

# The Volatility of Tax Revenues and Taxes as Automatic Stabilizers over Business Cycles

December 2015 | Hag-Soo Kim

## **Korea Institute of Public Finance**

336, Sicheong-daero, Sejong-si, Korea

Tel: 82-44-414-2114 Fax: 82-44-414-2179

URL: [www.kipf.re.kr](http://www.kipf.re.kr)

© 2015 KIPF

# The Volatility of Tax Revenues and Taxes as Automatic Stabilizers over Business Cycles

December 2015

*Hag-Soo Kim*

# Contents ■ ■ ■

<b>I . Introduction .....</b>	<b>7</b>
<b>II . The Volatilities of Tax Bases and Revenues over the Business Cycles ..</b>	<b>9</b>
1. The volatility of personal income tax .....	9
A. Income tax base .....	9
B. Income tax revenue .....	11
2. The volatility of corporate income tax .....	13
A. Corporate income tax base .....	13
B. Corporate tax revenue .....	15
3. The volatility of VAT .....	16
Tax base for VAT .....	16
4. Features of tax base and tax revenue volatility .....	19
<b>III. Empirical analysis for the automatic stabilizer effect .....</b>	<b>22</b>
1. Methods .....	22
2. Multiplier model .....	24
A. Personal income tax .....	25
B. Corporate income tax .....	26
C. Value added tax .....	27
D. All together .....	28
3. Correlation with the cyclical component of GDP .....	29
A. Method .....	29
B. Results .....	29

The Volatility of Tax Revenues and  
Taxes as Automatic Stabilizers over Business Cycles

4. Automatic Stabilization of the corporate tax using firm-level data ..	33
A. Using the Devereux-Fuest measuring method .....	33
B. Using the Buettner-Fuest measuring method .....	35
5. Economic stabilizing effects due to tax system changes .....	39
A. Corporate tax rate .....	39
B. Corporate loss offset rule .....	39
6. Summary and implications .....	43
 IV. Conclusion .....	 46
References .....	49
Appendix. Duration for business cycles .....	50

## List of Tables ■ ■ ■

<Table II-1>	Trends in the national accounts' income tax base and nominal GDP over business cycles and their elasticities .....	10
<Table II-2>	Trends in income tax base by tax laws and nominal GDP over business cycles and their elasticities .....	11
<Table II-3>	Trends in income tax revenue and nominal GDP over business cycles and tax revenue elasticities .....	12
<Table II-4>	Trends in the national accounts' corporate tax base and nominal GDP over business cycles and elasticities .....	14
<Table II-5>	Trends in corporate tax base under the laws and nominal GDP over business cycles and elasticities .....	15
<Table II-6>	Trends in corporate tax revenue and nominal GDP over business cycles and elasticities .....	16
<Table II-7>	Trends in tax base for VAT and nominal GDP over business cycles and elasticities .....	18
<Table II-8>	Trends in tax base under the law and nominal GDP over business cycles and elasticities .....	18
<Table II-9>	Trends in value added tax revenue and nominal GDP over business cycles and elasticities .....	19
<Table II-10>	Distributional features and characteristics of tax bases over the cycles	21
<Table III-1>	Automatic Stabilizer Effects of each tax .....	24
<Table III-2>	Automatic stabilization effects of personal income tax over business cycles: average per period .....	25
<Table III-3>	Automatic stabilization effects of corporate income tax over business cycles: average per period .....	26
<Table III-4>	Automatic stabilization effects of VAT over business cycles: average per period .....	27
<Table III-5>	Automatic stabilization effects of three major taxes over business cycles: average per period .....	28
<Table III-6>	Correlation of real GDP and total national tax Revenue .....	31

---

<Table III-7>	Correlation of real GDP and peronal income tax .....	31
<Table III-8>	Correlation of real GDP and corporate tax .....	32
<Table III-9>	Correlation of Real GDP and value added tax .....	32
<Table III-10>	Devereux-Fuest Automatic Stabilization Effects .....	35
<Table III-11>	Buettner-Fuest Automatic Stabilization effects .....	37
<Table III-12>	Buettner-Fuest economic stabilizing effects by economic state .....	38
<Table III-13>	Economic stabilizing effects by economic state, according to deficit handling method .....	41
<Appendix>	Duration for business cycles .....	50

## List of Figures

- [Figure III-1] Coincident composite index changes and DF automatic stabilization effects:  
using proportion of deficit companies from National Tax Service ..... 34
- [Figure III-2] Coincident composite index changes and BF automatic stabilization  
effects ..... 36
- [Figure III-3] Economic stabilizing effect comparison:  
complete carryback deduction vs. deficit carried forward deduction ... 40





# I

## Introduction

When Korean economy plummeted into deep troughs such as the foreign currency crisis in 1998 and the global financial crisis in 2008, the government implemented expansionary fiscal and financial policies quite actively. In response to economic shocks, the stabilization function inherent in the economy is automatically operated and economic shocks are supposed to be dampened with the active actions of the government. The function of automatic stabilization is enacted not only through discretionary fiscal expenditures but also through tax policies.

The automatic stabilization effect of tax system, in which tax revenue works in the same direction as the economy, suppresses additional overheat of the economy in stages of economic expansion by collecting more tax, and alleviate further worsening by collecting less in times of recession. The economic stabilization effect immanent in tax system - in other words, the automatic stabilization effect of tax system - has a great advantage, in that there is no time delay in policy implementation, over the fiscal expenditure adjustments getting through the law making process and implemented by the government in response to the economic conditions.

There has been many researches analyzing the stabilization effect of fiscal expenditures to reduce the volatility of business. However, it is difficult to find domestic studies of qualitative or quantitative analysis on the automatic stabilization effect of tax system. As such, this research is an experimental study on a topic that has not recently been explicitly addressed domestically, and aims to explore the characteristics of tax revenue and the tax base of major taxes

over business cycles. More specifically, the automatic stabilizers of three major taxes such as personal income tax, corporate income tax, and VAT have been evaluated with various methods from existing foreign studies, for which the goal of this research lies.

The structure of the this report is as follows. First, in chapter II, the volatility of the tax bases and revenues of major taxes will be examined over business cycles. Both tax bases reported by the National Tax Service and analogous bases in national income accounts will be reviewed, and we will discuss how different characteristics they have over the different states of business cycles.

The chapter III reviews the existing researches that evaluate the automatic stabilization effects of tax system, suggests an applicable method of measuring the automatic stabilization effects with currently available data, and discusses the measurement results. The correlation between the volatilities of tax bases and revenues of major three taxes and the volatility of real GDP will also be analyzed. In addition, whether tax revenue and tax base variables are countercyclical over the business cycles will be discussed. In conclusion, what has been discussed in this report will be summarized and its implications will be suggested.

## II

# The Volatilities of Tax Bases and Revenues over the Business Cycles

### 1 The volatility of personal income tax

#### A. Income tax base

The taxable personal income will be the sum of comprehensive income amounts, which includes individual taxpayers wages and salaries, unincorporated business income, interests and dividend income, and etc. The tax base that is derived from the total taxable income after subtracting allowed deductions and exemptions can be considered the narrow definition of the income tax base. The tax base for personal income tax according to the current laws is analogous to the wages and salary, the operating surplus of the household sector, interests, dividends, and etc, specified within the national accounts. Through the elasticity of each index with respect to GDP, the volatility of the income tax base will be examined over the business cycles.

By dividing the business cycles into expansion and recession periods, and calculating the national accounts tax base elasticity, it has been shown that there is no discrete difference of elasticity between the two aforementioned states.<sup>1)</sup>

---

1) Periods of expansion and recession are classified using time periods of peaks and troughs of the business cycle as a standard, announced by Statistics Korea. The transition between a trough and peak is classified as an expansion and an opposite instance is classified as a recession. (Please refer to Appendix for more related data.) The growth rates of different economic conditions and elasticity trends that are mentioned hereafter all apply the terms expansion and recession in the same manner.

In terms of the national accounts, the elasticity of the income tax base with respect to nominal GDP shows how the tax base changes when there is a 1% change in the nominal GDP. When the time period from 1981 to 2014 is considered(see <Table II-1>), the elasticity of the income tax base in the national accounts is 0.9, while the elasticity during a recession is 1.0. The gap, however, is minor.

The results in Table 1 show that the nominal GDP and the income tax base of the national accounts have a nearly identical movement. However, if we look at further specific periods, the tax base elasticity of the expansional periods after the year 2000 depicts a shrinking level of 0.7, while the elasticity during a recession spans up to 1.2.

**<Table II-1> Trends in the national accounts' income tax base and nominal GDP over business cycles and their elasticities**

(Unit of measurement: %, none)

	Tax base growth rate		Nominal GDP growth rate		Elasticity	
	Expansion	Recession	Expansion	Recession	Expansion	Recession
Total period	12.1	8.9	13.3	9.1	0.9	1.0
1981–1990	18.6	15.5	19.1	15.2	1.0	1.0
1991–2000	13.3	8.6	14.9	8.9	0.9	1.0
2001–2010	5.5	5.9	7.1	7.2	0.8	0.8
2007–2014	4.3	4.5	6.9	4.2	0.6	1.1
2008–2014	4.7	4.5	6.5	4.2	0.7	1.1
2009–2014	4.7	4.5	6.5	3.7	0.7	1.2

Source: 1. Statistics Korea, "June 2015 Composite Economic Index," Volume 414, August 2015.  
2. Bank of Korea, Economic Statistics System, <http://ecos.bok.or.kr/>, accessed October 12, 2015.

**<Table II-2> Trends in income tax base by tax laws and nominal GDP over business cycles and their elasticities**

(Unit of measurement: %, none)

	Tax base growth rate		Nominal GDP growth rate		Elasticity	
	Expansion	Recession	Expansion	Recession	Expansion	Recession
2002~2013	11.7	8.9	6.9	5.5	1.7	1.6
2007~2013	12.4	8.9	6.9	4.3	1.8	2.1
2008~2013	10.6	8.9	6.5	4.3	1.6	2.1
2009~2013	10.6	10.2	6.5	3.6	1.6	2.9

Source: 1. Statistics Korea, "June 2015 Composite Economic Index," Volume 414, August 2015  
 2. Bank of Korea, Economic Statistics System, <http://ecos.bok.or.kr/>, accessed October 12, 2015  
 3. National Tax Service, "Statistical Yearbook of National Tax," respective years

The elasticity of income tax base according to the tax laws with respect to the nominal GDP shows an insignificant disparity in the expansions and recessions from 2002 to 2013(see <Table II-2>). However, after 2007, the income tax base elasticity during recessions appears to increase in greater increments, and the difference between the expansion and recession periods is enlarged. The elasticity in expansion periods shows a value of 1.8 during the term 2007~2013; and afterwards, depicts a slightly decreasing aspect, reaching 1.6 after 2009. On the other hand, the elasticity values of assessment standards in recessions grew larger, to 2.9 after 2009. Such high income tax base elasticity in recessions may give rise to a sharp increase in income tax revenue even if the same tax rates are applied, and there is a strong chance that it will play a role in aggravating economic fluctuations during recessions.

