DEPARTMENT OF ECONOMICS

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The Impact of Government Expenditure on Prepayment for Health Services: Evidence from Cointegration Analysis in Heterogeneous Panel Data

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Abstract

Prepayment of health care financing is a crucial factor to ensure that all individuals have access to effective public and personal health care at affordable prices. However, it is important to find out what the determinants of the level of prepayment are. More specifically, does more government expenditure mean higher prepayment rates in the health financing system? What are the different effects of government expenditure towards the two financing sectors, public financing and private prepaid plans, respectively? To answer these questions, the present paper introduces a three-sector health finance model and uses 34 OECD member data over the 1990-2009 period through panel cointegration analysis. Our findings show that, overall, government expenditure increases the level of prepayment in the health financing system, although the improvement is varied across economies. Our research also highlights that government expenditure has a significant positive effect on public financing in cases where the system is further divided by financing sectors. However, it does not discourage the growth of private prepaid plans.

Key Words: Health Financing System, Government Expenditure, Public Financing, Private Prepaid Plans, Panel Cointegration Analysis, OECD Members

JEL Classification: I13, I18, H51

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"The purpose of health financing is to make funding available, as well as to set the right financial incentives for providers, to ensure that all individuals have access to effective public health and personal health care." ——The 2000 World Health Report.

In order to achieve the goals, there should be a high level of prepayment, whereas the proportion of out-of-pocket health payments should be reduced and better managed.[1] So an interesting research question is how can we increase prepayment and what are the factors stimulating prepayment? Or more focused, does government financing increase the level of prepayment for health services? The present paper mainly focuses on the impact of government expenditure on the prepayment of nation's health financing systems from both theoretical and empricial aspects, and the extent to which it influences two financing approaches, namely public financing and private prepaid plans.

1 Introduction

Currently, prepayment has been considered as the most effective method to manage the risk of sickness in modern societies. There are at least three main reasons. First, sickness is often unforeseen and the treatment can be costly. When people pay for health care at the moment of need, it can lead to personal financial catastrophe. For instance, health care financing with high out-of-pocket expenses create problems of access, particularly for vulnerable groups, such as low-income populations. Secondly, high level of prepayment, especially through public financing, has a positive impact on the fairness of the burden of payment's distribution. Whatever financing approaches countries have chosen, tax-based system, social health insurance, or a mixed system, it's always much possible to increase fairness, spread financial risk and subsidize the poor than out-of-pocket health payments. Thirdly, the level of prepayment would strongly influence goal achievement of the health system. The degree of risk sharing in health-financing organization positively affects health system attainment (Carrin et al., 2004), for instance, the five goals defined by World Health Organization (2000).

Since the significance of prepayment is widely accepted, it is crucial to further investigate the determinants of the prepaid financing approaches. In recent years, there has been much interesting work in this area. Six possible categories of theories dominate the studies on the determinants of the growth of social security system, which are political legitimacy, capitalism vulnerability, demographic heterogeneity, Wagner's law, Leviathan as well as demonstration effects.(Flora and Alber, 1981; Tabellini, 1990; Easterly and Levine, 1997; Miron and Weil, 1998;

[1] *Note:* According to the Organisation for Economic Co-operation and Development (OECD)'s definition of universal access, out-of-pocket payments for health should not exceed 30% of a person's income.

Becker and Mulligan, 1998; Culter and Johnson, 2004) Besides, some remarkable discussions could also be found in the field of the determinants of universal coverage for health care services. World Health Organization (2000) believes that predominant revenue collection mechanism is the major determinant of the level of prepayment in the system. Carrin and James (2003) argue that the transition to universal coverage is not an unobtainable mirage for countries that cannot maintain the high economic growth rates. A more educated work-force, reduced income inequality and improved political rights should facilitate the transition to universal coverage even in slower growing countries. Carrin and James (2005) analyse the socioeconomic and political context, especially in relation to the level of income, structure of the economy, distribution of the population, sound government management and level of solidarity within the country as well as the important stewardship role government can play. These have been found to be facilitating factors influencing the transition to universal coverage, according to social health insurance practices of eight countries.

It should be noted that current literature primarily concentrates on the growth of the social security system from a macroeconomic perspective. However, the studies on the different levels of the system, social aid (e.g. social support following natural disasters), social insurance and social benefits, and the main components of the social insurance, such as pension, health insurance, insurance for unemployed, work injuries (which belongs to health insurance in some countries), are relatively rare. Moreover, there has been little exploration of the empirical studies on the long run influence of a single factor on the national health system and different financing approaches.

According to the analysis above, the paper first constructs a three-section health finance model to discuss the factors that influence the level of prepayment. Besides, we attempt to explain the long term impact of government expenditure on the level of prepayment of health financing system with panel cointegration analysis. Further, the system would be subdivided into public financing and private prepaid plans as different financing approaches and compare their respective reaction towards government attitudes.

The remainder of this paper is organized as follows. Subsequent section builds a three-sector health finance model. Section 3 describes the econometric methodology used. In the fourth section, we explore the empirical results. The final section concludes.

2 A Three-Sector Health Finance Model

2.1 Outline of the Model

The basic idea behind the theoretical model is the factors influence the level of prepayment, more specifically, the impact of government expenditure on the prepayment and two financing

approaches.

