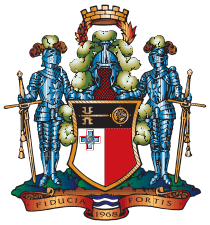

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RECENT DEVELOPMENTS IN MALTA'S PUBLIC CAPITAL STOCK AND THE MACROECONOMIC BENEFITS OF CLOSING THE GAP

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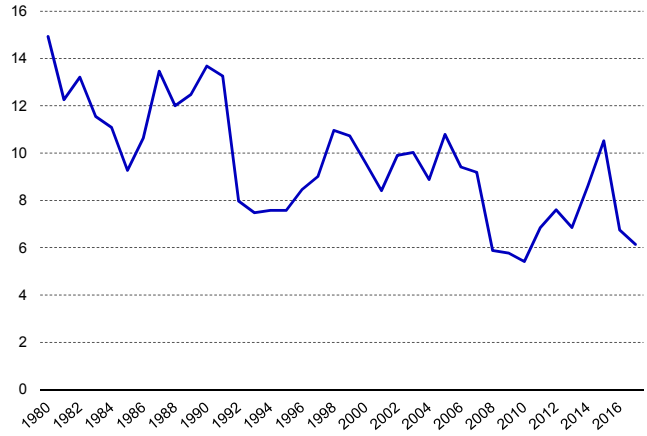
BOX 1: RECENT DEVELOPMENTS IN MALTA'S PUBLIC CAPITAL STOCK AND THE MACROECONOMIC BENEFITS OF CLOSING THE GAP[1]

In recent years, Malta's public infrastructure has struggled to keep up with the rapid expansion in both the country's economic activity and population. As shown in Chart 1, the share of government investment spending fell from around 14% in the early 1980s to around 6% in 2017.

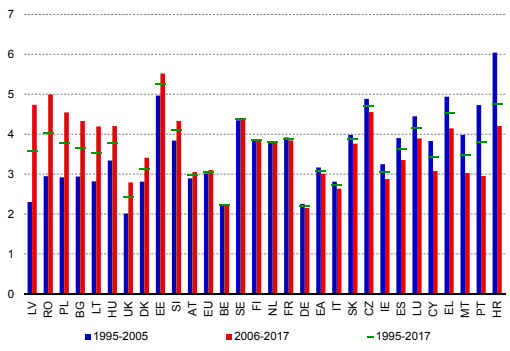
Chart 1
SHARE OF GFCF GOVERNMENT EXPENDITURE
(% of total government expenditure)



Source: Grech (2015).

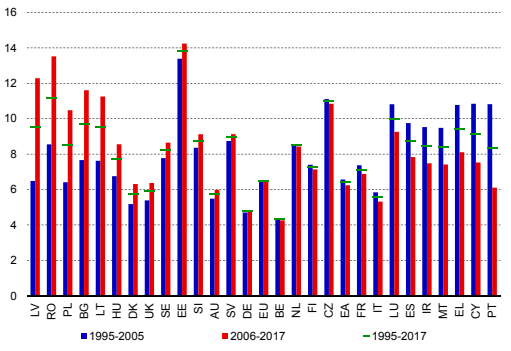
Charts 2a and 2b compare dynamics of general government gross fixed capital formation (GFCF) expenditure normalised with total government expenditure and GDP across time and countries. Both charts show that average government investment in the EU has remained broadly unchanged between the periods 1995-2005 and 2006-2017. However, average aggregate figures hide considerable heterogeneity across countries. Generally speaking, government investment has declined the most in countries with relatively high investment ratios and in countries that were hit hardest by the sovereign debt crisis. On the other hand, investment ratios have increased the most in converging countries that have benefitted from increasing support of EU funds.

Chart 2a
SHARE OF GOVERNMENT INVESTMENT IN GDP
(% of GDP, ranked by magnitude of change in ppts between 2006-2017 and 1995-2005)



Sources: Eurostat; authors' calculations.

