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Cyclicality of Irish Public Spending

VICTORIA OYEWOLE AND KEVIN MEANEY

CENTRAL EXPENDITURE POLICY SECTION
DEPARTMENT OF PUBLIC EXPENDITURE AND REFORM

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This paper has been prepared by IGEES staff in the Department of Public Expenditure and Reform. The views presented in this paper do not represent the official views of the Department or Minister for Public Expenditure and Reform.

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Executive Summary

- Under Keynesian macroeconomic principles, fiscal policy should be conducted in a countercyclical manner. As the economy grows, government spending should not contribute to overheating. On the other hand, in times of recession, government spending should support aggregate demand and the recovery of the economy.

- The purpose of this paper is to assess the cyclicality of the components parts of public expenditure, namely current, non-pay, pay and pensions, capital and total expenditure, over the period 1996 to 2018.

- The analysis makes use of output gap estimates from the EU CIRCABC database to assess the cyclicality of expenditure. As highlighted in previous research, for Ireland, these estimates are subject to significant uncertainty and revision over time. Therefore, the results and key findings in this paper should be considered in this context.

- The authors note recent work by the Department of Finance in producing alternative estimates of the output gap to better reflect the Irish economy. Using Department of Finance estimates, it is likely that the results of the analysis presented in this paper would be different, however, the use of EU CIRCABC data reflects the European Commission's Commonly Agreed Methodology (CAM) of estimating the output gap.

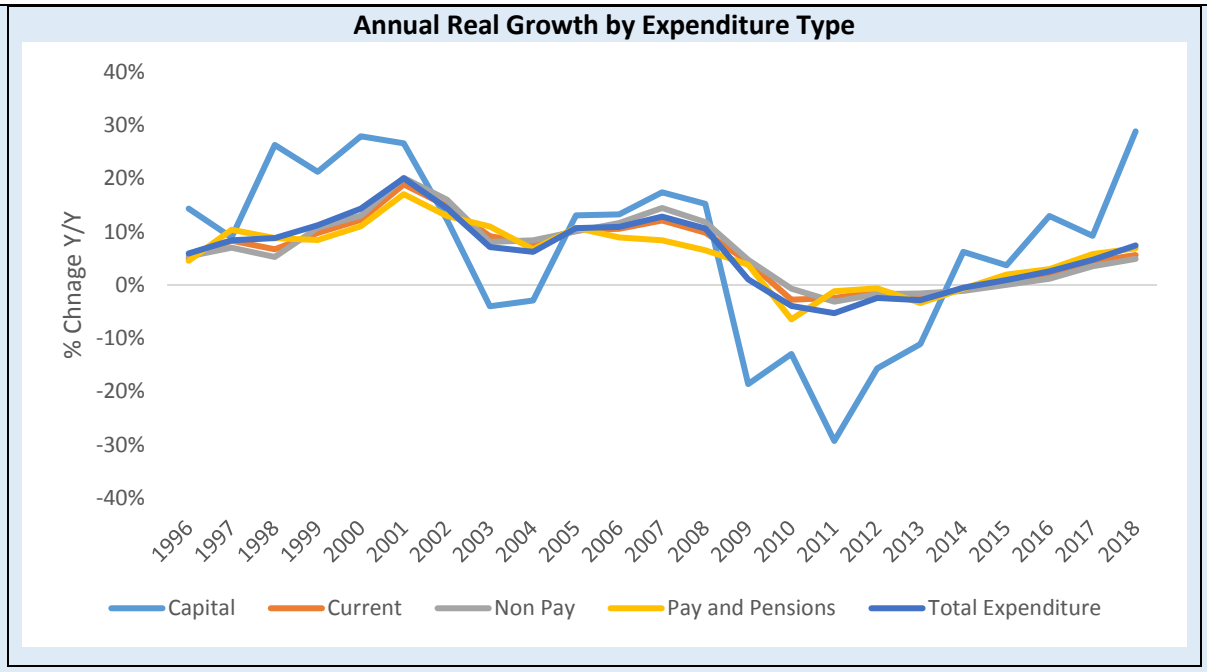
Key Findings

Public expenditure, particularly capital expenditure, is susceptible to cyclical variations

- The results of a correlation analysis suggest that a positive relationship exists between the output gap and the sub-components of public expenditure i.e. all components of spending have tended to increase in times of economic growth and decrease in times of economic contraction.

- Capital expenditure has experienced the largest levels of variation in spending over time, ranging from 26 per cent growth in 1998 to a 30 per cent decline in 2011. This closely tracks the business cycle and could indicate pro-cyclicality.

- However, the regression analysis conducted as part of this paper suggests that there is no statistically significant evidence of pro-cyclicality over time for current, non-pay and pay and pensions expenditure. While the results indicated that there is a statistically significant relationship for capital expenditure, econometric testing indicates that this finding may not be valid and additional technical regression analysis (DOLS and FMOLS) could achieve more consistent results.



Source: DPER calculations

Policy Considerations

- However, it is possible to draw some policy considerations from the analysis. The evidence suggests that public expenditure, and in particular, capital expenditure has experienced significant volatility over the period analysed. While the regression analysis does not go as far as supporting the conclusion that fiscal policy has been strongly pro-cyclical, it is also clear that it has not be counter-cyclical.

- The correlation analysis presented in the paper, when considered alongside expenditure trends in the run up to and during the crisis period, suggests that a reduction in the level of volatility in public expenditure over time would be desirable.

- In support of this, a number of expenditure reforms, including multi-annual expenditure ceilings and updated EU Fiscal Rules, were introduced following the crisis. However, the difficulty in measuring the cyclical position of the Irish economy through the output gap means that the application of EU Fiscal Rules in the Irish case can be problematic.

- Because of this, as highlighted in the Summer Economic Statement 2019, it may be prudent to supplement Ireland's requirements under the EU Fiscal Rules with a domestic expenditure framework / anchor that supports sustainable expenditure policy in a way that reduces reliance on estimates of the cyclical position of the economy which are known to be problematic.

1. Introduction

Keynesian macroeconomic principles support the use of a countercyclical approach in the conduct of fiscal policy, i.e. reducing government spending and accumulating savings when the economy is growing and using tax and expenditure levers to support aggregate demand and economic recovery in a recession.

It has been argued that Irish fiscal policy has been pro-cyclical[1]. This paper investigates whether the various components of public expenditure – current, non-pay, pay and pensions[2], capital and total expenditure – have experienced pro-cyclicality. The paper focuses on expenditure voted by the Oireachtas given that this expenditure is rooted in policy decisions which impact on allocations across the various expenditure categories from year to year. Non-voted expenditure is excluded because it is outside of the short term policy remit of Government, e.g. interest on the national debt and contributions to the EU budget.

The paper uses correlation analysis to understanding the relationship between the components of public expenditure and the output gap with a view to ascertaining whether expenditure has tended to be pro-cyclicality or not. The paper supplements this with regression analysis, and an international comparative analysis of the cyclicality of expenditure on Gross Fixed Capital Formation (GFCF). This paper is structured as follows:

- **Section 2** details the data, methodology and limitation of the analysis;
- **Section 3** provides a comparison of cyclicality of public spending using the output gap;
- **Section 4** provides the results of a regression analysis on the cyclicality of public spending;
- **Section 5** provides a comparison of the cyclicality of Gross Fixed Capital Formation across the Euro Area; and
- **Section 6** set out key finding and policy implications.

