Working Paper 2015-14

The Effects of Fiscal Expenditure on Employment and Welfare

– A CGE Analysis

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The Effects of Fiscal Expenditure on Employment and Welfare: A CGE Analysis

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ISBN: 978-89-6827-312-4 93330

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Summary

1. Background and objectives

□ In Korea today, the fertility rate is plummeting and the population is aging at an unprecedented rate.

○ At the same time, protracted low economic growth has steadily decreased Korean industries' capability to create jobs, which has increased fears of a possible long-term recession.

□ The household structure in Korea is rapidly changing due to an increase in the number of single-person households.

○ At the same time, income inequality is growing and rapid population aging is causing an increase in social welfare spending.

○ Rapid increases in social welfare expenditure will have a dramatic impact on fiscal allocation policies in Korea in the future.

○ Thus, there is a critical need to predict the likely effects of fiscal spending programs so that policy matters can be better prioritized.

□ The objectives of this study are as follows.

○ First, develop a computable general equilibrium (CGE) model with which to analyze the effects of fiscal expenditure on economic growth, employment, and income distribution.

○ Second, use our CGE model to predict the likely impact of various fiscal spending programs on employment- and welfare-friendly policy goals.

○ Third, identify the appropriate policy priorities based on the results of CGE analysis that will ensure a maximize efficiency of fiscal resource allocation.

2. Main findings

1) Overview

□ In general, a CGE model entails more variables than a simple formula. In order to get the solution of this model, we treated some of its variables as additional exogenous variables.

○ For this study, we chose to use the basic closure of the ORANI model, setting variables such as technological progress, foreign exchange rates, real government balance, real wage, and capital stock as exogenous variables.

□ We focused our analysis on the ripple effects of Korea's representative fiscal spending programs—those for public administration and defense, education, healthcare, and social welfare.

○ In particular, we analyzed the elasticity of fiscal expenditure and fiscal multipliers.

- The elasticity of fiscal expenditure is a measure of how much the endogenous variables (gross domestic product and employment level) increase in response to each one-percent increase in a given fiscal spending program.
- A fiscal multiplier is a measure of how much an endogenous variable increases in response to each unit increase in a given fiscal spending item.

□ Table A lists the amounts the government spent on the representative spending programs, as well as the likely increases in those amounts that would occur in response to an additional KRW 1 trillion, as detailed in the Input-Output Table of 2009.

〈Table A〉 Increases in Government Spending by Additional KRW 1 Trillion

(Units: KRW 1 trillion, %)

Sector number	Sector	Government consumption and spending (KRW 1 tn.)	Increase in response to additional KRW 1 tn. spending (%)
25	Public administration and defense	91.5	1.1%
26	Education	37.0	2.7%
27	Healthcare	33.8	3.0%
28	Social welfare	2.4	42.5%
	Total	170.3	

2) Effects on employment

□ In examining the effects of additional fiscal expenditure on employment, we found that the additional spending of KRW 1 trillion on public administration and national expenditure, for example, increases the number of persons employed by approximately 20,500 (0.1403 percent).

○ Additional spending of KRW 1 trillion on education, healthcare, and social welfare each similarly increases the number of persons employed by 9,500 (0.067 percent), 5,600 (0.0392 percent), and 8,800 (0.0620 percent), respectively.

○ The employment multipliers were 20.45 for public administration and defense, 9.53 for education, 5.58 for healthcare, and 8.82 for social welfare.

○ In other words, the extent of job-creating benefits from additional fiscal expenditure by sector will occur in the following order, from greatest to least: public administration and defense, education, social welfare, and healthcare.

○ Additional fiscal expenditure on healthcare has the least job-creating effect, most likely because the sector is capital-intensive.

〈Table B〉 Sector-by-Sector Comparison of Employment Elasticity of Fiscal Expenditure

(Units: KRW 1 trillion, 1,000 persons, p)

	Initial value	Change	Change rate	Elasticity	Employment multiplier
Public administration and defense	91.5	1.0	1.1000%	0.1307	20.45
(Employed persons, in 1,000s)	14,223.7	20.5	0.1438%		
Education	37.0	1.0	2.7055%	0.0248	9.53
(Employed persons, in 1,000s)	14,223.7	9.5	0.0670%		
Healthcare	33.8	1.0	2.9612%	0.0131	5.58
(Employed persons, in 1,000s)	14,223.7	5.6	0.0392%		
Social welfare	2.4	1.0	42.4701%	0.0015	8.82
(Employed persons, in 1,000s)	14,223.7	8.8	0.0620%		

3) Effects on social welfare

□ The effects of different fiscal spending programs on the welfare of households can be summarized as follows.

○ Each additional fiscal expenditure of KRW 1 trillion can increase overall household utility by 0.9412 to 2.416 percent.

○ Spending on social welfare showed the highest rate of utility increase, at 2.4161 percent, followed by healthcare, at 2.0508 percent, and education, at 1.459 percent. Public administration and defense showed the lowest rate, at 0.9412 percent.

○ Additional fiscal expenditure on social welfare shows the highest utility increase rate for the lowest-income group. This is most likely because additional spending on this sector directly aims at supporting the poor by providing the National Basic Livelihood Security Guarantee and other benefits.

〈Table C〉 Changing Utility Rates Resulting from Additional Fiscal Expenditure

(Unit: percentage)

Income decile	Public administration and defense	Education	Healthcare	Social welfare
1st	0.1256	0.0993	1.0339	2.3504
2nd	0.2833	0.2802	0.9173	0.8183
3rd	0.3359	0.3949	0.7496	0.7542
4th	0.3329	0.4724	0.6229	0.5321
5th	0.3154	0.5108	0.4479	0.4516
6th	0.2829	0.5633	0.3310	0.1877
7th	0.1066	0.3006	0.0167	-0.1350
8th	0.0118	0.0899	-0.2051	-0.2952
9th	-0.2741	-0.3115	-0.6558	-0.8413
10th	-0.5791	-0.9405	-1.2076	-1.4067
Total	0.9412	1.4594	2.0508	2.4161

□ Table D provides an overall comparison of the job-creating and welfare-enhancing effects of increased fiscal expenditure in different sectors.

○ Fiscal expenditure on social welfare produced considerable job-creating and welfare-enhancing effects for households.

○ Fiscal expenditure on public administration and defense produced considerable job-creating effects, but had little effect on improving household utility.

○ Fiscal expenditure on healthcare produced a significant utility-improving effect for households, but was not as

effective for increasing jobs.

〈Table D〉 Sector-by-Sector Comparison of Job-Creating and Welfare-Enhancing Effects of Fiscal Expenditure

(Units: percentage, p)

Spending sector	Employment increase (%)	Welfare increase (%)
Public administration and defense	0.0645 (2)	09412 (4)
Education	0.0324 (3)	1.4594 (3)
Healthcare	0.0092 (4)	2.0508 (2)
Social welfare	0.0761 (1)	2.4161 (1)

Note: Fiscal expenditure on public administration and defense was distributed in its entirety across industries, while expenditure on other sectors was distributed in equal parts across industries and households.

