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Measuring fiscal sustainability in the welfare state: fiscal space as fiscal sustainability

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Abstract
This study measures the fiscal capacity of welfare states to derive parameters for a sustainable welfare state. To secure fiscal soundness, it is critical to maintain affordable welfare spending by ensuring public capacity. Adapting the concept of fiscal space, defined as the difference between the current level of public debt and the debt limit implied by the country's historical record of fiscal adjustment by Ostry et al. (2010) and Ghosh et al. (2011), this research measures and compares the fiscal sustainability of 17 welfare states. To derive this fiscal space, the debt limit of each country is set, primarily based on the estimating of fiscal reaction function and selecting interest schedule (Ghosh et al. 2011, p. F13). We use a pooled-time-series-cross-sectional model to estimate fiscal reaction function and the vector regression model to set the interest schedule. It is found that Southern European welfare states are unsustainable if they do no immediately change their fiscal policies. Countries outside of Southern Europe are generally financially sustainable. However, the UK, the US, and France have in their recent actions exacerbated their financial sustainability. For their part, the social democratic states remain financially sound, despite high levels of welfare spending. This indicates that welfare spending does not necessarily weaken fiscal soundness, which depends on the type of welfare state.

Keywords Sustainability · Public finance · Fiscal space · Welfare state

1 Introduction

This study measures the fiscal capacity of welfare states to derive parameters for a sustainable welfare state. We focus on measuring the finances of welfare states in a

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long-term perspective. Furthermore, we propose a method of measurement that reflects the capacity of a country to manage its finances, taking into account not only macro-economic indicators but also political and social factors. This study shows the financial sustainability measurement of welfare states in a way that can be objectively grasped through comparison among countries, while reflecting the differences in the capacity for financial management exhibited by each country.

To secure fiscal soundness, it is vital to maintain affordable welfare spending by ensuring public capacity (Doherty and Yeaman 2008, p. 81; Marcel 2014, p. 1). Previous studies have precisely specified the fiscal sustainability of the welfare state, focusing on primary balances or debt levels (Seok 2014; Stoian 2012). Deficit and debt levels are easy to use to evaluate the financial status and the fiscal status of welfare states for each fiscal year. The European Union, for example, reviews the deficit and debt levels of its member states as part of its Stability and Growth Pact. However, in this study, we stress that it is essential to measure financial status in a longer time horizon.

The long-term sustainability of public debt should outweigh the immediate fiscal balance because debt accumulation does not always inhibit the fiscal capacity (Song 2012, p. 17–18). Governments increase deficits by expanding public expenditures, reflecting the economic situation. Such increases lead to high levels of debt in the short term can often return to previous levels when the economy improves. Continual financial pressure, however, can hinder the capacity to implement policy. That is, states can restore fiscal balance when they are able to continue to maintain a given fiscal stance without defaulting (Afonso & Jalles, 2014; Buiter 1985; Buiter and Patel 1992; Richter and Paparas 2012).

Here, we prioritize long-term fiscal soundness. That is, the fiscal sustainability of the welfare state is measured by means of fiscal space, defined as "the availability of budgetary room that allows a government to provide resources for a desired purpose without any prejudice to the sustainability of a government's financial position" by Heller (2005, p. 3). Securing fiscal space revolves around the issue of how to raise the funds needed to fulfill a social obligation without harming economic growth or fiscal sustainability (Marcel 2014, p. 1; Ortiz et al. 2011; Harris 2013, p. 114; Ortiz et al. 2015). In particular, the fiscal space of high-income countries can be understood as indicating the ability of funding policy to respond to welfare needs for demographic change and worsening market conditions (Heller 2005, p. 5; Schick 2009, p. 3). Thus, fiscal space is a useful concept for examining the long-term fiscal sustainability of the advanced welfare state.

However, we must warn against disregarding the political, economic, and social sustainability of the welfare state by giving undue weight to financial aspects. Even where strict fiscal balance appears, a government may not allocate adequate resources to welfare. This makes it challenging for the welfare system to respond appropriately to social problems such as poverty and inequality. Such a circumstance can undermine social cohesion and even reduce political support for the welfare state in the long run, eventually eroding the financial basis for welfare. The sustainability of the welfare state is here identified using multiple dimensions, not just with regard to economic indicators (Esping-Andersen 1999; Esping-Andersen 2002; Seok 2014). This study investigates the fiscal sustainability of the welfare state beyond a simple macro-economic level. We draw upon Ostry et al. (2010) and Ghosh et al. (2011), using their measures of the fiscal

sustainability of welfare states. The political, economic, and social conditions of each country assessed should be examined as well in the measurement of the fiscal sustainability of its welfare state and to compare it those conditions to historical patterns.

In the next section, we explore measurements of the fiscal sustainability of welfare states as found in previous work and discuss the reasons that we borrow from Ostry et al. (2010) and Ghosh et al. (2011). In section 3, we discuss the methods of analysis for target and timing. Section 4 presents the results for the fiscal sustainability of the welfare state in different countries. The final section offers our conclusions and provides the implications of the analysis.

2 Theoretical background

2.1 Concept of fiscal sustainability

Fiscal sustainability is defined by whether the governmental budge meets the no-Ponzi condition and the maintenance of a certain level of debt to GDP (Song 2012, pp. 9, 15–18). The former criterion indicates a state where current debt levels are covered by real assets; cases meeting this criterion can be divided into two groups (Song 2012, pp. 15–16). For the first group, the growth of public debt is lower than the real interest rate, and the discount rate of the public debt depends on the interest rate (Greiner and Fincke 2009, p. 5). For this case, the present value of public debt converges to zero. For the second group, the inter-governmental budget constraint is met if future primary fiscal surplus can repay public debt, and fiscal sustainability is guaranteed. The maintenance of the target debt level is evidence of fiscal sustainability (Buiter 1985; Buiter and Patel 1992).