There are three sectors: government, households and private health insurers. The revenue of the government (G) comes from taxes on total income (Z). The revenue of private health insurers (S) comes from contributions paid by households. The disposable income of households (Y) is equal to what remains of total income after deduction of the taxes and the health insurance contributions, i.e. $Y = Z - G - S$.

Households use their income to buy health care (H) and other consumption goods (C). The out-of-pocket costs (D) for health care are equal to the difference between the value of health care and the sum of public prepayments (P_1), financed by the government, and private prepayments (P_2), financed by the private health insurers. In other terms, we have $D = H - P_1 - P_2$. The government sector uses its revenue to finance the production of public goods (E) and to subsidize health care by means of public prepayments (P_1). The health insurance sector uses its revenue entirely in the form of private prepaymens of health care (P_2).

All sectors are assumed to be in equilibrium, i.e. there is no accumulation of debt. This implies that out-of-pockets costs are determined endogenously, in such a way that the total expenditures on health care are exactly equal to the sum of the contributions by households, private insurers, and the government. The private "price" of health care to households (d) can be calculated ex-post as the ratio of out-of-pocket costs to health care.

2.2 Accounting Identites and Further Assumptions

Total income is equal to the sum of the income of the three sectors. By assumption all sectors are in equilibrium, and health care expenditures are fully covered. This means:

$$Z = Y + G + S \tag{2.1}$$

$$Y = C + (H - P_1 - P_2) = C + D \tag{2.2}$$

$$G = P_1 + E \tag{2.3}$$

$$S = P_2 \tag{2.4}$$

It can be checked easily that total income is spent on health care, non-health consumption, and public goods:

$$Z = H + C + E \tag{2.5}$$

The model is established with three assumptions. First, total income Z is given. Secondly, the revenue of the government comes from a flat tax τ on total income: $G = \tau Z$, while the tax rate τ is given. Thirdly, the revenue of the private health insurers comes from a flat contribution

σ on after-tax income: $S = \sigma(Z - G) = \sigma(1 - \tau)Z$, while the contribution σ is given. As a result, the disposable income of households is equal to: $Y = (1 - \sigma)(1 - \tau)Z$.

Hence, households have a utility function $U(H, C, E)$. They choose H and C such that $U(H, C, E)$ is maximized under the constraint $Y = C + (H - P_1 - P_2)$. Since $Y = (1-\sigma)(1-\tau)Z$ and $P_2 = S = \sigma(1 - \tau)Z$, this can be tranformed into $(1 - \tau)Z = C + H - P_1$. To simplify things, we take the following utility function:

$$U(H, C, E) = H^{\alpha} C^{\beta} E^{\gamma} \tag{2.6}$$

where $0 < \alpha < 1$, $0 < \beta < 1$, and $0 < \gamma < 1$.

The government has an objective function $W(H, C, E)$. It chooses P_1 and E such that $W(H, C, E)$ is maximized under the constraint $G = P_1 + E$, i.e. $\tau Z = P_1 + E$. We assume that the government knows how much health cost and other consumption households will consume for given levels of P_1 and E, i.e. it knows the functions $H(P_1, E)$ and $C(P_1, E)$ specifying the amounts of health care and other consumption which would maximize the utility function of households. To simplify things we work with the following objective function:

$$W(H, C, E) = H^{a} C^{b} E^{c} \tag{2.7}$$

where $0 < a < 1$, $0 < b < 1$, and $0 < c < 1$.

2.3 Solution of the Model

The goal is to express all variables in terms of the parameters and total income Z. We begin by looking at the behaviour of households. The optimization problem of households looks as follows:

$$\underset{H,C}{Max}\ H^{\alpha} C^{\beta} E^{\gamma} \tag{2.8}$$

subject to the constraint:

$$(1 - \tau)Z = C + H - P_1 \tag{2.9}$$

From this it can be derived that the demands for health care and non-health consumption are equal to:

$$H = \frac{\alpha}{\alpha + \beta} \left[(1 - \tau)Z + P_1\right] \tag{2.10}$$

$$C = \frac{\beta}{\alpha + \beta} \left[(1 - \tau)Z + P_1\right] \tag{2.11}$$

Next we look at the government. Its optimization problem can be formulated as follows:

$$\underset{P_1,E}{Max}\ H^{a} C^{b} E^{c} \tag{2.12}$$

subject to the constraint:

$$\tau Z = P_1 + E \tag{2.13}$$

The assumption that the government knows how much health care and other consumption households will demand, implies that the government knows the functions (2.10) and (2.11). Hence, (2.12) becomes:

$$\underset{P_1,E}{Max} \left(\frac{\alpha}{\alpha+\beta}\right)^a \left(\frac{\beta}{\alpha+\beta}\right)^b [(1-\tau)Z + P_1]^{a+b} E^c \tag{2.14}$$

This leads to the following solution:

$$P_1 = \left(\tau - \frac{c}{a+b+c}\right) Z \tag{2.15}$$

$$E = \frac{c}{a+b+c} Z \tag{2.16}$$

Clearly, for P_1 to be positive we must have:

$$\tau > \frac{c}{a+b+c} \tag{2.17}$$

Now we return to (2.10) and (2.11). Given (2.15), these can be rewritten as:

$$H = \left(\frac{\alpha}{\alpha+\beta}\right)\left(\frac{a+b}{a+b+c}\right) Z \tag{2.18}$$

$$C = \left(\frac{\beta}{\alpha+\beta}\right)\left(\frac{a+b}{a+b+c}\right) Z \tag{2.19}$$