□ The results of our CGE analysis, however, vary significantly depending on how we define the scope of fiscal expenditure on each sector, the definitions of the initial equilibrium we use, and the rules of distribution we adopt. Therefore care must be given in interpretation of the results.

○ The point in time at which we analyze our data (i.e., our initial equilibrium) and the ratio of fiscal expenditure distribution between households and industries have an important bearing on the final results.

3. Conclusion and implications

□ We have used an Australian-style CGE model to analyze the effects of different fiscal spending programs on employment and welfare.

○ Fiscal expenditure on social welfare showed the greatest job-creating effect, followed in order by expenditure on public administration and defense, education, and healthcare.

○ Fiscal expenditure on social welfare also showed the greatest welfare-enhancing effect, followed in order by expenditure on healthcare, education, and public administration and defense.

○ Fiscal spending on public administration and defense, which are purely public goods, actually worsened the state of income redistribution.

□ Conventional macro-econometric models for analyzing the economic effects of different fiscal spending programs failed to distinguish between the income-redistribution effect on households, on the one hand, and the growth and employment effects on individual industries, on the other.

○ Analyses based on the Input-Output Tables or social accounting matrices were capable of identifying

income-redistribution effects, but they were based on the demand-side models and were incapable of supporting dynamic analyses.

□ Our CGE model allows us to distinguish and analyze the different effects of fiscal expenditure, which will contribute to enhancing the validity of fiscal policy analyses in the future.

○ Our study also presents a model that policy researchers and analysts can actually use for their policy studies.

- Our CGE model, as a significant improvement over conventional demand-side models, provides systematic analyses of the correlations between fiscal expenditure and diverse macroeconomic variables.
- Our counter-factual simulation analyses will enable policy makers to analyze and identify specific policy measures needed to promote economic growth, employment, and welfare.

□ The CGE model we have developed for this study is for comparative static analysis.

○ Since the discussions on the role of fiscal expenditure need further medium- to long-term analyses, it is necessary to expand upon our present model to make it capable of dynamic analyses.

○ A dynamic CGE model is required for analysis of the economic ripple effects of medium- to long-term fiscal projections and to enable policy makers to find appropriate solutions for Korea's declining total fertility rate and rapid population aging.

1 Introduction

1. Background and objectives
2. Methodology and structure

1 Introduction

1. Background and objectives

Having sustained two major economic crises in the recent decades, the Korean economy has fallen into the trap of protracted low growth. The near-stagnant economic growth continues to lower the capability of Korean industries to create jobs, thus threatening to increase income poverty and widening social polarization. The employment induction coefficients on the Input-Output Tables have continued to drop over the years, raising fears of a long-term recession. Compounding these problems is the fact that Korea is experiencing a decline in total fertility rate and the population aging that is unprecedented and the fastest in the world. The household structure in Korea is also undergoing a dramatic change with a sudden multiplication of single- and two-person households, accompanied by growing income inequality.

Consequently, the Korean government is coming under increasing pressure to address these social issues. Although it has responded to some extent by rapidly increasing its social welfare spending in the public sector, it has been incapable of satisfying the growing welfare demand welfare in the private sector. The dearth of welfare resources at a local government

level today should prompt policy makers to review and prevent the potential nationwide repercussions of the sudden increases in public welfare spending. Yet candidates of all parties running for elections in Korea have repeatedly made far-fetched vote-getting promises to spend on welfare, without proposing feasible and effective measures for raising the requisite resources. They promise greater welfare spending, on the one hand, and yet oppose increasing taxes, on the other. What they could end up doing is opting to transfer the financial burden onto future generations.

It is therefore critical to find ways to ensure objective analyses of the effects of fiscal expenditure on diverse sectors of the Korean society and economy. Such analyses will be necessary to review and access policy issues and goals concerning social welfare, thereby enabling policy makers to more effectively design and prioritize fiscal spending programs.

To this end, our study seeks to provide a wide-ranging analysis of the effects of fiscal expenditure on various sectors of Korean economy. Using a computable general equilibrium (CGE) model originally developed in Australia, we first analyze the effects of fiscal spending programs on employment and welfare. Then we review the most efficient way of allocating fiscal resources among these programs to achieve employment- and welfare-related policy goals.

2. Methodology and organization

In the past, it was popular to use macro-econometric models utilizing time series data to systematically analyze the macro-economic effects of fiscal expenditure. The fiscal multipliers used in these models may differ depending on the researcher because debate continues among researchers as to the appropriate sizes of such multipliers. The proto-type Keynesian school argues that a fiscal multiplier carries a positive value greater than one, while the Neo-classical school in contrast argues that a fiscal multiplier typically falls between zero and one and may even be negative in some cases. The theoretical differences in the sizes of fiscal multipliers reflects the differences in the underlying assumptions and ideologies regarding the role of the government. We therefore need to explain our position on fiscal multipliers with empirical evidence.

In the 1980s, microeconomic data was widely used among policy researchers in developed countries, and it was around this time that policy makers began to conduct empirical analyses of policy effects using the partial equilibrium approach. A good example is the analysis of the redistributing effects of policy measures based upon the household survey data. The partial equilibrium approach, however, failed to take into account the behavioral changes in individual economic actors resulting from changes in policy measures and failed to support analyses of the

bi-directional correlations among variables. The CGE approach was subsequently developed to overcome these shortcomings. The CGE models take into account the mutual interactions among variables, thus enabling more comprehensive analyses that the partial approach could not provide.

However, to use the CGE approach effectively, we first need to set up a comprehensive database that combines the Input-Output Tables (IOTs), the System of National Accounts (SNA), and the household survey data. The database encompassing all of these is known as a social account matrix (SAM).[1] Typically, SAM-based analyses cater to the demand side only, failing to take into account the behavioral changes in economic actors resulting from policy changes. Certain CGE models, however, such as the ORANI-G model originally developed in Australia, can overcome this shortcoming. Although the Australian ORANI-G model is chosen, we still needed to modify and adapt it to conditions in Korea and review whether the model would fit the database that exists for this country. After completing this review, we were able to perform simulation analyses on the likely effects of the policy options.

One main objective of this study is to provide preliminary analyses of the likely ripple effects of fiscal expenditure on dif-

1) Pyatt and Round (1985), conducting research on behalf of the World Bank, have done a representative study that provides a systematic summary of SAM and its application to reality. The latest study on the use and creation of SAMs is Roos (2013).

ferent sectors of the Korean economy. We therefore ran simulations and used the results to arrange the available policy alternatives in order of preference.

This study is structured as follows. In Chapter II, we provide a brief overview of Korea's SAM database for 2009 and of the ORANI-G model. In Chapter III, we perform simulation analyses using our model and the SAM database, and we explain the likely ripple effects of fiscal expenditure and how the available policy options should be prioritized. In Chapter IV, we summarize our findings and the policy implications of our analysis.

2 Database and the Model

1. Developing a database
2. Structure of the CGE model

2 Database and the Model

1. Developing a database

SAM is a database that contains information beyond the input-output table, which only concerns activities of production. The SAM database provides information not only on production, but also on institutions and households. Using the multiplier effect, SAM allows researchers to identify and analyze the ripple effects that an increase in income in one sector exerts on other sectors.