It is difficult to derive policy implications through a simple examination of the no-Ponzi condition (Song 2012, p. 16). Moreover, even if it is satisfied, public debt could continue to grow. Where public debt is excessively high, the risk premium likewise becomes significantly higher than usual, which may result in bankruptcy (Ostry et al. 2015). Furthermore, excessively high public debt can hurt economic growth. Thus, it is necessary to maintain debt levels below a certain level to encourage sustainable growth and lower the risk of future financial crises (Ostry et al. 2015). However, the problem of setting adequacy levels for debt is not straightforward. It is necessary to fully reflect the fact that countries differ in their ability to manage their finances. In addition, national finance influences the development of the country, meaning that it is difficult to believe that a specific financial threshold will uniformly apply to all countries (Horne 1991, pp. 3–6).

2.2 Measurement of fiscal sustainability

Fiscal sustainability, measured by the above criteria has been tested in two ways: using statistical tests (the no-Ponzi condition) and indicators (maintaining a certain level of debt). With the former, the assessment of fiscal sustainability simply asks whether the inter-temporal budget constraints of the government are is likely to be satisfied using a unit root test (Hakio & Rush, 1991; Hamilton and Flavin 1986; Trehan and Walsh

1988, 1991; Wilcox 1989) or a cointegration test (Greiner and Fincke 2009; Hakio and Rush 1991; Hatemi-J 2002; Olekalns 2000; Trehan and Walsh 1988, 1991). The latter measures the deviation between actual deficits and an ideal target (Blanchard 1990; Buiter 1985; Croce and Hugo Juan-Ramon 2003; Polito and Wickens 2005, 2011, 2012).

In measures of fiscal sustainability, the context in which public finance is embedded is an important consideration (Block and Evans 2005; Campbell 1993). Fiscal crisis may not arise from changes in financial conditions; the political, economic, and social context must be evaluated as well. The evaluation of fiscal sustainability as measured by statistical tests may lead to questionable results. For example, in the investigation of Greece's fiscal sustainability by Richter and Paparas (2012), its public finances were found, using statistics, to be sustainable. The subsequent default of Greece in 2015 may prompt suspicion of the means by which this result was obtained.

The Bohn test can be used to minimize limitations of statistical tests. Bohn (1995, 1998), 2007) assessed whether primary fiscal balances increase debt levels, controlling for political, economic, and social factors. A sufficiently positive response to the Bohn test ensures that the no-Ponzi condition is satisfied and public debt can be repaid over the long run. The test can incorporates various factors related to fiscal management, both in the fiscal management capacity and the historical fiscal response of that country, to test fiscal sustainability (Bohn 1995, 1998, 2007; Greiner 2007; Ostry et al. 2010, p. 4; Sakuragawa and Hosono 2011). This test also has the additional feature of being free from arbitrariness in setting a target debt level.

However, this test has major two limitations (Ostry et al. 2010, pp. 4–5). First, it omits to assess the non-linear relationship between primary balance and public debt. Specifically, for shallow levels of debt, the primary balance responds little to rising debt. Policymakers do react to changes in the level of public debt unless the public debt is fairly high (Bajo-Rubio et al. 2006) Thus, the increase in the primary balance appears negligible when debt is low. However, excessively high debt can make it difficult to offset debt accumulation because the marginal response of the primary balance to public debt is lower when public debt is high (Mendoza and Ostry 2008). As debt increases, the balance responds, but eventually, adjustment effort peters out as tax increases or spending cuts become politically infeasible (Daniel & Shiamptanis, 2013; Ganghof 2006; Steinmo 1993).

Second, this test ignores uncertainty. When the accumulation of public debt reaches a level that is challenging for the government to deal with, creditors are reluctant to buy public bonds because of concerns for national bankruptcy. To ensure fiscal sustainability, countries should be willing to raise their interest rates through risk premiums due to increases in default risk. Thus, in measuring fiscal reaction, it is essential to consider the endogenous relationship between the interest rate and public debt.

To compensate for these limitations, Ostry et al. (2010) and Ghosh et al. (2011) constructed the idea of the debt limit.

In Fig. 1, the solid line represents the behavior of the primary balance as a function of public debt. It reflects a non-linear relation between primary balance and public debt, compensating for the limitations of the Bohn test. The dashed line shows the effective interest rate schedule, derived from the differential between the interest rate and the growth rate of GDP, multiplied by the debt ratio. For low levels of debt, interest rate is the risk-free rate; assuming that output growth is independent of the public debt level

and the interest rate, this schedule is expressed as a straight line whose slope is determined by the differential between the risk-free interest rate and the growth rate. When the debt reaches the debt limit, the interest rate rapidly increases due to the risk premium, as with the non-dashed line between d^ and d⁻.

The lower intersection (d^*) between the primary balance and the interest payment schedules indicates a point of conditional stability: if the debt level exceeds this point, the primary balance in subsequent periods will more than offset the higher interest payments, returning the debt ratio to its long-run average. However, the upper intersection (d⁻) cannot guarantee fiscal sustainability. If the debt exceeds this point, then it will rise forever because the primary surplus will never be enough to offset the growing debt. Beyond d⁻, there is no positive relationship between primary balance and public debt. This point is the public debt limit, the critical point for debt determined by historical fiscal response, without special action of government (Ostry et al. 2010, p. 7).