[1] Cronin and McQuinn (2018): The Cyclicality of Irish Fiscal Policy Ex-Ante and Ex-Post, Economic and Social Studies; Colin Hunt (2005): Discretion and Cyclicality in Irish Budgetary Management 1969-2003, TCD; Philip Lane (2003): The cyclical behaviour of fiscal policy: evidence from the OECD, TCD; Philip Lane (1999), On the Cyclicality of Irish Fiscal Policy, TCD; Scott and Bedogni (2017): The Irish Experience: Fiscal Consolidation 2008-2014.

[2] Walker, E and Ryan, C. (2019), Public Service Employment & Expenditure Modelling, DPER. This paper assesses in-depth the causal relationship between the pay bill, the economic cycle and demographics.

2. Data, Methodology and Limitations

Data

The data used in this study are derived from the Department of Public Expenditure and Reform (DPER) expenditure database, the Central Statistics Office (CSO), EU CIRCABC output gap statistics and the Eurostat Classification of the Functions of Government (COFOG) database.

Methodology

There are two main analytical methodologies used. Firstly, a trend analysis is conducted, comparing different types of public expenditure (current, non-pay, pay and pensions, capital and total expenditure) against the output gap. The paper compares the output gap against real measures of these expenditure aggregates from 1996 to 2018, providing plots to assess the relationships.

Secondly Ordinary Least Squares (OLS) and Instrumental Variable (IV) regression analysis is conducted. Using similar assumptions to Cronin and McQuinn (2018)[3] and Scott and Bedogni (2017)[4], this analysis is designed to gain a deeper understanding of the relationship between subcomponents of public expenditure and cyclical measures of the economy such as real GDP growth and the output gap. The analysis was conducted using STATA software and the results are set out in Appendix 1. This analysis is intended to be illustrative as several limitations apply.

Limitation of the Analysis

The pro-cyclicality of public expenditure can be indicated by expenditure increasing while the economy is operating above potential output and expenditure decreasing when the economy is operating below potential output.

The output gap is a key variable in measuring the cyclical position of the economy and is the difference between the actual output of the economy (observable) and potential output

[3] Cronin and McQuinn (2018): The Cyclicality of Irish Fiscal Policy Ex-Ante and Ex-Post, Economic and Social Studies.

[4] Scott and Bedogni (2017): The Irish Experience: Fiscal Consolidation 2008-2014, DPER.

(unobservable). As potential output is unobservable, it must be estimated and there are a variety of ways of doing this.

Importantly, the European Commission estimates the output gap using the Commonly Agreed Methodology (CAM). These estimates are then applied as part of the EU Fiscal Rules, which must be adhered to by all EU Member States. This presents a particular challenge for Ireland as there are well flagged concerns about the accuracy of output gap estimates using the CAM for a small open economy like Ireland (Bedogni and Meaney, IFAC, DoF)[5].

Research conducted in this area has shown that estimates of potential output and the output gap are proven to be imprecise in real time and may provide an inaccurate guide for assessing the cyclical position of the economy and the underlying fiscal position (Bedogni and Meaney, IFAC, DoF, ESRI)[6]. Estimates for Ireland have tended to be revised often and by significant magnitudes. This arguably reduces the efficacy of the EU Fiscal Rules as a guide for expenditure policy in Ireland.

The authors note that alternative output gap estimates exist. For example, in recent research, the Department of Finance apply a statistical filter models[7]. If the Department's estimates of the output gap were to be applied in this analysis, it is likely that the results of the analysis may be different. However, the use of EU CIRCABC data reflects the European Commission's Commonly Agreed Methodology (CAM) of estimating the output gap which continues to apply as the official estimates of the output gap. Therefore, despite the limitations that exist, these data are used in this analysis and the results should be considered in the context of these limitations.

[5] Bedogni and Meaney (2018): EU Fiscal Rules: Real-time Measurement Issues of the Output Gap; Eddie Casey (2018): Inside the "Upside Down": Estimating Ireland's Output Gap, IFAC; Murphy, Martina and Daly (2018), Estimating Ireland's Output Gap, Department of Finance.
[6] Bedogni and Meaney (2018): EU Fiscal Rules: Real-time Measurement Issues of the Output Gap; Eddie Casey (2018): Inside the "Upside Down": Estimating Ireland's Output Gap, IFAC; Murphy, Martina and Daly (2018), Estimating Ireland's Output Gap, Department of Finance; Kieran McQuinn (2018), Capacity constraints in the Irish economy? A partial equilibrium approach, ESRI.
[7] Department of Finance (2018): Estimating Ireland's output gap; an analysis using selected statistical filters.

3. Comparison of Cyclicality of Public Spending using the Output Gap

Research literature has covered many considerations of the cyclicality of public spending particularly Lane (1998 and 2003)[8] who looked across many countries, Hunt (2005)[9] and more recently, Cronin and McQuinn (2018)[10] who looked at cyclicality ex-post versus ex-ante. These papers find that Ireland has had a history of agreeing and subsequently running pro-cyclical budgets, with the Cronin and McQuinn paper finding the ex-post position to be more pro-cyclical than the ex-ante position on average.

This paper aims to further develop this work by separating public spending into its component parts to ascertain if particular types of spending may be more susceptible to cyclical variations. Policy makers obviously have choices around the totality of spending which previous papers have addressed, but the decision of which type of spending that policy makers ultimately prefer to align with the business cycle has yet to be addressed. The paper aims to identify the types of expenditure that may be more prone to pro-cyclicality.

3.1 Real Growth in Public Expenditure Components

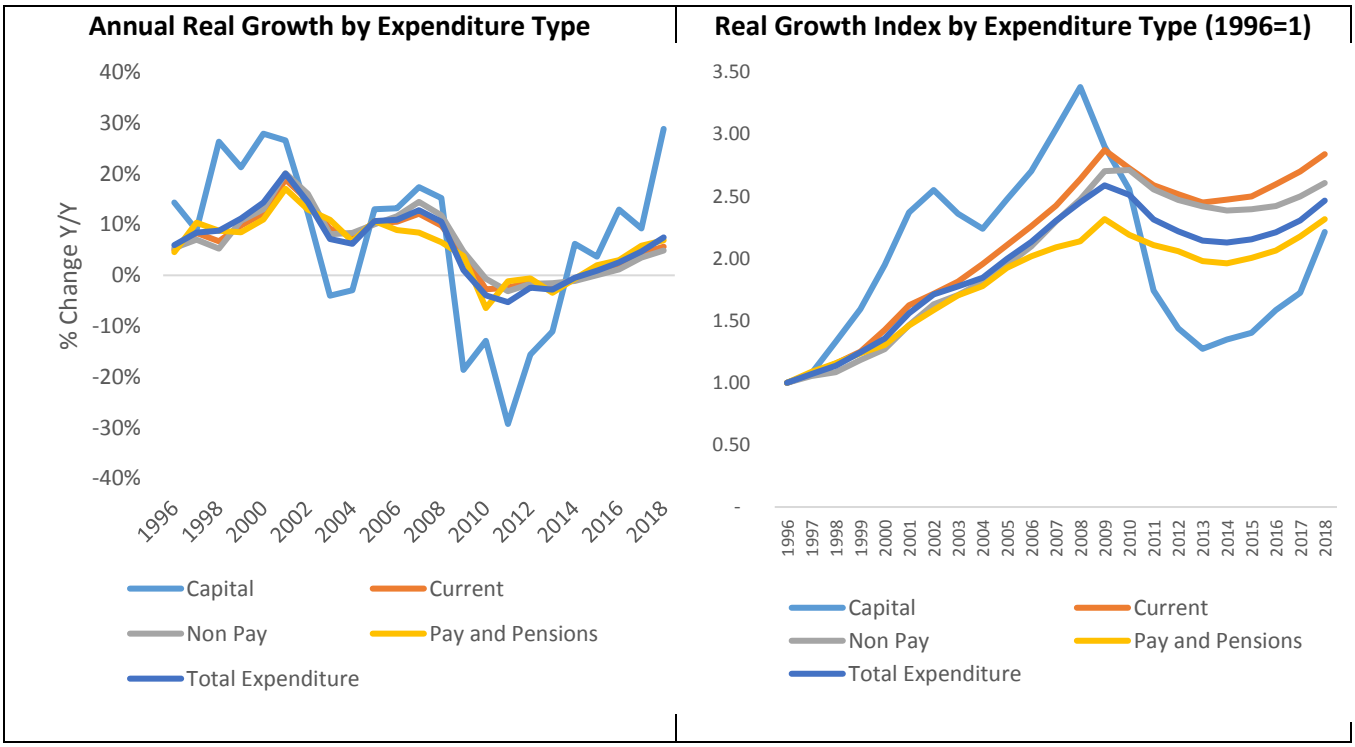
The following figures detail the real growth in five spending areas – capital, current, non-pay, pay and pensions and total spending – from 1996 to 2018. Similar figures were published as part of the *Trends in Public Expenditure* paper (DPER, 2018)[11], however the below data are presented in real terms.