Some OECD countries have begun to develop official nationwide SAMs and to publish their analysis results on a regular basis, but Korea has yet to develop such a system. We therefore created a SAM for our purposes by bringing together the IOTs of the Bank of Korea (BOK), the data on transactions in each sector found on BOK's System of National Account (SNA), and other micro data, such as those on Household Income and Expenditure survey data of the Statistics Korea.

As with Nam, Moon, and Lee (2012), we modified our SAM based on data as of 2009 and used it as the database for our CGE model analysis. The SAM we used was expanded to include the heterogeneity of the household sector in the IOT, which allowed us to analyze diverse effects of income redistribution policies.

We developed this Korean database with a view to adapting and applying the ORANI-G model, originally developed at the CoPS of the Monash University.[2] Later we modified the structure of the ORANI-G model so that it would fit our Korean SAM. In Korea, it is customary for researchers to develop and adapt diverse SAMs as they see fit, according to the characteristics of their methodologies, research objectives, or subject matters. Researchers that do not explicitly consider the problem of internal consistency in their SAMs,[3] or who use error terms or combine error terms with other sectors, use diverse modifications to ensure the consistency of their databases.

Han and Kim (1999) and Ju (2007) used the RAS method to create their SAMs. Shin (2000), on the other hand, applied the cross-entropy technique (Robinson, Cattaneo, and El-Said, 2001), while Nam, Moon, and Lee (2012) used a balancing technique based on the least-squares method. Our experience tells us that there is no significant difference between the latter two methods.

The key database used in this study is based upon both the basic price and the producer price of IOTs in 2009 (BOK, 2011). The ORANI-G model uses different tax tables based on the producer price and the basic price tables. Figure 2-1 summarizes the main components of our database for the analysis. For industrial categorizations, we followed the Integrated

2) The Center of Policy Studies (CoPS) has been relocated to Victoria University as of March 2014.
3) Ok, Ji, and Choi (2004) provides an example.

Industrial Categorization System of the IOTs and then made modifications as required by our analysis of that database. The modified sectors are education, healthcare, and social welfare. See Table 2-2 for the list of industrial categories we used.[4)]

[Figure 2-1] Database Components

		Absorption Matrix					
		1	2	3	4	5	6
		Producers	Investors	Households	Exports	Government	Inventory changes
		← I →	← I →	← 1 →	← 1 →	← 1 →	← 1 →
Basic prices	↑ C×S ↓	V1BAS	V2BAS	V3BAS	V4BAS	V5BAS	V6BAS
Taxation	↑ C×S ↓	V1TAX	V2TAX	V3TAX	V4TAX	V5TAX	Including taxes on inventory values.
Labor	↑ O ↓	V1LAB	C = 30 (domestic, exports) types of commodities. I = 30 (categories of industries). S = 2, domestic and imported goods. O = 1, no distinction between skilled and unskilled labor. The investment tax (V2TAX) and the indirect taxes included in the inventories were set at the default value of zero so that indirect taxes could be included in basic prices. In Korea, both the export tax (V4TAX) and government spending tax (V5TAX) are zero.				
Capital	↑ 1 ↓	V1CAP					
Other production taxes	↑ 1 ↓	V1PTX					
Other costs	↑ 1 ↓	V1OCT					

	Combined production matrix
Type	← I →
↑ C ↓	MAKE

	Import customs
Type	← 1 →
↑ C ↓	V0TAR

Source: Nam, Moon, and Lee (2012), p. 260.

4) For descriptions of the ORANI model and the database we used, see Nam, Moon, and Lee (2012), pp. 259-265.

〈Table 2-1〉 Re-classification of the Industries

Industrial category	Industries included
C1. Agriculture, forestry, and fishery	Crops, livestock and sericulture, agricultural services, forestry products, fishery products
C2. Coals, crude oil, natural gas and minerals	Coals, crude oil and natural gas, metallic ores, non-metallic ores
C3. Food and beverages	Meat and dairy products, processed seafood, refined grains and flours, sugar manufacture, bread/confectionary and noodles, other food products, beverages, tobacco
C4. Textile and leather goods	Threads and yarns, fabrics, textile products, apparel and accessories, leather goods and fur
C5. Wood and paper	Lumber and wooden goods, wooden furniture, pulp and paper
C6. Printing, publishing and duplication	Newspapers, publishing, printing, and printing and duplication of record media
C7. Coal and petroleum products	Coal products, naphtha, fuel oil, other petroleum products
C8. Chemical products	Organic raw and intermediate chemicals, inorganic raw chemicals, chemical fertilizers and pesticides, synthetic fibers, pharmaceuticals and cosmetics, synthetic resins and rubber, other chemical products
C9. Non-metallic mineral products	Glass and ceramics, cement and concrete, other ceramic and earthen products
C10. Primary steel products and other	Primary steel products, non-ferrous metal ingots and primary products, pig iron and crude steel
C11. Metallic products	Metallic building products, metallic containers, machine tools and wire products
C12. General machinery	Engines and turbines, general-purpose machinery parts, industrial transportation machinery, air-conditioning equipment
C13. Electric and electronic machinery	Power generators, motors, electric conversion devices, other electric devices, electronic display devices, semiconductors, other electronic parts, acoustic equipment, broadcasting equipment, computers and peripheral devices, office devices.
C14. Precision machinery	Medical and calibration devices, optical devices, watches
C15. Transportation equipment	Vehicles, other transportation machinery
C16. Furniture and other manufactured goods	Furniture, toys and sports gear, other manufactured goods
C17. Electricity, gas, and waterworks	Electricity, urban gas, steam and hot water supplies, waterworks

Industrial category	Industries included
C18. Construction	Construction and construction repair, civil architecture and engineering
C19. Wholesale and retail	Wholesale and retail
C20. Restaurants and lodging	Restaurants, lodging businesses
C21. Transportation	Railways, roads, courier services, on-water and air transportation, transportation support services, etc.
C22. Communications and broadcasting	Mail, telegrams, telephone, additional communications services, nonprofit broadcasting, industrial broadcasting
C23. Finance and insurance	Finance and insurance
C24. Real estate services	Real estate, business support services, research organizations, computer-related services, manpower supplies, etc.
C25. Public administration and defense	Public administration and defense
C26. Education	Education and research
C27. Healthcare	Healthcare and medicine
C28. Social welfare	Social welfare
C29. Social services, other	Social services, cultural/entertainment/other services, other
C30. Other	Office supplies, non-household consumption and spending, not elsewhere classified

For our study, we added equations to link our SAM to the standard model and the data structure described above, explaining their correlations, with the aim of capturing the integrated system according to which values flow society-wide.

It is now pertinent to explain the structure of our SAM. A SAM database systematically and consistently records transactions in all directions and among all economic factors that make up a country's economy. For our study, we created a SAM for the year 2009 using data provided by BOK's Input-Output Tables and SNA as well as Statistics Korea's Household Income and Expenditure surveys.[5] As a matrix that combines all these

data along with government budget execution records, according to the general equilibrium approach, our SAM lists a set of identical accounts along rows and columns in a symmetrical manner. Rows indicate the amount of money received by each account, while columns indicate the amount of money spent out of each account (expenditure).