Ostry et al. (2010) and Ghosh et al. (2011) defined fiscal space as the gap between the debt limit and current debt level, implied by the historical record of fiscal adjustment in each country (Ostry et al. 2010, pp. 7–8; Ghosh et al. 2011, pp. F4–F5). On the one hand, if the fiscal space can ensure financial sustainability, there is no need to change the current fiscal stance. On the other hand, change to current fiscal policy is necessary if financial sustainability does not have sufficient fiscal space. Without fiscal space or a debt limit, a current fiscal stance cannot allow the ability to afford the debt burden. That is, countries are not always facing a fiscal crisis, but it may be difficult to ensure a country's fiscal sustainability unless a significant change of current fiscal stance occurs (Ostry et al. 2010, p. 7). We examined fiscal sustainability in welfare states by calculating fiscal space in such welfare states, following Ostry et al. (2010) and Ghosh et al. (2011).
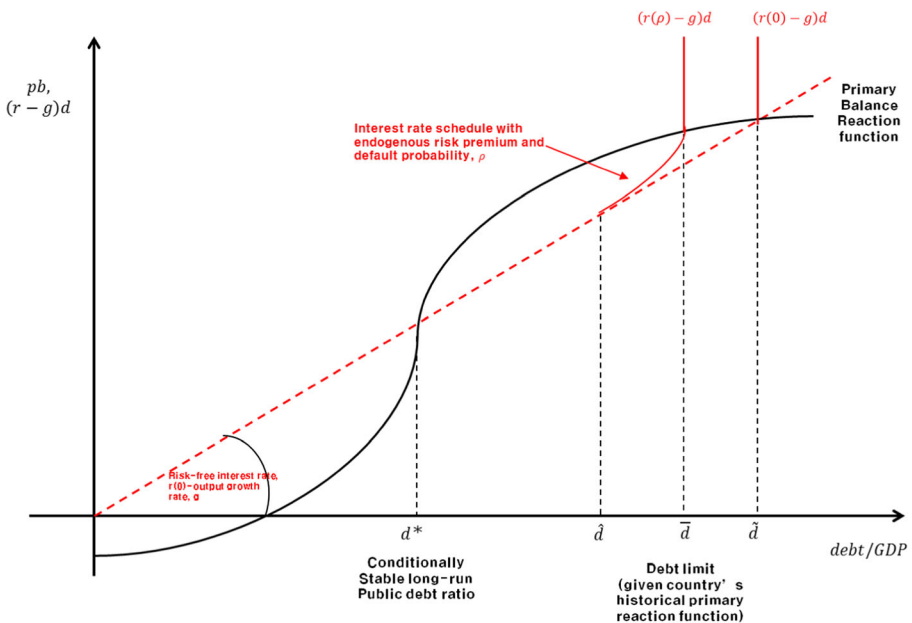

Fig. 1 Determination of Debt limit from Ostry et al. 2010: 8; Ghosh et al. 2011: F11

We included some additional considerations for measuring fiscal sustainability in welfare states. First, we selected variables to estimate the fiscal reaction function, using theory and previous studies. We excluded certain variables (openness, inflation, oil prices, and non-oil commodity prices), replacing them with more appropriate variables to avoid multicollinearity problems. Further, we counted only public welfare spending, instead of total public expenditures, in examining the fiscal sustainability. Second, we estimated the interest rate using a vector autoregressive (VAR 1) model based on Polito and Wickens (2011, 2012) to minimize the problems caused by arbitrary regulations and to reflect the endogenous relationship between debt and interest rate.

3 Methodology

3.1 Scope of analysis

Using data collected from 17 OECD countries (Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the UK, and the US from 1986 to 2013, this study evaluates the fiscal sustainability of each welfare state. Not all countries belonging to the OECD are accounted for here because relevant data for some OECD countries are not available for the entire period. In particular, it is difficult to locate financial data for Eastern European countries for the period before 1995, and institutional factors are less easy to get for Asian countries.

Fiscal crises are a chronic problem in developing countries due to the insufficient ability to collect taxes. Previous studies of fiscal bankruptcy and fiscal capacity have focused on low-income countries (Corbacho et al. 2013). Following the recessions of the 1980s and then the larger global economic crisis of 2008–2009, interest in the fiscal problems of advanced welfare state increased (Afonso and Jalles 2014; Ciżkowicz et al. 2015; Fournier and Fall 2015; Ghosh et al. 2011; Marcel 2014; OECD 2012; Ostry et al. 2010). The analysis of the fiscal sustainability of welfare state may produce considerable distortion in its results when low-income and high-income countries are analyzed simultaneously, due to the differences in the economies, taxation structures, and the levels of public expenditure between these types. Thus, we limit ourselves to the OECD countries as examples of advanced welfare states, selecting 17 of them with regard to data availability. These countries implemented a series of welfare reforms after the severe economic downturns of the late 1970s (OECD 2012). The effects of such reforms likely appeared following a time lag, so we set the beginning of our analysis in the late 1980s.

3.2 Research methods

The judgment of the fiscal sustainability of a welfare state is done by measuring the fiscal space of each country. To derive this fiscal space, the debt limit of each country is set, primarily based on the estimating of fiscal reaction function and selecting interest schedule (Ghosh et al. 2011, p. F13). In this study, we use a pooled-time-series-cross-sectional model to estimate fiscal reaction function, following Ostry et al. (2010) and Ghosh et al. (2011). The vector regression model is used to set the interest schedule.

We construct the fiscal reaction function related to debt and primary balance, taking into account the economic structures and political and institutional factors with a pooled-time-series-cross-sectional model designed by Beck and Katz (1995). In the empirical implementation, we estimate this relationship using the terms lagged debt, debt square, and cubic debt, which reflect a nonlinear relationship between primary balance and debt. To use cross-sectional time-series data, additional treatments are required to avoid estimation bias (Beck 2001, pp. 274–275; Hicks 1994, pp. 171–172). These include serial correlation, contemporaneous correlation, heteroscedasticity, and fixed effects. To enable precise estimates, we use statistical treatments, following Ostry et al. (2010) and Ghosh et al. (2011). To control serial correlation, we adopt a panel-corrected AR(1) model. Using the panel-corrected standard errors designed by Beck and Katz (1995), we remove the problems of contemporaneous correlation and heteroscedasticity.[1] Finally, we incorporate fixed effects, including country dummy variables, reflecting the possibility that country-specific conditions may affect national finances (Croce and Hugo Juan-Ramon 2003; Stoian 2012; Stubelj & Dolenc, 2010) and adding year dummy variables after 2009 due to potential structural change in the fiscal status of the welfare state during that period (D'Erasmo et al. 2015, p. 12).[2] Additionally, the independent variable for estimating the fiscal reaction function is a lagged term (t-1), which accounts for the time lag of caUStion requirements established by temporal priority.