## B. Income tax revenue

The growth rate of income tax revenue does not show differences in economic state that are of any significance, except for a few periods(see <Table II-3>). The tax revenue elasticity of expansions is recorded as lower than that of recessions, and for the 1970s and later, the tax revenue elasticity scale has been decreasing. The growth rate differences in expansions and recessions up until the year 2000 are prominent in the nominal GDP, which is speculated to have

caused the disparity in tax revenue elasticity over the cycles. The average increase rate for income tax revenue according to time period did not show a considerable difference for the expansions and recessions during the 1970s through 1990s, but after 2000, such gaps in growth rate are noticeable.

**<Table II-3> Trends in income tax revenue and nominal GDP over business cycles and tax revenue elasticities**

(Unit of measurement: %, none)

	Tax base growth rate		Nominal GDP growth rate		Elasticity values	
	Expansion	Recession	Expansion	Recession	Expansion	Recession
Total period	17.8	15.0	16.9	14.3	1.05	1.05
1971~1980	23.8	24.0	30.9	30.1	0.77	0.80
1981~1990	22.4	21.5	19.1	15.2	1.17	1.42
1991~2000	16.3	12.2	14.9	8.9	1.09	1.37
2001~2010	10.4	5.3	7.1	7.2	1.46	0.75
2007~2014	10.4	4.4	6.9	4.2	1.52	1.05
2008~2014	5.5	4.4	6.5	4.2	0.84	1.05
2009~2014	5.5	8.1	6.5	3.7	0.84	2.20

Source: 1. Statistics Korea, "June 2015 Composite Economic Index," Volume 414, August 2015  
2. Bank of Korea, Economic Statistics System, <http://ecos.bok.or.kr/>, accessed July 3, 2015  
3. Ministry of Strategy and Finance, Collaboration Data, Tax Revenue Records

As shown in <Table II-3>, the difference between the income tax revenue growth rate during recessions and periods of expansion is not considerable. For such reasons, the income tax revenue elasticity during recessions until the year 2000 depicts a higher level in most time periods, and so arises suspicion that the income tax as an automatic stabilizer was not functioning properly. More currently, after the global financial crisis, the elasticity of income tax revenue during recessions appeared higher than that during expansions, and it seems that such problems have become more widespread.

## 2 The volatility of corporate income tax

### A. Corporate income tax base

In the case of the corporate income tax base, much like personal income tax, there is a tax base in the national accounts that is analogous to the one under the law that can be found in the Statistical Yearbook of National Tax. The tax base under the law will be the income during each business year made by corporations with profits and the calculated tax bases. The income made by corporations with profits is the result of deducting net interest payments and net rent payments from corporate net income before tax, adding foreign income, and through tax adjustments that tweak the differences between financial accounting standards and corporate income tax laws. The income, which tax rates apply to, is used to compute the calculated tax amount after deductions in the deficit carried forward and exemptions; this is referred to as the tax base.

The corporate tax base of the national accounts that is most closely related to the income during each business year made by corporations with profits is the operating surplus of the corporate sector.<sup>2)</sup> The operating surplus of the corporate sector, which is the corporate tax base of the national accounts, is the proportion of the gross value added produced within the boundaries of a nation, which is belong to the corporate sector. This kind of operating surplus encompasses the negative operating surplus of deficit companies, and as such, there is a distinction from the income made by corporations with profits, which does not reflect the net losses before tax of deficit enterprises.

In general, the operating surplus elasticity of the corporate sector during economic expansion is greater than during recessions(see <Table II-4>). If the entire time period is taken into account, the tax base growth rate of expansions averages 15.9%, while the growth rate of recessions averages 7.3%, which is a significant reduction. However, the nominal GDP growth rate averages 9.1% in recessions and 13.3% in expansions, which is relatively less of a slowdown,

---

2) Park et al.(2012), pp. 122~124.

and from these data, the elasticity of operating surplus for the corporate sector with respect to nominal GDP is seen to decrease to 0.8.

Such phenomena can be observed more markedly after the year 2000. Despite the overall diminishing growth rates for corporate operating surplus in the 2000s and later, the increase of corporate operating surplus during expansions was connected to corporate tax taking a favorable turn. However, during times of recession, it could be the major factor of rapid deterioration in corporate tax revenue.

〈Table II-4〉 Trends in the national accounts' corporate tax base and nominal GDP over business cycles and elasticities

(Unit of measurement: %, none)

	Tax base growth rate		Nominal GDP growth rate		Elasticity	
	Expansion	Recession	Expansion	Recession	Expansion	Recession
Total period	15.9	7.3	13.3	9.1	1.2	0.8
1981-1990	16.9	15.6	19.1	15.2	0.9	1.0
1991-2000	20.5	3.1	14.9	8.9	1.4	0.3
2001-2010	12.3	8.3	7.1	7.2	1.7	1.2
2007-2014	14.9	0.6	6.9	4.2	2.2	0.1
2008-2014	12.0	0.6	6.5	4.2	1.9	0.1
2009-2014	12.0	0.5	6.5	3.7	1.9	0.1

Source: 1. Statistics Korea, "June 2015 Composite Economic Index," Volume 414, August 2015  
 2. Bank of Korea, Economic Statistics System, <http://ecos.bok.or.kr/>, accessed October 12, 2015  
 3. National Tax Service, "Statistical Yearbook of National Tax," respective years

In the case of tax base under the laws, elasticity during an economic recession is higher and, especially after 2007, carries a negative (-) value(see <Table II-5>). The tax base growth rate, which incorporates deductions in the deficit carried forward, is depicted by a higher decreasing rate than that of income made by corporations with profits, at 3.3%~3.9%. Therefore, it can be said that corporate tax is working effectively as automatic stabilizer, since the tax base elasticity in recessions has a negative value, while in expansions, high levels of elasticity are derived in comparison to the nominal GDP. More thorough examinations are to be conducted in the future, but for now, it can be concluded that the



high elasticity in tax base during expansions leads to higher corporate tax revenue, executes a role in suppressing the possibility of overheating economy. In addition, during the periods of recession, the negative elasticity performs stabilizing effects by reducing corporate tax revenue.

〈Table II-5〉 Trends in corporate tax base under the laws and nominal GDP over business cycles and elasticities

(Unit of measurement: %, none)

	Tax base growth rate		Nominal GDP growth rate		Elasticity	
	Expansion	Recession	Expansion	Recession	Expansion	Recession
Total period	24.3	7.9	12.6	9.4	1.9	0.8
1982–1990	31.3	17.2	17.9	15.2	1.7	1.1
1991–2000	28.4	3.0	14.9	8.9	1.9	0.3
2001–2010	17.5	9.4	7.1	7.2	2.5	1.3
2007–2013	14.1	–3.3	6.9	4.3	2.0	–0.8
2008–2013	11.1	–3.3	6.5	4.3	1.7	–0.8
2009–2013	11.1	–3.9	6.5	3.6	1.7	–1.1

Source: 1. Statistics Korea, "June 2015 Composite Economic Index," Volume 414, August 2015  
 2. Bank of Korea, Economic Statistics System, <http://ecos.bok.or.kr/>, accessed October 12, 2015  
 3. National Tax Service, "Statistical Yearbook of National Tax," respective years

## B. Corporate tax revenue

According to the results of corporate tax revenue elasticity examined over the cycles, tax revenue elasticity in recessions was more often a higher value than during expansions, and so the stabilizing ability of corporate tax in recessions seems feeble. Such results come from the fact that corporate tax revenue growth rates in past recessions did not shrink greatly compared to expansions or, rather, they were reported higher. Especially after 2007, the growth rate for expansional corporate tax revenue was greatly dulled, more than the growth rate for recessions, and corporate tax revenue elasticity in recessions significantly diminished, more than during expansions(see <Table II-6>).

The corporate tax of Korea did not properly function as an automatic stabilizer over the cycles. However, after the 1990s, there have been stabilizing

effects to some extent, but during the years 2001~2010, tax revenue elasticity differences in recessions and expansions were reduced, and so it appears as though the economic stabilizing function of corporate tax was weakened. However, after 2007, corporate tax's automatic stabilizing effect became enforced, and especially after 2009, corporate tax revenue elasticity during recessions is a negative value, and to some extent, through reduction in corporate tax revenue, the corporate tax played as an automatic stabilizer.

〈Table II-6〉 Trends in corporate tax revenue and nominal GDP over business cycles and elasticities

(Unit of measurement: %, none)

	Tax base growth rate		Nominal GDP growth rate		Elasticity	
	Expansion	Recession	Expansion	Recession	Expansion	Recession
Total period	19.0	19.7	16.9	14.3	1.1	1.4
1971~1980	21.7	41.9	30.9	30.1	0.7	1.4
1981~1990	19.2	25.2	19.1	15.2	1.0	1.7
1991~2000	27.0	13.2	14.9	8.9	1.8	1.5
2001~2010	8.2	8.7	7.1	7.2	1.1	1.2
2007~2014	9.2	1.4	6.9	4.2	1.3	0.3
2008~2014	5.4	1.4	6.5	4.2	0.8	0.3
2009~2014	5.4	-1.6	6.5	3.7	0.8	-0.4

Source: 1. Statistics Korea, "June 2015 Composite Economic Index," Volume 414, August 2015  
 2. Bank of Korea, Economic Statistics System, <http://ecos.bok.or.kr/>, accessed July 3, 2015  
 3. Ministry of Strategy and Finance, Collaboration Data, Tax Revenue Records

### 3 The volatility of VAT

#### Tax base for VAT

The tax base for VAT in the national account is the final domestic consumption. Because the final consumption expenditure of the national account includes VAT revenue, the tax base for VAT is the final consumption expenditure of the national account excluding VAT revenue.<sup>3)</sup> The final consumption

expenditure of the national account is consistently increasing as the Korean economy expands, but the proportion of government consumption expenditures is getting larger due to expansion in the government sector. Still, the private sector accounts for approximately 77% of the final consumption expenditure.

