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# Recent Trends of Public and Private Debts: Cross Country Comparison

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# Recent Trends of Public and Private Debts: Cross Country Comparison

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## Abstract

This paper examines the evolution of government, household, and corporate debt across countries in response to the 2008 Great Recession and the extent to which these debts have been rebalanced. We examine 37 OECD countries from 2005 to 2019 using regression models based on the Difference in Differences (DID) method and classify 8 groups of countries that share comparable trends of debt evolution. South Korea belongs to Group 5 along with Belgium, Chile, Finland, and Luxembourg. This group shows a moderate increase in non-financial corporate debt rates during the crisis and a continuous increase in both public and private debt.

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# Table of Contents

# I. Introduction

Examining the evolution of public debt is essential when assessing a country's economic conditions because it affects macroeconomic performance (OECD, 2013). Existing studies have demonstrated that high levels of public debt can slow economic growth to a greater extent than high but declining levels of public debt (Reinhart and Rogoff, 2011). However, these studies do not address the role of private debt. During times of recession, governments increase spending to alleviate the economic crisis, inevitably increasing public debt (Bíró and Elek, 2019), but this could be dangerous because it is difficult to cut back on public spending after the economy recovers (Savage, 2018). Therefore, investigating private debt is also critical, but there is currently a lack of research addressing this topic.

Private debt consists of both household and non-financial corporate debts, and they are significant economic indicators because agents with high levels of debt are likely vulnerable to negative economic shocks, which can worsen a recession. For example, in 2008, the Global Financial Crisis resulted in an exponential increase in household debt in the United States, which led to a huge expansion of mortgages to high-risk borrowers. This caused US economic growth to plummet in the following years (Milan and Sufi, 2010). Furthermore, in 1997, the Asian Financial Crisis broke out due to the crash of the bubble economy, which made it nearly impossible for many Asian firms to renew their short-term debts (Warwick and Will, 1999).

This paper examines how the debts of governments, households, and firms in various countries changed in response to the 2008 Great Recession and related crises, and

the extent to which these debts have been rebalanced as of 2019. The Global Financial Crisis broke out in 2008 due to the burst of the housing bubble fueled by cheap credit and lax lending standards, which had resulted in US homeowners owing more on their mortgages than their homes were worth (Singh, 2021). The impact of the recession following the crisis affected not only the US economy, but global macroeconomic activity also dropped sharply, leading to a significant increase in unemployment rates and plummeting GDP levels. The increasing public and private debt leading up to the 2008 Great Recession is significant. This is because larger than average public and private debt accumulation in the years before a recession deepens the extent of debt increase and extends the duration of the drop in GDP for five years following the recession (Bernardi and Forni, 2017).

The extent of the impact of the recession varied by country due to different economic conditions and how each country had developed leading up to the period of economic recession. For instance, Southern European countries, such as Spain, Greece, and Portugal, had already been facing negative signals in their economy since joining the Eurozone, and they also share a similar southern European welfare model. Spain had gone through the Spanish Financial Crisis from 2008 to 2014, which had been triggered by a housing bubble. Greece entered the Eurozone in 2001 and had been accumulating debt, which led to a major financial crisis starting from 2009. Finally, Portugal had received multiple bailouts as a result of government-led austerity meant to reduce the national deficit.

The main objective of this paper is to classify countries that share similar time-series patterns in terms of their public, household, and corporate debt levels during and

after the 2008 Great Recession. This paper provides descriptive analyses based on the evolution of debt levels across countries and does not aim to explain the driving forces behind these changes. We limit our focus this way because each country is subject to unique political, social, and historical backgrounds. Therefore, discovering the underlying driving forces for each case will require in-depth country-by-country analysis, which is beyond the scope of this paper.

We construct our sample using the Global Debt Database compiled by IMF and the World Development Indicators compiled by the World Bank. The Global Debt Database is the result of a multi-year investigative process that began with the October 2016 Fiscal Monitor and includes gross debt levels for both private and public debt in an unbalanced panel of 190 countries. We use the latter dataset from the World Bank to complement missing data for Slovakia's central government debt from 2001 to 2005. Likewise, we use data from the European System of Central Banks to compensate for missing data for the Netherlands' central government debt and data from Saint Fred Louis sourcing IMF's World Economic Outlook for Mexico's general government debt.[1] Our dataset includes public and private debt, unemployment rates, employment rates, exchange rates from local currency to US dollars, and real GDP per capita for 37 OECD member countries from 2001 to 2019.

The outcome variables of interest are public debt represented by general government debt and central government debt, and private debt represented by non-

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[1] Mexico's general government debt: https://fred.stlouisfed.org/series/MEXGGXWDGGDP
The Netherlands'central government debt: The European System of Central Banks
https://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=325.GFS.A.N.NL.W0.S1311.S1W.N.L.L
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financial corporate debt and household debt. General government debt measures the gross debt of the general government and acts as a key indicator for the sustainability of government finance because it is a direct indicator of government deficits. Central government debt is a subsector of general government debt along with state and local government debt. We use both general government debt and central government debt because the central government debt is more likely to be subject to "monetization," as central banks do not generally buy or discount local government debt (Chouraqui et al., 1986). However, because financial systems vary between countries, we must be cautious about the international comparison of the data, which is why we include general government debt to check for consistency. As defined in the System of National Accounts 2008, private debt, also known as private credit, includes any debt extended to private institutions or individuals, both public and private non-financial corporations, households, and non-profit institutions serving households.

By plotting outcomes over time across countries, we classify countries into 8 groups that share qualitatively comparable time-series patterns. Table 1 displays the classification of the groups in detail. We first divide the groups based on which type of debt among government, household, and corporate experienced the dominant increase and then divide them further based on the evolution pattern of each type of debt.

Next, we conduct regression analyses to confirm the statistical differences across the groups classified above. Specifically, we split our study into three periods before, during, and after the 2008 Great Recession: 2005–2007, 2008–2010, and 2011–2019. We then regress each outcome on interaction terms between the group and period dummies, country and year fixed effects, and control variables. We expect that countries in one group

will show distinctive debt evolution patterns over time compared to countries in another group, which is what we find.

Groups 1 and 2 include countries where government debts show a dominant increase during the Global Financial Crisis. Group 1 includes countries with this trend in addition to an increase in private debt, while Group 2 includes countries with this trend and a decrease in private debt. Groups 3, 4, and 5 include countries where non-financial corporate debts show a dominant increase during the economic crisis. Group 3 includes countries that settled growing public debt trends while private debts increased; Group 4 includes countries with continued increasing public debt in combination with decreasing private debt, and Group 5 includes countries where both public and private debt rates increase. Group 6 includes countries where both private and public debt increase, but during Period 1, the dominant increase was in household debts. Group 7 includes countries where both corporate and household debts show a dominant increase during the crisis, followed by a decrease in household debt and a continued increase in government and corporate debts, but these rates eventually settle. Finally, Group 8 consists of countries where there is no single debt type with a clear and common dominant increase during Period 1 but shows increases in government and corporate debts while household debts settle or slightly increase after 2011. The panels of Figure 1 show the time-series patterns for each group.

South Korea, which belongs to Group 5, shows a constant increase in both public and private debt, especially household debt. This pattern implies that government spending during the recession helped to alleviate short-term household debt, which slightly decreased in 2009. However, this does not appear to have been effective in the long term.

In other words, government spending did not halt the growing trend of private debt rates during the recession and slowly but gradually led to an increasing public debt-to-GDP ratio. Firm debt rates also show a steady increase together with public debt rates. Additionally, as columns (4) and (5) of Table 4 indicate, the government could not cut spending following the recession and ended up increasing the social expenditure-to-GDP ratio more than other groups. The time-trend patterns of public and private debt evolution in South Korea pose a potential warning sign. Our study suggests that it is necessary to revisit the evolution patterns of public and private debt rates and their outcomes in South Korea by comparing them with those of the 37 OECD member countries.

The remainder of this paper is organized as follows. Section 2 explains the background and details of how the Seoul Metropolitan Government designed its shopping coupon program. Through this policy, we analyze how the government tried to alleviate the growing household debt rate while increasing the burden on national fiscal balance and gross public debt. Section 3 describes the data and the sample we use for the study, the econometric framework, and the identification strategy. Section 4 reports our results, and Section 5 presents a discussion of the results along with implications for South Korean policy and concluding remarks.

## II. Related Studies

The trends of public and private debt have been widely analyzed in the literature since the outbreak of the economic crisis in 2008, using unemployment rates as the main indicator for the economic recession (Hoffman and Lemieux, 2016). For instance, previous

empirical studies have identified that job losses lead to a massive transition to disability insurance, causing social expenditures to increase (A. Brio and P. Elek, 2020). This is especially true for expenditures related to health (Keegan et al., 2013). We analyze previous studies that are closely related to this one in terms of methodology, analysis using the latest trends in fiscal balance, and a focus on public and private debt and public spending.

Regarding the importance of grouping countries based on debt evolution patterns, the closest references for our paper are the works of Karanikolos et al. (2016) and Berkmen et al. (2012). The former also examine OECD member countries, grouping them based on income, and they find that countries with high incomes have mixed impacts on health. The latter also group countries based on income, dividing developed and developing countries, and they cross-compare economic vulnerability based on the income level and region of each country. Engemann and Wall (2010) also classify country groups based on demographics. However, none of these previous works have attempted to classify groups based on patterns of debt evolution. Additionally, we reference Lee (2014), who divides a sample of 8 European countries into two groups based on the degree of the change in unemployment rates before and after the 2008 crisis. While this research examines the differences between the two groups of countries, the scope is restricted to the European region. Our paper studies all 37 OECD member countries from 2005 to 2019, classifying them into 8 different groups based on empirical evidence of the cyclical patterns of both private and public debt.

Other related contributions to this research topic are Bernardi and Forni (2020), Batini et al. (2019), and Chang et al. (2016). The first study's main finding is the

interconnection between private and public debt during an economic recession, using data from 200 countries, both emerging and advanced economies, from 1950 to 2015. They suggest that the difference between the two debt sectors during an economic recession is obscure; thus, both should be studied carefully to evaluate the fiscal structure. The second paper designs an empirical model using data from European countries from 1980 to 2014 to explain that, while high private debt leads to deeper recessions, high public debt does not necessarily do so. This finding suggests that by alleviating the private sector's liabilities, the government can mitigate a recession and that equal attention should be paid to private debt along with public debt.

Lastly, we refer to Chang et al.'s (2016) paper, which empirically proves a positive correlation between social spending and government debt in the short term, using central government debt data for 13 OECD member countries from 1980 to 2010. As more individuals depend on government services during times of recession, governments decide to run higher social spending, which leads to higher public debt. Referring to these previous studies, we compare the cross-country patterns of all 37 OECD member states from 2005 to 2019. This paper contributes to the literature by making a descriptive analysis of the debt evolution patterns and a grouping of the 37 countries using the most recent data available.

## III.    Data and Sample

We use the Global Debt Database provided by IMF as our main data source. We collect a dataset that includes public and private debt, macroeconomic indicators, and social

indicators for all 37 OECD member countries from 2001 to 2019. The debt data is based on the annual average rates of central government debt, household debt, and non-financial corporate debt as percentages of GDP. Unfortunately, the data disclosed by IMF is not complete and does not include all data for all countries. Therefore, we complement the missing data from the World Economic Outlook database published in October 2020, the World Development Indicators by World Bank, Eurostat, and other national sources. We merge the datasets by aggregating by country and year. Thus, the unit of observation in our analysis is country by year.

For public debt, we use both general government debt and central government debt. For private debt, we collect separate data on household and non-financial corporate debt. We additionally collect data from the Bank of International Settlements (BIS) including general government, household, and non-financial corporate debt, as well as credit to the private non-financial sector from all sectors at market value. As BIS does not cover all OECD member countries and the data is not adjusted, we use this data as a robustness check. BIS data covers the credits of 31 OECD member countries from 2001 to 2019; Estonia, Iceland, Latvia, Lithuania, Slovak Republic, and Slovenia are not included. Data is provided quarterly, so we convert the data into an annual measurement by calculating the average of four unadjusted periods.[2]

We restrict the sample from 2005 to 2007, 2008 to 2010, and 2011 to 2019. We choose these sample periods for the following reasons. We select three years before and after the 2008 Financial Crisis, coinciding with the layoff announcements by Lehman

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[2]  We import BIS data in January 2021.

Brothers. Panel A of Table 2 reports that the average unemployment rates of OECD countries increased in the second period in comparison to the first period, while the employment rates dropped. These trends also shifted in the third period, from 2011 to 2019. Therefore, we consider the period from 2008 to 2010 as the treatment period for the 2008 Financial Crisis. We use the period from 2005 to 2010 for our empirical analyses and compare it with the period from 2011 to 2019. Our dataset goes until 2019 because not all OECD member countries disclose adjusted debt-to-GDP ratios for the next years. Since our dataset is aggregated by year, we compile a complete dataset up to 2019. Panels A and B of Table 2 report the means for socio-economic trends across OECD member countries according to our dataset. Each column represents the trend before, during, and after the economic crisis. Table 2 reports the summary statistics of our sample depending on the stage of the economic crisis: three years before the economic crisis occurs (column (1)), three years including and after 2008 when the economic crisis hit the global economy (column (2)), and the period from 2011 following the crisis (column (3)). We identify the latter two periods as post1 and post2.

Next, we classify the indicators into two types based on their characteristics – macroeconomic indicators and social indicators. We use aggregate data from OECD Stats and the World Bank's World Development Indicators for both macroeconomic and social indicators.[3] Macroeconomic data include GDP per capita (real), unemployment and employment rates, and exchange rates of US dollars into local currency. We exploit data for GDP per capita and currency exchange rates (constant, USD) from World Development

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[3] We extract OECD data in December 2020.

Indicators, and unemployment and employment rates from OECD Stats. We complement missing unemployment rate data from World Bank and missing employment rate data from the Federal Reserve Bank of Saint Louis, Eurostat, the German National Bureau of Statistics (Destatis), and World Bank.[4] Social data include spendings by the government, such as social expenditure, health expenditure, and public employment spending. We first analyze how each country's debt rates changed, narrow the analysis to debt rates change due to macroeconomic factors, and then analyze the relationship between the debt rates change and social spending by the government. Columns (4) and (5) of Table 4 reveal that different groups demonstrate different patterns in the adjustment of social and health expenditures before and after the economic crisis.

# IV.    Econometric Framework

We examine the differences in the magnitude of the impact of the 2008 Global Financial Crisis on each country by estimating the following DID specification:

$$\text{Debt}_{kt} = \alpha + \beta_1 \left(1\left(\text{country}_k \in group_g\right) \times 1(t \in \text{post1})\right) + \beta_2(1(\text{country}_k \in group_g) \times 1(t \in \text{post2})) + \gamma X_{kt} + \theta_k + \vartheta_t + \varepsilon_{kt}$$

where $Debt_{kt}$ is the rate of debt as a percentage of GDP of country $k$ in year $t$. We interact the dummies "post1" and "post2," which are indicators covering 2008–2010 and 2011–2019, with $\text{country}_k$ classified into $group_g$ based on its debt evolution pattern.

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[4] For more details, refer to the note in Table 2. Summary Statistics. We extract data in January 2021.

Therefore, $1(\text{country}_k \in \text{group}_g) \times 1(\text{t} \in \text{post1})$ represents the evolution of public and private debt in the three years following the Great Recession, and $1(\text{country}_k \in \text{group}_g) \times 1(\text{t} \in \text{post2})$ represents the evolution in the period after that. Parameters $\beta_1$ and $\beta_2$ capture the impact of the Great Recession during periods "post1" and "post2," respectively. Variable $X_{kt}$ includes macroeconomic and social indicators: GDP per capita, rates of employment and unemployment, and currency exchange rates in USD. See details regarding the construction of these variables in Table 3. Variable $\varepsilon_{kt}$ captures unexplained random shocks.

