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The effect of trade openness on government spending: does the compensation hypothesis hold in developing countries?

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Abstract

This paper aims to investigate whether or not the compensation hypothesis holds in developing countries by analyzing the effect of trade openness on government spending. Panel data consisting of 112 countries over the period 2000-2010 was used to analyze the effect of trade openness on aggregate government spending. Further analysis, consisting of 26 developing countries, focused on the relationship between different categories of government spending and trade openness. A significant positive effect of trade openness was found on aggregate government spending, while no significant effect of trade openness on different categories of government spending was found.

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1: Introduction

Ever since humanity exists, trade has been a part of economical human behavior. Whether it is exchanging volcanic stone for sharp blades in the stone age or importing thousands of semiconductor goods from the other side of the world today, we see trade everywhere.
A major factor which can contribute to opening up to trade is globalization. Even though trade exists as long as humanity records its history, trade has increased over time through better connectivity of countries. For example, in the Iron Age, the open-sea crossings done by the Phoenicians led to a bigger trade network (Bakker et al., 2021). Later, in the 19th century, the advent of steam ship technology increased the accessibility of some regions (Pascali, 2017). The advent of steam ship technology, together with other inventions, led to the start of the first trade globalization period, starting in 1870.

When looking at the consequences of trade, literature states that trade is not just useful for economic reasons. Opening up to trade can also lead to gains from technology diffusion (Sampson, 2016) and trade can lead to more peaceful relations between countries (McDonald, 2004).

One other possible consequence of trade is an increase or decrease in government spending. Samuelson and Stolper (1941) argue that some production factors gain from trade, while other factors lose. This can lead to inequality between production factors. Opening up to trade could therefore mean that insecurity will arise among the factors who might lose from trade. If there are people that lose from trade, a Pareto improvement cannot be achieved from trade. Kaldor (1939) and Hicks (1940) were among the first to argue that Pareto improvement could be achieved if the ones who gained from trade were able to compensate the losers without being worse off themselves. If governments are welfare-maximizing, this Pareto improvement should be achieved by compensating the losers from trade and thus solving any distributive issues. This can be done by, for example, improving unemployment insurances or expanding public services. This would lead to an increase in government spending. Later in 1978, the compensation hypothesis was first introduced by Cameron (1978). It suggested that higher international market exposure would lead to higher domestic economic volatility, thus leading to a higher demand for compensation in the form of a safety net from inhabitants. This higher

demand would result in more government spending, for example on unemployment insurances (Bergh, 2021).

Most research on this issue has focused on developed countries only. The previously mentioned effects, however, might be more relevant in developing countries. Easterly et al. (2001) found that developing countries face a much higher growth and employment volatility than OECD countries. Due to higher volatility in the developing countries, it is likely that there will be more demand for compensation in these countries, as stated by the compensation hypothesis. This paper attempts to seek whether this assumption holds. This leads to the following research question:

Does trade openness have a significant effect on government spending in developing countries?

Panel data from 112 developing countries over the period 2000-2010, obtained from the World Development Index by the World Bank (WDI), International Monetary Fund (IMF) and World Governance Indicators (WGI), will be used in order to examine the relationship between trade openness and government spending. For the analysis, a panel data fixed effects regression will be performed, using time dummies and country-specific fixed effects. The foundation of the regression equation comes from Benarroch and Pandey (2012), who did a similar panel data fixed effects regression and found no significant relationship between trade openness and government spending. In their analysis, however, Benarroch and Pandey do not consider the effects of government effectiveness, corruption and inflation. By using a different set of countries and adding these three control variables, which will be explained in the hypothesis development section, a regression can be performed to analyze the relationship between trade openness and government spending in developing countries. Furthermore, interaction effects of corruption with trade openness and government effectiveness with trade openness will be added to analyze whether there is a significant interaction between the variables. This paper also examines the relationship between trade openness and the different categories of government spending, to analyze if government spending categories are affected by trade openness. From the 112 developing countries used for the analysis on aggregate government spending, only 26 had complete data on government spending in different categories over the period 2000-2010. The data for the disaggregated government

spending is obtained from the International Monetary Fund. The outcome of the regressions performed in this thesis indicates that trade openness is significantly positively related to aggregate government spending. This is in accordance with the compensation hypothesis, meaning that indeed exposure to international markets leads to higher government spending in developing countries. Trade openness has no significant relationship with any of the government spending categories used for this analysis. A possible explanation for this result is that there were too few observations to have statistical power, given the amount of control variables used.

The structure of the thesis is as follows. Chapter 2 will discuss related literature on the topic of interest, giving a broad overview on all related theories and previous studies done. Chapter 3 will present the empirical strategy as well as the data, which will provide all collected data sources and methodology used for this thesis. Chapter 4 will present all the results and their interpretations, as well as a brief discussion on robustness. Finally, chapter 5 will give the concluding remarks on this thesis.

2: Related Literature

2.1: Theoretical literature

One of the first theoretical models on the positive relationship between trade openness and government spending is the model of embedded liberalism, introduced by Ruggie (1982). Ruggie used the recent history to argue why there was a positive relationship between trade openness and government spending. The foundation of his argument comes from the period between World War I and World War II, which was economically known for the Great Depression. The Great Depression was a severe worldwide crisis that started in 1929 and lasted approximately until World War II. In order to reduce the high levels of unemployment during the Great Depression, import tariffs were used worldwide to stop domestic production levels from falling. Trade levels were much lower than the pre-WWI levels. One of the major lessons governments learned from the Great Depression was that government intervention in order to maintain employment and economic growth levels was a necessary task for the government. These tasks were of little interest for governments before the interwar period (Polanyi, 2001). When the Bretton Woods system was introduced in 1944, countries agreed that currency production should be regulated in order to have fixed exchange rates. This meant that currencies became easier to convert, thus eliminating a part of the cost of trading. This led to an increase in trade openness ratios across the globe. While free trade was becoming more popular again, the main target of governments was to prevent another Great Depression, by maintaining high levels of employment, individual well-being and welfare (Harvey, 2005). Governments could increase individual welfare through, for example, higher pension payments or better healthcare. This combination of increasing levels of free trade and using the trade surpluses to maintain employment and increase individual well-being, which led to an increase in government spending between 1945 and the 1970s, was thus what Ruggie called embedded liberalism. The era of embedded liberalism ended when the Bretton Woods system ended in 1973.

Katzenstein (1985) examined why the average American had lower living standards compared to seven small countries in Europe. Similar to Ruggie, these countries had adopted what Katzenstein called democratic corporatism. This term comes down to the fact that with the organization of free trade, often one comes out as the winner, while the other factor loses as earlier described by Samuelson and Stolper (1941). A Pareto improvement can only be

achieved if governments are welfare-maximizing and are able to redistribute gains from trade so that losers are compensated. Katzenstein argued that the seven small European countries had better average living standards because the small European governments compensated losers from trade more than in the USA. His theory of democratic corporatism is another example of an argument in favor of the positive relationship between trade and government spending.

