جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Deanship of Scientific Research

RESEARCH PROPOSAL

Substitutability between Government and Private Consumption in the GCC Countries: An Econometric Investigation

الاستبدالية بين الاستهلاك الحكومي والخاص في دول مجلس التعاون الخليجي : بحث في الاقتصاد القياسي

Submitted under

Fast Track Research Grant

Principal Investigator, ***Dr. Khaled Albinali, Chairman***

Department of Finance and Economics

Date: 06/03/2010

PROJECT INFORMATION

<table>
<tr><td>Project Title</td><td colspan="5">Substitutability between Government and Private Consumption in the GCC Countries: An Econometric Investigation</td></tr>
<tr><td>Project Type</td><td colspan="5">☐ Basic ☐√ Applied ☐Both</td></tr>
<tr><td>Proposed Total Budget</td><td colspan="5">(max. 100,000) Saudi Riyals 71,000.00</td></tr>
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<tr><td>Proposed Starting Date</td><td colspan="2">04 / 2010</td><td colspan="2">Ending Date</td><td>11/ 2011</td></tr>
<tr><td rowspan="20">Research Team</td><td colspan="5">Senior Personnel</td></tr>
<tr><td>No.</td><td>Name / Rank</td><td>Department</td><td>Role</td><td>Signature</td></tr>
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<tr><td>Is this Proposal being submitted under SABIC or Fast Track?</td><td colspan="3">☐ SABIC</td><td colspan="2">√ Fast Track</td></tr>
</table>

UNDERTAKING OF THE RESEARCH TEAM

The research team undertakes that:

1. This research proposal has not been submitted, either in part, or in full, or under different title to any funding agencies including KACST, Research Institute, Academic Development Centre, or any outside agency.

2. We stand to lose a chance to get financial support or any related action from the University if, at a later date, it is made known that a similar proposal submitted by us to another agency for funding.

3. We declare that whatever we have stated is true to the best of our knowledge and understanding.

4. We will inform the Deanship of Scientific Research if the PI decides to leave KFUPM for more than one academic semester at least one academic semester before his leave.

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SUMMARY

In this paper, we investigate empirically the extent to which government consumption substitutes for private consumption in the six GCC countries. We use a simple macroeconomic model that establishes the relationship between government and private consumption following the seminal work by Barro(1981). We show that the equilibrium relationship that is delivered by the model has direct econometric interpretation which formally defines a co-integrating relationship. We apply various panel and country specific time series co-integrating technique to estimate the long run elasticity of substitution between government and private consumption. Our estimate will shed light on the substitutability between government and private consumption which is very important for the success of several macroeconomic fiscal policy.

المُلخص:

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1.0 INTRODUCTION

An important issue in the design of fiscal policy is the substitutability between government and private consumption. If the private sector derives utility from government–provided goods and services and regards private and government consumption as close substitutes, an increase in government consumption will be offset by a corresponding decrease in private consumption, rendering the size of the fiscal multiplier relatively small and even potentially negative. On the other hand, if private and government consumption are complements, an expansionary fiscal policy will be relatively effective in stimulating aggregate demand as private consumption will reinforce the initial fiscal impulse. While it is easy to give examples of individual private and government goods that are substitutes or complements, it is an empirical question whether aggregate private and government consumption are substitutes or complements for a particular economy during certain period. The purpose of this paper is to empirically study the substitutability issue for six GCC countries; Bahrain, Kuwait, Oman, Qatar, UAE and Saudi Arabia.

2.0 PROJECT OBJECTIVES

The objective of this paper is to investigate empirically the extent to which government consumption substitutes for private consumption in the six GCC countries. This is the first time such an attempt is made. We will use a simple macroeconomic model that establishes the relationship between government and private consumption following the seminal work by Barro(1981). We will show that the equilibrium relationship that is delivered by the model has direct econometric interpretation which formally defines a co-integrating relationship. We will apply various panel and country specific time series co-integrating technique to estimate the long run elasticity of substitution between government and private consumption. Our estimate will shed light on the substitutability between government and private consumption which is very important for the success of several of macroeconomic fiscal policy.