We assume that the trends in public and private debt rates would have increased at a different magnitude and that different types of debt would have varying patterns. To test the plausibility of our assumption, we restrict our sample to 2008 to 2010 and estimate a linear regression model including the interaction effects between the two indicators: one for each country's debt-to-GDP ratio by type and one for the year 2008 to 2010. Similarly, we include the same interaction effects between debt rates and the years 2011 to 2019. If countries share the same time trends, then the interaction effects should not be different from 0, which is what we find. Columns (1) to (4) of Table A in the appendix report the estimates of those interaction terms, which are statistically significant at a conventional level.

# V. Results

Columns (1) to (3) of Table 5 present our estimates of the impact of the economic recession on each country's debt-to-GDP ratio. Conditional on time and country fixed effects, both

government debt and private debt increased during the economic crisis. We classify

countries into different categories based on which types of debts were dominantly affected

during the Great Recession.

Next, we examine whether the impact of the economic crisis on debt rates depends

on the initial macroeconomic level of each country. To test this possibility, we include

control variables to narrow down the correlational influence of macroeconomic indicators,

such as unemployment and employment rates, currency exchange rate, and GDP per capita,

in equation (1). We regress the debt rates of country $k$ in year $t$ on the explanatory

variables and added control variables. Table 5 reports the results of the impact of the

economic crisis on the trends of public and private debt. With the controls, we find a

stronger correlation of the interaction variable of country $k$ in year $t$ on debt rates,

especially during the post2 period, which is three years after the outbreak of the economic

crisis.

Table 5 shows the results for each country's debt trend of public and private debt

for period 1 and period 2, which we name post1 and post2. The two types of public debt,

general government debt, and central government debt reveal similar trends to one another.

Both types of debt increase and decrease in a similar pattern but differ in magnitude.

During the post1 period, from 2008 to 2010, we note that the public government debt

dominantly increased in 13 countries – Austria, Australia, Colombia, France, Germany,

Greece, Mexico, the Netherlands, Japan, Portugal, Spain, the United Kingdom, and the

United States. The result is most notable in Greece and the United Kingdom, which saw

respective increases of 28.552% and 26.218% during period 1 at a statistically significant

level of 1%. Private debt includes two types of debt – non-financial corporate debt and

household debt. Non-financial corporate debt showed a dominant increase in 19 countries, and 5 countries, including Canada, the Czech Republic, Denmark, Poland, and the Slovak Republic, saw household debt rates increase the most. These results demonstrate that the impact was more severe for non-financial corporate debt during this period, as some countries in the former group, such as Iceland, Ireland, and Luxembourg, experienced a respective increase of 156.965%, 60.9118%, and 92.555%, and Canada and Denmark in the latter group experienced an increase of 18.01% and 18.426%. These results are all statistically significant at the conventional level.

We then classify countries into eight groups based on the change of debt trends in each country during period 2, which we define as the period from 2011 to 2019. Table 1 presents the classification in detail. Table 3 displays our estimates of the impact of the economic crisis on public and private debt types for each group. Each column in Table 3 represents the result of a different regression. Columns (1) and (2) demonstrate the impact on public debt, and columns (3) and (4) show the impact on private debt. Groups 1 and 2 include countries where government debt dominantly increased during the Global Financial Crisis. We exclude Austria, Germany, and the Netherlands from these groups because their public debt rates were relatively alleviated or increased at a moderate rate compared to increases in other debt types during period 2. Therefore, we classify the remaining 10 countries that share this trend during period 1 into Groups 1 and 2.

Groups 1 and 2 both demonstrate a dominant increase in government debt in period 1 and this trend of increasing government debt continues into period 2. However, the key difference between the two groups is that, in period 2, Group 2 sees an alleviation in private debts relative to Group 1. For Groups 1 and 2, the trend of increasing public debt continued

into period 2 because countries in these groups decided to create more government debt to help alleviate private debt rates during the economic recession. However, countries in Group 1 did not successfully alleviate private debt, especially in household debt. Instead, private debt rates were maintained or increased during period 2. While general government debt rates increased from 14.481% to 35.450%, household debt rates increased to 18.483% (both statistically significant at the conventional level), and non-financial corporate debt did not show a dramatic decrease while also not being statistically significant. On the other hand, the government debt increase in Group 2 seems to have been relatively more successful in lessening the burden on private debt, as non-financial corporate and household debt rates after the three-year recession period were alleviated. Almost 30% of both general and central government debt rates increased, and private debt rates plummeted (but not at a statistically significant level) in period 2 relative to the years before 2011.

Groups 3,4 and 5 are groups where non-financial corporate debt dominantly increased during the economic crisis. Group 3 saw a continued growing trend in private debt while public debts relatively recovered. These results were not statistically significant, but private debt rates – both firm and household debt – increased significantly. In contrast, countries in Group 4 saw a dramatic increase in public debt, more than tripling compared to the previous period, in exchange for alleviating private debt. Group 5 demonstrates an increase in all debt types. Both public and private debt rates increased but not at a dramatic rate (except for Luxembourg, which experienced an extreme increase in corporate debt).

Group 6 consists of countries that experienced a dominant increase in household debt during the economic recession, and this trend continued during the second period, increasing from 19.930% to 35.035%, both statistically significant at the conventional

level. Relative to other groups, Group 6 shows small debt rates in terms of numeric value, but this group also shows a constant increase in all debt types. Group 7, on the other hand, consists of countries that experienced the largest alleviation of household debt from 16.927% to 8.945%, statistically significant at the conventional level, while the government and corporate debt rates increased, statistically significant at the 10% level. This group has the largest standard error relative to other groups, which may be due to the outlier, Ireland. Ireland initially had a dominant increase in non-financial corporate debt, which peaked in 2015, during the global economic crisis. Although at a lesser magnitude, the other two countries in this group also show a similar pattern.

Similar to Group 7, Group 8 also contains an extreme outlier, Iceland. The IMF was called in to carry out a support program, as Iceland was hit incredibly hard by the financial crisis due to firms and households being heavily indebted with foreign currency and inflation-indexed loans. By carrying out unorthodox measures, including capital controls and safeguarding the social welfare system, the IMF was able to quickly adjust and bring up the current account and budget resulting in an extreme plummet in both public and private debt.[5] The countries in the same group as Iceland demonstrate a similar pattern of debt evolution, but with a much smaller magnitude in terms of size and extremity. During period 1, there is no clear dominant debt increase in these countries, but during period 2, the commonality becomes clear: the government and firms increased their debt rates, while household debts decreased compared to the years before 2011.

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[5] Iceland Lending Case Study, IMF https://www.imf.org/en/Countries/ISL/iceland-lending-case-study

Finally, Table 4 shows the results of the robustness check for each group's debt evolution and spending trends. Using the same group classification, we utilize BIS debt data on general government debt at a nominal rate, household debt, and non-financial corporate debt to check the consistent flow of the group's evolution pattern. Columns (1) to (3) demonstrate the results. Since BIS data covers 31 OECD member countries, excluding Estonia, Iceland, Latvia, Lithuania, Slovak Republic, and Slovenia, Table 4 shows the results without Iceland's extreme case for Group 8. Additionally, we examine the government spending trends during and after the crisis. We regress the social and health expenditure rates, which are calculated as a percentage of GDP, on the explanatory variables in equation (1). Columns (4) and (5) in Table 4 report the results. Regardless of the debt evolution pattern, all groups increased both social and health expenditures during the crisis at a statistically significant rate at the conventional level. Additionally, none of the groups were able to decrease social spending following the recessionary period. Group 5 made the largest increase in social expenditure rates, from 2.880% to 5.074%, at a statistically significant level. For health expenditure, Group 3 increased its expenditure level from 0.714% during period 1 to 2.060% during period 2. These findings are in line with the argument that it is difficult for governments to cut back on spending and support the fact that government policy designed to increase social expenditures should be made cautiously.

# VI.   Conclusion

This paper examines how the debts of the government, households, and firms in each

country changed in response to the 2008 Great Recession, and the extent to which these debts have been rebalanced afterward. Using the DID method, we group the countries that share a similar evolution pattern for each debt type. The biggest contribution of this paper is to demonstrate these patterns and cross-compare them using the latest data related to countries' debts. The findings suggest that government debt is positively correlated with social spending, as shown by increases in each group's spending rates. Likewise, we propose that this group classification can be used as a tool to inform fiscal decision-making by comparing national debt levels with other countries that share similar evolution patterns. This can be a helpful reference for the South Korean government, which often compares its debt level status with that of Japan, claiming that the national fiscal sustainability is at a decent level in comparison to Japan's.

Our study's group classification reveals that South Korea and Japan belong to groups with distinctively different debt evolution patterns. South Korea belongs to the group that experienced a dominant increase in non-financial corporate debt rates during the crisis along with continuously increasing public and private debts after the crisis. On the other hand, Japan belongs to a group that experienced a dominant increase in government debt during the financial crisis, while private debt levels increased relatively gradually compared to South Korea. The biggest disparity between the two countries is in the change of household debt levels. South Korean household debt levels increased dramatically from 2011 to 2019 compared to 2008 to 2010, whereas household debt levels in Japan experienced a relatively lower increase.

In other words, comparing the fiscal situations of countries with different debt evolution patterns is not an effective way to design fiscal policies. Instead, we propose

South Korea should make cross-country comparisons of debt levels with countries that belong to the same debt evolution group. According to our findings, these counties are Belgium, Chile, Finland, and Luxembourg. Additionally, when designing fiscal policies, governments should not carry out public spending programs that disregard future fiscal sustainability in exchange for alleviating the public's financial burden.

# REFERENCES

Auray, S., Eyquem, A., and Gomme, P. (2019). 'Debt hangover in the aftermath of the Great Recession', Journal of Economic Dynamics and Control, Vol. 105, 107-133.

Batini, N., Melina, G., and Villa, S. (2019). 'Fiscal buffers, private debt, and recession: The good, the bad and the ugly', Journal of Macroeconomics, Vol 62. 103044.

Berkmen, S. P., Gelos, G., Rennhack, R., and Walsh, J. P. (2012). 'The global financial crisis: Explaining cross-country differences in the output impact', Journal of International Money and Finance, Vol. 31(1), pp. 42-59.

Bernardini, M., and Forni, L. (2017).' Private and Public Debt: Are Emerging Markets at Risk?', IMF Working Paper 17/61

Bernardini, M., and Forni, L. (2020). 'Private and public debt interlinkages in bad times', Journal of International Money and Finance, Vol. 109 (C), 102239.

Bíró, A., and Elek, P. (2020). 'Job loss, disability insurance and health expenditure', Labour Economics, Vol. 65, 101856.

Chang, C. P., Lee, C. C., Feng, G., and Ning, S. L (2016). 'Does higher government debt link to higher social expenditure? New method, new evidence', Applied Economics, Vol. 48(16), pp. 1429-1451.

Chouraqui, J. C., Jones, B., and Montador, R. B. (1986). 'Public debt in a medium-term perspective', OECD Economic Studies, Vol.7, pp.103-139.

Engemann, K., and Wall, H. J. (2009). 'The effects of recessions across demographic groups'. Available at SSRN 1490041.

Hoffmann, F., and Lemieux, T. (2016). 'Unemployment in the Great Recession: a comparison of Germany, Canada, and the United States', Journal of Labor Economics, Vol. 34(S1), pp. S95-S139.

Karanikolos, M., Heino, P., McKee, M., Stuckler, D., and Legido-Quigley, H. (2016). 'Effects of the global financial crisis on health in high-income OECD countries: a narrative review' , International journal of health services, Vol.46(2), pp. 208-240.

Keegan, C., Thomas, S., Normand, C., and Portela, C. (2013). 'Measuring recession severity and its impact on healthcare expenditure', International Journal of Health Care Finance and Economics, Vol. 13(2), pp.139-155.

Kim, M.J., and Lee, S. (2020). 'Can stimulus checks boost an economy under covid-19? Evidence from South Korea', International Economic Journal, pp. 1-12.

Kim, S., and Kim, S, 'Changes in Economic Conditions under COVID-19 and the Effects of Fiscal Policy', Korean Economic Association, Vol. 13(4), pp.39-67

Lee, Y. (2018). 'The Great Recession, Government Performance, and Citizen Trust', Journal of International and Area Studies, Vol. 25(1), pp.57-70.

Milan, A., and Sufi, A. (2010). 'Household Leverage and the Recession of 2007–09', IMF Economic Review, Vol. 58 (1), pp.74-117.

OECD (2012), 'Debt and Macroeconomic Stability', OECD Economics Department Policy Notes, No. 16

Park, C. (2018). 'The Structural Change of Debt-Economy in Korea: From Corporate Debt to Household Debt', Center for the Reconstruction of Human Society, Vol. 33(2), pp.75-113

Reinhart, C.M., and Rogoff, K.S. (2011). 'From financial crash to debt crisis', American Economic Review, Vol. 101(5), pp.1676-1706.

Savage, L. (2019). 'The politics of social spending after the great recession: The return of partisan policy making', Governance, Vol. 32(1), pp.123-141.

Singh, Manjo. (2021, Jan 11). 'The 2007-2008 Financial Crisis in Review', Investopedia, Retrieved from https://www.investopedia.com/articles/economics/09/financial-crisis-review.asp

Sung, T.Y., Park, K.Y., and Ahn H., (2017). 'What Directions Household-Debt Management Policy Should Head for? A Comparative on Cross-Country Cases', Journal of Korean Economic Analysis, Vol. 23(1), pp. 112-183

Warwick, M., and Will, M. (1999). 'The East Asian Crisis: investigating causes and policy responses', Policy, Research working paper; no. WPS 2172 Washington, D.C.: World Bank Group, pp.55-118.

# Tables and Figures

## Table 1. Classification of Countries into Groups

| Classification | Period 1 (2008–2010) | Period 2 (2011–2019) | Countries |
|---|---|---|---|
| Group 1 | Dominant increase in Government debt | Both government and private debt continues to grow | Australia, Colombia, Japan, France, Mexico |
| Group 2 | Dominant increase in Government debt | Government debt continues to grow while private debt decreases | Greece, Portugal, Spain, United Kingdom, United States |
| Group 3 | Dominant increase in non-financial corporate debt | Public debt settles while private debt increases | Norway, Sweden, Switzerland, Turkey |
| Group 4 | Dominant increase in non-financial corporate debt | Public debt increases while the corporate debt remains or decreases | Estonia, Italy, Latvia, Lithuania, New Zealand, Slovenia |
| Group 5 | Dominant increase in non-financial corporate debt | Public debt gradually increases. Private debt increases | Belgium, Chile, Finland, Luxembourg, Korea |
| Group 6 | Dominant increase in Household debt | Private debt increases. Public debt increases but gradually recovers | Canada, Czech Republic, Poland, Slovak Republic |
| Group 7 | Dominant increase in Private debt | Government and firm debt increase, but gradually decrease. Household debt settles | Denmark, Ireland, Netherlands |
| Group 8 | Others: No clear dominant type, but increases in all debt types | Government and Firm debts increase Household debt decreases | Austria, Germany, Hungary, Iceland, Israel |

*Note:* This table provides the standards for group classification. There are 37 countries, divided into 8 groups, where each group is divided by its trend changes in debt types during period 1 and period 2. We gather debt information on general government debt from the World Economic Outlook published in October 2020 by IMF and central government debt, non-financial corporate debt, and household debt data from the Global Debt Database published in 2018 and revised in 2021 by IMF. We filled the missing data from the World Development Indicators compiled by the World Bank. Government debt includes general and central government debt.