Chart 2b
SHARE OF GOVERNMENT INVESTMENT IN TOTAL EXPENDITURE
(% of total expenditure, ranked by magnitude of change in ppts between 2006-2017 and 1995-2005)



Sources: Eurostat; authors' calculations.

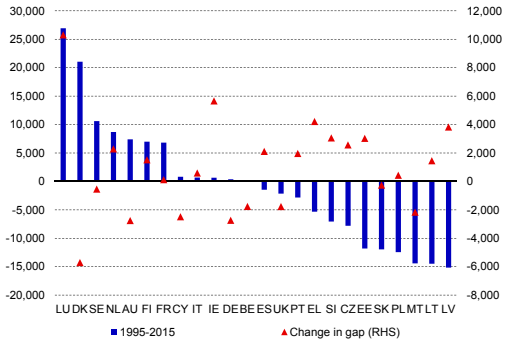
[1] Prepared by Noel Rapa, Principal Research Economist in the Research Department and Abigail Marie Rapa, Senior Economist within the Economic Analysis Department of the Central Bank of Malta. The views expressed in this Box, which are a summary of a broader article (Rapa N. and Rapa A. M. (2019), "The Macroeconomic Effects of Closing the Public Sector Capital Gap in Malta", *Central Bank of Malta Policy Note*, (July 2019), are the authors' own and do not necessarily reflect the views of the Bank.

On average, Malta's government spending on GFCF is comparable to the EU and euro area averages. However, Malta compares less favourably to its EU and euro area peers when government investment dynamics are taken in consideration. Malta's contraction in its government investment ratios between the periods 1995-2005 and 2006-2017 is of a similar magnitude to that registered in Portugal, Cyprus, Ireland and Greece – economies whose investment shares have been affected by the fiscal consolidation strategies employed during the euro area sovereign debt crisis. Against this backdrop, Malta's public sector investment and capital stock appear to be significantly lagging behind those of its peers.

Government investment dynamics are mirrored in changes in government capital stock in EU countries, with the majority of economies that have negative capital gaps with the EU average registering increases in their public capital stock relative to both their population and output. Charts 3a and 3b show that, when expressed as a ratio of population and national income, Malta has one of the lowest levels of public capital stock in the EU with an average negative public capital output gap between 1995 and 2015 of around US$ 15,000 per capita according to the International Monetary Fund's (IMF) Investment and Capital Stock dataset. Furthermore, Malta's public capital gap metrics have widened significantly in the last decade when compared to the EU average.

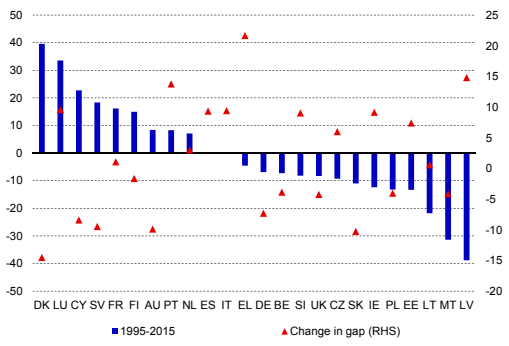
The analysis performed above suffers from a number of shortcomings mainly related to difficulties encountered when distinguishing between the effects of public investment and other government expenditure as well as when distinguishing between public and private investment.[2] In this light, qualitative measures of public capital stock try to overcome some of these shortcomings and add a qualitative dimension to measures of public infrastructure. Chart 4 shows that the Global Competitiveness Indicators (GCI) published by the World Economic Forum confirm the main trends identified by the metrics shown above with Malta's transport and utility infrastructure sub-indicators faring

Chart 3a
PUBLIC CAPITAL STOCK GAP – PER CAPITA US$ PPP TERMS
(Difference vs EU; change in gap between 2006-2015 and 1995-2005 (RHS))



Sources: IMF Investment and Capital Stock Dataset; Eurostat; authors' calculations.