3.0 LITERATURE REVIEW

Traditional macroeconomic models assume that government consumption works through its impact on private consumption through wealth effect or interest rate effect. Private consumption is crowded out either because the consumers may feel poorer as a result of negative wealth effect or they may be induced to postpone consumption in response to deficit–financed government spending. Bailey (1971) and Barro (1981) first suggest incorporating government consumption into the representative agent decision problem, making the public sector part of the general equilibrium system. The idea is that many government goods are to some extent substitutes for private consumption goods. Moreover, government purchases may also serve as useful inputs to the private production function so that government consumption can be productive. This is in contrast to the traditional models in which government consumption are regarded as purely wasteful or unrelated to private consumption or production. In recent theoretical literature, the interaction between government and private consumption has been assigned a central role in the study of fiscal policy, in both the neoclassical real business cycle fashion (e.g. Aiyagari et al. (1992) and Baxter and King (1993)) and the new Keynesian fashion with monopolistic competition, increasing returns, and nominal rigidities (e.g. Devereux et al. (1996) and Ganelli (2003)). However, depending on their assumptions about market structure and technology, these models can predict totally different reaction of private consumption in response to government spending shocks.

On the empirical front, a large literature has been developed to estimate the relationship between government and private consumption. Kormendi (1983) and Aschauer (1985) are representative of the earlier approach that relies on estimating a consumption function. Karras (1994), Ni (1995), Evans and Karras (1996), and Fiorito and Kollintzas (2004) are some of the more recent contributions along this approach. Ni's paper also provides a useful survey of the literature. The empirical analysis in this paper follows Amano and Wirjanto (1997, 1998) who make use of the cointegration approach of Ogaki (1992) and Ogaki and Park (1997) to estimate the preference parameter that governs the relationship between government and private consumption. The idea is to exploit the long–run restriction imposed by the intraperiod first–order condition that characterizes the optimal choice of private and government consumption. Ho (2001), Chiu (2001), and Okubo (2003) are some recent contributions along the same line.

The paper, however, that we will follow most closely is Kwan (2006). His paper investigated empirically the extent to which government consumption substitutes for private consumption in nine East Asia countries. He used conintegration method to estimate the elasticity of substitution for all the nine East Asian countries.

4.0 Organization of the Paper

The paper is organized in the following; Section 2 presents the empirical model in detail. We provide a structural interpretation to the cointegrating regression model by deriving it as an equilibrium condition. Section 3 provides a brief description of government expenditures in the GCC countries. The data and empirical results are presented in section 4. Section 5 concludes.

The empirical work in this paper centers around a cointegrating regression that relates the logarithm of private and government consumption ratio, $\frac{C_t}{G_t}$, to the logarithm of their relative price $\frac{P_t^g}{P_t^c}$.

$$\ln(\frac{C_t}{G_t}) = \alpha + \beta \ln\left(\frac{P_t^g}{P_t^c}\right) + u_t \tag{1}$$

where $\ln(\frac{C_t}{G_t})$ and $\ln\left(\frac{P_t^g}{P_t^c}\right)$ are both difference–stationary I(1) processes, and u_t is a stationary I(0) process. Formal statistical evidence for the cointegration property will be provided below. The slope parameter β is the elasticity of substitution between private and government consumption. A positive (negative)β means that the two goods are substitutes (complements). One attractive feature of cointegrating regression is that the slope parameters can be estimated consistently without the assumption that the regressors are econometrically exogenous. In eq. (1), for example,b can still be estimated consistently even though there may be stationary omitted variables or measurement errors. So far eq. (1) is treated as a pure statistical relationship between the consumption ratio of private and government goods and their relative prices. It is possible to provide the equation a structural interpretation by deriving it as an equilibrium condition, following the ideas of Ogaki (1992), Ogaki and Park (1997), and Ogaki and Reinhart (1998). Assume that the representative consumer values two goods, private and government, according to an expected life–time utility function subject to stationary preference shocks:

$$U = E_t\left[\sum_{j=0}^{\infty} \delta^j u\left(C^*_{t+j}\right)\right] \tag{2}$$

where:

$$C_t^* = \left[\phi \varepsilon_t C_t^{1-(\frac{1}{\sigma})} + (1-\phi) v_t G_t^{1-(\frac{1}{\sigma})}\right]^{\frac{1}{1-(\frac{1}{\sigma})}} \tag{3}$$