## Table 2. Summary Statistics

| | Before (2005–2007) (1) | During (2008–2010) (2) | After (2011–2019) (3) |
|---|---|---|---|
| **Panel A. Debts and Expenditures (% of GDP)** | | | |
| **A1. Debt Data from IMF** | | | |
| General Government Debt | 47.548 | 56.865 | 68.248 |
| Central Government Debt | 40.011 | 48.776 | 59.521 |
| Household Debt | 56.524 | 63.389 | 61.608 |
| Non-financial Corporate Debt | 87.073 | 105.79 | 100.796 |
| **A2. Debt Data from BIS** | | | |
| General Government Debt | 55.696 | 59.235 | 72.511 |
| Non-financial Corporate Debt | 102.494 | 120.494 | 131.322 |
| Household Debt | 63.288 | 73.808 | 74.532 |
| **A3. Expenditure Data from OECD** | | | |
| Social Expenditure | 18.211 | 20.16 | 20.66 |
| Health Expenditure | 7.888 | 8.556 | 8.735 |
| Public Employment Spending | 1.232 | 1.405 | 1.309 |
| **Panel B. Macroeconomic Variables** | | | |
| Exchange rate[1] | 114.05 | 113.353 | 125.372 |
| Employment rate[2] | 66.35 | 65.85 | 67.37 |
| GDP per Capita[3] | 38,010 | 38,193 | 40,846 |
| Unemployment[4] | 6.74 | 7.94 | 7.99 |
| Working Population[5] | 67.242 | 67.261 | 66.146 |

*Note:* This table provides mean values of key variables across three time periods from 2005 to 2019. The data is divided into debts and expenditures in Panel A and macroeconomic variables in Panel B. The unit of observation is country by year. We use the IMF Global Debt Database for Panel A1, BIS credit data for Panel A.2, and OECD expenditure data for Panel A3. We use OECD data for macroeconomic variables in Panel B. This table continues on the next page.

[1] The exchange rate is calculated by the total constant national currency unit/US dollars.

[2] The employment rate is the ratio of the employed to the working population. We complement missing data for Colombia from the World Bank, Germany from the German National Statistical Bureau (Destatis), France and Switzerland from FRED, and Lithuania and Luxembourg from Eurostat.

[3] GDP per capita is converted into US dollars, at a constant rate.

[4] Unemployment rates: an unemployed person as a percentage of the labor force. Since each country has different measures for calculating the unemployment rate, data given by OECD depends on the data provided by LFS (Labor Force Survey). For European countries, data from LFS is not available, so data is taken from EUROSTAT. For unemployment rates, we complement missing data from the World Bank's World Development Indicators from January 2021.

[5] Working population: population of people in the age group of 15 to 64.

## Table 2. Summary Statistics (continued)

| | Before (2005–2007) (1) | During (2008–2010) (2) | After (2011–2019) (3) |
|---|---|---|---|
| **Panel C. Debt by Groups and Periods** | | | |
| **General Government Debt** | | | |
| Group 1 | 65.041 | 74.007 | 91.794 |
| Group 2 | 63.767 | 82.848 | 117.579 |
| Group 3 | 46.691 | 41.963 | 37.033 |
| Group 4 | 29.967 | 38.658 | 53.247 |
| Group 5 | 33.838 | 38.135 | 48.142 |
| Group 6 | 43.74 | 48.578 | 57.112 |
| Group 7 | 33.83 | 52.801 | 62.892 |
| Group 8 | 60.609 | 75.306 | 70.577 |
| **Central Government Debt** | | | |
| Group 1 | 49.295 | 57.36 | 73.061 |
| Group 2 | 58.55 | 76.504 | 112.159 |
| Group 3 | 31.855 | 30.621 | 26.479 |
| Group 4 | 27.941 | 35.906 | 50.434 |
| Group 5 | 29.244 | 32.845 | 40.59 |
| Group 6 | 34.105 | 39.224 | 44.626 |
| Group 7 | 32.672 | 50.394 | 59.877 |
| Group 8 | 52.812 | 64.814 | 60.583 |
| **Household Debt** | | | |
| Group 1 | 47.586 | 51.103 | 54.798 |
| Group 2 | 78.259 | 84.473 | 74.743 |
| Group 3 | 63.008 | 68.39 | 79.465 |
| Group 4 | 40.21 | 48.613 | 41.677 |
| Group 5 | 47.27 | 54.266 | 61.843 |
| Group 6 | 31.797 | 42.785 | 49.463 |
| Group 7 | 105.623 | 120.836 | 100.246 |
| Group 8 | 57.693 | 59.457 | 51.213 |
| **Non-financial Corporate Debt** | | | |
| Group 1 | 65.413 | 68.761 | 73.315 |
| Group 2 | 82.583 | 95.606 | 88.314 |
| Group 3 | 80.053 | 98.921 | 109.959 |
| Group 4 | 72.173 | 85.212 | 70.788 |
| Group 5 | 110.169 | 141.823 | 156.714 |
| Group 6 | 46.342 | 51.705 | 61.763 |
| Group 7 | 117.54 | 148.231 | 173.894 |
| Group 8 | 127.929 | 164.963 | 100.891 |

*Note:* This table provides mean values of outcome variables in each period in Panel A1 by group. Unit of debt is the percentage of debt to the nominal GDP. See Table 1 for the classifications.

## Table 3. Trend Change by Group

| Dep. | General Government Debt | Central Government Debt | Non-Financial Corporation Debt | Household Debt |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **1(i: Post1, 2008-2010)** | | | | |
| ×1(group1) | 14.481*** | 13.100*** | 4.034* | 8.783*** |
| | (3.691) | (3.554) | (2.262) | (1.746) |
| ×1(group2) | 20.074*** | 19.269*** | 9.182** | 9.035*** |
| | (3.344) | (3.309) | (3.502) | (2.584) |
| ×1(group3) | 1.239 | 4.543 | 19.285*** | 11.268*** |
| | (1.609) | (3.445) | (4.584) | (2.056) |
| ×1(group4) | 9.932*** | 9.538*** | 7.021 | 11.328*** |
| | (3.215) | (3.227) | (4.939) | (1.768) |
| ×1(group5) | 10.298*** | 9.279*** | 31.956** | 12.921*** |
| | (1.841) | (1.863) | (14.707) | (1.163) |
| ×1(group6) | 13.591*** | 13.276*** | 9.662*** | 19.930*** |
| | (2.274) | (1.881) | (3.298) | (2.280) |
| ×1(group7) | 19.617*** | 18.535** | 28.980* | 16.927*** |
| | (6.763) | (7.930) | (15.124) | (1.872) |
| ×1(group8) | 20.374** | 17.389** | 37.908 | 7.834*** |
| | (7.997) | (8.036) | (30.606) | (2.571) |

*Note:* This table shows the estimate result of the trend change of each debt pattern during the post 1 period. The unit of observation is country by year. Each column corresponds to a separate regression. Standard errors are clustered at the country level, reported in parentheses. This table continues on the next page.
Standard errors are clustered at the country level, reported in parentheses.
* Significant at 10%; ** Significant at 5%; *** Significant at 1%.

## Table 3. Trend Change by Group (continued)

| Dep. | General Government Debt | Central Government Debt | Non-Financial Corporation Debt | Household Debt |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **1(i: Post2, since 2011)** | | | | |
| ×1(group1) | 35.450*** | 32.092*** | 5.401 | 18.483*** |
| | (8.754) | (8.937) | (9.153) | (4.153) |
| ×1(group2) | 51.382*** | 52.331*** | -4.091 | 1.234 |
| | (3.715) | (4.407) | (7.962) | (3.392) |
| ×1(group3) | 0.966 | 4.747 | 25.146*** | 30.216*** |
| | (5.082) | (3.940) | (7.078) | (3.678) |
| ×1(group4) | 30.546*** | 29.643*** | -10.730 | 11.861*** |
| | (6.611) | (5.895) | (8.664) | (4.126) |
| ×1(group5) | 24.712*** | 21.228*** | 42.326** | 27.075*** |
| | (3.981) | (4.425) | (20.314) | (4.127) |
| ×1(group6) | 28.996*** | 25.085*** | 15.824** | 35.035*** |
| | (4.364) | (6.288) | (7.739) | (4.686) |
| ×1(group7) | 34.738* | 33.736* | 49.510*** | 8.945** |
| | (17.873) | (19.741) | (17.466) | (3.357) |
| ×1(group8) | 23.593*** | 20.183** | -30.307 | 6.599 |
| | (7.326) | (8.114) | (32.433) | (6.042) |
| Controls. | YES | YES | YES | YES |
| Observations | 554 | 553 | 554 | 554 |
| R-squared | 0.972 | 0.966 | 0.868 | 0.977 |
| Mean dep. | 61.85 | 53.45 | 99.19 | 61.04 |

*Note:* This table shows the estimate result of the trend change of each debt pattern during the post 2 period. We include macroeconomic controls, such as unemployment, employment rate, exchange rate, and GDP per capita (real). We also control for country and year fixed effects. The unit of debt is the percentage of GDP. There are 37 countries. Each column corresponds to a separate regression. Standard errors are clustered at the country level, reported in parentheses.
\* Significant at 10%; ** Significant at 5%; *** Significant at 1%

## Table 4. Robustness Check

| Dep. | BIS GG Debt | BIS HH Debt | BIS NFC Debt | Social Expenditure | Health Expenditure |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| **1(i: Post1, 2008-2010)** | | | | | |
| ×1(group1) | 11.596*** | 10.168*** | 7.548* | 2.125*** | 0.905*** |
| | (2.830) | (2.077) | (3.707) | (0.475) | (0.177) |
| ×1(group2) | 15.628*** | 9.900*** | 9.215* | 2.933*** | 1.242*** |
| | (3.723) | (3.251) | (5.060) | (0.401) | (0.200) |
| ×1(group3) | 0.167 | 11.772*** | 39.063*** | 1.316*** | 0.714*** |
| | (1.864) | (2.460) | (9.681) | (0.403) | (0.125) |
| ×1(group4) | 6.688*** | 10.954*** | 12.983** | 3.671*** | 1.158*** |
| | (2.163) | (1.270) | (4.981) | (0.694) | (0.248) |
| ×1(group5) | 9.980*** | 35.791* | 41.409** | 2.880*** | 0.995*** |
| | (2.084) | (18.402) | (20.206) | (0.367) | (0.178) |
| ×1(group6) | 12.679*** | 22.571*** | 14.911** | 2.348*** | 1.067*** |
| | (2.478) | (3.785) | (6.884) | (0.436) | (0.179) |
| ×1(group7) | 14.336** | 17.554*** | 28.209** | 2.626* | 1.581*** |
| | (6.218) | (2.134) | (12.076) | (1.326) | (0.427) |
| ×1(group8) | 9.810** | 10.660*** | 12.848** | 1.543*** | 0.427* |
| | (3.896) | (2.531) | (4.779) | (0.312) | (0.238) |

*Note:* This table checks the robustness of the data, using BIS credit data and OECD social expenditures data during the post 1 period. Standard errors are clustered at the country level, reported in parentheses. This table continues on the next page.
Standard errors are clustered at the country level, reported in parentheses.
* Significant at 10%; ** Significant at 5%; *** Significant at 1%.

## Table 4. Robustness Check (Continued)

| Dep. | BIS GG Debt (1) | BIS HH Debt (2) | BIS NFC Debt (3) | Social Expenditure (4) | Health Expenditure (5) |
|---|---|---|---|---|---|
| **1(i: Post2, since 2011)** | | | | | |
| ×1(group1) | 31.544*** | 20.646*** | 16.141 | 4.164*** | 1.763*** |
| | (7.976) | (4.775) | (11.850) | (0.868) | (0.617) |
| ×1(group2) | 48.343*** | 1.162 | -1.476 | 3.515*** | 1.410** |
| | (4.770) | (3.879) | (8.863) | (0.567) | (0.531) |
| ×1(group3) | -1.613 | 30.824*** | 86.922* | 3.223*** | 2.060*** |
| | (5.048) | (4.453) | (50.027) | (0.904) | (0.552) |
| ×1(group4) | 21.178*** | 12.784** | 2.839 | 4.272*** | 1.454*** |
| | (3.777) | (5.069) | (12.052) | (0.821) | (0.433) |
| ×1(group5) | 24.281*** | 53.270** | 62.223** | 5.074*** | 1.653** |
| | (4.390) | (23.420) | (26.650) | (1.059) | (0.717) |
| ×1(group6) | 25.469*** | 37.621*** | 29.974** | 3.881*** | 1.533*** |
| | (4.301) | (5.792) | (12.700) | (0.916) | (0.483) |
| ×1(group7) | 32.284* | 12.168*** | 50.784** | 3.259*** | 1.838*** |
| | (18.318) | (3.516) | (19.955) | (1.175) | (0.549) |
| ×1(group8) | 16.531** | 14.570** | 16.570 | 2.594*** | 0.827 |
| | (6.560) | (5.387) | (15.965) | (0.662) | (0.520) |
| Controls | YES | YES | YES | YES | YES |
| Observations | 461 | 464 | 464 | 491 | 554 |
| R-squared | 0.972 | 0.967 | 0.978 | 0.981 | 0.951 |
| Mean dep. | 66.85 | 72.21 | 123.9 | 20.03 | 8.537 |

*Note:* This table checks the robustness of the data, using BIS credit data and OECD social expenditures data during the post 2 period. The unit of observation is country by year. Each column corresponds to a separate regression. We refer to nominal general government debt, non-financial corporate debt, and household debt from BIS, and the unit of debt is the percentage of GDP. BIS data covers the credits of 31 OECD member countries; Estonia, Iceland Latvia, Lithuania, Slovak Republic, and Slovenia are not included. We add social and health expenditure disclosed by OECD stat to cross-check the spending trends of each group. The unit of both debt and expenditure is the percentage of GDP. Standard errors are clustered at the country level, reported in parentheses. Each column corresponds to a separate regression. Standard errors are clustered at the country level, reported in parentheses.
* Significant at 10%; ** Significant at 5%; *** Significant at 1%.