The tax base for VAT under the law is defined by the sum of the value added tax and zero tax rate sales tax base, with the tax base of input tax amounts excluded.<sup>4)</sup> Considering that all steps of Korea's value added taxation system is based on deductions in input tax amounts, the tax base can be defined as the sum of the tax base regarding sales. However, due to the characteristics of multiple-stage transactions, the sum of the tax base for sales is subject to double counts. Therefore, the tax base for VAT under the law can be defined as the remainder, excluding the tax base for input.

The elasticity of the tax base for VAT under the law does not appear to change significantly over the cycles(see <Table II-7>). Final consumption expenditure elasticity compared to nominal GDP in economic expansions and recessions exhibited very significant unit elasticity, close to the value of 1. Moreover, the difference in elasticity by period was not observed to be of great significance. Even though the tax base elasticity for VAT did not show significant disparities according to economic state, much like the tax base of the national accounts, the tax base elasticity for VAT was found to be rather inelastic compared to the national account tax base(see <Table II-8>).

This feature of the tax base elasticity for VAT over the cycles implies that the value added taxation system does not perform as an automatic stabilizer. Especially in the case of Korea, the elasticity of value added tax revenue is expected to continue its stable trend since the adoption of the value added taxation system in 1977, due to the same tax rates and small changes in taxable products.

---

3) Bank of Korea(2010), "System of National Accounts of Korea," p. 199.

4) The sales revenue portion of tax exemptions is excluded from the subject of taxation, much like the tax-free income of income tax, and as it also does not apply to deductions in input tax amounts, it is excluded from the calculation of the tax base for VAT.

〈Table II-7〉 Trends in tax base for VAT and nominal GDP over business cycles and elasticities

(Unit of measurement: %, none)

	Tax base growth rate		Nominal GDP growth rate		Elasticity	
	Expansion	Recession	Expansion	Recession	Expansion	Recession
Total period	12.6	8.9	13.3	9.1	0.9	1.0
1981–1990	15.7	14.3	19.1	15.2	0.8	0.9
1991–2000	15.9	9.5	14.9	8.9	1.1	1.1
2001–2010	7.1	5.4	7.1	7.2	1.0	0.8
2007–2014	6.0	4.4	6.9	4.2	0.9	1.0
2008–2014	5.5	4.4	6.5	4.2	0.9	1.0
2009–2014	5.5	3.5	6.5	3.7	0.9	1.0

Source: 1. Statistics Korea, "June 2015 Composite Economic Index," Volume 414, August 2015  
 2. Bank of Korea, Economic Statistics System, <http://ecos.bok.or.kr/>, accessed October 12, 2015  
 3. National Tax Service, "Statistical Yearbook of National Tax," respective years

〈Table II-8〉 Trends in tax base under the law and nominal GDP over business cycles and elasticities

(Unit of measurement: %, none)

	Tax base growth rate		Nominal GDP growth rate		Elasticity	
	Expansion	Recession	Expansion	Recession	Expansion	Recession
2006–2014	6.2	4.4	9.5	7.0	0.7	0.6
2007–2014	6.0	4.4	10.2	7.0	0.6	0.6
2008–2014	5.5	4.4	10.5	7.0	0.5	0.6
2009–2014	5.5	3.5	10.5	4.2	0.5	0.8

Source: 1. Statistics Korea, "June 2015 Composite Economic Index," Volume 414, August 2015  
 2. Bank of Korea, Economic Statistics System, <http://ecos.bok.or.kr/>, accessed October 12, 2015  
 3. National Tax Service, "Statistical Yearbook of National Tax," respective years

As shown in <Table II-9>, the elasticity of value added tax revenue was usually higher in economic expansion periods, but since 2007, was recorded higher during recessions than expansion periods, and this seems to have amplified economic fluctuations. In observing the entire period, the growth rate of tax revenue in recessions was lower than that of expansion periods in terms of a

1% increase in nominal GDP, and this implies that the value added taxation system of Korea might have partially performed the economic stabilizing function. However, the scale of tax revenue elasticity in expansion and recession periods has switched, increasing more during recessions than in expansion phases, and it is highly likely that it intensified economic states, rather than performed stabilizing effects.

〈Table II-9〉 Trends in value added tax revenue and nominal GDP over business cycles and elasticities

(Unit of measurement: %, none)

	Tax base growth rate		Nominal GDP growth rate		Elasticity values	
	Expansion	Recession	Expansion	Recession	Expansion	Recession
Total period	26.4	11.6	14.4	11.0	1.84	1.05
1977~1980	245.7	32.7	35.1	25.6	7.00	1.28
1981~1990	19.6	13.3	19.1	15.2	1.03	0.88
1991~2000	17.0	8.4	14.9	8.9	1.14	0.94
2001~2010	8.6	6.9	7.1	7.2	1.20	0.96
2007~2014	7.6	5.9	6.9	4.2	1.11	1.41
2008~2014	7.7	5.9	6.5	4.2	1.18	1.41
2009~2014	7.7	5.6	6.5	3.7	1.18	1.52

Source: 1. Statistics Korea, "June 2015 Composite Economic Index," Volume 414, August 2015  
 2. Bank of Korea, Economic Statistics System, <http://ecos.bok.or.kr/>, accessed July 3, 2015  
 3. Ministry of Strategy and Finance, Collaboration Data, Tax Revenue Records

#### 4 Features of tax base and tax revenue volatility

The distributional features and characteristics in different economic states for the tax base and tax revenue growth rates of major three taxes that have been discussed above can be summarized into three main points, as shown in <Table II-10>.

First, the volatility of the national account's tax base and tax revenue for personal income tax, corporate income tax, and VAT was higher than that of the coincident composite index of the entire period, but decreased after 2000.

However, the tax base and tax revenue growth rate distribution, including the corporate tax base of the National Tax Service, still appeared greater more often than that of the coincident composite index, which represents the overall volatility of Korean economy. In some exceptional cases, the growth rate distribution of the income tax base under the tax laws was narrower than that of the coincident composite index, and the volatility decreased substantially.<sup>5)</sup> In addition, the median of each variable's growth rate decreased after 2000 compared to that of the whole period, as well as the median growth rate of the coincident composite index. This implies that tax revenue elasticity has decreased, as the growth rate of the tax base and tax revenue slowed on average.

Second, for personal income tax and VAT, the national account tax base elasticity with respect to nominal GDP during recessions seemed higher or similar to those in economic expansions. Only in the case of corporate tax did both the national account tax base and the one under the tax law show low elasticities during recessions. This trend lasted to the post period of 2007. Greater tax base elasticity in recessions indicates that the tax burden will increase when the tax rate remains the same, so it can be said that the tax system is an intensifying factor of economic recessions. Conclusively, only the tax base of corporate tax among the three taxes performs the function of automatic stabilizer. In particular, the income made by corporations with profits and tax base under the law have displayed more prominent negative elasticity after 2007, which implies that they were the main factor of the recent decline in the corporate tax revenue. This implies in turn that they are the source of corporate tax's automatic stabilizing effect.

Third, although the tax revenue elasticities of major three taxes with respect to nominal GDP vary over the periods, in the case of personal income tax and value added tax, tax revenue elasticity during recessions was lower than that of expansion periods when taking the total period into consideration, and after 2007, only corporate tax revenue elasticity in recessions appeared lower than that of expansion periods. In the case of personal income tax, tax revenue elasticity of the entire period remained either steady regardless of economic condition or slightly lower only in the period of recession during 2000~2010.

---

5) The income tax and value added tax base of the National Statistics before 2000 were not available, making it impossible to examine this trend.

On the other hand, in the case of value added tax, tax revenue elasticity of the entire period until 2010 was lower in recessions and played as an automatic stabilizer, but that effect in recessions seems to have weakened since 2007, as it has the opposite effect in subdivided periods after 2007.

〈Table II-10〉 Distributional features and characteristics of tax bases over the cycles

Tax items	Variable	Volatility comparing to Coincident composite index		Elasticity w.r.t. Nominal GDP	
		Total period	After 2000	Total period	After 2007
Personal income tax	National Account tax base	– distributed widely (especially in the lower 50%) – similar median	– decreased enormously – distributed narrowly – low median	– a little higher or similar in recession	– high in recession
	Tax base under the law	–	– distributed widely – high median	–	– high in recession – more prominent since 2007
	Tax revenue	– distributed widely – a little higher median	– decreased enormously – still distributed widely – similar median	– similar – high during expansion only in 2000~2010	– high in recession since 2008
Corporate Tax	National Account tax base	– distributed widely – high median	– decreased enormously – still distributed widely – low median	– low in downturn	– very low in downturn
	Tax base under the law	– distributed widely – a little higher median	– decreased more or less – still distributed widely – low median	– low in recession	– very low in recession – more prominent since 2007
	Tax revenue	– distributed widely – a little higher median	– decreased enormously – low median	– high in recession – high only in 1990s expansions	– low in recession – negative elasticity in 2009~2014
Value Added Tax	National Service tax base	– distributed rather widely – a little higher median	– decreased more or less – still distributed widely – low median	– little higher or similar in recession	– little higher or similar in recession
	National Service tax base	–	– distributed narrowly (except for outliers) – little higher median	–	– little higher or similar in recession – high in recession since 2009
	Tax revenue	– distributed widely – little higher median	– decreased more or less – still distributed widely – low median	– low in downturn	– high in downturn

# III

## Empirical analysis for the automatic stabilizer effect

### 1 Methods

The built-in economic stabilizing function or automatic stabilizing function of the tax system indicates that the current system automatically operates and reduces the changes in income or product in response to economic shifts. Therefore, the strict meaning of these functions in the tax system should exclude the effects from discretionary tax reforms of the government in response to economic shifts. However, it is difficult to measure the effects of discretionary tax reform accurately and reflect them in reality because Korea undergoes tax reform every year.

Although rather less precise, the method of using a simple multiplier model to overcome this difficulty was introduced by Musgrave and Miller(1948), and improved by Eilbott(1966), among others. The method of measuring the tax system's automatic stabilizing effect using the multiplier model deals with only an approximate, but it is judged as a useful one that can be accessed with macroeconomic aggregate data. The Korean tax system's economic stabilizing function was measured with Musgrave and Miller's(1948) multiplier model, which is a classical method of measuring automatic stabilization effects, as a reference.