Here (ε_t, v_t) are random preference shocks which are assumed to be strictly stationary, have unit mean and finite variances. The stationarity assumption amounts to say preferences are stable in the long run. The period utility function is assumed to possess the usual properties $u^{'} > 0$ and $u^{''} < 0$. (ϕ, σ) are preference parameters which characterize the representative agent's utility function: ϕ is the relative weight assigned to private goods and σ is the substitution parameter which measures the curvature of the indifference curves. Given time–separability of the utility function, the optimal consumption bundle will have to satisfy the equality between marginal rate of substitution and relative price:

$$\frac{\frac{\partial U}{\partial G}}{\frac{\partial U}{\partial C}} = \frac{v_t(1-\phi)G_t^{\frac{-1}{\sigma}}}{\varepsilon_t \phi C_t^{\frac{-1}{\sigma}}} = \frac{P_t^g}{P_t^c} \tag{4}$$

Taking logarithm and rearranging yields:

$$\ln(\frac{C_t}{G_t}) = -\sigma \ln\left[\frac{(1-\phi)}{\phi}\right] + \sigma \ln(\frac{P_t^g}{P_t^c}) - \sigma \ln(\frac{v_t}{\varepsilon_t}) \tag{5}$$

Stable preferences implies that the residual term, $-\sigma \ln(\frac{v_t}{\varepsilon_t})$ is stationary and hence eq. (5) should be a cointegrating regression, provided that log consumption ratio, $\ln(\frac{C_t}{G_t})$and log price ratio, $\ln(\frac{P_t^g}{P_t^c})$ are both I(1) processes. In other words, the stable preferences assumption, together with the consumer optimality condition in eq. (4), imposes a cointegration restriction on the movements of the log consumption ratio and the log price ratio series. Eq. (5) provides a structural interpretation to eq. (1) which can be regarded as the reduced form equation with parameters and residuals related to their structural counterpart via the relationships:

$$\alpha = -\sigma \ln\left[\frac{(1-\phi)}{\phi}\right],\ \beta = \sigma,\ u_t = -\sigma \ln(\frac{v_t}{\varepsilon_t}) \tag{6}$$

Notice that eq. (5) is a theoretical demand equation, whereas eq. (1) is an empirical equation describing the equilibrium quantities and prices. Just like the classical supply–and–demand simultaneous equation model, interpreting eq. (1) as the demand equation requires identification assumption. In general, to identify the demand equation, we need variability from the supply side and the demand side should be relatively stable. Since the supply side has to do with production which is subject to technological improvement, it is reasonable to expect the quantity supplied series should be highly persistent which can be modeled as a stochastic trend. The demand side, on the other hand, has to do with taste and it is reasonable to expect preference shocks are relatively stable in comparison with technological shocks. In the context of demand analysis, Ogaki (1992) has shown formally that the assumptions of stable preferences and a stochastic trend in the quantity supplied are sufficient to ensure identification of a cointegrating demand equation like eq. (1).

In the theoretical analyses of Bailey (1971) and Barro (1981), followed by the empirical work of Kormendi (1983), Aschauer (1985), Evans and Karras (1996), among many others, the effective consumption is specified as a weighted average of private and government consumption:

$$C_t^* = C_t + \theta G_t \tag{7}$$

In this setup each unit of government goods is equivalent to units of private goods, irrespective of the current consumption level of the two goods. In other words, the indifference curves for the two goods are linear which corresponds to the extreme case of $\sigma = +\infty$ in the CES aggregator function in eq. (3). Clearly this is an empirically restrictive assumption, albeit a convenient one for analytical tractability.