Not every paper written about this topic assumes the same relationship between trade openness and government spending. Walter (2010) divides the compensation hypothesis into two components. These components are the demand side and the supply side. The demand side consists of the voters, who demand social protection when globalization increases. On the supply side, governments satisfy the demand by improving the welfare state through government spending.

On the supply side, an author who questions the validity of these assumptions is Cerny (1995). Cerny questions whether governments are able to satisfy the demand for social protection, mainly due to the increasing complexity of the economic organizations and markets. This means that with an increase in globalization comes a decrease in governmental efficiency in providing the necessary social protection in the form of public goods. This theory implies that the relationship between trade openness and government spending would be negative, rather than positive.

There are also several authors who do not believe that an increase in trade openness influences demand for a social safety net at all. Iversen and Cusack (2000) argue that not globalization, but other factors are the main reason for an increasing demand for social security. The authors name technological changes as the main contributor to the increasing demand. Innovations continuously lead to higher productivity and changing consumption patterns, making it the biggest reason for insecurity among the people.

Rehm (2007) identifies two main reasons for redistribution demand. The first reason is the desire for equality, meaning people want income redistribution because they are either disadvantaged or because people are principally in favor of equality, no matter whether it benefits them or not. The other reason is more in line with Iversen and Cusack (2000), namely that people want redistribution because of a desire for insurance. Through this insurance, people are able to maintain a consistent income flow over their entire lifespan.

2.2: Empirical literature

Various types of empirical research have been done on the compensation hypothesis and its causes and consequences. To empirically analyze the relationship between globalization and individual insecurity, the basis for the compensation hypothesis, Scheve and Slaughter (2004) studied British public opinion data from the 1990s. Scheve and Slaughter used Foreign Direct Investment (FDI) as independent variable and individual economic insecurity as dependent variable in a cross-sectional ordinary least squares regression. The authors found that for sectors with higher values of FDI, individual economic insecurity increased in these sectors. Though only one form of international exposure was used, the result indicates that indeed international exposure and globalization lead to more individual insecurity, which provides evidence for the foundation of the compensation hypothesis.

In 1978, Cameron (1978) was the first who found a direct positive association between government spending and trade openness. By performing a panel data regression for 18 countries over the period 1960-1975, Cameron attempted to find what variables were significantly related to government spending and found that trade openness was indeed significantly associated with government spending. This empirical finding led to many more empirical papers on the compensation hypothesis.

Another direct empirical evidence attempt for the compensation hypothesis was done by Rodrik (1998). As the compensation hypothesis states, Rodrik believed that trade openness causes greater economic volatility, leading to higher compensation demand and thus a higher amount of government spending. Rodrik wanted to analyze whether trade openness and government spending were significantly related by performing a logarithmic panel data fixed effects regression for different time periods between 1960 and 1992. Apart from using the logarithm of trade openness as independent variable and the logarithm of government spending as dependent variable, Rodrik used GDP per capita, age dependency ratio and urbanization as control variables. The economic intuition behind these control variables, which I will also use, will be explained in the data section. By performing the panel data fixed effects regression, Rodrik indeed found a positive correlation between trade openness and government expenditure. This formed further evidence in favor of the compensation hypothesis.

Later research by Benarroch and Pandey (2012) added population size as a control variable to

the regression performed by Rodrik (1998). Results from the panel data fixed effects regression that Rodrik performed with the addition of population indicated no significance when looking for the relationship between trade openness and government spending. Benarroch and Pandey also used a dynamic regression model, something that had not been done by other research before. In this dynamic regression model, first differences of the regressors were taken and used as instruments to identify a causal effect, rather than a relationship. No significant causal effect could be found between trade openness and aggregate government spending. For the disaggregated government spending functions, a significant positive causal effect was found of trade openness on education spending in low-income countries. This indicates that an increase in trade openness would lead to more government spending on education for low-income countries.

Walter (2010) tested the compensation hypothesis by examining three causal links that relate trade openness to government spending on individual level. The first link was to analyze the causes of job insecurity. By performing a binary logit regression, Walter found that education has a negative effect on the preference for a safe job, whereas trade exposure had a positive effect on the preference for a safe job. This implies that trade exposure causes more insecurity among individuals. The second link stated that job insecurity would lead to a higher preference for welfare state expansion. This link was analyzed using an ordered logit regression to determine whether insecurity indeed leads to greater compensation demand in the form of welfare state expansion. Walter found empirical support for this link and also found that poorer people are more in favor of social protection by the government. The final link investigates the relationship between individual preferences and the party they vote for. Also for the third link, Walter used a binary logit regression and found support for the compensation hypothesis through her analysis of Swiss voter behavior. She found that people that prefer more social protection tend to vote more often for the party in favor of that policy, in this case the Social Democratic Party.
Though Walter claims these links are causal, she also states that there is still a possibility of correlation between various independent and dependent variables.

Another empirical paper that found support for the compensation hypothesis is the one written by Bernauer and Achini (2000). By performing cross-sectional ordinary least squares regressions for different periods between 1960 and 1994 using public sector size, a different

name for government spending, as dependent variable and trade openness as independent variable, the authors found a significant positive coefficient of trade openness. When Bernauer and Achini divided the countries into two groups, OECD and non-OECD countries, they still found a significant positive relationship between trade openness and public sector size for both sets of countries. This empirically supports the compensation hypothesis.

Garrett (2001) examined the relationship between changes in trade as independent variable and changes in government spending as dependent variable for the periods 1970-1984 and 1985-1995 by performing a panel data OLS regression including regional dummies. He found that for both periods, a change in trade was negatively related to a change in government spending. Garrett performed this regression to see the elasticity of changes in government spending with respect to trade openness. This elasticity was negative, indicating that the growth of government spending is slower in a country where trade openness grows faster. Garrett argues that this negative elasticity is caused by the fact that rapid trade growth outweighs the ability of governments to keep up with that growth in trade and globalization because openness makes it easier for companies to relocate to countries where tax is lower. To keep companies in their country, governments thus have to lower taxes, meaning there will be less money to spend on public protection (Lammers et al., 2018).
However, when looking at the levels of trade and government spending, rather than looking at the changes, Garrett did find a significant positive relationship between trade and government spending, like Rodrik (1998) and Bernauer and Achini (2000) did. Garrett argues that levels of trade are positively related to levels of government spending through demand for social protection, because of the economic volatility caused by trade openness. This is in accordance with the compensation hypothesis.