As it is impossible to strictly measure and reflect all the effects of annual tax reforms, the tax system's stabilizing function in this report includes not only the effects from discretionary tax reform of the government in response to



economic shifts, but also encompasses the government's judgment errors of economic state, errors in policy tools, or errors due to the time difference of policy enforcement that occurs within democracy. Although it includes these various effects, they cannot be specified, but it is assumed that exploring whether the tax system policies of the government have performed conversely in response to economic states by using tax related variables and GDP is worthwhile.

If, by Keynesian's claim, the tax system of the government has prevented additional overheat in economic expansion by increasing tax rates in expansion periods through collecting more revenues, and prevented additional economic slowdown in recessions by decreasing tax rates and collecting less, the average effective rate of tax and the tax revenue proportion relative to GDP should have a statistically meaningful positive correlation with the cyclical component of GDP. If any meaningful correlation between these two is not found, this fact would support the tax smoothing theory, which proposes keeping a fixed tax rate in all economic states and supporting inadequate finance with debts in recessions and repaying them with economic surplus in expansion periods (Furceri and Karras, 2011).

The method of using financial statements of corporations that are subject to external audits regularly can be employed to analyze the automatic stabilizing effect with tax system changes when it is difficult to utilize individual tax payment data managed strictly by the National Tax Service. When micro-level data of individual companies was available, more thorough analysis reflecting company features, such as the legal marginal tax rate each company faces, average effective rate of tax, and deductions in deficit carried forward, was possible. There are existing studies by Devereux and Fuest(2009) and Buettner and Fuest(2010) that measured the automatic stabilizing effect of corporate tax and reflected the changes of the tax system in their analyses. These studies, excluding the aforementioned two empirical analyses, also measure the automatic stabilizing effect of corporate tax using an individual company's financial data, and compare and examine the changes in automatic stabilization effect in response to the change in tax rate or deficit carry forward and backward.

This study will try to quantify the automatic stabilization effects for three major taxes-personal income tax, corporate income tax, VAT, using the three methods mentioned above.

## 2 Multiplier model

Because micro-level data of individual tax payers is difficult to acquire, a multiplier model using macro-level aggregate data, similar to Musgrave and Miller's(1948) and Eilbott's(1966), will be used to study the approximate trends of automatic stabilizer of each tax. For the brevity of models, a closed economy excluding the foreign sector is assumed. The model aims to reveal how, in economies where personal income tax, value added tax, and corporate tax are separately levied or imposed all together, GDP change caused by external shock is dampened comparing to an economy where no such tax system is imposed. In other words, the effect of automatic stabilizer of the tax system can be expressed into  $\gamma = 1 - dY^{AS}/dY^X$ , where  $dY^{AS}$  denotes the GDP change caused by external shock in an economy where there exists an automatic stabilizer through the tax system,  $dY^X$  is the GDP change caused by aggregate demand shock in an economy where there is no such automatic stabilizer. The effects of automatic stabilizer for personal income tax, corporate tax, and value added tax can be calculated as follows in <Table III-1>.

<Table III-1> Automatic Stabilizer Effects of each tax

Classification	Economic auto-stabilizing effect
Income tax imposition	$\gamma_P = \frac{c \tau_P \rho_H}{1 - c(1 - \tau_P) \rho_H}$
Corporate tax imposition	$\gamma_C = \frac{\rho_F(1 - i(1 - \tau_C))}{1 - c \rho_H - i(1 - \tau_C) \rho_F}$
Value added tax imposition	$\gamma_V = \frac{c^2(1 - \hat{\tau}_V) \rho_H}{1 + c(1 - \hat{\tau}_V) - c \rho_H}$
Imposition of all 3 taxes	$\gamma_{all} = \frac{c \rho_H(1 - (1 + (1 - \hat{\tau}_V))^{-1}(1 - \tau_P)) + \rho_F(1 - i(1 - \tau_C))}{1 - c \rho_H(1 + c(1 - \hat{\tau}_V))^{-1}(1 - \tau_P) - \rho_F i(1 - \tau_C)}$

note: 1.  $c$  Marginal propensity to consume,  $i$  Marginal propensity to invest,  $\tau_P$  Income tax effective tax rates,  $\tau_C$  Corporate tax effective tax rates,  $\tau_V$  Value added tax effective tax rates,  $\hat{\tau}_V = 1/(1 + \tau_V)$ ,  $\rho_H$  Household income proportion relative to GDP,  $\rho_F$  Corporate sales surplus relative to GDP  
2. The derivation of each formula in detail can be provided upon request.

### A. Personal income tax

The calculation results of how much the personal income tax system alleviates income change caused by external shock in an economy where only income tax is imposed can be found in <Table III-2>. Korea's economic stabilizing effects of income tax per year has not been significantly large at around 1.5~4.7%.

As the influence on GDP increases along with the marginal propensity to consume in the multiplier model, the alleviation effect on income change by the income tax system will increase, as well. The automatic stabilization effect of income tax became slightly lower after 1975, then the estimated annual effects showed the trend of getting larger after the mid-1980s. Since then, the highest level of stability has been in 2007. Afterwards, there was a slight drop in the effect of automatic stabilizer for personal income tax, but after 2010, slightly improved.

Looking at each economic state, the effects for expansion periods and recession periods are quite similar. However, after 2007, the automatic stabilization effect of the recession period became greater than that of the expansion period, and the stabilization effects over the cycles began to show a trend in which the differences grew. The recent trend in the estimated automatic stabilization effect may be due to the enhanced progressiveness of personal income tax, for example, the new highest income tax rate of 38% and the downward adjustment of the highest tax bracket level of income in 2009.

**<Table III-2> Automatic stabilization effects of personal income tax over business cycles: average per period**

(Unit of measurement: %)

Classification	Automatic Stabilization effect I(MPC=0.6)		Automatic Stabilization effect II(MPC=0.7)		Automatic Stabilization effect III(MPC=0.8)	
	Expansion	Recession	Expansion	Recession	Expansion	Recession
Total period	2.3	2.3	2.9	2.9	3.5	3.6
1980's	1.7	1.7	2.2	2.2	2.7	2.8
1990's	2.6	2.7	3.2	3.4	4.0	4.2
2000's	2.5	2.4	3.1	2.9	3.8	3.6
2007~2014	2.6	2.7	3.2	3.4	3.9	4.1
2008~2014	2.5	2.7	3.1	3.4	3.7	4.1
2009~2014	2.5	2.8	3.1	3.4	3.7	4.2

## B. Corporate income tax

As shown in <Table III-3>, the automatic stabilization effect of corporate income tax per year is estimated at high rate of 14~22%. In other words, the changed portion of GDP caused by economic shock has been absorbed by the corporate tax system about by 14~22%, which implies the portion of GDP change that occurred in the actual economy is around 78~86% of the given external shock.

The automatic stabilization effect of corporate tax became progressively lower during the period 1979~1998, then rapidly enlarged after the foreign exchange crisis. Since 2010, however, it has declined. Looking at each economic state, the expansion and recession periods' automatic stabilization effects has been quite similarly estimated. Even when looking at the average of each period, having more than a 1% difference in the estimated effects of corporate taxes by economic state is not common.

**<Table III-3> Automatic stabilization effects of corporate income tax over business cycles: average per period**

(Unit of measurement: %)

Classification	Automatic Stabilization effect I (MPC=0.6, MPI=0.3)		Automatic Stabilization effect II (MPC=0.7, MPI=0.4)		Automatic Stabilization effect III (MPC=0.8, MPI=0.5)	
	Expansion	Recession	Expansion	Recession	Expansion	Recession
Total period	18.5	18.0	18.3	17.8	18.2	17.6
1980's	17.9	18.5	17.9	18.4	17.9	18.4
1990's	17.3	15.4	17.3	15.3	17.2	15.1
2000's	19.6	18.8	19.4	18.6	19.1	18.3
2007~2013	20.8	19.9	20.5	19.5	20.1	19.0
2008~2013	21.0	19.9	20.6	19.5	20.1	19.0
2009~2013	21.0	20.3	20.6	19.9	20.1	19.3

note: Years represent the business year and corporate effective tax rates are calculated as "corporate tax revenue/operating surplus of the corporate sector"

### C. Value added tax

In cases where only value added tax is implemented, the results of estimating automatic stabilization effects are shown in <Table III-4>. The automatic stabilization effect of value added tax alleviates less than 3% of the GDP change of economic shock, which is presumed to be the lowest effect among the major three taxes.

Value added tax acts similar to individual income tax based on the consumption level; thus, it suppresses the expansion or recession of consumption amounts over the cycles and represses the changes in GDP caused by external shocks. However, there is little difference between the automatic stabilization effects by the state of economy. In addition, since value added tax has been implemented, its stabilization effects have progressively diminished over the years. The value added tax rate has remained at 10% since its adoption so that the actual effective tax rate has decreased, which may be the main reason of the declining trend of the estimated automatic stabilization effect for VAT.

**<Table III-4> Automatic stabilization effects of VAT over business cycles:  
average per period**

(Unit of measurement: %)

Classification	Automatic Stabilization effect I (MPC=0.6, MPI=0.3)		Automatic Stabilization effect II (MPC=0.7, MPI=0.4)		Automatic Stabilization effect III (MPC=0.8, MPI=0.5)	
	Expansion	Recession	Expansion	Recession	Expansion	Recession
Total period	1.6	1.5	2.3	2.2	3.2	3.1
1980's	1.6	1.6	2.4	2.4	3.5	3.4
1990's	1.6	1.6	2.4	2.4	3.4	3.3
2000's	1.4	1.5	2.1	2.1	2.9	3.0
2007~2014	1.4	1.4	1.9	2.0	2.7	2.8
2008~2014	1.3	1.4	1.9	2.0	2.7	2.8
2009~2014	1.3	1.4	1.9	2.0	2.7	2.8

#### D. All together

In cases where all three major taxes are implemented, 20~25% of the GDP change caused by economic shock was alleviated by income, value added, and corporate tax. According to Eilbott(1966), when the marginal propensity to consume is 0.8 and marginal propensity to invest is 0.3, the American tax system's stabilizing effect is presumed to be 32.8%. In the case of Korea, when the same marginal propensity to consume and marginal propensity to invest is assumed, after 1975, the average effect of automatic stabilization over all periods was estimated as 27.0% in recessions—around 6% point less than Eilbott's minimum estimates(see <Table III-5>).