Proof. Government expenditures in the GCC Countries

To be Done later

Estimation

To be done later.

Robustness Check

To be done later. ■

4.1 Approach, Tasks and Phases

The theme of the study is shaped generally in this proposal. There are three major steps that need to be undertaken. First, we need to develop the model and derive all the necessary theoretical results. Second, we need to collect data on six GCC countries. Third, we need to carry out various con-integration tests, both at the panel and the time series level. The final shape of the study may take more than 18 months, but the core task should be done according to the following schedule:

Table 1: APPROACH UTILIZED FOR ACHIEVING OBJECTIVES

TASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Model Development	■	■	■	■														
Data Collection and Compilation					■	■	■	■										
Estimation									■	■	■	■	■					
Robustness Check														■	■			
Compare Results and write the Paper																■	■	■

Research tasks and activities should be divided into groups of assignments, listed in logical sequence and linked with the project objectives to be achieved (Table 2).

Table 2: MAPPING OF PHASES AND TASKS TO ACHIEVE OBJECTIVES

Objectives	Phases	Tasks
Develop the Model	1	Write down the specific model that will be used for estimation. Check for alternative modelling technique
Data Collection	2	Collect country level data. If the data is not available for public use, buy it.
Data Compilation	3	Clean the data. Format the data for this project and finally compile it in format suitable for desired software package.
Estimation	4	Use all available modern estimation technique.
Robustness Check	5	Assess the robustness of the panel and time series estimation results for possible variation in the technique and model specification
Compare Results and write the Paper	6	Analyze and compare results with existing works. Finally write the paper

4.2 Research Methodology

The methodology would be consistent with research objectives. First, we will use a simple macroeconomic model that establishes the relationship between government and private consumption following the seminal work by Barro(1981). We will show that the equilibrium relationship that is delivered by the model has direct econometric interpretation which formally defines a co-integrating relationship. Second, we will apply various panel and country specific time series co-integrating technique to estimate the long run elasticity of substitution between government and private consumption. Third, we will assess the robustness of our results by comparing them against alternative modelling strategy as well as other available data. Fourth, we will compare our results with other similar existing works that were done to other regions of the world.

4.3 Management Plan

The undergraduate research assistant Syed Mustafa will collect the data. Technician Mohammad Mobashar Hossain will then help us to clean and compile the data. The Junior Researcher Dr. Muhammad Saifur Rahman will conduct the empirical analysis. Principal investigator Dr. Khaled Albinali and Junior Researcher Dr. Muhammad Saifur Rahman will then the evaluate the results and the write the report with involvement of 100% of academic year and summer.

4.4 Project Deliverables

The objective of this paper is to investigate empirically the extent to which government consumption substitutes for private consumption in the six GCC countries. We use a simple macroeconomic model that establishes the relationship between government and private consumption following the seminal work by Barro(1981). We show that the equilibrium relationship that is delivered by the model has direct econometric interpretation which formally defines a co-integrating relationship. We apply various panel and country specific time series co-integrating technique to estimate the long run elasticity of substitution between government and private consumption. Below, we highlight a road map for my research.

Table 3: PROJECT WORK PLAN

PHASES & TASKS	INVOLVEMENT DURATION						6						12						18
PHASE I	Participation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Model Development	1. Develop the Macroeconomic Model. 2. cross check the correctness of the Model																		
PHASE 2																			
Task 2.1 **Data Collection**	1. Check for the availability of the data 2. If necessary, obtain special permission or provide financial resources to obtain the data																		
Task 2.2 **Data Clean**	1. Clean the data for possible mistakes. 2. check for structural consistency of the data																		
Task 2.3: **Data Compilation**	1. Record the data to use it with particular computer package(Stata, Matlab and Fotran) 2. Derive basic descriptive statistics to investigate the validity of the data set. Also compile data for submission to the committee in any acceptable form.																		
PHASE 3																			
Task 3.1 **Estimation for Panel Level Data**	Apply various panel co-integration techniques to estimate the elasticity of substitution.																		