## Table 5. Trend Change by Country

| | General Government Debt | Central Government Debt | Non-financial Corporate Debt | Household Debt |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **Group 1** | | | | |
| **1(i: Post1, 2008–2010)** | | | | |
| × Australia | 15.191*** | 13.037*** | 2.306 | 10.509*** |
| | (1.344) | (1.570) | (1.988) | (1.259) |
| × Colombia | 10.648*** | 8.573*** | 5.336 | 9.585*** |
| | (1.586) | (1.776) | (3.290) | (1.190) |
| × France | 20.314*** | 17.482*** | 12.020*** | 12.321*** |
| | (1.194) | (1.370) | (1.677) | (0.874) |
| × Japan | 27.006*** | 25.594*** | 5.693*** | 5.206*** |
| | (1.264) | (1.448) | (1.815) | (1.016) |
| × Mexico | 11.001*** | 11.917*** | 2.626 | 4.806*** |
| | (1.275) | (1.433) | (1.725) | (1.229) |
| **1(i: Post2, since 2011)** | | | | |
| × Australia | 41.247*** | 35.074*** | -0.750 | 26.059*** |
| | (2.438) | (2.712) | (5.075) | (3.619) |
| × Colombia | 24.206*** | 18.105*** | 18.874*** | 24.862*** |
| | (3.861) | (4.190) | (6.766) | (4.578) |
| × France | 39.802*** | 34.101*** | 31.320*** | 24.082*** |
| | (2.211) | (2.441) | (4.295) | (2.875) |
| × Japan | 70.167*** | 68.031*** | 8.623 | 12.098*** |
| | (3.105) | (3.398) | (6.152) | (3.578) |
| × Mexico | 22.280*** | 22.418*** | 14.085*** | 14.522*** |
| | (2.088) | (2.261) | (3.944) | (2.712) |
| **Group 2** | | | | |
| **1(i: Post1, 2008-2010)** | | | | |
| × Greece | 28.552*** | 28.589*** | 15.039*** | 15.953*** |
| | (1.288) | (1.480) | (1.792) | (1.129) |
| × Portugal | 24.836*** | 21.544*** | 17.919*** | 11.384*** |
| | (1.331) | (1.487) | (1.841) | (1.419) |
| × Spain | 16.514*** | 16.142*** | 5.861 | 4.025 |
| | (2.828) | (3.084) | (5.669) | (4.042) |
| × United Kingdom | 26.218*** | 26.269*** | 6.220*** | 7.372*** |
| | (1.262) | (1.356) | (1.690) | (1.294) |
| × United States | 23.922*** | 23.036*** | -2.625 | 0.272 |
| | (1.602) | (1.629) | (2.493) | (2.017) |

*Note:* This table continues on the next page. Standard errors are clustered at the country level, reported in parentheses. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

## Table 5. Trend Change by Country (continued)

| | General Government Debt (1) | Central Government Debt (2) | Non-Financial Corporation Debt (3) | Household Debt (4) |
|---|---|---|---|---|
| **Group 2** | | | | |
| **1(i: Post2, since 2011)** | | | | |
| × Greece | 63.055*** | 68.165*** | -1.522 | 2.269 |
| | (3.247) | (3.518) | (7.102) | (5.594) |
| × Portugal | 62.937*** | 63.536*** | 14.856*** | 2.682 |
| | (1.643) | (1.827) | (2.993) | (2.524) |
| × Spain | 58.354*** | 54.679*** | -23.850*** | -9.413 |
| | (3.672) | (4.223) | (8.556) | (5.884) |
| × United Kingdom | 54.465*** | 53.675*** | 1.497 | 7.772*** |
| | (2.249) | (2.457) | (4.305) | (2.799) |
| × United States | 51.919*** | 53.559*** | 1.975 | -0.793 |
| | (1.719) | (1.879) | (2.966) | (3.474) |
| **Group 3** | | | | |
| **1(i: Post1, 2008-2010)** | | | | |
| × Norway | 2.211* | 13.358*** | 31.080*** | 11.559*** |
| | (1.226) | (1.413) | (1.822) | (0.837) |
| × Sweden | 1.679 | 0.236 | 26.320*** | 15.009*** |
| | (1.223) | (1.387) | (1.638) | (1.086) |
| × Switzerland | 5.219*** | 6.555*** | 13.944*** | 6.942*** |
| | (1.504) | (1.774) | (2.421) | (1.603) |
| × Turkey | 7.722*** | 8.056*** | 11.942*** | 9.394*** |
| | (1.996) | (2.353) | (4.295) | (2.162) |
| **1(i: Post2, since 2011)** | | | | |
| × Norway | -6.699*** | 9.949*** | 30.363*** | 33.273*** |
| | (1.706) | (1.749) | (2.937) | (2.145) |
| × Sweden | 11.808*** | 7.710** | 38.360*** | 35.000*** |
| | (2.918) | (3.242) | (6.015) | (3.748) |
| × Switzerland | 10.530*** | 10.317*** | 30.558*** | 31.134*** |
| | (2.814) | (3.203) | (6.030) | (4.112) |
| × Turkey | 14.716*** | 13.297** | 37.982*** | 26.632*** |
| | (4.967) | (5.625) | (11.504) | (6.140) |

*Note:* This table continues on the next page. Standard errors are clustered at the country level, reported in parentheses. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

## Table 5. Trend Change by Country (continued)

|  | General Government Debt | Central Government Debt | Non-Financial Corporation Debt | Household Debt |
|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) |
| **Group 4** | | | | |
| **1(i: Post1, 2008-2010)** | | | | |
| × Estonia | 4.940** | 4.774* | 3.031 | 10.860*** |
|  | (2.217) | (2.419) | (4.101) | (3.090) |
| × Italy | 11.289*** | 10.325*** | 13.259*** | 8.031*** |
|  | (1.093) | (1.161) | (1.504) | (0.828) |
| × Latvia | 26.236*** | 26.840*** | 6.261 | 8.087** |
|  | (2.803) | -3.104 | (5.617) | (3.949) |
| × Lithuania | 17.879*** | 17.696*** | -7.626 | 11.329*** |
|  | (2.692) | (2.995) | (5.352) | (3.746) |
| × New Zealand | 12.103*** | 12.188*** | 4.454** | 8.629*** |
|  | (1.299) | (1.412) | (1.737) | (1.438) |
| × Slovenia | 16.066*** | 13.606*** | 23.932*** | 13.231*** |
|  | (1.380) | (1.620) | (2.104) | (1.281) |
| **1(i: Post2, since 2011)** | | | | |
| × Estonia | 20.946*** | 22.709*** | 1.218 | 12.712*** |
|  | (3.528) | (3.996) | (7.356) | (4.367) |
| × Italy | 26.987*** | 27.314*** | 8.838** | 7.734** |
|  | (2.189) | (2.513) | (3.881) | (2.853) |
| × Latvia | 45.208*** | 44.020*** | 4.054 | 2.724 |
|  | (3.548) | (4.088) | (7.710) | (4.699) |
| × Lithuania | 47.792*** | 44.806*** | -10.776 | 19.718*** |
|  | (4.756) | (5.480) | (10.807) | (6.407) |
| × New Zealand | 29.223*** | 28.741*** | -9.058* | 16.911*** |
|  | (2.397) | (2.699) | (5.012) | (3.578) |
| × Slovenia | 55.167*** | 48.417*** | 1.094 | 17.787*** |
|  | (2.255) | (2.548) | (4.557) | (3.146) |

*Note:* This table continues on the next page. Standard errors are clustered at the country level, reported in parentheses. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

## Table 5. Trend Change by Country (continued)

| | General Government Debt | Central Government Debt | Non-Financial Corporation Debt | Household Debt |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **Group 5** | | | | |
| **1(i: Post1, 2008-2010)** | | | | |
| × Belgium | 14.592*** | 11.766*** | 30.590*** | 12.495*** |
| | (1.219) | (1.409) | (1.776) | (0.928) |
| × Chile | 12.436*** | 11.338*** | 11.813*** | 11.738*** |
| | (2.056) | (2.446) | (3.688) | (2.082) |
| × Finland | 9.502*** | 8.296*** | 18.030*** | 12.931*** |
| | (1.115) | (1.248) | (1.514) | (0.802) |
| × Luxembourg | 14.703*** | 13.857*** | 92.555*** | 12.333*** |
| | (1.341) | (1.565) | (1.956) | (1.131) |
| × Korea | 12.340*** | 12.162*** | 15.334*** | 15.114*** |
| | (1.457) | (1.763) | (1.971) | (2.088) |
| **1(i: Post2, since 2011)** | | | | |
| × Belgium | 24.254*** | 18.387*** | 42.762*** | 26.857*** |
| | (2.275) | (2.404) | (4.396) | (2.932) |
| × Chile | 34.370*** | 31.649*** | 41.092*** | 29.356*** |
| | (4.979) | (5.539) | (9.982) | (5.796) |
| × Finland | 28.421*** | 23.073*** | 33.948*** | 23.655*** |
| | (2.056) | (2.201) | (3.725) | (2.391) |
| × Luxembourg | 24.995*** | 23.908*** | 131.661*** | 24.793*** |
| | (3.007) | (3.391) | (5.965) | (3.608) |
| × Korea | 36.779*** | 30.835*** | 14.778** | 40.743*** |
| | (3.427) | (3.827) | (7.149) | (5.568) |
| **Group 6** | | | | |
| **1(i: Post1, 2008-2010)** | | | | |
| × Canada | 12.674*** | 12.546*** | 6.430*** | 18.010*** |
| | (1.210) | (1.339) | (1.580) | (1.120) |
| × Czech Republic | 14.690*** | 15.941*** | 4.645*** | 16.009*** |
| | (1.177) | (1.342) | (1.691) | (1.147) |
| × Poland | 18.199*** | 13.559*** | 21.662*** | 27.437*** |
| | (1.872) | (1.990) | (4.070) | (2.194) |
| × Slovak Republic | 16.606*** | 17.827*** | 8.369*** | 19.749*** |
| | (1.389) | (1.607) | (2.268) | (1.731) |

*Note:* This table continues on the next page. Standard errors are clustered at the country level, reported in parentheses. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

## Table 5. Trend Change by Country (continued)

| | General Government Debt | Central Government Debt | Non-Financial Corporation Debt | Household Debt |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **Group 6** | | | | |
| **1(i: Post2, since 2011)** | | | | |
| × Canada | 30.015*** | 18.492*** | 26.202*** | 35.793*** |
| | (1.983) | (2.123) | (3.792) | (2.854) |
| × Czech Republic | 29.433*** | 29.699*** | 24.390*** | 28.599*** |
| | (3.578) | (3.868) | (7.303) | (4.272) |
| × Poland | 32.978*** | 26.089*** | 33.996*** | 43.150*** |
| | (4.388) | (4.497) | (9.140) | (5.495) |
| × Slovak Republic | 42.381*** | 41.551*** | 20.946*** | 43.783*** |
| | (3.248) | (3.418) | (6.881) | (4.684) |
| **Group 7** | | | | |
| **1(i: Post1, 2008-2010)** | | | | |
| × Denmark | 8.806*** | 5.591*** | 10.090*** | 18.426*** |
| | (1.320) | (1.274) | (2.028) | (1.426) |
| × Ireland | 34.712*** | 36.379*** | 60.910*** | 15.021*** |
| | (2.062) | (1.974) | (3.743) | (3.073) |
| × Netherlands | 22.716*** | 20.939*** | 14.824*** | 14.203*** |
| | (1.806) | (2.140) | (3.152) | (1.644) |
| **1(i: Post2, since 2011)** | | | | |
| × Denmark | 13.307*** | 8.243*** | 16.096*** | 14.411*** |
| | (1.511) | (1.608) | (2.286) | (2.807) |
| × Ireland | 87.286*** | 90.044*** | 88.160*** | -1.670 |
| | (3.493) | (4.128) | (7.860) | (6.636) |
| × Netherlands | 30.617*** | 27.796*** | 48.429*** | 14.575*** |
| | (3.233) | (3.621) | (6.567) | (3.912) |

*Note:* This table continues on the next page. Standard errors are clustered at the country level, reported in parentheses. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

## Table 5. Trend Change by Country (continued)

| | General Government Debt | Central Government Debt | Non-Financial Corporation Debt | Household Debt |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **Group 8** | | | | |
| **1(i: Post1, 2008-2010)** | | | | |
| × Austria | 20.426*** | 13.164*** | 11.412* | 8.137*** |
| | (1.563) | (2.179) | (6.155) | (2.201) |
| × Germany | 18.432*** | 14.219*** | 10.651*** | 4.260*** |
| | (1.659) | (1.899) | (3.093) | (1.387) |
| × Hungary | 18.730*** | 17.028*** | 14.095*** | 14.178*** |
| | (1.413) | (1.541) | (2.039) | (1.610) |
| × Iceland | 53.104*** | 51.083*** | 156.965*** | 0.741 |
| | (1.752) | (1.763) | (2.904) | (2.254) |
| × Israel | 3.683** | 3.011* | 0.291 | 10.958*** |
| | (1.473) | (1.719) | (2.517) | (1.322) |
| **Group 8** | | | | |
| **1(i: Post2, since 2011)** | | | | |
| × Austria | 28.251*** | 17.276*** | 14.863* | 12.233*** |
| | (3.307) | (2.885) | (8.525) | (3.040) |
| × Germany | 26.668*** | 22.980*** | 17.492** | 11.525** |
| | (3.891) | (3.996) | (7.912) | (4.662) |
| × Hungary | 27.150*** | 26.362*** | 16.991* | 10.627** |
| | (4.392) | (4.917) | (8.649) | (5.123) |
| × Iceland | 47.562*** | 45.218*** | -128.937*** | -10.367*** |
| | (1.963) | (2.183) | (3.656) | (3.080) |
| × Israel | 8.609 | 5.624 | 0.193 | 22.906*** |
| | (5.320) | (5.837) | (10.902) | (6.088) |
| Controls | YES | YES | YES | YES |
| Observations | 554 | 553 | 554 | 554 |
| R-squared | 0.989 | 0.988 | 0.948 | 0.986 |
| Mean dep. | 61.85 | 53.45 | 99.19 | 61.04 |

*Note:* The unit of observation is country by year. Each column corresponds to a separate regression. We include macroeconomic controls, such as unemployment, employment rate, exchange rate, and GDP per capita (real). We also control for country and year-fixed effects. The unit of debt is the percentage of GDP. There are 37 countries. Standard errors are clustered at the country level, reported in parentheses.
* Significant at 10%; ** Significant at 5%; *** Significant at 1%.

# Figure 1. Time Series Patterns of Public and Private Debt by Group

**Panel 1.**
**Group 1 (Australia, Colombia, Japan, France, Mexico):**
Public debt increased dominantly during the recession. Public and private debt increase.
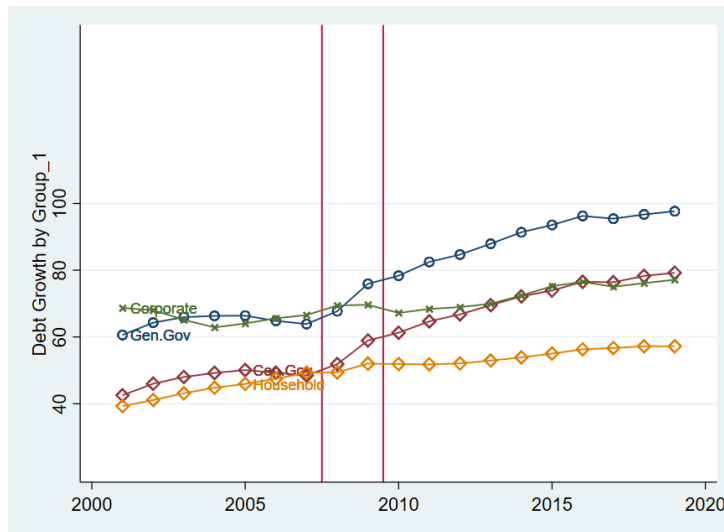


**Panel 2.**
**Group 2 (Greece, Portugal, Spain, United Kingdom, United States):**
Public debt increased dominantly during the recession. Public debt continues rising while private debt settles.)