Chart 3b
PUBLIC CAPITAL STOCK GAP – % of GDP TERMS
(Difference vs EU ppts; change in gap between 2006-2015 and 1995-2005 (RHS))

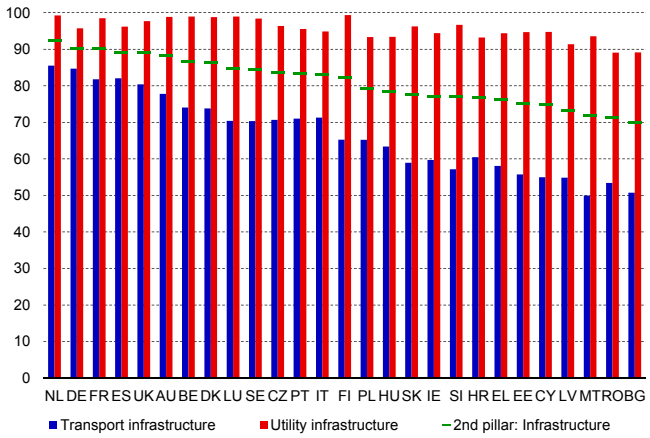


Sources: IMF Investment and Capital Stock Dataset; authors' calculations.

[2] To maximise comparability between public capital stock estimates across countries, this study makes use of government capital stock data found in the IMF Investment and Capital Stock Dataset. The database is computed using the perpetual inventory method using data found in the OECD Analytical Database, the Penn World Tables, IMF World Economic Outlook and European Investment Bank. The depreciation rates used are time-varying and depend on the country income-grouping.

considerably worse than the EU average, with particularly low scores for the former.[3]

Chart 4
INFRASTRUCTURE PILLAR AND TRANSPORT AND UTILITY SUB-PILLARS
(score normalised to 100; ranked by quality of overall infrastructure)



Source: The Global Competitiveness Report 2018.

The relationship between public capital stock and economic growth

There are two broad strands of literature that aim to shed light on the effects public investment is expected to have on other macroeconomic variables, one based on partial equilibrium analysis and another based on general equilibrium effects. Partial equilibrium analysis is mainly conducted by augmenting a Cobb Douglas function with a public capital measure and estimating the output elasticity of public capital (γ_g).

$$Y_t = A_t K_t^{\gamma_K} N_t^{\gamma_N} K_t^{G\gamma_g} \qquad \text{Eq 1.}$$

Literature suggests estimates of the output elasticity of public capital ranging from -1.7 to 2.0, with an average elasticity of 0.1.[4] This implies that a 1% increase in public capital stock is expected to increase long run output by 0.1%. Estimating equation 1 for Malta using a variety of specifications leads to estimates for γ_G ranging from 0.1 to 0.5, thus broadly in line with estimates of other EU economies.[5]

One disadvantage of using partial equilibrium analysis is the fact that such models are unable to explicitly take in consideration the two-way feedback that exists between public sector capital and output. VAR-based analysis reveals that the effects on output of an increase in public sector capital stock is positive and statistically different from zero but is lower than estimates derived from production function approaches. VAR estimates, however, confirm the results put forward by partial equilibrium studies, that indicate stronger positive effects of infrastructure spending when compared to other types of public capital.[6] Studies by the IMF show that apart from the state of the economy, the effects of public investment depend on the method of financing chosen by the government, with debt

[3] One needs to keep in consideration that GCI indicators for 2018 might still not fully take in consideration the effects of the recent overhaul of the energy sector which are expected to lead to significant long-run macroeconomic gains (see Rapa, N. (2018) "The Macroeconomic Effects of Energy Reforms in Malta", *Central Bank of Malta Research Bulletin* 2018, pp. 5-10).

[4] See Bom, P. R. D. and J. E. Lighart. (2014). "What Have We Learned From Three Decades of Research on the Productivity of Public Capital?", *Journal of Economic Surveys*, vol. 28, issue 5, pp. 889-916 for a literature review survey.