It is clear from the analysis that capital expenditure experienced the largest levels of variation, ranging from 26 per cent growth in 1998 to a 30 per cent decline in 2011. It is important to note that this closely tracks the business cycle and would indicate some level of pro-cyclicality.

[8] Philip Lane (2003): The cyclical behaviour of fiscal policy: evidence from the OECD, TCD; Philip Lane (1999), On the Cyclicality of Irish Fiscal Policy, TCD.
[9] Colin Hunt (2005): Discretion and Cyclicality in Irish Budgetary Management 1969-2003, TCD.
[10] Cronin and McQuinn (2018): The Cyclicality of Irish Fiscal Policy Ex-Ante and Ex-Post, Economic and Social Studies.
[11] Department of Public Expenditure and Reform (2018): Trends in Public Expenditure.

Looking at the index analysis presented, the trend of capital spending differs somewhat from the other areas of expenditure, whereby the index reached much larger levels pre-crisis to then subsequently become the lowest in the post crisis period (see Figure 1). It is also interesting to note that the index for pay and pensions is lower than other spending types and has remained below the index of total expenditure in 2017. This could be expected as spending on hiring and wages tends to be stickier than other types of expenditure. The chart also shows that non-pay expenditure has grown at a rate above total expenditure over the 1996 to 2018 period, non-pay including social welfare payments, the largest component of Exchequer expenditure.

Figure 1: Public Expenditure Aggregates - Annual Real Growth and Real Growth Index



Source: DPER calculations

3.2 Assessing the Degree of Cyclicality of Public Spending Components

This section uses plots of real growth of spending components against Ireland's potential output estimates taken from EU CIRCABC database in each year from 1996 to 2018. As highlighted above, it should be noted that there are well flagged concerns about the accuracy

of Irish output gap estimates (Bedogni and Meaney, IFAC, DoF)[12], therefore the estimates, particularly for more recent years, should be treated with caution. However, this analysis provides a useful insight into the likely cyclicality of expenditure over the past two decades.

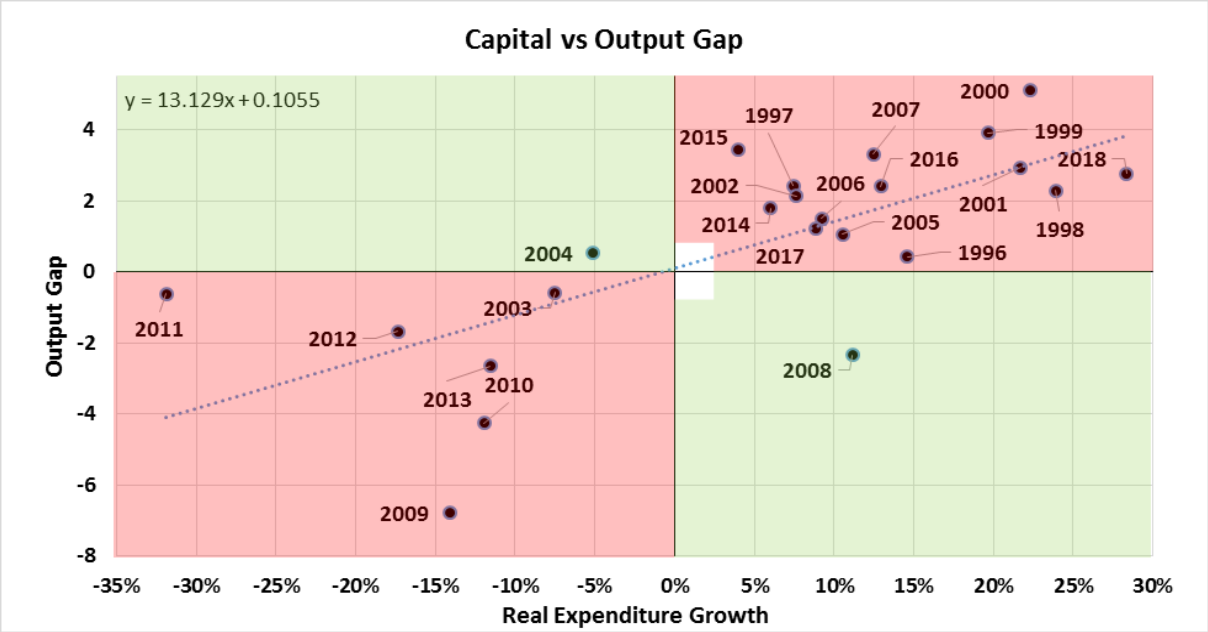
The estimate of the output gap – the difference between actual and potential output – should indicate the cyclical position of the economy[13]. An output gap ranging from 1.5 to -1.5 indicates that the economy is in a normal state. An output gap above 1.5 indicates that the economy is performing above potential output, meaning that the economy is performing above its full capacity. When the output gap is below -1.5, this indicates that the actual output of the economy is less than what the economy is capable of producing when all factors of production are employed to full capacity.

3.2.1 Capital Expenditure

Considering the growth pattern of capital expenditure presented above, it could be expected that capital expenditure may be particularly at risk of pro-cyclicality. The plot of real capital expenditure growth and output gap presented below suggests this to be the case. In particular, the periods 1996-2003, 2005-2007 and 2009-2018 appear to show pro-cyclicality to varying degrees. In both 2004 and 2008, capital expenditure was countercyclical, particularly in 2008, where capital expenditure increased by 11 per cent, when the economy was below potential output. This was in the context of rapid economic change and given the nature of multi-year capital expenditure, there may be a lag effect evident here.

[12] Bedogni and Meaney (2018): EU Fiscal Rules: Real-time Measurement Issues of the Output Gap; Eddie Casey (2018): Inside the "Upside Down": Estimating Ireland's Output Gap, IFAC; Murphy, Martina and Daly (2018), Estimating Ireland's Output Gap, Department of Finance.
[13] European Commission (2019): Vade Mecum on the Stability & Growth Pact.