**Panel 3.**
**Group 3 (Norway, Sweden, Switzerland, Turkey)**
Corporate debt dominantly increased during the crisis and continues to increase along with household debt afterward, while public debt settles.
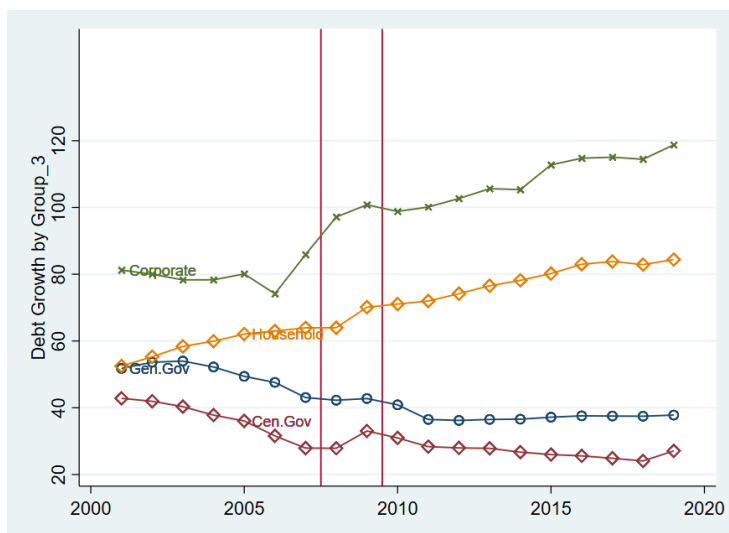


**Panel 4.**
**Group 4 (Estonia, Italy, Latvia, Lithuania, New Zealand, Slovenia):**
Corporate debt dominantly increased during the crisis, but private debt is decreasing while public debt is increasing.
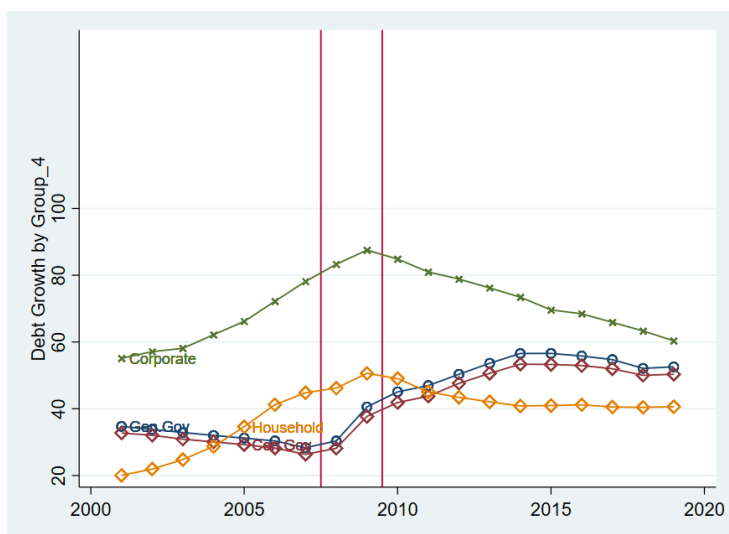
**Panel 5.**
**Group 5 (Belgium, Chile, Finland, Luxembourg, Korea):**
Corporate debt dominantly increased during the crisis and continues to increase. Both public and private debt also gradually increase.
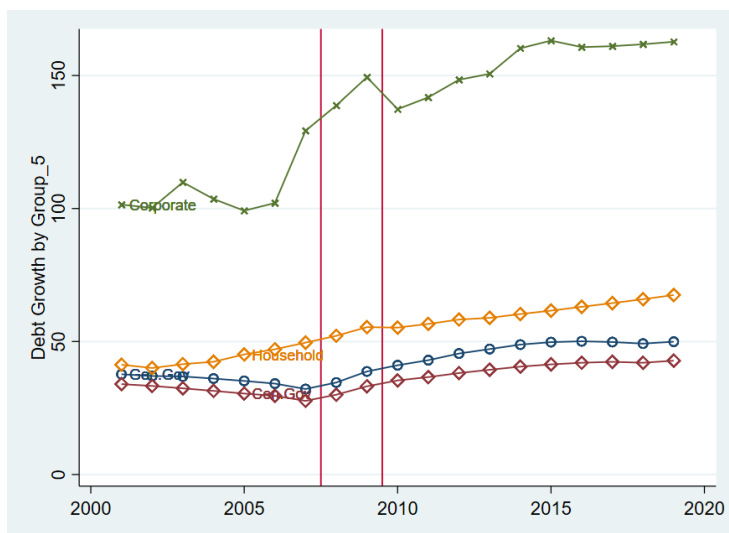


**Panel 6.**
**Group 6 (Canada, Czech Republic, Poland, Slovak Republic):**
Dominant increase in household debt during the crisis, and both public and private debts continue to increase, but public debt is gradually recovering since 2015.
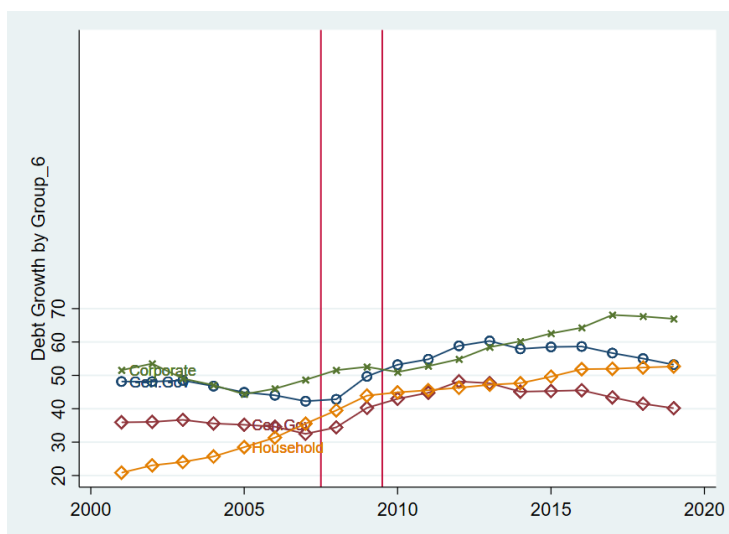
**Panel 7.**
**Group 7 (Denmark, Ireland, Netherlands)**
Dominant increase in corporate and household debt during the crisis, but afterward, household debt was alleviated. The government and firm debts continued to increase but gradually recovered from 2014 and 2015, respectively.
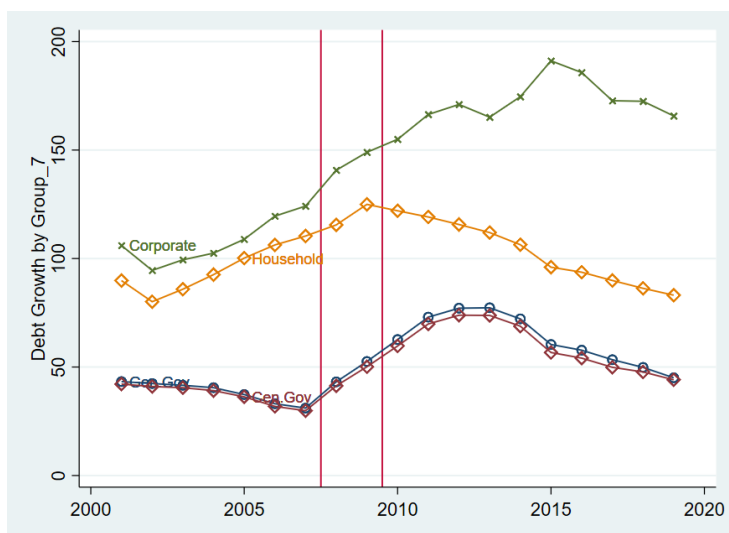


**Panel 8.**
**Group 8 (Austria, Germany, Hungary, Iceland, Israel)**
We define this group as the others. The dominant increase was not clearly defined, but the recovery pattern for all debt types is similar and relatively well alleviated for all types.
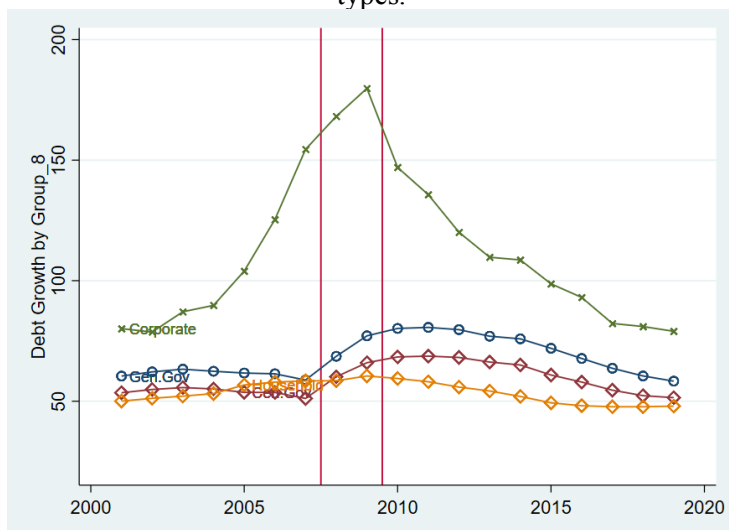
# Appendix: Figure 2. Evolution Patterns by Types of Debt by Group

**Group 1 (Australia, Colombia, Japan, France, Mexico)**

**Panel A: General Government Debt of Group 1.**
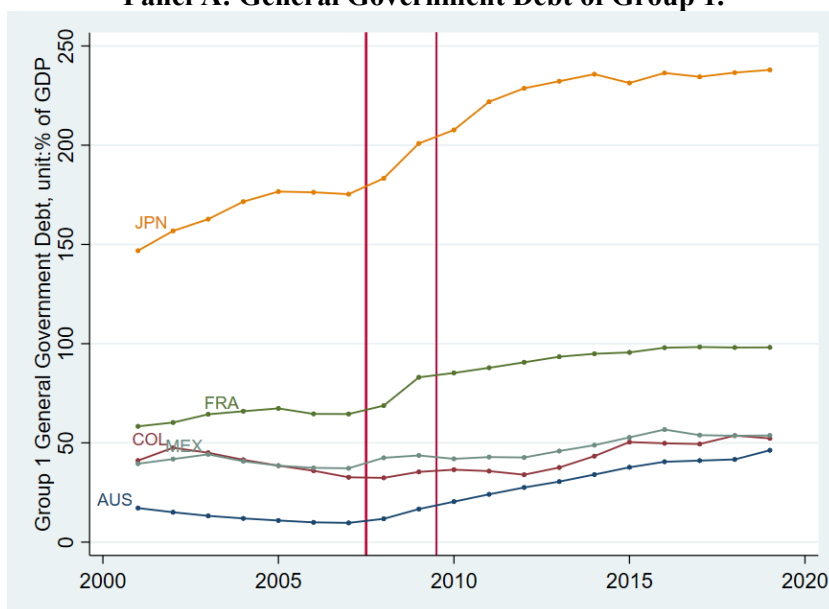


**Panel B: Central Government Debt of Group 1.**
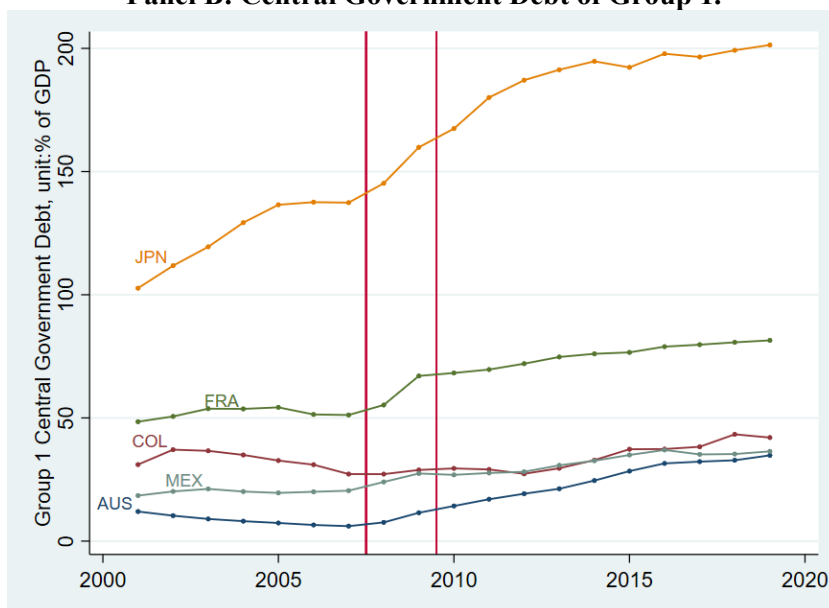
**Group 1 (Australia, Colombia, Japan, France, Mexico) (continued)**

**Panel C: Household Debt of Group 1.**
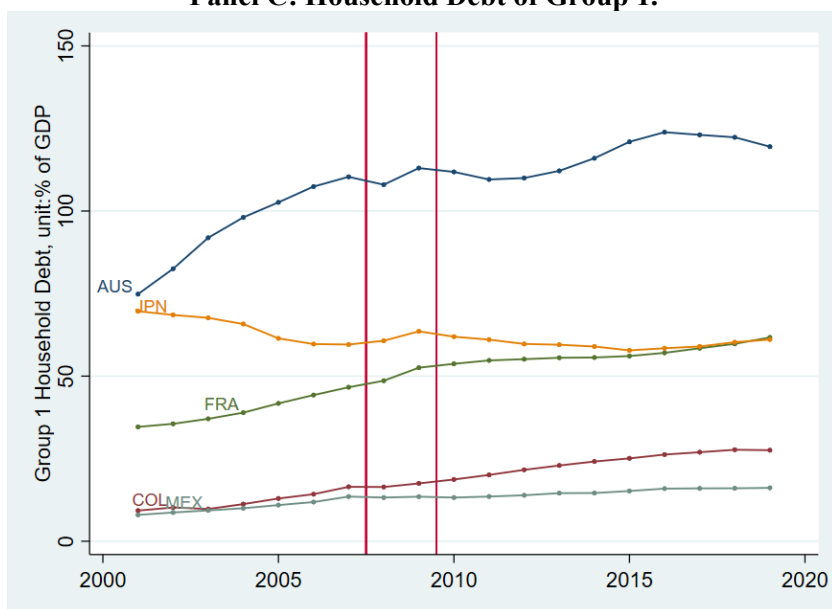


**Panel D: Non-financial Corporate Debt of Group 1.**
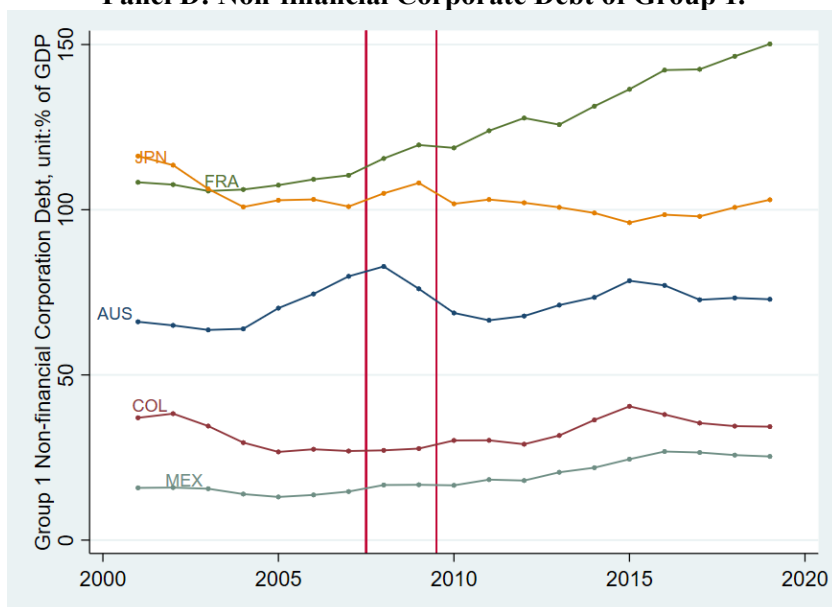
**Group 2 (Greece, Portugal, Spain, United Kingdom, United States)**