Not every empirical study has found either no or positive relationship between levels of trade openness and government spending. Garrett and Mitchell (2001) used data on 18 OECD countries over a period of 32 years (1961-1993). By performing a panel data fixed effects regression, the authors found a significant negative association between trade as independent variable and total government spending as dependent variable. A reason the authors name as to why the result differs from most results on this topic as to then, lies in the use of the country-specific fixed effects and time dummies, which had not been done by the other papers before.

2.3: Hypothesis development

As mentioned before, Easterly et al. (2001) found that developing countries face a much higher growth and employment volatility than OECD countries. Kim (2007) found the same association using development level as independent variable on dependent variables aggregate income volatility and per capita income volatility respectively. Moreover, Easterly et al. (2001) found that trade openness is much higher in developing countries than in OECD countries, which could imply that trade openness plays a big role in the higher volatility for developing countries. This research on developing countries would therefore be more interesting for voters and governments, as volatility through openness of trade in these countries seems more problematic in general than in OECD countries. Therefore, the main hypothesis of this paper states:

Trade openness has a significant positive effect on government spending in developing countries.

Gnangnon (2020) did research on the relationship between trade openness and a category of government spending, namely social protection. The author states that economic openness has both negative and positive impacts, the positive effect being the possible gains from trade and the negative impact being four types of risks. These four types are risks to individual lifecycle, environment, economy and governance. Similar to the compensation hypothesis, Gnangnon also states that governments can contain these risks by developing welfare state programs. This would lead to an increase in social expenditure. By using panel data from 112 countries over 30 years, Gnangnon found a significant positive relationship between social protection expenditure and trade openness. From this result, a sub-hypothesis for this paper can be formed:

To provide a bigger safety net, governments will significantly increase spending on social protection when trade openness increases in developing countries.

Many studies, like Ezirim et al. (2008), Olayungbo (2013) and Attari and Javed (2013), all found long-run relationships between inflation and government expenditure for respectively the United States, Nigeria and Pakistan. Ezirim et al. (2008) argue that inflation is an important factor in government expenditure, especially for developing countries. This is the case because of frequently occurring problems like cost overrunning and project abandonment, which

happen more often in developing countries. Based on Ezirim et al. (2008), a sub-hypothesis can be formed:

Inflation and government spending have a significant negative relationship in all categories of government spending

Another variable related to government spending is corruption. Corrupt governments seize gains from trade and use them for private gain. This often occurs through bribes or informal contracts with government officials. So rather than using these gains from trade to compensate the losers from trade, corrupt governments seize these gains for private benefit. This could have its effect on government spending, as corrupt countries are less likely to compensate. Less corruption would thus strengthen the effect of trade openness on government spending, as fewer gains from trade will be seized. This means that the fraction of the gains from trade available for compensation is bigger for less corrupt countries. As stated by Olken and Pande (2012), corruption is often high in developing countries and lower in developed countries. This theory leads to the following sub-hypothesis:

The interaction effect between control on corruption and trade openness has a significant positive effect on government spending.

Another variable closely related to government spending is government effectiveness Whereas corruption looks at if a government is willing to compensate, government effectiveness indicates whether a government is able to compensate. If a government gains from trade, but is unable to compensate the losers, for example due to a low quality of policy formulation or policy implementation, this could negatively influence government spending. As with corruption, higher government effectiveness is expected to strengthen the effect that trade openness has on government spending. Butkiewicz and Yanikkaya (2011) empirically investigated the relationship between ineffective governments and government spending for developing nations from 1990-2004. The authors found a significant negative relationship between ineffective governments and government spending. Another sub-hypothesis can be formed from these results and theory:

The interaction effect between government effectiveness and trade openness has a significant positive effect on government spending.

3: Empirical strategy and data

3.1: Data

I will start with the data I will use. Total government expenditure (% of GDP) data will be taken from the IMF (International Monetary Fund) and trade openness data will be collected from WDI (World Development Index, by the World Bank). Control on Corruption (COC) data and Government Effectiveness Index (GEI) data will be collected from Worldwide Governance Indicators (WGI). Both variables, originally ranging from -2.5 to 2.5, will be rescaled to a scale of 0 to 10 to prevent any issues with interactive variables. Both variables also did not have data available for the year 2001. The mean of the values in the years 2000 and 2002 will determine the value for the year 2001. Later, in the robustness section, a test for the years 2002-2007 and 2002-2010 will be performed to check whether or not leaving out the constructed values for 2001 gives significantly different results. The robustness test until 2010 includes the financial crisis and the robustness test until 2007 does not, to also check if leaving out the financial crisis changes the main results. I will collect the remaining control variable data for the developing countries from WDI. The different categories of government expenditure are retrieved from the Government Finance Statistics database by the International Monetary Fund. The assignment of which countries are developed and which are developing will be according to IMF rules. This list of countries will be retrieved from WorldData.info. The final dataset will be panel data consisting of 112 developing countries. The dataset will consist of a period of 10 years: 2000-2010. The original list of developing countries consists of 152 countries, but due to missing data the list has been narrowed down to 112 countries.

For this analysis, a total of seven control variables have been added in order to limit as much bias included in the analysis as possible. I will explain the meaning and intuition behind each of the variables, in order to be able to interpret the findings we get in the results section of this thesis. I will start by explaining the variables that are also used by Benarroch and Pandey (2012), which are age dependency ratio, GDP per capita, urbanization and population.

The age dependency ratio is the ratio of the dependent people, those aged younger than 15 and older than 64, to the working population, those aged between 15 and 64. The dependent population does not work and often depends on other people to take care of them. If this ratio increases, it indicates that the number of the non-working population increases relative to the number of the working population. The economic intuition behind this variable is that the

higher the non-working population is, the larger the demand for pension payments, schooling and elderly care will be. This will lead to an increase in government spending, thus a positive relationship is expected between the dependency ratio and government spending.

GDP per capita is the amount of GDP of a country divided by its total population. Rodrik (1998) explains that Wagner's law states that the demand for government services is income elastic. In this case, GDP per capita is the income indicator. Thus, if income increases, so will the demand for government services, indicating that a positive relationship is expected between GDP per capita and government spending.

The urbanization ratio shows how many people live in the urban area as a fraction of total population. Linn (1982) explains that people living in urban areas are often better organized in terms of forming labor unions and collectively demanding protection in the form of unemployment benefits or other social services. If labor unions and other bargaining organizations are well organized, it is more likely that a government knows about these demands and can thus handle accordingly. Hence, the higher the urbanization ratio is, the higher amount of government spending is expected.

Finally, as the total population of a country increases, governments will have to spend more money to satisfy the increasing demand, meaning a positive relationship between population and government spending is expected.

In addition to the variables used by Benarroch and Pandey (2012), three variables have been added for this research: inflation, control on corruption and government effectiveness. Inflation has been added because long-run relationships were found by, for example, Ezirim et al. (2008). Higher costs can lead to a government deciding not to run a project, influencing government spending. Thus, a negative relationship between inflation and government spending is expected.