Looking at the estimated effects of the three main tax systems by economic state, generally, the effects during the expansion period is presumed to be greater. However, since 2000, the effects during the contraction period have been enlarged. These trends are the same for the automatic stabilization effect for corporate income tax, which is presumed to be due to corporate tax having higher effective tax rates than any other system and thus the total effect could be controlled by the automatic stabilization effects of corporate income tax.

**<Table III-5> Automatic stabilization effects of three major taxes over business cycles: average per period**

(Unit of measurement: %)

Classification	Automatic Stabilization effect I (MPC=0.6, MPI=0.3)		Automatic Stabilization effect II (MPC=0.7, MPI=0.4)		Automatic Stabilization effect III (MPC=0.8, MPI=0.5)	
	Expansion	Recession	Expansion	Recession	Expansion	Recession
Total period	21.6	21.1	22.6	22.1	23.9	23.3
1980's	20.7	21.2	21.8	22.3	23.2	23.7
1990's	20.7	19.0	22.0	20.1	23.5	21.7
2000's	22.8	21.9	23.6	22.7	24.7	23.8
2007~2013	24.0	23.2	24.7	23.9	25.6	24.7
2008~2013	24.0	23.2	24.6	23.9	25.4	24.7
2009~2013	24.0	23.6	24.6	24.2	25.4	25.1

note: Years represent the business year and corporate effective tax rates are calculated as "corporate tax revenue/operating surplus of the corporate sector"

### 3 Correlation with the cyclical component of GDP

#### A. Method

Through correlation analysis using tax related aggregate data and GDP data of Korea to evaluate how Korea's tax policy has been responding to the economy, this study aims to analyze what correlation tax related variables, such as average effective tax rates and tax revenue ratio to GDP, have with the cyclical component of real GDP. If the government has been, according to Keynesian's standard arguments, actively trying to control the economy through increasing tax rates during expansion periods while decreasing rates during recession periods, tax related variables would have a statistically significant correlation with the cyclical component of real GDP. However, in cases where the correlation is not statistically significant, it can be assumed that the tax smoothing theory discussed in previous literature is applicable to Korea as well. If a negative correlation is presumed to be statistically significant, it can be conferred that Korea's tax policy has pro-cyclicality and intensified the conditions of that economy.

The Baxter-King(BK) and Hodrick-Prescott(HP) filters within Stata, the statistics program, along with the average effective tax rates estimated on the basis of the tax base of national accounts, have been used. The economic fluctuation portion excluding GDP trends and the correlation between tax related variables are assumed.

#### B. Results

According to the correlation analysis results, the average effective tax rates and tax revenue ratio to GDP generally have a very weak correlation with the trend excluded cyclical component of real GDP, and as such, is statistically negligible. This analysis result, as mentioned by Furceri and Karras(2011), supports the tax soothing theory in which regardless of the economic condition, tax rates are evenly maintained, while during economic recessions, revenue is made up through borrowing, and during economic expansions, the debt is paid back with extra revenue. In other words, the government does not increase tax

rates during expansion periods, thereby suppressing additional expansion, nor decrease tax rates during economic recessions to nurture the economy.

In the case of total national tax, regardless of the economic phase, the level variable of the total national tax and the ratio to GDP are highly correlated with the real GDP level(see <Table III-6>). This indicates that the national tax revenue and its ratio to GDP have a very close positive relationship, and that tax revenue sensitively reacts to the economic situation. However, the correlation with the trend excluded cyclical component of real GDP is insignificant; hence, it is unlikely tax policies perform a stabilizing function counter-cyclically. This analysis result is the same for two different filters used.

In the cases of income tax and value added tax, there is a statistically meaningful negative correlation during expansion periods, which indicates possible pro-cyclical tax policy management (see <Table III-7> and <Table III-9>). In particular, the negative correlation between average effective income tax rates and the cyclical component of GDP in expansions is supported by the BK and HP filters. In the case of corporation tax, corporate tax rates and the corporate tax revenue ratio to GDP have no statistically meaningful correlation with the cyclical component of GDP(see <Table III-8>).

According to the results discussed above, the tax policy management in Korea responding to economic fluctuations can be generally seen as tax smoothing rather than counter-cyclical Keynesian type. Hence, Korea's tax policy tends to sustain current tax rates while deficit is supplemented by borrowing debt during economic recessions and paying back the debt through extra tax revenue in economic expansions.<sup>6)</sup>

---

6) For the tax smoothing theory to hold validity, government expenses over economic expansion periods should not be increased, while extra revenue should be used to repay debt. However, in real world, most major countries are continuously expanding their national debt; thus, analyses should be conducted after taking government expenses into account.



〈Table III-6〉 Correlation of real GDP and total national tax Revenue

Classification	Total period			By economic state					
	real GDP	Trend excluded		real GDP		Trend excluded(1)		Trend excluded(2)	
		(1)	(2)	Expansion	Recession	Expansion	Recession	Expansion	Recession
Total national tax Revenue	0.995 (0.000)	0.093 (0.574)	0.044 (0.775)	0.994 (0.000)	0.996 (0.000)	-0.512 (0.025)	0.090 (0.706)	-0.033 (0.883)	0.286 (0.197)
Revenue Ratio to GDP	0.932 (0.000)	0.118 (0.476)	0.092 (0.547)	0.928 (0.000)	0.939 (0.000)	-0.340 (0.154)	-0.049 (0.837)	0.089 (0.687)	0.198 (0.378)

note: 1. P-values are denoted in parentheses

2. Trend excluded(1) is the value after the removal of trend values through the Baxter–King filter

3. Trend excluded(2) is the value after the removal of trend values through the Hodrick–Prescott filter

4. In the case of real GDP, the economic state was determined using the business cycle of the composite economic index announced by Statistics Korea, while the trend exclusion was determined through the real GDP removed of trends by the respective methods as a standard

〈Table III-7〉 Correlation of real GDP and peronal income tax

Classification	Total period			By economic state					
	Real GDP	Trend excluded		Real GDP		Trend excluded(1)		Trend excluded(2)	
		(1)	(2)	Expansion	Recession	Expansion	Recession	Expansion	Recession
Income tax revenue	0.990 (0.000)	0.108 (0.511)	0.039 (0.802)	0.993 (0.000)	0.989 (0.000)	-0.533 (0.019)	0.185 (0.435)	-0.131 (0.552)	0.326 (0.139)
Revenue Ratio to GDP	0.859 (0.000)	0.120 (0.466)	0.049 (0.747)	0.894 (0.000)	0.831 (0.000)	-0.481 (0.037)	0.287 (0.219)	-0.282 (0.193)	0.350 (0.111)
Effective tax rates	0.904 (0.000)	0.065 (0.705)	0.036 (0.825)	0.908 (0.000)	0.900 (0.000)	-0.487 (0.035)	0.348 (0.157)	-0.500 (0.029)	0.327 (0.147)

note: Refer to 〈Table III-6〉 notes 1~4

〈Table III-8〉 Correlation of real GDP and corporate tax

Classification	Total period			By economic state					
	Real GDP	Trend excluded		Real GDP		Trend excluded(1)		Trend excluded(2)	
		(1)	(2)	Expansion	Recession	Expansion	Recession	Expansion	Recession
Corporate tax revenue	0.985 (0.000)	0.114 (0.490)	0.029 (0.854)	0.987 (0.000)	0.984 (0.000)	-0.538 (0.018)	0.202 (0.393)	-0.133 (0.547)	0.291 (0.201)
Revenue Ratio to GDP	0.482 (0.001)	0.184 (0.262)	-0.002 (0.991)	0.647 (0.001)	0.283 (0.226)	-0.387 (0.102)	0.326 (0.161)	-0.309 (0.151)	0.263 (0.250)
Effective tax rates	0.210 (0.199)	0.191 (0.257)	-0.085 (0.608)	0.286 (0.198)	0.131 (0.616)	-0.017 (0.945)	0.182 (0.469)	0.033 (0.893)	-0.020 (0.933)

note: Refer to 〈Table III-6〉 notes 1~4

〈Table III-9〉 Correlation of Real GDP and value added tax

Classification	Total period			By economic state					
	Real GDP	Trend excluded		Real GDP		Trend excluded(1)		Trend excluded(2)	
		(1)	(2)	Expansion	Recession	Expansion	Recession	Expansion	Recession
Value added tax revenue	0.983 (0.000)	-0.058 (0.741)	-0.062 (0.712)	0.976 (0.000)	0.994 (0.000)	-0.530 (0.020)	0.441 (0.087)	-0.455 (0.050)	0.394 (0.095)
Revenue ratio to GDP	0.634 (0.000)	-0.267 (0.121)	-0.106 (0.526)	0.627 (0.002)	0.657 (0.004)	-0.417 (0.076)	0.223 (0.406)	-0.252 (0.298)	0.467 (0.044)
Effective tax rates	0.753 (0.000)	-0.165 (0.343)	-0.059 (0.726)	0.728 (0.000)	0.838 (0.000)	-0.511 (0.025)	0.580 (0.018)	-0.279 (0.248)	0.645 (0.003)

note: Refer to 〈Table III-6〉 notes 1~4

#### 4 Automatic Stabilization of the corporate tax using firm-level data

Since corporate tax revenue shows considerable volatility and sensitively changes with economy shifts, it can substantially influence the automatic stabilization effect of the overall tax system. Due to practical limitations, the automatic stabilization effect of the corporate tax system using the financial data of individual corporations will be analyzed, which helps with assuming some partial information on individual tax payment data.

Devereux and Fuest(2009) and Buettner and Fuest(2010), using financial data and credit constraint information of individual corporations of England and Germany, respectively, offer a method to measure the automatic stabilization effect of corporate tax. These studies show that the investment scale depends largely on the internal available resources because, among credit constraint corporations, those that bear the expense of corporate tax find it hard to obtain investment resources from outside sources. Therefore, they measure how much reductions in the investment scale will be alleviated by corporate income tax when economic shock is given. Corporations that do not bear the expense of corporate tax or have credit constraints are based on the theoretical model that even when an economic shock occurs, the investment shrinkage alleviation effect does not occur through corporate income tax.

In this study, data of the KISVALUE corporations subject to external audit was used from the period 2000 to 2013. Corporations that received a credit rating of 7 or higher from the National Information & Credit Evaluation agency were classified as credit constraint corporations, which are more likely to have difficulty with external fund borrowing.