Figure 2: Plot of Real Capital Spending Growth and Output Gap measure



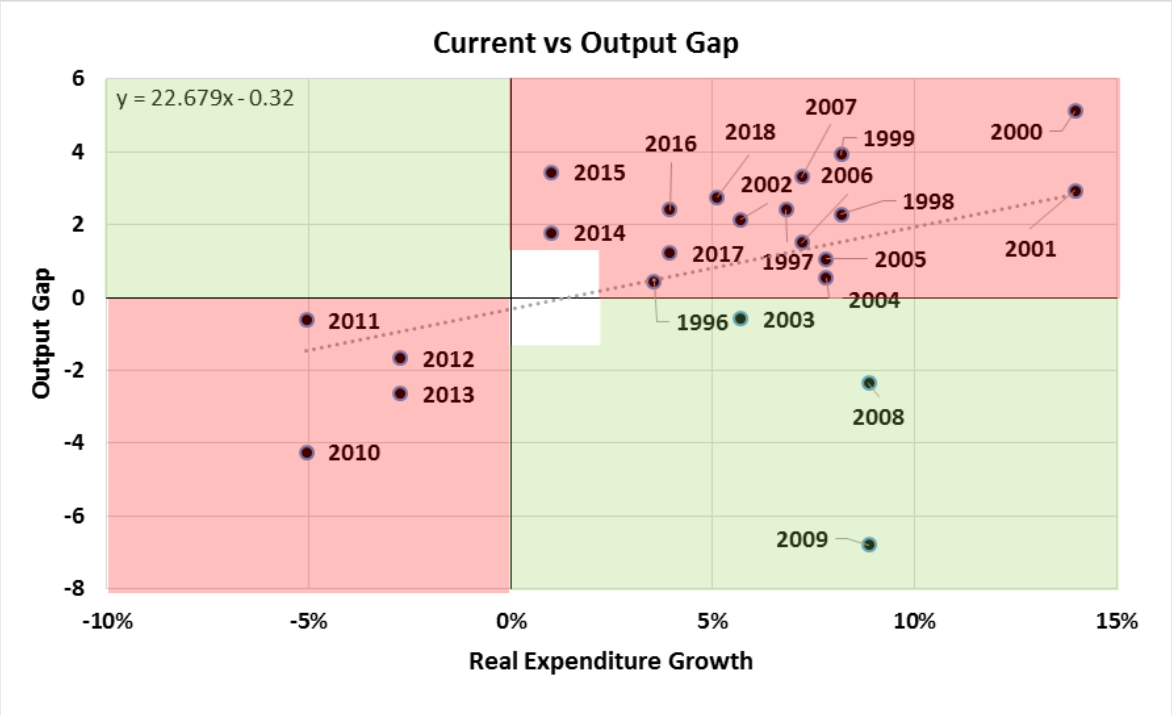
Source: EU CIRCABC database; DPER calculations

3.3 Current Expenditure

Current expenditure includes both pay and non-pay expenditure. The in-built automatic stabilisers in current expenditure, if allowed to apply, should ordinarily generate a countercyclical pattern as, for example, the number of welfare claimants decreases during times of economic growth and increases during recessions. However, the analysis shows that in the periods 1996-2002, 2004-2007 and 2010-2018, to varying degrees, currently expenditure appears to be pro-cyclical.

Current expenditure followed a countercyclical pattern in 2003, 2008 and 2009, with an increase in current expenditure while output gap estimates suggested that the economy was operating below its potential. Overall, the figure indicates that current expenditure has been more pro-cyclical than countercyclical.

Figure 3: Plot of Real Current Spending Growth and Output Gap measure



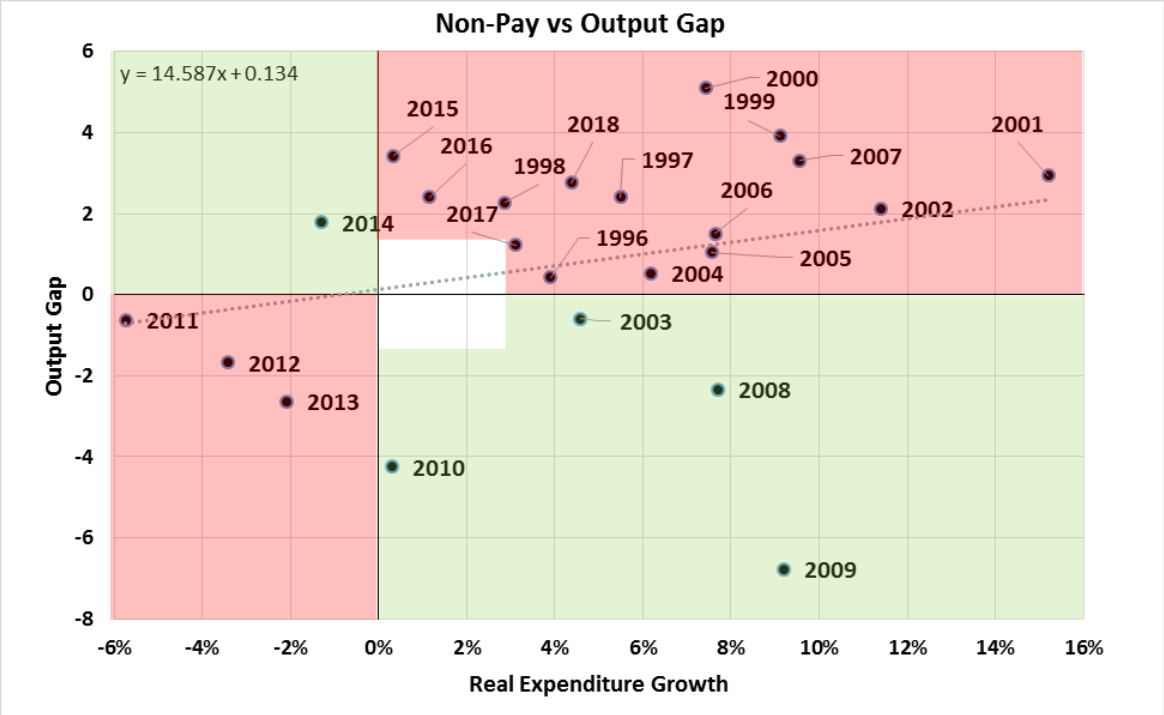
Source: EU CIRCABC database; DPER calculations

3.4 Non-Pay Expenditure

Non-pay expenditure forms part of current expenditure and is dominated by the policy areas of social welfare and health. Given the former, it would be expected that non-pay expenditure would be at less risk of pro-cyclicality than other expenditure components. However, the analysis suggests this is not the case as the periods of 1996-2002, 2004-2007, 2011-2013, and 2015-2018 follow a pro-cyclical pattern.

The years 2003 and from 2008-2010 follow a countercyclical pattern, as non-pay expenditure increased when the economy was below potential. This may indicate the application of the automatic stabilisers in two recessionary periods.