Next, to reflect the endogenous relationship between interest rates and debt, we estimated interest rate based on VAR 1. The long-term interest rate can be derived in two ways (Ostry et al. 2010, p. 12). The first assumes that the interest rate observed market reflects the perceived possibility of national bankruptcy. Here, there is a danger of overestimation of the maximum debt level for a sustainable fiscal stance because this means overlooks the fact that interest rates increase sharply when a debt limit is reached (Ostry et al. 2010, p. 12). The alternative method uses the estimated interest rate to consider the endogenous relationship between debt levels and interest rates. Ostry et al. (2010) and Ghosh et al. (2011) calculate an interest rate with the assumption that the recovery rate in a bankruptcy is 90% (Ostry et al. 2010, p. 12).

Using the alternative method for estimating the interest rate from Ostry et al. (2010) and Ghosh et al. (2011) reflects the endogenous relationship between interest rates and government debt, as presented in Fig. 1. However, Ostry et al. (2010) and Ghosh et al. (2011) do not provide a clear basis for their assumptions about recovery rate, leaving this means open to challenges due to its arbitrariness. To overcome this, we used VAR to estimate the changes in the endogenous macroeconomic variables and to estimate long-term interest rates. The VAR model inputs all lagged variables, including the

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[1] Although this has been criticized as inefficient (Chen et al. 2010; Reed and Ye 2011), it has been used to generate adequate precision in a more than 15-year pooled-time-series, cross-sectional set of data (Beck 2001, pp. 278–279; Beck and Katz 1995, pp. 639–641). Therefore, it is considered appropriate for the analysis of the 28-year period that this study analyzes.

[2] It is necessary to point out that the estimates have greater bias in the fixed-effects regression models in combination with the autoregressive model (Beck and Katz 2011, pp. 341–342). Beck and Katz (2011) recommend using a lagged dependent variable over the two models (Beck and Katz 2011, pp. 341–342). However, the financial variables, such as debt and primary balance, can only determine the lag of the dependent variable with difficulty because they have the potential of producing a cumulative effect. In addition, if the time series is greater 20, the bias of the estimates is significantly reduced (Beck and Katz 2011, p. 342), making this study relatively safe to use with two models.

estimated model, to derive the predictive value for each variable. Thus it minimizes the debate over how to set up the model and increases predictive power. We estimated the long-term interest rate for 2013, using the endogenous relationship between the interest rate and the public debt, adding factors that affect the long-term interest rate, such as government spending, government revenues, economic growth, inflation, and the short-term interest rate, through VAR (Polito and Wickens 2005; Polito and Wickens 2011; Polito and Wickens 2012). VAR estimation is performed for each country to capture its particular characteristics, and VAR 1 is used to analyze annual VAR (Polito and Wickens 2005, Polito and Wickens 2011, 2012).

The fiscal reaction function and the interest rate allow us to calculate the debt limit and fiscal space for each studied welfare state in each year. Specifically, the debt limit exhibits the maximum point of intersection between the fiscal reaction function and the interest rate schedule, and the fiscal space is the gap between the debt limit and the current debt level in each country. If a given welfare state exhibits no intersection between the fiscal reaction function and the interest rate schedule, it the fiscal space and debt limit cannot be calculated, meaning that it does not have sufficient financial capacity to pay its interest burden on its public debt under its current fiscal stance. This means that if it does not change its fiscal stance, it may experience fiscal risk. However, if another welfare state's data do feature a crossing point, we can derive a debt limit and then calculate fiscal space to indicate its fiscal sustainability. The size of the fiscal space may vary among states.

3.3 Operational definition of variables

3.3.1 Estimating the fiscal reaction function

The dependent variable is the primary balance, and the independent variables are financial factors (debt, welfare spending, output gap, and inflation) and structural economic factors (unemployment, service-specific gravity, involuntary part-time work gravity, self-employment share, economic openness, aging rate, and future elderly support payments), political and financial institutional factors (elections, ideological change, delegate-type or other political system, central concentrations of fiscal policy decision making, and fiscal rules). A list of variables used to derive the fiscal reaction function is found in Table 1.

Financial factors are determined by dividing gross debt or net debt. For most fiscal institutions, debt growth entails increase in assets, so net debt rather than gross debt would be more appropriate to identify the fiscal capacity of a government (Coeure and Pisani-Ferry 2005; Jones and Fukawa 2015, p. 9) because gross debt is measured by the total face value of bond funds, while net debt is calculated as this value but excluding financial assets. However, although accounting for government-owned assets is a benefit of net debt, it nevertheless has some limitations (Jones and Fukawa 2015, p. 9). It is difficult for governmental assets to become immediately liquid in a crisis because most assets are fixed-form assets. Moreover, the quality of the government-owned assets is uncertain, so funding using them is limited even where they can be cashed out. Further, certain assets such as the balance in a pension fund, cannot be used for other purposes. Thus, net debt may overstate the financial condition of the government, meaning that gross debt may be more appropriate for assessing financial

Table 1 Variables for estimating fiscal reaction function

			Definition	Sources
Dependent variable		Primary balance	Government net borrowing or net lending excluding interest payments on consolidated government liabilities / nominal GDP	OECD Economic Outlook OECD Social Expenditure database
Independent variables	Finance	Lagged debt	General Government Debt/ nominal GDP	
		Output gap	Difference between actual and potential (calculated using the Hodrick-Prescott filter) real GDP	
		Welfare expenditure	Public social expenditure/	
		Inflation	$\Delta CPI_t /CPI_t - 1$	
	Economic structure	unemployment	(Unemployed/ labor force population) × 100	OECD Employment and Labour Market Statistics database
		Service industry	(workers in Service industry/total employment) × 100	
		Part-time worker	(non-voluntary part time worker/ labor force population) × 100	
		Self-employed	(self-employed/ labor force population) × 100	
		Capital openness	Chinn-Ito index	Chinn-Ito index (KAOPEN) http://web.pdx.edu/~ito/Chinn-Ito_website.htm
		Age dependency	(people over age 65 /Total population) × 100	OECD Employment and Labour Market Statistics database
		Future dependency	(people over age 65 /Population of age from 15 to 64) × 100, years ahead	
	Political and fiscal systems	Election	Dummy variable of election (election: 1 no election: 0)	Comparative political dataset/IMF fiscal rules database
		Political stability	ideological differences between Current and former Cabinet	
		Majority system	Majority system:1; Others	
		Centralization		