[5] Technical details are available in Rapa, N. and Rapa, A. M. (2019)

[6] See Kamps, C. (2004). "New Estimates of Government Net Capital Stocks for 22 OECD Countries 1960–2001", *IMF Working Paper*, WP/04/67 and de Jong, J., Ferdinandusse M., Funda J. and I. Vetlov. (2017). "The Effect of Public Investment in Europe: A Model-Based Assessment", *ECB Working Paper Series*, No 2021/February 2017.

financing having significantly larger effects on economic activity than tax or expenditure financing.[7]

Structural models within a general equilibrium framework are especially useful to analyse the trade-off that exists between the positive effects of government investment and the negative effects brought about by the financing options chosen by the government. Furthermore, structural models are also able to internalise general equilibrium effects stemming from the two-way relation that exists between public capital stock and other factors of production. Moreover, this strand of literature argues that despite being significantly expansionary in the long run, positive public investment shocks can be mildly contractionary in the short run especially if investment outlays are financed by raising highly distortionary taxes such as labour taxes.[8]

The contained short-run effects of public investment shocks are also confirmed by another strand of literature that models public investment in a time-to-build setup.[9] These studies suggest that in the short run, implementation delays associated with public investment projects may lead to negative wealth effects.

The possible macroeconomic benefits of closing Malta's infrastructure gap

In order to shed some light on the macroeconomic implications of a sustained increase in government investment meant to bridge Malta's public sector capital gap with the rest of the EU, we perform a number of simulations using the fiscal version of MEDSEA.[10] The model assumes that in order to ensure a stable debt ratio, the government can use internally-funded fiscal instruments consisting of distortionary taxes on consumption, labour and capital/dividend income as well as non-distortionary lump-sum taxes. In order to take into consideration the fact that the government can complement tax increases or expenditure cuts with external financing options relating to EU structural funds as well as Malta's sovereign fund which accumulates proceeds from the Individual Investor Programme (IIP), the baseline version of the model was extended in line with Varga and in't Veld (2009).[11] Since funds available through either EU structural funds or the IIP are not financed by levying taxes on Maltese residents, these two external funding options do not have distortionary effects on the Maltese output.

Chart 5 shows the dynamic effects of a transitory, but persistent, ex-ante increase in government investment under different assumptions on the source of financing chosen by

7 Abiad, A., Furceri, D. and P. Topalova. (2015). "The Macroeconomic Effects of Public Investment: Evidence from Advanced Economies", *IMF Working Paper*, WP/15/95.

8 Bom, P. R. D. and J. E. Lighart. (2014). "What Have We Learned From Three Decades of Research on the Productivity of Public Capital?", *Journal of Economic Surveys*, vol. 28, issue 5, pp. 889-916.

9 Kydland, F. E. and E. C. Prescott. (1982). "Time to Build and Aggregate Fluctuations", *Econometrica*, No. 50, pp. 1345-1370