Figure 4: Plot of Real Non-Pay Spending Growth and Output Gap measure



Source: EU CIRCABC database; DPER calculations

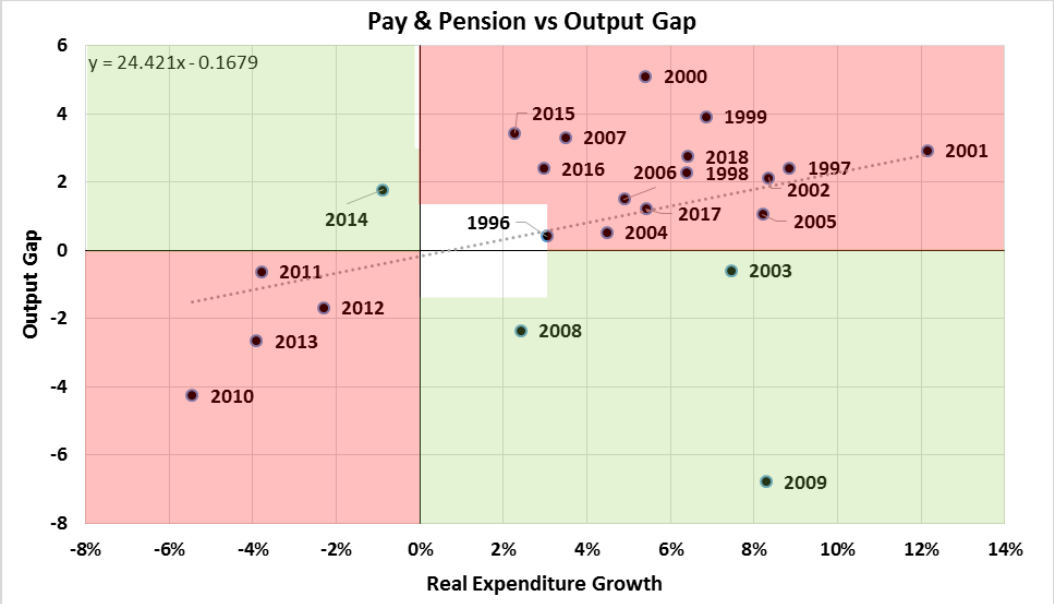
3.5 Pay and Pensions Expenditure

It would be expected that pay and pensions spending would be at risk of pro-cyclicality as public sector wage demands may be more likely to increase when the economy is experiencing growth. Walker and Ryan (2019)[14] provide an in-depth analysis on the casual relationship of the pay bill, the economic cycle and demographics. Public sector pay has reflected the development of the Irish economy over the last 20 years with periods of rapid expansion and contraction. The most recent output gap estimates and real growth in pay and pensions spending suggest predominately pro-cyclical policy in pay and pension expenditure.

Persistent pro-cyclicality mark the periods of 1997-2002, 2004-2007 and 2015-2018. During these periods, pay and pension expenditure grew strongly, when the economy was operating above potential. Further pro-cyclicality is seen in the 2010-2013 period when there was large reductions in pay and pensions spending at a time when the output gap suggested that the economy was operating below potential.

[14] Walker, E and Ryan, C. (2019), Public Service Pay Bill Expenditure: Scenario Analysis, DPER.

Figure 5: Plot of Real Pay and Pension Spending Growth and Output Gap measure

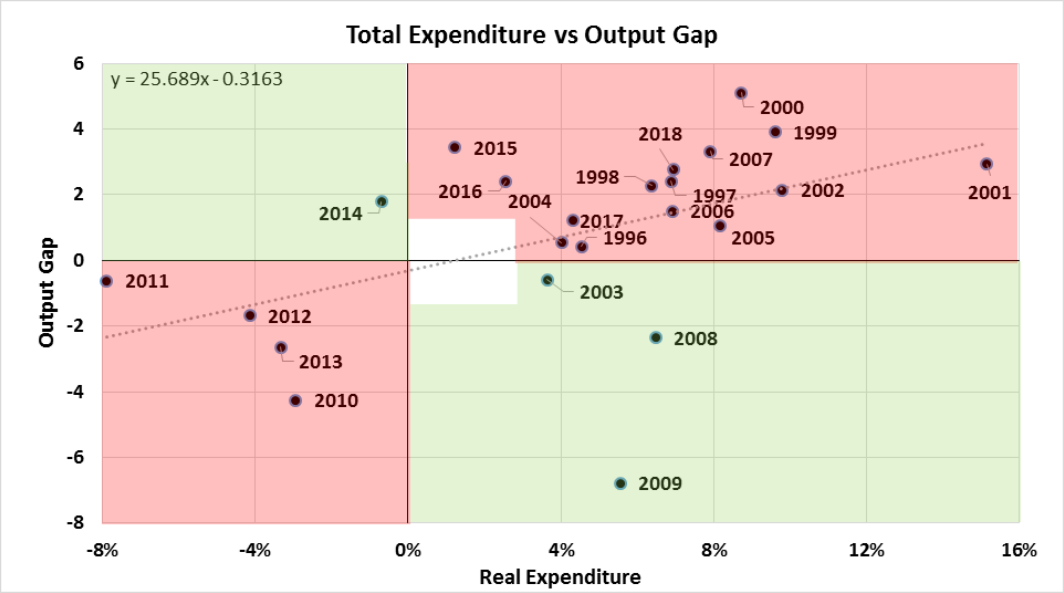


Source: EU CIRCABC database; DPER calculations

3.6 Total Expenditure

Looking at total expenditure with the same lens produces broadly similar results. This is not surprising given that the sub-components of total spend are indicated to be pro-cyclical in the analysis. Varying degrees of pro-cyclicality are evident in the periods 1996-2002, 2010-2013 and 2015-2018.

Figure 6: Plot of Real Total Expenditure Growth and Output Gap measure



Source: EU CIRCABC database; DPER calculations

In summary, using the plots of real growth of spending components against output gap estimates in each year suggests that a positive relationship exists between the output gap and the sub-components of public expenditure i.e. spending has tended to increase in times of economic growth and decrease in times of economic contraction.

4. Regression Analysis

In order to add another level of technical rigour to the above analysis, this paper also presents an OLS and IV regression analysis. The initial OLS analysis conducted uses a simple regression designed to understand the relationship between the subcomponents of public expenditure and both Real GDP and the output gap.

For this analysis, there is a problem of endogeneity with the explanatory variable Real GDP. This is because Government expenditure is one of the components that forms Real GDP and with such a relationship, Real GDP becomes dependent on public expenditure and vice versa. As a result the error term in the regression analysis is inflated and will result in biased estimates. Therefore, the Two Stage Least Squares (2SLS) estimator is used to mitigate the bias in the results of the OLS model.

The instruments used to control for endogeneity are the lag of Real GDP and the lag of private consumption, and although private consumption forms part of GDP it is separate from public expenditure and therefore should reduce the endogeneity problem. The authors note the further employment of dynamic ordinary least squares (DOLS) and fully modified OLS (FMOLS) procedures by Cronin and McQuinn (2018) as a further control on endogeneity.

The results of the IV regression using the lag of private consumption show that all components of public spending are statistically insignificant (See Appendix 2), meaning that private consumption in year t-1 has no association with public expenditure in year t. The lag of private consumption is also found to be a weak instrument. In addition, the result of the Durbin and Wu–Hausman tests indicate that endogeneity remains.

The results of the IV regression using the lag of real GDP as an instrument show that it is a statistically insignificant predictor of changes in current expenditure, pay and pension, non-pay and total expenditure. While the relationship between the lag of Real GDP and capital expenditure is found to be statistically significant, the lag of Real GDP is found to be a weak instrument and endogeneity persists. Therefore, strong conclusion cannot be drawn from the regression analysis.

An option for further work would be the employment of dynamic ordinary least squares (DOLS) and fully modified OLS (FMOLS) procedures on the components of public expenditure in order to further control for endogeneity.