	Definition	Sources
	Index of federalism, the strength of the bicameral, effective number of parties and the independence of the financial management organization	
fiscal rule	Index of introduction of fiscal rules, legislative base of rules, existence of the multi-year spending limit, exception and financial monitoring system	

Table 1 (continued)

liabilities of government. As noted, gross debt and net debt each have advantages, so we examine gross debt and net debt separately.

Next, economic openness (Byrne et al. 2011; Drelichman and Voth 2008; Hauner and Kumar 2005; Sims 1999) and inflation (Anand and van Winbegen 1987; Bajo-Rubio et al. 2009; Doi et al. 2011) must be estimated. Trade volume is not a precise measure of to economic openness, because the openness of the financial market includes factors that facilitate capital gains by the government (Byrne et al. 2011; Drelichman and Voth 2008; Hauner and Kumar 2005; Sims 1999). We used the Chinn-Ito index to measure the openness of capital markets. In line with the decision to measure the fiscal sustainability of the welfare state specifically rather than overall financial sustainability, we measured public welfare spending levels rather than the total spending gap.

We considered economic structures and institutional conditions. Labor market structures are needed to support resource extraction. High unemployment may lead to a worsening state of financial resources due to increased public spending and a loss of taxable base (Esping-Andersen 1996, p. 68). An aging population also impacts welfare systems of social insurance, inevitably leading to increased welfare spending, not only for the present but also in future generations. Further, it is hard to reduce unemployment and poverty (Korpi, 1997). Precarious employment also leads to alienation from the welfare system, which focuses on full-time employment (Emmenegger 2012). In particular, involuntary part-time work may be a more serious challenge than absolute unemployment. On the other hand, the expansion of self-employment is closely related to tax evasion, and tax avoidance can inhibit the fiscal capacity of the welfare state (Buhen and Schneider 2012; Schneider et al. 2010). Expansion of the service sector is also closely associated with resource extraction capabilities because the service sector has lower productivity than the manufacturing sector (Baumol 1967; Lindbeck 2006).

Political and financial institutions should reflect on the financial sustainability of the welfare state. First, it is necessary to consider the timing of elections because politicians may increase public spending to promote their own re-election, which can then affect the financial condition of country (Berenger and Llorca 2007; Besley and Case 1995a, 1995b; Carey et al. 1998; Carey et al. 2000; Hallerberg et al. 2004, 2007; Illera and Mulas-Granados 2008; Miriam and Lucio 2008). Further, debt accumulation may sharply increase in relation to a lower possibility of re-election or significant differences in political ideology between the ruling party and others (Hallerberg et al. 2004, 2007), so one should always judge an election in the context of the uncertainty of the re-election (Alesina and Perotti 1995). Thus, we included an interaction term for an election and the degree of ideological change due to that election.

Next, previous research has noted that the collegiate system, which pursues power distribution and promotes rule by leftist parties, can be undermined by fiscal health (Kontopoulos and Perotti 1997, 1999; Perotti and Kontopolos 2002; Ricciuti 2004; Volkerink and Hann 2001). Because there are many participants in public decision-making, it can be difficult to reach consensus. Leftist parties often exhibit a positive attitude toward public spending and generosity toward deficits and debt. Therefore, fiscal conditions can degenerate under the rule of such parties (Volkerink and Hann 2001). Moreover, Hallerberg et al. (2004, 2007) showed that financial institutions can be corrected by common pool problems in the political system. According to their

Table 2 Variables for estimating long-term interest rate

Variables	Definition	Sources
Public debt	General government public debt as a percentage of GDP	OECD Economic Outlook No. 97 (Edition 2015/1)
Government revenue	Total government revenue as a percentage of GDP	
Government expenditure	Total government expenditure as a percentage of GDP	
Output gap	Difference between actual GDP and potential GDP	
Inflation	the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services	
Long-term interest rate	Interest rate of government bonds maturing in ten years	
Short-term interest rate	Interest rate which is money market rate	

Each variable in the estimated variables are included from $t-1$ **to** $t-n$. $t = 1, \cdots, 27$

work, a pluralist system and a mixed system can yield strong fiscal performance, expanding the discretionary fiscal policy to provide rights to fiscal authorities rather than regulating strict fiscal rules. On the other hand, superior fiscal performance can be obtained by faithfully pursuit of fiscal goals through the legislation of fiscal rules in a collegiate system.

We include interaction terms for the characteristics of the political and fiscal systems, as well as the traits of the political system alone.[3] Specifically, political systems are classified into majority systems (pluralist systems) and others (collegiate systems). Next, a proxy for fiscal systems is constructed by concentrating indexed and fiscal rules index, as proposed by Hallerberg et al. (2004, 2007). This concentration index reflects the financial system as a political decision-making entity. The index tracks federalism, the strength of the legislature, and effective number of parties to measure the fragmentation of the political system (Ko 2014; Ricciuti 2004; Volkerink and Hann 2001), as well as the independence of the financial management organization (Cottarelli 2009, p. 13). Next, the fiscal rules index is calculated to reflect the existence of the multi-year spending limit, exceptions, and the financial monitoring system. Additionally, the index includes the strength of the rules reflecting the legislative base (constitutional, statutory, coalition agreement, and political commitment) on the basis of the work of Augustine et al. (2011), along with the introduction of rules and each index is unified according to min–max normalization methods.