Control on corruption has been added because, as explained earlier, more corruption can lead to more seized gains from trade, meaning a smaller fraction of the gains from trade can be spent on projects to compensate losers from trade. Control on corruption is an index where countries get a score for how much corruption is observed in that country. 10 is the best score a country can get, whereas 0 is the worst score a country can get. This means that the higher the value of control on corruption, the less corruption there is in that country. Knowing that a higher value of the control on corruption index means less corruption, a positive relationship

between the control on corruption index and government spending is expected.
Finally, the government effectiveness index has been added. The more effective a government is in forming and implementing good compensation policies, the higher government spending will be in comparison to when that same government would not be able to form those policies. Like with control on corruption, government effectiveness is also an index where countries get a score for how effective their government is, with 10 being the best score and 0 being the lowest. Thus, a positive relationship between the government effectiveness index and government spending is expected.

The descriptive statistics of all variables used in the main regression can be found in Table 1A. The descriptive statistics for the different categories of government expenditure can be found in table 1B. Note that all the expenditure categories in table 1B are expressed as share of GDP.

Table 1A: Descriptive statistics

Variables	*Mean*	*Min*	*Max*	*Std. deviation*	*Obs.*
Government Expenditure (% GDP)	27.862	8.184	107.309	11.053	1232
Trade openness	76.038	20.964	225.023	34.706	1232
Age dependency ratio	67.302	28.852	110.838	18.489	1232
Inflation	11.530	-25.313	2630.123	75.712	1232
Population (millions)	46.000	0.081	1337.705	164.000	1232
Urban ratio	49.640	8.246	100.000	20.868	1232
GDP per capita	3762.172	113.567	55494.930	5650.753	1232
GEI	4.169	0.458	8.144	1.277	1232
COC	4.131	1.556	8.185	1.302	1232

Table 1B: Descriptive statistics of government spending categories

Variables (Government spending as a % of GDP)	*Mean*	*Min*	*Max*	*Std. deviation*	*Obs.*
Defense	2.060	0.000	12.897	2.366	286
Economic affairs	3.484	0.014	25.361	2.912	286
Education	3.266	0.144	23.547	2.206	286
Public services	7.451	1.792	25.602	4.220	286
Health	1.462	0.014	4.906	1.003	286
Recreation, culture and religion	0.361	0.000	2.570	0.383	286
Social protection	1.776	0.000	12.592	1.950	286

3.2: Methodology

In this panel data fixed effects regression analysis, government expenditure as a percentage of GDP will be the dependent variable. The main independent variable will be trade openness, which is the sum of imports and exports as a ratio of GDP. The regression used will consist of the same basics of the research done by Benarroch and Pandey (2012) and will look as follows:

$$lnExp_{it} = \alpha_0 + \alpha_1 lnOpen_{it-1} + \beta X_{it} + \gamma pd\_dum + \eta_i + \varepsilon_{it}$$

A logarithmic scale will be used to avoid potential skewness problems. X represents the control variables. In this analysis, control variables will be: dependency ratio, total population, urbanization rate, inflation, corruption on corruption index (COC), government effectiveness index and GDP per capita. Time-specific fixed effects and country-specific fixed effects are included through period dummies (pd_dum) and η_i respectively. Error term ε_{it} is also included. The variable trade openness is lagged by one year to capture government expenditure as a result of trade openness from the year before.

In the analysis, interaction effects of corruption with trade openness and government effectiveness with trade openness will be added to analyze whether there is a significant correlation between the variables. By adding these variables, most omitted variable bias will be eliminated and the regression estimate will be likely close to its true value.

An additional panel data fixed effects analysis will focus on different government expenditure categories. Though this is not the main focus of this paper, having a look at different categories of government spending could be interesting for those involved in these sectors. Due to a lack of data, 26 developing countries will be used in the sample to look at the association of trade openness with 7 of the largest government spending categories: defense, economic affairs, education, general public services, health, recreation and social protection. Due to a lack of data on housing expenditure, this variable has been left out. The data has been gathered from the IMF database and is expressed as a ratio of GDP. The regression will look as follows:

$$lnExp\_cat_{it} = \alpha_0 + \alpha_1 lnOpen_{it-1} + \beta X_{it} + \gamma pd\_dum + \eta_i + \varepsilon_{it}$$

The same control variables will be used and all categories will be separately analyzed.

Even though new control variables have been added to the fixed effects analysis, this paper recognizes its limitations when it comes to endogeneity issues. Using panel data fixed effects, most bias is attempted to be eliminated by introducing new control variables. However, it remains likely that there are still unobserved variables that influence government spending. This would mean that the value found for trade openness in this regression is not the real value, because it is a biased estimator. Something that could prevent this from happening is a dynamic panel regression model. This is an advanced regression method where lagged first differences of regressors are used as instruments to eliminate bias (Benarroch and Pandey, 2012). However, this kind of regression is beyond the scope of this thesis. By using the panel data fixed effects analysis in combination with the control variables used, I believe that the value for trade openness found in the regression is close to its real value.

Another possible problem occurring when using a simple fixed effects model is reverse causality. Previous literature, like Walter (2010), Rodrik (1998) and Bernauer and Achini (2000) all found empirical evidence of significant positive relationships between trade openness and government spending. However, this does not eliminate the possibility that government spending reverse causes trade openness. If that is the case, it is more likely that the two variables are correlated, but there is no specific effect of one variable on the other. To address this possibility, a panel data fixed effects regression will be done in the robustness section by using lagged government spending as independent variable and trade openness as dependent variable. This analysis will be performed to examine if lagged government spending has a significant effect on trade openness. If so, this could be an indication of reverse causality, weakening the assumption of a causal effect of trade openness on government spending in the main regression analysis.

4: Results and Robustness

4.1: Results

To first analyze the relationship between trade openness and government spending, a scatter plot was plotted displaying the relationship between the logarithm of government spending and the logarithm of the lagged variable of trade openness. As seen in figure 1, a positive relationship is displayed, implying that indeed trade openness and government spending are positively related as stated by the compensation hypothesis.