##### A. Using the Devereux-Fuest measuring method

Devereux and Fuest(2009) (hereafter DF) use individual firm-level data to measure the automatic stabilization effect of the corporate tax system, which can be computed using the equation below:

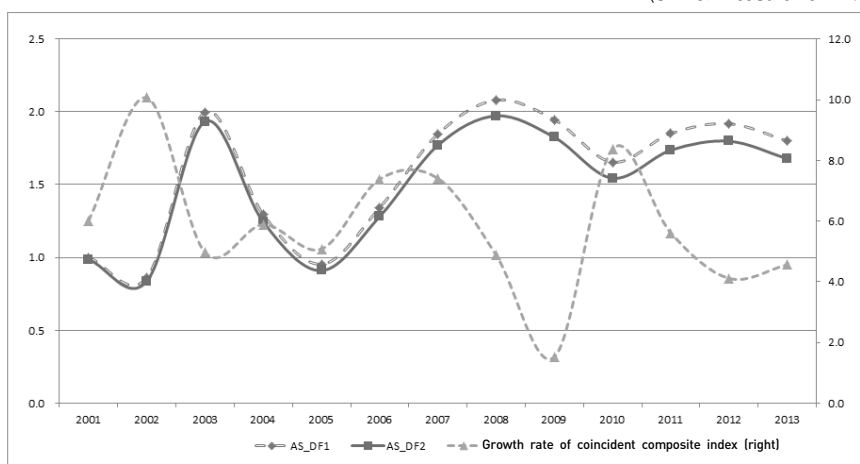
$$AS_t^{DF} = \max[\tau(k_t - l_t), 0]$$

Here,  $\tau$  refers to the weighted average of the legal marginal tax rate faced by corporations,  $k$  to the proportion of credit-constrained corporations, and  $l$  refers to the proportion of deficit corporations. DF measures the automatic stabilization effect of the corporate tax system on the investment of a t-year. In other words, it measures the proportion of investment that was alleviated due to the corporate tax system, out of the investments that were reduced due to economic shock when the corporate tax system was non-existent.

Looking at the outcome of calculating the DF automatic stabilization effect using the proportion of deficit corporations by KISVALUE, as shown in Table 20, when the deduction of deficit carried forward is not applied, the average effect is 4.2% after 2001, and when it is applied, the average is 4.0%. A legal marginal tax rate reduction of about 1.2%, including the amount of local tax, leads to a meager 0.2% reduction effect in the economy stabilizing function.

**[Figure III-1] Coincident composite index changes and DF automatic stabilization effects: using proportion of deficit companies from National Tax Service**

(Unit of measurement: %)



〈Table III-10〉 Devereux-Fuest Automatic Stabilization Effects

(Unit of measurement: %)

Fiscal year	Weighted average of legal tax rate		KISVALUE proportion of deficit corporations		Statistical Yearbook of National Tax proportion of deficit corporations	
	Deduction of deficit carried forward not applied	Deduction of deficit carried forward applied	AS_DF1	AS_DF2	AS_DF1	AS_DF2
2001	28,0	27,6	5,8	5,7	1,0	1,0
2002	27,3	26,5	5,4	5,2	0,9	0,9
2003	27,6	26,7	6,3	6,1	2,0	2,0
2004	28,1	27,0	5,7	5,5	1,3	1,3
2005	26,2	25,0	4,7	4,5	1,0	0,9
2006	26,3	25,1	4,6	4,4	1,4	1,3
2007	26,3	25,2	4,7	4,5	1,9	1,8
2008	25,0	23,7	3,5	3,3	2,1	2,0
2009	22,5	21,1	3,3	3,1	2,0	1,8
2010	22,5	21,0	3,3	3,1	1,7	1,6
2011	22,6	21,2	3,0	2,8	1,9	1,8
2012	20,7	19,4	2,6	2,5	2,0	1,8
2013	20,7	19,3	2,6	2,4	1,8	1,7

note: 1. AS\_DF1 is the DF economy stabilizing effect using the weighted average of the legal marginal tax rate with deductions in deficit carried forward applied  
 2. AS\_DF2 is the DF economy stabilizing effect using the weighted average of the legal marginal tax rate with deductions in deficit carried forward not applied  
 3. Above tax rate includes the local corporate tax

Source: 1. Written by author using KISVALUE corporation financial data

2. Written by author using National Tax Service, Statistical Yearbook of National Tax, respective years

## B. Using the Buettner-Fuest measuring method

The measuring equation of the automatic stabilization effect of the corporate tax system by Buettner and Fuest (2010) (BF) follows:

$$AS_t^{BF} = \tau_t \frac{m_t}{n_t}$$

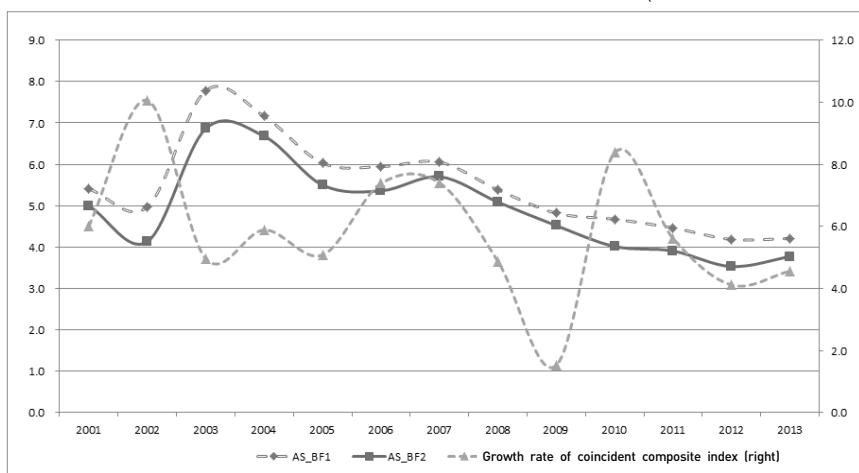
Here,  $\tau$  refers to the weighted average of the legal marginal tax rate confronted by credit-constrained corporations that are with profits according to

the tax law,  $m$  refers to the number of credit-constrained corporations among corporations with profits, and  $n$  refers to the total number of corporations. Consequently, because the automatic stabilization effect of the BF corporate tax system retains profitability within the economy, the percentage is measured by the proportion of companies that bear a tax burden but have a credit constraint multiplied by the weighted average of the legal marginal tax rate of those corporations. This proportion shows the degree of the investment reduction due to economic shock, which shrinks less than when the corporate tax system, due to the automatic stabilization effect, is not introduced.

After calculating the proportion of corporations that are credit constrained but making profits using credit scores included in the KISVALUE corporation financial data and applying the BF measuring method, the period average of the investment reduction alleviation effect due to economic shock is estimated about 4.9~5.5% in Korea(see <Table III-11>). In both cases, the automatic stabilization effect reached its peak in 2003 and shrunk afterwards. This implies that the automatic stabilization effect of Korea's tax system somewhat weakened after the early stage of 2000.

[Figure III-2] Coincident composite index changes and BF automatic stabilization effects

(Unit of measurement: %)



〈Table III-11〉 Buettner-Fuest Automatic Stabilization effects

(Unit of measurement: %)

Fiscal year	Weighted average of legal marginal tax rate concerning surplus and credit constrained corporations		AS_BF1	AS_BF2
	Deduction of deficit carried forward not applied	Deduction of deficit carried forward applied		
2001	30.7	28.4	5.4	5.0
2002	29.6	24.6	5.0	4.1
2003	29.6	26.1	7.8	6.9
2004	29.6	27.6	7.2	6.7
2005	27.4	25.0	6.0	5.5
2006	27.4	24.7	5.9	5.4
2007	27.4	25.8	6.0	5.7
2008	27.2	25.7	5.4	5.1
2009	24.1	22.6	4.8	4.5
2010	24.1	20.7	4.7	4.0
2011	24.0	21.0	4.5	3.9
2012	23.0	19.4	4.2	3.5
2013	23.0	20.6	4.2	3.8

notes: 1. AS\_BF1 is the BF automatic stabilization effect using the weighted average of the legal marginal tax rate with deductions in deficit carried forward not applied

2. AS\_BF2 is the BF automatic stabilization effect using the weighted average of the legal marginal tax rate with deductions in deficit carried forward applied

Source: Written by author using KISVALUE corporation financial data

Since the more information of corporations that are credit constrained and profitability is used than the DF method, the estimation of the BF automatic stabilization effect is considered more precise. Looking at the yearly BF automatic stabilization effect and the growth rate of the coincident composite index, the automatic stabilization effect and the growth rate of the coincident composite index concerning the BF automatic stabilization effect went in opposite directions until 2007, but afterwards, they follow the same direction(see [Figure III-2]). Until 2007, in years with low growth rates of the coincident composite index—or during times of economic slowdown—there is a high economic

stabilizing effect that alleviates investment shrinkage. Conversely, in years with high growth rates of the coincident composite index, the effect that restrains additional economic expansion was relatively lower than the investment reduction alleviation effect of the recession period. However, it is difficult to see this after 2007, with the exception of 2010. As in the DF economy stabilizing effect discussed above, this kind of movement influences the period average of the economy stabilizing effect by economic state.

Specifically, the economy stabilizing effect of the corporate tax system is greater in the recession period than the expansion period from 2001 to 2007 (see <Table III-12>). From 2008, there is an insignificant difference in the effect of each economic condition on average. Until 2007, just before the global financial crisis, the economy stabilizing effect of corporate tax was about 1% higher in the recession period than in the expansion period. Afterwards, the effect on both periods was similar. The corporate tax economy stabilizing effect is higher in the recession period of the entire term average because the period of 2001 to 2007, in which the economy stabilizing effect of the contraction period was relatively higher, is dominant.