Since $D = H - P_1 - P_2$, we can use (2.18), (2.15) and $P_2 = \sigma(1-\tau)Z$ to obtain:

$$D = \left[(1-\sigma)(1-\tau) - \frac{\beta(a+b)}{(\alpha+\beta)(a+b+c)}\right] Z \tag{2.20}$$

It follows that for D to be positive we must have:

$$\tau < 1 - \frac{\beta(a+b)}{(\alpha+\beta)(a+b+c)(1-\sigma)} \tag{2.21}$$

The implicit price of health care is:

$$d = \frac{(\alpha+\beta)(a+b+c)(1-\sigma)(1-\tau) - \beta(a+b)}{\alpha(a+b)} \tag{2.22}$$

2.4 Interpretation of the Model

Since $\frac{P_1+P_2}{Z} = \frac{P_2}{Z} + \frac{G}{Z}\frac{P_1}{G}$, we can write:

$$\frac{P_1+P_2}{Z} = \sigma(1-\tau) + \tau\frac{P_1}{G} \tag{2.23}$$

The equation (2.23) theoretically demonstrate the relationship between the level of public and private prepayment $\frac{P_1+P_2}{Z}$ and government expenditure $\frac{P_1}{G}$. The estimated constant can be related to $\sigma(1-\tau)$ and the estimated coefficient of x to τ. Since tax rate τ always is positive, the equation shows that government expenditure should have a positive effect on the prepayment rate of health care financing.

3 Empirical Model and Data

Based on the interpretation of the health finance model, we establish a panel regression model to measure the long run relationship between the growth of prepayment of health care financing and government expenditure:

$$Y_{it} = \alpha_i + \beta X_{it} + \mu_{it} \tag{3.1}$$

In Model (3.1), the levels of prepayment of health care financing Y are modeled conditional on the government expenditure X, where the variables Y and X have both i and t subscripts for $i = 1, 2, ..., N$ countries and $t = 1, 2, ..., T$ years. Y denotes the prepaid expenditure on health (total expenditure without out-of-pocket payments) as a ratio to GDP, while X stands for general government expenditure on health as ratio to total government expenditure. α_i is unit-specific fixed effects of panel cointegration; β is the coefficient of panel unit; and μ_{it} is the error term.

Given the importance of "the prepayment of health care financing" issue raised in the health finance model, we purse a way to divide it into public financing (Y_2) and private prepaid plans (Y_3) for further investigation. Y_2 denotes public financing on health as a percentage of GDP, while Y_3 represents private prepaid plans as a percentage of GDP.

The empirical study will analyze the overall effects of government expenditure on the growth of prepayment for health care services and comparing its different influences towards two financing sectors. We choose the annual series of 34 OECD members over the period of 1990-2009 in form of a panel setting mainly from the OECD Library and the WHO Global Health Observatory Data Repository.

4 Econometric Methodology and Result

In this section, we estimate the effects of government expenditure on health care financing and its different influences towards two financing approaches by three steps. Our analysis is started with panel unit-root tests to examine the stationarity of variables. After that, the long run relationship of non-stationary data is considered with panel cointegration tests. Finally, three different approaches Fully Modified Ordinary Least Squares (FMOLS), Dynamic Ordinary Least Squares (DOLS) and Vector Error Correction Model (VECM) two-step estimation procedure are applied to estimate panel cointegration on the variables whose long run relationship exists.[2]

[2] In this section, the paper use Eviews 7.0 to achieve the tests of unit-root and cointegration, OLS, FMOLS and DOLS Estimations of time series data; Stata 11.0 for DOLS Estimation of panel cointegration model; Gauss 9.0 for panel cointegration test of McCoskey and Kao (1998) method, FMOLS and two-step Estimations of panel cointegration model.

4.1 Panel Unit-Root Tests

To discuss the long run relationship of variables Y_1, Y_2, Y_3 with X, the integration and cointegration properties of variables should be firstly examined. Recent studies show that panel unit-root and cointegration tests are reliable for non-stationary panels.[3]

We test the data set by 6 panel unit-root tests including the LLC test (Levin et al., 2002), Breitung test (Breitung, 2000), IPS test (Im, et al., 2003), Fisher (ADF, PP) test (Maddala and Wu, 1999; Choi, 2001) and Hadri test (Hadri, 2000) for the data stationarity. Since it is a bit difficult to reach the exact same results for the various test methods in practice, the present paper report all 6 tests results in Appendix Table 1 including both intercept, trend-and-intercept.

-Appendix Table 1 about here-

The result of these tests are shown, the levels' intercept, trend and intercept of all variables involved could not reject the null hypothesis as expected, which simply means unit-root existed for the levels. The results improve a little for the first differences value. Y_3 and X could reject the existence of unit-root hypothesis, but Y_1 and Y_2 still not. However, the results show further improvement for the second differences value. All the variables have rejected the null hypothesis. According to the result below, we observe no presence of unit-root for the first differences of indicators (Y_3, X) and the second differences of indicators (Y_3, X) and (Y_2, X). As a result, there are $AR(1)$ and $AR(2)$ process which meet the requirements for next panel cointegration tests.