Task 3.2 **Estimation for State Level Data**	Apply various kinds of co-integration technique at the country level time series data											■	■	■					
Task 3.3 **Robustness Check**	Check the robustness of the estimation results against alternative modelling specifications and data sources														■	■			
PHASE 4																			
Task 4.1 **Compare Results**	1. Compare results with other existing works																■		
Task 4.2 **Write the Paper**	1. Write the paper. 2. Proof read it. 3. Submit the paper for international conference presentations 4. Submit the paper for possible journal publication																	■	■

5.0 PROJECT EXECUTION

5.1 Requested Resources

We will need to buy an External Hard Drive which will be necessary to collect, carry and compile data. We will also need a scanner and a printer for our research work.

5.2 Proposed Budget

Proposed budget for my research SR 71,000.00

5.3 Equipment Justification

We will also need to buy an External Hard Drive which will be necessary to collect, carry and compile data. We will also need a scanner and a printer for our research work.

Table 4: PROPOSED BUDGET

SEE GUIDELINES BEFORE COMPLETING | SUMMARY PROPOSED BUDGET | *(in Saudi Riyals)*

ITEM	CATEGORY	NO.	COMPENSATION	INVOLVEMENT MONTHS	INVOLVEMENT BUDGET	TOTAL	DESCRIPTION
PROJECT TITLE		**What Determines Specific Schooling Decisions in the USA? A Dynamic General Equilibrium Analysis**					
DURATION		(max. 18) 18 MONTHS					
MANPOWER	CONSULTANTS		-				
	PRINCIPAL INVESTIGATOR		1200 / month	18	18 X 1200	21600.00	
	CO-INVESTIGATOR 1		1000 / month	18	18x1000	18000.00	
	CO-INVESTIGATOR 2		1000 / month				
	CO-INVESTIGATOR 3		1000 / month				
	CO-INVESTIGATOR 4		1000 / month				
	PHD STUDENTS		800 / month				
	MS STUDENTS		600 / month				
	UNDERGRADUATE STUDENTS		400 / month	18	18x400	7200.00	
	TECHNICIANS		400 / month	8	8x400	3200.0	
	SECRETARIAL- CLERICAL		1,000 / year				
	OTHER		Two Month of Summer Compensation				
			TOTAL SALARIES			50000.00	MAX. 50,000
EQUIPMENT & MATERIAL	PC / LAPTOP (Standard)	6,000					
	WORK STATION / SPECIAL LAPTOP	-					
	PRINTER (Standard Laser)	1,500					
	SCANNER (Standard)	500					
	SOFTWARE	- Fortran					
	HARDWARE	- Portable Hard Drive				2000.00	
	EQUIPMENT	-					
	MATERIALS	-					
	CHEMICALS	-					
	SERVICES	- Possible Purchase of Data				4000.00	
			ITEM TOTAL			14000.00	
TRAVEL	INTL. CONFERENCES	-					
	PER DIEM LOCAL	-					
	PER DIEM OVERSEAS	-					
			ITEM TOTAL				
OTHERS	PUBLICATIONS	3,000					
	BOOKS & REFERENCES	2,500					
	STATIONARY	1,500					
			ITEM TOTAL			7000.0	
GRAND TOTAL						71,000.00	

6.0 REFERENCES

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7.0 RESUME

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EDUCATION

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- **Dissertation Committee:** Eric M. Leeper (Chair), Gerhard Glomm, Michael Kaganovich, Brian Peterson

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Thesis Title: Structural Adjustment in Bangladesh: An Analytical Overview
B.S.S in Economics, University of Dhaka, Bangladesh 1997
First Class Second Position