Embodying the logic that all flows in an economy occur from some economic actors to others, a SAM is necessarily in the shape of a square matrix, and the sums of accounts heading each row and the column must always be identical (i.e., revenue = expenditure). Major accounts included in this matrix include those on production, consumption, capital formation, and external transactions, which researchers typically modify with considerable leeway in light of the nature of available statistics and the objectives of their studies.

It was Corong and Horridge (2012) that recently attempted to expand the ORANI-G model so that it could accommodate the use of a SAM. This analysis technique, therefore, is slightly different from traditional multi-sectoral CGE model.[6]

5) The capital stock data used in this study are the estimates presented in Pyo (2012).

6) Dixon and Jorgenson (2013) provides a summary of the recent trends in CGE model research.

〈Table 2-2〉 Accounts Used in the SAM

Serial no.	Variable name	Description
1	Firm	Firms (producers)
2	DomCom	Domestic commodities
3	ImpCom	Imported commodities
4	Labor	Labor input
5	Capital	Capital input
6	ProdTax	Production tax
7	ComTax	Commodity tax
8	Tariff	Tariffs
9	DirTax	Direct taxes
10	Households	Household sector
11	Enterprises	Enterprise sector
12	GovCurrent	Gov't Current transactions
13	GovInvest	Government investment
14	PrvInvest	Private investment
15	Stocks	Stock changes
16	ROW	Overseas

Table 2-2 lists the accounts (variables) that are included in our macro SAM as of 2009.[7] Table 2-3 below is the actual macro SAM that was used in our study. Micro SAMs that are used in actual simulations are far more complex in structure. Firms, DomCom, placed in Rows 1 and 2, for example, have a scalar value of KRW 2,775 trillion in a macro SAM, but turn into a 30-by-30 matrix in a micro SAM. A micro SAM, in other words, is considerably larger than a macro SAM in scale and structure.

The Australian ORANI-G model requires a special type of

7) The list of accounts (variables) shown in Table 2-2 is common to all studies based on the ORANI-G model.

database. All data files need to be converted into a binary format with the extension "HAR" and kept in the database accordingly. These requirements, however, significantly hinder the wider acceptance of the model, which is why the Australian modeling technique remains relatively under-developed today. The Center of Policy Studies (CoPS), which has developed and distributes the Australian CGE model, does not create a new database each year because that would involve a significant amount of time and labor, and in any case, the overall economic structure does not change dramatically over the short time span of a year or two.[8) 9)]

8) This was the answer given in person by Professor Mark Horridge, whom the authors met at the TERM Model Workshop at PAN in Warsaw, Poland, in mid-October 2013.

9) An anonymous commentator brought to our attention the fact that the gap between 2009, the base year of our database, and the economic situation of 2014, in which we wrote this report, was far too broad. As we explained, however, it is impossible to use the Input-Output Tables of the latest year unless all supplementary data are disclosed along with those tables. It will be necessary in the future to develop a way to update our database for use in a given analysis model.

〈Table 2-3〉 Macro SAM (2009)

(Unit: KRW 1 trillion)

SAM	1	2	3	4	5	6	7	8	9
1. Firms	0	2775.0	0	0	0	0	0	0	0
2. DomCom	1272.1	0	0	0	0	0	0	0	0
3. ImpCom	417.6	0	0	0	0	0	0	0	0
4. Labor	493.7	0	0	0	0	0	0	0	0
5. Capital	452.7	0	0	0	0	0	0	0	0
6. ProdTax	101.5	0	0	0	0	0	0	0	0
7. ComTax	37.4	0	0	0	0	0	0	0	0
8. Tariff	0	0	9.1	0	0	0	0	0	0
9. DirTax	0	0	0	0	0	0	0	0	0
10. Households	0	0	0	493.7	167.2	0	0	0	0
11. Enterprises	0	0	0	0	244.9	0	0	0	0
12. GovCurrent	0	0	0	0	56.4	101.5	77.6	9.1	85.3
13. GovInvest	0	0	0	0	0	0	0	0	0
14. PrvInvest	0	0	0	0	0	0	0	0	0
15. Stocks	0	0	0	0	0	0	0	0	0
16. ROW	0	0	488.2	0	0	0	0	0	0
Total	2775.0	2775.0	497.2	493.7	468.5	101.5	77.6	9.1	85.3

Source: Nam, Moon, and Lee (2012), pp. 263-264.

2. Structure of the CGE model[10)]

Adelman and Robinson (1978) had developed a CGE model for the Korean economy in the late 1970s, ahead of the CGE models later employed for many other countries.

10) The first half of this section is similar to the discussion in Nam, Moon, and Lee (2012, pp. 251-256). Professor Mark Horridge, the original author of the ORANI-F model, recommends that researchers refer to the explanation he gives in his study as much as possible.

〈Table 2-3〉 Macro SAM (2009): Continued

(Unit: KRW 1 trillion)

SAM	10	11	12	13	14	15	16	Total
1. Firms	0	0	0	0	0	0	0	2775.0
2. DomCom	488.1	0	170.3	8.4	262.9	39.0	534.1	2775.0
3. ImpCom	47.6	0	0	1.8	37.9	-7.7	0	497.2
4. Labor	0.0	0	0	0	0	0	0	493.7
5. Capital	0.0	0	15.8	0	0	0	0	468.5
6. ProdTax	0.0	0	0	0	0	0	0	101.5
7. ComTax	40.2	0	0	0	0	0	0	77.6
8. Tariff	0.0	0	0	0	0	0	0	9.1
9. DirTax	45.8	39.5	0	0	0	0	0	85.3
10. Households	0.0	14.7	114.1	0	0	0	14.1	803.8
11. Enterprises	15.8	0	0	0	0	0	0.7	261.4
12. GovCurrent	81.4	38.1	0	0	0	0	0.2	449.5
13. GovInvest	0.0	0	10.2	0	0	0	0	10.2
14. PrvInvest	68.8	125.2	137.0	0	0	0	1.1	332.1
15. Stocks	0.0	0	0	0	31.3	0	0	31.3
16. ROW	16.1	44.0	1.9	0	0	0	0	550.2
Total	803.8	261.4	449.5	10.2	332.1	31.3	550.2	9721.4

Despite this relatively long history of CGE modeling in Korea, few researchers have turned to it until now and it is still relatively unknown to policy makers.

Adelman and Robinson (1978) had developed a CGE model specifically suited to Korea decades ago, in the late 1970s, ahead of the CGE models later employed for many other countries. Despite this relatively long history of CGE modeling in Korea, few researchers have turned to it until now and it is still relatively unknown to policy makers.

The CGE model we have chosen for this study is based on the CGE model developed in Australia, which had its origins in the ORANI model developed by Dixon, Parmenter, and Vincent (1978) in the late 1970s. The ORANI model consists of a series of linear equations that represent the percentage changes in the amounts or sizes of given variables. It employs the Johansen algorithm to obtain solutions using initial values and rates of increases, and a separate software program named Gempack has been developed to support the model's computational ability.[11)]

The Australian CGE model originally analyzed the ripple effects of government spending using IOTs. Corong and Horridge (2012), however, invented the method of using SAMs in the place of IOTs to conduct analysis using the Australian model. In Korea, Nam, Moon, and Lee (2012) did the pioneering work of modifying the ORANI-G model and the available databases to create a Korean SAM to use with the model.