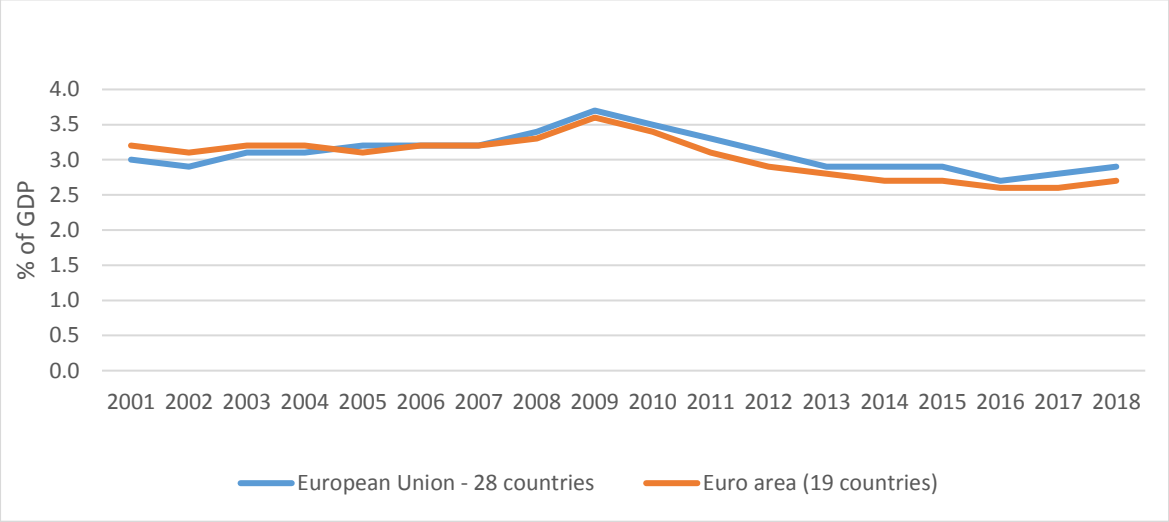
5. Cyclicality of Capital Spending across the EU

The analysis presented in the paper up to this point suggests that capital expenditure has been the most volatile component of public expenditure over time and is more likely than other components of expenditure to exhibit pro-cyclicality. It is useful to assess whether Ireland is an outlier in this respect or whether there is evidence of volatility in capital expenditure over time in other countries. To investigate, this section uses plots of annual expenditure on gross fixed capital formation against output gap estimates in each year from

1996 to 2017 across the 19 Euro Area countries to identify and compare the cyclicality of capital spending.

As a first step it is useful to chart the development of gross fixed capital formation in the EU and Euro Area over time. As Figure 7 shows, from 2009 to 2016, public investment as a percentage of GDP fell in response to the economic crisis.

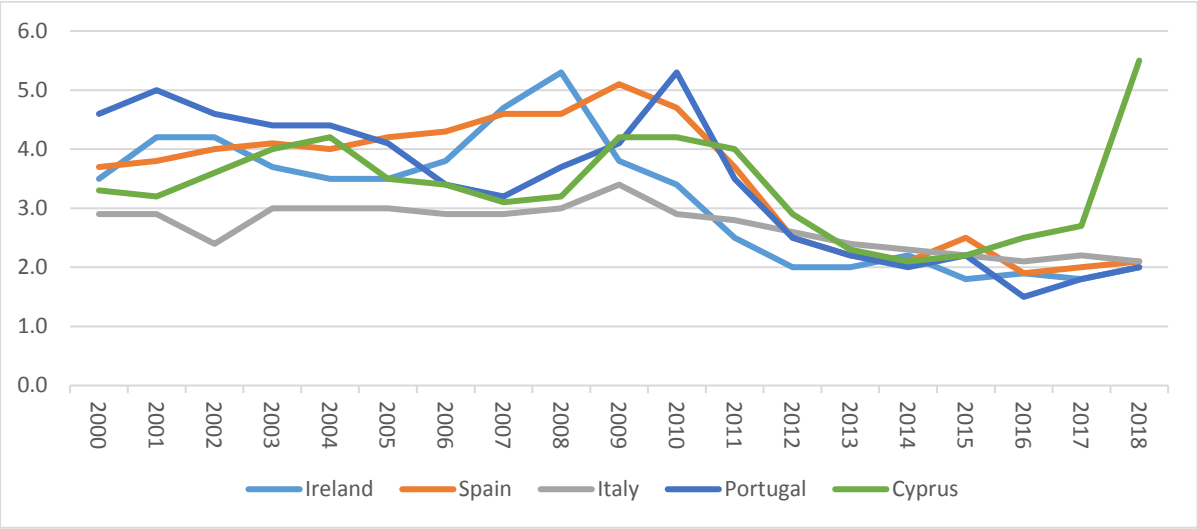
Figure 7: Gross fixed capital formation as a % of GDP, 2001 – 2018



Source: Eurostat database. Note: (Euro Area: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia and Spain)

As shown in Figure 8 below, this fall in investment expenditure was more pronounced in some European countries, particularly in Ireland, Spain, Italy, Portugal, Greece and Cyprus. Ireland experienced a sharp decline in public investment, falling from 5.3 per cent of GDP in 2008 to 2 per cent of GDP in 2012. In Spain public investment fell from 5.1 per cent of GDP in 2009 to 2.5 per cent of GDP in 2012 while in Portugal investment declined from 5.3 per cent of GDP in 2008 to 2.2 per cent of GDP in 2013.

Figure 8: Gross Fixed Capital Formation, % of GDP, 2000-2018

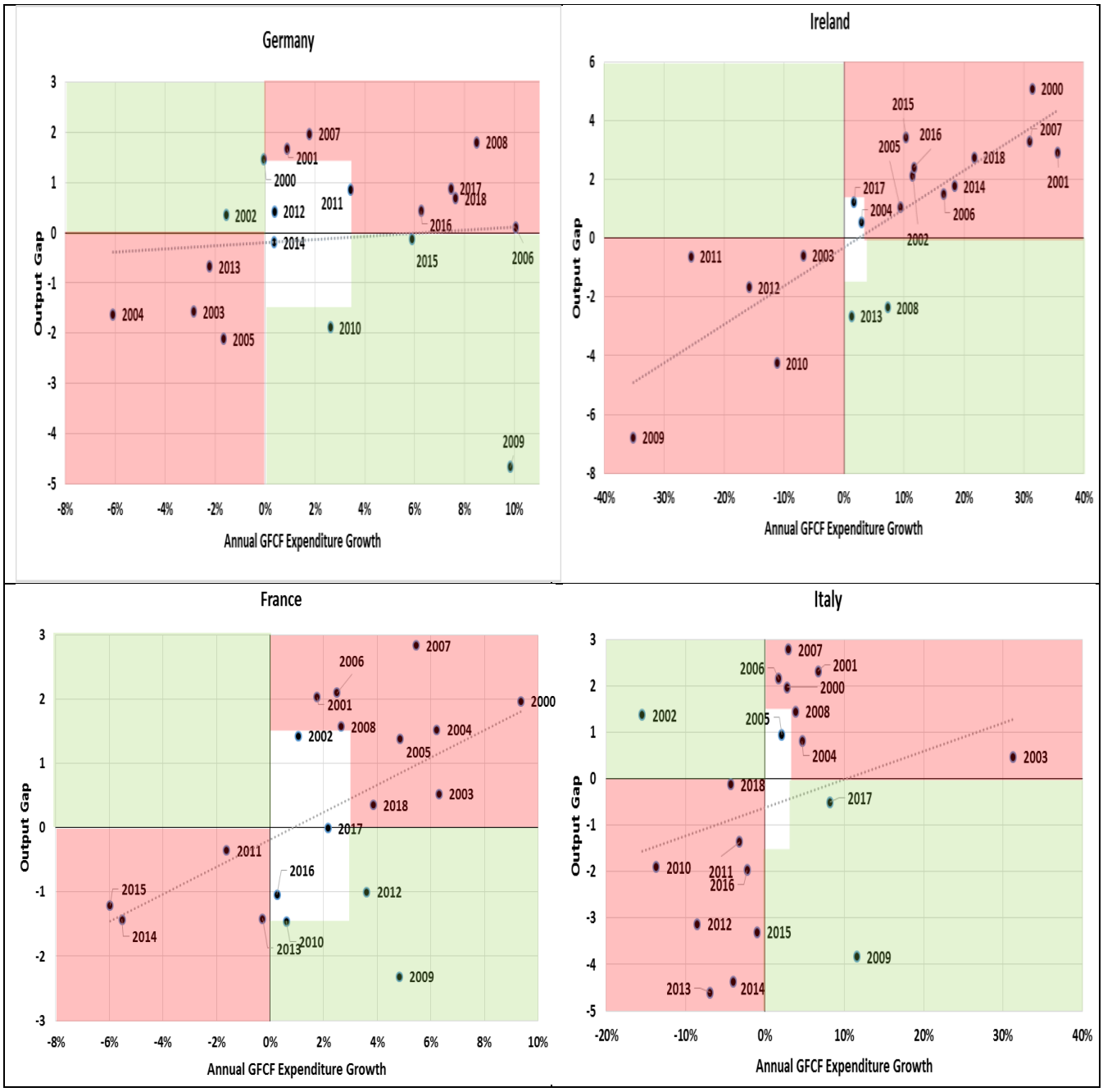


Source: Eurostat database. (Note: Greece has been excluded from this diagram for presentation purposes)

Below, plots of capital expenditure and the output gap are recreated for a number of European countries. The analysis, which includes the period 2000 to 2018, suggests, to varying degrees, that public capital investment tended to be pro-cyclical over the period.