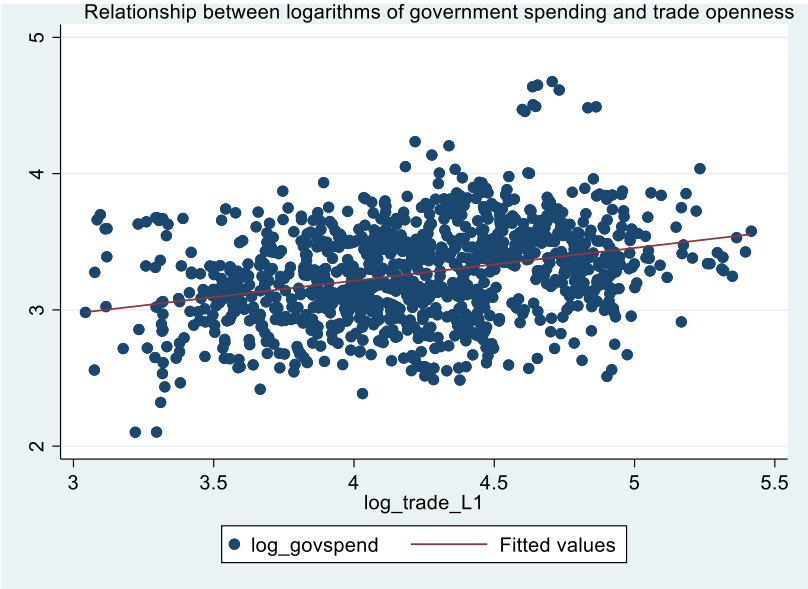

Figure 1: The relationship between logarithms of government spending and trade openness.

The results of the first couple of regressions can be found in table 2A. While estimating the relationship between trade openness and government spending, a first fixed effects regression was performed while just using the log of government spending as dependent variable and the lagged log of trade openness as independent variable. No control variables were added in the first regression, which can be found in the first column of table 2A. A significant positive effect of trade openness on government spending was found for all three significance levels. In the second column of table 2A, the control variables used by Benarroch and Pandey (2012) were added. As seen in the table, even with the addition of these control variables, a significant positive effect was found. This result is in contrast to the results from the paper by Benarroch and Pandey (2012), as they had found no significant relationship between trade openness and government spending.

Table 2A: Panel data fixed effects regression with trade openness as independent variable and government expenditure as dependent variable.

	(1)	(2)	(3)	(4)	(5)	(6)
$ln(Openness_{t-1})$	0.215***	0.214***	0.321*	0.606***	0.190**	0.508***
	(0.082)	(0.081)	(0.182)	(0.190)	(0.075)	(0.183)
$ln(Age\ dependency)$		0.499**	0.448*	0.485**	0.496*	0.452*
		(0.242)	(0.267)	(0.244)	(0.273)	(0.245)
$ln(Population)$		-0.135	0.038	-0.101	0.041	-0.058
		(0.238)	(0.243)	(0.238)	(0.246)	(0.232)
ln(GDP per capita)		-0.015	-0.040	-0.064	-0.043	-0.063
		(0.057)	(0.059)	(0.057)	(0.056)	(0.057)
ln(Urban ratio)		0.076	0.050	0.034	0.051	0.025
		(0.362)	(0.354)	(0.312)	(0.343)	(0.311)
ln(Inflation)			-0.006	-0.003	-0.007	-0.003
			(0.007)	(0.007)	(0.007)	(0.006)
GEI				0.579***	0.078 **	0.744***
				(0.193)	(0.036)	(0.245)
COC			0.171		0.007	-0.270
			(0.178)		(0.025)	(0.208)
Trade*GEI				-0.119***		-0.160***
				(0.045)		(0.057)
Trade*COC			-0.032			0.067
			(0.041)			(0.047)
Constant	2.340***	2.206	0.546	0.262	-0.549	0.132
	(0.345)	(4.887)	(5.011)	(4.579)	(5.126)	(4.487)
R^2	**0.153**	**0.171**	**0.180**	**0.235**	**0.200**	**0.242**
Observations	**1120**	**1120**	**1047**	**1047**	**1047**	**1047**

Notes: All six columns represent a fixed effects regression with both time- and country-specific fixed effects. Column one shows a direct regression with government expenditure as dependent variable and lagged trade openness as independent variable. Column two shows the regression performed with the same variables used by Benarroch and Pandey (2012). Column three shows a regression with all the control variables, but control on corruption isolated from government effectiveness. Column for shows the same regression, but government effectiveness isolated from control on corruption. Column five adds both variables together in the regression, but without the interaction variables. Finally, column six added the two interaction variables together. All coefficients are given with the standard error given in parentheses. The stars indicate the significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

In column 3, control on corruption and its interaction variable are added to the regression. No significant effect was found for either of the two variables. In column 4, government effectiveness and its interaction variable are added to the regression, but control on corruption and its interaction variable are left out to see how these two variables behave when isolated from each other. Both government effectiveness and its interaction variable have a significant effect on trade openness. While adding the three control variables in addition to the ones used by Benarroch and Pandey (2012) in column 5, we see that the significance of trade openness drops a bit, but it remains significant at the 5% level. This value indicates that when trade openness increases by 1%, government spending increases by 0.190% in the next period. Note that these values are percentual changes, rather than changes in the absolute value of a variable, since we are working with logarithms.

Another variable that differs from the results of Benarroch and Pandey (2012) is the age dependency variable. Whereas in the authors' analysis, age dependency does not have a significant relationship with government spending, this research has found that for developing countries there is a significant positive relationship between age dependency and government spending. If the age dependency ratio increases by 1%, government spending would increase by 0.496%. As discussed in the data section, this outcome is in line with what was expected. This empirically confirms that if the number of non-working people increases relative to the number of working people, government spending indeed increases significantly.

The added variable Government Effectiveness Index (GEI) still has a significant positive relationship in column 5, meaning if this index improves by 1%, government spending would increase by 0.078%.

In column 6, the results can be observed when adding the interaction variables between trade and corruption and trade and government effectiveness. The direct effect of trade openness on government spending remains significant and has become even bigger. The effect of government effectiveness on government spending also remains significant and has also improved relative to its values in columns 4 and 5.

As mentioned earlier, the hypothesis for both interaction terms was that both would be significantly positive. The interaction term between trade openness and government effectiveness is significantly negative. This means that when trade openness is positive and increases, its effect will be less positive when government effectiveness is also increasing. This

is the complete opposite of the hypothesis stated earlier.

Looking at the other interaction variable, we do not find a significant interaction effect between corruption and trade openness in columns 3 and 6. In the discussion, possible explanations for these effects will be discussed.