3.3.2 Estimating the long-term interest rate

The variables used in the estimation of the long-term interest rate are shown in Table 2: public debt, government revenue, government spending, output gap, inflation, and short-term and long-term interest rates. The long-term interest rate is a function of real economic growth, inflation, and public debt issuance (Polito and Wickens 2012, p. 53)

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[3] The interaction term between the political and fiscal systems is calculated by using average centering.

Table 3 Debt limit and fiscal space; gross debt (Unit: %, the proportion of GDP)

	$r-g$	Model 1			Model 2			Model 3		
		Debt limit	Fiscal space		Debt limit	Fiscal space		Debt limit	Fiscal space	
			mean	2013		mean	2013		mean	2013
AUT	1.68	178.47	100.61	83.37	161.54	83.68	66.45	157.18	79.32	62.08
BEL	2.06	175.01	47.49	57.42	156.48	28.96	38.89	152.03	24.51	34.43
CAN	0.07	191.59	105.70	99.26	178.28	92.38	85.94	173.36	87.47	81.03
DNK	1.73	177.99	114.77	120.72	160.87	97.64	103.60	156.51	93.28	99.24
FIN	2.94	166.33	121.50	101.19	140.59	95.77	75.45	131.99	87.17	66.85
FRA	0.69	186.77	117.01	75.39	172.45	102.70	61.07	167.83	98.07	56.45
DEU	1.29	181.85	118.72	100.24	166.16	103.03	84.55	161.75	98.61	80.13
GRC	14.78	–	−117.2	−182.0	–	−117.2	−182.0	–	−117.2	−182.0
ITA	5.86	117.90	2.900	−26.86	–	−115.0	−144.8	–	−115.0	−144.8
NLD	2.45	171.30	98.62	94.34	150.46	77.78	73.50	145.53	72.85	68.57
NOR	1.38	181.03	143.76	146.06	165.07	127.80	130.10	160.68	123.41	125.70
PRT	9.86	–	−82.96	−141.8	–	−82.96	−141.8	–	−82.96	−141.8
ESP	6.17	–	−59.90	−102.0	–	−59.90	−102.1	–	−59.90	−102.1
SWE	0.17	190.83	132.64	146.00	177.37	119.18	132.54	172.51	114.32	127.68
CHE	−1.14	200.32	159.94	154.75	188.23	147.85	142.66	182.68	142.29	137.11
GBR	−0.13	193.08	138.86	92.24	180.02	125.80	79.18	175.00	120.78	74.17
USA	−0.06	192.58	123.17	83.37	179.44	110.03	70.23	174.45	105.04	65.25

Note: Model 1 include only fiscal variables, model 2 include economic structure and institutional variables as well as fiscal variable, and model 3 add the structural changes of the public finance after the financial crisis 2008 in model 2 in the result of each table

so when long-term interest rate is estimated, the budget constraints of the government related to the public debt, such as government revenue, government spending, and output gap, and inflation (Polito and Wickens 2011, p. 11), should be considered. Further, to capture the variation between interest rates and financial variables, it is necessary to consider long- and short-term interest rates (Polito and Wickens 2011, p. 11).

4 Fiscal sustainability of the advanced welfare state

The determination of the fiscal space of welfare states, derived from the fiscal reaction function and interest schedule, are shown in Table 3 (in relation to gross debt) and Table 4 (in relation to net debt).[4] Model 1 includes only fiscal variables; Model 2 includes economic structure and institutional variables as well as fiscal variables; and

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[4] The results obtained for the fiscal reaction function are presented in the Appendix due to length restrictions to this article.

Model 3 adds the structural changes in the public finances following the financial crisis of 2008 to Model 2.

As shown in Tables 3 and 4, we do not derive fiscal space for the four Southern European countries, Greece, Spain, Italy, and Portugal, with the possible exception that for Italy, fiscal space can be obtained using only financial variables and gross debt. This is consistent with previous work on the financial crisis in these countries (Fournier and Fall 2015; Ghosh et al. 2011; Ostry et al. 2010). The public debt of these countries does not converge to a certain level, meaning that they can bear their debt burden in their current fiscal stance only with great difficulty.

The public debt of these countries was relatively stable before the 2008 financial crisis. Gross debt as a percentage of GDP for Greece and Italy was already above 100% in the early 2000s, and this level was maintained until 2008. Spain and Portugal were maintained their gross debt 60% of GDP, but they experienced chronic deficits, increasing interest on public debt, making it hard to afford interest burden. In particular, it became more challenging to deal with the debt burden under the circumstances of decreased economic growth as a result of the financial crisis (Ullah and Ahmed 2014). Further, before joining the Eurozone, these countries were able to use monetary policy tools, such as currency devaluation, but afterwards, they experienced a vicious cycle of

Table 4 Debt Limit and Fiscal Space; Net Debt (Unit: %, the proportion of GDP)

	$r-g$	Model 1			Model 2			Model 3		
		Debt limit	Fiscal space		Debt limit	Fiscal space		Debt limit	Fiscal space	
			mean	2013		mean	2013		mean	2013
AUT	1.85	65.82	23.75	8.37	272.40	230.33	214.94	380.56	338.50	323.11
BEL	2.12	61.99	−43.31	−28.48	260.62	155.32	170.16	369.09	263.79	278.62
CAN	0.18	84.89	36.20	45.21	330.11	281.42	290.44	439.61	390.92	399.93
DNK	1.77	45.58	26.27	42.89	275.68	256.37	272.99	383.81	364.50	381.11
FIN	3.05	45.58	81.30	99.13	208.48	244.19	262.03	322.68	358.40	376.23
FRA	0.68	79.73	46.26	9.85	314.61	281.13	244.73	423.40	389.93	353.52
DEU	1.34	72.38	34.39	27.05	292.39	254.40	247.06	400.58	362.59	355.24
GRC	15.01	–	−83.73	−117.5	–	−83.73	−117.5	–	−83.73	−117.5
ITA	5.93	–	−93.34	−118.2	–	−93.34	−118.2	–	−93.34	−118.2
NLD	2.26	59.92	27.87	19.51	254.23	222.18	213.81	362.97	330.92	322.55
NOR	1.19	59.92	142.61	264.20	297.57	380.26	501.85	405.85	488.54	610.13
PRT	8.56	–	−54.69	−98.74	–	−54.69	−98.74	–	−54.69	−98.74
ESP	6.46	–	−37.97	−68.75	–	−37.97	−68.75	–	−37.97	−68.75
SWE	0.14	85.31	85.98	114.94	331.38	332.05	361.01	440.94	441.61	470.57
CHE	−1.03	95.89	90.82	89.04	363.02	357.95	356.17	474.56	469.49	467.71
GBR	−0.50	91.25	63.78	25.65	349.17	321.70	283.57	459.77	432.30	394.17
USA	0.12	85.42	35.09	0.05	331.70	281.37	246.33	441.28	390.95	355.91