4.2 Panel Cointegration Tests

After investigating the property of data integration, we observe no unit-root existence for the first differences of indicators (Y_3, X) and the second differences of indicators (Y_1, X) and (Y_2, X). In this case, cointegration tests are considered for non-stationary panels to discuss spurious regression problems.

Before considering cointegration in panels, it is useful to examine the time series data of OECD members respectively. In Appendix Table 2, the results of Johansen cointegration test show no cointegration relationship existed between the indicators (Y_1, X), (Y_2, X) and (Y_3, X) in several countries. However, it should be noted that for this type of test the asymptotic distribution does not provide a good approximation to the small sample distribution. Consequently,

[3] *Note:* Before examining the variables' stationarity, we first apply DF test (Dickey and Fuller, 1979), ADF test (Dickey and Fuller, 1981; Doldado, et al., 1990) and PP test (Phillips and Perron, 1988) on time series data of the 34 members. The results imply the explanatory variables Y_1, Y_2, Y_3 and X could not reject the null hypothesis (existence of unit-root) at the 5% significance level.

we could not definitely say that no long run relationship existed between those indicators.

-Appendix Table 2 about here-

Table 2 presents that the group ADF and the panel v statistics of indicators (Y_1, X) and (Y_2, X) reject the null hypothesis, while its LM-FMOLS and LM-DOLS statistics do not reject the null at the highest significance level. Besides, the group ADF statistics of indicators (Y_3, X) reject the null, while LM-DOLS statistics do not at 5% significance level. However, its panel v and LM-FMOLS statistics report the opposite result.

Table 1: Panel Cointegration Tests of the Prepayment, Public and Private Financing

Methods	Y_1	Y_2	Y_3
Pedroni (1999) Group ADF	-4.2397	-3.9215	-1.9198
	(0.0000)	(0.0000)	(0.0274)
Pedroni (1999) Panel ν	6.9449	5.7523	-264.9510
	(0.0000)	(0.0000)	(1.0000)
Pedroni (1999) Panel ρ	0.2480	-0.2242	1.0821
	(0.5979)	(0.4113)	(0.8604)
McCoskey and Kao (1998) LM-FMOLS	3.9291	2.7382	-1.9123
	(1.0000)	(1.0000)	(0.9411)
McCoskey and Kao (1998) LM-DOLS	4.1213	3.1012	-2.1457
	(0.9999)	(1.0000)	(0.9623)

Note **:** The null hypothesis of Pedroni (1999) test is that the variables are not cointegrated, while the null of McCoskey and Kao (1998) test is the existence of cointegration. p values are in parentheses.

To summarize, our results suggest that model (3.1) is the panel regression model of the prepaid levels of national health system and its different financing approaches, which described the long run relationship between government expenditure and the prepayment of health financing systems. The paper concludes that the existence of cointegration between indicators (Y_1, X) and (Y_2, X). However, the situation of indicators (Y_3, X) needs to be further discussed.

4.3 Panel Cointegration Model

With the panel unit-root and cointegration tests above, we state that long run relationship between national health system and government financing exists. In this section, three different estimation procedures, FMOLS (Pedroni, 2001), DOLS (Kao and Chiang, 2000; Mark and Sul, 2003) and Two-Step Method (Breitung, 2005) would be applied to the panel model. To

address this point, we have estimated time series data by OLS, FMOLS and DOLS approaches separately, the results of which are presented in the Appendix as Table 3.

-Appendix Table 3 about here-

As can be seen the estimations of FMOLS and DOLS show that the indicators (Y_1, X) coefficient at the highest among 34 members are Demark, the United States, Austria, France and Portugal. For example, the level of prepayment in Demark health financing system would rise 0.7556% with a government expenditure increase of 1%. To further investigate the panel cointegration regression, we introduce panel estimation of the cointegration vector in Table 3.

Table 2: Panel Estimations of the Cointegration Vector

Methods	Y_1	Y_2	Y_3
FMOLS (Pedroni, 2001)	0.1962	0.2925	-0.1643
	(9.71)	(4.02)	(-2.01)
DOLS (Mark, Sul, 2003)	0.2031	0.3245	-0.1981
	(9.37)	(4.11)	(-2.19)
Two-Step (Breitung, 2005)	0.2117	0.3194	-0.1456
	(10.06)	(4.07)	(-2.47)

Note **:**The leading and lagged terms of DOLS estimation are 1. t values are in parentheses. Theoretically, the procedures of FMOLS, DOLS and Two-Step method are asymptotic equivalence. However, the results would show slightly differences due to limited samples in practice.

According to the panel regression, we have observed that the coefficient of indicator (Y_1, X) and (Y_2, X) are significant at the 1% level by 3 different approaches, the value of which meet the predictions of our analysis. When government financing increases by 1%, the long run level of prepayment rises by 0.196% along with the financing power of public sector rising by 0.293%. However, the coefficients of indicators (Y_3, X) are not significant at the 5% level which support the results of panel cointegration tests as well.