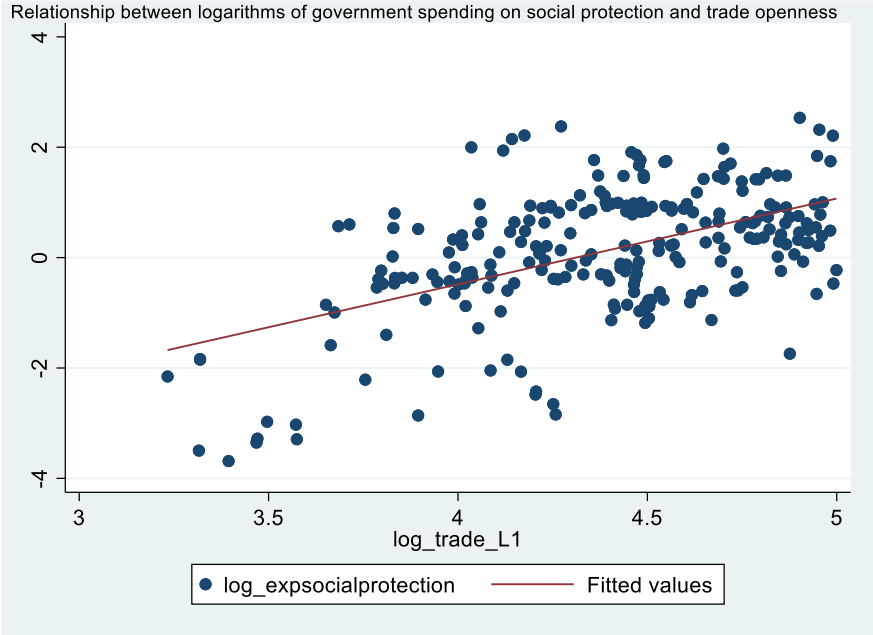

Figure 2: The relationship between logarithms of government spending on social protection and trade openness.

Analyzing the relationship between government spending on social protection and lagged trade openness, we find a positive linear relationship between the two logarithms of the variables.

Looking at the panel data regression results for disaggregated government spending in table 2B, we see that trade has no significant relationship with any of the government spending categories. Even though there is a positive linear relationship between government spending on social protection and lagged trade openness, we do not find a significant outcome in the regression to support that hypothesis. This outcome is the same as what Benarroch and Pandey (2012) found when analyzing the effect of trade openness on different categories of government spending.

Adding the interaction variables that were also used in the analysis for aggregate government spending does not change anything for the significance of trade openness, as can be seen in table A2 in the appendix.

Table 2B: Panel data fixed effects regression with trade openness as independent variable and different government expenditure categories as dependent variable.

	Defense Expenditure	**Education Expenditure**	**Economic affairs Expenditure**	**Public service Expenditure**
$ln(Openness_{t-1})$	0.356	0.032	0.037	0.154
	(0.340)	(0.222)	(0.406)	(0.151)
$ln(Age\ dependency)$	0.605	-0.567	-1.131	0.095
	(0.537)	(0.515)	(2.056)	(0.701)
$ln(Population)$	-0.382	-1.179**	2.442	-3.027***
	(0.616)	(0.466)	(1.678)	(0.683)
ln(GDP per capita)	0.083	0.111	0.264	0.050
	(0.288)	(0.135)	(0.302)	(0.124)
ln(Urban ratio)	0.393	-0.429	-2.789**	-0.517
	(0.852)	(0.604)	(1.224)	(0.493)
ln(Inflation)	-0.044**	-0.016	-0.033	0.025
	(0.018)	(0.024)	(0.050)	(0.019)
GEI	0.213	0.062	-0.116	-0.044
	(0.147)	(0.110)	(0.172)	(0.081)
COC	0.259	0.219***	0.193	-0.026
	(0.163)	(0.071)	(0.140)	(0.060)
Constant	-1.602	21.572**	-25.739	51.707***
	(13.014)	(8.825)	(27.704)	(12.013)
R^2	**0.293**	**0.301**	**0.196**	**0.362**
Observations	**225**	**246**	**243**	**246**

Notes: A fixed effects regression with both time- and country-fixed effects has been performed with the different categories of government spending as dependent variable. All coefficients are given with the standard error given in parentheses. The stars indicate the significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table 2B (Continued)

	Health Expenditure	**Recreation, Culture and Religion Expenditure**	**Social Protection Expenditure**
$ln(Openness_{t-1})$	-0.117 (0.219)	-0.040 (0.430)	0.260 (0.868)
$ln(Age\ dependency)$	0.593 (0.578)	-0.082 (1.826)	1.627 (1.591)
$ln(Population)$	0.039 (0.554)	3.167 (1.858)	2.631** (1.053)
ln(GDP per capita)	0.030 (0.176)	0.580 (0.461)	-0.214 (0.348)
ln(Urban ratio)	0.096 (0.636)	0.882 (1.093)	-2.214 (1.838)
ln(Inflation)	-0.022 (0.029)	-0.078* (0.045)	-0.006 (0.055)
GEI	0.064 (0.079)	-0.019 (0.150)	0.075 (0.194)
COC	0.201* (0.098)	0.082 (0.109)	0.312 (0.204)
Constant	-4.492 (10.306)	-60.393* (35.121)	-42.400* (22.003)
R^2	**0.206**	**0.189**	**0.190**
Observations	**246**	**219**	**236**

Notes: A fixed effects regression with both time- and country fixed effects has been performed with the different categories of government spending as dependent variable. All coefficients are given with the standard error given in parentheses. The stars indicate the significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Whereas inflation was expected to have a significant negative relationship with all categories of government spending, this was only true for expenditures on defense and recreation, culture and religion. All the other variables, except for public services, did have a negative coefficient, though the number was not statistically significant. Control of corruption is another variable that seems significantly positive for some of the categories. This is quite surprising, since this variable does not have a significant relationship with total government spending.

4.2: Robustness

A couple of tests have been performed in order to examine the robustness of the results found in the previous section. As mentioned in the methodology section, we assume that trade openness has an effect on government spending. However, performing a panel data fixed effects analysis and finding a significant positive coefficient does not necessarily mean there is an effect of variable x on variable y. It could be that variable y also has a significant effect on variable x, indicating both variables are probably just correlated rather than variable x having an effect on variable y. Thus, a reverse causality analysis can be performed to test whether government spending has a significant effect on trade openness. The robustness test that has been performed to test this was a panel data fixed effects regression with trade openness as dependent variable and lagged government spending as independent variable.

As table 3A shows, no significant effect was found for lagged government spending on trade openness. As explained above, this strengthens the assumption of an effect of trade openness on government spending rather than a relationship, because no indication of reverse causality was found in this robustness test.

The second robustness test on aggregate government spending as seen in table 3B used only data from 2002-2007 (column 1-3) and data from 2002-2010 (column 4-6). This test was done to see whether taking the means of the values for the years 2000 and 2002 for control of corruption and government effectiveness could have influenced the robustness of the regression. The first three columns consist of data without the financial crisis, whereas the last three columns also contain years from the financial crisis. This is done to see whether including those years gives a different outcome to the analysis.

