of Policy Modeling, ECONMODELS.Com.

Mulligan, C, Sala-i-Martin, X. (1991), "A note on the time-elimination method for solving recursive dynamic economic models", NBER Working Paper NO. 116, Cambridge, Massachusetts.

Appendix
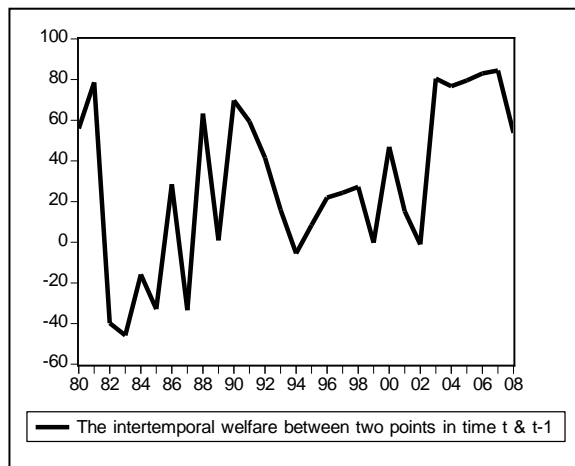
	WELFARE
Mean	29.00140
Median	27.19759
Maximum	84.45678
Minimum	-45.78639
Std. Dev.	40.60139
Skewness	-0.239936
Kurtosis	1.907541
Jarque-Bera	1.720357
Probability	0.423087

Figure 1: The time path of the intertemporal welfare of Saudi Arabia (in real billions of Rials) and its descriptive statistics.
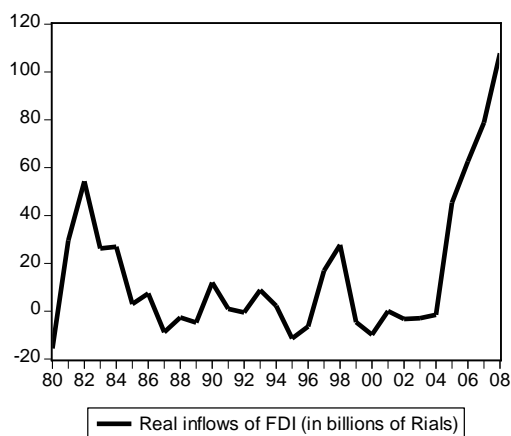
	REALFDI
Mean	15.14238
Median	2.246996
Maximum	107.8260
Minimum	-15.57164
Std. Dev.	29.53115
Skewness	1.577892
Kurtosis	4.953603
Jarque-Bera	16.64545
Probability	0.000243

Figure 2: The time path of the inflows of foreign direct investment to Saudi Arabia (in real billions of Rials) and its descriptive statistics.
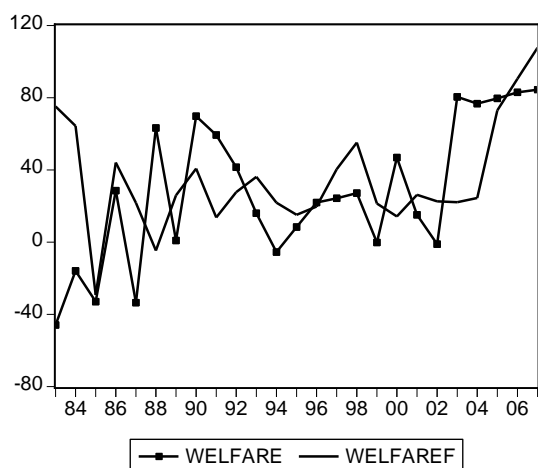
	WELFARE	*WELFAREF*
Mean	27.70267	34.81648
Median	24.28869	25.94602
Maximum	84.45678	107.7064
Minimum	-45.78639	-29.22310
Std. Dev.	39.57705	29.72874
Skewness	-0.087049	0.566561
Kurtosis	1.942377	3.530272
Jarque-Bera	1.196746	1.630369
Probability	0.549705	0.442558

Figure 3: The time path of both *WELFARE* and *WELFAREF* in addition to their descriptive statistics.

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[i] Martin L. Weitzman (March, 2001), A contribution to the theory of Welfare Accounting, the Scandinavian Journal of Economics, Volume 103, Issue 1, Pages 1-23.