Model 1 include only fiscal variables, model 2 include economic structure and institutional variables as well as fiscal variable, and model 3 add the structural changes of the public finance after the financial crisis 2008 in model 2 in the result of each table

increasing interest rates on their public debt and resulting downgrades to their credit rating (Ullah and Ahmed 2014).

The countries of Southern Europe showed substantial differences in its economic structure from other advanced welfare states (Ullah and Ahmed 2014) due to factors found in the estimated fiscal reaction function. In the golden age of the welfare state, Southern Europe featured an industrial structure of agriculture and self-employment, in contrast to other European welfare states, with an informal economy amount amounting to about 15–30% of GDP. This made a clear segmentation between the formal and informal sectors, and even today the population engages in small-scale cottage industries, and primary industries account for a large part of the economy (Ferrera 2005).

The public finance base in these countries is vulnerable, as the share of the service sector, including tourism, is an outsized share of the entire industry. Trust in government and in institutional capacity are also low in these countries. With the exception of Italy, democracy was only instituted in these countries in the 1970s, and there authoritarian remnants in the collusion of the political system with the economic system (Sotiropoulos 2004, p. 405). Enterprises can derive benefits from the government through protectionism and promoting the accumulation of capital (Sotiropoulos 2004: 408). Likewise, tax collection can be quite lacking, and there is little trust in tax fairness (Obinger and Wagsshal 2010).

Southern Europe features a social security system with social insurance at the center, in a conservative-style welfare state. In particular, the social security systems in these countries were built around a generous pension scheme that targeted male workers in the formal sector (Ferrera 2005, p. 5). Old-age pensions are generous, but public assistance is insufficient. This was implemented as part of a strategy to minimize the financial burden of the system on the country, tied to the family as the primary safety net, linked to a male breadwinner (Trifiletti 1999). The wide breadth of the informal economy and the service sector made resulted in narrow and fragmented coverage for the social security system (Ferrera 2005). After the financial crisis, moreover, the positions provided by the labor market and the public sector were limited, and the financing capacity of the welfare state fell further, due to the decline in the employment rate. Additionally, these countries have been forced to increase the fiscal burden of the welfare state, given the rapid growth in spending due to the aging of the population in connection with the generous old-age pension.

Beyond the Southern European countries, the other welfare states examined are considered here to be fiscally sustainable due to their fiscal space, as shown in Tables 3 and 4. Note that the precise fiscal space differs for in each welfare state. Denmark, Sweden, and Norway exhibit improvements in their fiscal space for both gross and net debt. Sweden's fiscal space, in particular, is considerable. By contrast, France, the UK, and the US show a significant trend of decrease from previous fiscal space to the fiscal space of 2013. Moreover, the fiscal space for the welfare states is generally similar, with slight differences in the size of the fiscal space depending on the precise variables. Fiscal space based on gross debt is the smallest, reflecting only financial variables, while fiscal space based on net debt is largest. Additionally, when the estimation reflects structural change due to the financial crisis, the fiscal space based on gross debt tends to decrease, except for countries without a debt limit, whereas fiscal space based on net debt is increased, in response to structural change (see Models 2 and 3). Financial sustainability depends on national assets and fiscal capacity.

5 Conclusion and discussion

This study presents a method of measuring financial sustainability in welfare states. In particular, this method incorporates the nation's capacity for financial management in the long run. Besides, to reflect the capacity for financial management, it is necessary to reflect political and institutional factors beyond economic variables. Doing so allows a picture of what strategies are required to confront financial risks within the institutional environment of the given welfare state.

The analysis of the fiscal sustainability of the welfare state, using a method that upgrades the measurement used by Ostry et al. (2010) and Ghosh et al. (2011), indicated that Greece, Spain, Italy, and Portugal did not emerge from the recent financial crisis with financial sustainability intact. These countries have not been able to guarantee sufficient fiscal capacity, due to the high interest rate burden on public debt, low growth, and insufficient governance for treating fiscal problems. Therefore, these countries may face continued fiscal difficulties if they do not alter their current fiscal stance. However, all but these four countries examined have the ability to secure fiscal sustainability, although all feature some fiscal risk.

Although some countries do show promise for the fiscal sustainability of their welfare states, the ultimate financial status is unlikely to be optimistic. When measuring the financial sustainability of a welfare state by examining financial management capability, the UK, the US, and France, whose fiscal spaces have contracted, are likely to fail to guarantee their fiscal sustainability in the future. While they were once easily able to cope with their fiscal problems by maintaining low interest rates, unlike Greece, Spain, Italy, and Portugal, but due to recent declines in fiscal space, the path to securing fiscal sustainability in the future is unclear. In fact, previous studies have noted that these countries may not maintain sufficient fiscal capacity in the near future (Ghosh et al. 2011; Ostry et al. 2010). Norway, Denmark, and Sweden are considered to be generous welfare states, which have retained their fiscal sustainability in spite of the global economic crisis. However, in contrast to the conventional wisdom, we cannot simply conclude that low welfare spending with a high tax burden can ensure fiscal sustainability. Although liberal welfare states like the UK and the US do have relatively low rates welfare spending and do currently exhibit fiscal sustainability, their fiscal capacity has recently been reduced. The Northern European countries of Denmark, Norway, and Sweden have maintained financial sustainability since the mid-1980s, and indeed their fiscal space has steadily widened.