**Panel A: General Government Debt of Group 2.**



**Panel B: Central Government Debt of Group 2.**
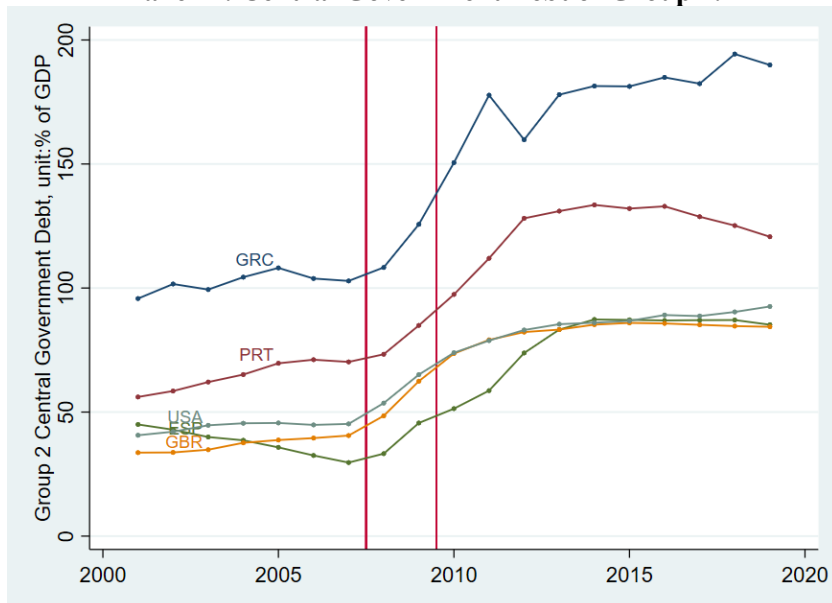
**Group 2 (Greece, Portugal, Spain, United Kingdom, United States) (continued)**

**Panel C: Household Debt of Group 2.**
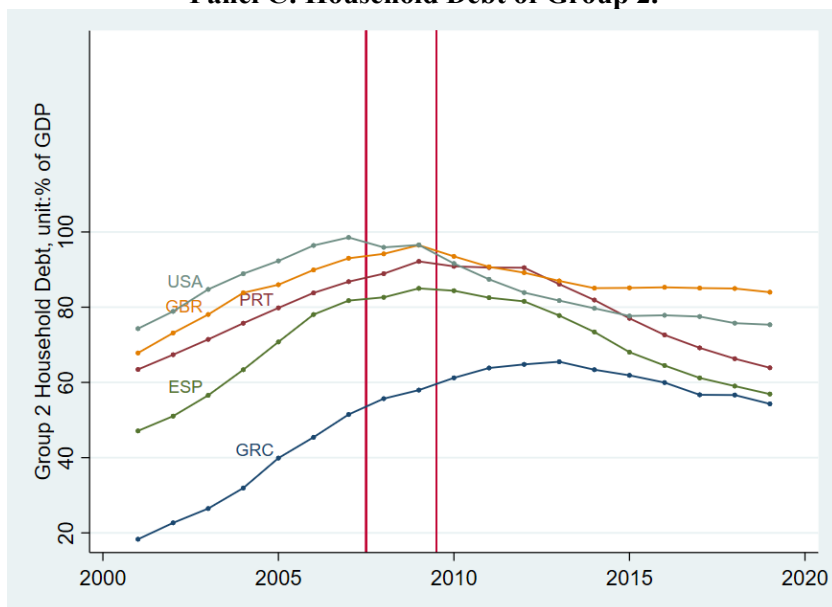


**Panel D: Non-financial Corporate Debt of Group 2.**
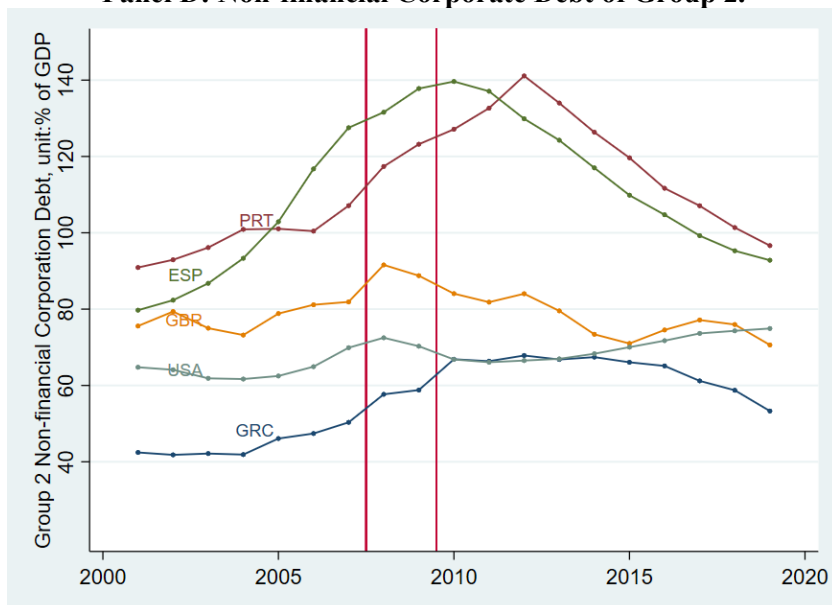
**Group 3 (Norway, Sweden, Switzerland, Turkey)**

**Panel A: General Government Debt of Group 3.**
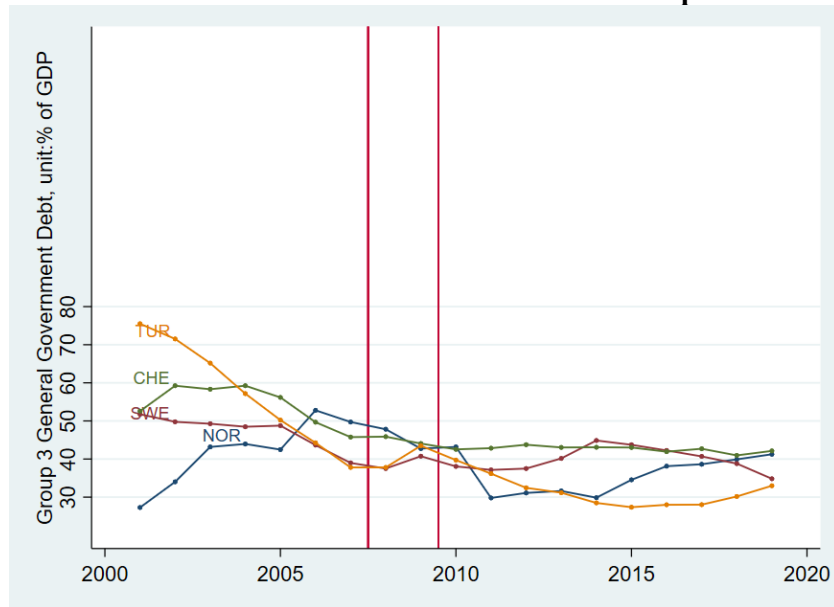


**Panel B: Central Government Debt of Group 3.**
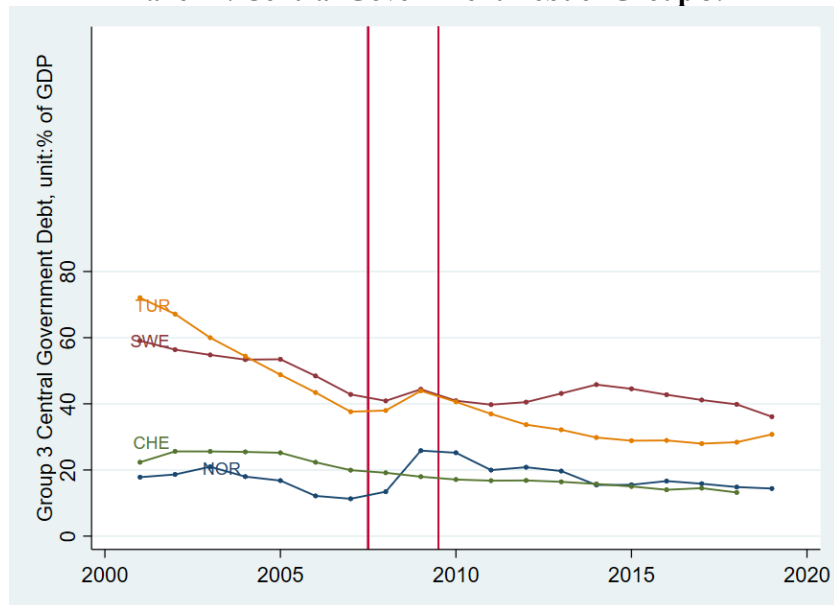
**Group 3 (Norway, Sweden, Switzerland, Turkey) (continued)**

**Panel C: Household Debt of Group 3.**
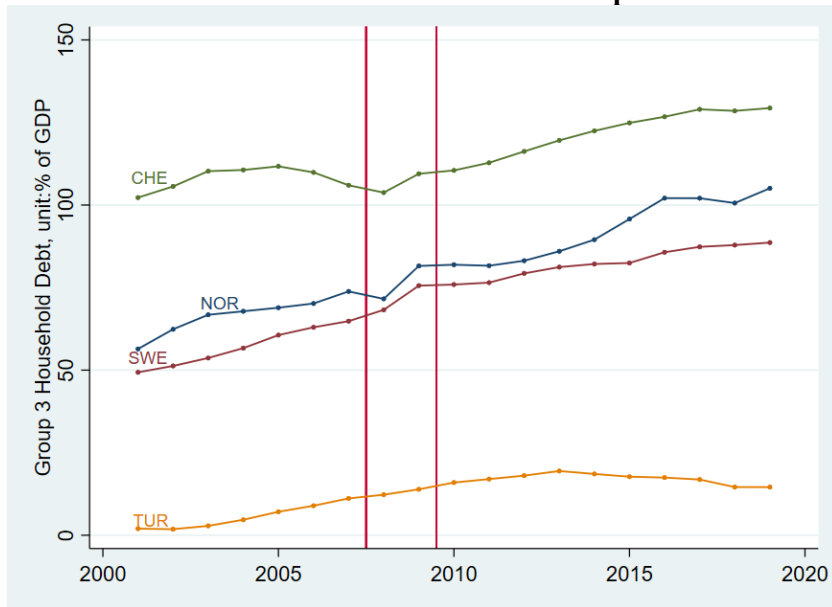


**Panel D: Non-financial Corporate Debt of Group 3.**
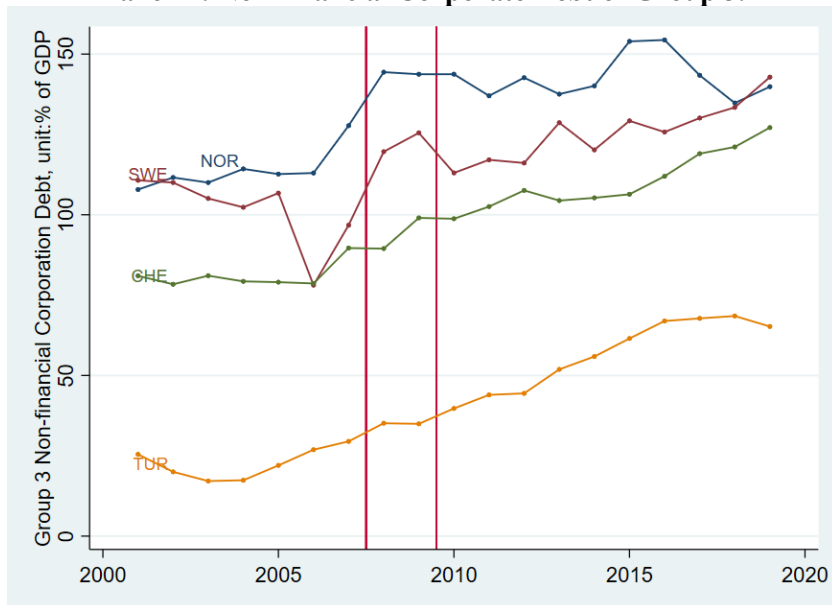
**Group 4 (Estonia, Italy, Latvia, Lithuania, New Zealand, Slovenia)**

**Panel A: General Government Debt of Group 4.**
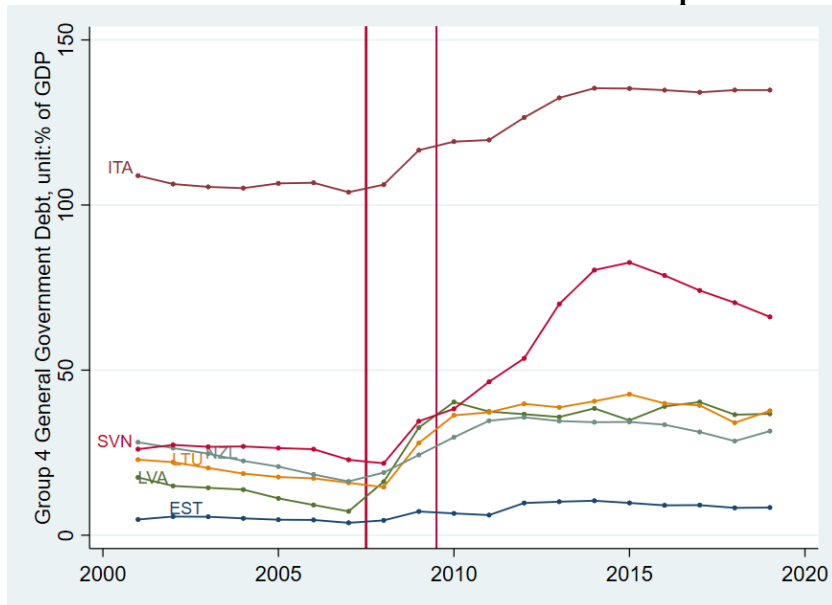


**Panel B: Central Government Debt of Group 4.**
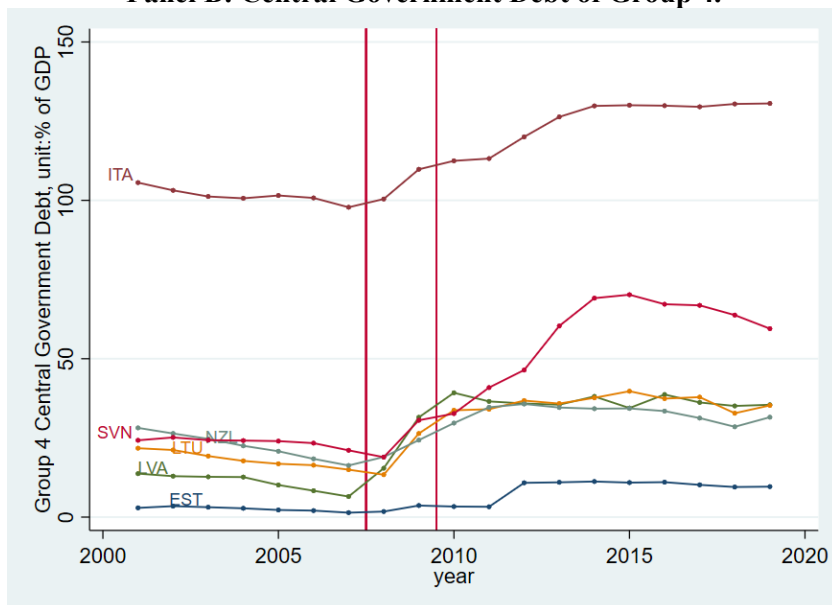
**Group 4 (Estonia, Italy, Latvia, Lithuania, New Zealand, Slovenia) (continued)**