The supply and demand equations of the private sector that form the main frame of the model are used to find solutions to optimization problems—such as profit maximization, cost minimization, and utility maximization—according to the underlying assumptions of the Neo-classical school of microeconomics. The school assumes that economic actors are price takers, and that producers face a competitive market from which they cannot gain

11) As for the latest updates for the Gempack software, see the *Gempack Manual*, by Harrison, Horridge, Jerie, and Pearson (2014), pp. 2-3.

pure profits.

Next, a series of stock values, such as capital stock of enterprises and net external debts are added to these static factors. These additional variables change over time due to flows such as investment, depreciation, and trade balances, It is in consideration of all of these factors that the update and forecast simulations are run using our model. Our model consists of equations that explain the following over a fixed period of time:

- Firms' demand for intermediate inputs and primary production factors
- Supply by producers
- Demand for capital formation
- Household demand
- Demand for exports
- Government demand
- Correlations among the production cost, the purchaser price, and the basic price
- Conditions for the market equilibrium of commodities and primary factors
- Macro variables and price indices, etc.

In the next chapter, we shall analyze the economic ripple effects of fiscal expenditure on various sectors using the Australian CGE (ORANI-G) model.

3 Effects of Fiscal Expenditure on Employment and Welfare

3 Effects of Fiscal Expenditure on Employment and Welfare

1. Overview

Since the 1960s, the Korean government has been actively using fiscal expenditure to achieve its policy goals and to promote economic development. As a result, Korea's fiscal spending has shown sustained growth over the last few decades.

The policy goals to which fiscal resources were allocated have differed over the decades since the '60s. Until the 1980s, the emphasis was on economic growth, but by the late 1990s that had changed to an emphasis on overcoming financial crisis. In recent years, the emphasis of public spending has been on income redistribution and welfare. If the Korean government is to achieve its major policy goals in the light of sweeping changes in both the international economy and domestic policy environment, it is crucial for policy makers to conduct thorough analyses of the likely ripple effects of fiscal spending on the various sectors of the national economy. Only with appropriate analyses can they hope to correctly identify and prioritize fiscal spending measures to meet given policy goals.

In the past, time-series analyses of the effects of government spending formed the mainstream approach, but researchers

today increasingly resort to panel data. Researchers might also use input-output analyses and SAMs in situations where time-series data are unavailable and/or where it is necessary to analyze and determine the interactive effects among industries.

In this study, we use the latest approach—i.e., CGE modeling—to analyze the likely ripple effects of fiscal expenditure on employment and welfare. We then use the findings of our analysis to determine the relative priorities of fiscal spending programs with a view to maximizing the efficiency of fiscal spending.

A broad consensus in the literature sees government spending as often done sector by sector and that spending on each sector exerts different effects on the national economy as a whole. However, a number of obstacles prevent the empirical analysis and confirmation of this consensus. First, it is difficult for researchers to access detailed data on the varying levels and purposes of fiscal expenditure. In Korea, a persistent mismatch exists between the list of budget items and actual fiscal statistics. Fiscal authorities in Korea need to address this situation and help researchers sort and organize detailed fiscal data with greater ease and systematic access by making the needed data readily available.

2. Findings

In general, a CGE model often involves more variables than equations, making it necessary for the researcher to treat some of them as exogenous for the identification. Known as a 'closure', this task produces outcomes that vary according to the opinions and specific research objectives of researchers involved. In our case, according to the standard closure format of the ORANI model, we treated technological progress, foreign exchange rates, real government balances, real wages, capital stock, and the like as exogenous variables.

Of the sectors and areas in need of fiscal spending, we focused, on public administration and defense, education, healthcare, and social welfare, and we reviewed how spending on these sectors affects on the employment and welfare of the national economy. To this end, we ran simulations to test and analyze the likely ripple effect of an additional fiscal spending of KRW 1 trillion, on top of the current government spending level, for each of these sectors.

For ease of analysis, we used expenditure elasticity and fiscal multipliers. Expenditure elasticity is a measure of the percentage by which an endogenous variable, such as the gross domestic product (GDP), would increase in response to each one-percent increase in fiscal expenditure. The concept of elasticity is often contrasted with that of multiplier. A fiscal

multiplier is a measure of how many units by which the size of an endogenous variable would increase in response to the every single-unit increase in fiscal expenditure.

With the Australian-style CGE (ORANI-G) model we are able to analyze each and every variable in terms of changes in percentage. The supporting software Gempack, which employs the Johansen algorithm, is designed to calculate equilibrium values using the initial values and the rates of change from the initial equilibrium.[12] Gempack was a relatively inexpensive way of conducting the necessary computations and finding solutions to given problems or equations. The larger the size of the model involved in analysis, the more time Gempack saves—in comparison to GAMS that employs a different, level-based algorithm—and the greater its practical utility.[13]

〈Table 3-1〉 Structure of Fiscal Expenditure (2009)

(Units: KRW 1 trillion, %)

Sector no.	Sector	Gov't spending (KRW 1 trillion)	Rate of Increase in additional KRW 1 tn. spending (%)
25	Public administration	91.5	1.1%
26	Education	37.0	2.7%
27	Healthcare	33.8	3.0%
28	Social welfare	2.4	42.5%
	Total	170.3	

Sources: Nam, Lee, and Yoo (2014), p. 26; BOK, Input-Output Tables of 2009 (with the base year of 2005).

12) In the General Algebraic Modeling System (GAMS), the researcher finds the solution using the levels of all the variables involved.

13) This is why even the US International Trade Commission, which requires a very large-scale model for analyzing international trade, uses Gempack and its variant of Johansen algorithm.

Table 3-1 indicates the ratio of each extra spending of KRW 1 trillion to the given amount of fiscal expenditure on each sector, as indicated on the IOTs. The IOTs of 2009 show that the fiscal expenditure on different sectors amounted to KRW 3.9 trillion on real estate and business services, KRW 91.5 trillion on public administration and defense, KRW 36.9 trillion on education, KRW 33.8 trillion on healthcare, KRW 2.4 trillion on social welfare, and KRW 1.8 trillion on other services.

To arrive at the fiscal multipliers, we first need to estimate the percentage changes in our exogenous variables and exert exogenous shocks to our model, as follows. For example, an additional KRW 1 trillion in fiscal expenditure on each sector would lead to the percentage changes of 1.1 percent in public administration and defense, 2.7 percent in education, 3.0 percent in healthcare, and 42.5 percent in social welfare. The ORANI-G model requires the researcher to enter the percentage increases, as caused by additional fiscal spending, rather than the direct amounts of money involved in deciding the sizes of external shocks.

(1) Effects on economic growth and employment

To analyze the effects of fiscal expenditure on growth and employment, we first needed to access data on the amount of fiscal expenditure on different sectors and its distribution by income groups. We found the data we needed in Statistics Korea's *Surveys* on *Household Income and Expenditure*

Dynamics and other research publications. Seong, Song, and Jeon (2010), for example, provides an analysis of the distribution of tax burdens and social benefits for 2009. Nam, Kwon, and Yoo (2013) similarly analyze the distribution of tax burdens and social benefits by income class for 2010. These two studies, however, show that the results of analyses vary depending on the perspectives of researchers involved and on the raw data subjected to analysis.