Not all welfare states are fiscally vulnerable. Likewise, it is not true that welfare spending in itself undermines fiscal sustainability, as has been thought. It is necessary to determine the reasons for the observed differences in fiscal sustainability by focusing on the structures of expenditures and revenues in welfare states, in addition to total social expenditures or tax burdens. This study found that not all welfare states are encountering financial difficulties. In other words, financial performance may differ, depending on the type of welfare state. However, this study does not indicate which traits contribute to the creation of a financially sustainable welfare state. In future studies, these means will be expanded to identify concrete policy implications.

Appendix

Appendix 1

Table 5 Estimated results for the fiscal reaction function; gross debt

		Model 1		Model 2		Model 3	
		Beta	SE	Beta	SE	Beta	SE
Finance	Lagged debt	−0.01300	0.0692	−0.10121	0.0902	−0.15116	0.0914†
	Lagged debt_square	0.00146	0.0009†	0.00226	0.0011*	0.00294	0.0011**
	Lagged debt_cubic	−0.00001	0.0000*	−0.00001	0.0000*	−0.00001	0.0000**
	Output gap	0.16802	0.0659*	0.08247	0.0683	0.00274	0.0691
	Welfare expenditure	−1.10124	0.0989***	−1.23191	0.0962***	−1.18801	0.0992***
	Inflation	0.06949	0.0866	0.16318	0.0833*	0.09651	0.0889
Economic structure	unemployment			−0.00365	0.0707	−0.05143	0.0716
	Service industry			−0.89278	0.6019	−0.70893	0.6205
	Part-time worker			0.16966	0.1090	0.17648	0.1105
	Self-employed			−0.23763	0.1002*	−0.20014	0.1018*
	Capital openness			0.63132	0.3029*	0.53014	0.3119†
	Age dependency			0.29900	0.2475	0.27485	0.2549
	Future dependency			−0.00885	0.0818	0.07558	0.0911
Political and fiscal systems	Election			−0.29645	0.1307*	−0.29886	0.1291*
	Political stability			0.17697	0.1463	0.17420	0.1447
	Majority system			17.24871	3.8100***	15.98564	3.9456***
	Majority*Centralization			2.88171	8.2584	0.83217	8.1243
	Majority*fiscal rule			3.58062	5.2201	1.79626	5.1450

Table 5 (continued)

	Model 1		Model 2		Model 3	
	Beta	SE	Beta	SE	Beta	SE
Proportional* Centralization			9.11105	2.9685**	9.78482	3.0361**
Proportional* fiscal rule			1.82614	1.0125†	1.15473	1.0852
Fiscal crisis					−1.78511	0.6140**
Number of obs	433		391		391	
Number of groups	17		17		17	
r^2	0.5364		0.6023		0.6129	
Wald x^2	745.20***		999.26***		831.44***	

$* * * p < 0.001, * * p < 0.01, * p < 0.05, † p < 0.1$

Note: Model 1 include only fiscal variables, model 2 include economic structure and institutional variables as well as fiscal variable, and model 3 add the structural changes of the public finance after the financial crisis 2008 in model 2 in the result of each table

Appendix 2

Table 6 Estimated results for the fiscal reaction function; net debt

		Model 1		Model 2		Model 3	
		Beta	SE	Beta	SE	Beta	SE
Finance	Lagged debt	0.03568	0.0144*	0.02171	0.0150	0.01699	0.0155
	Lagged debt_square	0.00022	0.0001†	0.00022	0.0001**	0.00025	0.0001**
	Lagged debt_cubic	−0.00000	0.0000†	−0.00000	0.0000†	−0.00000	0.0000
	Output gap	0.21578	0.0757**	0.13917	0.0698*	0.06346	0.0719
	Welfare expenditure	−0.92728	0.1186***	−1.07550	0.0993***	−1.03823	0.1042***
	Inflation	0.06216	0.0969	0.18011	0.0871*	0.12805	0.0939
Economic structure	unemployment			0.05417	0.0644	0.02010	0.0667
	Service industry			−1.45612	0.6100*	−1.31691	0.6431*
	Part-time worker			0.26783	0.1167*	0.24628	0.1190*
	Self-employed			−0.25364	0.1015*	−0.22621	0.1020*
	Capital openness			0.44414	0.3138	0.39726	0.3229
	Age dependency			0.62174	0.2580*	0.60523	0.2618*
	Future dependency			−0.00950	0.0894	0.06671	0.0986
Political and fiscal systems	Election			−0.32811	0.1300*	−0.32745	0.1282*
	Political stability			0.17263	0.1503	0.16087	0.1474
	Majority system			14.47173	2.9618***	12.89781	3.2442***
	Majority*Centralization			−2.99946	8.0011	−5.60086	7.7511
	Majority*fiscal rule			2.60063	5.0567	1.08895	4.9697
	Proportional* Centralization			10.03498	3.0360*	11.27176	3.2550**
	Proportional* fiscal rule			2.48862	1.0445*	1.75868	1.1967

Table 6 (continued)

	Model 1		Model 2		Model 3	
	Beta	SE	Beta	SE	Beta	SE
Fiscal crisis					−1.52300	0.6499*
Number of obs	425		389		389	
Number of groups	17		17		17	
r^2	0.4985		0.5805		0.5888	
Wald $x.^2$	1562.55***		927.56***		853.61***	

$* * * p < 0.001, * * p < 0.01, * p < 0.05 \dagger p < 0.1$

Model 1 include only fiscal variables, model 2 include economic structure and institutional variables as well as fiscal variable, and model 3 add the structural changes of the public finance after the financial crisis 2008 in model 2 in the result of each table

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