5 Concluding Remarks

This paper relates the health sector to its financing approaches. Universal coverage is a concept that at present remains of paramount importance in the health systems of most world economies. Thus, the level of prepayment is always a crucial factor to secure that all the individuals could afford adequate healthcare. Therefore, it is essential to analyse what are the important factors driving a health financing system towards higher prepayment rates.

Besides, the relatively contradictory characteristics of the health sector also pose challenging problems for access to healthcare. On the one hand, health care services should be public financed. As a fundamental demand of all individuals, every member has the right to enjoy it regardless of gender, race, economic and other social factors. As a result, modern governments should take the responsibility to finance at least the basic health services for every citizen and also establish the risk share mechanism of sickness. On the other hand, health care services are also private. Unlike other public goods, people enjoy the health care services individually instead of sharing with others. However, if the government took all in charge, the market would face the problem of inefficiency, seen through, for example, long waiting lists. Situation in which private finance dominates the system, more problems would be created. For instance, the price of health care service is uncontrolled, particularly for more vulnerable groups in society who have limited access to the service. Consequently, it would also be vital to balance the public and private sectors in the health system, especially the health financing system for efficiency and welfare gains of the sector.

We have been looking at these issues above in two ways. First, through the analysis of a three-sector health finance model, we observe that government expenditure has a positive impact on the level of prepayment in health care financing. In addition to the theoretical model, this paper has shed light on their long run relationship by analysing the data of 34 OECD countries over the 1990-2009 period using panel cointegration analysis. The main analytical results of the empirical study also demonstrate that, on the overall, public financing increases the level of prepaid expenditure on health, although this growth is varied across economies.

However, when the system is further divided into the two financing approaches, public financing and private prepaid plans, we find the answer. Government expenditure has a significant positive effect on public financing as predicted, while it does not discourage the growth of private prepaid plans. These results are more reliable and robust than time series analysis because our panel estimations captured country specific effects and considered broader observations.

Furthermore, it has also been shown that when government increases expenditure on the health sector, the growth of prepayment of health care financing would be expected along with different situations of private prepaid plans. The results are consistent with practices in various countries. We find a "strong-weak" group with strong public but weak private financing, particularly in Northern Europe, like Norway and Sweden. We also find a "strong-strong" group with strong public and relatively strong private financing in Western Europe, for countries such as France and The Netherlands. Once again, the empirical results remind us that government expenditure would be a critical driver of the growth of prepayment of health care financing, while great attention should also be paid to its different influences towards the two financing approaches. In light of our findings, we consider the relationship between public and private

financing, particularly private prepaid plans, as an imperative area for furture research.

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Appendix

Table 1: Panel Unit-Root Tests of the Variables

Variables			LLC	Breitung	IPS	Fisher-ADF	Fisher-PP	Hadri
Y_1	Level	Intercept	3.8716(0.9999)	/	6.2056(1.0000)	36.5232(0.9994)	39.1427(0.9981)	14.8737(0.0000)
		Trend and Intercept	0.5530(0.7099)	1.9824(0.9763)	1.3401(0.9099)	61.2708(0.7052)	30.9939(1.0000)	10.7420(0.0000)
	First Difference	Intercept	-0.1941(0.4230)	/	-5.1990(0.0000)	135.6540(0.0000)	195.8820(0.0000)	2.9862(0.0014)
		Trend and Intercept	-1.8251(0.0340)	4.3391(1.0000)	3.8370(0.0001)	121.0720(0.0001)	194.5040(0.0000)	6.3509(0.0000)
	Second Difference	Intercept	-10.7114(0.0000)	/	-12.1696(0.0000)	276.5130(0.0000)	1133.0600(0.0000)	1.6409(0.0504)
		Trend and Intercept	-7.4640(0.0000)	-0.5840(0.7204)	-7.9571(0.0000)	195.9750(0.0000)	457.9430(0.0000)	6.4156(0.0000)
Y_2	Level	Intercept	3.2789(0.9995)	/	4.7864(1.0000)	46.7551(0.9771)	39.1480(0.9981)	13.8957(0.0000)
		Trend and Intercept	1.4655(0.9286)	1.9656(0.9753)	1.3401(0.9099)	60.6980(0.7232)	32.3535(0.9999)	10.9622(0.0000)
	First Difference	Intercept	-0.5737(0.2831)	/	-5.3896(0.0000)	140.0910(0.0000)	220.0380(0.0000)	2.7111(0.0034)
		Trend and Intercept	-2.3250(0.0100)	3.0448(0.9988)	-4.4092(0.0000)	130.2220(0.0000)	220.9010(0.0000)	6.0935(0.0000)
	Second Difference	Intercept	-10.4615(0.0000)	/	-13.5311(0.0000)	306.7390(0.0000)	1361.4000(0.0000)	1.4097(0.0793)
		Trend and Intercept	-6.7394(0.0000)	-0.5613(0.2873)	-9.6244(0.0000)	223.3360(0.0000)	489.5110(0.0000)	8.2283(0.0000)
Y_3	Level	Intercept	1.2577(0.8957)	/	4.2865(1.0000)	40.0019(0.9865)	41.7856(0.9772)	12.4015(0.0000)
		Trend and Intercept	-1.1963(0.1158)	1.0950(0.8632)	-0.0819(0.5326)	80.0836(0.0609)	49.9614(0.8642)	7.4050(0.0000)
	First Difference	Intercept	-6.1301(0.0000)	/	-6.2749(0.0000)	152.5510(0.0000)	233.3450(0.0000)	0.7650(0.2221)
		Trend and Intercept	-5.8593(0.0000)	1.0537(0.8540)	-3.0332(0.0012)	101.1130(0.0013)	173.5140(0.0000)	11.2582(0.0000)
	Second Difference	Intercept	-10.6911(0.0000)	/	-12.8028(0.0000)	277.5360(0.0000)	1797.5100(0.0000)	5.9254(0.0000)
		Trend and Intercept	-7.7522(0.0000)	-2.2206(0.0132)	-9.7847(0.0000)	209.8880(0.0000)	496.8940(0.0000)	33.0197(0.0000)
X	Level	Intercept	-3.9575(0.0000)	/	-1.5684(0.0584)	91.4028(0.0308)	107.6650(0.0016)	11.7299(0.0000)
		Trend and Intercept	-2.5246(0.0058)	1.1926(0.8835)	0.4925(0.6888)	64.6189(0.5938)	65.4647(0.5647)	9.9335(0.0000)
	First Difference	Intercept	-9.3175(0.0000)	/	-8.5214(0.0000)	197.7930(0.0000)	374.2700(0.0000)	3.1782(0.0007)
		Trend and Intercept	-8.4732(0.0000)	-5.6411(0.0000)	-6.7273(0.0000)	163.2600(0.0000)	359.6570(0.0000)	11.0863(0.0000)
	Second Difference	Intercept	-18.1827(0.0000)	/	-18.8940(0.0000)	416.3650(0.0000)	3041.4400(0.0000)	6.8456(0.0000)
		Trend and Intercept	-14.2966(0.0000)	-8.9879(0.0000)	-14.3569(0.0000)	306.0270(0.0000)	648.5320(0.0000)	31.3776(0.0000)