For all six columns, trade openness keeps its significant effect on government spending. What is most noticeable is the significant effect that corruption and its interaction variable with trade openness have on government spending in the years 2002-2007. In the main analysis, presented in the results section and in column six of table 3B, corruption and its interaction variable do not have a significant effect on government spending. It could thus be that in years where countries are not in a recession, government officials seize gains from trade, but cannot do that when there is a crisis because the gains from trade are needed to overcome the recession. This could explain why over the entire period 2000-2010, no significant effect of corruption on government spending was found.

Table 3A: Panel data fixed effects regression with trade openness as dependent variable.

	(1)
$ln(Government\ Spending_{t-1})$	0.267
	(0.224)
$ln(Age\ dependency)$	-0.114
	(0.250)
$ln(Population)$	-0.164
	(0.243)
ln(GDP per capita)	-0.252***
	(0.051)
ln(Urban ratio)	0.247
	(0.369)
ln(Inflation)	0.016**
	(0.006)
GEI	0.362*
	(0.204)
COC	-0.173
	(0.211)
Spending*GEI	0.010
	(0.064)
Spending*COC	0.061
	(0.066)
Constant	6.930
	(4.524)
R^2	**0.272**
Observations	**1047**

Notes: A fixed effects regression with both time- and country fixed effects has been performed to identify and reverse causal relationships. All coefficients are given with the standard error given in parentheses. The stars indicate the significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table 3B: Panel data fixed effects regression with government spending as dependent variable.

	(1)	(2)	(3)	(4)	(5)	(6)
$ln(Openness_{t-1})$	0.198**	0.203**	0.481***	0.189**	0.190**	0.390**
	(0.091)	(0.088)	(0.175)	(0.087)	(0.087)	(0.168)
$ln(Age\ dependency)$		1.030***	0.901***		0.502**	0.507**
		(0.349)	(0.324)		(0.229)	(0.233)
$ln(Population)$		-0.227	-0.175		-0.108	0.007
		(0.337)	(0.279)		(0.247)	(0.231)
ln(GDP per capita)		-0.041	-0.083		0.000	-0.040
		(0.065)	(0.066)		(0.056)	(0.056)
ln(Urban ratio)		0.392	0.188		0.200	0.231
		(0.453)	(0.344)		(0.363)	(0.301)
ln(Inflation)			-0.010			-0.008
			(0.008)			(0.007)
GEI			0.929***			0.665**
			(0.225)			(0.242)
COC			-0.503***			-0.298
			(0.173)			(0.204)
Trade*GEI			-0.207***			-0.142**
			(0.052)			(0.056)
Trade*COC			0.119***			0.075
			(0.040)			(0.046)
Constant	2.432***	0.494	-0.088	2.469***	1.301	-1.554
	(0.385)	(6.850)	(5.736)	(0.364)	(5.000)	(4.556)
R^2	**0.049**	**0.105**	**0.226**	**0.158**	**0.175**	**0.245**
Observations	**672**	**672**	**641**	**1008**	**1008**	**949**

Notes: All six columns represent a fixed effects regression with both time- and country-specific fixed effects. Columns 1-3 represent the years 2002-2007. Columns 4-6 represent the years 2002-2010. The stars indicate the significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

5: Discussion and Conclusion

5.1: Discussion

Results of the research done in this paper show that there is a positive significant relationship between trade openness and aggregate government spending. This is in accordance with what the compensation hypothesis assumes. However, not every result came as expected. First off, no significant relationship was found between corruption and government spending. Whereas expected that the relationship between the degree of corruption and government spending would be negative, the opposite could be true for some sectors. d'Agostino et al. (2016) explain that limited competition in, for example, the defense sector could lead to more spending on defensive practice through more informal contracts and rent-seeking activities. Through these informal contracts and rent-seeking activities, corrupt governments allocate a bigger fraction of the gains from trade to these sectors. That means that there are fewer gains from trade available to spend on other categories. Because not every sector faces this limited competition, the relationship between corruption and government spending differs between sectors, possibly canceling any significant effect out when analyzing the effect of corruption on aggregate government spending.

The value of the other interaction variable between trade openness and government effectiveness was negative, rather than positive as stated in the hypothesis. This means that when trade openness is positive and increases, its effect will be less positive when government effectiveness is also increasing. Though this may seem really unlikely at first, especially since both variables significantly increase government spending, the negative interaction effect can be intuitively explained by the compensation hypothesis. The positive effect of trade openness on government spending can be explained by the fact that when trade openness increases, demand for protection and welfare states increases, leading to higher government spending in accordance with the compensation hypothesis. The positive effect of government effectiveness on government spending can be explained through the fact that effective governments are more able to implement compensation, because they are more capable to form and implement good policies. The negative interaction effect can be explained by the following: if government effectiveness increases, meaning that good policy formation and public service quality increases, the effect that trade openness has on government spending becomes less due to the fact that people feel less insecure about the exposure they face

through trade. This leads to less demand for more protection, decreasing the effect trade openness has on government spending.

Even though this paper found significant results, it still suffered from limitations. At first, not every developing country was included in the list due to missing data from those countries. This could affect the validity of the estimations for developing countries. Furthermore, values for the year 2001 were missing for two control variables, leading to the fact that the mean from the years 2000 and 2002 had to be used in order to construct values. However, this could also affect the validity of the results.

The analysis of disaggregate government spending was also heavily impacted by data unavailability, having full data for only 26 of the 152 developing countries. This major limitation to the sample size could have led to too few observations in order to have any statistical power given the number of control variables.

5.2: Conclusion

This paper empirically investigated whether the positive relationship between trade openness and government spending, as stated by the compensation hypothesis, exists. The findings of this paper show that trade openness has a significant positive relationship with aggregate government spending in developing countries. This result can be used to form evidence to support the compensation hypothesis and is in accordance with research done by Cameron (1978), Rodrik (1998) and Bernauer and Achini (2000). All of these papers also found a positive significant relationship between trade openness and aggregate government spending. The findings for different categories show that trade openness has no significant relationship with any of the seven used government spending categories. This finding is more or less in line with the findings of Benarroch and Pandey (2012), who did a similar analysis and only found a significant relationship between trade openness and health expenditure.

Whereas previous literature focused mostly on developed countries, this research has contributed to existing literature by focusing on developing countries and adding variables that had not been used in this context until now. Any recommendations on further research would be to use more recent years, as the necessary data from those years is much more complete for the period I have used. This way, no values have to be constructed by using means, making any further research more representative for the countries in question. Due to initial missing data, this research could not make use of all data in recent years. In order to estimate a causal effect, further research could also make use of a dynamic regression to eliminate any bias and endogeneity issues still involved in my analysis. Dynamic regression, as explained earlier in the methodology section, makes use of advanced techniques and regressions in order to eliminate all possible bias. This is beyond the scope of this thesis and is therefore the reason I did not use it myself.