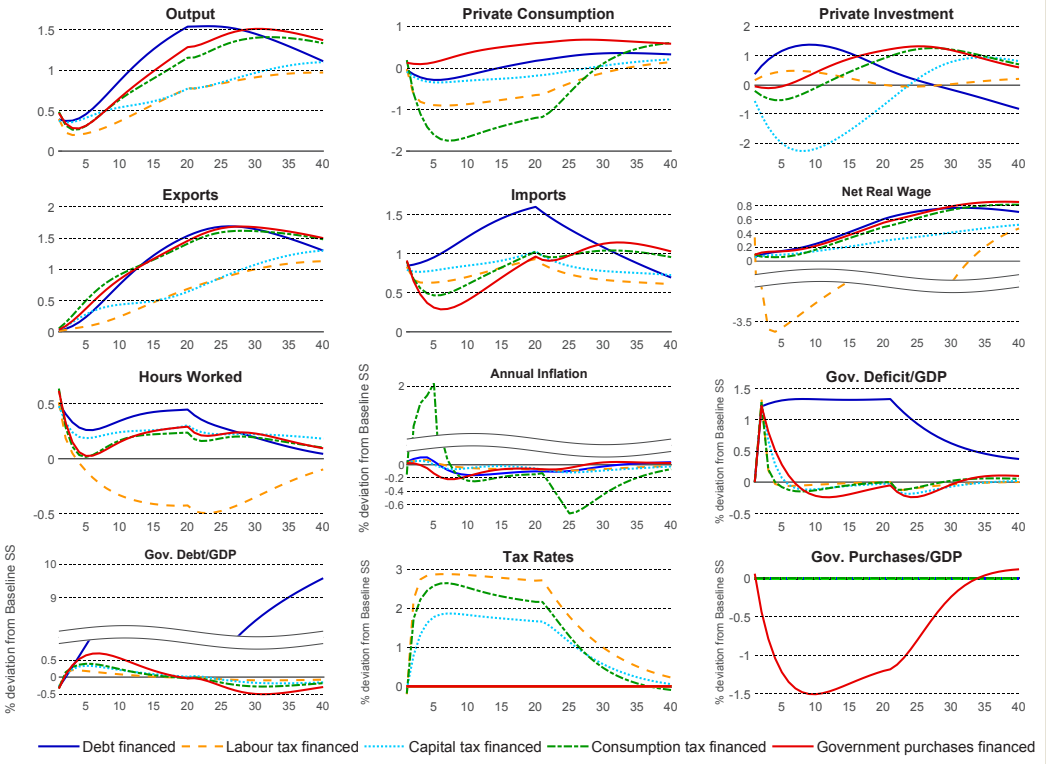
10 Technical details of this model are available in Rapa, N. (2017). "Estimates of Fiscal Multipliers using MEDSEA", *Central Bank of Malta Working Paper*, WP/04/2017.

11 See Varga, J. and J. in't Veld (2009). "A Model-based Analysis of the Impact of Cohesion Policy Expenditure 2000-06: Simulations with the QUEST III endogenous R&D model", *European Economy Economic Papers*, no. 387. This modification extends the government budget constraint with an externally-funded fiscal instrument which complements the existing number of domestic funding instruments available to the government. The external funds received by the Maltese state are significantly small when compared to the aggregate expenditure of donor countries. In this light, and in line with the modelling strategy employed for the rest of foreign variables present in the model, the externally-funded fiscal instrument is modelled in reduced form ignoring the (significantly small) second-round effects on foreign demand emanating from the need of the donor states to finance the structural funds transferred to the Maltese state.

the government. To this end, we shock government investment as percent of GDP by 1 percentage point over 20 quarters. Thereafter, the government investment-to-output ratio is allowed to gradually return to its baseline figure. This exercise assumes that the government can choose to finance its investment outlays by using one of the following five options: increasing debt, labour income tax, capital income tax, consumption tax or through a reduction in government purchases.[12]

Under all scenarios, an increase in government investment is expansionary throughout the time-period under consideration. Results also point at significantly different macro-dynamics depending on the instrument used by government to finance its capital projects. As expected, debt-financing has the most positive effect in the short-to-medium run (blue line). The lowest effects on overall output in the medium run are registered in the case government chooses to finance its investment outlays by levying distortionary taxes on factors of production such as labour (dashed orange line) and capital (dashed sky blue line). The distortionary effects on overall output brought about by a non-debt neutral financing strategy are lowest in the case of either a hike in consumption taxes (dotted green line) or a reduction in government purchases (red line).

Chart 5
IMPULSE RESPONSES FOR TEMPORARY SHOCK TO GOVERNMENT INVESTMENT



[12] Under the debt financing option, it is assumed that no attempt is made to rebalance the debt-to-GDP ratio in the sample under consideration. Under a balanced-budget assumption, it is assumed that the government will either increase one tax rate at a time or reduce government purchases in order to stabilise its debt-to-GDP ratio.