Note: The table reports t values for LLC test and Bretung test, w values for IPS test, chi-square statistics for Fisher-ADF and Fisher-PP test, z values for Hadri test. t values are in parentheses.

Appendix

Table 2: The Johansen Cointegration Test of OECD Members

Members	Y_1	Y_2	Y_3	Members	Y_1	Y_2	Y_3
Australia	3.4787(0.9410)	8.6116(0.4025)	9.8177(0.2950)	Japan	14.6419(0.0669)	12.8476(0.1205)	24.4099(0.0018)
Austria	7.4605(0.5247)	9.6594(0.3079)	16.5414(0.0347)	Korea	12.1386(0.1504)	14.6959(0.0657)	6.0624(0.6882)
Belgium	21.2213(0.0061)	18.1857(0.0192)	20.4992(0.0081)	Luxembourg	7.13337(0.5622)	6.6628(0.6171)	11.3114(0.1930)
Canada	13.9546(0.0842)	14.9372(0.0605)	11.9840(0.1577)	Mexico	6.6445(0.6193)	6.0380(0.691)	13.6582(0.0928)
Chile	13.0283(0.1138)	9.4580(0.3247)	8.4193(0.4217)	Netherland	8.3799(0.4257)	9.0016(0.3652)	10.7451(0.2276)
Czech Republic	13.3994(0.1010)	13.0696(0.1123)	9.6011(0.3127)	New Zealand	26.5755(0.0007)	27.1078(0.0006)	19.2148(0.0131)
Demark	6.1467(0.6782)	6.8120(0.5996)	11.9951(0.1572)	Norway	3.1338(0.9605)	7.7274(0.4950)	(NA)
Estonia	8.9601(0.3691)	11.2615(0.1959)	4.4429(0.8647)	Poland	9.7696(0.2989)	10.4726(0.2461)	9.3033(0.3381)
Finland	18.5565(0.0167)	19.2983(0.0127)	29.2590(0.0002)	Portugal	12.2829(0.1439)	10.8377(0.2216)	9.8770(0.2903)
France	6.9263(0.5862)	7.9603(0.4697)	7.6952(0.4986)	Slovak Republic	8.0364(0.4615)	7.9843(0.4671)	(NA)
Germany	17.4037(0.0255)	16.7614(0.0321)	17.8815(0.0214)	Slovenia	14.5639(0.0687)	14.4102(0.0723)	13.4763(0.0985)
Greece	6.8639(0.5935)	8.6098(0.4027)	10.0148(0.2796)	Spain	6.9793(0.5801)	6.8129(0.5995)	10.7424(0.2278)
Hungary	14.1506(0.0789)	13.8059(0.0884)	16.6220(0.0337)	Sweden	5.1915(0.7882)	4.9015(0.8192)	5.0988(0.7982)
Iceland	18.0529(0.0201)	18.6329(0.0163)	(NA)	Switzerland	5.5613(0.7466)	6.6055(0.6239)	12.4367(0.1372)
Ireland	5.3988(0.7651)	5.7715(0.7223)	6.0626(0.6881)	Turkey	15.4947(0.1908)	12.1490(0.1499)	11.7012(0.1718)
Israel	15.8682(0.0439)	18.3575(0.0180)	16.9733(0.0297)	United Kingdom	3.7796(0.9205)	4.1364(0.8922)	3.3176(0.9506)
Italy	15.4730(0.0504)	14.2593(0.0761)	19.7605(0.0107)	United States	7.0867(0.5676)	9.8756(0.2904)	4.9880(0.8101)

Note: The table reports the trace statistics of Johansen test at the 5% significance level. p values are in parentheses. The ratio of PHI to GDP is almost zero in Norway and Slovak Republic, so no values could be reported.