This can be seen in Figure 9 below which compares expenditure on GFCF in Ireland with the Euro Area's three largest economies, France, German and Italy. However, the degree to which expenditure is pro-cyclical in these countries is less pronounced than is the case for Ireland.

Figure 9: GFCF Expenditure Growth vs Output Gap, 2000-2018



Source: EU CIRCABC and Eurostat database; DPER calculations

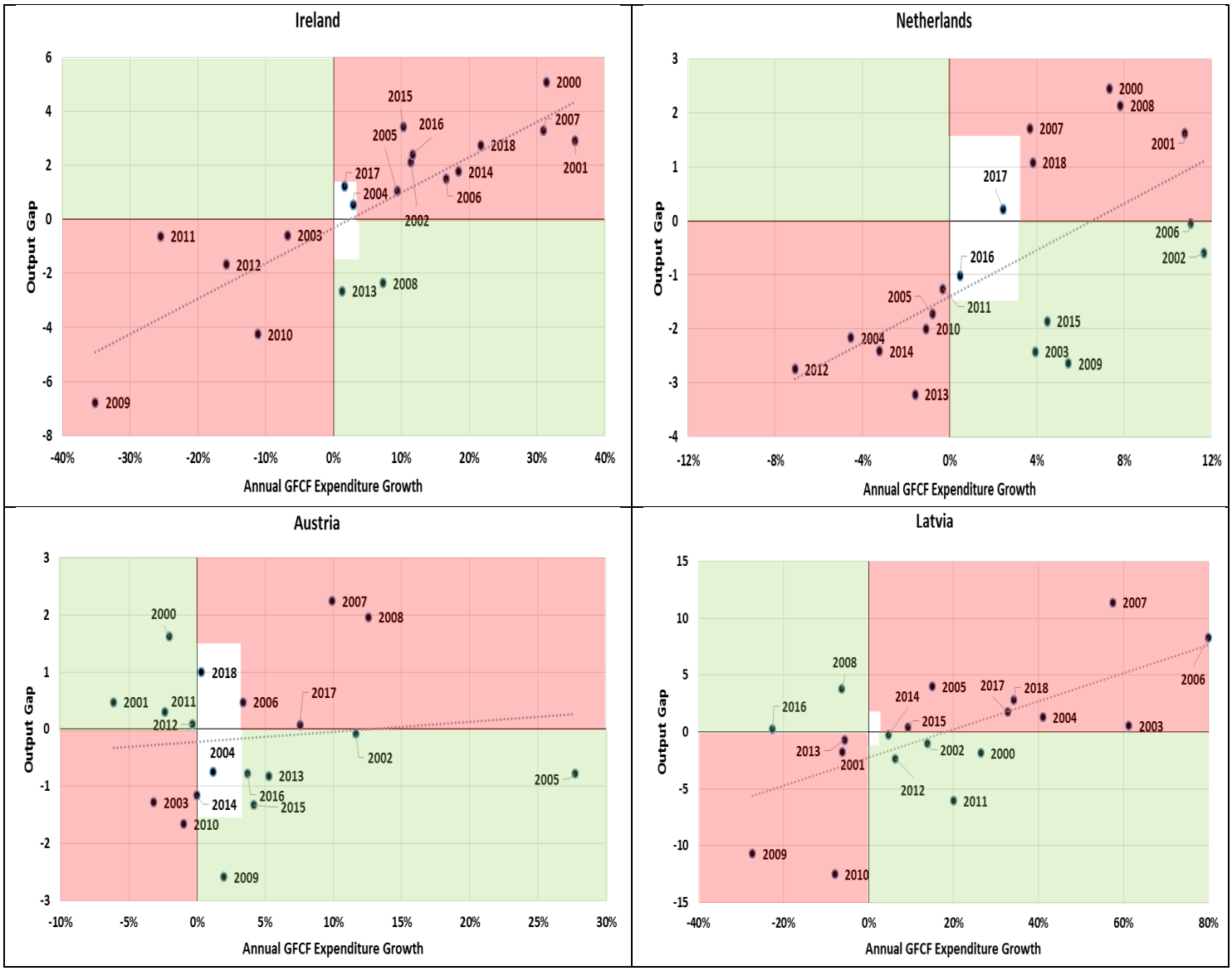
While the above analysis is useful, it is perhaps more appropriate to compare Ireland to countries which share the characteristics of an advanced small open economy. Figure 10 does this and draws on the work of Keogh and Brassill, 2018[15] to identify comparator countries. These include Austria, Netherlands, Latvia, Finland and Lithuania.

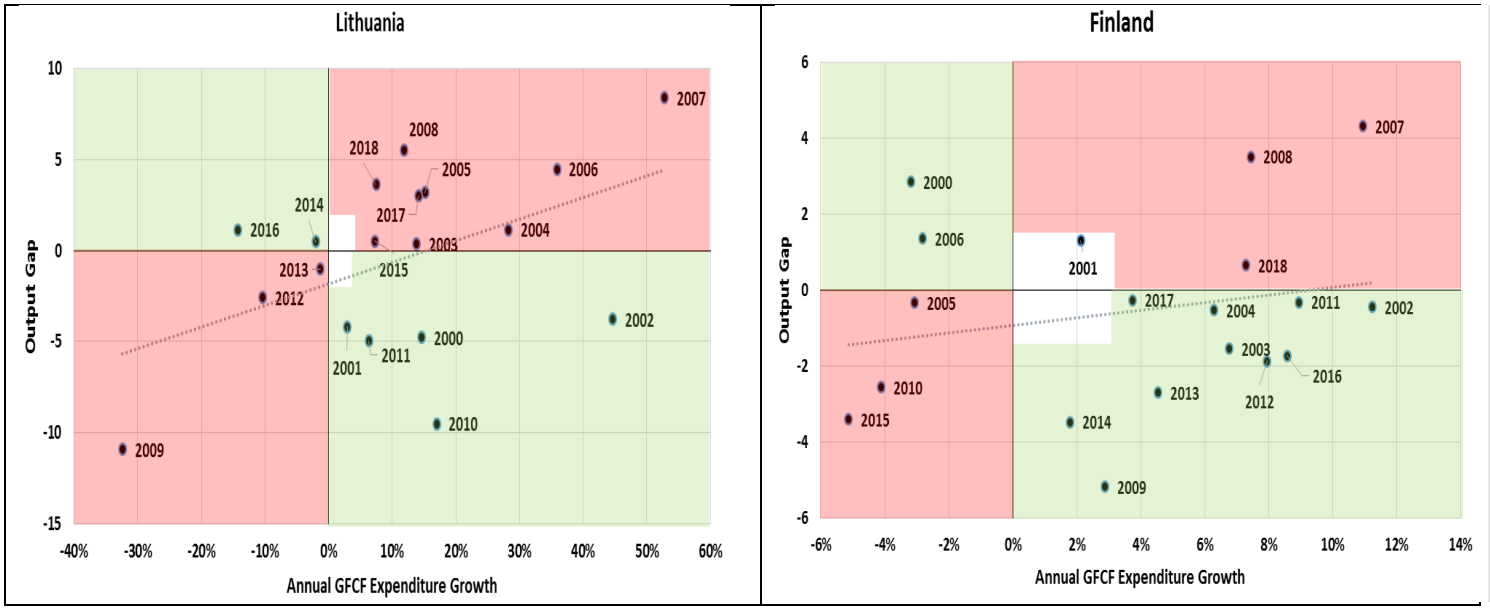
[15] Keogh and Brassill (2018): Small Advanced Open Economies – A comparative analysis, Department of Public Expenditure and Reform.