In order to estimate the long-run economic implications of closing Malta's capital-to-output gap with that of the EU average, we simulate the model with a permanent shock to the government investment-to-GDP ratio. We calibrate the shock such that the change in the government capital stock-to-output ratio in the new steady state equals Malta's 2015 capital gap as estimated in the IMF Investment and Capital Stock Dataset. All simulations are performed under the assumption of government debt neutrality in the long run. The government can choose to finance its investment outlays either by raising one of the three tax rates at its disposal or by reducing its recurrent expenditure (see Table 1). To this end the table also contains information on the long-run change in the fiscal instrument chosen by the government to stabilise its debt-to-output ratio.[13] We also take in consideration the government's ability to utilise European Structural and Investment Funds, as well as funds available in the recently-established National Development and Social Fund (NDSF).

Results indicate that there are significant long-term GDP benefits to be achieved from increasing the public capital stock-to-output ratio. As expected, however, both the extent of the output gains as well as the drivers behind such gains vary significantly depending on the financing options chosen by the government. As already suggested by simulations in Chart 5, financing capital projects by increasing taxation on the returns of factors of production leads to the lowest impact on GDP. A rise in capital or labour income taxes distorts the optimal capital-to-labour ratio chosen by firms, as well as the optimal consumption, investment and labour supply decisions of households. Under the assumption of full internal financing, overall output gains of closing the public capital stock-to-output ratio lies

Table 1
LONG-RUN MACROECONOMIC EFFECTS OF CLOSING THE PUBLIC CAPITAL GAP

% deviation from baseline; fiscal instrument results shown in terms of pp deviations in tax rates and government purchases-to-GDP ratio

	Labour income tax			Capital income tax			Consumption tax			Government purchases		
	No EU	EU	EU_ NDSF	No EU	EU	EU_ NDSF	No EU	EU	EU_ NDSF	No EU	EU	EU_ NDSF
Real activity												
GDP	7.2	8.1	10.0	6.1	7.2	9.6	10.2	10.4	11.0	10.9	11.0	11.2
Private Consumption	-2.1	-1.5	-0.4	-1.8	-1.3	-0.3	-0.2	-0.1	0.2	6.6	5.3	2.5
Private Investment	2.9	3.5	4.7	-6.0	-3.7	1.5	4.8	4.9	5.2	6.6	6.4	5.9
Exports	8.8	9.7	11.6	7.2	8.4	11.0	11.8	12.0	12.6	11.6	11.9	12.5
Imports	6.5	7.2	8.6	5.4	6.3	8.2	8.7	8.9	9.3	8.6	8.8	9.3
Labour market												
Real Wages	-11.4	-7.8	0.1	3.0	3.6	5.0	6.5	6.4	6.2	7.1	6.9	6.4
Employment	-2.5	-1.7	0.2	1.2	1.3	1.5	0.4	0.6	1.2	0.5	0.8	1.2
Fiscal Instrument	12.8	10.2	4.4	7.4	5.9	2.5	7.9	6.3	2.7	-4.0	-3.2	-1.4

Source: Authors' calculations.

[13] Long-run debt financing is not explored in this box. Debt financing implies a higher debt-to-GDP ratio in the long run which in turn requires a higher primary surplus in the long run to finance interest expenses. When conducting debt-neutral shocks in the long run one still needs to specify a fiscal instrument that will be used to stabilise the debt ratio by running a primary surplus. Thus, even under a debt-financing strategy, long-run results will still be dependent on the fiscal instrument chosen to pay for interest expenses. In general, while debt-neutral strategies are preferred in the short run, they consistently deliver lower output results in the long run.

between 6% and 7% in case of capital and labour income tax financing options respectively. Distortions are significantly less pronounced in case the government chooses to finance its capital projects through a rise in consumption taxes or a reduction in its government expenditure, with output gains ranging between 10% and 11% under the assumption of full internal financing. Results also show that the possibility for government to utilise EU-funds as well as funds accumulated within the NDSF would significantly reduce the distortionary effects of all financing options, most notably those consisting of increases in labour and capital income tax finances.