**Panel C: Household Debt of Group 4.**
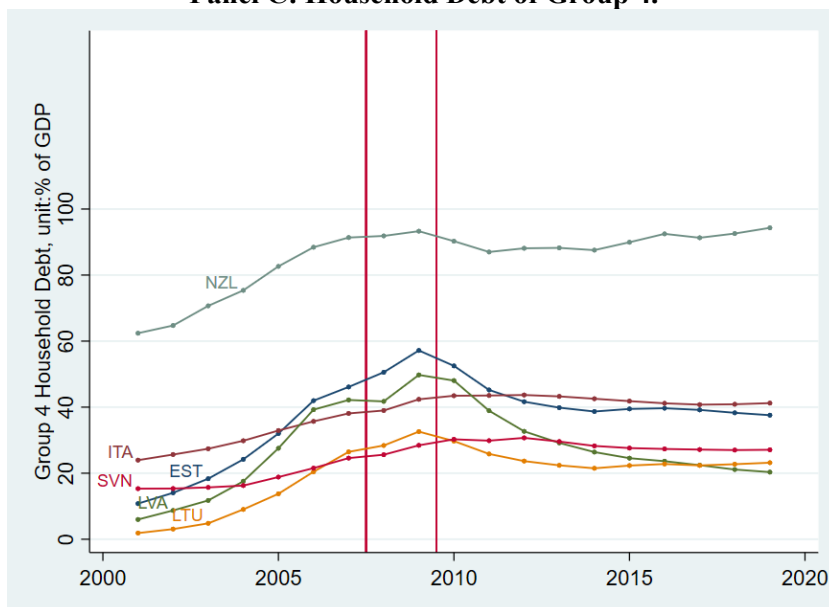


**Panel D: Non-financial Corporate Debt of Group 4.**
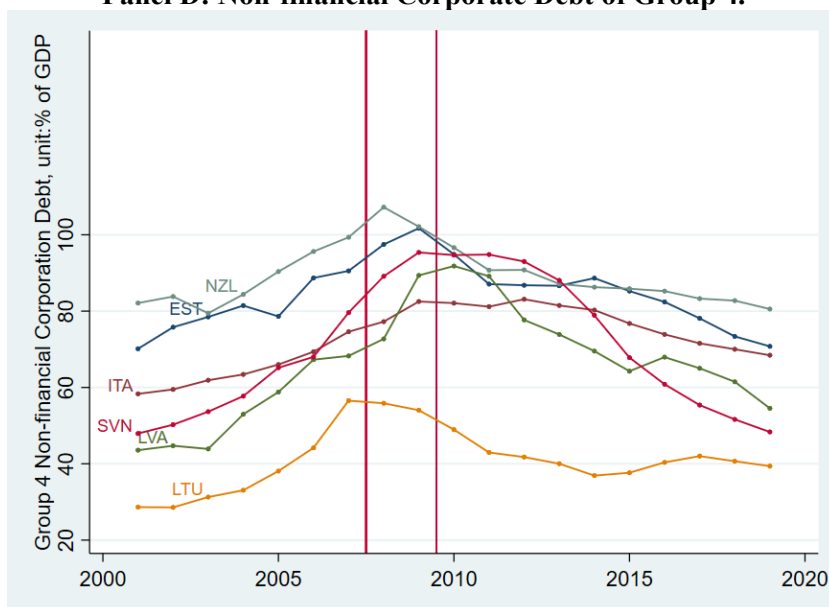
# Group 5 (Belgium, Chile, Finland, Luxembourg, Korea)

## Panel A: General Government Debt of Group 5.
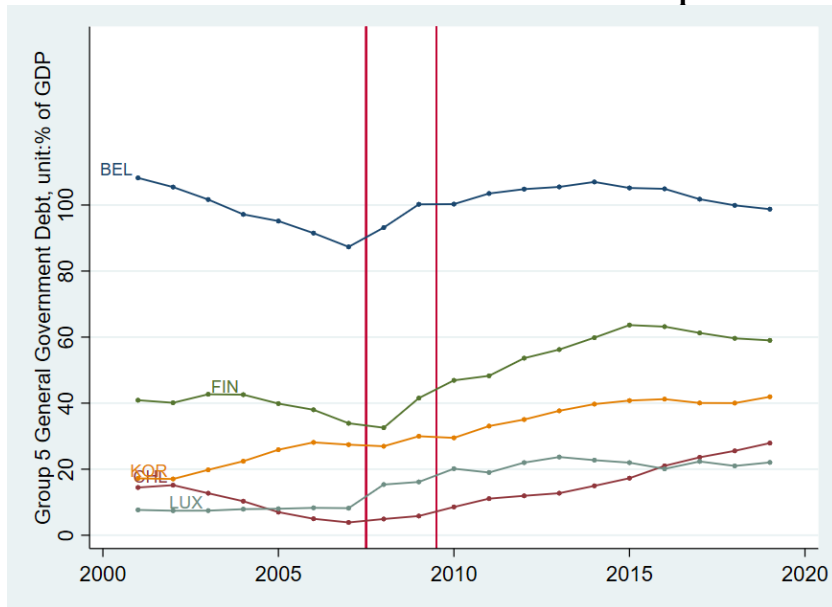


## Panel B: Central Government Debt of Group 5.
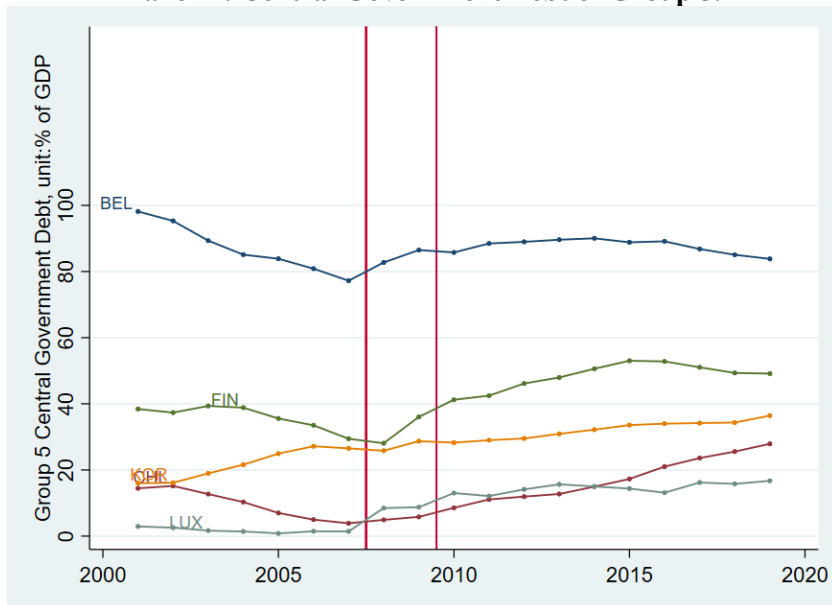
# Group 5 (Belgium, Chile, Finland, Luxembourg, Korea) (continued)

## Panel C: Household Debt of Group 5.
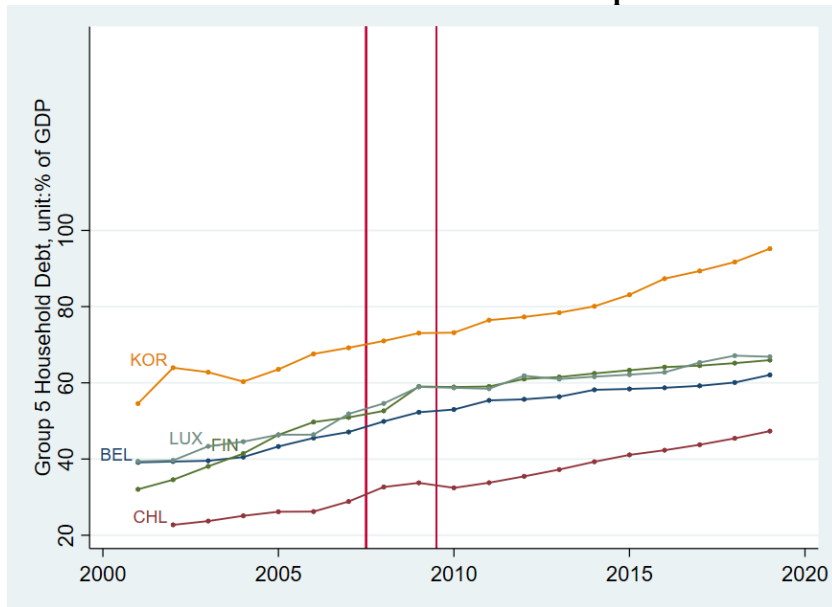


## Panel D: Non-financial Corporate Debt of Group 5.
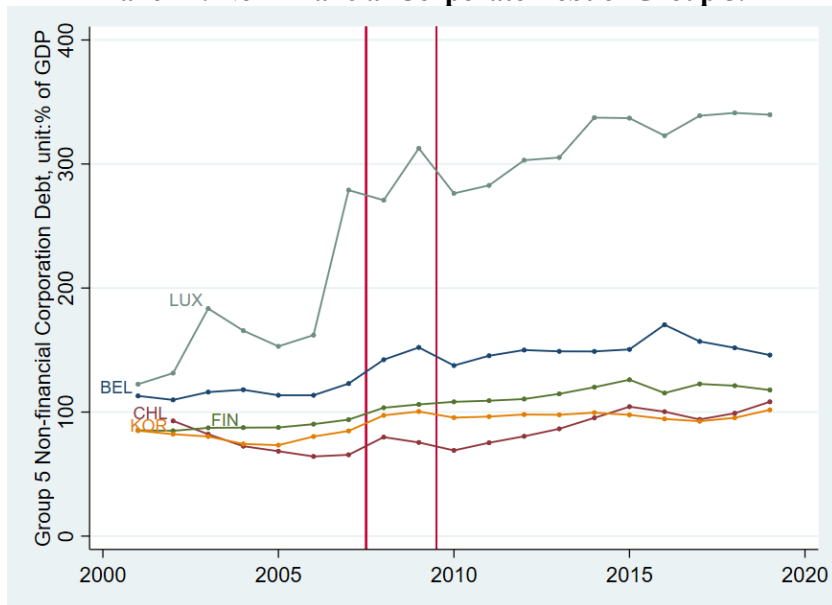
# Group 6 (Canada, Czech Republic, Poland, Slovak Republic)

## Panel A: General Government Debt of Group 6.
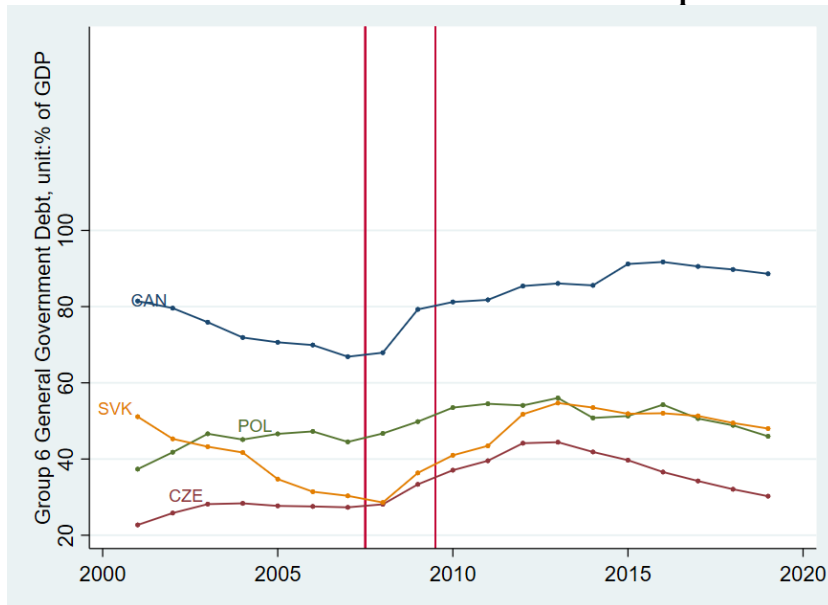


## Panel B: Central Government Debt of Group 6
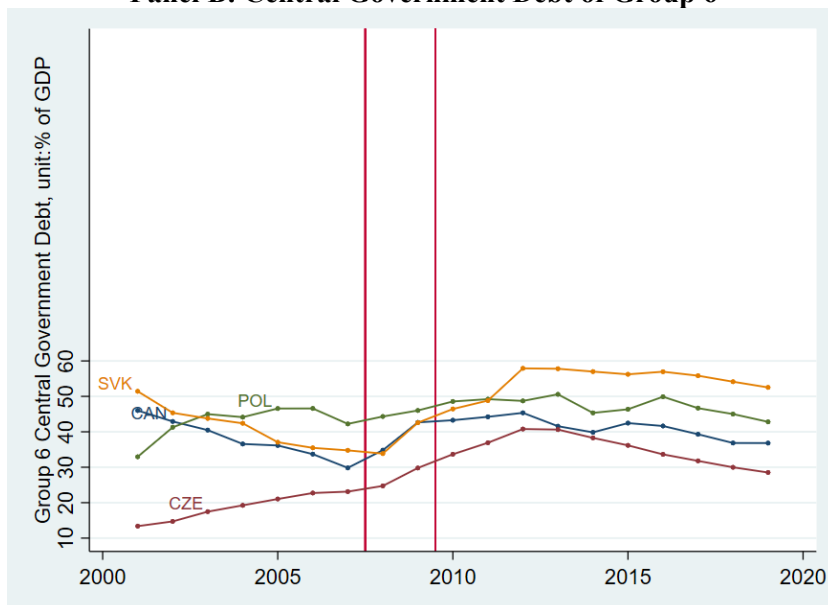
**Group 6 (Canada, Czech Republic, Poland, Slovak Republic) (continued)**

**Panel C: Household Debt of Group 6.**
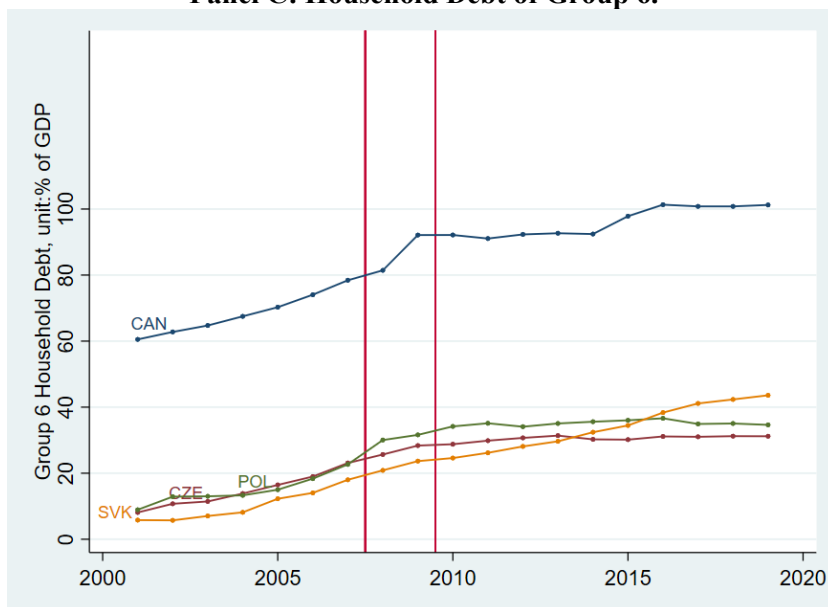


**Panel D: Non-financial Corporate Debt of Group 6.**
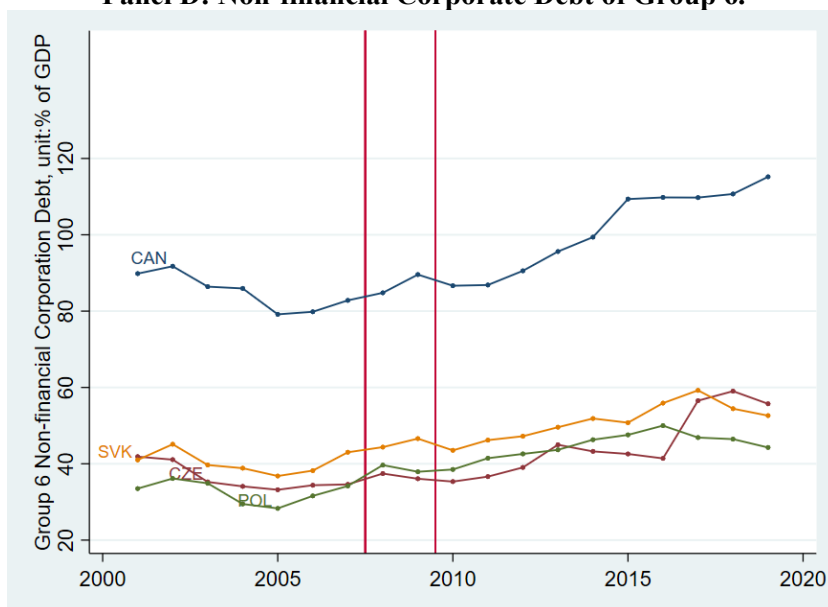
## Group 7 (Denmark, Ireland, Netherlands)