The estimates from the output gap and GFCF expenditure suggest a more mixed picture in other countries than in Ireland. For example, there are more years of counter-cyclical expenditure on GFCF in all of the other countries examined. In particular, capital spending in Austria, Finland, Slovakia and Sweden appears to follow a more counter-cyclical pattern.

There may be lessons for Ireland from these countries in terms of how capital expenditure is managed through the economic cycle.

Figure 10: GFCF Expenditure Growth vs Output Gap amongst comparator economies, 2000-2018





Source: EU CIRCABC and Eurostat database; DPER calculations

6. Key Findings and Policy Considerations

Public expenditure, particularly capital expenditure, is susceptible to cyclical variations

- The results of the correlation analysis suggest that a positive relationship exists between the output gap and the sub-components of public expenditure i.e. all components of spending have tended to increase in times of economic growth and decrease in times of economic contraction.

- Capital expenditure has experienced the largest levels of variation in spending over time, ranging from 26 per cent growth in 1998 to a 30 per cent decline in 2011. This closely tracks the business cycle and could indicate pro-cyclicality.

- However, the regression analysis conducted as part of this paper suggests that there is no statistically significant evidence of pro-cyclicality over time for current, non-pay, pay and pensions and total expenditure. While the results indicated that there is a statistically significant relationship for capital expenditure, econometric testing indicates that this finding may not be valid and additional technical regression analysis (DOLS and FMOLS) could achieve more consistent results.

Policy Considerations

- However, it is possible to draw some policy considerations from the analysis. The evidence suggests that public expenditure, and in particular, capital expenditure has experienced significant volatility over the period analysed. While the regression analysis does not go as far as supporting the conclusion that fiscal policy has been strongly pro-cyclical, it is also clear that it has not been counter-cyclical.

- The correlation analysis presented in the paper, when considered alongside expenditure trends in the run up to and during the crisis period, suggests that a reduction in the level of volatility in public expenditure over time would be desirable.

- In support of this, a number of expenditure reforms, including multi-annual expenditure ceilings and updated EU Fiscal Rules, were introduced following the crisis. However, the difficulty in measuring the cyclical position of the Irish economy through the output gap means that the application of EU Fiscal Rules in the Irish case can be problematic.

- Because of this, as highlighted in the *Summer Economic Statement 2019*[16], it may be prudent to supplement Ireland's requirements under the EU Fiscal Rules with a domestic expenditure framework / anchor that supports sustainable expenditure policy in a way that reduces reliance on estimates of the cyclical position of the economy which are known to be problematic.

[16] Department of Public Expenditure and Reform (2019): Summer Economic Statement 2019.

7. Appendices

Appendix 1 – OLS Regression Result, 1995-2017

(i) Capital Growth	(1)	(2)	(3)	(4)	(5)
Output Gap	3.78***				
	(0.82)				
Real GDP		1.00			
		(0.50)			
Lag Real GDP			1.51**		
			(0.45)		
Private Consumption				2.93***	
				(0.58)	
Lag Private Consumption					2.75***
					(0.63)
R^2	0.49	0.15	0.35	0.54	0.48
(ii) Current Growth					
Output Gap	0.53				
	(0.34)				
Real GDP		0.00			
		(0.17)			
Lag Real GDP			0.17		
			(0.17)		
Private Consumption				0.54*	
				(0.24)	
Lag Private Consumption					0.92***
					(0.18)
R^2	0.10	0.00	0.04	0.19	0.56
(iii) Pay and Pension Growth					
Output Gap	0.65				
	(0.33)				
Real GDP		0.09			
		(0.17)			
Lag Real GDP			0.27		
			(0.16)		
Private Consumption				0.53*	
				(0.24)	
Lag Private Consumption					0.87***
					(0.19)
R^2	0.15	0.01	0.12	0.18	0.48
(iv) Non Pay Growth					
Output Gap	0.47				
	(0.37)				
Real GDP		-0.44			
		(0.18)			
Lag Real GDP			0.11		
			(0.18)		
Private Consumption				0.54*	
				(0.26)	
Lag Private Consumption					0.96***
					(0.20)

R^2	0.07	0.00	0.02	0.16	0.51
(v) Total Expenditure Growth					
Output Gap	0.91*				
	(0.35)				
Real GDP		0.1			
		(0.19)			
Lag Real GDP			0.32		
			(0.18)		
Private Consumption				0.83**	
				(0.24)	
Lag Private Consumption					1.15***
					(0.17)
R^2	0.23	0.02	0.12	0.35	0.67

Source: Authors Estimations

Note: Figures in parentheses are standard errors of coefficient estimates. *** indicates coefficient estimate at 1% significance level; ** at 5% level; * at 10% level

Appendix 2 – Instrumental Variable Two-Stage Least Squares (Robust) Regression Results

	Real GDP = Lag of Private Consumption	Real GDP = Lag of Real GDP
Capital Expenditure Growth	7.75	4.03**
	(4.54)	(1.51)
Prob > chi2	0.08	0.01
Current Expenditure Growth	2.58	0.45
	(1.82)	(0.47)
Prob > chi2	0.16	0.35
Pay and Pension Expenditure Growth	2.43	0.72
	(1.63)	(0.56)
Prob > chi2	0.14	0.20
Non Pay Expenditure Growth	2.69	0.29*
	(1.99)	(0.46)
Prob > chi2	0.18	0.53
Total Expenditure Growth	3.21	0.84
	(2.16)	(0.51)
Prob > chi2	0.14	0.10

Source: Authors Estimations

Note: Figures in parentheses are standard errors of coefficient estimates. *** indicates coefficient estimate at 1% significance level; ** at 5% level; * at 10% level

Quality Assurance process

To ensure accuracy and methodological rigour, the author engaged in the following quality assurance process.

- ✓ Internal/Departmental
  - ✓ Line management
  - ✓ Spending Review Steering group
  - ✓ Other divisions/sections
  - ✓ Peer review (IGEES network, seminars, conferences etc.)

- ☐ External
  - ☐ Other Government Department
  - ☐ Steering group
  - ☐ Quality Assurance Group (QAG)
  - ☐ Peer review (IGEES network, seminars, conferences etc.)
  - ☐ External expert(s)

- ☐ Other (relevant details)

An Roinn Caiteachais
Phoiblí agus Athchóirithe
Department of Public
Expenditure and Reform

Tithe an Rialtas. Sráid Mhuirfean Uacht,
Baile Átha Cliath 2, D02 R583, Éire
Government Buildings, Upper Merrion Street,
Dublin 2, D02 R583, Ireland

T:+353 1 676 7571
@IRLDeptPer
www.per.gov.ie