In line with these two studies, we divided households in Korea into 10 deciles according to their disposable income, and we estimated the benefits that would accrue from fiscal expenditure to each income group to determine each income group's share.

〈Table 3-2〉 Sector-by-Sector Fiscal Expenditure (2009)

(Unit: KRW 1 billion)

Income decile	Public administration and defense	Education	Healthcare	Social welfare
1	1,655.8	593.8	3,604.7	846.2
2	3,512.8	1,484.4	3,604.7	404.7
3	4,811.9	2,226.6	3,415.0	239.1
4	5,873.0	2,968.9	3,415.0	165.6
5	6,934.2	3,711.1	3,225.2	128.8
6	7,986.2	4,750.2	3,415.0	128.8
7	9,385.9	4,898.6	3,225.2	110.4
8	11,160.6	5,047.0	3,225.2	128.8
9	14,023.9	5,492.4	3,225.2	92.0
10	26,145.1	5,789.3	3,415.0	110.4
Total	91,489.4	36,962.2	33,770.1	2,354.6

Note: This is the distribution of fiscal expenditure, as indicated in the IOTs of 2009, by income decile.

Source: Nam, Lee, and Yoo (2014), p. 27.

We also needed to determine into which sector of the economy the additional fiscal expenditure would be injected. There are two possible alternatives to consider: the injection of additional fiscal spending directly into certain industries, or the distribution of additional fiscal spending to households in the form of increased income, as shown in Cho (2009). The latter option requires us to determine both the rule by which the current level of fiscal spending is distributed to households and the rule by which additional fiscal expenditure on different sectors—public administration and defense, education, and healthcare—is to be distributed to households.[14]

In our study, however, we assumed that the additional fiscal expenditure on public administration and defense would go directly to industries and that additional spending on all other sectors would be divided equally between industries and households. We assumed this because it was unlikely that increasing fiscal spending on public administration and defense would directly increase household income. As for the other sectors, it was more realistic to assume that additional fiscal expenditure would be divided between industries and households rather than be going solely to households. In the case of social welfare, additional fiscal expenditure was concentrated in low-income groups in the

14) That is, we would have to arrive at two separate rules, i.e., (a) the ratio according to which the additional spending is to be divided between industries and households, and (b) the ratio according to which the additional spending is to be divided among household income deciles.

form of Basic Livelihood Security Guarantee benefits or distributed evenly across all the 10 income deciles in the form of pension benefits. Lacking detailed information, we assumed that increased spending on social welfare would entail both.[15)]

Let us first consider the case of increasing fiscal expenditure on public administration and defense by KRW 1 trillion. This addition would increase the amount of exogenous spending on public administration and defense by 1.1 percent, leading to the effects summarized in Table 3-3. All the changes in the values, except the fiscal balance, indicate the percentages by which the values changed from their initial equilibrium values. By dividing the percentage changes in the sizes of dependent variables by the percentage changes in the amount of fiscal expenditure for an individual sector, we can determine the elasticity of expenditure on that sector.

Table 3-3 lists the likely ripple effects of increasing fiscal expenditure on public administration and defense, education, healthcare, and social welfare by KRW 1 trillion each. The table indicates that such additional fiscal expenditure would raise the GDP, the employment level, the nominal wage, and the consumer price.[16)]

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15) This assumption affects the ratio by which additional fiscal expenditure is distributed to households, and ultimately the level of welfare and employment.

16) In our CGE model, we used a fixed real wage level, allowing the nominal wage level and the consumer price to change in consistent proportions and in the same direction.

〈Table 3-3〉 Sector-by-Sector Comparison of the Ripple Effects of Additional Fiscal Expenditure

(Unit: %)

Description	Public administration and defense	Education	Healthcare	Social welfare
Government balance-to-GDP ratio (income-expend.)/GDP, change)	-0.0007	-0.0003	0.0000	-0.0001
Employment (wage bill weights)	0.1438	0.0670	0.0392	0.0620
GDP deflator	0.0066	-0.0006	-0.0124	-0.0167
Nominal wage	-0.0154	-0.0012	-0.0141	-0.0153
Consumer price index (CPI)	-0.0154	-0.0012	-0.0141	-0.0153
Imports (C.I.F., in KRW)	0.0017	-0.0025	0.0003	-0.0051
Nominal GDP (expenditure side)	0.0698	0.0279	0.0031	0.0092
Reward for capital factors	0.0377	0.0018	-0.0091	-0.0199
Reward for labor factors	0.1284	0.0658	0.0251	0.0468
Total nominal household income	-0.0781	-0.0383	-0.0853	-0.0725
Government investment spending	-0.1376	-0.0214	-0.0228	-0.0235
Private-sector investment spending	-0.0013	-0.0026	-0.0130	-0.0115
Current government expenditure	0.4058	0.3381	0.3378	0.3225
Total government expenditure	-0.0574	-0.0245	-0.0553	-0.0385
Government revenue	0.2718	0.2267	0.2229	0.2112
Fiscal balance	0.0066	-0.0006	-0.0124	-0.0167
Income tax + commodity tax	0.4055	0.3386	0.3478	0.3305
Import amount	0.0017	-0.0025	0.0003	-0.0051
Real GDP (expenditure side)	0.0632	0.0285	0.0155	0.0259

Note: Effects of the additional spending of KRW 1 trillion on each sector, with the ratio of industries-household distribution varying by sector.

In detail, the additional fiscal expenditure of KRW 1 trillion on public administration and defense industries would raise the real GDP by 0.0632 percent. For this sector, the elasticity of the GDP to the increase in fiscal expenditure would amount to 0.0575 (=0.0632/1.1), which represents an increase of KRW

662.3 billion to the real GDP, and yields a fiscal multiplier of 0.6391. The fiscal multipliers for education, healthcare, and social welfare would be 0.6039, 0.3475, and 0.5786, respectively. Thus, in terms of the multiplier effect on the GDP, increasing fiscal expenditure was most effective in public administration and defense, followed in order by education, social welfare, and healthcare (Table 3-4).

These results are based on the Johansen algorithm of the ORANI model, indicates all variables as changes in percentage.[17)]

〈Table 3-4〉 Elasticity of the GDP in Response to Additional Fiscal Expenditure on Each Sector

(Units: KRW 1 billion, p)

	Initial value	Final value	Difference	Change (%)	Elasticity	Fiscal multiplier
Public admin. and defense	91,489	92,489	1,000	1.1000	0.0558	0.6391
(GDP)	1,047,905	1,048,549	643.4	0.0614		
Education	36,962	37,962	1,000	2.7055	0.0213	0.6039
(GDP)	1,047,905	1,048,507	601	0.0574		
Healthcare	33,770	34,770	1,000	2.9612	0.0112	0.3475
(GDP)	1,047,905	1,048,258	352	0.0336		
Social welfare	2,354	3,354	1,000	42.4701	0.0013	0.5786
(GDP)	1,047,905	1,048,503	597	0.0570		

Table 3-5 summarizes the effects of additional fiscal expenditure on employment. An additional KRW 1 trillion spent on public administration and defense, for example, would in-

17) Even with this technique and model, however, we cannot analyze dynamic effects. The Johansen algorithm was first introduced in Johansen (1960).

crease the employment level by 0.1438 percent. And the employment level would rise by 0.1345, 0.0819, and 0.1308 percent for education, healthcare, and social welfare, respectively. These translate into the employment multipliers of 0.0199, 0.0191, 0.0116, and 0.0186 for public administration and defense, education, healthcare, and social welfare, respectively. Thus, increasing fiscal expenditure on public administration and defense would be the most effective in terms of creating jobs, followed in order by education, social welfare, and healthcare.