Appendix

Table 3: Estimation of the Cointegration Vector of OECD Members (p1)

Indictors	Y_1: National Health System			Y_2: SHI			Y_3: PHI		
Members	OLS	FMOLS	DOLS	OLS	FMOLS	DOLS	OLS	FMOLS	DOLS
Australia	0.2306(3.2207)	0.2858(2.9017)	0.4310(2.8544)	0.2963(4.6492)	0.3520(4.1246)	0.4959(4.1755)	-0.0513(-3.2103)	-0.0580(-2.5190)	-0.1080(-4.8422)
Austria	0.5532(6.3390)	0.5745(5.6701)	0.3747(4.8234)	0.4520(10.1727)	0.4690(7.9847)	0.4102(6.3666)	-0.0472(-6.1656)	-0.0591(-6.0463)	-0.0720(-11.6400)
Belgium	-0.0380(-0.3156)	-0.1323(-0.9138)	0.1361(-0.3435)	-0.0840(-0.4524)	-0.2132(-0.8329)	-0.1656(-0.2057)	-0.0595(-1.9360)	-0.0833(-1.8523)	-0.0965(-0.6655)
Canada	-0.0108(-0.1228)	0.0671(0.4769)	0.3854(1.5700)	0.0697(1.0454)	0.1310(1.2373)	0.3770(2.1644)	-0.0874(-4.4325)	-0.0722(-2.3214)	-0.0090(-0.1572)
Chile	-0.0648(-1.6735)	-0.0822(-1.6954)	-0.0770(-1.7061)	0.0494(2.6439)	0.0448(2.0932)	0.0520(2.8598)	0.0254(2.9222)	0.0362(3.1468)	0.0491(4.2739)
Czech Republic	-0.0955(-3.2468)	-0.0820(-2.2445)	-0.0308(-0.7912)	-0.0846(-2.8117)	-0.0693(-1.8230)	-0.0179(-0.4480)	-0.0013(-3.9467)	-0.0016(-3.0045)	-0.0017(-2.8120)
Demark	0.6344(5.3632)	0.7556(5.0496)	0.6469(6.8235)	0.7601(8.0144)	0.8557(7.2701)	0.7546(12.3777)	0.0180(4.9159)	0.0197(3.8013)	0.0168(3.1433)
Estonia	0.0968(3.7711)	0.1026(2.8838)	0.1135(2.6431)	0.1098(4.8092)	0.1145(3.5001)	0.1240(3.1005)	-0.0004(-1.1978)	-0.0004(-0.9305)	-0.0002(-0.2493)
Finland	0.1432(4.8340)	0.1844(4.8509)	0.2654(7.1685)	0.1609(6.2462)	0.1974(6.3171)	0.2638(8.6384)	-0.0006(-0.5522)	-0.0003(-0.2927)	0.0007(0.3425)
France	0.5035(3.6797)	0.4991(2.5130)	0.4258(1.8052)	0.4208(4.0829)	0.4119(2.7563)	0.3506(2.0016)	0.0823(3.0734)	0.0863(2.2824)	0.0777(1.7658)
Germany	0.0055(0.0904)	-0.0739(-1.8080)	-0.0236(-2.4125)	0.0479(0.8235)	-0.0289(-0.8036)	0.0157(1.9610)	-0.0323(-2.8196)	-0.0479(-8.3730)	-0.0419(-19.9642)
Greece	0.1634(6.5009)	0.1758(6.0018)	0.1658(6.6106)	0.1832(6.5006)	0.2009(5.9823)	0.1782(6.6790)	0.0037(4.4808)	0.0040(5.0489)	0.0039(4.7374)
Hungary	0.0490(3.5622)	0.0552(3.0821)	0.0613(3.9206)	0.0695(5.6615)	0.0762(4.8395)	0.0819(6.2002)	-0.0055(-3.1301)	-0.0058(-1.9694)	-0.0051(-1.5352)
Iceland	-0.2007(-3.0597)	-0.2188(-2.3441)	-0.2668(-1.7124)	-0.1876(-3.0601)	-0.2074(-2.3879)	-0.2632(-1.7755)	0(NA)	0(NA)	0(NA)
Ireland	0.1662(2.0086)	0.1652(1.8447)	0.1260(1.6068)	0.2075(3.0423)	0.2076(2.7502)	0.1804(2.6017)	-0.0076(-0.5281)	-0.0088(-0.5418)	-0.0171(-1.3371)
Israel	0.0330(3.2916)	0.0323(2.8479)	0.0509(2.5001)	0.0762(9.8022)	0.0773(9.2145)	0.1013(6.1987)	-0.0397(-12.1496)	-0.0410(-10.2992)	-0.0462(-10.9449)
Italy	0.1754(5.6271)	0.1989(6.5433)	0.2205(9.1097)	0.1681(5.5580)	0.1913(6.3588)	0.2110(9.2202)	-0.0003(-0.2999)	0.0006(0.5589)	0.0014(1.8872)