WORKING PAPERS

- (**Job Market Paper**) "Government Spending and Consumption in the Presence of Borrowing Constraints"
- "Should Dynamic Scoring be Done with Heterogeneous Agent-Based Models? Challenging the Conventional Wisdom," CAEPR Working Paper No. 2008-024
  (Submitted to *Journal of Public Economics*)
- "Demographic Uncertainty and Welfare in a Life-cycle Model under Alternative Public Pension Systems," CAEPR Working Paper No. 2008-025
  (Submitted to *European Economic Review*)
- "Strategic Quality Choice and Charter School: Some Comments," Mimeo, Indiana University
  (Submitted to *Journal of Public Economics*)

RESEARCH IN PROGRESS

- "Government Spending and Consumption in the Presence of Borrowing Constraints: An Estimation of the DSGE Model using Bayesian Technique"
- "Who Bears the Public Debt? Understanding the Distributional Aspect of Government Debt Burden using a Heterogeneous Agent Model"
- "Robustifying the Generalized Taylor Rule: Understanding the Role of Regime Spillovers"
- "The Effect of Tax Policy under Alternative Fiscal Financing Schemes on Income Distribution and Growth: A Savers-Spenders Model Perspective"
- "What Determines Specific Schooling Decisions? Linking Theory with Data"

PUBLICATIONS

- "Medium-Term Outlook for Rice Production and Demand: Projections to 2020," with Paul Dorosh and Quazi Shahabuddin, IFPRI-FMRSP Working Paper No. 36, June 2001 (Reprinted as "Price Responsiveness of Food Grain Supply in Bangladesh and Projections 2020," The Bangladesh Development Studies, Volume XXVIII, March-June 2002, Nos. 1 & 2)
- "Bangladesh-EU Development Relationship: Major Features and Emerging Issues," with Mustafizur Rahman, CPD Occasional Paper Series, No. 5, Centre for Policy Dialogue, June 2000
- "Ageing in Bangladesh: Issues and Challenges," with Jakir Hossain, CPD Dialogue Reports No. 23, Centre for Policy Dialogue, May 2000

RESEARCH EXPERIENCE

Fall 2004 - Spring 2005	Research Assistant to Professor Gerhard Glomm, Department of Economics, Indiana University, Bloomington. Solving models, compilation of data and running simulations; data support.
Fall 2004	Research Assistant to Professor Eric Leeper, Department of Economics, Indiana University, Bloomington.
Summer 2002	Research Assistant to Professor John Geweke, Department of Economics, University of Iowa.
June 2000 - June 2001	Research Analyst, International Food Policy Research Institute (IFPRI)-FMRSP Project, Dhaka, Bangladesh. Model simulation, forecasting and data support, writing research papers.
January 2000 - June 2000	Research Associate, Centre for Policy Dialogue (CPD), Dhaka, Bangladesh. Writing dialogue reports, occasional papers, model simulation, forecasting and data support.
June 1998 - December 1998	Research Assistant, Dr. Nazmul Ehsan Fatmi, Professor, Department of Economics, University of Dhaka, Dhaka, Bangladesh. Designing survey for a "Socio-Economic Survey" for BEXIMCO group of industries (the largest group of industries in Bangladesh), conducting, compiling and publishing the survey results.

CONFERENCE AND SEMINAR PRESENTATIONS

- Midwest Macroeconomics Conference, May 2009
- 17th Annual Symposium of the Society for Non-linear Dynamics and Econometrics held at the Federal Reserve Bank of Atlanta, Georgia, April 16&17, 2009.
- Eighth Annual Missouri Economics Conference, University of Missouri-Columbia, March 2008
- Jordan River Conference, Indiana University, Bloomington, April 2008
- Selected for presentation at the Conference on Institutional and Social Dynamics of Growth and Distribution, Lucca, Italy, December 2007
- Selected for presentation at the First International Conference on Growth, Development and Poverty, Kathmandu, Nepal, December 2007
- Second Economics Graduate Students' Conference, Washington University at St. Louis, September 2007

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