<Table III-12> Buettner-Fuest economic stabilizing effects by economic state

(Unit of measurement: %)

	Deductions in deficit carried forward not applied		Deductions in deficit carried forward applied	
	Expansion	Recession	Expansion	Recession
2001~2007 average	5.7	6.8	5.2	6.2
2008~2013 average	4.7	4.6	4.1	4.1
Total average	5.3	5.7	4.7	5.2



## 5 Economic stabilizing effects due to tax system changes

### A. Corporate tax rate

As suggested in existing studies, a high tax rate strengthens the automatic stabilization effect of the tax system in general and this is applied to corporate tax as well. Other conditions being equal, when the corporate tax rate is raised, more tax is collected during an economic expansion period. Through reduction of income after a tax rate raise, investment and other economic expansions are restrained. During an economic recession period, a high tax rate leads to more tax burden reduction through corporate income reduction, alleviating investment reduction and exercising the economy stabilizing function.<sup>7)</sup>

Suppose the legal national tax rate is raised by 1% point more than the actual applied legal tax rate in each year after 2001 based on the DF and BF economy stabilizing effect assumed using the financial data of individual corporations. According to the outcome of such assumptions, a 1% point tax rate increase leads to the improvement of automatic stabilization effect by 0.2% on average. However, the resources distribution distortion effect of corporate tax is considerable and because the effect of a tax rate increase brings about the opposite outcome not only in a recession period but also in an extension period, it is unlikely that raising corporate tax rates is desirable in order to enhance the economy automatic stabilization effect.

### B. Corporate loss offset rule

One advantage of the DF and BF methods is the simplicity of measuring the stabilizing effects of the corporate tax system when profit and loss is treated symmetrically and the carryback of deficit is assumed to be entirely allowed. According to Devereux and Fuest(2009) and Buettner and Fuest(2010), when corporate tax law allows a very generous carryback of deficit in which we give

---

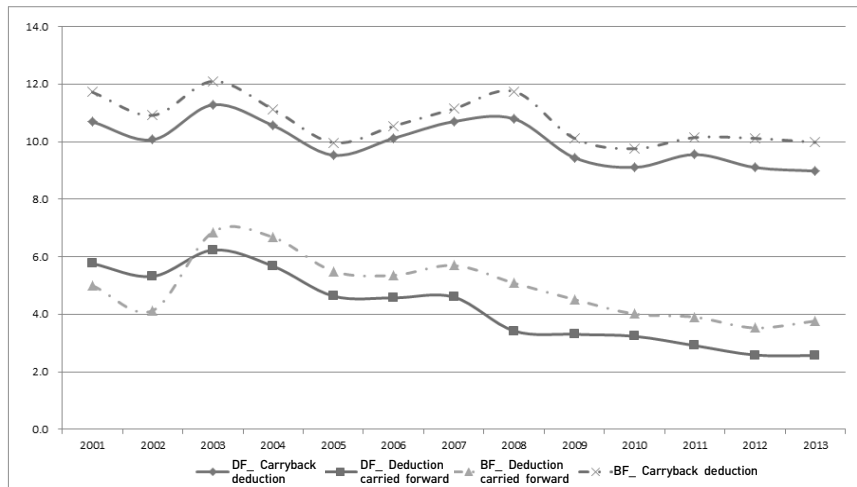
7) Raising the national corporate tax rates by 1% is equal to increasing the corporate tax rate, which includes local tax, by 1.1%.

back the previously paid tax amount to corporations with loss, the proportion of deficit corporations according to tax laws becomes 0, and therefore, the stabilizing effect of corporate tax is calculated by the legal marginal tax rate multiplied by the proportion of credit-constrained corporations.

If we apply 0 as the proportion of deficit corporations to the data of Korea after 2001, in both the DF and BF measuring methods, the economy stabilizing effect occurring from the corporate tax system has an annual average of 10% and is 9% or higher every year. The BF automatic stabilization effect is higher by a small margin than the DF automatic stabilization effect because the weighted average of the legal marginal tax rate used in the BF method is slightly higher than that used in the DF method.<sup>8)</sup>

**[Figure III-3] Economic stabilizing effect comparison: complete carryback deduction vs. deficit carried forward deduction**

(Unit of measurement: %)



8) Devereux and Fuest(2009) used the legal marginal tax rate applied to all corporations with profits due to limitations in obtaining the individual financial data of credit-constrained corporations. Taking this point and the differences with the BF measurement method, which uses the financial and tax payment information of credit-constrained companies, into account, the weighted average of the legal marginal tax rate used in the DF measurement method is the weighted average of the legal marginal tax rate faced by all companies with profits.

As indicated in [Figure III-3], when allowing complete carryback deduction, the trends of the economy stabilizing effect changed gradually. Compared to when only deduction carried forward was allowed, the difference between the maximum and minimum of the economy stabilizing effect was reduced. In instances when only deduction carried forward was allowed, the difference between the maximum and minimum was 3.7% point from both measuring methods. However, when complete carryback deduction was allowed, the weakening of the economy stabilizing effect after the mid-2000s slowed down and the difference was reduced to 2.3% point. As the proportion of deficit corporations out of credit-constrained corporations continuously increased after the mid-2000s, corporations with profits among credit-constrained corporations. In other words, the targets of the corporate tax economy stabilizing effect were reduced. Therefore, the phenomenon of a quickly weakening DF and BF economy stabilizing effect after the mid-2000s appears in cases allowing deductions in deficits carried forward. In a hypothetical situation where the carryback of deficit was completely allowed, the stabilizing effect was high during the economic recession period because there were no deficit corporations according to tax laws among credit-constrained corporations.

〈Table III-13〉 **Economic stabilizing effects by economic state, according to deficit handling method**

(Unit of measurement: %)

DF measurement method		Complete carryback deductions applied		Deductions in deficit carried forward applied	
		Expansion	Recession	Expansion	Recession
	2001~2004 average	10.1	10.9	5.4	5.9
	2005~2013 average	9.7	9.6	4.1	3.2
	Total average	9.8	10.2	4.3	4.2
BF measurement method		Complete carryback deductions applied		Deductions in deficit carried forward applied	
		Expansion	Recession	Expansion	Recession
	2001~2007 average	10.6	11.7	5.2	6.2
	2008~2013 average	10.0	10.6	4.1	4.1
	Total average	10.4	11.1	4.7	5.2

Looking at Table 23, which compares the economy stabilizing effect by economic state when complete carryback deduction is allowed, the effect of the recession period shows a greater improvement in both measuring methods. When deduction in deficit carried forward is applied, the DF economy stabilizing effect of economic recession periods was greater than that of expansion periods until 2004, but afterwards, it appeared 0.9% point lower. However, when carryback deduction is applied, the 2005~2013 average economy stabilizing effect of the recession period was reformed to 9.6%—only 0.1% point less than the expansion period effect. When complete carryback of deficit is applied in the BF method, the average economy stabilizing effect of the recession period after 2007 is 10.6%, or 0.6% point higher than the average of the expansion period.

When the deductions in deficit carried forward approach is used, deductions for past deficits will be offset either from the firm's current or future income. As a result, this affects the legal marginal corporate tax rate levied upon the firm, adjusting the tax rate faced by the company currently or in the future in a downward direction. In other words, the aforementioned deficit carried forward deduction approach serves as a trigger that induces a reduction in the economic stabilizing effect of the corporate tax system, caused by a decrease in the legal marginal corporate tax rate—one of the fundamental factors that determine the stabilizing effect. Considering such aspects, the direction of policy adjustments, which calls for set limits to the deductions in the deficit carried forward, and was announced through the recent tax laws amendment bill, are expect to further enhance the economy-stabilizing effect of the corporate taxation system.

This effect is observed to be greater in the case of the complete carryback deduction approach, as with such tax methods, the amount of deficits carried back and deducted signify the security of investment potentials and capacity for companies with credit constraints, thus proven even more expedient in stabilizing the economy during its recession periods. Given this, some lean towards making rather magnanimous amendments to enhance carryback of deficits. However, scaling up such tax methods may result in rapid deterioration in the nation's financial status due to loss of tax revenue. The issue of moral hazard that may occur in the firms benefitting from the tax laws is yet another

drawback. The most significant factor to consider, nevertheless, is the fundamental premise based on the theoretical backgrounds of DF/BF measurement methods that suggests that firms with investment capacities will invest to their potential. Therefore, there is a need to impose the enlarged deficit carryback taxation with exclusivity and only in cases where it is known that it will induce investment from firms.

## **6 Summary and implications**

In conducting a quantitative and qualitative assessment on the effects of the national taxation system on stabilizing the economy, the availability of useable data was taken into consideration to draw out three methods of analysis. First, the Keynesian multiplier model—known for its use in early studies of the automatic stabilizing effects of tax systems—was utilized to assess the stabilizing power of major tax items as well as the economy stabilizing properties of the total national tax revenue. Next, the taxation policies were assessed by using a correlation analysis between various tax indexes and changes in real GDP following economic fluctuations. Following this, an analysis of the managerial approaches of the national taxation system, especially in the face of changes in economic conditions, was conducted. However, as the aforementioned method of assessment utilizes the comprehensive index, it was impossible to determine and observe the automatic stabilization effects stimulated by the tax reform using it. Thus, an alternate mode of analysis was used for the results, and for this particular case, an empirical analysis was conducted by examining individual firms' credit-rating information and financial statements to determine the economic stabilizing factor of the corporate tax system.

When the multiplying model was employed, out of the three major taxes that were examined for their automatic economy stabilizing effects, corporate tax proved to be the most influential, followed by income tax, and value added (VAT) tax. While the automatic stabilization of the former two taxes displayed an annual expansionary trend with minor fluctuations, the latter tax form displayed a diminishing trend. When the data collection was examined per

economic condition, it became clear that the automatic stabilization of income tax during the recession period of the early 1990s was greater than that of the expansion period. In the case of corporate tax, automatic stabilization took on continuous incremental changes during a recession in the early 2000s. The VAT, however, did not display any noticeable trend of change. In the instance in which all three taxes were imposed simultaneously, the economy regulating effect experienced a continuous expansionary trend after the early 2000s. It was thereby deduced that corporate tax among three major taxes was determined to have the greatest impact on economic stability and is the chief factor that dictates the overall trend of the economic stability function.

The correlation analysis that examined the relationship between various tax indexes and changes in real GDP following economic fluctuations generally substantiates the tax smoothing theory, as suggested by Furceri and Karras (2011). The tax smoothing theory, in its essence, implies covering up for the tax shortages of recession periods in the form of liabilities, and reimbursing these amounts as the economy enters the expansion phase and tax revenue accumulates a surplus value, rather than to partake in an active economic policy that adjusts tax rates according to economic condition to prevent further expansions during expansion cycles and vice versa during recessions. Exceptions were also observed while examining the major taxes individually, as the estimated correlation with the cyclical component of GDP varies depending on the filtering technique that eliminates the trend of real GDP. Therefore, it is extremely difficult to evaluate the managerial approach of the national taxation system as either an pro-cyclical or counter-cyclical system.