Appendix

Table 3: Estimation of the Cointegration Vector of OECD Members (p2)

Indictors	Y_1: National Health System			Y_2: SHI			Y_3: PHI		
Members	OLS	FMOLS	DOLS	OLS	FMOLS	DOLS	OLS	FMOLS	DOLS
Japan	0.3401(3.3890)	0.3888(2.5524)	0.3288(1.3974)	0.3480(3.5883)	0.3933(2.6385)	0.3382(1.4343)	-0.0112(-3.1082)	-0.0148(-2.9319)	-0.0328(-4.1941)
Korea	0.1093(10.5671)	0.1137(7.0975)	0.1074(6.4897)	0.0960(10.6104)	0.1007(7.2911)	0.0958(6.7720)	0.0092(9.7666)	0.0091(8.1159)	0.0084(10.9311)
Luxembourg	-0.1956(-9.1078)	-0.2018(-8.3035)	-0.2038(-6.2645)	-0.1698(-7.9959)	-0.1755(-7.1608)	-0.1773(-5.5776)	-0.0230(-19.447)	-0.0239(-18.5807)	-0.0240(-26.9071)
Mexico	0.1359(4.9609)	0.1674(3.5573)	0.1365(1.8329)	0.1179(5.1941)	0.1402(3.6434)	0.1106(1.7848)	0.0179(3.4562)	0.0272(2.9612)	0.0257(1.9985)
Netherlands	0.0413(1.1270)	0.0329(0.6410)	-0.0205(-0.3514)	0.1182(4.8483)	0.1137(3.3230)	0.0755(2.0084)	-0.0675(-8.6025)	-0.0620(-6.2652)	-0.0540(-3.3785)
New Zealand	0.1257(1.1830)	0.2646(1.9483)	0.4480(2.6630)	0.1508(1.5623)	0.2817(2.2240)	0.4631(2.9025)	-0.0292(-3.7515)	-0.0242(-3.2832)	-0.0224(-2.5321)
Norway	-0.0955(-0.6775)	-0.1507(-0.9290)	-0.3137(-2.0388)	-0.0772(-0.5018)	-0.1434(-0.6918)	-0.2864(-1.0027)	0(NA)	0(NA)	0(NA)
Poland	0.0064(0.2853)	0.0367(0.5291)	0.0186(0.1962)	0.0148(0.8936)	0.0419(0.8506)	0.0378(0.5966)	-0.0012(-1.4455)	-0.0014(-0.5105)	-0.0034(-0.8020)
Portugal	0.4104(4.5799)	0.4990(5.2803)	0.4936(4.9572)	0.3913(5.0966)	0.4811(5.2835)	0.4830(4.9285)	0.0413(2.9702)	0.0609(3.1761)	0.0663(2.8201)
Slovak Republic	-0.0228(-1.5336)	-0.0391(-2.2074)	-0.0419(-3.0405)	-0.0020(0.1844)	-0.0139(-1.0384)	-0.0157(-1.5145)	0(NA)	0(NA)	0(NA)
Slovenia	-0.1476(-2.7982)	-0.1778(-2.4394)	-0.1989(-3.4334)	-0.0532(-1.2441)	-0.0715(-1.2236)	-0.0799(-1.7849)	-0.0816(-6.5835)	-0.0912(-4.8327)	-0.0939(-5.7462)
Spain	-0.0725(-1.3491)	-0.0089(-0.1149)	0.0438(0.4943)	-0.0314(-0.7157)	0.0167(0.2686)	0.0606(0.8918)	-0.0262(-2.9006)	-0.0198(-1.5520)	-0.0158(-0.8644)
Sweden	-0.0967(-4.7645)	-0.1073(-4.7542)	-0.0996(-5.4485)	-0.0516(-2.4352)	-0.0635(-2.6401)	-0.0588(-3.1917)	-0.0022(-7.2296)	-0.0023(-5.8361)	-0.0023(-9.1518)
Switzerland	0.2745(11.4036)	0.2538(7.8808)	0.2309(6.9486)	0.2835(16.2167)	0.2709(11.6520)	0.2569(9.8780)	-0.0117(-1.3698)	-0.0197(-1.6976)	-0.0282(-2.9505)
Turkey	0.1388(1.9895)	0.2302(1.8178)	0.2341(0.9527)	0.1333(2.4072)	0.2064(2.0605)	0.2030(1.0516)	0.0002(0.0416)	0.0037(0.4242)	-0.0012(-0.0653)
United Kingdom	0.0102(0.0901)	-0.0480(-0.3930)	-0.0421(-0.3453)	0.0398(0.3852)	-0.0118(-0.1069)	-0.0060(-0.0556)	0.0257(5.8399)	0.0281(5.7562)	0.0292(6.1376)
United States	0.6036(5.0665)	0.7352(2.9641)	0.6645(1.7560)	0.3864(6.8538)	0.4558(3.9577)	0.4175(2.4449)	0.1889(3.1497)	0.2431(1.9248)	0.2148(1.0652)

Note: The leading and lagged terms of DOLS estimation are 1. t values are in parentheses.