〈Table 3-5〉 Sector-by-Sector Comparison of the Employment-Increasing Effect of Additional Fiscal Expenditure

(Units: KRW 1 trillion, 1,000 persons, p)

	Initial value	Difference	Change (%)	Elasticity	Employment multiplier
Public administration and defense	91.5	1.0	1.1000%	0.1307	20.45
(Employment, in 1,000s)	14,223.7	20.5	0.1438%		
Education	37.0	1.0	2.7055%	0.0248	9.53
(Employment, in 1,000s)	14,223.7	9.5	0.0670%		
Healthcare	33.8	1.0	2.9612%	0.0131	5.58
(Employment, in 1,000s)	14,223.7	5.6	0.0392%		
Social welfare	2.4	1.0	42.4701%	0.0015	8.82
(Employment, in 1,000s)	14,223.7	8.8	0.0620%		

(2) Effects on the level of welfare

Household utility is a useful measure of welfare in a given state of income distribution.[18] The Stone-Geary utility function used in our CGE model can be expressed as follows:

$$U = \Pi_i (q_i - \gamma_i)^{\beta_i}$$

Here, U equals the level of utility, and q_i, the amount of commodity i consumed. β and γ are parameters. If γ_i = 0, the Stone-Geary utility function would coincide with the Cobb-Douglas utility function.

Using the Stone-Geary utility function, we can determine a linear expenditure function system that corresponds to the demand function. The demand function can therefore be expressed as follows:

$$q_i = \gamma_i + \frac{\beta_i}{p_i}(y - \sum_j \gamma_j p_j)$$

Here, y equals total expenditure, and p_i, the price of the ith commodity. Roy Geary was the first to formulate this function while commenting on a study by Klein and Rubin (1947/1948) (Geary, 1950/51, p. 65, eq. 7). Sir Richard Stone was the first to make an empirical analysis of the linear expenditure function system (Stone 1954, p. 518). That is why this utility function is known as the Klein-Rubin or Stone-Geary utility function.[19]

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18) Other studies on the income-redistributing effect of fiscal expenditure include Park, Kim, and Jeon (2004), Park, Seong, Kim, and Kim (2006), Seong and Park (2008), Cho (2009), and Nam (2014). See Chapter 3 of Choi, Ryu, and Park (2005) for a detailed discussion of economic growth and income distribution.

19) See http://en.wikipedia.org/wiki/Stone-Geary_utility_function(retrieved October

Table 3-9 summarizes the changes in utility levels resulting from increase in fiscal expenditure on different sectors. An additional fiscal expenditure of KRW 1 trillion could raise the household utility level by 0.9412 to 2.416 percent. Public administration and defense showed the lowest rate of increase (0.9412 percent), followed in order by education (1.4594 percent), healthcare (2.0508 percent), and social welfare (2.4161 percent).

Increasing fiscal expenditure on social welfare led to the greatest increase in utility in the first income decile (2.3504 percent), but it raised the utility level by only 0.8183 percent and 0.7542 percent in the next two income deciles. Increased social welfare spending also lowered the utility level for the 10th decile by 1.4067 percent and for the 9th decile by 0.8413 percent. In other words, low-income groups would benefit significantly from increased fiscal expenditure, though its effect would diminish for higher-income groups. In particular, the utility level declines for the seventh and higher deciles.

A similar pattern is noted with respect to additional expenditure on healthcare. Here the utility level increases for the first seven deciles and declines for the eighth and higher deciles.

Increased fiscal expenditure on education and public administration and defense would also raise the utility level for the

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18, 2014) and Neary (1997, p. 1).

7th and lower deciles, but lower it for the eighth through 10th deciles. However, education shows a greater utility-increasing effect than do public administration and defense.

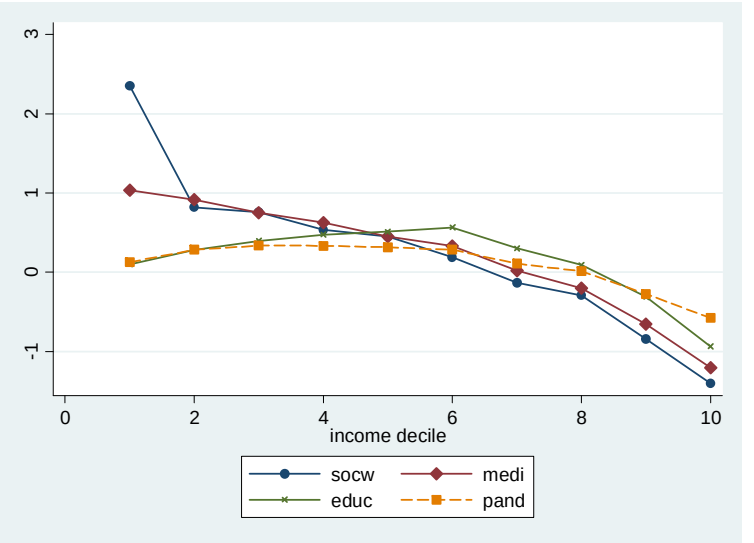
〈Table 3-9〉 Additional Fiscal Expenditure and Changes in Utility Levels

(Unit: %)

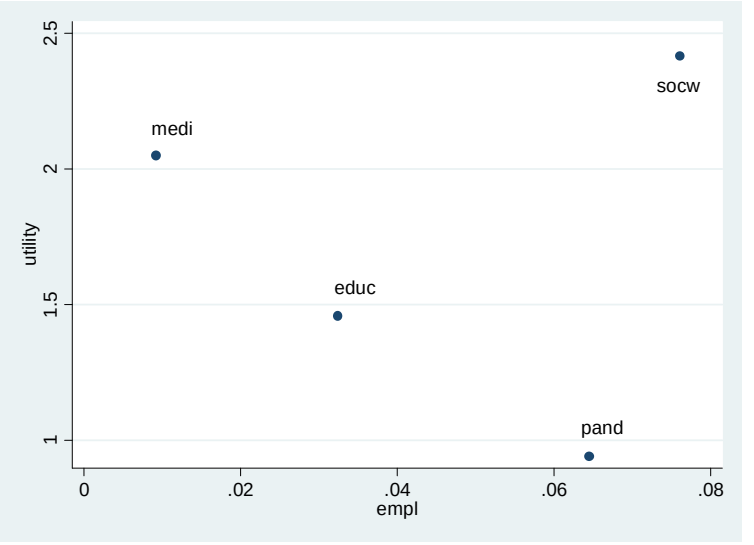
Income decile	Public administration and defense	Education	Healthcare	Social welfare
1st	0.1256	0.0993	1.0339	2.3504
2nd	0.2833	0.2802	0.9173	0.8183
3rd	0.3359	0.3949	0.7496	0.7542
4th	0.3329	0.4724	0.6229	0.5321
5th	0.3154	0.5108	0.4479	0.4516
6th	0.2829	0.5633	0.3310	0.1877
7th	0.1066	0.3006	0.0167	-0.1350
8th	0.0118	0.0899	-0.2051	-0.2952
9th	-0.2741	-0.3115	-0.6558	-0.8413
10th	-0.5791	-0.9405	-1.2076	-1.4067
Total	0.9412	1.4594	2.0508	2.4161

Healthcare show a relatively low employment-increasing effect because they form a particularly capital-intensive sector.