Knowing that trade openness is significantly related to government spending, further research could also lead to more knowledge about what trade policies should be implemented. For example, does subsidizing exports eliminate the significance of the effect of trade openness on government spending? Or does protecting the domestic market, by imposing import barriers and thus collecting tariff revenue rather than spending money on social protection, provide the compensation demanded by those hurt by trade openness? By using these policy dummies, further research can keep track of what policies work to eliminate or reduce compensation demands.

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Appendix

Table A1: List of all developing countries

List of developing countries		
Afghanistan	**Gabon**	***Pakistan***
Albania	**Gambia**	Palau
Algeria	***Georgia***	**Panama**
Angola	**Ghana**	Papua New Guinea
Antigua and Barbuda	Grenada	**Paraguay**
Argentina	***Guatemala***	**Peru**
Armenia	**Guinea**	***Philippines***
Aruba	**Guinee-Bissau**	**Poland**
Azerbaijan	Guyana	Qatar
Bahamas	**Haiti**	**Romania**
Bahrain	**Honduras**	***Russia***
Bangladesh	**India**	**Rwanda**
Barbados	**Indonesia**	Saint Kitts and Nevis
Belarus	**Iran**	Saint Lucia
Belize	Iraq	Saint Vincent and the Grenadines
Benin	**Ivory Coast**	Samoa
Bhutan	***Jamaica***	Sao Tome and Principe
Bolivia	***Jordan***	**Saudi Arabia**
Bosnia and Herzegovina	Kazakhstan	**Senegal**
Botswana	***Kenya***	**Serbia**
Brazil	**Kiribati**	**Seychelles**
Brunei	Kosovo	**Sierra Leone**
Bulgaria	**Kuwait**	**Solomon Islands**
Burkina Faso	**Kyrgyzstan**	Somalia
Burma	**Laos**	**South Africa**
Burundi	***Lebanon***	South Sudan
Cambodia	Lesotho	***Sri Lanka***
Cameroon	Liberia	**Sudan**
Cape Verde	**Libya**	Suriname
Central African Republic	**Macedonia**	**Syria**
Chad	**Madagascar**	**Tajikistan**
Chile	**Malaysia**	**Tanzania**
China	Malawi	***Thailand***
Colombia	Maldives	**Togo**
Congo-Brazzaville	**Mali**	**Tonga**
Comoros	Marshall Islands	Trinidad and Tobago
Costa Rica	Mauritania	***Tunisia***
Dem. Rep. Congo	***Mauritius***	**Turkey**
Djibouti	**Mexico**	**Turkmenistan**
Dominica	***Moldova***	Tuvalu
Dominican Republic	**Mongolia**	**Uganda**
East Timor	Montenegro	***Ukraine***
Ecuador	**Morocco**	**Uruguay**
Egypt	**Mozambique**	**Uzbekistan**
El Salvador	***Namibia***	**Vanuatu**
Equatorial Guinea	Nauru	**Venezuela**
Eritrea	***Nepal***	**Vietnam**
Eswatini	**Nicaragua**	Yemen
Ethiopia	**Niger**	**Zambia**
Federal States of Micronesia	**Nigeria**	Zimbabwe
Fiji	***Oman***	

Notes: Countries marked in bold font were used in the analysis of aggregate government spending and trade openness. Countries in bold and italics were used in the analysis of disaggregate government spending and trade openness.

Table A2: Panel data fixed effects regression with trade openness as independent variable and different government expenditure categories as dependent variable.

	Defense Expenditure	**Education Expenditure**	**Economic affairs Expenditure**	**Public service Expenditure**
$ln(Openness_{t-1})$	-0.015	-0.688	1.901	-0.466
	(1.364)	(0.581)	(1.161)	(0.402)
$ln(Age\ dependency)$	0.589	-0.641	-0.942	0.032
	(0.533)	(0.509)	(2.006)	(0.694)
$ln(Population)$	-0.390	-1.208**	2.412	-3.012***
	(0.594)	(0.460)	(1.635)	(0.674)
ln(GDP per capita)	0.105	0.154	0.193	0.072
	(0.297)	(0.137)	(0.313)	(0.124)
ln(Urban ratio)	0.365	-0.464	-2.594**	-0.588
	(0.796)	(0.559)	(1.149)	(0.504)
ln(Inflation)	-0.045**	-0.019	-0.029	0.025
	(0.019)	(0.024)	(0.050)	(0.018)
GEI	-0.352	-1.143	1.935	-0.671
	(1.404)	(0.733)	(1.540)	(0.693)
COC	0.497	0.797*	-0.168	-0.034
	(1.046)	(0.458)	(1.116)	(0.630)
Trade*GEI	0.131	0.278	-0.476	0.146
	(0.330)	(0.170)	(0.369)	(0.157)
Trade*COC	-0.054	-0.131	0.080	-0.013
	(0.214)	(0.103)	(0.258)	(0.144)
Constant	0.210	25.260***	-34.157	54.450***
	(13.746)	(8.383)	(28.063)	(12.156)
R^2	**0.295**	**0.313**	**0.206**	**0.366**
Observations	**225**	**246**	**246**	**246**

Notes: A fixed effects regression with both time- and country fixed effects has been performed with the different categories of government spending as dependent variable. All coefficients are given with the standard error given in parentheses. The stars indicate the significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table A2 (Continued)

	Health Expenditure	**Recreation, Culture and Religion Expenditure**	**Social Protection Expenditure**
$ln(Openness_{t-1})$	-0.367	0.274	2.103
	(1.264)	(1.458)	(1.975)
$ln(Age\ dependency)$	0.642	-0.062	1.893
	(0.645)	(1.853)	(1.687)
$ln(Population)$	0.064	3.163	2.584**
	(0.555)	(1.866)	(1.075)
ln(GDP per capita)	0.000	0.574	-0.274
	(0.190)	(0.459)	(0.368)
ln(Urban ratio)	0.117	0.906	-2.132
	(0.750)	(1.111)	(1.804)
ln(Inflation)	-0.020	-0.078*	-0.002
	(0.028)	(0.045)	(0.055)
GEI	0.907	0.289	1.681
	(1.266)	(1.270)	(1.874)
COC	-0.223*	0.061	0.431
	(0.698)	(0.797)	(1.488)
Trade*GEI	-0.194	-0.071	-0.376
	(0.296)	(0.291)	(0.441)
Trade*COC	0.096	0.004	-0.029
	(0.145)	(0.173)	(0.343)
Constant	-7.004	-61.813	-50.391**
	(13.898)	(37.164)	(22.700)
R^2	**0.210**	**0.189**	**0.196**
Observations	**246**	**219**	**236**

Notes: A fixed effects regression with both time- and country fixed effects has been performed with the different categories of government spending as dependent variable. All coefficients are given with the standard error given in parentheses. The stars indicate the significance level: * p < 0.10, ** p < 0.05, *** p < 0.01