### Panel A: General Government Debt of Group 7.
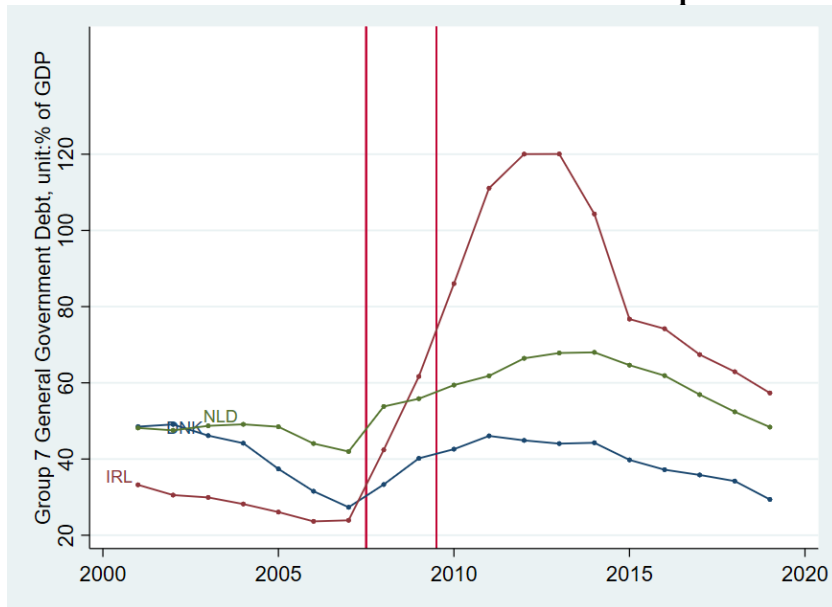


### Panel B: Central Government Debt of Group 7.
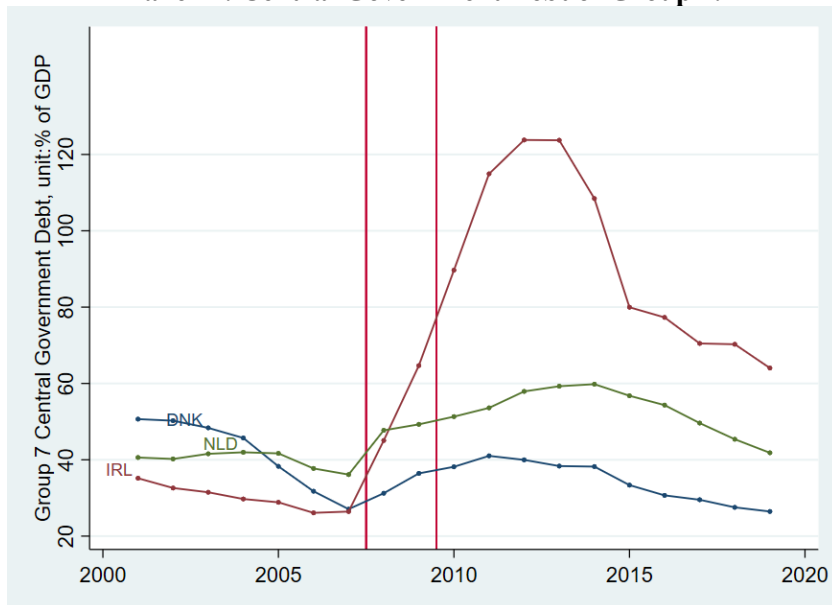
## Group 7 (Denmark, Ireland, Netherlands) (continued)

### Panel C: Household Debt of Group 7.
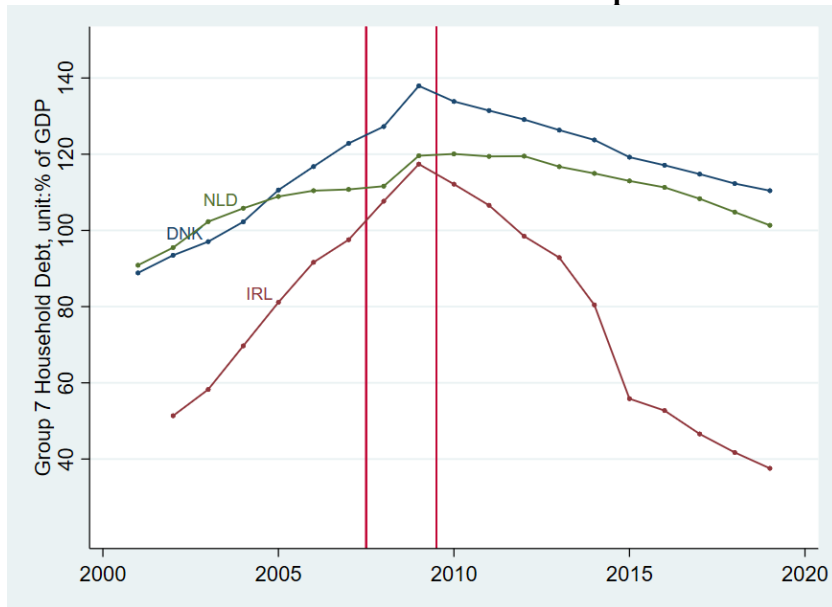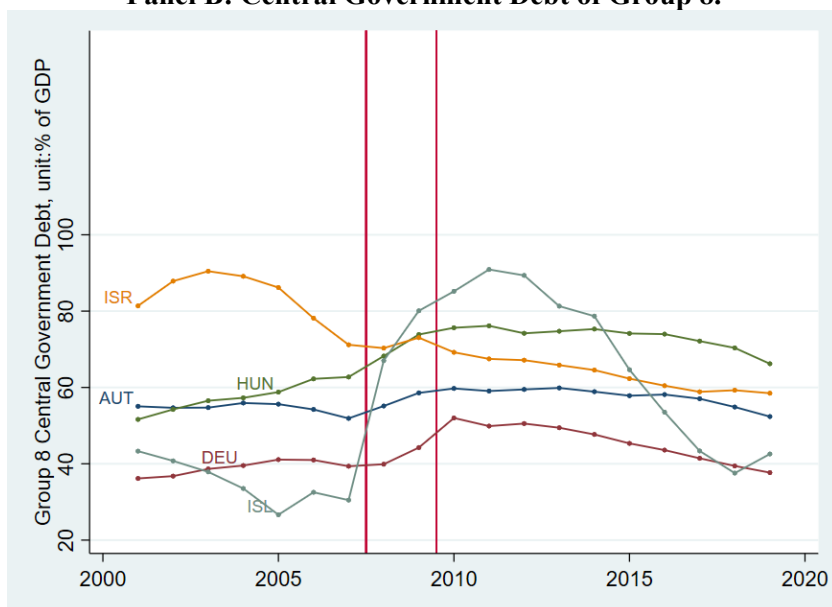


### Panel D: Non-financial Corporate Debt of Group 7.
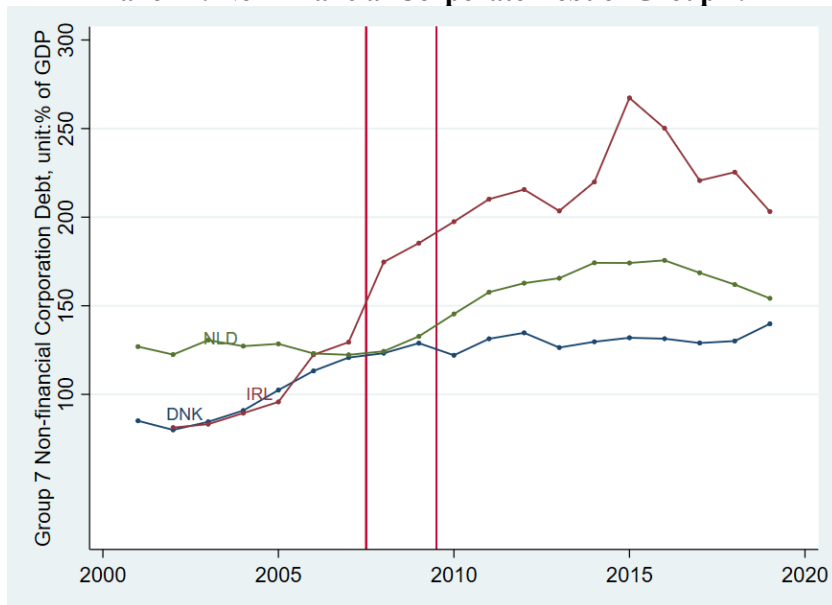
# Group 8 (Austria, Germany, Hungary, Iceland, Israel)
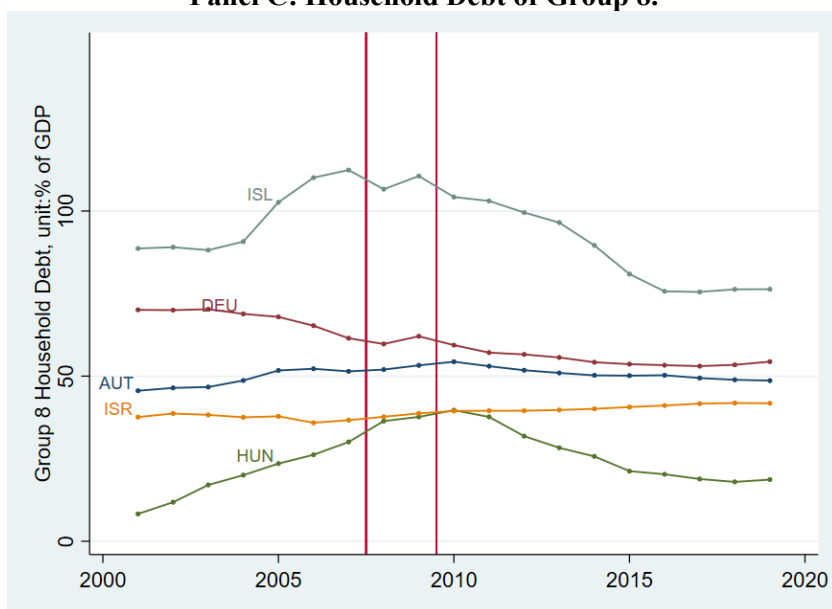
## Panel A: General Government Debt of Group 8.
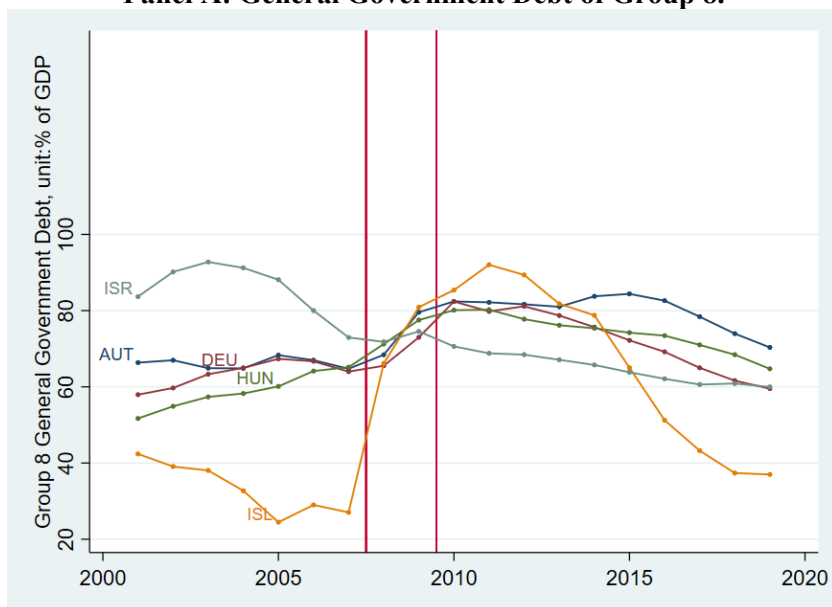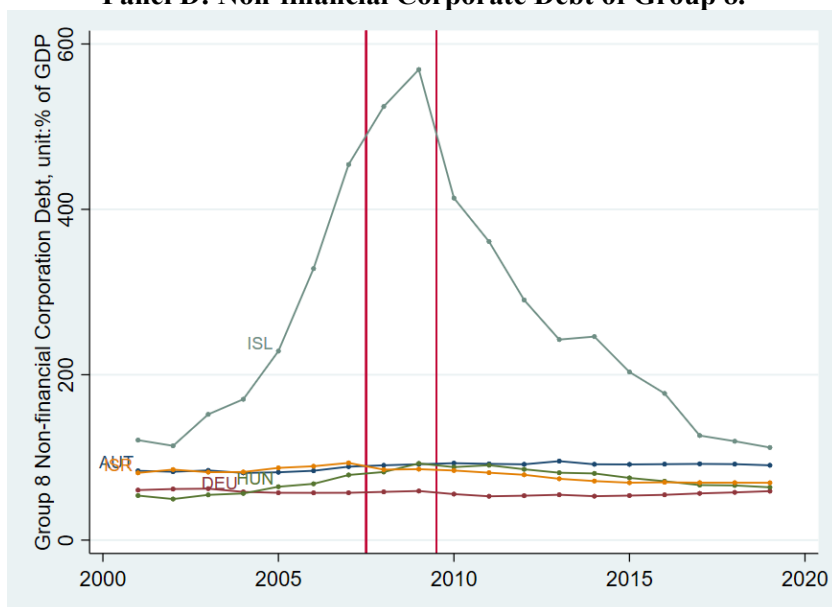


## Panel B: Central Government Debt of Group 8.

**Group 8 (Austria, Germany, Hungary, Iceland, Israel) (continued)**

**Panel C: Household Debt of Group 8.**



**Panel D: Non-financial Corporate Debt of Group 8.**

# 국문 초록

# 최근 공공부채와 민간부채의 동향:
# 국가간 비교

본 논문은 2008 년 금융위기로 인해 발생한 국가 간 정부, 가계 및 기업 부채의 변화를 살펴보고, 각 부채가 조정된 정도를 연구한다. 이중차분법(DID)에 기반한 회귀 모델을 사용하여 2005 년부터 2019 년까지 37 개 OECD 국가간 부채 동향을 살펴보고 비슷한 추세를 공유하는 국가끼리 8 개의 그룹으로 분류한다. 한국은 벨기에, 칠레, 핀란드, 룩셈부르크와 함께 그룹 5 에 속한다. 이 그룹은 금융위기 기간 동안 비 금융 기업 부채 비율이 완만하게 증가하고 공공 및 민간 부채가 지속적으로 증가하고 있음을 보여준다.