[Figure 3-1] Changes in Welfare and Employment by Income Decile (%)



[Figure 3-2] Changing Welfare and Employment Levels



3. Chapter conclusion

Increasing fiscal expenditure would show the greatest employment-increasing effect in social welfare, followed in order by public administration and defense, education, and healthcare. The welfare-enhancing effect of additional fiscal expenditure would also be the greatest in social welfare, followed in order by healthcare, education, and public administration and defense.

〈Table 3-10〉 Sector-by-Sector Comparison of the Employment- and Welfare-Increasing Effects of Fiscal Expenditure

(Unit: %, p)

Sector	Employment (%)	Welfare (%)
Public administration and defense	0.0645 (2)	09412 (4)
Education	0.0324 (3)	1.4594 (3)
Healthcare	0.0092 (4)	2.0508 (2)
Social welfare	0.0761 (1)	2.4161 (1)

Note: The additional fiscal expenditure on public administration and defense went directly to industries only, while the expenditure on other sectors was divided equally between industries and households.

Based on our analysis, we would prioritize the fiscal expenditure items as follows:

〈Table 3-11〉 Prioritizing Fiscal Expenditure Items to Increase Employment and Welfare

Priority	Employment (A)	Welfare (B)
1st	Social welfare	Social welfare
2nd	Public administration and defense	Healthcare
3rd	Education	Education
4th	Healthcare	Public administration and defense

Note: The quality of employment was not taken into account.

The results of analysis would vary widely depending on the base year of the database chosen, the scope of industries and sectors included, the definition of the initial equilibrium used, and the rules of distribution adopted. Due to the lack of detailed IOT data concerning more recent years, we based our analysis on the base year of 2009. However, spending on welfare has increased steeply over the last several years, so the initial equilibrium value of social welfare expenditure we used in our analysis would differ considerably from the possible value today.[20] The kinds of rules by which additional fiscal spending might be distributed also bear important implications on the results of analysis. Our results would vary significantly if additional fiscal expenditure was distributed to industries only or households only (in the form of increases in disposable in-

20) This may be why the ripple effects seemed to be particularly greater in social welfare. We need additional and more detailed research.

come). We also need to substitute more realistic values for the parameters we used in creating our model, and we should be cautious in interpreting the present results.[21] In the future, it will be necessary to expand our model into a dynamic one so that we can analyze and determine the changing effects of fiscal expenditure over the medium- to long-term.

21) Note that our results do not reflect any dynamic characteristics.

4 Findings and Policy Implications

1. Summary of findings
2. Policy implications
3. Directions for future research

4 Findings and Policy Implications

1. Summary of findings

Using the Australian CGE model, we analyzed the employment- and welfare-increasing effects of fiscal expenditure on different sectors of the Korean economy. Our analysis shows that fiscal expenditure on social welfare had the greatest job-creating effect, followed in order by fiscal expenditure on public administration and defense, education, and healthcare. Similarly, fiscal expenditure on social welfare had the greatest welfare-enhancing effect, followed in order by fiscal expenditure on healthcare, education, and public administration and defense.

Note that the results of analysis would vary widely depending on the initial equilibrium (initial database), the scope of industries and sectors included, the definition of the initial equilibrium used, and the rules of distribution adopted. Due to the lack of detailed IOT data concerning more recent years, we based our analysis on the base year of 2009. However, spending on welfare has increased steeply over the last several years, so the initial equilibrium value of social welfare expenditure we used in our analysis would differ considerably from the possible value today. We will therefore need to find ways to update

our existing database to reflect the available latest data.

The kinds of rules by which additional fiscal spending is to be distributed also bear important implications on the results of analysis. Our results would vary significantly if additional fiscal expenditure was distributed to industries only or households only (in the form of increases in disposable income). That is why caution is warranted in interpreting the present results.

2. Policy implications

Conventional macroeconomic econometric models for analyzing the economic effects of different fiscal spending programs fail to distinguish between the income-redistribution effect on households, and the effects on the growth and employment of individual industries. Although analyses based on the input-output tables or social accounting matrices are capable of identifying income redistribution effects, they are based on demand-side models and thus are not capable of analyzing dynamic aspects of the economy. As an alternative approach, the Australian-style CGE model is free of these shortcomings. Applying this model to policy analysis can significantly help to enhance the efficiency of fiscal resource allocation.

The CGE model we present in this study is capable of delineating and analyzing the distinctive effects of fiscal expenditure on different sectors. It will therefore allow policy researchers to increase the validity of their analyses on fiscal ef-

fects in the future. Our model is also free of the shortcomings of the partial equilibrium approach, and thus produces more reliable analysis results, And it can help policy makers to improve the effectiveness of their fiscal policies.

Our model is a significant improvement upon conventional demand-side models, providing systematic analyses of the correlations between fiscal expenditure and diverse macroeconomic variables. Our counter-factual simulation analyses will enable policy makers to analyze and identify specific policy measures needed to promote economic growth, employment, and welfare.

The most promising aspect of our model is that it can be applied by working-level policy makers and researchers to actual economic realities, particularly to analyzing the possible income redistribution effect of various fiscal policy measures before they are implemented. The approach used in this study will therefore help policy researchers amass the important basic data necessary for establishing national fiscal plans and determining the priorities of budget items.

3. Direction for future research

The SAMs used in CGE-based analyses so far have tended to produce results that varied significantly according to the involved researchers' opinions and research purposes. While nei-

ther the Korean government nor BOK compiles and distributes SAMs, fiscal authorities will need to start disclosing the detailed data necessary for the establishment of effective Korean SAMs.

The CGE model developed for this study supports comparative static analyses only. In reality, however, no discussion on the role of fiscal policies can be effective without the analyses of medium- to long-term prospects as well. It is therefore crucial that our model need to be expanded in the future towards a recursive dynamic CGE model. This will be necessary for analyzing the economic ripple effects of medium- to long-term fiscal projections, thereby enabling policy makers to better prepare for the issues associated with Korea's declining in the total fertility rate and rapid population aging.

We also need to analyze the possible effects of the different way in which fiscal resources are financed. In this study, we do not make any explicit mention of where fiscal resources come from, but the ripple effect of a fiscal policy would differ significantly depending on how it is funded—such as by indirect taxes or direct taxes. Therefore, further research is needed in this area.

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