Results based on the individual firms' financial statements and data from credit-rating companies, as proposed by Devereux and Fuest(2009) and Buettner and Fuest(2010), regarding the automatic stabilization effects of the corporate tax system suggest that utilizing financial statements to investigate firms with deficits can lead to up to 5% of an alleviatory effect over investment reductions on an annual average. Meanwhile, utilizing the Devereux and Fuest(2009) estimation method for a firm that faces a deficit, as listed on the Statistical Yearbook of National Tax, proved to have an approximately 2% or lower effect on an annual average.

Through analyzing how tax rate raises and alternation in the method with

which deficits are managed affects the economic stabilization effect using DF/BF measurements, a 1% point increase in corporate tax was observed to result in a 0.2% point increase in the economic stabilization effect. In this study, income before tax was estimated through the deductions in deficit carried forward approach. However, if such was not the case, and the deficits were accounted for using the deficit carryback approach, this could be assumed to have approximately 10% of automatic stabilization effects. Some may suggest enhancing corporate tax rate, as well as the carryback of the deficit approach, restrictively allowed only to small- and medium-sized firms. However, on the basis of this research, the following points should be considered.

First, a tax rate increment incurs efficiency costs, thereby causing an adverse impact on the economy as a whole. In addition, as it suppresses growth during expansion periods, it may also soothe the economic contraction in the recessionary cycle. Moreover, an expansion of the carryback of deficit approach could hinder securing tax revenue, as the number of firms with budget deficit soars during a recession period, and these firms might attempt to be reimbursed more for what they paid in the past, which will increase the fluctuations of corporate tax revenue. There is also a need to review the most fundamental assumption of this paper—that firms will invest as soon as an investment source is settled.

One of the most significant factors that determine a corporate taxation system's automatic stabilization effect is the ratio of corporations with profits among the credit-constrained firms. This is especially true for credit-restricted firms and the ratio of corporations with profits for which it is virtually impossible to attract investment sources from outer sources, as the higher the ratio of such firms, the more automatic stabilization effect. In the case of South Korea, the ratio of surplus body corporations to credit-constrained firms after 2001 has been in continuous decline since 2004. This current trend indicates there is a need for the government to enact policies to help weak, credit-constrained firms secure profitability, or, through systematic restructuring, guide the firms with chronic losses to exit the market.

# IV

## Conclusion

Not only is automatic stabilization conducted through the government's discretionary fiscal policies, but also through taxation. Automatic stabilization through the taxation system refers to when tax revenue and the business cycle work in tandem to prevent additional economic overheating as well as overcome the state of recession. In addition, there is a fundamental advantage in seeking stabilization through the taxation system, as doing so allows for direct application of the suggested change, unlike other discretionary financial adjustment policies implemented by the government regarding economic shifts, which take longer for changes to be apparent. Considering such benefits, the automatic stabilization feature of the tax system may be a better solution than the current government's fiscal policy. Nevertheless, raising tax rates with the goal of strengthening the automatic stabilization effect is not viable, as doing so will incur efficiency costs. Therefore, as stressed in previous studies, there is a need to find a method to strengthen the economic stabilization power through tax without increasing the size of the government, and doing so is an important policy task.

Before evaluating the specifications of the economic stabilizing effect of the tax system, it is beneficial to first estimate the stabilizing function inherent within Korea's taxation system as a whole. First, in chapter II, the differences between the major taxes' tax bases and tax revenues volatility over business cycles were studied. Excluding the income tax base of national accounts and the National Service tax base of value added tax with outliers removed, the remaining tax depict a wider growth rate distribution of national accounts and the National Service tax base, more so than the distributional width of economic



change. As such, it was found that the core factor is tax revenue volatility, which is greater than the change in economic state. Such phenomena continued after 2000, when economic fluctuations and tax revenue volatility diminished. In the case of tax revenue, tax revenue volatility exceeds economic fluctuations, and after 2000, such volatility shrank; however, the volatility of tax revenue still surpassed the economical aspect. There is a slight difference according to taxes, but for the most part, tax revenue elasticity in relation to the nominal GDP in expansions and recessions appears differently, and searching for a way to create a tax revenue forecasting method that reflects such aspects is also thought to be a worthwhile pursuit to enhance the accuracy of tax revenue estimations.

In chapter III, to further examine the automatic stabilization effects of three main taxes, three methods were used when the availability of data was taken into account. First, if the classical deduction method of the automatic stabilization effect of the taxation system, or the multiplier effect model, was used, the stabilizing ability of Korea's corporate tax had higher results than income tax or value added tax, and this is because the effective tax rate of corporate tax is relatively higher than other taxes. Second, the results of studying how the Korean tax policies have been managed in response to economic conditions give strength to the theory of tax smoothing, which asserts that rather than controlling the economy by adjusting tax rates in different economic states, a flat tax rate should be maintained with the tax revenue shortage amended for by increasing debt during times of recession. Finally, the automatic stabilization effect, if the corporate financial data for individual firm is used, is determined to be an average of 5% after 2000, and the stabilizing effect during recessions is assessed to be relatively higher. In addition, a 1% point tax rate increase gives rise to a 0.2% point increase in the stabilizing effect, and if the complete carryback of deficit is verified, an approximate 5~6% point increase results. The policy task of strengthening the economic stability function inherent within the tax system is without a doubt an important policy task; however, such policy directions may have negative side effects, such as increasing efficiency costs or jeopardizing the security of government tax revenues, and should be approached with caution.

This study explored a topic not explicitly tackled on domestic grounds for a considerable time—examining the characteristics depicted by tax base and tax

revenue by economic state, and the economic stabilizing function of major taxes, conducted by using available data. The statistical data related to tax collection was composed mainly of annual aggregate data; yet, there is a need for a database using individual tax payment data covering many years to assess in more detail the stabilizing effect changes as a result of tax system shifts. In this study, in an attempt to bypass restrictions of access to such data, the financial data of companies have been used within the boundaries of the corporate tax system to analyze the changes in automatic stabilization effects as the tax rate and deficit handling methods change.

To more vigorously evaluate the effects of the government's policy direction in response to economic conditions on the economic stabilizing ability inherent within the tax system, and to determine implications to policy, diverse data should be available, and research should be undertaken using various analytic methods. It is hoped that this study takes on the role of a pioneer that brings forth more scrutinizing analysis in the future.

## References

- Auerbach, A. and D. Feenberg, "The Significance of Federal Taxes as Automatic Stabilizers," *Journal of Economic Perspectives*, 14(3), 2000, pp. 37–56.
- Bank of Korea, Economic Statistics System, <http://ecos.bok.or.kr/>, accessed October 12, 2015)
- Bank of Korea, "System of National Accounts of Korea," 2010.
- Baunsgaard, T. and S. A. Symansky, "Automatic Fiscal Stabilizer," IMF Staff Position Note, 2009.
- Buettner, T. and C. Fuest, "The Role of the Corporate Income Tax as an Automatic Stabilizer," *International Tax & Public Finance*, 17, 2010, pp. 696–698.
- Cohen, D. and G. Follette, "The Automatic Fiscal Stabilizers: Quietly Doing Their Thing," *Federal Reserve Bank of New York Economic Policy Review*, 6(1), 2000, pp. 35–68.
- Devereux, M. P. and C. Fuest, "Is the Corporation Tax an Effective Automatic Stabilizer?" *National Tax Journal*, 62(3), 2009, pp. 429–437.
- Eilbott, P., "The Effectiveness of Automatic Stabilizers," *The American Economic Review*, 56(3), 1966, pp. 450–465.
- Furceri, D. and G. Karras, "Average Tax Rate Cyclicalities in OECD Countries: A Test of Three Fiscal Policy Theories," *Southern Economic Journal*, 77(4), 2011, pp. 958–972.
- Kim, H., "Study on Corporate Characteristics and Average Effective Corporate Tax Rates," Research report 13-04, Korea Institute of Public Finance, 2013.
- Musgrave, R. A. and M. H. Miller, "Built-in Flexibility," *The American Economic Review*, 38(1), 1948, pp. 128–134.
- Musgrave, R. A., *The Theory of Public Finance*, New York, 1959.
- National Tax Service, "Statistical Yearbook of National Tax," respective years.
- Park, G. and H. Park, *Study on the Economic Stabilizing Effect of Public Finance*, Korea Institute of Public Finance, 2002.
- Park, G., *Study on the Financial Management Form of Korea*, Korea Institute of Public Finance, 2001.
- Park, H., Park, M., Kim, H. and J. Jung, *Analysis of Tax Revenue Variation Factors in Mid/Long Terms and Future Outlooks*, Research report 12-02, Korea Institute of Public Finance, 2012.
- Romer, C., "Changes in Business Cycles: Evidence and Explanations," *Journal of Economic Perspectives*, 13(2), 1999, pp. 23–44.
- Statistics Korea, "June 2015 Composite Economic Index," Volume 414, August 2015.
- Vegh, C. A. and G. Vuletin, "How is Tax Policy Conducted Over the Business Cycle?" *American Economic Journal: Economic Policy*, 7(3), 2015, pp. 327–370.

## Appendix. Duration for business cycles

### 〈Appendix〉 Duration for business cycles

(Unit of measurement: months)

	Period	Peak	Duration	Expansion	Recession
1stcycle	Mar. 1972~Jun. 1975	Feb. 1974	39	23	16
2ndcycle	Jun. 1975~Sep. 1980	Feb. 1979	63	44	19
3rdcycle	Sep. 1980~Sep. 1985	Feb. 1984	60	41	19
4thcycle	Sep. 1985~July 1989	Jan. 1988	46	28	18
5thcycle	July 1989~Jan. 1993	Jan. 1992	42	30	12
6thcycle	Jan. 1993~Aug. 1998	Mar. 1996	67	38	29
7thcycle	Aug. 1998~July 2001	Aug. 2000	35	24	11
8thcycle	July 2001~Apr. 2005	Dec. 2002	45	17	28
9thcycle	Apr. 2005~Feb. 2009	Jan. 2008	46	33	13
Average of 1stcycle~9thcycle			49	31	18
10thcycle	Feb. 2009	Aug. 2011	Greater than 78	30	Greater than 48

note: The duration of the 10th cycle was recorded with August 2015 as the standard  
Source: Made by author in reference to Statistics Korea ("June 2015 Composite Economic Index," Volume 414, August 2015)